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 pressurizer will maintain the higher pressure following a sudden 10 percent liquid outsurge from each pressurizer, and why?

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 removing a relatively small amount of energy during the outsurge.

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

[redacted]

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 pressurizer will maintain the higher pressure during a sudden 10 percent liquid outsurge from each pressurizer, and why?

A. Pressurizer A due to the subcooled water removing a relatively small amount of energy 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.

[redacted]

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

A 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 gpm

B. 330,000 to 339,000 gpm

C. 340,000 to 349,000 gpm

D. 350,000 to 359,000 gpm

[redacted]

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 steady-state liquid temperature above the boiling point.

B. result in a subcooled liquid.

C. result in some of the liquid vaporizing.

D. result in a superheated liquid.

[redacted]

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 10 percent liquid outsurge 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

[redacted]

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

Consider a saturated steam-water mixture with a 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; increase

B. decrease; decrease

C. remain the same; increase

D. remain the same; decrease

[redacted]

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

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

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.

[redacted]

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.

[redacted]

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

A steam-water mixture is initially saturated with a quality of 95 percent when a small amount of heat is added to the mixture. If the mixture remains saturated and pressure remains constant, the temperature of the mixture will _____; and the quality of the mixture will _____.

A. increase; remain the same

B. increase; increase

C. remain the same; remain the same

D. remain the same; increase

[redacted]

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

An open container holds 1.0 lbm of saturated water at standard atmospheric pressure. The addition of 1.0 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.

[redacted]

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

Consider a saturated steam-water mixture with a 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

[redacted]

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 1,350 psia. When pressurizer pressure stabilizes at 1,350 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

[redacted]

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. If 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

[redacted]

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

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

A. 24 percent

B. 27 percent

C. 73 percent

D. 76 percent

[redacted]

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

Consider a pressurizer containing a saturated steam-water mixture at 636°F with a quality of 15 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

[redacted]

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 saturated steam-water mixture that remains in a saturated condition?

A. Temperature will increase.

B. Temperature will decrease.

C. Quality will increase.

D. Quality will decrease.

[redacted]

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

[redacted]

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

An open container holds 1.0 lbm of saturated water at standard atmospheric pressure. The addition of 4.0 Btu will...

A. result in 4°F of superheat.

B. vaporize a portion of the water.

C. increase the density of the water.

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

[redacted]

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

Consider a sealed vessel containing 1,000 lbm of a saturated steam-water mixture at 500°F. The vessel is perfectly insulated with no 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

[redacted]

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

[redacted]

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

[redacted]

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.

[redacted]

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	=	568°F
Pressurizer vapor temperature	=	596°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

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.08 [2.8/2.8]
QID: P2074 (B2074)

Consider a saturated steam-water 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

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P7709 (B7709)

Consider 1.0 lbm of dry saturated steam at 200 psia. If pressure does not change, which one of the following will be caused by the addition of 6.0 Btu to the steam?

A. The steam will remain saturated at the same temperature.

B. The steam will become superheated at the same temperature.

C. The steam will remain saturated at a higher temperature.

D. The steam will become superheated at a higher temperature.

[redacted]

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

An open vessel contains 1.0 lbm 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.

[redacted]

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

A 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 reactor coolant leaving the SGs? (Assume the reactor coolant leaves the SGs at the SG saturation temperature.)

A. 580 psia

B. 600 psia

C. 620 psia

D. 640 psia

[redacted]

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

A reactor is shut down with reactor coolant system (RCS) pressure at 1,000 psia and core decay heat is being removed via the steam generators (SGs). What pressure must be maintained in the SGs to obtain a 50°F subcooling margin in the reactor coolant leaving the SGs? (Assume the reactor coolant leaves the SGs at the SG saturation temperature.)

A. 550 psia

B. 600 psia

C. 650 psia

D. 700 psia

[redacted]

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

Which one of the following will increase the subcooling of the condensate in the main condenser hotwell?

