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?

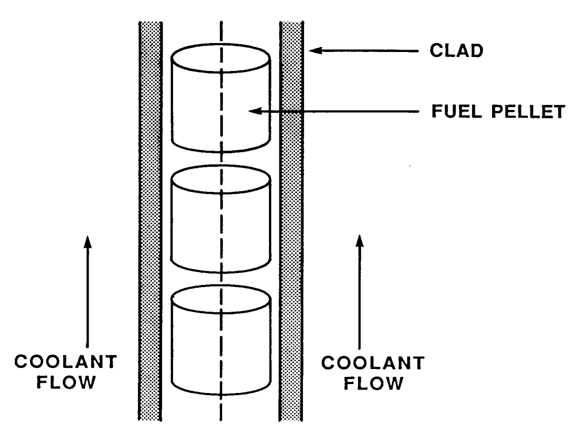
A. Conduction

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 before 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.