TOPIC: 293003
KNOWLEDGE: K1.07 [2.7/2.8]
QID: B474

Initially, a saturated steam-water mixture has a quality of 50 percent. Assume the mixture remains saturated and the pressure of the mixture remains constant.

If a small amount of heat is added to the mixture, the quality of the mixture will _____; and the temperature of the mixture will _____.

A. increase; increase

B. increase; remain the same

C. remain the same; increase

D. remain the same; remain the same

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.07 [2.7/2.8]
QID: B1074 (P674)

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.

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.07 [2.7/2.8]
QID: B1874 (P1374)

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

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.07 [2.7/2.8]
QID: B1974 (P1474)

An open container holds 1.0 lbm of saturated water at standard atmospheric pressure. The addition of 1.0 Btu to the water 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: 293003
KNOWLEDGE: K1.07 [2.7/2.8]
QID: B3374 (P2874)

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.

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.07 [2.7/2.8]
QID: B3474

The temperature of a quantity of water is 212°F.

Which one of the following parameters, when paired with the temperature, provides insufficient information to determine whether the water is a saturated liquid rather than a saturated liquid-vapor mixture?

A. Enthalpy

B. Entropy

C. Pressure

D. Specific volume

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.07 [2.7/2.8]
QID: B3574 (P1974)

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, the mixture steam quality will _____; and the 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: 293003
KNOWLEDGE: K1.09 [2.5/2.6]
QID: B146

Which one of the following contains a pair of water states for which an addition of heat will result in a temperature increase?

A. Dry saturated steam and subcooled water.

B. Wet steam and dry saturated steam.

C. Saturated water and dry saturated steam.

D. Subcooled water and wet steam.

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.09 [2.5/2.6]
QID: B875 (P874)

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

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.09 [2.5/2.6]
QID: B1274

Which one of the following will occur if 500 Btu is removed from 1.0 lbm of dry saturated steam at 800 psia? (Assume that pressure does <u>not</u> change.)

A. Temperature will decrease.

B. Density will decrease.

C. Specific volume will decrease.

D. Enthalpy will increase.

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.09 [2.5/2.6]
QID: B1474

Which one of the following will decrease if heat is added to a saturated vapor at a constant pressure?

A. Density

B. Temperature

C. Entropy

D. Enthalpy

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.09 [2.5/2.6]
QID: B1574 (P1574)

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

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.09 [2.5/2.6]
QID: B2074 (P2074)

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

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.09 [2.5/2.6]
QID: B2174

Consider dry saturated steam at 470°F. If the pressure of the steam remains constant while heat is added, steam temperature will _____; and steam quality will _____.

A. remain the same; remain the same

B. remain the same; increase

C. increase; remain the same

D. increase; increase

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.09 [2.5/2.6]
QID: B2975 (P2974)

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

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.09 [2.5/2.6]
QID: B7709 (P7709)

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.

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.12 [2.5/2.6]
QID: B141

What is the approximate quality of wet steam leaving a reactor at 530 psig with an enthalpy of 928.9 Btu/lbm?

A. 25 percent

B. 37 percent

C. 63 percent

D. 75 percent

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.12 [2.5/2.6]
QID: B2375 (P2374)

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.

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.12 [2.5/2.6]
QID: B2874 (P1976)

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

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.12 [2.5/2.6]
QID: B3075 (P3074)

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

Which one of the following parameter values, when paired with the temperature, provides <u>insufficient</u> 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.

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.16 [2.8/2.8]
QID: B74

Given a reactor operating at 985 psig with a feedwater inlet temperature of 400°F, what is the amount of feedwater subcooling?

A. 136.6°F

B. 140.6°F

C. 144.6°F

D. 148.6°F

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.16 [2.8/2.8]
QID: B775

What effect will occur if heat is removed from water that is in a subcooled condition?

A. The temperature of the water will increase.

B. The enthalpy of the water will decrease.

C. The quality of the water will increase.

D. The density of the water will decrease.

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.16 [2.8/2.8]
QID: B2973 (P2975)

An open vessel contains 1.0 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: 293003
KNOWLEDGE: K1.22 [2.9/3.2]
QID: B1175 (P1675)

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

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.22 [2.9/3.2]
QID: B1377

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. 775 Btu/lbm

C. 418 Btu/lbm

D. 357 Btu/lbm

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.22 [2.9/3.2]
QID: B1577

Dry saturated steam undergoes an ideal expansion process in an ideal turbine from 294 psig to 27 inches Hg vacuum. Approximately how much specific work is being performed by the turbine?

A. 1,203 Btu/lbm

B. 418 Btu/lbm

C. 343 Btu/lbm

D. 308 Btu/lbm

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.22 [2.9/3.2]
QID: B1675

Which one of the following is the approximate reactor coolant heatup rate if reactor vessel pressure increases from 470 psig to 980 psig over a two-hour period?

A. 40°F/hr

B. 60°F/hr

C. 80°F/hr

D. 120°F/hr

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.22 [2.9/3.2]
QID: B6038 (P6039)

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

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B75

The saturation pressure corresponding to 400°F is approximately...

A. 232 psia.

B. 247 psia.

C. 262 psia.

D. 444 psia.

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7800 (P7800)

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

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B103

An operator suspects that a steam line temperature instrument reading is not correct. A recently calibrated pressure gauge sensing steam pressure for the same steam line indicates 351 psig.

Assuming the system is operating at saturation pressure, what approximate temperature should the temperature instrument indicate?

A. 424°F

B. 428°F

C. 432°F

D. 436°F

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B139

The saturation temperature for steam at a pressure of 785 psig is approximately...