A. Isolate circulating water to one shell of the main condenser.

B. Increase circulating water inlet temperature.

C. Decrease circulating water flow rate.

D. Decrease main turbine steam flow rate.

[redacted]

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

Given a set of steam tables that lists the following parameters for saturated steam and water:

- 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

[redacted]

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 throughout the entire spent fuel pool. Average spent fuel assembly temperature is elevated but stable. Assume that the spent fuel pool contains pure water in thermal equilibrium, and 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

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

[redacted]

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

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 the spent fuel pool remains in thermal equilibrium, and there is no heat removal from the spent fuel pool.)

A. 18 hours

B. 31 hours

C. 48 hours

D. 61 hours

[redacted]

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

[redacted]

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

Given the following reactor coolant system (RCS) parameters, what is the 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

[redacted]

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.

[redacted]

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

What is the approximate enthalpy of a saturated steam-water mixture at 130°F with a quality of 90 percent?

A. 1,015 Btu/lbm

B. 1,093 Btu/lbm

C. 1,118 Btu/lbm

D. 1,216 Btu/lbm

[redacted]

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

The following steady-state 100 percent power conditions existed just prior to a plant shutdown for maintenance:

RCS T_{ave} = 573.5°F
SG T_{stm} = 513.5°F

During the shutdown, 5 percent of the total steam generator (SG) tubes were plugged. Upon completion of the maintenance, the plant was returned to 100 percent power with RCS mass flow rate and RCS temperatures unchanged.

Which one of the following is the approximate current SG steam pressure with the plant at 100 percent power?

A. 711 psia

B. 734 psia

C. 747 psia

D. 762 psia

[redacted]

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 main condenser pressure?

A. 1.78 psia

B. 1.51 psia

C. 1.35 psia

D. 1.20 psia

[redacted]

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

For steam at 230 psia and 900°F, what is the approximate amount of superheat?

A. 368°F

B. 393°F

C. 506°F

D. 535°F

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P1675 (B1175)

Which one of the following is the approximate temperature of a saturated steam-water 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

[redacted]

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

What is the approximate amount of heat required to convert 3.0 lbm of water at 100°F and 100 psia to dry saturated steam at 100 psia?

A. 889 Btu

B. 1,119 Btu

C. 2,666 Btu

D. 3,358 Btu

[redacted]

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

Dry 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

[redacted]

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

A saturated steam-water mixture with a quality of 30 percent leaves a main turbine at 1.0×10^6 lbm/hr and enters a steam condenser at 2.0 psia. Condensate enters the hotwell at 118°F.

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

A. 3.1×10^8 Btu/hr

B. 5.8×10^8 Btu/hr

C. 7.2×10^8 Btu/hr

D. 9.9×10^8 Btu/hr

[redacted]

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 dry saturated steam at 100 psia?

A. 1,119 Btu

B. 1,187 Btu

C. 2,238 Btu

D. 2,374 Btu

[redacted]

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 specific ambient heat loss is required before moisture formation can occur in the steam line?

A. 31 Btu/lbm

B. 45 Btu/lbm

C. 58 Btu/lbm

D. 71 Btu/lbm

[redacted]

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 superheated steam at 400°F and 100 psia?

A. 1,119 Btu

B. 1,159 Btu

C. 2,239 Btu

D. 2,319 Btu

[redacted]

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

What is the approximate 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

[redacted]

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, main condenser condensate depression is 2°F with main condenser pressure at 2.0 psia.

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

[redacted]

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

[redacted]

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 parameter values, when paired with the temperature, provides insufficient information to determine the quality of the mixture?

A. Pressure is 499.96 psia.

B. Enthalpy is 977.33 Btu/lbm.

C. Entropy is 1.17 Btu/lbm -°R.

D. Specific volume is 0.817 ft^3/lbm.

[redacted]

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

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

A. 31 Btu/lbm

B. 45 Btu/lbm

C. 58 Btu/lbm

D. 71 Btu/lbm

[redacted]

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.

[redacted]

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 2.0 lbm of water at 100°F and 100 psia to dry saturated steam at 100 psia?

