TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P73

An atmospheric pressure of 15.0 psia is equivalent to...

A. 30.0 psig.

B. 29.4 psig.

C. 14.7 psig.

D. 0.0 psig.

ANSWER: D.

TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P273

A pressure gauge on a condenser reads 27.0 inches of mercury (Hg) vacuum. What is the absolute pressure corresponding to this vacuum? (Assume an atmospheric pressure of 15.0 psia.)

A. 14.0 psia

B. 13.5 psia

C. 1.5 psia

D. 1.0 psia

ANSWER: C.

TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P473

Assuming a standard atmospheric pressure of 15.0 psia, 5.0 inches of mercury (Hg) vacuum is equivalent to...

A. 2.5 psia.

B. 5.0 psia.

C. 10.0 psia.

D. 12.5 psia.

ANSWER: D.

TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P873

If a main steam line pressure gauge reads 900 psig, what is the absolute pressure?

A. 870 psia

B. 885 psia

C. 915 psia

D. 930 psia

ANSWER: C.

TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P1173

Which one of the following is equivalent to 5 psia?

A. 20 psig

B. 10 psig

C. 10 inches of mercury (Hg) vacuum

D. 20 inches of mercury (Hg) vacuum

ANSWER: D.

TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P1273

Which one of the following is arranged from the lowest pressure to the highest pressure?

A. 8 psia, 20 inches Hg absolute, 2 psig

B. 8 psia, 2 psig, 20 inches Hg absolute

C. 20 inches Hg absolute, 2 psig, 8 psia

D. 20 inches Hg absolute, 8 psia, 2 psig

ANSWER: A.

TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P1573

Which one of the following is arranged from the highest pressure to the lowest pressure?

A. 2 psig, 20 inches Hg absolute, 8 psia

B. 2 psig, 8 psia, 20 inches Hg absolute

C. 8 psia, 20 inches Hg absolute, 2 psig

D. 8 psia, 2 psig, 20 inches Hg absolute

ANSWER: A.

TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P1773

Which one of the following is approximately equivalent to 2 psig?

A. 11 psia

B. 13 psia

C. 15 psia

D. 17 psia

ANSWER: D.

TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P2073

Which one of the following is arranged from the lowest pressure to the highest pressure?

A. 2 psig, 12 inches Hg absolute, 8 psia

B. 2 psig, 18 inches Hg absolute, 8 psia

C. 12 psia, 20 inches Hg absolute, 2 psig

D. 12 psia, 30 inches Hg absolute, 2 psig

ANSWER: D.

TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P2173

Which one of the following is the approximate condenser vacuum when condenser pressure is 16 inches Hg absolute?

A. 4 inches Hg vacuum

B. 8 inches Hg vacuum

C. 12 inches Hg vacuum

D. 14 inches Hg vacuum

ANSWER: D.

TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P2273

Which one of the following is arranged from the highest pressure to the lowest pressure?

A. 2 psig, 12 inches Hg absolute, 8 psia

B. 2 psig, 18 inches Hg absolute, 8 psia

C. 12 psia, 20 inches Hg absolute, 2 psig

D. 12 psia, 30 inches Hg absolute, 2 psig

ANSWER: B.

TOPIC: 193001
KNOWLEDGE: K1.01 [2.5/2.7]
QID: P2773

Which one of the following is arranged from the highest pressure to the lowest pressure?

A. 2 psig, 12 inches Hg absolute, 8 psia

B. 2 psig, 18 inches Hg absolute, 8 psia

C. 12 psia, 20 inches Hg absolute, 2 psig

D. 12 psia, 30 inches Hg absolute, 2 psig

ANSWER: B.

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P374 (B373)

Refer to the drawing of two water storage tanks with four differential pressure level detectors (see figure below).

The tanks are identical and are being maintained at 17 psia and the same constant water level. They are surrounded by atmospheric pressure.

Which one of the level detectors is sensing the greatest D/P?

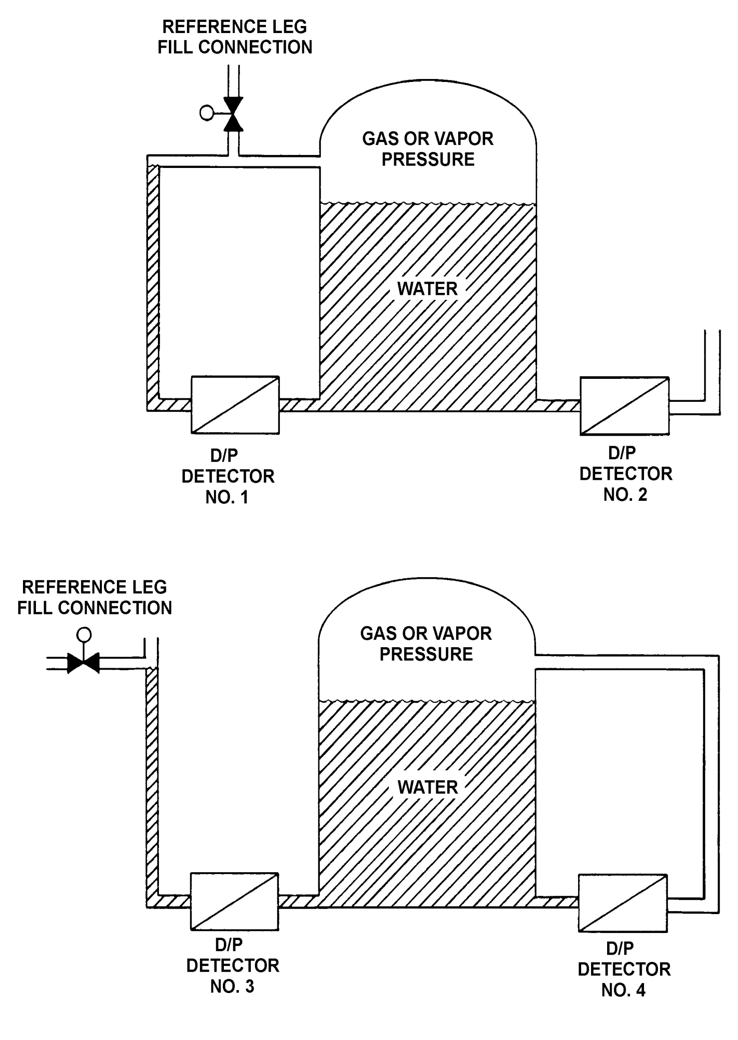
A. 1

B. 2

C. 3

D. 4

ANSWER: B.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P573 (B1873)

An enclosed water storage tank is pressurized with nitrogen to prevent air inleakage. A differential pressure detector with a dry reference leg is used to measure the tank level.

To achieve the greatest accuracy of measurement, the low pressure side of the detector should sense which one of the following?

A. The pressure at the bottom of the tank.

B. The pressure of the atmosphere surrounding the tank.

C. The pressure of a column of water external to the tank.

D. The pressure of the gas space at the top of the tank.

ANSWER: D.

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P709 (B710)

Refer to the drawing of two water storage tanks with four differential pressure level detectors (see figure below).

The tanks are identical and are being maintained at 17 psia and 70 percent water level (calibration conditions). They are located in a building that is currently at atmospheric pressure.

If the building ventilation system creates a vacuum in the building, which level detectors will provide the lowest level indications?

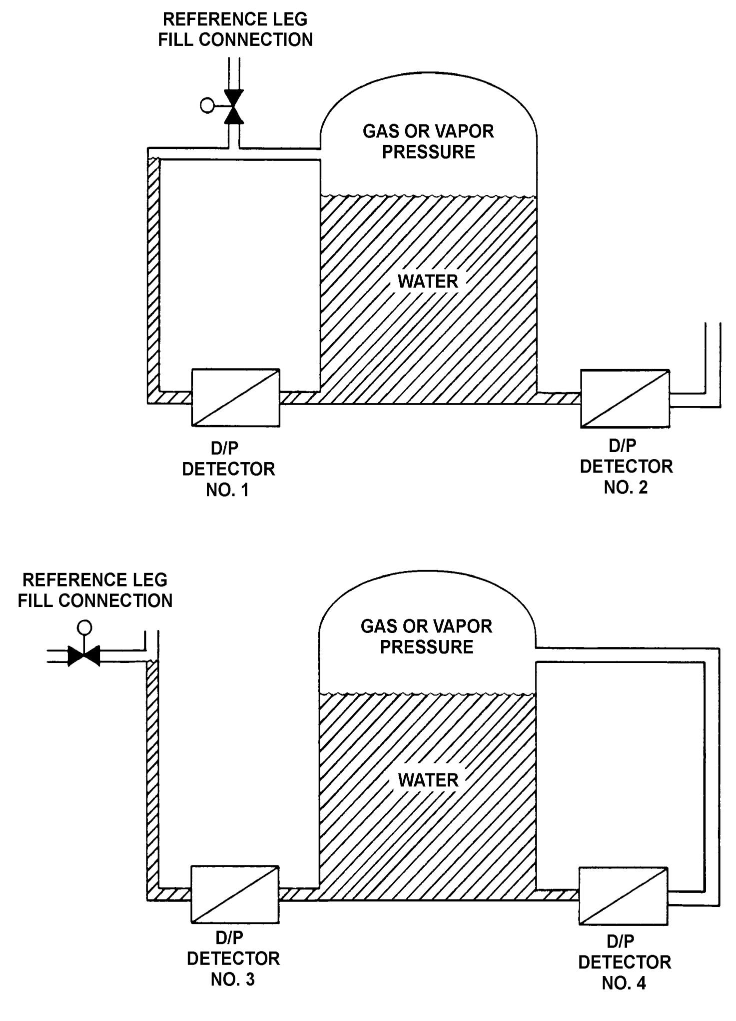
A. 1 and 3

B. 1 and 4

C. 2 and 3

D. 2 and 4

ANSWER: B.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P1673 (B1174)

Refer to the drawing of two water storage tanks with four differential pressure level detectors (see figure below).

The tanks are identical and are currently at 2 psig overpressure, the same constant water level, and a temperature of 60°F. They are surrounded by atmospheric pressure. All level detectors have been calibrated and are producing the same level indication.

If a leak in the top of each tank causes a complete loss of overpressure, which level detector(s) will produce the lowest level indication?

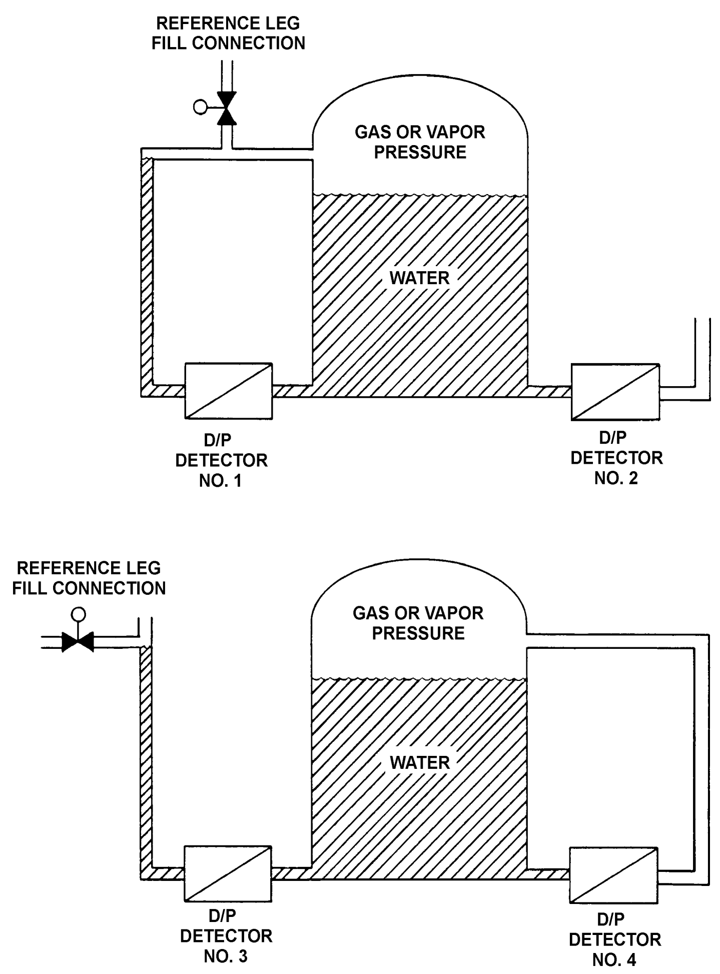
A. No. 1 only

B. No. 2 only

C. No. 1 and 4

D. No. 2 and 3

ANSWER: D.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P2373 (B2373)

Refer to the drawing of two water storage tanks with four differential pressure level detectors (see figure below).

The tanks are identical and they are presently at 2 psig overpressure, 60°F, and the same constant water level. They are located within a sealed containment structure that is being maintained at atmospheric pressure. All level detectors have been calibrated and are producing the same level indication.

If a ventilation malfunction causes containment structure pressure to decrease to 12 psia, which level detectors will produce the lowest level indication?

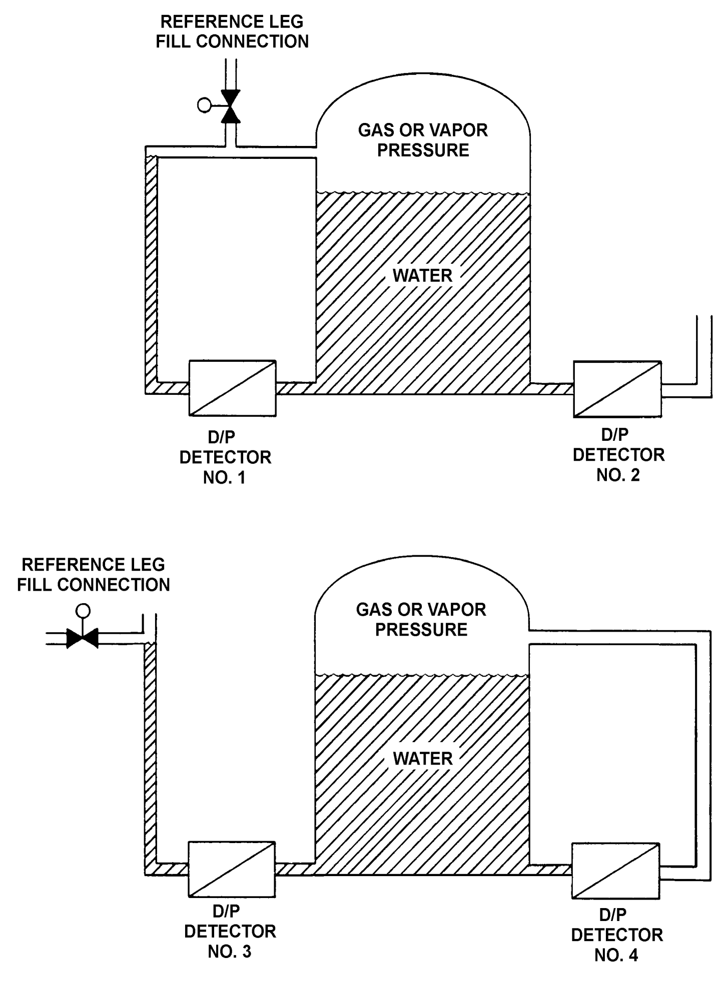
A. 1 and 3

B. 2 and 4

C. 1 and 4

D. 2 and 3

ANSWER: C.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P2574 (B2573)

Refer to the drawing of two water storage tanks with four differential pressure level detectors (see figure below).

The tanks are identical and are presently at 2 psig overpressure, 60°F, and the same constant water level. They are located within a sealed containment structure that is being maintained at atmospheric pressure. All level detectors have been calibrated and are producing the same level indication.

If a ventilation malfunction causes the containment structure pressure to decrease to 13 psia, which level detectors will produce the highest indication?

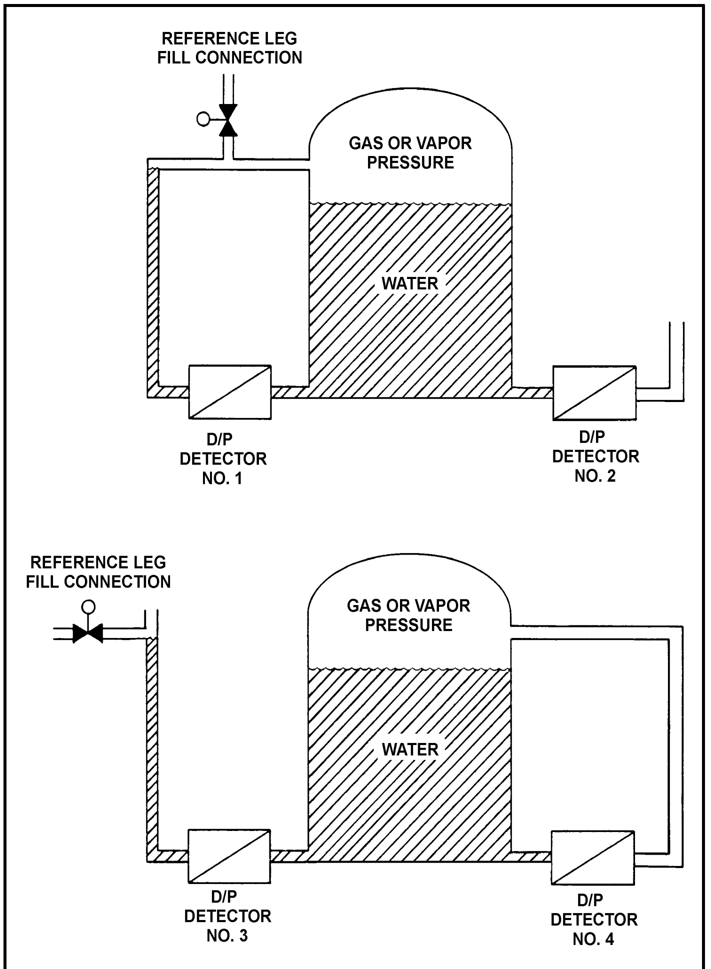
A. 1 and 2

B. 3 and 4

C. 1 and 4

D. 2 and 3

ANSWER: D.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P2673 (B73)

Refer to the drawing of a differential pressure manometer (see figure below).

A differential pressure manometer is installed across an orifice in a ventilation duct. With the ventilation conditions as shown, the pressure at P1 is __________ than P2, and airflow is from __________.

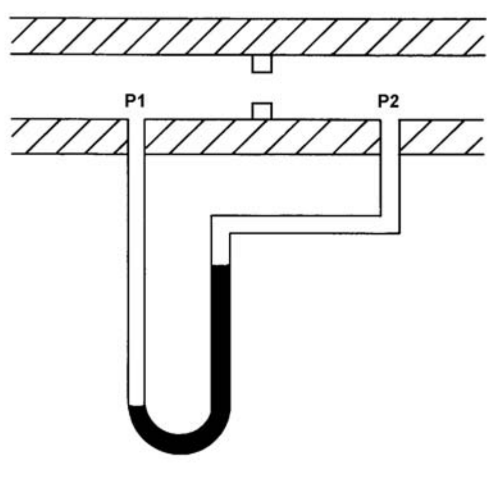
A. greater; left to right

B. greater; right to left

C. less; left to right

D. less; right to left

ANSWER: A.



DIFFERENTIAL PRESSURE MANOMETER

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P2873 (B1073)

Refer to the drawing of two water storage tanks with four differential pressure level detectors (see figure below).

The tanks are identical and being maintained at 30 psia with a water level of 20 feet. They are surrounded by standard atmospheric pressure. The water temperatures in the tanks and reference legs are the same.

If each detector experiences a ruptured diaphragm, which detector(s) will cause indicated tank level to decrease? (Assume actual tank water level remains constant.)

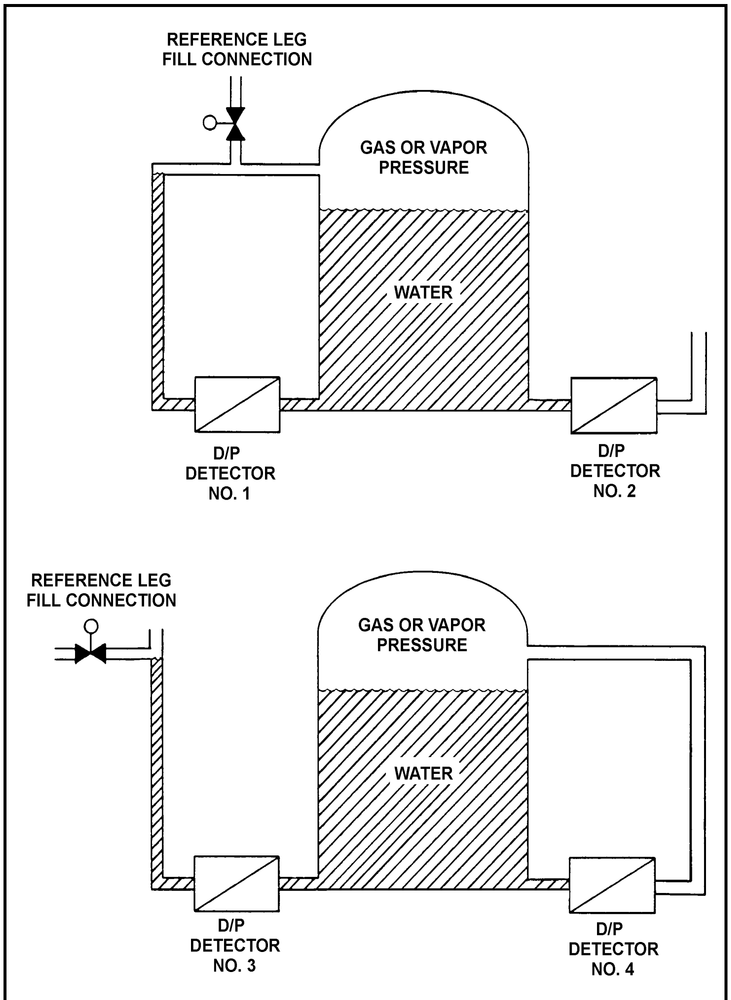
A. No. 1 only

B. No. 2 only

C. No. 1, 2, and 3

D. No. 2, 3, and 4

ANSWER: D.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P2973 (B673)

Refer to the drawing of a differential pressure manometer in a ventilation duct (see figure below).

P1 and P2 are pressures sensed in the ventilation duct. With the conditions shown, P1 is __________ than P2; and airflow is to the __________.

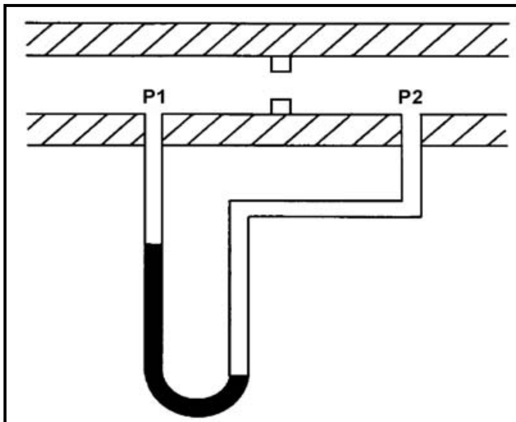
A. less; left

B. less; right

C. greater; left

D. greater; right

ANSWER: A.



DIFFERENTIAL PRESSURE MANOMETER

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P3173 (B3173)

A water storage tank is vented to atmosphere. The tank is located at sea level and contains 100,000 gallons of 80°F water. A pressure gauge at the bottom of the tank reads 5.6 psig. What is the approximate water level in the tank?

A. 13 feet

B. 17 feet

C. 21 feet

D. 25 feet

ANSWER: A.

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P3673 (B3673)

Refer to the drawing of a tank with a differential pressure (D/P) level detector (see figure below).

If the tank contains 30 feet of water at 60°F, what is the approximate D/P sensed by the detector?

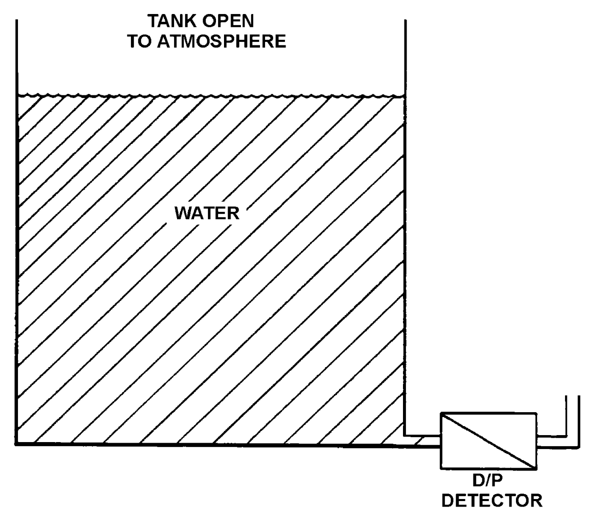
A. 7 psid

B. 13 psid

C. 20 psid

D. 28 psid

ANSWER: B.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P3873 (B3873)

A water storage tank is vented to atmosphere. The tank is located at sea level and contains 100,000 gallons of water at 80°F. A pressure gauge at the bottom of the tank reads 7.3 psig. What is the approximate water level in the tank?

A. 13 feet

B. 17 feet

C. 21 feet

D. 25 feet

ANSWER: B.

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P4537 (B4537)

A water storage tank is vented to atmosphere. The tank is located at sea level and contains 100,000 gallons of water at 80°F. A pressure gauge at the bottom of the tank reads 9.0 psig. What is the approximate water level in the tank?

A. 13 feet

B. 17 feet

C. 21 feet

D. 25 feet

ANSWER: C.

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P4837 (B4837)

Refer to the drawing of two water storage tanks with four differential pressure level detectors (see figure below).

The tanks are identical and are presently at 2 psig overpressure, the same constant water level, and a temperature of 60°F. They are surrounded by atmospheric pressure. All level detectors have been calibrated and are producing the same level indication. A leak in the top of each tank causes a complete loss of overpressure in both tanks.

Which level detector(s) will produce the highest level indication?

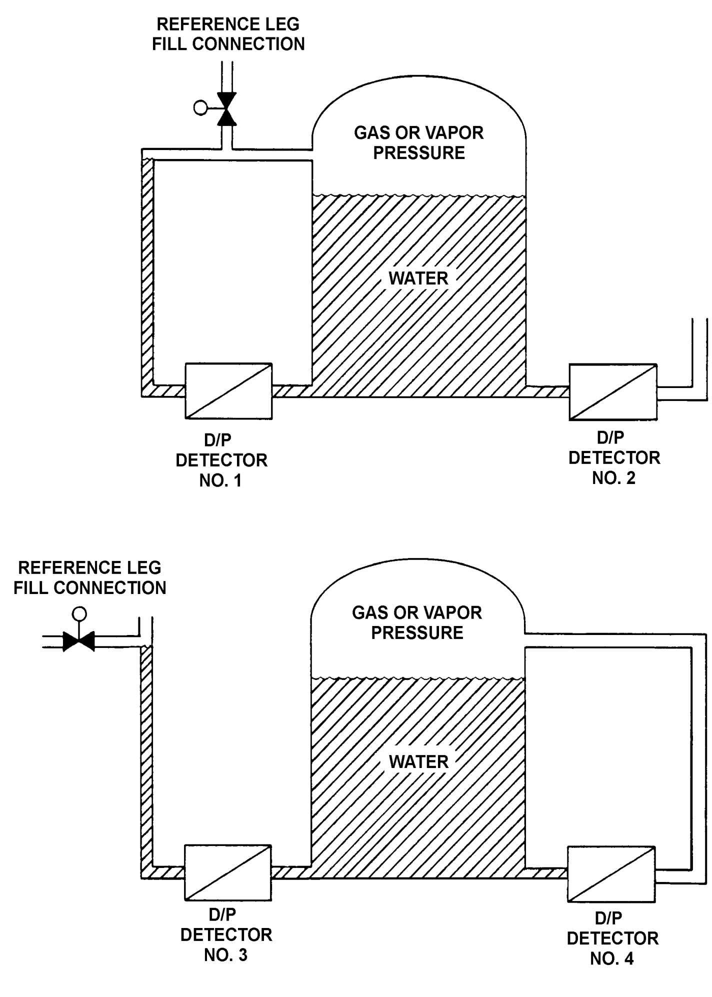
A. No. 1 only

B. No. 2 only

C. No. 1 and 4

D. No. 2 and 3

ANSWER: C.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

TOPIC: 193001
KNOWLEDGE: K1.03 [2.6/2.6]
QID: P5837 (B5837)

Refer to the drawing of a water storage tank with a differential pressure (D/P) level indicator that is vented to atmosphere (see figure below). Both the tank and the level indicator are surrounded by standard atmospheric pressure. Tank water temperature is 70°F.

The D/P level indicator is sensing a differential pressure of 4.0 psi. What is the water level in the tank above the instrument penetration?

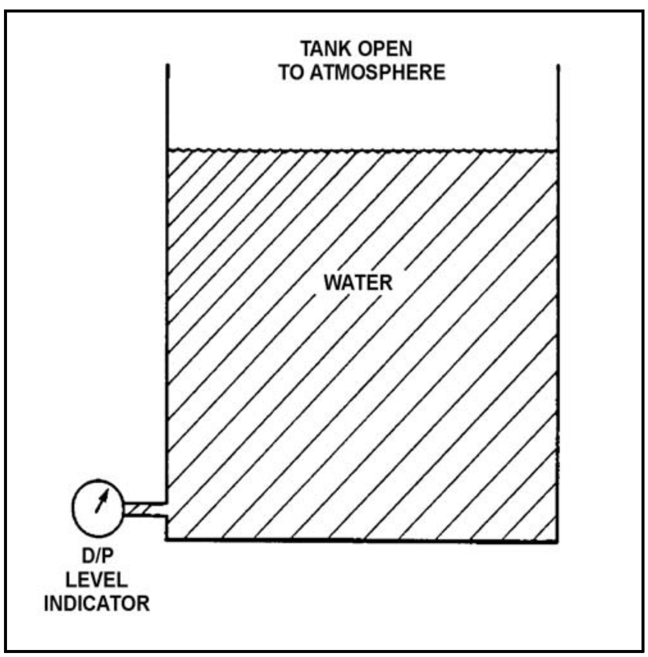
A. 9.2 feet

B. 16.7 feet

C. 24.7 feet

D. 43.2 feet

ANSWER: A.



There are no test items available for topic 193002.

TOPIC: 193003
KNOWLEDGE: K1.02 [2.4/2.5]
QID: P1774

Two identical pressurizers are connected to the same location on two identical reactor coolant systems operating at 1,000 psia. Pressurizer A volume contains 50 percent saturated water and 50 percent saturated steam. Pressurizer B volume contains 50 percent subcooled water (at 300°F) and 50 percent nitrogen.

Which one of the following explains which pressurizer will maintain the highest pressure following a sudden 10 percent liquid outsurge from each pressurizer?

A. Pressurizer A due to vaporizing of saturated water as pressure begins to decrease

B. Pressurizer A due to the expansion characteristics of saturated steam being better than the expansion characteristics of nitrogen

C. Pressurizer B due to the subcooled water resulting in a smaller amount of energy being lost upon the outsurge

D. Pressurizer B due to the expansion characteristics of nitrogen being better than the expansion characteristics of saturated steam

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.02 [2.4/2.5]
QID: P1973

Two identical pressurizers are connected to the same location on two identical reactor coolant systems operating at 1,000 psia. Pressurizer A volume contains 50 percent subcooled water (at 300°F) and 50 percent nitrogen. Pressurizer B volume contains 50 percent saturated water and 50 percent saturated steam.

Which one of the following explains which pressurizer will maintain the highest pressure during a sudden 10 percent liquid outsurge from each pressurizer?

A. Pressurizer A due to the subcooled water resulting in a smaller amount of energy being lost during the outsurge.

B. Pressurizer A due to the expansion characteristics of nitrogen being better than the expansion characteristics of saturated steam.

C. Pressurizer B due to vaporizing of saturated water as pressure begins to decrease.

D. Pressurizer B due to the expansion characteristics of saturated steam being better than the expansion characteristics of nitrogen.

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.02 [2.4/2.5]
QID: P3874

A nuclear reactor is operating normally at 100 percent power. Reactor coolant enters the reactor vessel at a temperature of 556°F and a total flow rate of 320,000 gpm. The reactor coolant leaves the reactor vessel at 612°F.

What is the approximate flow rate of the reactor coolant leaving the reactor vessel?

A. 320,000 to 329,000 gpm

B. 330,000 to 339,000 gpm

C. 340,000 to 349,000 gpm

D. 350,000 to 359,000 gpm

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P674 (B1074)

A liquid is saturated with 0 percent quality. Assuming pressure remains constant, the addition of a small amount of heat will...