A. 560 Btu

B. 1,120 Btu

C. 2,238 Btu

D. 3,356 Btu

[redacted]

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

The following steady-state 100 percent power conditions existed just prior to a plant shutdown for maintenance:

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

[redacted]

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

A 100 ft^3 vessel contains a saturated steam-water 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

[redacted]

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 (CET) temperature	=	550°F

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

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

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

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

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

[redacted]

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 dry saturated steam.
- 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

[redacted]

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

A saturated steam-water mixture at 50 percent quality is leaving a main turbine at 1.0×10^6 lbm/hr and entering a condenser at 1.6 psia. Condensate enters 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

[redacted]

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

[redacted]

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

Consider a 100 lbm quantity of a saturated steam-water mixture at standard atmospheric pressure. The mixture has a quality of 70 percent. Assume that pressure remains constant and there is no 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

[redacted]

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

An open vessel contains 1.0 lbm-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 steam.

A. 8°F; 1 percent

B. 8°F; 10 percent

C. 16°F; 1 percent

D. 16°F; 10 percent

[redacted]

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

[redacted]

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

An open vessel contains 1.0 lbm 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.

[redacted]

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 mass flow rate?

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

[redacted]

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

Dry 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

[redacted]

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 dry 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

[redacted]

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 dry 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

[redacted]

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 dry 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?

A. 400 gpm

B. 2,400 gpm

C. 4,000 gpm

D. 24,000 gpm

[redacted]

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

What happens to the enthalpy of the saturated steam in a steam generator (SG) as heat addition 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.

[redacted]

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

[redacted]

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

Dry saturated steam is flowing to 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

[redacted]

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 about the same; less

D. remain about the same; more

[redacted]

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

Dry saturated steam at 240 psia enters an ideal low pressure (LP) turbine and exhausts to a steam condenser at 1.0 psia. Compared to the LP turbine 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

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7239 (B7238)

An open vessel contains 1.0 lbm of water at 120°F and standard atmospheric pressure. Which one of the following will be caused by the addition of 540 Btu to the water?

A. The water temperature will increase to approximately 212°F; and less than 50 percent of the water will vaporize.

B. The water temperature will increase to approximately 212°F; and more than 50 percent of the water will vaporize.

C. The water temperature will increase to significantly higher than 212°F; and less than 50 percent of the water will vaporize.

D. The water temperature will increase to significantly higher than 212°F; and more than 50 percent of the water will vaporize.

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7339 (B7338)

Dry saturated steam at 1,000 psia enters an ideal high pressure (HP) turbine and exhausts at 100 psia. The HP turbine exhaust then enters an ideal low pressure (LP) turbine and exhausts to a steam condenser at 1.5 psia. Which one of the following will cause the HP and LP turbines to produce more equal power? (Assume all pressures remain the same unless stated otherwise.)

A. Reheat the HP turbine exhaust.

B. Lower the steam condenser pressure.

C. Remove the moisture from the HP turbine exhaust.

D. Decrease the pressure of the dry saturated steam entering the HP turbine.

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7439

A nuclear power plant experienced a reactor trip. One hour after the trip, core cooling is being accomplished by relieving dry saturated steam from a steam generator (SG). Water level in the SG is being maintained by an operating feedwater pump. Average fuel temperature is stable.

Given the following current conditions:

Core decay heat rate = 33 MW
SG pressure = 1,000 psia
Feedwater temperature = 90°F

For the above conditions, approximately what feedwater flow rate is needed to maintain a constant mass of water in the SG?

A. 100,000 lbm/hr

B. 125,000 lbm/hr

C. 170,000 lbm/hr

D. 215,000 lbm/hr

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7539 (B7538)

Subcooled water is flowing through a heat exchanger with the following parameters:

Inlet temperature = 75°F
Outlet temperature = 120°F
Mass flow rate = 6.0×10^4 lbm/hr

What is the approximate heat transfer rate in the heat exchanger?

A. 1.1×10^6 Btu/hr

B. 2.1×10^6 Btu/hr

C. 2.7×10^6 Btu/hr

D. 3.3×10^6 Btu/hr

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7609 (B7609)

A main condenser is operating at 1.0 psia. If 20,000 ft^3 of dry saturated steam is condensed to saturated water in the condenser, what will be the approximate volume of the saturated water?