A. raise the liquid temperature above the boiling point.

B. result in a subcooled liquid.

C. result in vaporization of the liquid.

D. result in a superheated liquid.

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P774

A pressurizer is operating in a saturated condition at 636°F. If a sudden pressurizer level decrease of 10 percent occurs, pressurizer pressure will ______________ and pressurizer temperature will ________________.

A. remain the same; decrease

B. remain the same; remain the same

C. decrease; decrease

D. decrease; remain the same

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P874 (B875)

Consider a water/steam mixture with a current quality of 99 percent. If pressure remains constant and heat is removed from the mixture, the temperature of the mixture will __________ and the quality of the mixture will __________. (Assume the mixture remains saturated.)

A. decrease; remain the same

B. decrease; decrease

C. remain the same; remain the same

D. remain the same; decrease

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P1075

A nuclear power plant is shut down with the following pressurizer conditions:

Pressurizer liquid temperature: 588°F
Pressurizer vapor temperature: 607°F
Pressurizer pressure: 1,410 psia

If the pressurizer is vented until pressure equals 1,200 psia, pressurizer liquid temperature will...

A. increase due to condensation of vapor.

B. increase due to evaporation of liquid.

C. decrease due to condensation of vapor.

D. decrease due to evaporation of liquid.

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P1174

Which one of the following describes the temperature of a saturated liquid?

A. Below the boiling point

B. At the boiling point

C. Above the boiling point

D. Unrelated to the boiling point

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P1374 (B1874)

Consider a water/steam mixture with a current quality of 95 percent. If pressure remains constant and heat is added to the mixture, the temperature of the mixture will __________ and the quality of the mixture will __________. (Assume the mixture remains saturated.)

A. increase; remain the same

B. increase; increase

C. remain the same; remain the same

D. remain the same; increase

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P1474 (B1974)

If 1 pound-mass of liquid water is in a saturated condition at a constant pressure, the addition of 1 Btu will...

A. raise the temperature of the water by 1°F.

B. vaporize a portion of the water.

C. increase the density of the water.

D. result in 1°F of superheat.

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P1574 (B1574)

Consider a steam-water mixture with a current quality of 79 percent. If pressure remains constant and heat is added to the mixture, the temperature of the mixture will __________ and the quality of the mixture will __________. (Assume the mixture remains saturated.)

A. increase; increase

B. increase; remain the same

C. remain the same; increase

D. remain the same; remain the same

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P1575

A nuclear power plant is shut down with the pressurizer in a saturated condition as follows:

Pressurizer liquid temperature = 588°F
Pressurizer vapor temperature = 588°F
Pressurizer pressure = 1,410 psia

Pressurizer spray is initiated to lower pressurizer pressure to 1350 psia. When pressurizer pressure stabilizes at 1350 psia, liquid temperature will be ____________ and vapor temperature will be ____________.

A. the same; the same

B. the same; lower

C. lower; the same

D. lower; lower

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P1974 (B3574)

A steam-water mixture is initially saturated with a quality of 50 percent, when a small amount of heat is added. Assuming pressure remains constant and the mixture remains saturated, mixture steam quality will ___________ and mixture temperature will ___________.

A. increase; increase

B. increase; remain the same

C. remain the same; increase

D. remain the same; remain the same

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P1976 (B2874)

Which one of the following is the approximate steam quality of a steam-water mixture at 467°F with an enthalpy of 1,000 Btu/lbm?

A. 25 percent

B. 27 percent

C. 73 percent

D. 75 percent

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P2174

Consider a pressurizer containing a saturated water/steam mixture at 636°F with a quality of 50 percent. If an outsurge removes 10 percent of the liquid volume from the pressurizer, the temperature of the remaining mixture will __________, and the quality of the remaining mixture will __________. (Assume the mixture remains saturated.)

A. decrease; decrease

B. decrease; increase

C. remain the same; decrease

D. remain the same; increase

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P2374 (B2375)

Which one of the following describes the effect of removing heat from a steam-water mixture that is in a saturated condition? (Assume the mixture remains saturated.)

A. Temperature will increase.

B. Temperature will decrease.

C. Quality will increase.

D. Quality will decrease.

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P2474

A nuclear power plant is shut down with the pressurizer in a saturated condition as follows:

Pressurizer liquid temperature	= 588°F
Pressurizer vapor temperature	= 588°F
Pressurizer pressure	= 1,410 psia

Pressurizer heaters are energized to raise pressurizer pressure to 1,450 psia. When pressurizer pressure stabilizes at 1,450 psia, liquid temperature will be ____________ and vapor temperature will be ____________.

A. the same; the same

B. the same; higher

C. higher; the same

D. higher; higher

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P2874 (B3374)

An open container holds one pound-mass of liquid water at saturated conditions and standard atmospheric pressure. The addition of 4 Btu will...

A. raise the temperature of the water by 4°F.

B. vaporize a portion of the water.

C. increase the density of the water.

D. result in 4°F of superheat.

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P2974 (B2975)

Consider a sealed vessel containing 1,000 lbm of a saturated water/vapor mixture at 500°F. The mixture is currently stable with no net heat gain or loss occurring.

If a leak near the bottom of the vessel results in a loss of 10 percent of the liquid volume from the vessel, the temperature of the mixture will __________, and the overall quality of the mixture will __________. (Assume the mixture remains saturated.)

A. decrease; increase

B. decrease; decrease

C. remain the same; increase

D. remain the same; decrease

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.12 [2.8/2.3]
QID: P3375 (B3378)

Given the following:

- A saturated steam-water mixture with an inlet quality of 60 percent is flowing through a moisture separator.
- The moisture separator is 100 percent efficient for removing moisture.

How much moisture will be removed by the moisture separator from 50 lbm of the steam-water mixture?

A. 10 lbm

B. 20 lbm

C. 30 lbm

D. 40 lbm

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.12 [2.8/2.3]
QID: P3774 (B3778)

Given the following:

- A saturated steam-water mixture with an inlet quality of 40 percent is flowing through a moisture separator.
- The moisture separator is 100 percent efficient for removing water.

How much water will be removed by the moisture separator from 50 lbm of the steam-water mixture?

A. 10 lbm

B. 20 lbm

C. 30 lbm

D. 40 lbm

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P574

Any vapor having a temperature above saturation temperature is a...

A. saturated vapor.

B. superheated vapor.

C. dry saturated vapor.

D. wet saturated vapor.

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P1674

A reactor trip occurred 10 minutes ago due to a loss of coolant accident. Emergency coolant injection is in progress and pressurizer level is increasing. Current pressurizer conditions are as follows:

Pressurizer liquid temperature	= 540°F
Pressurizer vapor temperature	= 607°F
Pressurizer pressure	= 1,410 psia
Pressurizer level	= 60 percent

Given these conditions, the pressurizer liquid is ____________ and the pressurizer vapor is ____________.

A. saturated; saturated

B. saturated; superheated

C. subcooled; saturated

D. subcooled; superheated

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P2074 (B2074)

Consider a saturated water/steam mixture at 500°F with a quality of 90 percent. If the pressure of the mixture is decreased with no heat gain or loss, the temperature of the mixture will __________ and the quality of the mixture will __________. (Assume the mixture remains saturated.)

A. decrease; decrease

B. decrease; increase

C. remain the same; decrease

D. remain the same; increase

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.16 [2.6/2.7]
QID: P2975 (B2973)

An open vessel contains one pound-mass of water at 206°F and standard atmospheric pressure. Which one of the following will be caused by the addition of 3.0 Btu to the water?

A. The water temperature will rise by approximately 3°F.

B. Approximately 3 percent of the water mass will vaporize.

C. The water density will decrease by approximately 3 percent.

D. The water will become superheated by approximately 3°F.

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.17 [3.0/3.2]
QID: P575

A nuclear reactor is shut down with reactor coolant system (RCS) pressure at 1,500 psia and core decay heat is being removed via the steam generators (SGs). What pressure must be maintained in the SGs to obtain a 110°F subcooling margin in the RCS loop cold legs? (Assume a negligible temperature difference across the SG tubes.)

A. 580 psia

B. 600 psia

C. 620 psia

D. 640 psia

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.17 [3.0/3.2]
QID: P675

Which one of the following steam generator (SG) pressures will come closest to producing a 50°F reactor coolant system (RCS) subcooling margin with RCS pressure at 1,000 psia? (Assume a negligible delta-T across the SG tubes.)

A. 550 psia

B. 600 psia

C. 650 psia

D. 700 psia

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.17 [3.0/3.2]
QID: P775

Which one of the following changes will result in increased subcooling of the condensate in the condenser hotwell?

A. Isolate one bay of the condenser circulating water system.

B. Increase circulating water temperature.

C. Decrease circulating water flow.

D. Decrease the main turbine steam flow rate.

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.24 [2.8/3.1]
QID: P1475

A nuclear power plant had been operating at 100 percent power (3,400 MWt) for six months when a main steamline break occurred, resulting in a reactor trip. The break was just isolated and all steam generators (SGs) stopped depressurizing at 700 psia. The reactor coolant system (RCS) cooldown stopped at 503°F. At the beginning of the ensuing heatup, plant conditions are as follows:

Total mass of water in the RCS and SGs:	800,000 lbm
Specific heat of RCS and SG water:	1.2 Btu/lbm-°F
Reactor coolant pump heat input to RCS:	15 MWt
Decay heat generation rate:	3 percent
RCS pressure:	1,600 psia
Feedwater flow to SGs:	Isolated

Assume that the RCS and SGs remain in thermal equilibrium during the heatup, the SGs remain saturated, and the only SG heat removal path is via the safety valve.

Approximately how long from break isolation will it take for SG pressure to reach the safety valve setpoint of 1,100 psia? (Assume that the amount of heat energy needed to vaporize SG water during the heatup is negligible.)

A. 2 minutes

B. 8 minutes

C. 16 minutes

D. 32 minutes

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.24 [2.8/3.1]
QID: P1675 (B1175)

Which one of the following is the approximate temperature of a water-steam mixture that has an enthalpy of 1,150 Btu/lbm and a quality of 95 percent?

A. 220°F

B. 270°F

C. 360°F

D. 440°F

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.24 [2.8/3.1]
QID: P6039 (B6038)

Given a set of steam tables with the following parameters for saturated steam-water mixtures:

- Pressure
- Enthalpy
- Specific volume
- Entropy
- Temperature

One can determine the ____________ of a saturated steam-water mixture given only the ____________.

A. temperature; enthalpy

B. temperature; pressure

C. pressure; entropy

D. pressure; specific volume

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.24 [2.8/3.1]
QID: P6939 (B6938)

A nuclear power plant experienced a loss of all AC electrical power due to a natural disaster. A few days later, there is turbulent boiling in the spent fuel pool. Average spent fuel temperature is elevated but stable. Assume that boiling is the only means of heat removal from the spent fuel pool.

Given the following stable current conditions:

Spent fuel decay heat rate: 4.8 MW
Spent fuel building pressure: 14.7 psia
Spent fuel pool temperature: 212°F

At what approximate rate is the mass of water in the spent fuel pool decreasing?

A. 4,170 lbm/hr

B. 4,950 lbm/hr

C. 14,230 lbm/hr

D. 16,870 lbm/hr

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.24 [2.8/3.1]
QID: P7039 (B7038)

Given the following initial conditions for a spent fuel pool:

- Spent fuel decay heat rate: 5.0 Mw
- Spent fuel pool water temperature: 90°F
- Spent fuel pool water mass: 2.5×10^6 lbm
- Spent fuel pool water specific heat: 1.0 Btu/lbm-°F
- Spent fuel pool surface pressure: 14.7 psia

If a complete loss of spent fuel pool cooling occurs, how long will it take for spent fuel pool water temperature to reach 212°F? (Assume that the spent fuel pool remains in thermal equilibrium, and that there is no heat removal from the spent fuel pool.)

A. 18 hours

B. 31 hours

C. 48 hours

D. 61 hours

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P75

Which one of the following is the approximate reactor coolant system subcooling margin when reactor coolant temperature is 280°F and pressurizer pressure is 400 psig?

A. 165°F

B. 168°F

C. 265°F

D. 268°F

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P141

Given the following reactor coolant system (RCS) parameters, determine the approximate RCS subcooling margin.

RCS pressure = 2,235 psig
RCS hot leg temperature = 610°F

A. 25°F

B. 31°F

C. 38°F

D. 43°F

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P275 (B275)

The saturation pressure for water at 328°F is approximately...

A. 85 psig.

B. 100 psig.

C. 115 psig.

D. 130 psig.

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P376

If a wet vapor is at 130°F and has a quality of 90 percent, its specific enthalpy is approximately...

A. 1,015 Btu/lbm.

B. 1,093 Btu/lbm.

C. 1,118 Btu/lbm.

D. 1,216 Btu/lbm.

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P385

Given the following nuclear power plant conditions:

Core Thermal Power = 3,400 MW
RCS T_{ave} = 573.5°F
SG T_{stm} = 513.5°F

A nuclear power plant is shut down for maintenance, during which 5.0 percent of the total steam generator (SG) tubes are plugged. Upon completion of the maintenance, the plant is returned to 3,400 MW with RCS mass flow rate and RCS temperatures unchanged.

Which one of the following is the approximate new SG steam pressure with the plant at 3,400 MW?

A. 711 psia

B. 734 psia

C. 747 psia

D. 762 psia

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P474

Main condenser hotwell condensate is 4°F subcooled at a temperature of 112°F. What is the condenser pressure?

A. 1.78 psia

B. 1.51 psia

C. 1.35 psia

D. 1.20 psia

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P1275

If steam pressure is 230 psia at a temperature of 900°F, what is the approximate amount of superheat?

A. 368°F

B. 393°F

C. 506°F

D. 535°F

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P1775 (B1776)

Which one of the following is the approximate amount of heat required to convert 3 lbm of water at 100°F and 100 psia to a saturated vapor at 100 psia?

A. 889 Btu

B. 1,119 Btu

C. 2,666 Btu

D. 3,358 Btu

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P1875

Saturated steam undergoes an ideal expansion process in an ideal turbine from 1,000 psia to 28 inches Hg vacuum. Approximately how much specific work is being performed by the turbine?

A. 1,193 Btu/lbm

B. 805 Btu/lbm

C. 418 Btu/lbm

D. 388 Btu/lbm

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P2275 (B2275)

1.0 x 10^6 lbm/hr saturated steam at 30 percent steam quality is leaving a main turbine and entering a condenser at 2.0 psia. Condensate is entering the hotwell at 118°F.

Which one of the following is the approximate condenser heat transfer rate?

A. 3.1 x 10^8 Btu/hr

B. 5.8 x 10^8 Btu/hr

C. 7.2 x 10^8 Btu/hr

D. 9.9 x 10^8 Btu/hr

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P2375 (B2374)

Which one of the following is the approximate amount of heat required to convert 2.0 lbm of water at 100°F and 100 psia to a saturated vapor at 100 psia?

A. 1,119 Btu

B. 1,187 Btu

C. 2,238 Btu

D. 2,374 Btu

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P2475 (B2475)

A steam line is carrying steam at 500 psia and 507°F. Approximately how much ambient heat loss is required before moisture formation occurs in the steam line?

A. 31 Btu/lbm

B. 45 Btu/lbm

C. 58 Btu/lbm

D. 71 Btu/lbm

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P2575 (B2575)

Which one of the following is the approximate amount of heat required to convert 2.0 lbm of water at 100°F and 100 psia to a superheated vapor at 400°F and 100 psia?

A. 1,119 Btu

B. 1,159 Btu

C. 2,238 Btu

D. 2,318 Btu

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P2675 (B2675)

What is the specific heat (Btu/lbm-°F) of water at 300°F and 100 psia?

A. 1.03 Btu/lbm-°F

B. 1.11 Btu/lbm-°F

C. 1.17 Btu/lbm-°F

D. 1.25 Btu/lbm-°F

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P2775 (B2776)

With a nuclear power plant operating near rated power, air inleakage into the main condenser causes main condenser pressure to increase from 1.0 psia to 2.0 psia.

Given the following:

- Initial main condenser condensate depression was 4°F.
- After the plant stabilizes, with main condenser pressure at 2.0 psia, main condenser condensate depression is 2°F.

Which one of the following is the approximate increase in main condenser specific heat rejection needed to restore condensate depression to 4°F?

A. 2 Btu/lbm

B. 4 Btu/lbm

C. 8 Btu/lbm

D. 16 Btu/lbm

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P2875

Given the following:

- A nuclear power plant is operating near rated power.
- The main turbine is comprised of a single unit with no reheat.
- Main turbine inlet steam conditions are 900 psia and 100 percent quality.
- Ideal steam expansion is occurring in the main turbine.
- Main condenser pressure is 1.0 psia.

Which one of the following is the approximate main condenser specific heat rejection needed to establish condensate depression at 4°F?

A. 716 Btu/lbm

B. 782 Btu/lbm

C. 856 Btu/lbm

D. 1,132 Btu/lbm

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P3074 (B3075)

The temperature of a saturated steam-water mixture is 467°F.

Which one of the following additional parameter values, when paired with the temperature, provides insufficient data to determine the approximate steam quality of the mixture?

A. Pressure at 499.96 psia

B. Enthalpy at 977.33 Btu/lbm

C. Entropy at 1.17 Btu/lbm -°R

D. Specific volume at 0.817 ft^3/lbm

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P3175 (B3175)

A steam line is carrying saturated steam vapor at 500 psia and 467°F. Approximately how much specific heat addition to the steam vapor is necessary to achieve 60°F of superheat?

A. 31 Btu/lbm

B. 45 Btu/lbm

C. 58 Btu/lbm

D. 71 Btu/lbm

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P3275 (B3274)

An ideal main turbine generator (MTG) is producing 1,000 MW of electrical power while being supplied with 100 percent quality steam at 920 psig. Steam supply pressure is then gradually increased to 980 psig at the same quality. Assume turbine control valve position and condenser vacuum remain the same.

Which one of the following describes why the MTG output increases as steam pressure increases?

A. Each lbm of steam entering the turbine has a higher specific heat.

B. Each lbm of steam entering the turbine has a higher specific enthalpy.

C. Each lbm of steam passing through the turbine expands to fill a greater volume.

D. Each lbm of steam passing through the turbine performs increased work in the turbine.

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P3475 (B3475)

Which one of the following is the approximate amount of heat required to convert 2 lbm of water at 100°F and 100 psia to a saturated vapor at 100 psia?

A. 560 Btu

B. 1,120 Btu

C. 2,238 Btu

D. 3,356 Btu

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P3575

The following stable nuclear power plant conditions existed just prior to a plant shutdown for maintenance:

Power = 100 percent
RCS T_{ave} = 572°F
SG T_{stm} = 534°F

During the shutdown, 5 percent of the total steam generator (SG) tubes were plugged. Which one of the following will be the approximate SG steam pressure when the plant is returned to 100 percent power? (Assume RCS mass flow rate and RCS T_{ave} are the same as their pre-shutdown 100 percent power values.)

A. 813 psia

B. 841 psia

C. 870 psia

D. 900 psia

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P3775 (B3774)

A 100 ft^3 vessel contains a saturated water-steam mixture at 1,000 psia. The water portion occupies 30 ft^3 and the steam portion occupies the remaining 70 ft^3. What is the approximate total mass of the mixture in the vessel?

A. 1,547 lbm

B. 2,612 lbm

C. 3,310 lbm

D. 4,245 lbm

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P3875

A nuclear power plant has been operating at full power for six months when a sustained station blackout occurs, resulting in a reactor trip and a complete loss of forced reactor coolant circulation. All means of reactor coolant injection and steam generator heat removal are unavailable. Reactor coolant system (RCS) pressure is being maintained at approximately 2,100 psia by operation of the pressurizer relief valves.

The following conditions exist five minutes after the reactor trip:

RCS pressure:	2,100 psia
Core exit thermocouple (CETC) temperature:	550°F

With RCS pressure constant at 2,100 psia, which one of the following describes the future response of the CETC temperature indication?

A. CETC indication will remain stable at approximately 550°F until the core becomes uncovered; then, CETC indication will become erratic.

B. CETC indication will remain stable at approximately 550°F until the core becomes uncovered; then, CETC indication will increase to approximately 643°F where it will become erratic.

C. CETC indication will steadily increase to approximately 643°F and stabilize; then, as the core begins to uncover, CETC indication will increase further until it becomes erratic.

D. CETC indication will steadily increase until it becomes erratic.

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P3939 (B3938)

Main steam is being used to reheat high-pressure (HP) turbine exhaust in a moisture separator reheater (MSR).

Given:

- The HP turbine exhaust enters the MSR reheater section as saturated steam (100 percent quality).
- The exhaust enters and exits the reheater section at 280 psia and a flow rate of 1.0E6 lbm/hr.
- The main steam heat transfer rate in the reheater section is 42.1E6 Btu/hr.

Which one of the following is the approximate temperature of the HP turbine exhaust leaving the reheater section of the MSR?

A. 450°F

B. 475°F

C. 500°F

D. 525°F

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P4139 (B4138)

Saturated steam at 50 percent steam quality is leaving a main turbine at a flow rate of 1.0×10^6 lbm/hr and entering a condenser at 1.6 psia. Condensate is entering the hotwell at 112°F.

Which one of the following is the approximate condenser heat transfer rate?

A. 3.1×10^8 Btu/hr

B. 3.8×10^8 Btu/hr

C. 4.5×10^8 Btu/hr

D. 5.2×10^8 Btu/hr

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P4339 (B4338)

A nuclear power plant is operating at 100 percent power. The main turbine has one high pressure (HP) unit and one low pressure (LP) unit.

Main steam enters the HP unit of the main turbine with the following parameters:

Pressure: 1,000 psia
Quality: 100 percent

The exhaust steam exits the HP unit at 200 psia, then goes through a moisture separator/reheater, and enters the LP units with the following parameters:

Pressure: 200 psia
Temperature: 500°F

The main condenser pressure is 1.0 psia. Assume that each unit of the main turbine is 100 percent efficient.

The higher enthalpy steam is being supplied to the ________ unit of the main turbine; and the greater moisture content is found in the exhaust of the ___________ unit.

A. LP; LP

B. LP; HP

C. HP; LP

D. HP; HP

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P4739 (B4738)

Consider a 100 lbm quantity of a steam-water mixture at standard atmospheric pressure. The mixture has a quality of 70 percent. Assume that pressure remains constant and there is <u>no</u> heat loss from the mixture.

Which one of the following is the approximate heat addition needed to increase the quality of the mixture to 100 percent?

A. 5,400 Btu

B. 12,600 Btu

C. 29,100 Btu

D. 67,900 Btu

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P4839 (B4838)

An open vessel contains one pound-mass of water at 204°F and standard atmospheric pressure. If 16.0 Btu of heat is added to the water, the water temperature will rise by about ___________; and approximately ___________ of the water mass will become vapor.

A. 8°F; 1 percent

B. 8°F; 10 percent

C. 16°F; 1 percent

D. 16°F; 10 percent

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P4939 (B4938)

Water enters an ideal convergent-divergent nozzle with the following parameters:

Pressure = 300 psia
Temperature = 102°F
Velocity = 50 ft/sec

The velocity of the water at the throat of the nozzle is 200 ft/sec.

Given that nozzles convert enthalpy to kinetic energy, and assuming no heat transfer to or from the nozzle, what is the approximate pressure of the water at the throat of the nozzle?

A. 296 psia

B. 150 psia

C. 75 psia

D. 50 psia

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P5039 (B5038)

An open vessel contains one pound-mass of water at 206°F and standard atmospheric pressure. Which one of the following will be caused by the addition of 12.0 Btu to the water?

A. The water temperature will rise by about 6°F and none of the water will vaporize.

B. The water temperature will rise by about 6°F and some of the water will vaporize.

C. The water temperature will rise by about 12°F and none of the water will vaporize.

D. The water temperature will rise by about 12°F and some of the water will vaporize.

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P5139 (B5138)

A feedwater pump discharges into a 16-inch diameter discharge line. Given the following:

Pump discharge pressure: 950 psia
Feedwater temperature: 300°F
Feedwater velocity: 15.2 ft/sec

What is the feedwater pump discharge flow rate in pounds-mass per hour (lbm/hr)?

A. 1.1×10^6 lbm/hr

B. 4.4×10^6 lbm/hr

C. 1.8×10^7 lbm/hr

D. 5.3×10^7 lbm/hr

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P5239 (B5238)

Saturated steam enters a frictionless convergent-divergent nozzle with the following parameters:

Pressure = 850 psia
Velocity = 10 ft/sec

The steam at the throat of the nozzle has a subsonic velocity of 950 ft/sec.

Given that nozzles convert enthalpy to kinetic energy, and assuming no heat transfer to or from the nozzle, what is the enthalpy of the steam at the throat of the nozzle?

A. 1,162 Btu/lbm

B. 1,171 Btu/lbm

C. 1,180 Btu/lbm

D. 1,189 Btu/lbm

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P5439 (B5438)

An ideal auxiliary steam turbine exhausts to the atmosphere. The steam turbine is supplied with saturated steam at 900 psia. Which one of the following is the maximum specific work (Btu/lbm) that can be extracted from the steam by the steam turbine?

A. 283 Btu/lbm

B. 670 Btu/lbm

C. 913 Btu/lbm

D. 1,196 Btu/lbm

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P5639

An ideal steam turbine exhausts to a steam condenser at 1.0 psia. The turbine is driven by saturated steam at 600 psia. What is the work (Btu/hr) of the steam turbine if the turbine steam flow rate is 200,000 lbm/hr?

A. 7.9×10^6 Btu/hr

B. 1.6×10^7 Btu/hr

C. 7.9×10^7 Btu/hr

D. 1.6×10^8 Btu/hr

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P5739 (B5738)

A steam turbine exhausts to a steam condenser at 1.0 psia. The steam turbine is supplied with saturated steam at 900 psia at a flow rate of 200,000 lbm/hr. What is the approximate rate of condensate addition to the condenser hotwell in gallons per minute (gpm)?

A. 400 gpm

B. 2,400 gpm

C. 4,000 gpm

D. 24,000 gpm

ANSWER: A.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P5939 (B5938)

What happens to the enthalpy of the saturated steam in a steam generator (SG) as heat addition to the feedwater increases SG pressure from 100 psia to 1,000 psia?

A. The enthalpy increases during the entire pressure increase.

B. The enthalpy initially increases and then decreases.

C. The enthalpy decreases during the entire pressure increase.

D. The enthalpy initially decreases and then increases.

ANSWER: B.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P6139 (B6113)

Water enters a positive displacement pump at 50 psig and 90°F. What is the available net positive suction head for the pump?

A. 80 feet

B. 114 feet

C. 133 feet

D. 148 feet

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P6339 (B6338)

Saturated steam (100 percent quality) is flowing through a reheater. The reheater inlet and outlet pressures are both 260 psia. If the reheater adds 60.5 Btu/lbm to the steam, what is the temperature of the steam exiting the reheater?

A. 405°F

B. 450°F

C. 465°F

D. 500°F

ANSWER: D.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P6439 (B6438)

An open vessel contains 5.0 lbm of water at constant standard atmospheric pressure. The water has been heated to the saturation temperature. If an additional 1,600 Btu is added to the water, the water temperature will ________, and _______ than 50 percent of the water will vaporize.

A. increase significantly; less

B. increase significantly; more

C. remain approximately constant; less

D. remain approximately constant; more

ANSWER: C.

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P6639 (B6638)

Saturated steam (100 percent quality) at 240 psia enters an ideal low pressure turbine and exhausts to a steam condenser at 1.0 psia. Compared to the entry conditions, the volumetric flow rate of the steam leaving the LP turbine will be about ______ times larger.

A. 103

B. 132

C. 174

D. 240

ANSWER: B.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P74 (B2277)

Condensate depression is the process of...

A. removing condensate from turbine exhaust steam.

B. spraying condensate into turbine exhaust steam.

C. heating turbine exhaust steam above its saturation temperature.

D. cooling turbine exhaust steam below its saturation temperature.

ANSWER: D.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P274

Excessive heat removal from the low pressure turbine exhaust steam in the main condenser will result in...

A. thermal shock.

B. loss of condenser vacuum.

C. condensate depression.

D. fluid compression.

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P477 (B277)

Main condenser pressure is 1.0 psia. During the cooling process in the condenser, the temperature of the low pressure turbine exhaust decreases to 100°F, at which time it is a...

A. saturated liquid.

B. saturated vapor.

C. subcooled liquid.

D. superheated vapor.

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P576 (B2676)

Which one of the following explains why condensate subcooling is necessary in a nuclear power plant steam cycle?

A. To provide a better condenser vacuum.

B. To maximize overall secondary efficiency.

C. To provide net positive suction head for the condensate pumps.

D. To minimize turbine blade and condenser tube erosion by entrained moisture.

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P876 (B1876)

Which one of the following is the approximate condensate subcooling in a steam condenser operating at 26 inches Hg vacuum with a condensate temperature of 100°F?

A. 2°F

B. 19°F

C. 25°F

D. 53°F

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P1076

Which one of the following is an advantage of condensate depression in the main condenser?

A. Increased secondary cycle efficiency.

B. Increased feedwater temperature entering the steam generators.

C. Increased net positive suction head available to condensate pumps.

D. Increased inventory in the main condenser hotwell.

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P1176 (B2176)

A nuclear power plant is operating at 80 percent power with 5°F of condensate depression in the main condenser. If the condensate depression increases to 10°F, plant efficiency will ____________ and the probability of condensate pump cavitation will ____________.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

ANSWER: D.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P1376

Which one of the following is the condensate depression in a steam condenser operating at 2.0 psia with a condensate temperature of 115°F?

A. 9°F

B. 11°F

C. 13°F

D. 15°F

ANSWER: B.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P1576 (B2976)

What is the approximate condensate depression in a condenser operating at 28 inches Hg vacuum with a condensate temperature of 100°F?

A. Less than 2°F

B. 3°F to 5°F

C. 6°F to 8°F

D. 9°F to 11°F

ANSWER: A.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P1977

Condensate is collecting in a main condenser hotwell at 90°F with a condenser pressure of 28 inches Hg vacuum. Which one of the following will improve steam cycle efficiency?

A. Main condenser cooling water flow rate decreases by 5 percent with no change in condenser vacuum.

B. Main condenser cooling water inlet temperature decreases by 10°F with no change in condenser vacuum.

C. Main condenser vacuum decreases to 27 inches Hg due to buildup of noncondensible gases.

D. Steam flow through the turbine decreases by 10 percent with no change in condenser vacuum.

ANSWER: A.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P2276 (B78)

The thermodynamic cycle efficiency of a nuclear power plant can be increased by...

A. decreasing power from 100 percent to 25 percent.

B. removing a high-pressure feed water heater from service.

C. lowering condenser vacuum from 29 inches to 25 inches.

D. decreasing the amount of condensate depression (subcooling).

ANSWER: D.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P2476 (B2077)

A nuclear power plant is operating at 90 percent of rated power. Main condenser pressure is 1.69 psia and hotwell condensate temperature is 120°F.

Which one of the following describes the effect of a 5 percent decrease in cooling water flow rate through the main condenser on overall steam cycle thermal efficiency?

A. Efficiency will increase because condensate depression will decrease.

B. Efficiency will increase because the work output of the main turbine will increase.

C. Efficiency will decrease because condensate depression will increase.

D. Efficiency will decrease because the work output of the main turbine will decrease.

ANSWER: D.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P2576 (B2576)

A nuclear power plant is operating at 80 percent power with 5°F of condensate depression in the main condenser. If the condensate depression decreases to 2°F, the steam cycle thermal efficiency will _____________ and the condensate pumps will operate ____________cavitation.

A. increase; closer to

B. increase; farther from

C. decrease; closer to

D. decrease; farther from

ANSWER: A.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P2976

What is the approximate value of condensate depression in a condenser operating at 27 inches Hg vacuum with a condensate temperature of 100°F?

A. 2°F

B. 4°F

C. 8°F

D. 16°F

ANSWER: D.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P3576 (B1484)

A main condenser is operating at 28 inches of Hg vacuum with a condensate outlet temperature of 92°F. Which one of the following is the approximate amount of condensate depression?

A. 5°F

B. 9°F

C. 13°F

D. 17°F

ANSWER: B.

TOPIC: 193004
KNOWLEDGE: K1.11 [2.4/2.5]
QID: P3876 (B3877)

Main turbine exhaust enters a main condenser and condenses at 126°F. The condensate is cooled to 100°F before entering the main condenser hotwell. Assuming main condenser vacuum does not change, which one of the following would improve the thermodynamic efficiency of the steam cycle?

A. Decrease main condenser hotwell level by 5 percent.

B. Increase main condenser hotwell level by 5 percent.

C. Decrease condenser cooling water flow rate by 5 percent.

D. Increase condenser cooling water flow rate by 5 percent.

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P76

A nuclear power plant is maintained at 2,000 psia with a pressurizer temperature of 636°F. A pressurizer relief safety valve is leaking to a collection tank which is being held at 10 psig. Which one of the following is the approximate temperature of the fluid downstream of the relief valve?

A. 280°F

B. 240°F

C. 190°F

D. 170°F

ANSWER: B.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P148

A pressurizer power-operated relief valve is stuck partially open with the fluid being discharged into a pressurizer relief tank. The pressurizer pressure is 2,200 psia and the relief tank pressure is 5 psig.

Which one of the following is the condition of the fluid downstream of the relief valve?

A. Superheated steam

B. Subcooled liquid

C. Dry saturated steam

D. Wet vapor

ANSWER: D.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P150

As steam goes through a throttling process in the main steam header to atmospheric leak, in which of the following parameters will there be an increase?

A. Enthalpy

B. Pressure

C. Specific volume

D. Temperature

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P276

A reactor coolant system is being maintained at 1,000 psia. A pressurizer safety/relief valve is slowly discharging to a collection tank, which is maintained at 5 psig.

Assuming 100 percent quality steam in the pressurizer vapor space, what is the approximate enthalpy of the fluid entering the tank?

A. 1,210 Btu/lbm

B. 1,193 Btu/lbm

C. 1,178 Btu/lbm

D. 1,156 Btu/lbm

ANSWER: B.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P377

What is the approximate temperature and phase of the fluid downstream of the pressurizer relief valve if it sticks partially open with 2,200 psia in the pressurizer and a 50 psia backpressure?

A. 281°F, saturated

B. 281°F, superheated

C. 332°F, saturated

D. 332°F, superheated

ANSWER: A.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P677

An operator is involved in a routine nuclear power plant shutdown with a steam bubble (100 percent quality) in the pressurizer. Pressurizer pressure is 415 psig and pressurizer pressure and level are slowly decreasing. The operator suspects a pressurizer power-operated relief valve (PORV) is partially open but the position indicating lights are not working.

Which one of the following will be the approximate PORV tailpipe temperature if the PORV is partially open? (Assume downstream pressure is atmospheric and no heat is lost from the tailpipe.)

A. 212°F

B. 280°F

C. 330°F

D. 450°F

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P877

A nuclear reactor is operating at 100 percent power. As steam escapes via a main steam header-to-atmosphere leak, which of the following parameters will increase in the leaking steam?

A. Enthalpy

B. Pressure

C. Specific volume

D. Temperature

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P1277

A heatup and pressurization of the reactor coolant system (RCS) is in progress following a maintenance shutdown. RCS pressure is 800 psia with a steam bubble in the pressurizer. Pressurizer power-operated relief valve (PORV) tailpipe temperature has been steadily rising. Assume 97.5 percent quality saturated steam in the pressurizer vapor space, PORV downstream pressure is 30 psia, and PORV leakage is an ideal throttling process.

Which one of the following is the approximate PORV tailpipe temperature if a PORV is leaking by?

A. 262°F

B. 282°F

C. 302°F

D. 322°F

ANSWER: B.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P1477

A nuclear power plant is operating at 100 percent power with steam generator pressure at 900 psia. A steam generator safety valve is leaking 100 percent saturated steam to atmosphere.

Which one of the following is the approximate temperature of the escaping steam once it reaches standard atmospheric pressure?

A. 532°F

B. 370°F

C. 308°F

D. 212°F

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P1577

A heatup and pressurization of the reactor coolant system (RCS) is in progress following a maintenance shutdown. RCS pressure is 800 psia with a steam bubble in the pressurizer. Pressurizer power-operated relief valve (PORV) tailpipe temperature has been steadily rising. The pressurizer vapor space contains 96.0 percent quality saturated steam and PORV downstream pressure is 20 psia.

Assuming PORV leakage is an ideal throttling process, which one of the following will be the approximate PORV tailpipe temperature if a PORV is leaking by?

A. 228°F

B. 260°F

C. 284°F

D. 320°F

ANSWER: B.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P1677

A nuclear power plant is being maintained at 2,220 psig. A pressurizer relief valve is leaking saturated steam (100 percent quality) to a collection tank which is being held at 20 psig.

Neglecting heat losses to ambient, which one of the following is the approximate temperature of the fluid downstream of the relief valve?

A. 162°F

B. 228°F

C. 259°F

D. 320°F

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P1777

Which one of the following is essentially a constant enthalpy process?

A. Steam flowing through an ideal convergent nozzle.

B. Condensation of turbine exhaust in a main condenser.

C. Expansion of main steam through the stages of an ideal turbine.

D. Throttling of main steam through main turbine steam inlet valves.

ANSWER: D.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P2077 (B2075)

A nuclear power plant is operating with the following main steam parameters at a main turbine steam inlet valve:

Pressure: 900 psia
Quality: 98 percent

The main turbine steam chest pressure is 400 psia. Which one of the following is the quality of the steam in the steam chest?

A. 97 percent

B. 98 percent

C. 99 percent

D. 100 percent

ANSWER: A.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P2377

A heatup and pressurization of the reactor coolant system (RCS) is in progress following a maintenance shutdown. RCS pressure is 800 psia with a steam bubble in the pressurizer. Pressurizer power-operated relief valve (PORV) tailpipe temperature has been steadily rising. The pressurizer vapor space contains 96.0 percent quality saturated steam and PORV downstream pressure is 20 psia.

Assuming PORV leakage is an ideal throttling process, which one of the following will be the approximate PORV tailpipe temperature and phase of escaping fluid if a PORV is leaking by?

A. 254°F, saturated

B. 254°F, superheated

C. 228°F, saturated

D. 228°F, superheated

ANSWER: B.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P2876

Refer to the drawing of two 1,000 ft^3 pressure vessels with installed relief valves (see figure below).

Both vessels are in saturated conditions at 281°F and approximately 35 psig. Vessel A is completely filled with saturated water. Vessel B contains one-half saturated steam (100 percent quality) volume and one-half saturated water (0 percent quality) volume. Both vessels are protected by identical relief valves.

If both relief valves begin to leak at a rate of 0.1 percent of design flow, the higher temperature fluid will initially be leaving the relief valve of vessel ________. And, if 100 lbm of fluid is released through both relief valves, the larger pressure decrease will occur in vessel ________.

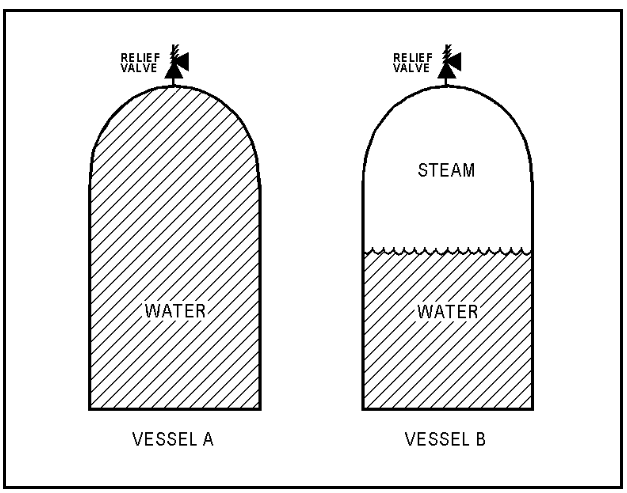
A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: D.



TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P3077 (B3074)

A nuclear power plant is operating at 100 percent power. Steam is escaping to atmosphere through a flange leak in a steam supply line to the low pressure section of the main turbine.

Given:

- Steam line pressure is 300 psia.
- Steam line temperature is 440°F.

What is the approximate temperature of the steam as it reaches standard atmospheric pressure?

A. 212°F

B. 268°F

C. 322°F

D. 358°F

ANSWER: D.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P3277

A nuclear power plant is operating at 100 percent power. Steam is escaping to atmosphere through a flange leak in a steam supply line to the low pressure section of the main turbine.

Given:

- Steam line pressure is 280 psia.
- Steam line temperature is 450°F.

What is the approximate temperature of the steam as it reaches standard atmospheric pressure?

A. 212°F

B. 268°F

C. 322°F

D. 378°F

ANSWER: D.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P3477

A pressurizer safety valve is leaking by, allowing the 100 percent quality steam in the pressurizer to flow to the pressurizer relief tank (PRT). The reactor has been shut down, and a plant cooldown and depressurization are in progress. PRT pressure is being maintained constant at 35 psia.

Which one of the following describes how the safety valve tailpipe temperature will be affected as pressurizer pressure slowly decreases from 1,500 psia to 500 psia? (Assume there is <u>no</u> ambient heat loss from the tailpipe.)

A. Increases, because the entropy of the pressurizer steam will be increasing.

B. Increases, because the enthalpy of the pressurizer steam will be increasing.

C. Decreases, because the mass flow rate of the leaking steam will be decreasing.

D. Decreases, because the temperature of the pressurizer steam will be decreasing.

ANSWER: B.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P3577 (B3575)

Saturated steam (100 percent quality) at 1,000 psia is being supplied to the inlet of a partially-open steam throttle valve on a main turbine. Pressure in the steam chest downstream of the throttle valve is 150 psia. Assume a typical throttling process with no heat gain or loss to/from the steam.

When compared to the conditions at the inlet to the throttle valve, which one of the following describes the conditions in the steam chest for specific enthalpy and entropy?

	Steam Chest Specific Enthalpy	Steam Chest Specific Entropy
A.	About the same	About the same
B.	About the same	Significantly higher
C.	Significantly lower	About the same
D.	Significantly lower	Significantly higher

ANSWER: B.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P3677 (B3675)

A nuclear power plant is shutdown and steam is escaping to atmosphere through a leak in a main steam line. If main steam line pressure is 300 psia, what is the approximate temperature of the steam as it reaches standard atmospheric pressure? (Assume the steam in the main steam line has a quality of 100 percent.)

A. 212°F

B. 268°F

C. 322°F

D. 358°F

ANSWER: C.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P4040

A heatup and pressurization of a reactor coolant system (RCS) is in progress following a maintenance shutdown. RCS pressure is 1,000 psia with a steam bubble in the pressurizer. Pressurizer power-operated relief valve (PORV) tailpipe temperature has been steadily rising. The pressurizer vapor space contains 100.0 percent quality saturated steam and PORV downstream pressure is 40 psia.

Assuming PORV leakage is an ideal throttling process, which one of the following will be the approximate PORV tailpipe temperature and phase of escaping fluid if a PORV is leaking by?

A. 267°F, saturated

B. 267°F, superheated

C. 312°F, saturated

D. 312°F, superheated

ANSWER: D.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P5340 (B5338)

A nuclear power plant is operating with the following main steam parameters at a main turbine steam inlet valve:

Pressure: 900 psia
Quality: 99 percent

The main turbine steam chest pressure is 300 psia. Which one of the following is the quality of the steam in the steam chest?

A. 100 percent

B. 98 percent

C. 88 percent

D. 87 percent

ANSWER: B.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P5640

A pressurizer safety valve is leaking by, allowing the 100 percent quality steam from the pressurizer to enter the discharge pipe, which remains at a constant pressure of 30 psig. Initial safety valve discharge pipe temperature is elevated but stable. Assume no heat loss from the safety valve discharge pipe.

Upon discovery of the leak, the reactor is shut down and a plant cooldown and depressurization are commenced. With the leak still present, as pressurizer pressure slowly decreases from 2,000 psig to 1,800 psig, the safety valve discharge pipe temperature will...

A. decrease, because the entropy of the safety valve discharge will be decreasing.

B. decrease, because the enthalpy of the safety valve discharge will be decreasing.

C. increase, because the safety valve discharge will become more superheated as pressurizer pressure decreases.

D. remain the same, because the safety valve discharge will remain a saturated steam-water mixture at 30 psig.

ANSWER: D.

TOPIC: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P6540 (B6538)

A nuclear power plant is operating at power. Steam is escaping to atmosphere through a flange leak in a steam supply line to the low pressure section of the main turbine.

Given:

- Steam line pressure is 200 psia.
- Steam line temperature is 400°F.

Assuming no heat transfer to/from the steam, what is the approximate temperature of the steam as it reaches atmospheric pressure?

A. 212°F

B. 284°F

C. 339°F

D. 375°F

ANSWER: C.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P77

Overall nuclear power plant thermal efficiency will decrease if...

A. the temperature of the steam at the turbine exhaust increases.

B. additional moisture is removed from the steam entering the turbine.

C. the temperature of the feedwater entering the steam generator increases.

D. the amount of condensate depression (subcooling) in the main condenser decreases.

ANSWER: A.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P277

Which one of the following will cause overall nuclear power plant thermal efficiency to increase?

A. Increasing total steam generator blowdown from 30 gpm to 40 gpm.

B. Changing steam quality from 99.7 to 99.9 percent.

C. Bypassing a feedwater heater during normal plant operations.

D. Increasing condenser pressure from 1 psia to 2 psia.

ANSWER: B.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P378 (B3578)

Steam turbines X and Y are identical 100 percent efficient turbines that exhaust to a condenser at 1.0 psia. Saturated steam at 250 psia enters turbine X. Superheated steam at 250 psia and 500°F enters turbine Y.

Which one of the following lists the percentage of moisture at the exhaust of turbines X and Y?

	Turbine X	Turbine Y
A.	24.5%	20.5%
B.	26.3%	13.0%
C.	24.5%	13.0%
D.	26.3%	20.5%

ANSWER: A.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P379

Which one of the following actions will decrease overall nuclear power plant thermal efficiency?

A. Reducing turbine inlet steam moisture content

B. Reducing condensate depression

C. Increasing turbine exhaust pressure

D. Increasing temperature of feedwater entering the steam generators

ANSWER: C.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P478

To achieve maximum overall nuclear power plant thermal efficiency, feed water should enter the steam generator (SG) ______________ and the pressure difference between the SG and the condenser should be as ______________ as possible.

A. as subcooled as practical; great

B. as subcooled as practical; small

C. close to saturation; great

D. close to saturation; small

ANSWER: C.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P878

Feed water heating increases overall nuclear power plant thermal efficiency because...

A. the average temperature at which heat is transferred in the steam generators is increased.

B. less steam flow passes through the turbine, thereby increasing turbine efficiency.

C. increased feed water temperature lowers the temperature at which heat is rejected in the condenser.

D. less power is required by the feed water pumps to pump the warmer feed water.

ANSWER: A.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P978

Which one of the following changes will increase the overall nuclear power plant thermal efficiency?

A. Decreasing the temperature of the feedwater entering the steam generators.

B. Decreasing the superheat of the steam entering the low pressure turbines.

C. Decreasing the circulating water flow rate through the main condenser.

D. Decreasing the concentration of noncondensible gases in the main condenser.

ANSWER: D.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P1378

Which one of the following actions will result in a decrease in overall nuclear power plant thermal efficiency?

A. Increasing steam quality by adding additional heat to the steam prior to entering the turbine.

B. Increasing the temperature of the feed water entering the steam generator.

C. Decreasing the amount of condensate depression in the main condenser.

D. Decreasing the amount of turbine steam extracted for feed water heating.

ANSWER: D.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P1478

Turbine X and turbine Y are ideal steam turbines that exhaust to a condenser at 1.0 psia. Turbine X is driven by saturated steam (100 percent quality) at 900 psia. Turbine Y is driven by superheated steam at 500 psia and 620°F.

The greatest amount of work is being performed by turbine ______, and the greatest moisture content exists in the exhaust of turbine ______.

A. X; Y

B. X; X

C. Y; Y

D. Y; X

ANSWER: D.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P1678

Turbine X and turbine Y are ideal steam turbines that exhaust to a condenser at 1.0 psia. Turbine X is driven by saturated steam (100 percent quality) at 500 psia. Turbine Y is driven by saturated steam (100 percent quality) at 700 psia.

The greatest amount of specific work is being performed by turbine ______; the greatest moisture content exists in the exhaust of turbine ______.

A. X; X

B. X; Y

C. Y; X

D. Y; Y

ANSWER: D.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P1878 (B1879)

A nuclear power plant is operating at 85 percent power when the extraction steam to a high-pressure feedwater heater is isolated. After the transient, the operator returns reactor power to 85 percent and stabilizes the plant. Compared to conditions just prior to the transient, current main turbine generator output (MWe) is...

A. higher because increased steam flow causes the turbine generator to pick up load.

B. lower because decreased steam flow causes the turbine generator to reject load.

C. higher because plant efficiency has increased.

D. lower because plant efficiency has decreased.

ANSWER: D.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P1980 (B1679)

A nuclear power plant is initially operating at steady state 85 percent reactor power when extraction steam to a high-pressure feedwater heater is isolated. Main generator load is returned to its initial value. When the plant stabilizes, reactor power will be __________ than 85 percent, and overall plant thermal efficiency will be __________.

A. greater; lower

B. greater; higher

C. less; lower

D. less; higher

ANSWER: A.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P2078

A nuclear power plant is operating at 90 percent power. Main condenser pressure is 1.7 psia and hotwell condensate temperature is 120°F.

If main condenser cooling water flow rate is reduced by 5 percent, overall steam cycle efficiency will...

A. increase because condensate depression will decrease.

B. decrease because condensate depression will increase.

C. increase because the work output of the main turbine will increase.

D. decrease because the work output of the main turbine will decrease.

ANSWER: D.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P2178 (B2178)

If superheating of the inlet steam to a low pressure turbine is reduced, low pressure turbine work output will _______; and low pressure turbine exhaust steam moisture content will ________. (Assume steam mass flow rate does not change.)

A. remain the same; increase

B. remain the same; decrease

C. decrease; increase

D. decrease; decrease

ANSWER: C.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P2278 (B2978)

If the moisture content of the steam supplied to a main turbine increases, (assume no change in steam pressure, condenser pressure, or control valve position) turbine work will...

A. decrease, because the enthalpy of the steam being supplied to the turbine has decreased.

B. decrease, because moist steam is more likely to leak between turbine stages.

C. increase, because the enthalpy of the steam being supplied to the turbine has increased.

D. increase, because moist steam is less likely to leak between turbine stages.

ANSWER: A.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P2478

Turbine X is an ideal steam turbine that exhausts to a condenser at 1.0 psia. Turbine X is driven by saturated steam (100 percent quality) at 500 psia. Which one of the following lists the approximate specific work output of turbine X and the moisture content of the steam exiting turbine X?

	Specific Work	Moisture Content
A.	388 Btu/lbm	72%
B.	388 Btu/lbm	28%
C.	817 Btu/lbm	72%
D.	817 Btu/lbm	28%

ANSWER: B.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P2678 (B1978)

If the moisture content of the steam supplied to a main turbine decreases, the overall steam cycle efficiency will increase because the...

A. operating temperature of the turbine blades has increased.

B. reheat capacity of the turbine extraction steam has increased.

C. mass flow rate of the steam through the turbine has increased.

D. enthalpy of the steam being supplied to the turbine has increased.

ANSWER: D.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P2778 (B2774)

The theoretical maximum efficiency of a steam cycle is given by the equation:

$$Eff_{thmax} = (1 - T_{out}/T_{in}) \times 100\%,$$

where T_{out} is the absolute temperature for heat rejection and T_{in} is the absolute temperature for heat addition. (Fahrenheit temperature is converted to absolute temperature by adding 460°.)

A nuclear power plant is operating with a stable steam generator pressure of 900 psia. What is the approximate theoretical maximum steam cycle efficiency this plant can achieve by establishing its main condenser vacuum at 1.0 psia?

A. 35 percent

B. 43 percent

C. 57 percent

D. 65 percent

ANSWER: B.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P3078 (B3077)

Which one of the following will be caused by a decrease in main condenser vacuum (higher absolute pressure) on a nuclear power plant operating at full power? (Assume main steam flow rate and condenser circulating water flow rate are unchanged.)

A. Decrease in the condensate temperature.

B. Decrease in the ideal steam cycle efficiency.

C. Decrease in the condensate pump required NPSH.

D. Decrease in the mass of noncondensible gas in the condenser.

ANSWER: B.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P3378 (B1278)

A nuclear power plant was initially operating at steady-state 90 percent reactor power when heating steam (supplied from main turbine extraction steam) to the feedwater heaters was isolated. With heating steam still isolated, reactor power was returned to 90 percent and the plant was stabilized.

Compared to the initial main generator MW output, the current main generator MW output is...

A. lower, because the steam cycle is less efficient.

B. higher, because the steam cycle is less efficient.

C. lower, because more steam heat energy is available to the main turbine.

D. higher, because more steam heat energy is available to the main turbine.

ANSWER: A.

TOPIC: 193005
KNOWLEDGE: K1.03 [2.5/2.6]
QID: P4441

Consider the steam cycle thermal efficiency of a nuclear power plant operating at rated power.

If the pressure at which saturated steam is produced in the steam generators is increased, thermal efficiency will ________; and if the temperature of the feedwater entering the steam generators is increased, thermal efficiency will ________.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P78

The possibility of water hammer in a liquid system is minimized by...

A. maintaining temperature above the saturation temperature.

B. starting centrifugal pumps with the casing vent valve fully open.

C. starting positive displacement pumps with the discharge valve closed.

D. venting systems prior to starting centrifugal pumps.

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P278

Which one of the following methods will increase the possibility and/or severity of water hammer?

A. Opening and closing system valves slowly.

B. Venting fluid systems prior to starting a pump.

C. Starting a centrifugal pump with the discharge valve fully open.

D. Starting a centrifugal pump with the discharge valve fully closed.

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P679 (B279)

A sudden stop of fluid flow in a piping system, due to rapid closure of an isolation valve, will most likely result in...

A. check valve slamming.

B. pump runout.

C. water hammer.

D. pressurized thermal shock.

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P879

One reason for keeping condensate out of the steam lines is to...

A. minimize corrosion buildup.

B. reduce heat losses.

C. eliminate steam traps.

D. prevent water/steam hammer.

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P1079

The possibility of water hammer will be increased by...

A. maintaining the discharge line filled with liquid on an automatically starting pump.

B. condensation in a steam line just prior to initiating flow.

C. warming steam lines prior to initiating steam flow.

D. slowly closing the discharge valve on an operating pump.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P1279

To minimize the possibility of water hammer when initiating flow in a system, the operator should...

A. vent the system prior to initiating flow.

B. vent the system only after flow has been initiated.

C. fully open the pump discharge valve prior to starting a pump.

D. rapidly open the pump discharge valve after a pump is running.

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P1879 (B2779)

Which one of the following describes why large steam lines are gradually warmed instead of suddenly admitting full steam flow?

A. To minimize the possibility of stress corrosion cracking of the steam lines.

B. To minimize the total thermal expansion of the steam lines.

C. To minimize the potential for water hammer in the steam lines.

D. To minimize the heat loss from the steam lines.

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P2079 (B2081)

Which one of the following will minimize the possibility of water hammer?

A. Draining the discharge line of a centrifugal pump after shutdown.

B. Draining condensate out of steam lines before and after initiating flow.

C. Starting a centrifugal pump with its discharge valve fully open.

D. Starting a positive displacement pump with its discharge valve partially closed.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P2279 (B2679)

Which one of the following operating practices minimizes the possibility of water hammer?

A. Change valve position as rapidly as possible.

B. Start a centrifugal pump with the discharge valve throttled.

C. Start a positive displacement pump with the discharge valve closed.

D. Vent a system only after initiating system flow.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P4042 (B4041)

Refer to the drawing of two lengths of 6-inch diameter pipe, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing

Water at 65°F is flowing at 1,000 gpm through each pipe. If the isolation valves instantly close, valve A and its associated piping will experience a pressure increase that is _________ the pressure increase experienced by valve B and its associated piping. The pressure spike will dissipate quicker in the _________ length of pipe.

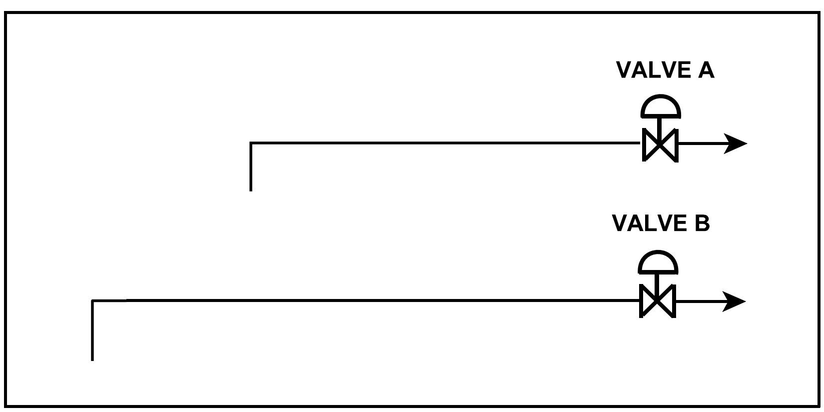
A. equal to; shorter

B. equal to; longer

C. less than; shorter

D. less than; longer

ANSWER: A.



TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P6242 (B6241)

Refer to the drawing of two lengths of 16-inch diameter pipe, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing.

Water is flowing at 10,000 gpm through each pipe when both isolation valves instantly close. Consider two cases:

Case 1: The water temperature upstream of both valves is 65°F.
Case 2: The water temperature is 65°F upstream of valve A, and 85°F upstream of valve B.

For which case(s), if any, will valve A experience a pressure spike that is greater than the pressure spike at valve B?

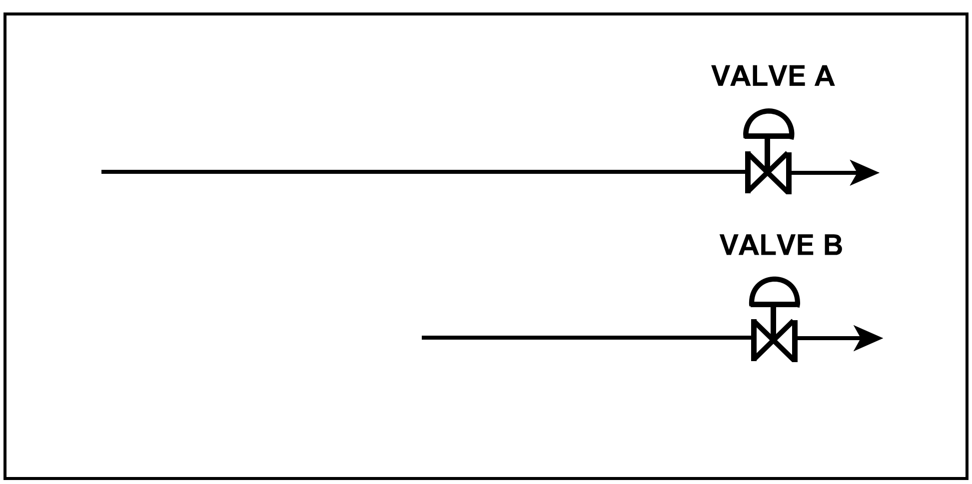
A. Case 1 only

B. Case 2 only

C. Both cases

D. Neither case

ANSWER: B.



TOPIC: 193006
KNOWLEDGE: K1.04 [3.4/3.6]
QID: P6742 (B6741)

Refer to the drawing of two lengths of 16-inch diameter pipe, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing.

Water is flowing at 10,000 gpm through each pipe when both isolation valves instantly close.

Consider two cases:

Case 1: The water temperature upstream of both valves is 65°F.
Case 2: The water temperature is 85°F upstream of valve A, and 65°F upstream of valve B.

For which case(s), if any, will valve A experience a pressure spike that is greater than the pressure spike at valve B?

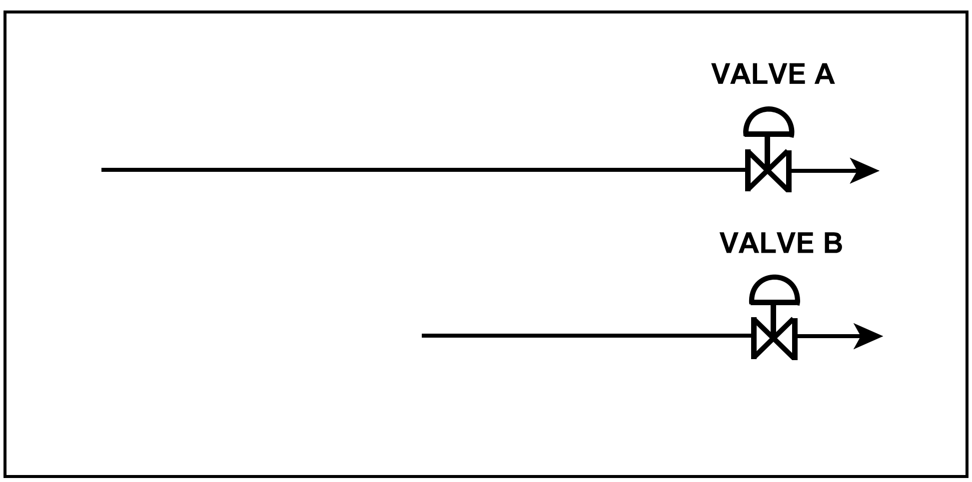
A. Case 1 only

B. Case 2 only

C. Both cases

D. Neither case

ANSWER: D.



TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P380 (B383)

An 85 gpm leak has developed in a cooling water system that is operating at 100 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 50 psig?

A. 60.1 gpm

B. 51.7 gpm

C. 42.5 gpm

D. 33.3 gpm

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P579

Mass flow rate equals volumetric flow rate (V) times...

A. specific volume.

B. density.

C. specific gravity.

D. velocity.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P680 (B681)

A 55 gpm leak to atmosphere has developed from a cooling water system that is operating at 100 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 50 psig?

A. 27.5 gpm

B. 31.8 gpm

C. 38.9 gpm

D. 43.4 gpm

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1382

A 75 gpm leak to atmosphere has developed from a cooling water system that is operating at 80 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 40 psig?

A. 37.5 gpm

B. 43.5 gpm

C. 53 gpm

D. 59 gpm

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1580 (B1979)

A 60 gpm leak to atmosphere has developed from a cooling water system that is operating at 150 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 75 psig?

A. 15.0 gpm

B. 30.0 gpm

C. 42.4 gpm

D. 53.1 gpm

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1679 (B2981)

A 100 gpm leak to atmosphere has developed from a cooling water system that is operating at 60 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 20 psig?

A. 33.3 gpm

B. 53.0 gpm

C. 57.7 gpm

D. 70.7 gpm

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1779 (B1783)

A 100 gpm leak to atmosphere has developed from a cooling water system that is operating at 45 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 30 psig?

A. 25 gpm

B. 50 gpm

C. 67 gpm

D. 82 gpm

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1986

A 47 gpm leak to atmosphere has developed from a cooling water system that is operating at 150 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 75 psig?

A. 23.5 gpm

B. 33.2 gpm

C. 36.5 gpm

D. 37.3 gpm

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2080 (B2080)

An 80 gpm leak to atmosphere has developed from a cooling water system that is operating at 100 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 75 psig?

A. 69 gpm

B. 60 gpm

C. 51 gpm

D. 40 gpm

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2379 (B2381)

A 60 gpm leak to atmosphere has developed from a cooling water system that is operating at 150 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 100 psig?

A. 27 gpm

B. 35 gpm

C. 40 gpm

D. 49 gpm

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2779 (B2781)

An 80 gpm leak to atmosphere has developed from a cooling water system that is operating at 150 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 75 psig?

A. 20 gpm

B. 40 gpm

C. 49 gpm

D. 57 gpm

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2980

An 80 gpm leak to atmosphere has developed from a cooling water system that is operating at 150 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 100 psig?

A. 36 gpm

B. 53 gpm

C. 56 gpm

D. 65 gpm

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P3080 (B3181)

A 75 gpm leak to atmosphere has developed from a cooling water system that is operating at 100 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 80 psig?

A. 26.5 gpm

B. 38.9 gpm

C. 56.4 gpm

D. 67.1 gpm

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P3780

Which one of the following describes the relationship between the main steam mass flow rate leaving a steam generator and the main feedwater mass flow rate entering the same steam generator at steady-state power operation? (Assume no other addition/removal of steam generator inventory.)

A. The mass flow rates will be the same only if downcomer level is constant.

B. The mass flow rates will be the same only if the reactor is operating near rated power.

C. The main steam mass flow rate is smaller than the main feedwater mass flow rate by the amount of moisture removed by the steam generator moisture separators.