A. 1 ft^3

B. 10 ft^3

C. 100 ft^3

D. 1,000 ft^3

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7629 (B7629)

An open vessel contains 2.0 lbm of water at 200°F and standard atmospheric pressure. Which one of the following will be caused by the addition of 16.0 Btu to the water?

A. The water temperature will increase, and all of the water will boil off.

B. The water temperature will increase, and none of the water will boil off.

C. The water temperature will rise to 212°F, and some of the water will boil off.

D. The water temperature will rise to 216°F, and some of the water will boil off.

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7659 (B7659)

Dry saturated steam at 900 psia enters an ideal high pressure (HP) turbine and exhausts at 240 psia. How much heat, if any, must be added to the HP turbine exhaust to produce dry saturated steam at 240 psia?

A. 0 Btu/lbm

B. 11 Btu/lbm

C. 111 Btu/lbm

D. 155 Btu/lbm

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7679 (B7679)

Dry saturated steam enters a turbine at 1000 psia with the turbine exhaust pressure at 2 psia. The efficiency of the turbine is 85 percent. What is the approximate specific work output of the turbine?

A. 329 Btu/lbm

B. 355 Btu/lbm

C. 387 Btu/lbm

D. 455 Btu/lbm

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7699 (B7699)

Saturated steam at 900 psia enters a high pressure (HP) turbine and exhausts at 200 psia. The HP turbine exhaust passes through a 100 percent efficient moisture separator (with no heat gain or loss) before it enters a low pressure (LP) turbine. What is the enthalpy of the 200 psia steam entering the LP turbine?

A. 1,028 Btu/lbm

B. 1,076 Btu/lbm

C. 1,107 Btu/lbm

D. 1,199 Btu/lbm

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7719 (B7719)

Three days ago, a nuclear power plant experienced a sustained loss of all AC electrical power. Currently, there is turbulent boiling occurring throughout the entire spent fuel pool. Spent fuel assembly temperatures are elevated but stable. Assume the spent fuel pool contains pure water in thermal equilibrium, and boiling is the only means of heat removal from the spent fuel pool.

Given the following current conditions:

Total Spent fuel decay heat rate = 1.4 MW
Spent fuel building pressure = 15.0 psia

What is the approximate rate of water loss occurring from the spent fuel pool?

A. 4,149 lbm/hr

B. 4,924 lbm/hr

C. 18,829 lbm/hr

D. 26,361 lbm/hr

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7729

A reactor is operating with the following reactor coolant system (RCS) parameters:

RCS pressure = 2,235 psig
RCS hot leg temperature = 600EF
RCS cold leg temperature = 580EF
RCS mass flow rate = 1.0 x 10^8 lbm/hr

What is the approximate thermal power output of the reactor in megawatts (MW)?

A. 124 MW

B. 587 MW

C. 821 MW

D. 2,798 MW

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7759 (B7759)

Given the following initial conditions for a spent fuel pool:

Spent fuel decay heat rate = 6.0 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

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

A. 6 hours

B. 15 hours

C. 26 hours

D. 51 hours

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7780 (B7780)

The pressure of a saturated steam-water mixture is 760 psia.

Which one of the following parameter values, when paired with the pressure of the mixture, provides insufficient information to determine the specific volume of the mixture?

A. Quality is 84.6 percent.

B. Temperature is 512.4°F.

C. Enthalpy is 764.5 Btu/lbm.

D. Entropy is 0.88 Btu/lbm-ER.

[redacted]

TOPIC: 193003
KNOWLEDGE: K1.25 [3.3/3.4]
QID: P7800 (B7800)

Three days ago, a nuclear power plant experienced a sustained loss of all AC electrical power, which disabled the normal means of heat removal from the spent fuel pool. Currently, there is turbulent boiling occurring throughout the spent fuel pool. A fire truck is being used to supply pure makeup water at 70°F to maintain the spent fuel pool water level.

For simplification of calculations, assume the following:

- The spent fuel pool contains pure water.
- All steam leaving the surface of the spent fuel pool is dry saturated steam at 15.0 psia.

Approximately how much heat is each pound-mass of makeup water removing from the spent fuel pool?

A. 143 Btu

B. 970 Btu

C. 1,113 Btu

D. 1,151 Btu

[redacted]