D. The main steam mass flow rate is greater than the main feedwater mass flow rate by the amount of moisture removed by the steam generator moisture separators.

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P5342 (B5342)

A heat exchanger has the following initial cooling water inlet temperature and differential pressure (ΔP) parameters:

Inlet Temperature = 70°F
Heat Exchanger ΔP = 10 psi

Six hours later, the current heat exchanger cooling water parameters are:

Inlet Temperature = 85°F
Heat Exchanger ΔP = 10 psi

In comparison to the initial cooling water mass flow rate, the current mass flow rate is...

A. lower because the density of the cooling water has decreased.

B. higher because the velocity of the cooling water has increased.

C. the same because the changes in cooling water velocity and density offset.

D. the same because the heat exchanger cooling water ΔP is the same.

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.06 [2.8/2.9]
QID: P580

Reactor coolant system (RCS) hot leg temperature is 568°F and RCS pressure is decreasing due to a small leak. Which one of the following pressure ranges includes the pressure at which two-phase flow will first occur in the hot leg?

A. 1,250 to 1,201 psig

B. 1,200 to 1,151 psig

C. 1,150 to 1,101 psig

D. 1,100 to 1,051 psig

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.06 [2.8/2.9]
QID: P1180

Reactor coolant system (RCS) hot leg temperature is constant at 538°F while RCS pressure is decreasing due to a small reactor coolant leak. Which one of the following RCS pressure ranges includes the pressure at which two-phase flow will first occur in the hot leg?

A. 1,100 to 1,151 psig

B. 1,050 to 1,001 psig

C. 1,000 to 951 psig

D. 950 to 901 psig

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.06 [2.8/2.9]
QID: P1480

Reactor coolant system (RCS) hot leg temperature is 520°F and RCS pressure is decreasing due to a small leak. Which one of the following pressure ranges includes the pressure at which two-phase flow will first occur in the hot leg?

A. 950 to 901 psig

B. 900 to 851 psig

C. 850 to 801 psig

D. 800 to 751 psig

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.06 [2.8/2.9]
QID: P2581

Reactor coolant system (RCS) hot leg temperature is 552°F and RCS pressure is decreasing due to a small leak. Which one of the following pressure ranges includes the pressure at which two-phase flow will first occur in the hot leg?

A. 1,100 to 1,051 psig

B. 1,050 to 1,001 psig

C. 1,000 to 951 psig

D. 950 to 901 psig

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.07 [2.7/2.7]
QID: P581

A nuclear power plant is recovering from a loss of offsite power that caused all reactor coolant pumps (RCPs) to stop. Pressurizer level indication is off-scale high.

Which one of the following is most likely to occur if the steam generator (SG) temperatures are 50°F higher than their associated reactor coolant system (RCS) loop temperatures when an RCP is restarted?

A. Localized water hammer in the RCS.

B. Pressurized thermal shock to the SGs.

C. A large pressure spike throughout the RCS.

D. Inadvertent lifting of a SG atmospheric relief valve.

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.08 [2.8/1.8]
QID: P279 (B143)

A centrifugal water pump was returned to service after maintenance. However, the operator failed to vent the pump.

Compared to normal pump operating conditions, after the pump is started the operator will see a __________ flow rate and a __________ discharge head.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P3481

Refer to the drawing of a cooling water system (see figure below).

Centrifugal pump A is circulating water at 100°F. Which one of the following will cause the centrifugal pump to operate closer to a condition in which gas/vapor binding can occur?

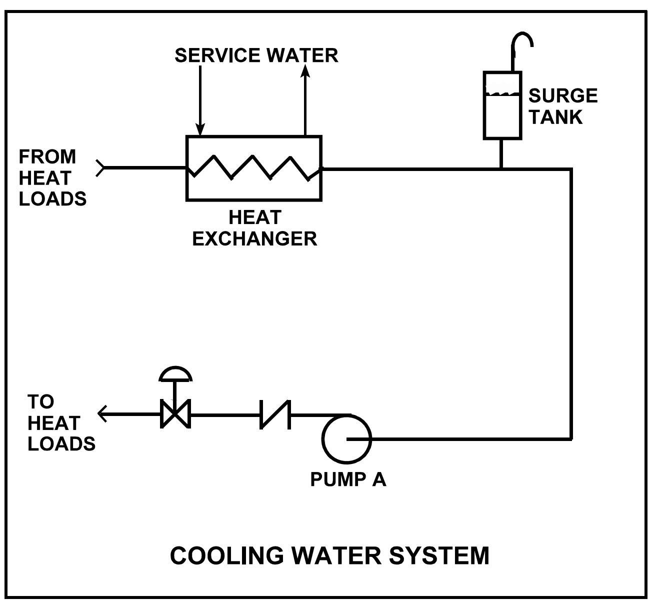
A. Surge tank level is raised by 5 percent.

B. Service water flow rate is decreased by 5 percent.

C. The pump discharge valve is used to decrease cooling water system flow rate by 5 percent.

D. Makeup water containing a high concentration of total dissolved solids is added to the cooling water system.

ANSWER: B.



TOPIC: 193006
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P80 (B79)

The piping system pressure change caused by suddenly stopping fluid flow is referred to as...

A. cavitation.

B. shutoff head.

C. water hammer.

D. flow head.

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P381 (B380)

The major concern with starting a main feedwater pump with downstream fluid in a saturated condition is...

A. cavitation.

B. water hammer.

C. thermal shock.

D. positive reactivity addition.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P2480 (B1180)

Which one of the following will increase the possibility of water hammer?

A. Opening and closing system valves very slowly

B. Venting liquid systems only after initiating system flow

C. Starting centrifugal pumps with the discharge valve closed

D. Starting positive displacement pumps with the discharge valve open

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P2880

The primary reason for slowly opening the discharge valve of a large motor-driven centrifugal cooling water pump after starting the pump is to minimize the...

A. net positive suction head requirements.

B. potential for a water hammer.

C. motor running current requirements.

D. potential for pump cavitation.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P79

Cavitation in an operating pump may be caused by...

A. lowering the pump suction temperature.

B. throttling the pump suction valve.

C. increasing the pump backpressure.

D. increasing the pump suction pressure.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P149

Cavitation of a centrifugal pump in an open system is indicated by __________ discharge pressure and __________ flow rate.

A. low; low

B. high; high

C. low; high

D. high; low

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P382 (B80)

Which one of the following is most likely to cause cavitation of an operating centrifugal pump?

A. Lowering the suction temperature.

B. Throttling the pump suction valve.

C. Throttling the pump discharge valve.

D. Decreasing the pump speed.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P481

While on surveillance rounds, an operator notices that a centrifugal pump is making a great deal of noise (like marbles rattling inside the pump casing) and the discharge pressure is fluctuating.

This set of conditions indicates pump...

A. runout.

B. cavitation.

C. bearing deterioration.

D. packing deterioration.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P882

Cavitation in an operating centrifugal pump may be caused by...

A. decreasing the pump suction temperature.

B. throttling down on the pump suction valve.

C. throttling down on the pump discharge valve.

D. decreasing the pump speed.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P1181

Which one of the following contains indications of pump cavitation?

A. Abnormally low discharge pressure and flow rate.

B. Abnormally high discharge pressure and flow rate.

C. Abnormally low discharge pressure and abnormally high flow rate.

D. Abnormally high discharge pressure and abnormally low flow rate.

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P1381

Cavitation is the formation of vapor bubbles in the ____________ of a pump and the subsequent collapse of these bubbles in the pump ____________.

A. impeller; casing

B. impeller; discharge piping

C. volute; casing

D. volute; discharge piping

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P2680 (B280)

Cavitation is the formation of vapor bubbles in the ______________ pressure area of a pump followed by the ______________ of these bubbles within the pump casing.

A. low; expansion

B. low; collapse

C. high; expansion

D. high; collapse

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P2981 (B1880)

Which of the following completes the following statement?

Pump cavitation occurs when vapor bubbles are formed at the eye of a pump impeller...

A. because the localized flow velocity exceeds sonic velocity for the existing fluid temperature.

B. because the localized pressure exceeds the vapor pressure for the existing fluid temperature.

C. and enter a high pressure region of the pump where they collapse causing damaging pressure pulsations.

D. and are discharged from the pump where they expand into larger bubbles causing damaging pressure pulsations.

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.12 [2.5/2.6]
QID: P81

In an operating cooling water system with a constant water velocity, if water temperature decreases, indicated volumetric flow rate (gpm) will...

A. remain the same, because the density of the water has not changed.

B. increase, because the density of the water has increased.

C. remain the same, because the water velocity has not changed.

D. increase, because the viscosity of the water has increased.

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.12 [2.5/2.6]
QID: P281

Flow instruments used to measure the mass flow rate of saturated steam are often density compensated because, for a steam pressure increase at a constant volumetric flow rate, steam density will ____________ and the actual mass flow rate will ____________.

A. decrease; increase

B. increase; decrease

C. increase; increase

D. decrease; decrease

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.12 [2.5/2.6]
QID: P982

A density-compensated flow instrument is being used to measure mass flow rate in a steam system. If the pressure of the steam decreases, <u>indicated</u> mass flow rate will: (Assume volumetric flow rate is constant.)

A. increase for all steam conditions.

B. decrease for all steam conditions.

C. increase, but only if the steam is saturated (not superheated).

D. decrease, but only if the steam is saturated (not superheated).

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.12 [2.5/2.6]
QID: P1083

A steam generator transient causes main steam pressure to decrease although the actual steam mass flow rate to the main turbine remains constant. If the main steam flow instrument is not density compensated, indicated steam mass flow rate will...

A. increase due to the velocity increase of the steam.

B. increase due to the increased density of the steam.

C. decrease due to the velocity decrease of the steam.

D. decrease due to the decreased density of the steam.

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.12 [2.5/2.6]
QID: P1182

A cooling water system is supplying 1.0×10^6 lbm/hour of flow at a temperature of 100°F. Assuming volumetric flow rate does not change, which one of the following is the mass flow rate that will be supplied by the system if cooling water temperature increases to 140°F?

A. 7.5×10^5 lbm/hr

B. 8.3×10^5 lbm/hr

C. 9.0×10^5 lbm/hr

D. 9.9×10^5 lbm/hr

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.12 [2.5/2.6]
QID: P1780

A reactor coolant system is supplying 1.0 x 10^8 lbm/hour of coolant flow at a temperature of 100°F. Assuming volumetric flow rate does not change, which one of the following is the approximate mass flow rate that will be supplied by the system if cooling water temperature increases to 400°F?

A. 1.2 x 10^8 lbm/hr

B. 1.1 x 10^8 lbm/hr

C. 9.2 x 10^7 lbm/hr

D. 8.7 x 10^7 lbm/hr

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.12 [2.5/2.6]
QID: P2182

A reactor coolant system is supplying 1.0 x 10^8 lbm/hr of coolant flow at a temperature of 100°F. Assuming volumetric flow rate does not change, which one of the following is the approximate mass flow rate that will be supplied by the system if coolant temperature increases to 500°F?

A. 1.2 x 10^8 lbm/hr

B. 1.1 x 10^8 lbm/hr

C. 8.7 x 10^7 lbm/hr

D. 7.9 x 10^7 lbm/hr

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.12 [2.5/2.6]
QID: P2681

A cooling water system is supplying 2,000 lbm/min coolant flow at a temperature of 100°F. Assuming volumetric flow rate does not change, which one of the following is the approximate mass flow rate that will be supplied by the system if cooling water temperature increases to 140°F?

A. 1,964 lbm/min

B. 1,980 lbm/min

C. 2,020 lbm/min

D. 2,036 lbm/min

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.12 [2.5/2.6]
QID: P2882

A steam generator transient causes main steam pressure to increase although the actual mass flow rate of steam remains constant. If the main steam flow instrument is <u>not</u> density compensated, the increased main steam pressure will cause indicated steam mass flow rate to...

A. increase due to a higher steam velocity.

B. increase due to a greater steam density.

C. decrease due to a lower steam velocity.

D. decrease due to a reduced steam density.

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.12 [2.5/2.6]
QID: P3081 (B3032)

The volumetric flow rate of cooling water entering a heat exchanger is 500 gpm.

Given the following:

Cooling water pressure entering and leaving the heat exchanger is 10 psig.
Cooling water inlet temperature is 90°F.
Cooling water outlet temperature is 160°F.
Heat exchanger inlet and outlet piping have the same diameter.

What is the approximate volumetric flow rate of the cooling water exiting the heat exchanger?

A. 496 gpm

B. 500 gpm

C. 504 gpm

D. 509 gpm

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.12 [2.5/2.6]
QID: P3783 (B3733)

A condensate pump is taking suction on a main condenser hotwell, containing water at 100°F, and discharging the water at a volumetric flow rate of 100,000 gpm to the main feedwater system. The main feedwater system heats the water to 400°F before it enters the steam generators. Assume there is <u>no</u> leakage, and <u>no</u> bypass or recirculation flow paths are in use.

What is the approximate volumetric flow rate of the feedwater entering the steam generators?

A. 100,000 gpm

B. 105,000 gpm

C. 109,000 gpm

D. 115,000 gpm

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P147

Operating two pumps in parallel instead of operating a single pump will result in a...

A. large increase in system head and a small increase in flow rate.

B. small increase in system head and a small increase in flow rate.

C. small increase in system head and a large increase in flow rate.

D. large increase in system head and a large increase in flow rate.

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P280

The major effect of starting a second centrifugal pump in parallel with an operating centrifugal pump in an open system is increased...

A. system pressure.

B. system flow rate.

C. pump discharge pressure.

D. pump flow rate.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P282

To decrease the flow rate through an operating positive displacement pump, an operator should...

A. throttle the pump discharge valve partially closed.

B. throttle the pump suction valve partially closed.

C. decrease the pump net positive suction head.

D. decrease the pump speed.

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P981

Which one of the following will decrease the head loss occurring in an operating cooling water system?

A. Starting a second pump in parallel with the operating pump.

B. Shifting two heat exchangers from parallel to series operation.

C. Replacing a 10 foot section of 10-inch diameter pipe with a 20 foot section of 10-inch diameter pipe.

D. Replacing a 20 foot section of 10-inch diameter pipe with a 20 foot section of 12-inch diameter pipe.

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P1282

Two centrifugal pumps and two positive displacement pumps are able to be cross connected to provide flow in a system. Each pump will produce 100 gpm at 1,000 psig and each pump has a design maximum pressure of 1,500 psig.

If system pressure is 1,200 psig, which one of the following will produce the greatest system flow rate?

A. Two positive displacement pumps in series.

B. Two positive displacement pumps in parallel.

C. Two centrifugal pumps in series.

D. Two centrifugal pumps in parallel.

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P1683

Two centrifugal pumps and two positive displacement pumps are able to be cross-connected to provide makeup water flow to a system. Each pump will produce 100 gpm at 1,000 psig backpressure.

If system pressure is 800 psig, which one of the following combinations will produce the greatest flow rate to the system?

A. Two centrifugal pumps in parallel

B. Two centrifugal pumps in series

C. Two positive displacement pumps in parallel

D. Two positive displacement pumps in series

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P1784 (B1725)

Two identical centrifugal pumps (CPs) and two identical positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1,000 psig.

Given the following information:

Centrifugal Pumps

Shutoff head:	1,500 psig
Maximum design pressure:	2,000 psig

Positive Displacement Pumps

Maximum design pressure:	2,000 psig

Which one of the following pump configurations will supply the lowest makeup flow rate to the cooling water system if system pressure is at 1,700 psig?

A. One PDP and one CP in series (CP supplying PDP)

B. One PDP and one CP in parallel

C. Two CPs in series

D. Two CPs in parallel

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P1979

Two identical centrifugal pumps (CPs) and two identical positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1,000 psig.

Given the following information:

Centrifugal Pumps

Shutoff head:	1,500 psig
Maximum design pressure:	2,000 psig

Positive Displacement Pumps

Maximum design pressure:	2,000 psig

Which one of the following pump configurations will supply the highest makeup flow rate to the system if system pressure is at 800 psig?

A. One PDP and one CP in series (CP supplying PDP)

B. One PDP and one CP in parallel

C. Two CPs in series

D. Two CPs in parallel

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P2282 (B2281)

Water at 90°F and 50 psig is flowing through a 10-inch diameter pipe at 100 lbm/sec. The pipe then splits into two pipes, a 4-inch diameter pipe and an 8-inch diameter pipe. Disregarding any flow restrictions other than pipe size, which one of the following lists the approximate flow rates through the 4-inch and 8-inch diameter pipes?

	4-inch Pipe (lbm/sec)	8-inch Pipe (lbm/sec)
A.	20	80
B.	25	75
C.	30	70
D.	33	67

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P2383 (B2324)

Two identical centrifugal pumps (CPs) and two identical positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1,200 psig.

Given the following information:

<u>Centrifugal Pumps</u>

Shutoff head:	1,500 psig
Maximum design pressure:	2,000 psig

<u>Positive Displacement Pumps</u>

Maximum design pressure:	2,000 psig

Which one of the following pump configurations will supply the <u>highest</u> makeup flow rate to the system if system pressure is at 500 psig?

A. Two CPs in series

B. Two CPs in parallel

C. Two PDPs in parallel

D. One CP and one PDP in series (CP supplying PDP)

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P2481 (B2479)

Water at 90°F and 50 psig is flowing through a 10-inch diameter pipe at 100 lbm/sec. The pipe then splits into two pipes, a 3-inch diameter pipe and a 6-inch diameter pipe. Disregarding any flow restrictions other than pipe size, which one of the following lists the approximate flow rates through the 3-inch and 6-inch diameter pipes? (Assume fluid velocity is the same in each pipe.)

	3-inch Pipe (lbm/sec)	6-inch Pipe (lbm/sec)
A.	10	90
B.	20	80
C.	25	75
D.	33	67

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P2582 (B2581)

Water at 90°F and 50 psig is flowing through a 10-inch diameter pipe at 100 lbm/sec. The pipe then splits into two pipes, a 6-inch diameter pipe and an 8-inch diameter pipe.

Disregarding any flow restrictions other than pipe size, which one of the following lists the approximate flow rates through the 6-inch and 8-inch diameter pipes? (Assume fluid velocity is the same in each pipe.)

	6-inch Pipe (lbm/sec)	8-inch Pipe (lbm/sec)
A.	24	76
B.	32	68
C.	36	64
D.	40	60

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P2783 (B2723)

Two identical centrifugal pumps (CPs) and two identical positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1,200 psig.

Given the following information:

Centrifugal Pumps

Shutoff head:	1,500 psig
Maximum design pressure:	2,000 psig
Flow rate with no backpressure:	180 gpm

Positive Displacement Pumps

Maximum design pressure:	2,000 psig

Which one of the following pump configurations will supply the highest makeup flow rate to the cooling water system if system pressure is at 1,700 psig?

A. Two CPs in series

B. Two CPs in parallel

C. Two PDPs in parallel

D. One CP and one PDP in series (CP supplying PDP)

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P3183

A four-loop nuclear power plant uses four identical reactor coolant pumps (RCPs) to supply reactor coolant flow through the reactor vessel. The plant is currently operating at 20 percent power with all RCPs in operation.

Which one of the following describes the stable RCS flow rate through the reactor vessel following the trip of one RCP? (Assume that no operator actions are taken and the reactor does not trip.)

A. Less than 75 percent of the original flow rate.

B. Exactly 75 percent of the original flow rate.

C. Greater than 75 percent of the original flow rate.

D. Unpredictable without pump curves for the RCPs.

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P3582

A reactor shutdown has been performed because of a leak from the reactor coolant system (RCS) to a steam generator (SG) via a tube leak.

Given the following initial conditions:

SG pressure is 1,000 psia.
RCS pressure is 2,200 psia.
RCS average temperature is 500°F.
Leak rate from the RCS to the SG is 100 gpm.

If RCS pressure is decreased to 1,600 psia, with no other changes in plant parameters, what will be the approximate leak rate from the RCS to the SG?

A. 50 gpm

B. 71 gpm

C. 79 gpm

D. 85 gpm

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P3683 (B3681)

Two identical single-speed centrifugal pumps (CPs) and two identical single-speed positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1,200 psig.

Given the following information:

Centrifugal Pumps

Discharge pressure at shutoff head:	1,500 psig
Maximum design pressure:	2,000 psig
Flow rate with no backpressure:	180 gpm

Positive Displacement Pumps

Maximum design pressure:	2,000 psig

Which one of the following makeup water pump configurations will supply the highest initial flow rate to a cooling water system that is drained and depressurized?

A. Two CPs in series

B. Two CPs in parallel

C. Two PDPs in parallel

D. One CP and one PDP in series (CP supplying PDP)

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P4243 (B4242)

Refer to the drawing of a venturi in a main steamline (see figure below). The venturi inlet and outlet pipe diameters are equal.

A main steamline break downstream of the venturi causes the main steam mass flow rate through the venturi to increase. Soon, the steam reaches sonic velocity in the throat of the venturi.

How will the main steam mass flow rate through the venturi be affected as the steam pressure downstream of the venturi continues to decrease?

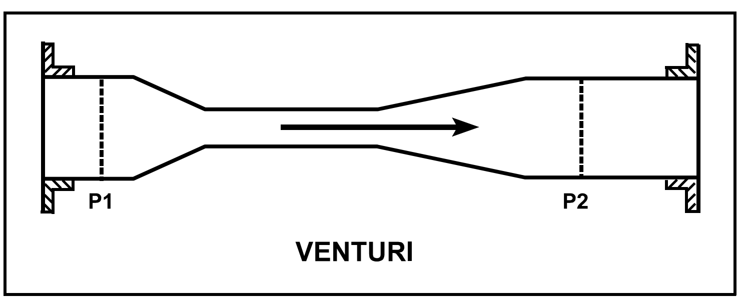
A. It will continue to increase at a rate that is dependent on the steam velocity in the throat of the venturi.

B. It will continue to increase at a rate that is dependent on the differential pressure (P1 - P2) across the venturi.

C. It will <u>not</u> continue to increase because the steam velocity <u>cannot</u> increase above sonic velocity in the throat of the venturi.

D. It will <u>not</u> continue to increase because the differential pressure (P1 - P2) across the venturi <u>cannot</u> increase further once the steam reaches sonic velocity in the throat of the venturi.

ANSWER: C.



TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P4343 (B4342)

Two identical single-speed centrifugal pumps (CPs) and two identical single-speed positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1,200 psig.

Given the following information:

Centrifugal Pumps

Discharge pressure at shutoff head:	1,500 psig
Maximum design pressure:	2,000 psig
Flow rate with no backpressure:	180 gpm

Positive Displacement Pumps

Maximum design pressure:	2,000 psig

Which one of the following pump configurations will supply the lowest initial flow rate of makeup water to a cooling water system that is drained and depressurized?

A. Two CPs in series

B. Two CPs in parallel

C. Two PDPs in parallel

D. One CP and one PDP in series (CP supplying PDP)

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P4543 (B4542)

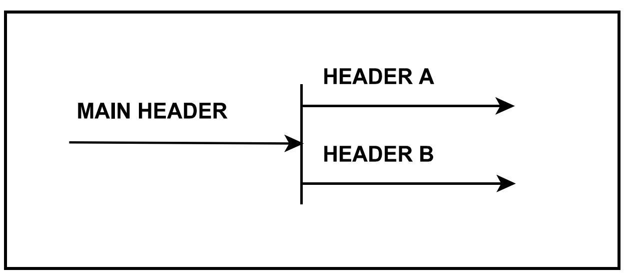
Refer to the drawing of a main water header that splits into two parallel headers (see figure below).

Header A has a 2-inch diameter and header B has a 3-inch diameter. The velocity of the water in both headers is the same.

If the main water header has a flow rate of 500 gpm, what is the approximate flow rate in each of the parallel headers?

	HEADER A (gpm)	HEADER B (gpm)
A.	125	375
B.	154	346
C.	200	300
D.	222	278

ANSWER: B.



TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P4643 (B4642)

A length of pipe in a cooling water system uses a reducer fitting to decrease the pipe diameter from 6 inches to 4 inches. The flow rate in the 6-inch diameter section of pipe is 200 gpm. What is the flow rate in the 4-inch diameter section of pipe?

A. 133 gpm

B. 200 gpm

C. 300 gpm

D. 450 gpm

ANSWER: B.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P4743

A four-loop PWR nuclear power plant uses four identical single-speed reactor coolant pumps (RCPs) to supply reactor coolant flow through the reactor vessel. The plant is currently shut down with one RCP in operation.

Which one of the following describes the stable reactor coolant flow rate through the reactor vessel following the start of a second RCP?

A. Less than twice the original flow rate.

B. Exactly twice the original flow rate.

C. More than twice the original flow rate.

D. Cannot be determined without additional information.

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P5543 (B5542)

A vented water storage tank contains 60 feet of water at 70°F. A cracked weld at the bottom of the tank results in a leak rate of 12 gpm. If makeup water flow rate is 5 gpm, at what water level will the tank stabilize?

A. 38.7 feet

B. 25.0 feet

C. 10.4 feet

D. 0.0 feet

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P5943 (B5942)

A vented water storage tank contains 64 feet of water at 70°F. A cracked weld at the bottom of the tank results in a leak rate of 12 gpm. At what water level will the leak rate be 3 gpm?

A. 48 feet

B. 32 feet

C. 16 feet

D. 4 feet

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P6143 (B6142)

A plant shutdown will be performed because of leakage from the main condenser cooling water system into the main condenser through a tube leak.

Given the following initial conditions:

- Main condenser pressure is 1.7 psia.
- Atmospheric pressure is 14.7 psia
- Main condenser cooling water pressure at the location of the tube leak is 18 psig.
- Cooling water leak rate into the main condenser is 80 gpm.

If the main condenser is brought to atmospheric pressure, with no changes to the main condenser cooling water system parameters, what will be the rate of cooling water leakage into the main condenser?

A. 36 gpm

B. 52 gpm

C. 61 gpm

D. 72 gpm

ANSWER: C.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P6543 (B6542)

An ideal positive displacement pump is initially operating with the following parameters:

Suction pressure: 10 psig
Discharge pressure: 25 psig
Flow rate: 100 gpm

A pump discharge valve is throttled such that pump discharge pressure increases to 40 psig. If pump suction pressure does not change, the pump flow rate will...

A. remain constant.

B. decrease in direct proportion to the change in pump differential pressure.

C. decrease in direct proportion to the square of the change in pump differential pressure.

D. decrease in direct proportion to the square root of the change in pump differential pressure.

ANSWER: A.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P6743 (B6742)

A centrifugal pump is operating at a constant speed in an open system with the following initial parameters:

Suction pressure: 10 psig
Discharge pressure: 25 psig
Pump flow rate: 500 gpm

If the pump discharge flow control valve is throttled such that the pump discharge pressure increases to 40 psig, the change in pump flow rate is...

A. directly proportional to the square of the change in pump differential pressure.

B. directly proportional to the square root of the change in pump differential pressure.

C. inversely proportional to the square root of the change in pump differential pressure.

D. impossible to determine from the provided information.

ANSWER: D.

TOPIC: 193006
KNOWLEDGE: K1.15 [3.1/3.3]
QID: P6843 (B6842)

Refer to the drawing of a venturi in a steam line (see figure below). The venturi inlet and outlet pipe diameters at P1 and P2 are equal.

Currently, steam is flowing through the venturi, reaching sonic velocity in the throat of the venturi. If the steam inlet pressure (P1) remains constant while the downstream pressure (P2) decreases, the mass flow rate of the steam will __________; and the velocity of the steam at the venturi outlet will __________.

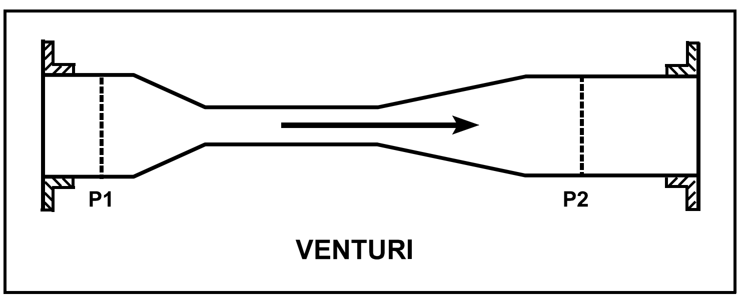
A. increase; increase

B. increase; remain the same

C. remain the same; increase

D. remain the same; remain the same

ANSWER: C.



TOPIC: 193007
KNOWLEDGE: K1.01 [2.5/2.5]
QID: P283

The transfer of heat from the reactor fuel pellets to the fuel cladding during normal plant operation is an example of ____________ heat transfer.

A. conduction

B. convection

C. radiant

D. two-phase

ANSWER: A.

TOPIC: 193007
KNOWLEDGE: K1.01 [2.5/2.5]
QID: P584 (B882)

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of a fuel cycle (see figure below).

Which one of the following is the primary method of heat transfer through the gap between the reactor fuel and the fuel clad?

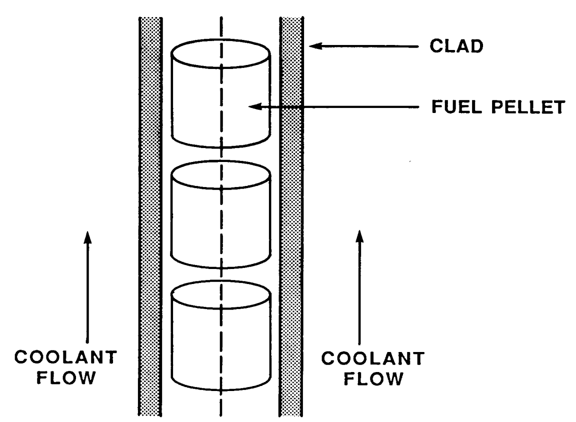
A. Conduction

B. Convection

C. Radiation

D. Natural circulation

ANSWER: A.



FUEL ROD AND COOLANT FLOW CHANNEL

TOPIC: 193007
KNOWLEDGE: K1.01 [2.5/2.5]
QID: P784

During a loss-of-coolant accident, which one of the following heat transfer modes provides the most core cooling when fuel elements are not in contact with the coolant?

A. Radiation

B. Emission

C. Convection

D. Conduction

ANSWER: A.

TOPIC: 193007
KNOWLEDGE: K1.01 [2.5/2.5]
QID: P985 (B1982)

Nuclear reactor fuel rods are normally charged with __________ gas to improve the heat transferred by __________ from the fuel pellets to the cladding.

A. helium; convection

B. helium; conduction

C. nitrogen; convection

D. nitrogen; conduction

ANSWER: B.

TOPIC: 193007
KNOWLEDGE: K1.01 [2.5/2.5]
QID: P1884

A nuclear power plant is operating at 60 percent power. Which one of the following is the primary method of heat transfer from the outer surface of the steam generator tubes to the bulk feedwater?

A. Radiolysis

B. Radiation

C. Convection

D. Conduction

ANSWER: C.

TOPIC: 193007
KNOWLEDGE: K1.01 [2.5/2.5]
QID: P2284

Which one of the following describes a heat transfer process in which convection is the most significant mode of heat transfer?

A. From the reactor fuel to the core barrel during core uncovery.

B. Through the tube walls in a steam generator during normal operation at 100 percent power.

C. From the reactor fuel to the steam generators following a loss of all RCPs.

D. From the fuel pellet centerline to the fuel clad during normal operation at 100 percent power.

ANSWER: C.

TOPIC: 193007
KNOWLEDGE: K1.01 [2.5/2.5]
QID: P2884 (B2882)

Which one of the following describes a heat transfer flow path in which conduction is the most significant mode of heat transfer?

A. From the reactor fuel to the core barrel during core uncovery

B. From the main turbine exhaust steam to the atmosphere via main condenser cooling water and a cooling tower during normal operation

C. From the reactor fuel to the steam outlet of the steam generators during a station blackout

D. From a fuel pellet to the fuel clad via the fuel rod fill gas during normal operation

ANSWER: D.

TOPIC: 193007
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P83

If excessive amounts of air are entrained/dissolved in the cooling water passing through a single-phase (liquid) heat exchanger, the overall heat transfer coefficient of the heat exchanger will decrease because the...

A. laminar layer thickness will decrease.

B. laminar layer thickness will increase.

C. thermal conductivity of the cooling fluid will decrease.

D. thermal conductivity of the cooling fluid will increase.

ANSWER: C.

TOPIC: 193007
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P1184 (B1882)

Why is bulk boiling in the tubes of a single-phase heat exchanger undesirable?

A. The bubble formation will break up the laminar layer in the heat exchanger tubes.

B. The turbulence will restrict fluid flow through the heat exchanger tubes.

C. The ΔT across the tubes will decrease through the heat exchanger.

D. The thermal conductivity of the heat exchanger tubes will decrease.

ANSWER: B.

TOPIC: 193007
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P2184 (B2184)

Which one of the following pairs of fluids undergoing heat transfer in typical cross-flow design heat exchangers will yield the greatest heat exchanger overall heat transfer coefficient? (Assume comparable heat exchanger sizes and fluid flow rates.)

A. Oil to water in a lube oil cooler

B. Air to water in an air compressor after-cooler

C. Steam to water in a turbine exhaust steam condenser

D. Water to water in a cooling water heat exchanger

ANSWER: C.

TOPIC: 193007
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P2384 (B2383)

Which one of the following pairs of fluids undergoing heat transfer in typical cross-flow design heat exchangers will yield the smallest heat exchanger overall heat transfer coefficient? (Assume comparable heat exchanger sizes and fluid flow rates.)

A. Oil to water in a lube oil cooler

B. Air to water in an air compressor after-cooler

C. Steam to water in a turbine exhaust steam condenser

D. Water to water in a cooling water heat exchanger

ANSWER: B.

TOPIC: 193007
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P3084 (B3084)

A nuclear power plant is operating near100 percent power. Main turbine extraction steam is being supplied to a feedwater heater. Extraction steam parameters are as follows:

Steam pressure: 414 psia
Steam flow rate: 7.5×10^5 lbm/hr
Steam enthalpy: 1,150 Btu/lbm

Assume the extraction steam condenses to a saturated liquid at 414 psia and then leaves the feedwater heater via a drain line.

Assuming an ideal heat transfer process, what is the heat transfer rate from the extraction steam to the feedwater in the feedwater heater?

A. 3.8×10^7 Btu/hr

B. 8.6×10^7 Btu/hr

C. 5.4×10^8 Btu/hr

D. 7.2×10^8 Btu/hr

ANSWER: C.

TOPIC: 193007
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P3384 (B3383)

A nuclear power plant was operating at a steady-state power level with the following main condenser parameters:

Main condenser pressure:	1.2 psia
Cooling water inlet temperature:	60°F
Cooling water outlet temperature:	84°F

As a result of increased condenser air inleakage, the overall heat transfer coefficient of the main condenser decreases by 25 percent. Main condenser heat transfer rate and cooling water temperatures are unchanged. Which one of the following is the approximate resulting pressure in the main condenser?

A. 1.7 psia

B. 2.3 psia

C. 3.0 psia

D. 4.6 psia

ANSWER: A.

TOPIC: 193007
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P3684 (B3684)

Which one of the following pairs of fluids undergoing heat transfer in typical cross-flow design heat exchangers will yield the greatest heat exchanger overall heat transfer coefficient? (Assume comparable heat exchanger sizes and fluid flow rates.)

A. Oil to water in a lube oil cooler

B. Steam to water in a feedwater heater

C. Water to air in a ventilation heating unit

D. Water to water in a cooling water heat exchanger

ANSWER: B.

TOPIC: 193007
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P5144 (B5143)

A nuclear power plant is operating near 100 percent power. Main turbine extraction steam is being supplied to a feedwater heater. Extraction steam parameters are as follows:

Steam pressure: 500 psia
Steam flow rate: 7.0×10^5 lbm/hr
Steam enthalpy: 1,135 Btu/lbm

Assume the extraction steam condenses to a saturated liquid at 500 psia and then leaves the feedwater heater via a drain line.

Assuming an ideal heat transfer process, what is the heat transfer rate from the extraction steam to the feedwater in the feedwater heater?

A. 3.2×10^8 Btu/hr

B. 4.8×10^8 Btu/hr

C. 5.3×10^8 Btu/hr

D. 7.9×10^8 Btu/hr

ANSWER: B.

TOPIC: 193007
KNOWLEDGE: K1.05 [2.7/2.9]
QID: P585

During steady state power operation, core thermal power can be most accurately determined by multiplying the total mass flow rate of the...

A. reactor coolant by the change in temperature across the core.

B. reactor coolant by the change in enthalpy in the steam generators.

C. feedwater by the change in enthalpy in the steam generators.

D. feedwater by the change in temperature across the core.

ANSWER: C.

TOPIC: 193007
KNOWLEDGE: K1.05 [2.7/2.9]
QID: P785

A nuclear reactor is producing 200 MW of core thermal power. Reactor coolant pumps are adding 10 MW of additional thermal power into the coolant system based on heat balance calculations. The core is rated at 1,330 MW thermal power.

Which one of the following is the core thermal power in percent?

A. 14.0 percent

B. 14.3 percent

C. 15.0 percent

D. 15.8 percent

ANSWER: C.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P137

The power range nuclear instruments have been adjusted to 100 percent based on a calculated heat balance. Which one of the following would cause indicated reactor power to be <u>greater</u> than actual reactor power?

A. The reactor coolant pump heat input term was omitted from the heat balance calculation.

B. The feedwater flow rate used in the heat balance calculation was lower than actual feedwater flow rate.

C. The steam pressure used in the heat balance calculation was 50 psi higher than actual steam pressure.

D. The enthalpy of the feed water was miscalculated to be 10 Btu/lbm higher than actual feed water enthalpy.

ANSWER: A.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P332

Which one of the terms in the equation, Q= UA(T1-T2), is affected the most, and therefore most responsible for the initial increase in heat transfer rate from the reactor fuel during a minor (3 percent) steamline break? (Assume no initial change in reactor power.)

A. U

B. A

C. T1

D. T2

ANSWER: D.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P384 (B386)

The power range nuclear instruments have been adjusted to 100 percent based on a calculated secondary heat balance. Which one of the following will result in indicated reactor power being greater than actual reactor power?

A. The feedwater temperature used in the heat balance calculation was higher than actual feedwater temperature.

B. The reactor coolant pump heat input term was omitted from the heat balance calculation.

C. The feedwater flow rate used in the heat balance calculation was lower than actual feedwater flow rate.

D. The steam pressure used in the heat balance calculation was higher than actual steam pressure.

ANSWER: B.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P1384

A secondary heat balance calculation is being performed at 90 percent reactor power to calibrate reactor power instrumentation. Which one of the following will result in a calculated reactor power that is less than actual reactor power?

A. Steam generator pressure is indicating 20 psi above actual steam generator pressure.

B. Steam generator water level is indicating 3 percent below actual steam generator water level.

C. Feedwater flow rate is indicating 3 percent above actual feedwater flow rate.

D. Feedwater temperature is indicating 20°F below actual feedwater temperature.

ANSWER: A.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P2185 (B2183)

The power range nuclear instruments have been adjusted to 100 percent based on a heat balance calculation. Which one of the following will result in indicated reactor power being lower than actual reactor power?

A. The feed water temperature used in the heat balance calculation was 20°F higher than actual feed water temperature.

B. The reactor coolant pump heat input term was omitted from the heat balance calculation.

C. The feed water flow rate used in the heat balance calculation was 10 percent higher than actual flow rate.

D. The steam pressure used in the heat balance calculation was 50 psi lower than actual steam pressure.

ANSWER: A.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P2485 (B2684)

The power range nuclear instruments have been adjusted to 100 percent based on a heat balance calculation. Which one of the following will result in indicated reactor power being higher than actual reactor power?

A. The feedwater temperature used in the heat balance calculation was 20°F higher than actual feedwater temperature.

B. The reactor coolant pump heat input term was omitted from the heat balance calculation.

C. The feedwater flow rate used in the heat balance calculation was 10 percent lower than actual feedwater flow rate.

D. The ambient heat loss term was omitted from the heat balance calculation.

ANSWER: B.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P2685 (B2284)

The power range nuclear instruments have been adjusted to 100 percent based on a heat balance calculation. Which one of the following will result in indicated reactor power being <u>lower</u> than actual reactor power?

A. The feedwater temperature used in the heat balance calculation was 20°F higher than actual feedwater temperature.

B. The reactor coolant pump heat input term was omitted from the heat balance calculation.

C. The feedwater flow rate used in the heat balance calculation were 10 percent higher than actual flow rates.

D. The operator miscalculated the enthalpy of the steam exiting the steam generators to be 10 Btu/lbm higher than actual.

ANSWER: A.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P2885

The power range nuclear instruments have been adjusted to 100 percent based on a calculated heat balance. Which one of the following will result in indicated reactor power being lower than actual reactor power?

A. The feed water temperature used in the heat balance calculation was 20°F lower than actual feed water temperature.

B. The reactor coolant pump heat input term was omitted from the heat balance calculation.

C. The ambient heat loss value used in the heat balance calculation was only one-half the actual ambient heat loss.

D. The feed water flow rates used in the heat balance calculation were 10 percent higher than actual flow rates.

ANSWER: C.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P3944 (B1684)

The power range nuclear instruments have been adjusted to 100 percent based on a calculated heat balance. Which one of the following will result in indicated reactor power being lower than actual reactor power?

A. The feedwater temperature used in the heat balance calculation was 10°F lower than actual feed water temperature.

B. The reactor coolant pump heat input term was omitted from the heat balance calculation.

C. The feedwater flow rate used in the heat balance calculation was 10 percent lower than actual feedwater flow rate.

D. The steam pressure used in the heat balance calculation was 50 psi lower than actual steam pressure.

ANSWER: C.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P5044

Two of the parameters listed below are used for calculating core thermal power using the standard heat balance method. Which one of the following identifies the two parameters?

	Reactor Coolant Mass Flow Rate	Feedwater Temperature	Steam Generator Pressure	Steam Generator Water Level
A.	Yes	No	Yes	No
B.	No	Yes	Yes	No
C.	Yes	No	No	Yes
D.	No	Yes	No	Yes

ANSWER: B.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P6044 (B6043)

The power range nuclear instruments have been adjusted to 100 percent based on a heat balance calculation. Which one of the following will result in indicated reactor power being higher than actual reactor power?

A. The steam pressure used in the heat balance calculation was 50 psi higher than actual steam pressure.

B. The ambient heat loss value used in the heat balance calculation was twice the actual ambient heat loss.

C. The feedwater flow rate used in the heat balance calculation was 10 percent lower than actual feedwater flow rate.

D. The feedwater temperature used in the heat balance calculation was 20°F higher than actual feedwater temperature.

ANSWER: B.

TOPIC: 193007
KNOWLEDGE: K1.06 [3.1/3.3]
QID: P6844

When performing a heat balance calculation to determine core thermal power, the measured thermal power is ________ by a value associated with the reactor coolant pumps (RCPs); the adjustment is needed because ________ of the flow energy added to the reactor coolant by the RCPs is converted to thermal energy of the reactor coolant.

A. increased; a small fraction

B. increased; nearly all

C. decreased; a small fraction

D. decreased; nearly all

ANSWER: D.

TOPIC: 193007
KNOWLEDGE: K1.08 [3.1/3.4]
QID: P84

In a two loop PWR nuclear power plant, indicated feedwater flow to each steam generator (SG) is 3.3×10^6 lbm/hr at an enthalpy of 419 Btu/lbm. The steam exiting each SG is at 800 psia with 100 percent steam quality.

Ignoring all other heat gain and loss mechanisms, what is the reactor core thermal power?

A. 677 MWt

B. 755 MWt

C. 1,334 MWt

D. 1,510 MWt

ANSWER: D.

TOPIC: 193007
KNOWLEDGE: K1.08 [3.1/3.4]
QID: P285

Reactor coolant enters a nuclear reactor core at 545°F and leaves at 595°F. The reactor coolant flow rate is 6.6 x 10^7 lbm/hour and the specific heat capacity of the coolant is 1.3 Btu/lbm-°F.

What is the reactor core thermal power?

A. 101 MWt

B. 126 MWt

C. 1,006 MWt

D. 1,258 MWt

ANSWER: D.

TOPIC: 193007
KNOWLEDGE: K1.08 [3.1/3.4]
QID: P485

A nuclear reactor is operating with the following parameters:

Reactor power	= 100 percent
Core ΔT	= 42°F
Reactor coolant system flow rate	= 100 percent
Average coolant temperature	= 587°F

A station blackout occurs and natural circulation is established with the following stable parameters:

Decay heat	= 2 percent
Core ΔT	= 28°F
Average coolant temperature	= 572°F

What is the core mass flow rate in percent?

A. 2.0 percent

B. 2.5 percent

C. 3.0 percent

D. 4.0 percent

ANSWER: C.

TOPIC: 193007
KNOWLEDGE: K1.08 [3.1/3.4]
QID: P685

A nuclear power plant is initially operating at 80 percent power with a core ΔT of 48°F when a station blackout occurs. Natural circulation is established and core ΔT stabilizes at 40°F. If reactor coolant mass flow rate is 3 percent, which one of the following is the current core decay heat level?

A. 1 percent

B. 2 percent

C. 3 percent

D. 4 percent

ANSWER: B.

TOPIC: 193007
KNOWLEDGE: K1.08 [3.1/3.4]
QID: P1485

During a nuclear power plant outage, 5 percent of all steam generator (SG) tubes were plugged due to wall thinning. Full power reactor coolant system flow rate and average coolant temperature (T_{ave}) have not changed. Given the following 100 percent power conditions before the outage:

T_{ave} = 578°F
$T_{S/G}$ = 538°F

Which one of the following will be the approximate SG pressure when the plant is returned to 100 percent power after the outage?

A. 960 psia

B. 930 psia

C. 900 psia

D. 870 psia

ANSWER: B.

TOPIC: 193007
KNOWLEDGE: K1.08 [3.1/3.4]
QID: P1782

A nuclear power plant is operating with the following parameters:

Reactor power:	100 percent
Core ΔT:	60°F
Reactor coolant system flow rate:	100 percent
Average coolant temperature:	587°F

A station blackout occurs and natural circulation is established with the following stable parameters:

Decay heat:	1 percent
Core ΔT:	30°F
Average coolant temperature:	572°F

What is the core mass flow rate in percent?

A. 2.0 percent

B. 2.5 percent

C. 3.0 percent

D. 4.0 percent

ANSWER: A.

TOPIC: 193007
KNOWLEDGE: K1.08 [3.1/3.4]
QID: P2085

During a nuclear power plant outage, 6 percent of all steam generator (SG) tubes were plugged. Full-power reactor coolant system flow rate and average coolant temperature (T_{ave}) have not changed. Given the following 100 percent power conditions before the outage:

T_{ave} = 584°F
$T_{S/G}$ = 544°F

Which one of the following will be the approximate SG pressure when the plant is returned to 100 percent power after the outage?

A. 974 psia

B. 954 psia

C. 934 psia

D. 914 psia

ANSWER: A.

TOPIC: 193007
KNOWLEDGE: K1.08 [3.1/3.4]
QID: P2585

During a nuclear power plant outage, 5 percent of all steam generator (SG) tubes were plugged. Full-power reactor coolant system flow rate and average coolant temperature (T_{ave}) have not changed. Given the following 100 percent power conditions <u>before</u> the outage:

T_{ave} = 588.0°F
$T_{S/G}$ = 542.0°F

Which one of the following will be the approximate SG pressure when the plant is returned to 100 percent power after the outage?

A. 998 psia

B. 979 psia

C. 961 psia

D. 944 psia

ANSWER: C.

TOPIC: 193007
KNOWLEDGE: K1.08 [3.1/3.4]
QID: P2985

A nuclear power plant is operating at power. Total feed water flow rate to all steam generators is 7.0 x 10^6 lbm/hr at a temperature of 440°F. The steam exiting the steam generators is at 1,000 psia with 100 percent steam quality.

Ignoring all other heat gain and loss mechanisms, what is the reactor core thermal power?

A. 1,335 MWt

B. 1,359 MWt

C. 1,589 MWt

D. 1,612 MWt

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.01 [2.8/3.0]
QID: P986

Which one of the following is an example of significant radiative heat transfer?

A. Heat transfer from the fuel pellet to the fuel cladding via direct contact.

B. Heat transfer from the reactor coolant to the feedwater in a steam generator.

C. Heat transfer from the center to the edge of a fuel pellet at end of core life.

D. Heat transfer from the fuel cladding to the reactor coolant through a stable vapor layer.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.01 [2.8/3.0]
QID: P1186 (B1986)

Refer to the drawing of a pool boiling curve (see figure below).

Identify the region of the curve where the most efficient form of heat transfer exists.

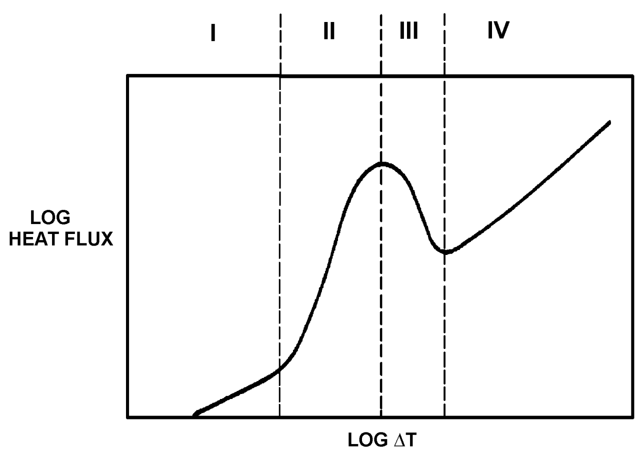
A. Region I

B. Region II

C. Region III

D. Region IV

ANSWER: B.



POOL BOILING CURVE

TOPIC: 193008
KNOWLEDGE: K1.01 [2.8/3.0]
QID: P1286 (B2088)

Refer to the drawing of a pool boiling curve (see figure below).

Which region of the curve contains the operating point at which the hottest locations of a nuclear reactor normally operate to transfer heat from the cladding to the coolant at 100 percent power?

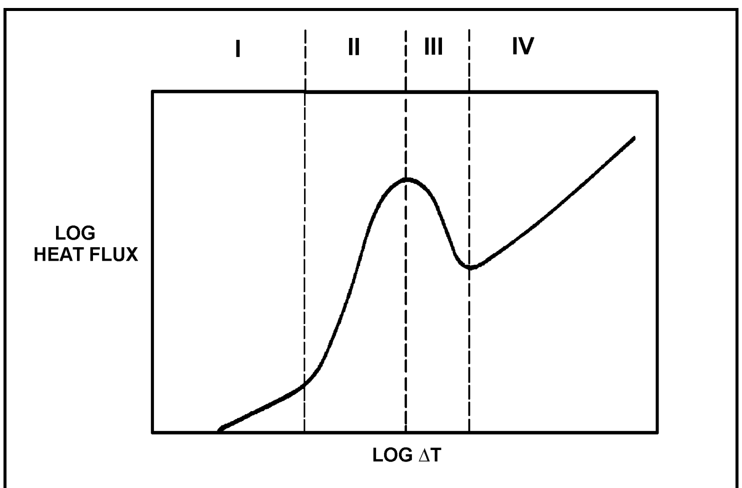
A. Region I

B. Region II

C. Region III

D. Region IV

ANSWER: B.



POOL BOILING CURVE

TOPIC: 193008
KNOWLEDGE: K1.02 [2.8/3.0]
QID: P85

Why does nucleate boiling improve heat transfer in a nuclear reactor core?

A. The formation of steam bubbles at nucleation sites on the fuel clad allows more heat to be transferred by conduction.

B. The formation of steam bubbles at nucleation sites on the fuel clad promotes local radiative heat transfer and allows more heat to be transferred by convection.

C. Heat is removed from the fuel rod as both sensible heat and latent heat of condensation, and the heat is transferred directly to the coolant by radiative heat transfer.

D. Heat is removed from the fuel rod as both sensible heat and latent heat of vaporization, and the motion of the steam bubbles causes rapid mixing of the coolant.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.02 [2.8/3.0]
QID: P886

Convection heat transfer improves when nucleate boiling begins on the surface of a fuel rod because:

A. steam bubble formation decreases coolant flow along the fuel rod.

B. steam bubble formation increases coolant flow along the fuel rod.

C. a steam blanket begins to form along the surface of the fuel rod.

D. the motion of the steam bubbles causes rapid mixing of the coolant.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.02 [2.8/3.0]
QID: P1086 (B2784)

How does the convective heat transfer coefficient vary from the bottom to the top of a fuel rod if subcooled reactor coolant enters the coolant channel and exits as superheated steam?

A. Increases continuously

B. Increases, then decreases

C. Decreases continuously

D. Decreases, then increases

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.02 [2.8/3.0]
QID: P1187

Nucleate boiling affects heat transfer from a fuel rod primarily by...

A. increasing the conductive heat transfer from the fuel rod to the coolant.

B. increasing the convective heat transfer from the fuel rod to the coolant.

C. decreasing the conductive heat transfer from the fuel rod to the coolant.

D. decreasing the convective heat transfer from the fuel rod to the coolant.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.02 [2.8/3.0]
QID: P2386

Subcooled water enters the bottom of an operating nuclear reactor core. As the water flows upward past the fuel assemblies, steam voids appear at the surface of a few fuel rods and are swept away.

If the coolant at the surface of the affected fuel rods had remained subcooled, average fuel temperature in the affected fuel rods would have been ________ because single-phase convection is a ________ efficient method of heat transfer than boiling at the surface of the fuel rods.

A. higher; more

B. higher; less

C. lower; more

D. lower; less

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.02 [2.8/3.0]
QID: P2686 (B2486)

Case 1: Pure subcooled reactor coolant is flowing through a fuel assembly in a reactor core operating at steady-state full power. As the coolant flows upward through the fuel assembly, the water heats up and exits the fuel assembly still subcooled.

Case 2: Same as above except that reactor coolant system pressure is decreased such that the coolant begins to boil halfway up the fuel assembly, which results in a saturated steam-water mixture exiting the fuel assembly.

Assume departure from nucleate boiling is avoided in both cases and that both cores continue to operate at full power. As compared to Case 1, the average fuel temperature for Case 2 will be ________ because boiling is a ________ efficient method of heat transfer.

A. higher; more

B. higher; less

C. lower; more

D. lower; less

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.02 [2.8/3.0]
QID: P2986 (B2986)

Subcooled reactor coolant flows into the bottom of a fuel assembly coolant channel and exits the top of the channel as a saturated steam-water mixture with a 98 percent moisture content. How does the overall heat transfer coefficient in the coolant channel change as the coolant travels upward along the channel?

A. Increases only.

B. Increases, then decreases.

C. Decreases only.

D. Decreases, then increases.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.02 [2.8/3.0]
QID: P3786 (B3785)

Subcooled water is flowing into a fuel assembly in an operating nuclear reactor core. As the water flows upward through the fuel assembly, some of the water in contact with the fuel rods begins to boil.

If fuel assembly power is unchanged and system pressure is increased such that all of the water remains subcooled, the average fuel temperature in the fuel assembly would be ________ because boiling is a ________ efficient method of heat transfer.

A. higher; more

B. higher; less

C. lower; more

D. lower; less

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.02 [2.8/3.0]
QID: P5745 (B5744)

Initially, subcooled water is flowing into a fuel assembly, with subcooled water exiting the fuel assembly several degrees hotter than when it entered, and no boiling is occurring in the fuel assembly. Assume that fuel assembly thermal power and water flow rate remain the same.

System pressure is decreased, causing some of the water in contact with the fuel rods to boil during transit through the fuel assembly. If the water exiting the fuel assembly remains subcooled, the average fuel temperature in the fuel assembly will be ________, and the temperature of the water exiting the fuel assembly will be ________.

A. higher; the same

B. higher; higher

C. lower; the same

D. lower; higher

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.03 [2.8/3.1]
QID: P86

Subcooled nucleate boiling is occurring along a heated surface. If the heat flux is increased slightly, what will be the effect on the ΔT between the surface and the fluid? (Assume subcooled nucleate boiling is still occurring.)

A. Small increase in ΔT because of steam blanketing.

B. Large increase in ΔT because of steam blanketing.

C. Small increase in ΔT as vapor bubbles form and collapse.

D. Large increase in ΔT causing radiative heat transfer to become significant.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.03 [2.8/3.1]
QID: P286 (B389)

As heat is transferred to water adjacent to a heating surface, many factors influence steam bubble formation. Which one of the following characteristics will enhance steam bubble formation?

A. Chemicals dissolved in the water.

B. The absence of ionizing radiation exposure to the water.

C. A highly polished heat transfer surface with minimal scratches or cavities.

D. The presence of gases dissolved in the water.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.03 [2.8/3.1]
QID: P387 (B388)

What type of boiling is described as follows: The bulk temperature of the liquid is below saturation, but the temperature of the heat transfer surface is above saturation. Vapor bubbles form at the heat transfer surface, but condense in the cold liquid so that no net generation of vapor is obtained.

A. Bulk boiling

B. Subcooled nucleate boiling

C. Total film boiling

D. Partial film boiling

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.03 [2.8/3.1]
QID: P1686 (B1087)

Which one of the following is a characteristic of subcooled nucleate boiling but not saturated nucleate boiling?

A. T_{Clad} equals T_{Sat}

B. T_{Clad} is greater than T_{Sat}

C. $T_{Bulk\ Coolant}$ equals T_{Sat}

D. $T_{Bulk\ Coolant}$ is less than T_{Sat}

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.03 [2.8/3.1]
QID: P1888 (B1786)

Which one of the following is a characteristic of saturated nucleate boiling but not subcooled nucleate boiling?

A. $T_{Bulk\ Coolant}$ equals T_{Sat}

B. $T_{Bulk\ Coolant}$ is less than T_{Sat}

C. T_{Clad} equals T_{Sat}

D. T_{Clad} is greater than T_{Sat}

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.03 [2.8/3.1]
QID: P2287 (B1086)

Which one of the following describes why the core heat transfer rate increases when nucleate boiling begins on the surface of a fuel rod?

A. Steam has a greater thermal conductivity than water.

B. The formation of steam bubbles increases coolant flow rate along the fuel rod.

C. Radiative heat transfer begins to supplement convective heat transfer.

D. Heat transfer by steam bubble formation is more effective than through a liquid film.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.03 [2.8/3.1]
QID: P2687 (B1287)

Which one of the following modes of heat transfer is characterized by steam bubbles moving away from a heated surface and collapsing in the bulk fluid?

A. Bulk boiling

B. Subcooled nucleate boiling

C. Saturated nucleate boiling

D. Saturated natural convection

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.03 [2.8/3.1]
QID: P2787 (B1285)

A nuclear reactor is operating at 100 percent power. Which one of the following will increase the likelihood of vapor bubble formation in the reactor coolant?

A. Surface scratches or cavities in the fuel clad

B. Subsurface void defect in the fuel clad

C. Increased coolant velocity past the fuel rods

D. Chemically inert material dissolved in the coolant

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.03 [2.8/3.1]
QID: P3686 (B3685)

A nuclear power plant is currently shut down after several months of operation at full power. The shutdown cooling system is in operation, maintaining an average reactor coolant temperature of 280°F. A pressure control malfunction causes RCS pressure to slowly and continuously decrease from 100 psia while reactor coolant temperature remains constant.

Which one of the following describes where nucleate boiling will first occur?

A. At a scratch on the surface of a fuel rod near the top of a fuel assembly.

B. At a scratch on the surface of a fuel rod near the bottom of a fuel assembly.

C. In the bulk fluid of a coolant channel near the top of a fuel assembly.

D. In the bulk fluid of a coolant channel near the bottom of a fuel assembly.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.04 [3.1/3.3]
QID: P93

If departure from nucleate boiling is reached in the core, the surface temperature of the fuel clad will...

A. increase rapidly.

B. decrease rapidly.

C. increase gradually.

D. decrease gradually.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.04 [3.1/3.3]
QID: P287 (B2987)

If ΔT is the temperature difference between the fuel clad surface and the bulk coolant, which one of the following describes the heat transfer from a fuel rod experiencing departure from nucleate boiling?

A. Steam bubbles begin to blanket the fuel clad surface, causing a rapid increase in the ΔT for a given heat flux.

B. Steam bubbles completely blanket the fuel clad surface, causing a rapid decrease in the ΔT for a given heat flux.

C. Steam bubbles begin to form on the fuel clad surface, causing a rapid decrease in the heat flux from the fuel rod for a given ΔT.

D. Steam bubbles completely blanket the fuel clad surface, causing a rapid increase in the heat flux from the fuel rod for a given ΔT.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.04 [3.1/3.3]
QID: P1288 (B1985)

Departure from nucleate boiling should not be allowed to occur in the core because the...

A. steam bubbles begin to blanket the clad and decrease radiative heat transfer.

B. steam bubbles in the coolant may cause flow oscillations.

C. rapid increase in ΔT between the clad and the coolant may cause clad damage.

D. associated addition of reactivity from the void coefficient could be uncontrollable.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.04 [3.1/3.3]
QID: P3388 (B1288)

Which one of the following is indicated by a rapid increase in the fuel clad-to-coolant ΔT and a decrease in heat flux from the fuel?

A. Bulk boiling is occurring.

B. Nucleate boiling is occurring.

C. Critical heat flux is increasing.

D. Departure from nucleate boiling has been reached.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P138

Which one of the following reactor coolant system parameters has the least effect on margin to departure from nucleate boiling?

A. Pressurizer level

B. Local power density

C. Cold leg temperature

D. Coolant flow rate

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P144

An adequate subcooling margin during a loss of coolant accident is the most direct indication that _______ is being maintained.

A. steam generator water level

B. pressure level

C. core cooling

D. subcriticality

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P288

Which one of the following parameter changes will reduce the departure from nucleate boiling ratio?

A. Decrease in reactor power

B. Increase in pressurizer pressure

C. Increase in reactor coolant flow

D. Increase in reactor coolant temperature

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P489

Which one of the following incidents will cause the departure from nucleate boiling ratio to increase? (Assume the reactor does not trip.)

A. A reactor coolant pump trips at 20 percent reactor power.

B. A rod drops at 100 percent reactor power with manual rod control.

C. One steam dump valve fails open at 50 percent reactor power.

D. All pressurizer heaters energize fully at 40 percent reactor power.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P1093

Which one of the following will increase the departure from nucleate boiling ratio?

A. Increasing reactor coolant temperature

B. Increasing pressurizer pressure

C. Increasing core bypass flow

D. Increasing reactor power

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P1787

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 45 percent in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Assuming reactor power level does not change, which one of the following will increase the steady-state departure from nucleate boiling ratio?

A. One reactor coolant pump trips with automatic rod control.

B. A spray valve malfunction decreases reactor coolant system pressure by 20 psig with no rod motion.

C. The operator decreases reactor coolant boron concentration by 5 ppm with no rod motion.

D. Core Xe-135 builds up in proportion to the axial and radial power distribution with automatic rod control.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P1889

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 45 percent in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will decrease the steady-state departure from nucleate boiling ratio?

A. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction increases reactor coolant system pressure by 20 psig with no control rod motion.

C. The operator decreases reactor coolant boron concentration by 5 ppm with no control rod motion.

D. Core Xe-135 builds up in proportion to the axial and radial power distribution with automatic rod control.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P2288

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 55 percent in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will decrease the steady-state departure from nucleate boiling ratio?

A. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction increases reactor coolant system pressure by 20 psig.

C. The operator increases reactor coolant boron concentration by 5 ppm with no rod motion.

D. Core Xe-135 depletes in proportion to the axial and radial power distribution with no rod motion.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P2387

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 45 percent in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will decrease the steady-state departure from nucleate boiling ratio?

A. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction decreases reactor coolant system pressure by 20 psig with no rod motion.

C. The operator increases reactor coolant boron concentration by 5 ppm with no control rod motion.

D. Core Xe-135 builds up in proportion to the axial and radial power distribution with automatic rod control.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P2487 (B2487)

A nuclear reactor is shutdown at normal operating temperature and pressure with all control rods inserted. Which one of the following will decrease the departure from nucleate boiling ratio for this reactor? (Assume the reactor remains shutdown.)

A. Fully withdrawing a bank of shutdown rods

B. Diluting RCS boron concentration by 50 ppm

C. Reducing RCS flow rate by 1 percent

D. Increasing RCS pressure by 10 psig

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P2587

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 55 percent in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will increase the steady-state departure from nucleate boiling ratio?

A. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction decreases reactor coolant system pressure by 20 psig.

C. The operator decreases reactor coolant boron concentration by 5 ppm with no rod motion.

D. Core Xe-135 depletes in proportion to the axial and radial power distribution with no rod motion.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P2788

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 45 percent in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will increase the steady-state departure from nucleate boiling ratio?

A. Core Xe-135 decays with no change in the axial and radial power distributions.

B. A reactor trip occurs and one control rod remains fully withdrawn from the core.

C. The operator decreases reactor coolant boron concentration by 5 ppm with no control rod motion.

D. A pressurizer malfunction decreases reactor coolant system pressure by 20 psig with no control rod motion.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.05 [3.4/3.6]
QID: P2989

A nuclear reactor is shut down at normal operating temperature and pressure with all control rods inserted. Which one of the following will decrease the departure from nucleate boiling ratio for this reactor? (Assume the reactor remains shutdown.)

A. Fully withdrawing a bank of shutdown rods.

B. Diluting RCS boron concentration by 50 ppm.

C. Reducing RCS temperature by 5°F.

D. Decreasing RCS pressure by 10 psig.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.06 [2.8/2.9]
QID: P87

Which one of the following parameter changes would move a nuclear reactor farther away from the critical heat flux?

A. Decrease pressurizer pressure

B. Decrease reactor coolant flow

C. Decrease reactor power

D. Increase reactor coolant temperature

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.06 [2.8/2.9]
QID: P145

How does critical heat flux vary from the bottom to the top of a nuclear reactor core during normal full power operation?

A. Increases continuously.

B. Increases, then decreases.

C. Decreases continuously.

D. Decreases, then increases.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.06 [2.8/2.9]
QID: P587

The heat transfer rate that causes departure from nucleate boiling is the...

A. critical heat flux.

B. nucleate heat flux.

C. transition heat flux.

D. departure heat flux.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.06 [2.8/2.9]
QID: P989

Critical heat flux is the heat transfer rate per unit __________ of fuel rod that will initially cause __________.

A. volume; nucleate boiling

B. area; nucleate boiling

C. volume; departure from nucleate boiling

D. area; departure from nucleate boiling

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.06 [2.8/2.9]
QID: P1087

How does critical heat flux (CHF) vary with core height during normal full power operation?

A. CHF increases from the bottom to the top of the core.

B. CHF decreases from the bottom to the core midplane, then increases from the midplane to the top of the core.

C. CHF decreases from the bottom to the top of the core.

D. CHF increases from the bottom to the core midplane, then decreases from the midplane to the top of the core.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.06 [2.8/2.9]
QID: P1586

A nuclear reactor is operating at steady-state 75 percent power. Which one of the following parameter changes will cause the core to operate closer to critical heat flux? (Assume reactor power does not change unless stated.)

A. Decrease reactor coolant flow by 5 percent.

B. Decrease reactor power by 10 percent.

C. Decrease reactor coolant temperature by 3°F.

D. Increase pressurizer pressure by 20 psia.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.06 [2.8/2.9]
QID: P3587 (B1997)

Which one of the following is most likely to result in fuel clad damage?

A. Operating at 110 percent of reactor vessel design pressure.

B. An inadvertent reactor trip from 100 percent power.

C. Operating at a power level that exceeds the critical heat flux.

D. Operating with subcooled nucleate boiling occurring in a fuel assembly.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.07 [2.6/2.6]
QID: P689

A small increase in ΔT (at the fuel clad-to-coolant interface) causes increased steam blanketing and a reduction in heat flux. This describes which type of boiling?

A. Subcooled boiling

B. Nucleate boiling

C. Partial film boiling

D. Total film boiling

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.07 [2.6/2.6]
QID: P1089

Refer to the drawing of a pool boiling curve (see figure below).

Choose the region of the curve where transition boiling is the primary heat transfer process.

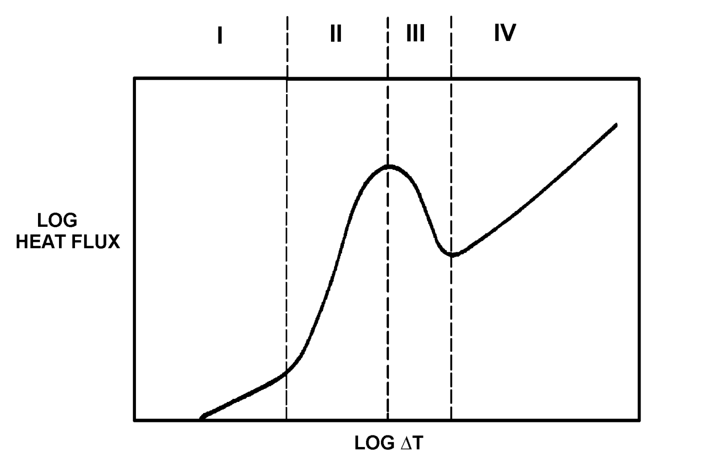
A. Region I

B. Region II

C. Region III

D. Region IV

ANSWER: C.



POOL BOILING CURVE

TOPIC: 193008
KNOWLEDGE: K1.07 [2.6/2.6]
QID: P1689 (B1386)

Refer to the drawing of a pool boiling curve (see figure below).

Which one of the points shown represents the onset of transition boiling?

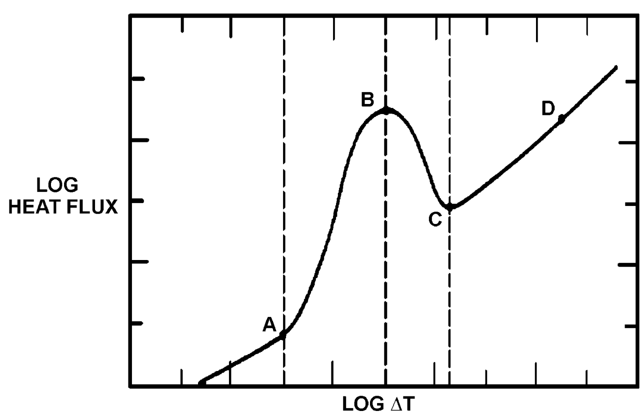
A. A

B. B

C. C

D. D

ANSWER: B.



POOL BOILING CURVE

TOPIC: 193008
KNOWLEDGE: K1.07 [2.6/2.6]
QID: P1891 (B987)

Which one of the following describes the conditions in a fuel assembly coolant channel that is experiencing transition boiling?

A. Complete steam blanketing of the fuel rod surface.

B. Alternate wetting and drying of the fuel rod surface.

C. Saturated nucleate boiling.

D. Subcooled nucleate boiling.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.07 [2.6/2.6]
QID: P1987 (B2288)

Which one of the following describes the conditions in a fuel channel that is experiencing transition boiling?

A. Complete steam blanketing of the fuel rod surface

B. Alternate wetting and drying of the fuel rod surface

C. Steam bubbles form and collapse on the fuel rod surface

D. Steam bubbles form on the fuel rod surface and are swept away by subcooled bulk coolant

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.07 [2.6/2.6]
QID: P2188 (B2185)

Refer to the drawing of a pool boiling curve (see figure below).

Which one of the following describes the conditions in a fuel channel that is experiencing region III heat transfer?

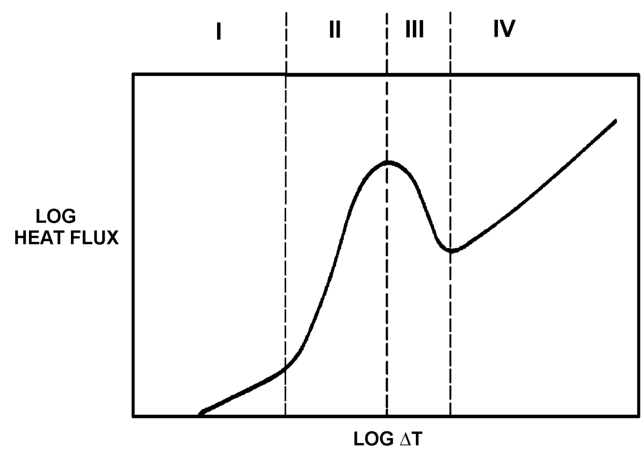
A. Complete steam blanketing of the fuel rod surface

B. Alternate wetting and drying of the fuel rod surface

C. Saturated nucleate boiling

D. Subcooled nucleate boiling

ANSWER: B.



POOL BOILING CURVE

TOPIC: 193008
KNOWLEDGE: K1.07 [2.6/2.6]
QID: P2289 (B289) (B2688)

Refer to the drawing of a pool-boiling curve (see figure below).

The point at which heat flux stops increasing and the critical heat flux has been reached (point B), marks the beginning of...

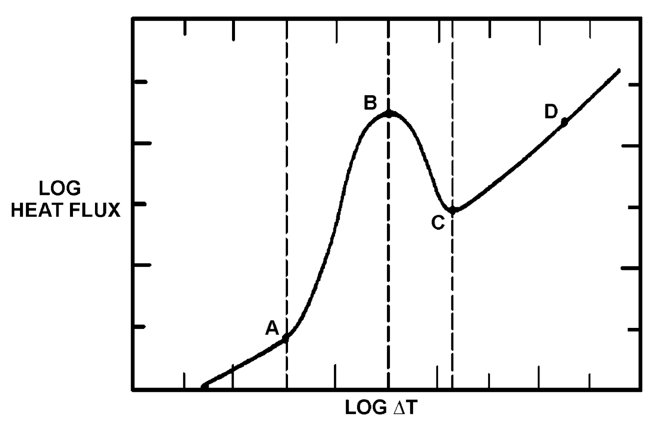
A. nucleate boiling.

B. stable film boiling.

C. partial film boiling.

D. single-phase convection.

ANSWER: C.



POOL BOILING CURVE

TOPIC: 193008
KNOWLEDGE: K1.07 [2.6/2.6]
QID: P2688 (B1486)

Refer to the drawing of a pool-boiling curve (see figure below).

Which one of the following regions represents the most unstable heat transfer?

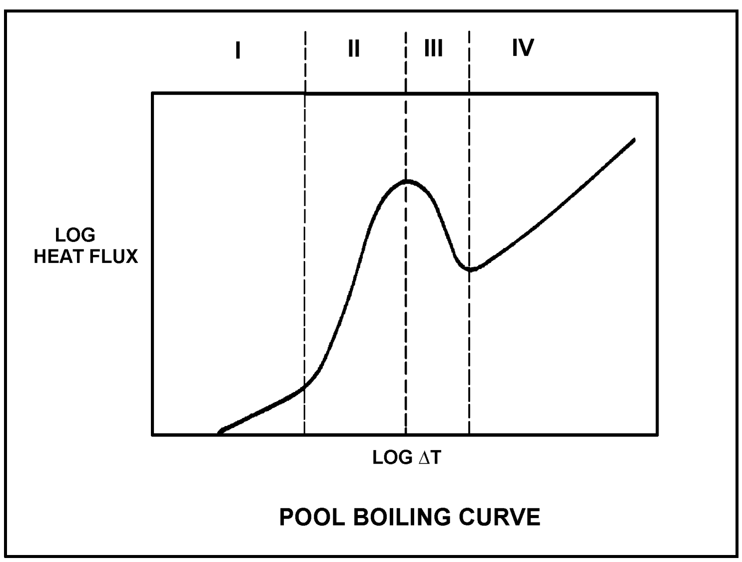
A. I

B. II

C. III

D. IV

ANSWER: C.



TOPIC: 193008
KNOWLEDGE: K1.08 [2.6/2.6]
QID: P88

Film boiling heat transfer is...

A. the most efficient method of boiling heat transfer.

B. heat transfer through an oxide film on the cladding.

C. heat transfer being accomplished with no enthalpy change.

D. heat transfer through a vapor blanket that covers the fuel cladding.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.08 [2.6/2.6]
QID: P139

Reactor power is increased sufficiently to cause steam blanketing of several fuel rods. This condition is being caused by...

A. departure from nucleate boiling.

B. subcooled nucleate boiling.

C. saturated nucleate boiling.

D. onset of nucleate boiling.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.08 [2.6/2.6]
QID: P889 (B1987)

If the fission rate in a nuclear reactor core steadily increases, the mode of heat transfer that occurs immediately after the critical heat flux is reached is called...

A. transition boiling.

B. subcooled nucleate boiling.

C. saturated nucleate boiling.

D. stable film boiling.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.08 [2.6/2.6]
QID: P1587 (B1587)

Refer to the drawing of a pool boiling curve (see figure below).

Which one of the points shown marks the smallest ΔT at which stable film boiling can exist?

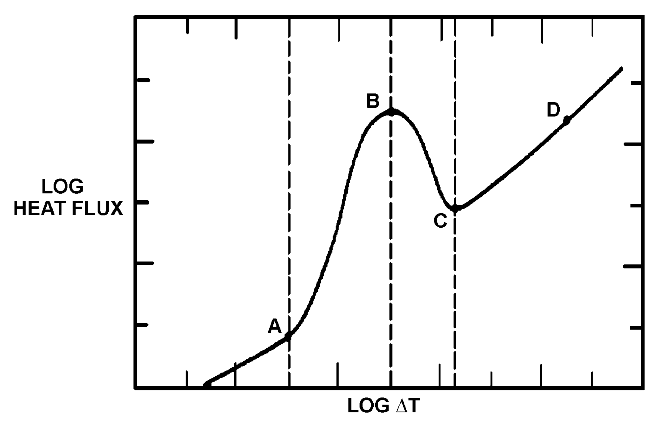
A. A

B. B

C. C

D. D

ANSWER: C.



POOL BOILING CURVE

TOPIC: 193008
KNOWLEDGE: K1.08 [2.6/2.6]
QID: P2588 (B2588)

Refer to the drawing of a pool boiling curve (see figure below).

Which one of the following describes the conditions in a fuel channel that is experiencing region IV heat transfer?

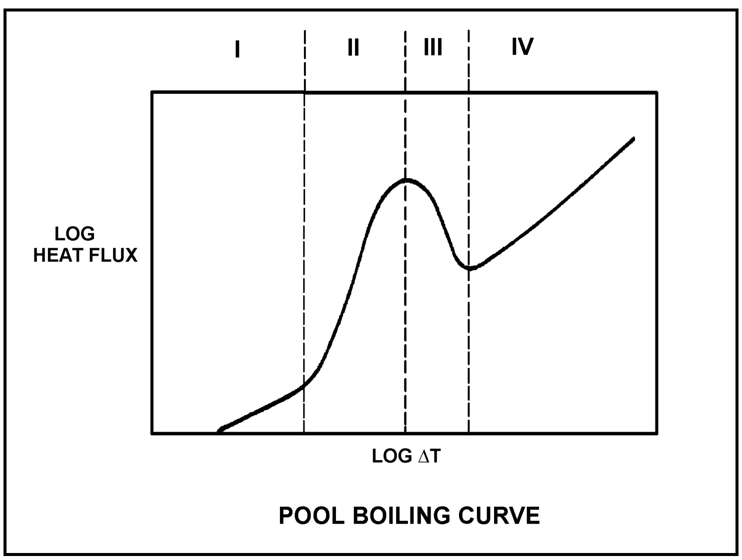
A. Complete steam blanketing of the fuel rod surface

B. Alternate wetting and drying of the fuel rod surface

C. Saturated nucleate boiling

D. Subcooled nucleate boiling

ANSWER: A.



TOPIC: 193008
KNOWLEDGE: K1.08 [2.6/2.6]
QID: P3488 (B3485)

During a loss of coolant accident, the reactor fuel may experience stable film boiling. Which one of the following types of heat transfer from the fuel cladding will increase significantly when stable film boiling begins?

A. Forced convection

B. Natural convection

C. Conduction

D. Radiation

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.10 [2.9/3.1]
QID: P89

The departure from nucleate boiling (DNB) ratio is defined as the...

A. actual heat flux divided by the critical heat flux at any point along a fuel rod.

B. critical heat flux divided by the actual heat flux at any point along a fuel rod.

C. core thermal power divided by the total reactor coolant mass flow rate.

D. number of coolant channels that have reached DNB divided by the number of coolant channels that are subcooled.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.10 [2.9/3.1]
QID: P289

In the definition of the departure from nucleate boiling ratio, the term "actual heat flux" refers to the...

A. heat transfer rate per unit area at any point along the fuel rod.

B. average heat transfer rate per unit area across the core.

C. integrated heat transfer rate along the entire fuel rod.

D. total heat transfer rate along the entire fuel rod.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.10 [2.9/3.1]
QID: P990

A nuclear reactor is operating at 100 percent steady-state power at the end of core life with all control rods fully withdrawn. At what axial location in a typical fuel assembly will the minimum departure from nucleate boiling ratio occur?

A. At the bottom of the fuel assembly.

B. At the top of the fuel assembly.

C. Between the bottom and the midplane of the fuel assembly.

D. Between the midplane and the top of the fuel assembly.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.10 [2.9/3.1]
QID: P1190

A nuclear reactor is operating at steady state 100 percent power near the end of a fuel cycle with all control rods fully withdrawn. At what axial location in a typical fuel assembly will the maximum departure from nucleate boiling ratio occur?

A. At the top of the fuel assembly.

B. At the bottom of the fuel assembly.

C. Between the bottom and midplane of the fuel assembly.

D. Between the midplane and the top of the fuel assembly.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.10 [2.9/3.1]
QID: P2590

If a nuclear reactor is operating with the departure from nucleate boiling ratio (DNBR) at its limit, which one of the following is indicated?

A. None of the fuel rods are experiencing critical heat flux.

B. A small fraction of the fuel rods may be experiencing critical heat flux.

C. All radioactive fission products are being contained within the reactor fuel.

D. All radioactive fission products are being contained within either the reactor fuel or the reactor vessel.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.14 [2.6/2.7]
QID: P389 (B588)

Core heat transfer is maximized by the presence of...

A. laminar flow with no nucleate boiling.

B. turbulent flow with no nucleate boiling.

C. laminar flow with nucleate boiling.

D. turbulent flow with nucleate boiling.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.14 [2.6/2.7]
QID: P690

The heat transfer coefficient of the core will be directly increased if: (Assume bulk coolant subcooling.)

A. the coolant temperature is decreased.

B. the coolant flow rate is decreased.

C. nucleate boiling occurs in the coolant.

D. the coolant flow is laminar instead of turbulent.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.14 [2.6/2.7]
QID: P891

Increasing coolant flow rate through a nuclear reactor core improves heat transfer from the fuel because it __________ the laminar film thickness and __________ the temperature of the coolant adjacent to the fuel.

A. increases; raises

B. increases; lowers

C. decreases; raises

D. decreases; lowers

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.14 [2.6/2.7]
QID: P1691

Which one of the following will minimize core heat transfer?

A. Laminar flow with no nucleate boiling

B. Turbulent flow with no nucleate boiling

C. Laminar flow with nucleate boiling

D. Turbulent flow with nucleate boiling

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.15 [3.6/3.8]
QID: P90

A nuclear power plant is operating at 100 percent power. The reactor coolant subcooling margin will be directly reduced by:

A. increasing reactor coolant temperature.

B. increasing pressurizer pressure.

C. increasing reactor coolant flow.

D. increasing pressurizer level.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.15 [3.6/3.8]
QID: P290

The difference between the actual temperature and the saturation temperature of a liquid is the...

A. critical heat flux.

B. subcooling margin.

C. departure from nucleate boiling.

D. saturation margin.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.15 [3.6/3.8]
QID: P393

Which one of the following must be present to assure adequate core cooling following a small loss-of-coolant accident?

A. Emergency cooling injection flow rate on scale.

B. Pressurizer level in the indicating range.

C. Subcooling margin greater than zero.

D. Pressurizer pressure greater than safety injection actuation setpoint.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.15 [3.6/3.8]
QID: P992

Which one of the following will increase the reactor coolant system (RCS) subcooling margin with the reactor operating at full power?

A. Decreased RCS pressure.

B. Decreased RCS hot leg temperature.

C. Increased RCS cold leg temperature.

D. Increased concentration of soluble gases in the RCS.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.15 [3.6/3.8]
QID: P1491

A 60°F/hour reactor coolant system (RCS) cooldown and depressurization with natural circulation is in progress. After one hour, RCS subcooling will be minimum in the...

A. reactor vessel head.

B. RCS loop hot leg.

C. RCS loop cold leg.

D. reactor core.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.15 [3.6/3.8]
QID: P2090

A reactor coolant system (RCS) cooldown and depressurization is in progress on natural circulation following a loss of offsite power. The following conditions exist:

RCS Tcold:	520°F, decreasing
RCS Thot:	538°F, decreasing
Pressurizer pressure:	2,000 psia, decreasing

If the cooldown rate is being maintained at 50°F/hour, which one of the following locations is most likely to experience steam formation?

A. Reactor vessel head

B. RCS loop hot leg

C. Steam generator U-tubes

D. Reactor core

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.15 [3.6/3.8]
QID: P2591

Which one of the following is most likely to result in steam bubble formation in a reactor vessel head while maintaining a 60°F subcooling margin in the hottest reactor coolant system (RCS) hot leg?

A. Performing a 25°F/Hr RCS cooldown on natural circulation.

B. Performing a 50°F/Hr RCS cooldown on natural circulation.

C. Performing a 25°F/Hr RCS heatup on forced circulation.

D. Performing a 50°F/Hr RCS heatup on forced circulation.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.15 [3.6/3.8]
QID: P2790

Which one of the following is most likely to result in steam bubble formation in a reactor vessel head while maintaining a 40°F subcooling margin in the hottest RCS hot leg?

A. Performing a 25°F/Hr RCS cooldown on natural circulation.

B. Performing a 25°F/Hr RCS cooldown on forced circulation.

C. Performing a 50°F/Hr RCS cooldown on natural circulation.

D. Performing a 50°F/Hr RCS cooldown on forced circulation.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.15 [3.6/3.8]
QID: P2890

A nuclear power plant maintains the reactor coolant system (RCS) cold leg temperature (T_{cold}) at 557°F from 0 percent to 100 percent power. At 100 percent power, the reactor differential temperature (T_{hot} - T_{cold}) is 60°F.

If this plant also maintains RCS pressure constant at 2,235 psig, which one of the following is the approximate RCS subcooling margin at 50 percent power?

A. 30°F

B. 36°F

C. 66°F

D. 96°F

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.15 [3.6/3.8]
QID: P2991

Assume that a 30°F subcooling margin is maintained in the reactor coolant system (RCS) hot legs during each of the following shutdown reactor cooldown operations. Which one of the following will maintain the greatest subcooling margin in the reactor vessel head?

A. Performing a 25°F/Hr RCS cooldown on natural circulation using one steam generator.

B. Performing a 25°F/Hr RCS cooldown with all reactor coolant pumps running.

C. Performing a 100°F/Hr RCS cooldown on natural circulation using all steam generators.

D. Performing a 100°F/Hr RCS cooldown with one reactor coolant pump running.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.16 [2.4/2.6]
QID: P391 (B1989)

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of a fuel cycle (see figure below).

At 100 percent reactor power, the greatest temperature difference in a fuel channel radial temperature profile will occur across the: (Assume the temperature profile begins at the fuel centerline.)

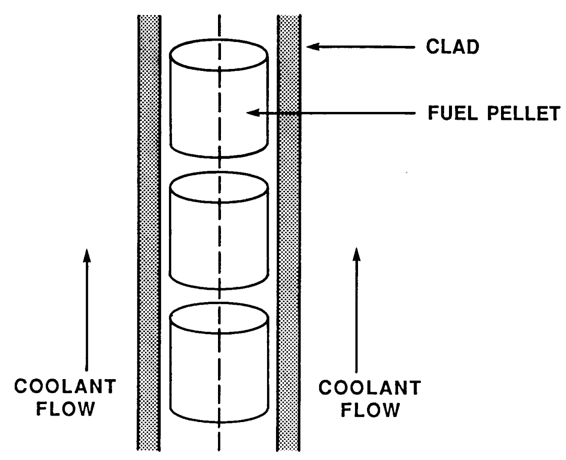
A. fuel pellet centerline to pellet surface.

B. fuel pellet surface-to-clad gap.

C. zircaloy cladding.

D. flow channel boundary (laminar) layer.

ANSWER: A.



FUEL ROD AND COOLANT FLOW CHANNEL

TOPIC: 193008
KNOWLEDGE: K1.17 [2.9/3.2]
QID: P692

During a plant cooldown and depressurization with forced circulation, reactor coolant system (RCS) loop flow and reactor coolant pump (RCP) current indications become erratic. These abnormal indications are most likely caused by...

A. RCP cavitation.

B. RCP runout.

C. RCS loop water hammer.

D. RCS hot leg saturation.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.18 [2.3/2.5]
QID: P1790 (B1789)

Single-phase coolant flow resistance (head loss) in a nuclear reactor core is directly proportional to the square of coolant __________ and inversely proportional to __________.

A. velocity; fuel assembly length

B. temperature; fuel assembly length

C. velocity; coolant channel cross-sectional area

D. temperature; coolant channel cross-sectional area

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.18 [2.3/2.5]
QID: P5446 (B5445)

Refer to the drawing of a section of pipe that contains flowing water (see figure below).

Given:

Pressure at P_1 is 24 psig.
Pressure at P_2 is 16 psig.
Pressure change due to change in velocity is 2 psig.
Pressure change due to change in elevation is 10 psig.

The pressure decrease due to friction head loss between P_1 and P_2 is ____________; and the direction of flow is from ______________.

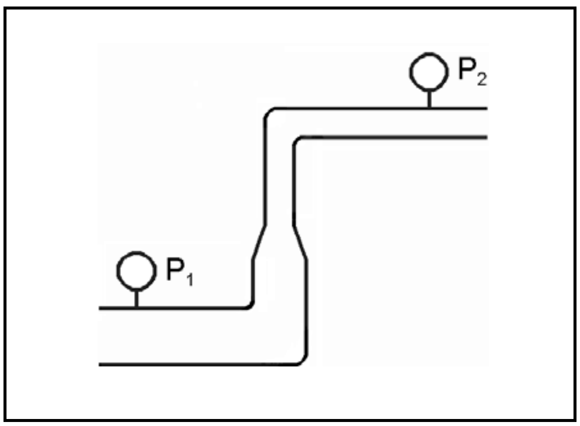
A. 2 psig; left to right

B. 2 psig; right to left

C. 4 psig; left to right

D. 4 psig; right to left

ANSWER: D.



TOPIC: 193008
KNOWLEDGE: K1.18 [2.3/2.5]
QID: P5847 (B5845)

Refer to the drawing of a section of pipe that contains flowing subcooled water (see figure below).

Given:

Pressure at P_1 is 26 psig.
Pressure at P_2 is 34 psig.
Pressure change due to change in velocity is 2 psig.
Pressure change due to change in elevation is 8 psig.

The pressure decrease due to friction head loss between P_1 and P_2 is ____________; and the direction of flow is from ______________.

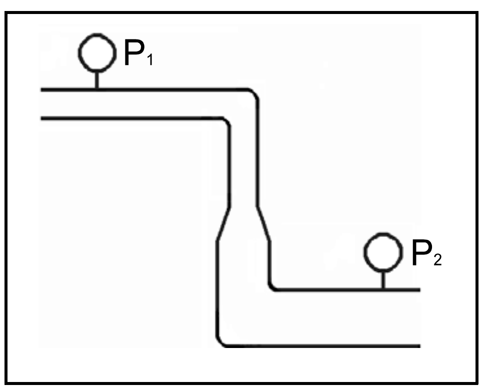
A. 2 psig; left to right

B. 2 psig; right to left

C. 4 psig; left to right

D. 4 psig; right to left

ANSWER: A.



TOPIC: 193008
KNOWLEDGE: K1.18 [2.3/2.5]
QID: P6648 (B6646)

Refer to the drawing of a section of pipe with subcooled water flowing through it (see figure below).

Given:

Pressure at P_1 is 30 psig.
Pressure at P_2 is 32 psig.
Pressure change due to change in velocity is 2 psig.
Pressure change due to change in elevation is 2 psig.

The pressure decrease due to friction head loss between P_1 and P_2 is ____________; and the direction of flow is from ______________.

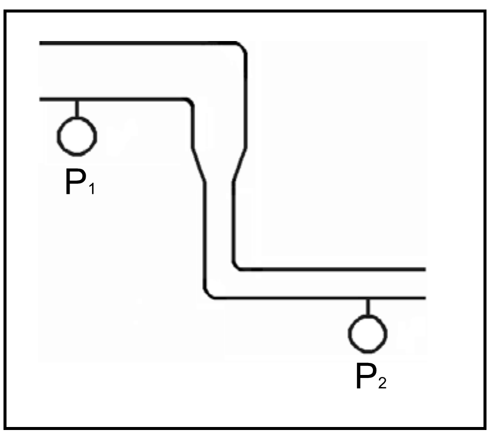
A. 2 psig; left to right

B. 2 psig; right to left

C. 6 psig; left to right

D. 6 psig; right to left

ANSWER: B.



TOPIC: 193008
KNOWLEDGE: K1.18 [2.3/2.5]
QID: P7048 (B7046)

Refer to the drawing of a section of pipe that contains flowing subcooled water (see figure below).

Given:

Pressure at P_1 is 34 psig.
Pressure at P_2 is 20 psig.
Pressure change due to change in velocity is 2 psig.
Pressure change due to change in elevation is 8 psig.

The pressure decrease due to friction head loss between P_1 and P_2 is ____________; and the direction of flow is from ______________.

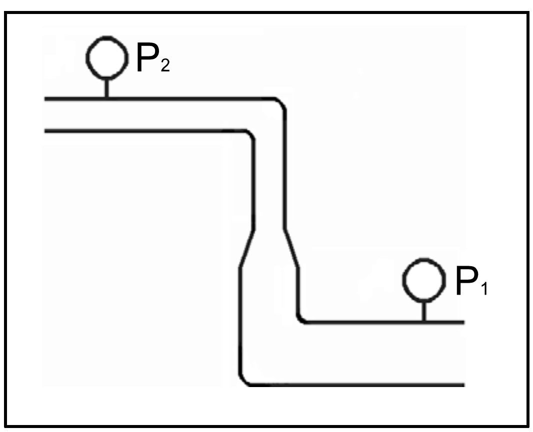
A. 2 psig; left to right

B. 2 psig; right to left

C. 4 psig; left to right

D. 4 psig; right to left

ANSWER: D.



TOPIC: 193008
KNOWLEDGE: K1.19 [2.5/2.8]
QID: P1192

A nuclear reactor is producing 3,400 MW of thermal output with a vessel ΔT of 60°F and a vessel mass flow rate of 1.4 x 10^8 lbm/hr. If core ΔT is 63.6°F, what is core bypass flow rate? (Assume bypass flow ΔT equals 0°F.)

A. 7.92 x 10^6 lbm/hr

B. 8.40 x 10^6 lbm/hr

C. 1.26 x 10^8 lbm/hr

D. 1.32 x 10^8 lbm/hr

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.19 [2.5/2.8]
QID: P1886

A nuclear reactor is producing 3,400 MW of thermal output with a vessel ΔT of 60°F and a vessel mass flow rate of 1.0 x 10^8 lbm/hr. If core ΔT is 63.6°F, what is core bypass flow rate? (Assume bypass flow ΔT equals 0°F.)

A. 5.66 x 10^6 lbm/hr

B. 8.40 x 10^6 lbm/hr

C. 3.60 x 10^7 lbm/hr

D. 9.43 x 10^7 lbm/hr

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.19 [2.5/2.8]
QID: P2291

A nuclear reactor is producing 3,400 MW of thermal output with a vessel differential temperature (ΔT) of 60°F and a vessel mass flow rate of 1.1 x 10^8 lbm/hr. If core ΔT is 63.6°F, what is core bypass flow rate? (Assume bypass flow ΔT equals 0°F.)

A. 5.66 x 10^6 lbm/hr

B. 6.23 x 10^6 lbm/hr

C. 5.66 x 10^7 lbm/hr

D. 6.23 x 10^7 lbm/hr

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.20 [2.9/2.9]
QID: P590

Adequate core bypass flow is needed to...

A. cool the excore nuclear instrument detectors.

B. provide reactor coolant pump minimum flow requirements.

C. prevent stratification of reactor coolant inside the reactor vessel.

D. equalize the temperatures between the reactor vessel and the upper vessel head.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.20 [2.9/2.9]
QID: P1391

Which one of the following describes a function of core bypass flow?

A. Prevents excessive reactor vessel wall differential temperature

B. Prevents boron precipitation in the core baffle area

C. Provides a means of measuring core flow

D. Provides cooling to various reactor vessel internal components

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.20 [2.9/2.9]
QID: P1488

Which one of the following is a function of core bypass flow?

A. Provides even flow distribution through the fuel.

B. Provides mixing of water in the reactor vessel head.

C. Ensures that core exit thermocouple readings represent average fuel temperatures.

D. Ensures that natural circulation will be initiated when forced circulation is lost.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.21 [3.9/4.2]
QID: P91

Maximizing the elevation difference between the core thermal center and the steam generator thermal center and minimizing flow restrictions in the reactor coolant system (RCS) piping are plant designs that...

A. minimize the RCS volume.

B. maximize the RCS flow rate during forced circulation.

C. ensure a maximum RCS loop transit time.

D. ensure RCS natural circulation flow can be established.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.21 [3.9/4.2]
QID: P292

Which one of the following must exist for natural circulation flow to occur?

A. The heat source must be larger than the heat sink.

B. The heat source must be located higher than the heat sink.

C. The heat sink must be larger than the heat source.

D. The heat sink must be located higher than the heat source.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.21 [3.9/4.2]
QID: P893

The driving head for natural circulation flow through the core is developed by differences in __________ between the hot leg and the cold leg.

A. water density

B. water volume

C. pipe diameter

D. piping length

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.21 [3.9/4.2]
QID: P1387

If the steam generator thermal centers were at the same elevation as the reactor core thermal center, natural circulation flow in the reactor coolant system would...

A. not occur.

B. not be affected.

C. be greater than if they were at different elevations.

D. flow in the reverse direction.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.21 [3.9/4.2]
QID: P1393

A nuclear reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0 percent of rated thermal power. Stable natural circulation mass flow rate is 1,000 gpm.

When decay heat generation decreases to 0.5 percent of rated thermal power, stable natural circulation flow rate will be approximately...

A. 125 gpm.

B. 250 gpm.

C. 707 gpm.

D. 794 gpm.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.21 [3.9/4.2]
QID: P1692

A nuclear reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0 percent of rated thermal power. Core ΔT has stabilized at 16°F.

When decay heat generation decreases to 0.5 percent of rated thermal power, core ΔT will be approximately...

A. 2°F.

B. 4°F.

C. 8°F.

D. 10°F.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.21 [3.9/4.2]
QID: P1887

Establishing natural circulation requires that a heat sink be ____________ in elevation than a heat source and that a ____________ difference exist between the heat sink and heat source.

A. lower; pressure

B. lower; temperature

C. higher; pressure

D. higher; temperature

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.21 [3.9/4.2]
QID: P1989 (B2386)

Which one of the following conditions must occur to sustain natural circulation in a fluid system?

A. Subcooling of the fluid

B. A phase change in the fluid

C. A density change in the fluid

D. Radiative heat transfer to the fluid

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.21 [3.9/4.2]
QID: P2092

A nuclear reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0 percent of rated thermal power. Core ΔT has stabilized at 16°F.

When decay heat generation decreases to 0.333 percent of rated thermal power, core ΔT will be approximately...

A. 2°F.

B. 4°F.

C. 8°F.

D. 10°F.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.21 [3.9/4.2]
QID: P2392

A nuclear reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0 percent of rated thermal power. Core ΔT has stabilized at 13°F.

When decay heat generation decreases to 0.5 percent of rated thermal power, core ΔT will be approximately...

A. 4°F.

B. 6°F.

C. 8°F.

D. 10°F.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.21 [3.9/4.2]
QID: P2491

A nuclear reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0 percent of rated thermal power. Stable natural circulation flow rate is 800 gpm.

When decay heat generation decreases to 0.5 percent of rated thermal power, stable natural circulation flow rate will be approximately...

A. 400 gpm.

B. 565 gpm.

C. 635 gpm.

D. 696 gpm.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.22 [4.2/4.2]
QID: P1492

A nuclear power plant is operating at 100 percent power when a loss of offsite power occurs, resulting in a reactor trip and a loss of forced reactor coolant circulation. After 30 minutes, reactor coolant system (RCS) hot leg temperature is greater than cold leg temperature and steam generator (SG) levels are stable.

Which one of the following combinations of parameter trends, occurring 30 minutes after the trip, indicates that natural circulation is occurring? (CETC = core exit thermocouple)

	RCS Hot Leg Temperature	RCS Cold Leg Temperature	SG Pressures	RCS CETC Subcooling
A.	Decreasing	Stable	Stable	Increasing
B.	Increasing	Decreasing	Increasing	Decreasing
C.	Decreasing	Decreasing	Decreasing	Decreasing
D.	Increasing	Increasing	Decreasing	Increasing

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.22 [4.2/4.2]
QID: P1791

A nuclear power plant is operating at 100 percent power when a loss of offsite power occurs, resulting in a reactor trip and a loss of forced reactor coolant circulation. After 30 minutes, reactor coolant system (RCS) hot leg temperature is greater than cold leg temperature and steam generator (SG) levels are stable.

Which one of the following combinations of parameter trends, occurring 2 hours after the trip, indicates that natural circulation is not occurring? (CETC = core exit thermocouples)

	RCS Hot Leg Temperature	RCS Cold Leg Temperature	SG Pressures	RCS CETC Subcooling
A.	Stable	Decreasing	Decreasing	Stable
B.	Stable	Stable	Decreasing	Decreasing
C.	Decreasing	Decreasing	Decreasing	Increasing
D.	Decreasing	Stable	Stable	Increasing

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.23 [3.9/4.1]
QID: P92

A nuclear reactor is shut down at normal operating temperature and pressure with all reactor coolant pumps stopped. Stable natural circulation cooling is in progress with 50°F of RCS subcooling. Which one of the following, if increased, will not affect natural circulation flow rate?

A. Reactor coolant pressure

B. Time after reactor trip

C. Feed water flow rate

D. Steam generator pressure

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.23 [3.9/4.1]
QID: P293

Fully-developed natural circulation flow rate will be greatest when...

A. all reactor coolant pumps stop sequentially within 1 hour after a reactor trip.

B. all reactor coolant pumps stop at the same time the reactor trips.

C. all reactor coolant pumps run for 1 hour after a reactor trip, and then stop.

D. only one reactor coolant pump runs for 1 hour after a reactor trip, and then stops.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.23 [3.9/4.1]
QID: P392

Natural circulation flow can be enhanced by...

A. increasing the elevation of the heat source to equal that of the heat sink.

B. increasing the temperature difference between the heat sink and the heat source.

C. decreasing the temperature difference between the heat sink and the heat source.

D. decreasing the elevation difference between the heat source and the heat sink.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.23 [3.9/4.1]
QID: P1493

Which one of the following will enhance natural circulation flow in the reactor coolant system?

A. Pressurizer level decreases.

B. Steam generator level increases.

C. Pressurizer pressure decreases.

D. Steam generator pressure increases.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.23 [3.9/4.1]
QID: P1591

A nuclear reactor had been operating at a constant power level for the last two weeks when a loss of all ac power occurred, thereby causing a reactor trip and a loss of forced reactor coolant flow. Natural circulation reactor coolant flow developed and stabilized 30 minutes after the trip.

Which one of the following combinations of initial reactor power and post-trip steam generator pressure will result in the highest stable natural circulation flow rate 30 minutes after the trip?

	Initial Reactor Power	Post-trip Steam Generator Pressure
A.	100 percent	1,100 psia
B.	25 percent	1,100 psia
C.	100 percent	1,000 psia
D.	25 percent	1,000 psia

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.23 [3.9/4.1]
QID: P1985

A nuclear reactor had been operating at a constant power level for the last two weeks when a loss of all ac power occurred, thereby causing a reactor trip and a loss of forced reactor coolant flow. Natural circulation reactor coolant flow developed and stabilized 30 minutes after the trip.

Which one of the following combinations of initial reactor power and post-trip steam generator pressure will result in the lowest stable natural circulation flow rate 30 minutes after the trip? (Assume constant steam generator water levels.)

	Initial Reactor Power	Post-trip Steam Generator Pressure
A.	100 percent	1,100 psia
B.	25 percent	1,100 psia
C.	100 percent	1,000 psia
D.	25 percent	1,000 psia

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.23 [3.9/4.1]
QID: P2492

A nuclear reactor had been operating at steady state 100 percent power when a loss of offsite power occurred, thereby causing a reactor trip and a complete loss of forced reactor coolant flow. Natural circulation reactor coolant flow developed and stabilized approximately 30 minutes after the trip.

Which one of the following combinations of reactor power history and post-trip steam generator pressure will result in the highest stable natural circulation flow rate?

	Days At Full Power	Post-trip Steam Generator Pressure
A.	12	1,100 psia
B.	100	1,100 psia
C.	12	1,000 psia
D.	100	1,000 psia

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.23 [3.9/4.1]
QID: P3292

A few minutes ago, a nuclear power plant experienced a loss of offsite power that caused a reactor trip and a loss of all reactor coolant pumps. Natural circulation flow is currently developing in the reactor coolant system (RCS).

Which one of the following operator actions will enhance RCS natural circulation flow rate?

A. Establish and maintain saturation conditions in the RCS.

B. Establish and maintain a steam bubble in the reactor vessel.

C. Establish and maintain steam generator pressure above RCS pressure.

D. Establish and maintain steam generator water level high in the normal operating range.

ANSWER: D.

TOPIC: 193008
KNOWLEDGE: K1.24 [2.7/3.1]
QID: P592

During the reflux boiling method of core cooling, the steam that is generated in the core is condensed in the ____________ side of a steam generator and flows back into the core via the ____________. (Assume the steam generators contain U-tubes.)

A. hot leg; hot leg

B. cold leg; hot leg

C. hot leg; cold leg

D. cold leg; cold leg

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.24 [2.7/3.1]
QID: P786

Which one of the following describes the method of core heat removal during reflux core cooling following a loss of coolant accident?

A. Convection with forced coolant flow.

B. Convection with natural circulation coolant flow.

C. Conduction with stagnant coolant flow.

D. Radiation with total core voiding.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.24 [2.7/3.1]
QID: P2692

A nuclear power plant is experiencing natural circulation core cooling following a loss of coolant accident. Which one of the following, when it first occurs, marks the beginning of reflux core cooling? (Assume the steam generators contain U-tubes.)

A. Reactor core steam production results in two-phase coolant entering the hot leg and being delivered to the steam generators.

B. Hot leg steam quality is so high that the steam generators cannot fully condense it and two-phase coolant is returned to the reactor vessel via the cold leg.

C. Hot leg condensation is unable to pass completely through the steam generators to enter the cold legs.

D. The steam generators are no longer able to condense any of the steam contained in the hot leg.

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P593

A reactor coolant system cooldown is in progress on natural circulation via the steam generator (SG) atmospheric steam relief valves (operated in manual control). If high point voiding interrupts natural circulation, which one of the following will occur? (Assume feed flow rate, relief valve position, and decay heat level are constant.)

A. SG level increases and SG pressure increases.

B. SG level increases and SG pressure decreases.

C. SG level decreases and SG pressure increases.

D. SG level decreases and SG pressure decreases.

ANSWER: B.

TOPIC: 193008
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P793

A reactor coolant system natural circulation cooldown is in progress via the steam generator (SG) atmospheric steam relief valves (operated in manual control). Assume feed flow rate, relief valve position, and decay heat level are constant.

If high point voiding interrupts natural circulation, SG levels will gradually __________; and core exit thermocouple indications will gradually ____________.

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

ANSWER: C.

TOPIC: 193008
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P2093

A reactor coolant system natural circulation cooldown is in progress using the steam generator (SG) atmospheric steam relief valves (operated in manual control).

If voids interrupt natural circulation, which one of the following will occur? (Assume feed flow rate, relief valve position, and decay heat level are constant.)

A. SG pressure decreases and core exit thermocouple (CETC) temperature increases.

B. SG pressure decreases and CETC temperature remains constant.

C. SG pressure increases and CETC temperature increases.

D. SG pressure increases and CETC temperature remains constant.

ANSWER: A.

TOPIC: 193008
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P2493

A reactor coolant system natural circulation cooldown is in progress using the steam generator (SG) atmospheric steam relief valves, operated in manual control. Assume feed flow rate, relief valve position, and decay heat level remain constant.

If SG tube high point voiding interrupts natural circulation, SG steam flow rate will _________ and core exit thermocouple temperature will _________.

A. decrease; increase

B. decrease; remain constant

C. increase; increase

D. increase; remain constant

ANSWER: A.

TOPIC: 193009
KNOWLEDGE: K1.01 [2.3/2.8]
QID: P2794

A nuclear reactor is operating at 75 percent power at the middle of a fuel cycle with radial power distribution peaked in the center of the core. All control rods are fully withdrawn and in manual control.

Assuming all control rods remain fully withdrawn, except as noted, which one of the following will cause the maximum steady-state radial peaking (or hot channel) factor to decrease?

A. Turbine load/reactor power is reduced by 20 percent.

B. A control rod located at the edge of the core drops into the core.

C. Reactor coolant system boron concentration is reduced by 10 ppm.

D. The reactor is operated continuously at 75 percent power for three months.

ANSWER: D.

TOPIC: 193009
KNOWLEDGE: K1.02 [2.3/2.8]
QID: P1195

A nuclear reactor is operating at 80 percent power near the middle of a fuel cycle. All control rods are fully withdrawn and in manual control. Core axial power distribution is peaked below the core midplane.

Which one of the following will significantly decrease the core maximum axial peaking (or hot channel) factor? (Assume no subsequent operator action is taken and that main turbine load and core xenon distribution do not change unless stated.)

A. One bank of control rods is inserted 10 percent.

B. One control rod fully inserts into the core.

C. Turbine load/reactor power is reduced by 20 percent.

D. Reactor coolant system boron concentration is reduced by 50 ppm.

ANSWER: C.

TOPIC: 193009
KNOWLEDGE: K1.04 [2.3/2.7]
QID: P3295

A PWR core consists of 50,000 fuel rods; each fuel rod has an active length of 12 feet. The core is producing 1,800 MW of thermal power. If the nuclear heat flux hot channel factor, $F_Q(z)$, (also called the total core peaking factor) is 2.0, what is the maximum local linear power density being produced in the core?

A. 4.5 kW/ft

B. 6.0 kW/ft

C. 9.0 kW/ft

D. 12.0 kW/ft

ANSWER: B.

TOPIC: 193009
KNOWLEDGE: K1.04 [2.3/2.7]
QID: P3794

A PWR core consists of 50,000 fuel rods; each fuel rod has an active length of 12 feet. The core is producing 1,800 MW of thermal power. If the nuclear heat flux hot channel factor, $F_Q(z)$, (also called the total core peaking factor) is 1.5, what is the maximum local linear power density being produced in the core?

A. 4.5 kW/ft

B. 6.0 kW/ft

C. 9.0 kW/ft

D. 12.0 kW/ft

ANSWER: A.

TOPIC: 193009
KNOWLEDGE: K1.04 [2.3/2.7]
QID: P4949

A PWR core consists of 50,000 fuel rods; each fuel rod has an active length of 12 feet. The core is producing 1,800 MW of thermal power. If the nuclear heat flux hot channel factor, $F_Q(z)$, (also called the total core peaking factor) is 3.0, what is the maximum local linear power density being produced in the core?

A. 4.5 kW/ft

B. 6.0 kW/ft

C. 9.0 kW/ft

D. 12.0 kW/ft

ANSWER: C.

TOPIC: 193009
KNOWLEDGE: K1.04 [2.3/2.7]
QID: P5249

A nuclear reactor is operating at 3,400 MW thermal power. The core linear power density limit is 12.2 kW/ft.

Given:

- The reactor core contains 198 fuel assemblies.
- Each fuel assembly contains 262 fuel rods, each with an active length of 12.0 feet
- The highest total peaking factors measured in the core are as follows:

  Location A: 2.5
  Location B: 2.4
  Location C: 2.3
  Location D: 2.2

Which one of the following describes the operating conditions in the core relative to the linear power density limit?

A. All locations in the core are operating below the linear power density limit.

B. Location A has exceeded the linear power density limit while the remainder of the core is operating below the limit.

C. Locations A and B have exceeded the linear power density limit while the remainder of the core is operating below the limit.

D. Locations A, B, and C have exceeded the linear power density limit while the remainder of the core is operating below the limit.

ANSWER: D.

TOPIC: 193009
KNOWLEDGE: K1.04 [2.3/2.7]
QID: P6249 (B6247)

A nuclear reactor is operating at steady state conditions in the power range with the following average temperatures in a core plane:

$T_{coolant}$ = 550°F
$T_{fuel\ centerline}$ = 1,680°F

Assume that the fuel rod heat transfer coefficients and reactor coolant temperatures are equal throughout the core plane. If the maximum total peaking factor in the core plane is 2.1, what is the maximum fuel centerline temperature in the core plane?

A. 2,923°F

B. 3,528°F

C. 4,078°F

D. 4,683°F

ANSWER: A.

TOPIC: 193009
KNOWLEDGE: K1.05 [3.1/3.5]
QID: P56

The basis for the maximum power density (kW/foot) power limit is to...

A. provide assurance of fuel integrity.

B. prevent xenon oscillations.

C. allow for fuel pellet manufacturing tolerances.

D. prevent nucleate boiling.

ANSWER: A.

TOPIC: 193009
KNOWLEDGE: K1.05 [3.1/3.5]
QID: P94

If a nuclear reactor is operated within core thermal limits, then...

A. plant thermal efficiency is optimized.

B. fuel cladding integrity is ensured.

C. pressurized thermal shock will be prevented.

D. reactor vessel thermal stresses will be minimized.

ANSWER: B.

TOPIC: 193009
KNOWLEDGE: K1.05 [3.1/3.5]
QID: P396 (B1793)

The 2,200°F maximum peak fuel cladding temperature limit is imposed because...

A. 2,200°F is approximately 500°F below the fuel cladding melting temperature.

B. the rate of the zircaloy-steam reaction increases significantly at temperatures above 2,200°F.

C. any cladding temperature higher than 2,200°F correlates to a fuel centerline temperature above the fuel melting point.

D. the thermal conductivity of zircaloy decreases rapidly at temperatures above 2,200°F.

ANSWER: B.

TOPIC: 193009
KNOWLEDGE: K1.05 [3.1/3.5]
QID: P894

During normal operation, fuel clad integrity is ensured by...

A. the primary system relief valves.

B. core bypass flow restrictions.

C. the secondary system relief valves.

D. operating within core thermal limits.

ANSWER: D.

TOPIC: 193009
KNOWLEDGE: K1.05 [3.1/3.5]
QID: P994

Maximum fuel cladding integrity is attained by...

A. always operating below 110 percent of reactor coolant system design pressure.

B. actuation of the reactor protection system upon a reactor accident.

C. ensuring that actual heat flux is always less than critical heat flux.

D. ensuring operation above the critical heat flux during all operating conditions.

ANSWER: C.

TOPIC: 193009
KNOWLEDGE: K1.05 [3.1/3.5]
QID: P1194

Nuclear reactor core peaking (or hot channel) factors are used to establish a maximum reactor power level such that fuel pellet temperature is limited to prevent __________ and fuel clad temperature is limited to prevent _________ during most analyzed transients and abnormal conditions.

A. fuel pellet melting; fuel clad melting

B. excessive fuel pellet expansion; fuel clad melting

C. fuel pellet melting; excessive fuel clad oxidation

D. excessive fuel pellet expansion; excessive fuel clad oxidation

ANSWER: C.

TOPIC: 193009
KNOWLEDGE: K1.05 [3.1/3.5]
QID: P1295

Nuclear reactor thermal limits are established to...

A. ensure the integrity of the reactor fuel.

B. prevent exceeding reactor vessel mechanical limitations.

C. minimize the coolant temperature rise across the core.

D. establish control rod insertion limits.

ANSWER: A.

TOPIC: 193009
KNOWLEDGE: K1.05 [3.1/3.5]
QID: P1395 (B1893)

Thermal limits are established to protect the nuclear reactor core, and thereby protect the public during plant operations which include...

A. normal operations only.

B. normal and abnormal operations only.

C. normal, abnormal, and postulated accident operations only.

D. normal, abnormal, postulated and unpostulated accident operations.

ANSWER: C.

TOPIC: 193009
KNOWLEDGE: K1.05 [3.1/3.5]
QID: P2194 (B2194)

Which one of the following describes the basis for the 2,200°F maximum fuel clad temperature limit?

A. 2,200°F is approximately 500°F below the fuel clad melting temperature.

B. The material strength of zircaloy decreases rapidly at temperatures above 2,200°F.

C. The rate of the zircaloy-water reaction becomes significant at temperatures above 2,200°F.

D. At the normal operating pressure of the reactor vessel a clad temperature above 2,200°F indicates that the critical heat flux has been exceeded.

ANSWER: C.

TOPIC: 193009
KNOWLEDGE: K1.05 [3.1/3.5]
QID: P2796

Given the following initial core parameters for a segment of a fuel rod:

Power density = 3 kW/ft
$T_{coolant}$ = 579°F
$T_{fuel\ centerline}$ = 2,400°F

Reactor power is increased such that the following core parameters now exist for the same fuel rod segment:

Power density = 5 kW/ft
$T_{coolant}$ = 590°F
$T_{fuel\ centerline}$ = ?

Assuming no boiling occurs and coolant flow rate is unchanged, what will be the new stable $T_{fuel\ centerline}$?

A. 3,035°F

B. 3,614°F

C. 3,625°F

D. 4,590°F

ANSWER: C.

TOPIC: 193009
KNOWLEDGE: K1.05 [3.1/3.5]
QID: P2995 (B2292)

Which one of the following describes the basis for the 2,200°F maximum fuel clad temperature limit?

A. 2,200°F is approximately 500°F below the fuel clad melting temperature.

B. The rate of the zircaloy-steam reaction increases significantly above 2,200°F.

C. If fuel clad temperature reaches 2,200°F, the onset of transition boiling is imminent.

D. The differential expansion between the fuel pellets and the fuel clad becomes excessive above 2,200°F.

ANSWER: B.

TOPIC: 193009
KNOWLEDGE: K1.07 [3.1/3.5]
QID: P383 (B394)

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of core life (see figure below).

Given the following initial core parameters:

Reactor power = 100 percent
$T_{coolant}$ = 500°F
$T_{fuel\ centerline}$ = 3,000°F

What would the fuel centerline temperature be if, over core life, the total fuel-to-coolant thermal conductivity were doubled? (Assume reactor power is constant.)

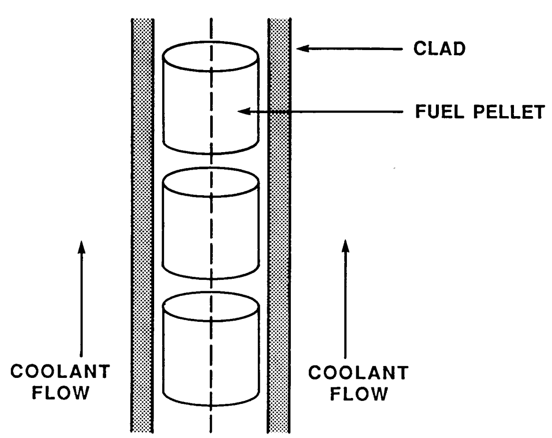
A. 2,000°F

B. 1,750°F

C. 1,500°F

D. 1,250°F

ANSWER: B.



FUEL ROD AND COOLANT FLOW CHANNEL

TOPIC: 193009
KNOWLEDGE: K1.07 [3.1/3.5]
QID: P394 (B396)

The pellet-to-clad gap in fuel rod construction is designed to...

A. decrease fuel pellet slump.

B. reflect fission neutrons.

C. increase heat transfer rate.

D. reduce internal clad strain.

ANSWER: D.

TOPIC: 193009
KNOWLEDGE: K1.07 [3.1/3.5]
QID: P495 (B495)

Refer to the drawing of a fuel rod and coolant flow channel (see figure below) at the beginning of core life.

Given the following initial core parameters:

Reactor power = 100 percent
$T_{coolant}$ = 500°F
$T_{fuel\ centerline}$ = 2,500°F

What would the fuel centerline temperature be if, over core life, the total fuel-to-coolant thermal conductivity were doubled? (Assume reactor power is constant.)

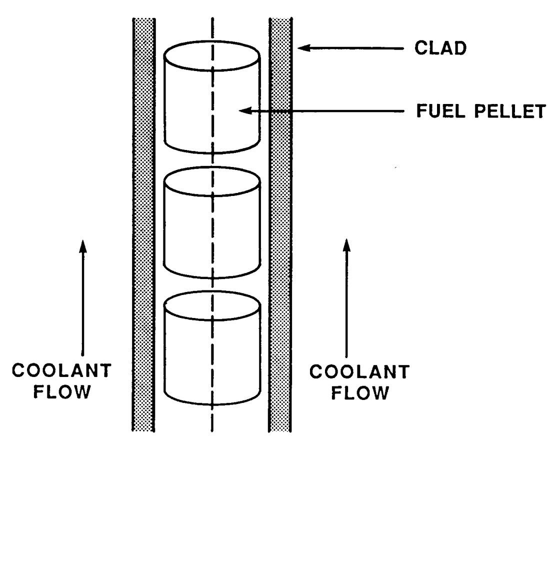
A. 1,000°F

B. 1,250°F

C. 1,500°F

D. 1,750°F

ANSWER: C.



FUEL ROD AND COOLANT FLOW CHANNEL

TOPIC: 193009
KNOWLEDGE: K1.07 [3.1/3.5]
QID: P1095

A nuclear reactor is operating at 80 percent power with all control rods fully withdrawn and in manual control. Compared to a 50 percent insertion of one control rod, a 50 percent insertion of a group (or bank) of control rods will cause a ________ increase in the steady state core maximum axial power peaking factor and a ________ increase in the steady state core maximum radial power peaking factor. (Assume reactor power remains constant.)

A. smaller; smaller

B. smaller; larger

C. larger; smaller

D. larger; larger

ANSWER: C.

TOPIC: 193009
KNOWLEDGE: K1.07 [3.1/3.5]
QID: P1594 (B1594)

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of core life (see figure below).

Given the following initial core parameters:

Reactor power = 100 percent
$T_{coolant}$ = 500°F
$T_{fuel\ centerline}$ = 2,700°F

Which one of the following will be the fuel centerline temperature at the end of core life if the total fuel-to-coolant thermal conductivity doubles? (Assume reactor power is constant.)

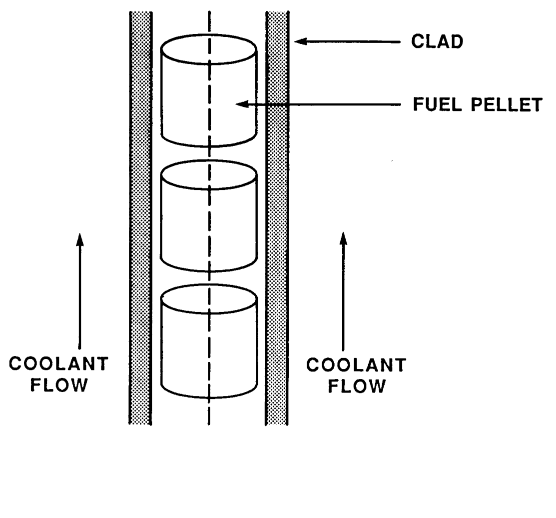
A. 1,100°F

B. 1,350°F

C 1,600°F

D. 1,850°F

ANSWER: C.



FUEL ROD AND COOLANT FLOW CHANNEL

TOPIC: 193009
KNOWLEDGE: K1.07 [3.1/3.5]
QID: P1795

A nuclear reactor is operating at 80 percent power with all control rods fully withdrawn. Compared to a 50 percent insertion of a group (or bank) of control rods, a 50 percent insertion of a single control rod will cause a _______________ increase in the axial peaking hot channel factor and a _______________ increase in the radial peaking hot channel factor. (Assume reactor power remains constant.)

A. larger; larger

B. larger; smaller

C. smaller; larger

D. smaller; smaller

ANSWER: C.

TOPIC: 193009
KNOWLEDGE: K1.07 [3.1/3.5]
QID: P1894 (B1395)

Which one of the following describes the fuel-to-coolant thermal conductivity at the end of core life (EOL) as compared to the beginning of core life (BOL)?

A. Smaller at EOL due to fuel pellet densification.

B. Smaller at EOL due to contamination of fill gas with fission product gases.

C. Larger at EOL due to reduction in gap between fuel pellets and clad.

D. Larger at EOL due to greater temperature difference between fuel pellets and coolant.

ANSWER: C.

TOPIC: 193009
KNOWLEDGE: K1.07 [3.1/3.5]
QID: P1994 (B1995)

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of core life (see figure below).

Given the following initial core parameters:

Reactor power = 60 percent
$T_{coolant}$ = 540°F
$T_{fuel\ centerline}$ = 2,540°F

Which one of the following will be the fuel centerline temperature at the end of core life if the total fuel-to-coolant thermal conductivity doubles? (Assume reactor power is constant.)

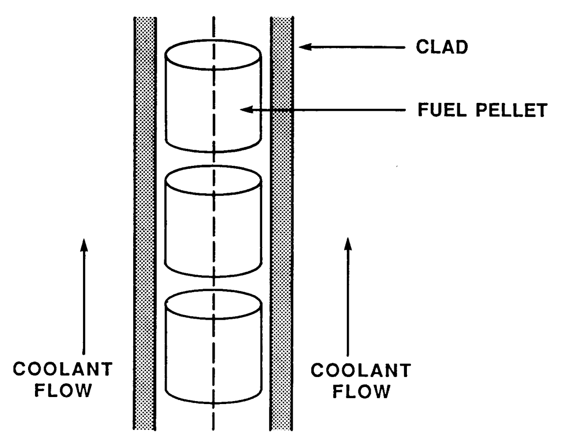
A. 1,270°F

B. 1,370°F

C. 1,440°F

D. 1,540°F

ANSWER: D.



FUEL ROD AND COOLANT FLOW CHANNEL

TOPIC: 193009
KNOWLEDGE: K1.07 [3.1/3.5]
QID: P2195 (B2192)

Which one of the following describes the fuel-to-coolant thermal conductivity for a fuel assembly at the beginning of a fuel cycle (BOC) as compared to the end of a fuel cycle (EOC)?

A. Larger at BOC due to a higher fuel pellet density.

B. Larger at BOC due to lower contamination of fuel rod fill gas with fission product gases.

C. Smaller at BOC due to a larger gap between the fuel pellets and clad.

D. Smaller at BOC due to a smaller corrosion film on the surface of the fuel rods.

ANSWER: C.

TOPIC: 193009
KNOWLEDGE: K1.07 [3.1/3.5]
QID: P2296 (B2696)

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of core life (see figure below).

Given the following initial core parameters:

Reactor power = 60 percent
$T_{coolant}$ = 560°F
$T_{fuel\ centerline}$ = 2,500°F

Which one of the following will be the fuel centerline temperature at the end of core life if the total fuel-to-coolant thermal conductivity doubles? (Assume reactor power is constant.)

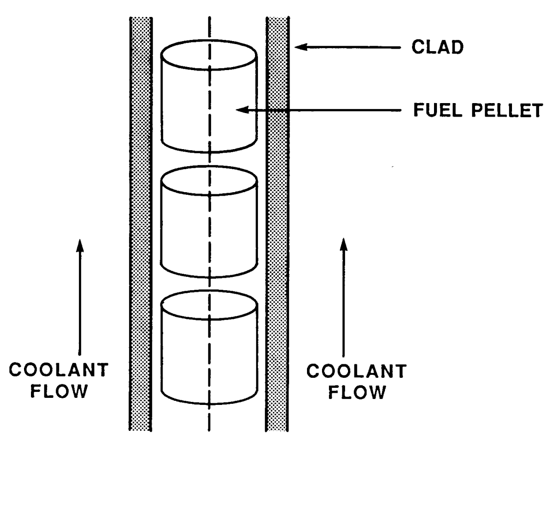
A. 1,080°F

B. 1,250°F

C. 1,530°F

D. 1,810°F

ANSWER: C.



FUEL ROD AND COOLANT FLOW CHANNEL

TOPIC: 193009
KNOWLEDGE: K1.07 [3.1/3.5]
QID: P2395 (B2394)

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of core life (see figure below).

The nuclear reactor is shut down with the following parameter values:

$T_{coolant}$ = 320°F
$T_{fuel\ centerline}$ = 780°F

What would the fuel centerline temperature be under these same conditions at the end of core life if the total fuel-to-coolant thermal conductivity were doubled?

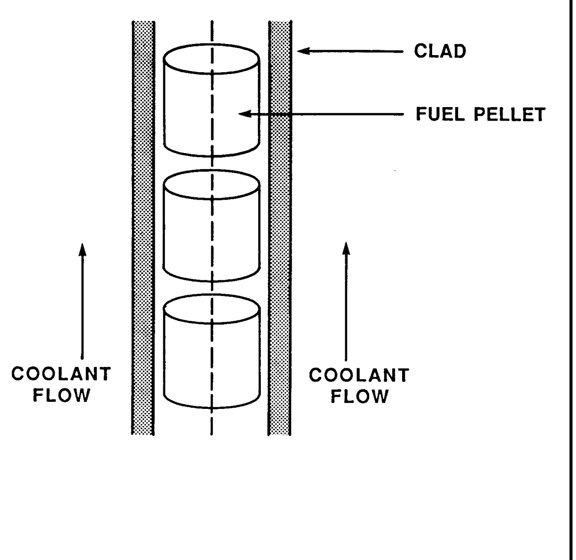
A. 550°F

B. 500°F

C. 450°F

D. 400°F

ANSWER: A.



FUEL ROD AND COOLANT FLOW CHANNEL

TOPIC: 193009
KNOWLEDGE: K1.07 [2.9/3.3]
QID: P3195 (B3193)

Refer to the drawing of a fuel rod and coolant flow channel (see figure below).

The nuclear reactor is shut down at the beginning of a fuel cycle with the following average parameter values:

$T_{coolant}$ = 440°F
$T_{fuel\ centerline}$ = 780°F

If the total fuel-to-coolant thermal conductivity doubles over core life, what will the fuel centerline temperature be with the same coolant temperature and reactor decay heat conditions at the end of the fuel cycle?

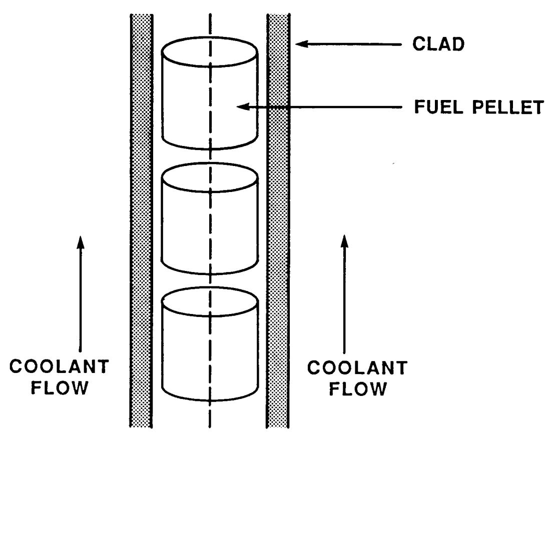
A. 610°F

B. 580°F

C. 550°F

D. 520°F

ANSWER: A.



FUEL ROD AND COOLANT FLOW CHANNEL

TOPIC: 193009
KNOWLEDGE: K1.07 [2.9/3.3]
QID: P3395 (B1697)

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of core life (see figure below).

Given the following initial core parameters:

Reactor power = 50 percent
$T_{coolant}$ = 550°F
$T_{fuel\ centerline}$ = 2,750°F

What will the fuel centerline temperature be if, over core life, the total fuel-to-coolant thermal conductivity doubles? (Assume reactor power and $T_{coolant}$ are constant.)

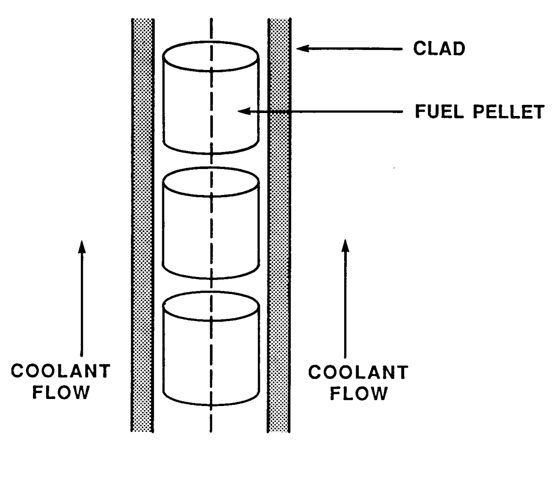
A. 1,100°F

B. 1,375°F

C. 1,525°F

D. 1,650°F

ANSWER: D.



FUEL ROD AND COOLANT FLOW CHANNEL

TOPIC: 193009
KNOWLEDGE: K1.07 [2.9/3.3]
QID: P3895

Refer to the drawing of a fuel rod and coolant flow channel (see figure below).

Given the following initial stable core parameters:

Reactor power = 50 percent
$T_{coolant}$ = 550°F
$T_{fuel\ centerline}$ = 2,250°F

Assume that the total heat transfer coefficient and the reactor coolant temperature do not change. What will the approximate stable fuel centerline temperature be if reactor power is increased to 75 percent?

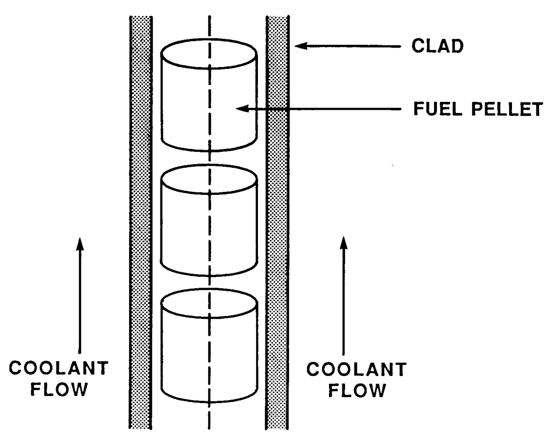
A. 2,550°F

B. 2,800°F

C. 2,950°F

D. 3,100°F

ANSWER: D.



FUEL ROD AND COOLANT FLOW CHANNEL

TOPIC: 193009
KNOWLEDGE: K1.07 [2.9/3.3]
QID: P6449 (B6449)

Consider a new fuel rod operating at a constant power level for several weeks. During this period, fuel densification in the fuel rod causes the heat transfer rate from the fuel pellets to the cladding to _________; which causes the average fuel temperature in the fuel rod to _________.

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P97 (B899)

A pressure stress applied to the reactor vessel is...

A. compressive at the inner wall, tensile at the outer wall.

B. tensile at the inner wall, compressive at the outer wall.

C. tensile across the entire wall.

D. compressive across the entire wall.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P296

Brittle fracture is the fragmentation of metal resulting from the application of _____________ stress at relatively _____________ temperatures.

A. compressive; high

B. compressive; low

C. tensile; high

D. tensile; low

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P397 (B398)

Brittle fracture of the reactor coolant system pressure boundary is most likely to occur at...

A. 120°F and 2200 psig.

B. 120°F and 400 psig.

C. 400°F and 2200 psig.

D. 400°F and 400 psig.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P497 (B499)

Which one of the following comparisons will result in a higher probability of brittle fracture of the reactor vessel?

A. A high reactor gamma flux rather than a high neutron flux.

B. A high reactor vessel material strength rather than a high material ductility.

C. A high reactor coolant oxygen content rather than a low oxygen content.

D. A rapid 100°F reactor cooldown at a high temperature rather than a low temperature.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1200

Which one of the following reduces the probability of brittle fracture of the reactor vessel?

A. The presence of a preexisting flaw

B. The presence of a tensile stress

C. Operation at low temperatures

D. Small heatup and cooldown rates

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1296

Which one of the following comparisons increases the probability of brittle fracture of a pressure vessel wall?

A. A high temperature rather than a low temperature.

B. A tensile stress rather than a compressive stress.

C. Performing a 100°F/hour heatup rather than a 100°F/hour cooldown.

D. Using materials fabricated from stainless steel rather than carbon steel.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1396

Which one of the following statements describes the relationship between brittle fracture and nil-ductility temperature?

A. Operation below the nil-ductility temperature will result in brittle fracture.

B. Operation above the nil-ductility temperature will result in brittle fracture.

C. Operation below the nil-ductility temperature will increase the probability of brittle fracture.

D. Operation above the nil-ductility temperature will increase the probability of brittle fracture.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1597 (B1899)

Which one of the following comparisons increases the probability of brittle fracture for a reactor pressure vessel wall?

A. Using materials fabricated from stainless steel rather than carbon steel.

B. A compressive stress rather than a tensile stress.

C. A high reactor coolant temperature rather than a low reactor coolant temperature.

D. Performing a 100°F/hr cooldown rather than a 100°F/hr heatup.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1696 (B2700)

Which one of the following comparisons increases the probability of brittle fracture of a reactor pressure vessel wall?

A. Performing a 50°F/hr cooldown at 1,600 psia rather than a 50°F/hr cooldown at 1,200 psia.

B. A compressive stress rather than a tensile stress across the vessel wall.

C. A high reactor coolant temperature rather than a low reactor coolant temperature.

D. Changing wall design to increase toughness while maintaining the same strength.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1796

Brittle fracture of the reactor coolant system pressure boundary is <u>least likely</u> to occur at...

A. 120°F and 2,200 psig.

B. 120°F and 400 psig.

C. 400°F and 2,200 psig.

D. 400°F and 400 psig.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1896 (B1299)

Brittle fracture of the reactor vessel (RV) is most likely to occur during a ____________ of the reactor coolant system (RCS) when RCS temperature is ____________ the RV reference temperature for nil-ductility transition (RT_{NDT}).

A. heatup; above

B. heatup; below

C. cooldown; above

D. cooldown; below

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P2096 (B2099)

Which one of the following will prevent brittle fracture failure of a reactor vessel?

A. Manufacturing the reactor vessel from low carbon steel.

B. Maintaining reactor vessel pressure below the maximum design limit.

C. Operating above the reference temperature for nil-ductility transition (RT_{NDT}).

D. Maintaining the number of reactor vessel heatup/cooldown cycles within limits.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P2196

Brittle fracture of the reactor vessel (RV) is least likely to occur during a ____________ of the RV when RV temperature is ____________ the reference temperature for nil-ductility transition (RT_{NDT}).

A. cooldown; above

B. heatup; above

C. cooldown; below

D. heatup; below

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P2496 (B2499)

Brittle fracture of a low-carbon steel is more likely to occur when the temperature of the steel is __________ the nil ductility temperature, and will normally occur when the applied stress is __________ the steel's yield strength (or yield stress).

A. less than; less than

B. less than; greater than

C. greater than; less than

D. greater than; greater than

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P2497 (B2500)

Which one of the following comparisons will result in a higher probability of brittle fracture failure of the reactor vessel?

A. An RCS pH of 8.5 rather than 9.0

B. A high reactor coolant oxygen content rather than a low oxygen content

C. A 50°F/hr RCS cooldown rather than a 100°F/hr heatup

D. A high gamma flux rather than a high neutron flux

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P2896

Which one of the following comparisons will result in a lower probability of brittle fracture failure of the reactor vessel?

A. An RCS pH of 9.0 rather than 8.5

B. A low reactor coolant oxygen content rather than a high oxygen content

C. A 50°F/hr RCS cooldown rather than a 100°F/hr heatup

D. A high gamma flux rather than a high neutron flux

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.02 [2.4/2.5]
QID: P98

The nil-ductility temperature is that temperature...

A. below which the probability of brittle fracture significantly increases.

B. determined by fracture mechanics to be equivalent to reference transition temperature.

C. determined by Charpy V-notch test to be equivalent to reference transition temperature.

D. below which the yield stress of the metal is inversely proportional to Young's modulus of elasticity.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.02 [2.4/2.5]
QID: P597 (B2699)

The nil-ductility transition temperature of the reactor vessel (RV) is the temperature...

A. above which the RV metal will elastically deform as RCS pressure decreases.

B. above which the RV metal loses its ability to elastically deform as RCS pressure increases.

C. below which the RV metal will elastically deform as reactor coolant system (RCS) pressure decreases.

D. below which the RV metal loses its ability to elastically deform as RCS pressure increases.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.02 [2.4/2.5]
QID: P697 (B1500)

The reference temperature for nil-ductility transition (RT_{NDT}) is the temperature above which...

A. a large compressive stress can result in brittle fracture.

B. a metal exhibits more ductile tendencies.

C. the probability of brittle fracture increases.

D. no appreciable deformation occurs prior to failure.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.02 [2.4/2.5]
QID: P996 (B2299)

The nil-ductility transition temperature is that temperature...

A. below which vessel failure is imminent.

B. above which vessel failure is imminent.

C. below which the probability of brittle fracture significantly increases.

D. above which the probability of brittle fracture significantly increases.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P96 (B100)

The likelihood of brittle fracture failure of the reactor vessel is reduced by...

A. increasing vessel age.

B. reducing vessel pressure.

C. reducing vessel temperature.

D. reducing gamma flux exposure.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P142

Operating with which of the following conditions is least effective in preventing brittle fracture in the reactor coolant system (RCS)?

A. Operating within prescribed heatup and cooldown rate limitations.

B. Operating with RCS temperature greater than nil-ductility transition temperature.

C. Operating with RCS pressure low when RCS temperature is low.

D. Operating with a ramped RCS temperature as power level varies.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P297

Why are reactor coolant system cooldown rate limitations established?

A. Prevent excessive reactivity additions.

B. Prevent brittle fracture of the reactor vessel.

C. Prevent excessive reactor coolant system subcooling.

D. Prevent impurities from precipitating out of solution in the reactor vessel.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P300

The thermal stress experienced by the reactor vessel during a reactor coolant system heatup is...

A. compressive at the inner wall and tensile at the outer wall of the vessel.

B. tensile at the inner wall and compressive at the outer wall of the vessel.

C. tensile across the entire vessel wall.

D. compressive across the entire vessel wall.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P398 (B400)

The probability of reactor vessel brittle fracture is <u>decreased</u> by minimizing...

A. oxygen content in the reactor coolant.

B. operation at high temperatures.

C. the time taken to cool down the reactor coolant system.

D. the amount of copper manufactured into the reactor vessel.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P399 (B399)

The total stress on the reactor vessel inner wall is greater during cooldown than heatup because...

A. heatup stress totally offsets pressure stress at the inner wall.

B. both pressure stress and cooldown stress are tensile at the inner wall.

C. cooldown stress and heatup stress are both tensile at the inner wall, but cooldown stress is greater in magnitude.

D. the tensile cooldown stress at the inner wall is greater in magnitude than the compressive pressure stress at the same location.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P898

The likelihood of brittle fracture failure of the reactor vessel is reduced by...

A. increasing vessel age.

B. reducing reactor vessel pressure.

C. reducing reactor vessel temperature.

D. increasing gamma flux exposure.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P1098

Which one of the following will increase the compressive stress on the <u>outside</u> surface of the reactor vessel wall?

A. Neutron irradiation

B. Gamma irradiation

C. Reactor coolant system cooldown

D. Reactor coolant system heatup

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P1298

Which one of the following applies a compressive stress to the inner wall of the reactor pressure vessel during a reactor coolant system heatup?

A. Embrittlement stress

B. Yield stress

C. Pressure stress

D. Thermal stress

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P1397

Which one of the following is the most limiting component for establishing reactor coolant system heatup/cooldown rate limits?

A. Pressurizer

B. Reactor vessel

C. Fuel rod

D. Steam generator

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P1598

Which one of the following stresses is compressive on the outer wall of the reactor pressure vessel during a reactor coolant system cooldown?

A. Yield stress

B. Thermal stress

C. Pressure stress

D. Embrittlement stress

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P1897 (B300)

Which one of the following will apply a compressive stress to the outside wall of the reactor vessel?

A. Decreasing reactor coolant system (RCS) pressure

B. Increasing RCS pressure

C. Performing an RCS cooldown

D. Performing an RCS heatup

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P2397 (B2399)

Reactor coolant system pressure-temperature limit curves are derived by using a conservative value for the reactor vessel reference temperature for nil ductility transition (RT_{NDT}).

Early in core life, the assumed value of RT_{NDT} is ____________ than actual RT_{NDT}; and actual RT_{NDT} is verified periodically over core life by ________________.

A. higher; removing and testing irradiated specimens of reactor vessel material

B. higher; inservice inspection and analysis of the reactor vessel wall

C. lower; removing and testing irradiated specimens of reactor vessel material

D. lower; inservice inspection and analysis of the reactor vessel wall

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P2998

Which one of the following operating limitations is designed to prevent brittle fracture of the reactor vessel?

A. Maximum setpoint for the pressurizer safety valves

B. Maximum differential pressure between the RCS and the steam generators

C. Maximum RCS pressure vs. RCS temperature for a given RCS heatup rate

D. Maximum differential temperature between the RCS and the pressurizer

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P3698 (B3700)

A nuclear reactor is shutdown with the residual heat removal system maintaining reactor coolant temperature at 240°F immediately following an uncontrolled cooldown from 500°F. If reactor coolant temperature is held constant at 240°F, which one of the following describes the change in tensile stress on the inner wall of the reactor vessel (RV) over the next few hours?

A. Decreases, because the temperature gradient across the RV wall will decrease.

B. Increases, because the temperature gradient across the RV wall will decrease.

C. Decreases, because the inner RV wall temperature will approach the nil-ductility transition temperature.

D. Increases, because the inner RV wall temperature will approach the nil-ductility transition temperature.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P95

Fast neutron irradiation of the reactor vessel results in ________ stresses within the vessel metal, thereby _________ the nil-ductility transition temperature.

A. decreased; increasing

B. decreased; decreasing

C. increased; increasing

D. increased; decreasing

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P143

Fast neutron irradiation adversely affects the reactor pressure vessel primarily by causing...

A. metal embrittlement.

B. brittle fracture.

C. flaw initiation.

D. flaw propagation.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P298 (B599)

Prolonged exposure of the reactor vessel to a fast neutron flux will cause the reference temperature for nil-ductility transition (RT_{NDT}) to...

A. increase due to the propagation of existing flaws.

B. decrease due to the propagation of existing flaws.

C. increase due to changes in the material properties of the vessel wall.

D. decrease due to changes in the material properties of the vessel wall.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P499 (B500)

Which one of the following types of radiation significantly reduces the ductility of the metal of a reactor pressure vessel?

A. Beta

B. Thermal neutrons

C. Gamma

D. Fast neutrons

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P899 (B1900)

After several years of operation the maximum allowable stress to the reactor pressure vessel is more limited by the inner wall than the outer wall because...

A. the inner wall operates at a higher temperature than the outer wall.

B. the inner wall has a smaller surface area than the outer wall.

C. the inner wall experiences more neutron-induced embrittlement than the outer wall.

D. the inner wall experiences more tensile stress than the outer wall.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P998 (B1999)

Prolonged exposure to ___________ will cause nil-ductility transition temperature of the reactor vessel to ___________.

A. neutron radiation; increase

B. neutron radiation; decrease

C. boric acid; increase

D. boric acid; decrease

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1100 (B1100)

Two identical nuclear reactors have been in operation for the last 10 years. Reactor A has experienced 40 heatup/cooldown cycles with an average power capacity of 50 percent. Reactor B has experienced 30 heatup/cooldown cycles with an average power capacity of 60 percent.

Which reactor will have the lowest reactor vessel nil-ductility transition temperature?

A. Reactor A due to the lower average power capacity.

B. Reactor A due to the greater number of heatup/cooldown cycles.

C. Reactor B due to the higher average power capacity.

D. Reactor B due to the fewer number of heatup/cooldown cycles.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1498

The two factors that have the greatest effect on the reference temperature for nil-ductility transition (RT_{NDT}) of the reactor vessel over its life are...

A. thermal neutron flux and vessel copper content.

B. thermal neutron flux and vessel carbon content.

C. fast neutron flux and vessel copper content.

D. fast neutron flux and vessel carbon content.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1699 (B1800)

Two identical nuclear reactors have been in operation for the last 10 years. Reactor A has experienced 30 heatup/cooldown cycles and has an average power capacity of 60 percent. Reactor B has experienced 40 heatup/cooldown cycles and has an average power capacity of 50 percent.

Which reactor will have the lowest reactor vessel nil-ductility transition temperature?

A. Reactor A due to the fewer number of heatup/cooldown cycles

B. Reactor A due to the higher average power capacity

C. Reactor B due to the greater number of heatup/cooldown cycles

D. Reactor B due to the lower average power capacity

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1898 (B1200)

Which one of the following is the <u>major</u> contributor to embrittlement of the reactor vessel?

A. High-energy fission fragments

B. High operating temperature

C. High-energy gamma radiation

D. High-energy neutron radiation

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1997 (B299)

Which one of the following describes the effect of fast neutron irradiation on a reactor pressure vessel?

A. Increased fatigue crack growth rate

B. Increased plastic deformation prior to failure

C. Increased metal toughness

D. Increased nil-ductility reference transition temperature

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2098 (B2100)

Two identical nuclear reactors have been in operation for the last 10 years. Reactor A has experienced 30 heatup/cooldown cycles and has an average power capacity of 60 percent. Reactor B has experienced 40 heatup/cooldown cycles and has an average power capacity of 50 percent.

Which reactor will have the highest reactor vessel nil-ductility transition temperature?

A. Reactor A due to the fewer number of heatup/cooldown cycles

B. Reactor A due to the higher average power capacity

C. Reactor B due to the greater number of heatup/cooldown cycles

D. Reactor B due to the lower average power capacity

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2298

Two identical nuclear reactors have been in operation for the last 10 years. Reactor A has experienced 40 heatup/cooldown cycles and has an average power capacity of 50 percent. Reactor B has experienced 30 heatup/cooldown cycles and has an average power capacity of 60 percent.

Which reactor will have the highest reactor vessel nil-ductility transition temperature?

A. Reactor A due to the greater number of heatup/cooldown cycles

B. Reactor A due to the lower average power capacity

C. Reactor B due to the fewer number of heatup/cooldown cycles

D. Reactor B due to the higher average power capacity

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2599 (B2600)

Two identical nuclear reactors are currently shut down for refueling. Reactor A has an average lifetime power capacity of 60 percent and has been operating for 15 years. Reactor B has an average lifetime power capacity of 75 percent and has been operating for 12 years.

Which reactor, if any, will have the lowest reactor vessel nil ductility transition temperature?

A. Reactor A due to the lower average lifetime power capacity.

B. Reactor B due to the higher average lifetime power capacity.

C. Both reactors will have approximately the same nil ductility transition temperature because each core has produced approximately the same number of fissions.

D. Both reactors will have approximately the same nil ductility transition temperature because fast neutron irradiation in a shut down core is not significant.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2698 (B3000)

Two identical nuclear reactors are currently shut down for refueling. Reactor A has an average lifetime power capacity of 60 percent and has been operating for 15 years. Reactor B has an average lifetime power capacity of 60 percent and has been operating for 12 years.

Which reactor, if any, will have the lower reactor vessel nil ductility transition temperature?

A. Reactor A because it has produced more total fissions.

B. Reactor B because it has produced less total fissions.

C. Both reactors will have approximately the same nil ductility transition temperature because they have equal average lifetime power capacities.

D. Both reactors will have approximately the same nil ductility transition temperature because the fission rate in a shut down core is not significant.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2799 (B2800)

Two identical nuclear reactors have been in operation for the last 10 years. Reactor A has experienced 30 heatup/cooldown cycles and has an average power capacity of 60 percent. Reactor B has experienced 20 heatup/cooldown cycles and has an average power capacity of 80 percent.

Which reactor will have the highest reactor vessel nil-ductility transition temperature and why?

A. Reactor A due to the greater number of heatup/cooldown cycles

B. Reactor A due to the lower average power capacity

C. Reactor B due to the fewer number of heatup/cooldown cycles

D. Reactor B due to the higher average power capacity

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P3197 (B3200)

A nuclear reactor is shut down for refueling following 18 months of operation at an average power level of 85 percent. During the shutdown, a reactor vessel metal specimen is removed from the reactor vessel for testing. The testing determines that the nil-ductility transition (NDT) temperature of the specimen has decreased from 44°F to 42°F since the previous refueling shutdown.

Which one of the following conclusions is warranted?

A. The test results are credible and the reactor vessel is <u>more</u> likely to experience brittle fracture now than after the previous refueling shutdown.

B. The test results are credible and the reactor vessel is <u>less</u> likely to experience brittle fracture now than after the previous refueling shutdown.

C. The test results are questionable because the specimen NDT temperature would <u>not</u> decrease during the described 18 month period of operation.

D. The test results are questionable because the specimen NDT temperature would decrease by <u>more</u> than 2°F during the described 18 month period of operation.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P3297 (B3300)

A nuclear reactor is shut down for refueling following 18 months of operation at an average power level of 85 percent. During the shutdown, a reactor vessel metal specimen was removed from the reactor vessel for testing. The testing determined that the nil-ductility transition (NDT) temperature of the specimen increased from 42°F to 44°F since the previous refueling shutdown.

Which one of the following conclusions is warranted?

A. The test results are credible and the reactor vessel is <u>more</u> susceptible to brittle fracture now than after the previous refueling shutdown.

B. The test results are credible and the reactor vessel is <u>less</u> susceptible to brittle fracture now than after the previous refueling shutdown.

C. The test results are questionable because the vessel NDT temperature would <u>not</u> increase during the described 18 month period of operation.

D. The test results are questionable because the vessel NDT temperature would increase by <u>at least</u> 10°F during the described 18 month period of operation.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P3598 (B3600)

A nuclear reactor is shut down for refueling following 18 months of operation at an average power level of 85 percent. During the shutdown, a reactor vessel metal specimen is removed from the reactor vessel for testing. The testing indicates that the nil-ductility transition (NDT) temperature of the specimen has decreased from 44°F to 32°F since the previous refueling shutdown.

Which one of the following conclusions is warranted?

A. The test results are credible and the reactor vessel is more likely to experience brittle fracture now than after the previous refueling shutdown.

B. The test results are credible and the reactor vessel is less likely to experience brittle fracture now than after the previous refueling shutdown.

C. The test results are questionable because the actual specimen NDT temperature would not decrease during the described 18 month period of operation.

D. The test results are questionable because the actual specimen NDT temperature would decrease by much less than indicated by the test results.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P3898 (B3900)

Two identical nuclear reactors are currently shut down for refueling. Reactor A has an average lifetime power capacity of 90 percent and has been operating for 10 years. Reactor B has an average lifetime power capacity of 80 percent and has been operating for 15 years.

Which reactor will have the higher reactor vessel nil ductility transition temperature and why?

A. Reactor A because it has the higher average lifetime power capacity.

B. Reactor B because it has the lower average lifetime power capacity.

C. Reactor A because it has produced significantly less fissions.

D. Reactor B because it has produced significantly more fissions.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P4250 (B4250)

A nuclear reactor is shut down for refueling following 18 months of operation at an average power level of 85 percent. During the shutdown, a reactor vessel metal specimen was removed from the reactor vessel for testing. The tests determined that the nil-ductility transition (NDT) temperature of the specimen has increased from 42°F to 72°F since the previous refueling shutdown.

Which one of the following conclusions is warranted?

A. The test results are credible and the reactor vessel is <u>more</u> likely to experience brittle fracture now than after the previous refueling shutdown.

B. The test results are credible and the reactor vessel is <u>less</u> likely to experience brittle fracture now than after the previous refueling shutdown.

C. The test results are questionable because the specimen NDT temperature would <u>not</u> increase during the described 18 month period of operation.

D. The test results are questionable because the specimen NDT temperature would increase by <u>less</u> than indicated during the described 18 month period of operation.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P4450 (B4450)

A nuclear reactor is shut down for refueling. During the shutdown, a reactor vessel metal specimen is removed from the reactor vessel for testing. The specimen was last tested six years ago. During the subsequent six years, the reactor has completed several 18 month fuel cycles with an average power level of 85 percent.

The test determines that the nil-ductility transition (NDT) temperature of the specimen has remained unchanged at 44°F since it was last tested. Which one of the following conclusions is warranted?

A. The test results are credible, however, the reactor vessel is more susceptible to brittle fracture now than six years ago.

B. The test results are credible, however, the reactor vessel is less susceptible to brittle fracture now than six years ago.

C. The test results are questionable because the specimen NDT temperature should have increased since it was last tested.

D. The test results are questionable because the specimen NDT temperature should have decreased since it was last tested.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P4650 (B4650)

Two identical nuclear reactors are currently shut down for refueling. Reactor A has achieved an average lifetime power capacity of 60 percent while operating for 12 years. Reactor B has achieved an average lifetime power capacity of 60 percent while operating for 15 years.

Which reactor, if any, will have the lower reactor vessel nil ductility transition temperature?

A. Reactor A because it has produced less total fissions.

B. Reactor B because it has produced more total fissions.

C. Both reactors will have approximately the same nil ductility transition temperature because they have equal average lifetime power capacities.

D. Both reactors will have approximately the same nil ductility transition temperature because the fission rate in a shut down core is not significant.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P5550 (B5550)

Two identical nuclear reactors are currently shut down for refueling. Reactor A has an average lifetime power capacity of 90 percent and has been operating for 24 years. Reactor B has an average lifetime power capacity of 72 percent and has been operating for 30 years.

Which reactor, if any, will have the lowest reactor vessel nil ductility transition temperature?

A. Reactor A because it has produced more total fissions.

B. Reactor B because it has produced less total fissions.

C. Both reactors will have approximately the same nil ductility transition temperature because fast neutron irradiation in a shut down core is not significant.

D. Both reactors will have approximately the same nil ductility transition temperature because each core has produced approximately the same number of total fissions.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P6350 (B6350)

Which one of the following comparisons yields a <u>higher</u> probability of brittle fracture for a reactor vessel?

A. A high reactor fast neutron flux rather than a high gamma flux.

B. A high reactor vessel material ductility rather than a high material strength.

C. A rapid 100°F reactor heatup at a high temperature rather than a low temperature.

D. A rapid 100°F reactor cooldown at a high temperature rather than a low temperature.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P6950 (B6950)

Two identical nuclear reactors are currently shut down for refueling. Reactor A has an average lifetime power capacity of 90 percent and has been operating for 16 years. Reactor B has an average lifetime power capacity of 80 percent and has been operating for 18 years.

Which reactor, if any, will have the lowest reactor vessel nil ductility transition temperature, and why?

A. Reactor A due to the higher average lifetime power capacity.

B. Reactor B due to the lower average lifetime power capacity.

C. Both reactors will have approximately the same nil ductility transition temperature because each core has produced approximately the same number of fissions.

D. Both reactors will have approximately the same nil ductility transition temperature because fast neutron irradiation in a shut down core is not significant.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.06 [3.6/3.8]
QID: P99

A nuclear power plant is shut down with the reactor coolant system at 1,200 psia and 350°F. Which one of the following would be most likely to cause pressurized thermal shock of the reactor vessel?

A. A rapid depressurization followed by a rapid heatup

B. A rapid depressurization followed by a rapid cooldown

C. A rapid cooldown followed by a rapid pressurization

D. A rapid heatup followed by a rapid pressurization

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.06 [3.6/3.8]
QID: P299

Pressurized thermal shock is a condition that can occur following a rapid __________ of the reactor coolant system (RCS) if RCS pressure is rapidly ____________.

A. cooldown; decreased

B. cooldown; increased

C. heatup; decreased

D. heatup; increased

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.06 [3.6/3.8]
QID: P2800

Which one of the following would be most likely to cause pressurized thermal shock of a reactor vessel?

A. Starting a reactor coolant pump in an idle loop with the associated steam generator temperature less than RCS loop temperature.

B. Starting a reactor coolant pump in an idle loop with the associated steam generator temperature greater than RCS loop temperature.

C. Continuous emergency coolant injection to the RCS during and after a complete and unisolable rupture of a steam generator steam outlet nozzle.

D. Continuous emergency coolant injection to the RCS during and after a complete and unisolable rupture of a reactor vessel coolant outlet nozzle.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P100

During a severe reactor coolant system overcooling transient, a major concern is...

A. accelerated zirconium hydriding.

B. loss of reactor vessel water level.

C. loss of reactor coolant pump net positive suction head.

D. brittle fracture of the reactor vessel.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P1000

An uncontrolled cooldown is a brittle fracture concern because it creates a large ___________ stress at the ___________ wall of the reactor vessel.

A. tensile; inner

B. tensile; outer

C. compressive; inner

D. compressive; outer

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P1099

During an uncontrolled cooldown of a reactor coolant system, the component most susceptible to pressurized thermal shock is the...

A. reactor vessel.

B. steam generator tube sheet.

C. cold leg accumulator penetration.

D. loop resistance temperature detector penetration.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P1199

Which one of the following describes the thermal stress placed on the reactor vessel during a cooldown of the reactor coolant system?

A. Tensile across the entire wall.

B. Compressive across the entire wall.

C. Tensile at the inner wall, compressive at the outer wall.

D. Compressive at the inner wall, tensile at the outer wall.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P1500

The thermal stress experienced by the reactor vessel during a reactor coolant system cooldown is...

A. tensile across the entire vessel wall.

B. tensile at the inner wall, compressive at the outer wall of the vessel.

C. compressive across the entire vessel wall.

D. compressive at the inner wall, tensile at the outer wall of the vessel.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P2797

A nuclear power plant heatup is in progress using reactor coolant pumps. The heatup stress applied to the reactor vessel is...

A. tensile across the entire wall.

B. tensile at the inner wall and compressive at the outer wall.

C. compressive across the entire wall.

D. compressive at the inner wall and tensile at the outer wall.

ANSWER: D.