A. 510°F.

B. 513°F.

C. 515°F.

D. 518°F.

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B190

Which one of the following is the approximate quality of steam leaving a cyclone separator at 985 psig and 1,186 Btu/lbm?

A. 95 percent

B. 96 percent

C. 97 percent

D. 99 percent

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B275 (P275)

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: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B375

Dry saturated steam at 250 psia enters turbine X. Superheated steam at 250 psia and 500°F enters turbine Y. Both turbines are 100 percent efficient and exhaust to a condenser at 1 psia.

Which one of the following lists the approximate percentages of moisture at the exhausts of turbines X and Y?

A. Turbine X = 24.5%; turbine Y = 20.8%

B. Turbine X = 26.3%; turbine Y = 13.0%

C. Turbine X = 24.5%; turbine Y = 13.0%

D. Turbine X = 26.3%; turbine Y = 20.8%

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B382

Cooling water exits a fuel channel with an enthalpy of 1,195 Btu/lbm at a reactor pressure of 1,050 psig. What is the state of the fluid at the exit of the fuel channel?

A. Saturated

B. Superheated

C. Compressed

D. Subcooled

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B974

Which one of the following sets of parameters for a saturated steam-water mixture will result in the highest quality?

A. 500°F; 1,100 Btu/lbm

B. 320°F; 1,070 Btu/lbm

C. 200°F; 1,040 Btu/lbm

D. 160°F; 960 Btu/lbm

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B975

Which one of the following is the enthalpy of steam at 235.3 psig and 500°F?

A. 1,201.1 Btu/lbm

B. 1,202.2 Btu/lbm

C. 1,263.5 Btu/lbm

D. 1,286.6 Btu/lbm

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B1375

A saturated steam-water mixture leaving a reactor core has the following parameter values:

Temperature = 550.5°F
Pressure = 1,035 psig
Quality = 14.5 percent

Which one of the following is the approximate enthalpy of the steam-water mixture?

A. 610 Btu/lbm

B. 643 Btu/lbm

C. 720 Btu/lbm

D. 860 Btu/lbm

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B1575

A saturated steam-water mixture leaving a reactor core has the following parameter values:

Temperature = 550.5°F
Pressure = 1,035 psig
Quality = 20 percent

Which one of the following is the approximate enthalpy of the steam-water mixture?

A. 641 Btu/lbm

B. 678 Btu/lbm

C. 751 Btu/lbm

D. 1,063 Btu/lbm

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B1776 (P1775)

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

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B2075 (P2077)

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

Pressure = 900 psia
Quality = 98 percent

The main turbine steam chest pressure is 400 psia. Assuming an ideal throttling process, what 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: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B2275 (P2275)

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

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B2374 (P2375)

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

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B2474

Turbine X is an ideal steam turbine that exhausts to a condenser at 1.0 psia. Turbine X is driven by dry saturated steam 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: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B2475 (P2475)

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

ANSWER: A

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B2575 (P2575)

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. 930 Btu

B. 1,160 Btu

C. 1,860 Btu

D. 2,320 Btu

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B2675 (P2675)

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

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B2774 (P2778)

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

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

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°F.)

A nuclear power plant is operating with a stable reactor vessel 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. 65 percent

D. 81 percent

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B2776 (P2775)

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

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B2875

A nuclear power plant is operating at a low power level. Main steam at the main turbine steam inlet valves has the following properties:

Pressure = 900 psia
Quality = 99 percent

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

A. 417°F

B. 439°F

C. 496°F

D. 532°F

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B3074 (P3077)

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 steam 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: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B3175 (P3175)

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

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B3274 (P3275)

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: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B3275

A nuclear power plant is shutdown at normal operating temperatures and pressures. Reactor coolant temperature is being controlled by dumping main steam (100 percent quality) to the main condenser.

Given the following:

- Main steam pressure is 1,000 psia.
- Main condenser vacuum is 28"Hg.

Which one of the following is the approximate temperature of the steam as it enters the main condenser?

A. 102°F

B. 212°F

C. 295°F

D. 358°F

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B3475 (P3475)

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

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B3575 (P3577)

Dry saturated steam 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 specific 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: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B3675 (P3677)

A nuclear power plant is shut down and steam is escaping to atmosphere through a leak in a main steam line. The main steam line contains dry saturated steam at 300 psia. 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: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B3774 (P3775)

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

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B3938 (P3939)

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

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B4038

A 100 ft^3 vessel contains a saturated steam-water mixture at 1,000 psia. The water portion occupies 70 ft^3 and the steam portion occupies the remaining 30 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: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B4138 (P4139)

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

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B4338 (P4339)

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: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B4738 (P4739)

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

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B4838 (P4839)

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

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B4938 (P4939)

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: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B5038 (P5039)

An open vessel contains 1 lbm of water at 206°F and standard atmospheric pressure. If 12 Btu is added to the water, the water temperature will rise by about _____; and _____ of the water will vaporize.

A. 6°F; none

B. 6°F; some

C. 12°F; none

D. 12°F; some

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B5138 (P5139)

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

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B5238 (P5239)

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

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B5338 (P5340)

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

Pressure = 900 psia
Quality = 99 percent

The main turbine steam chest pressure is 300 psia. Assuming an ideal throttling process, what 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: 293003
KNOWLEDGE: K1.23
QID: B5438 (P5439)

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

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B5638

A main steam line safety valve is leaking by, allowing 100 percent quality steam from the reactor vessel to enter the discharge pipe, which remains at a constant pressure of 10 psig. Initial safety valve discharge pipe temperature is elevated but stable. Assume no heat loss from the safety valve discharge pipe.

When the leak is noted, the reactor is shut down and a plant cooldown and depressurization are commenced. As the main steam pressure slowly decreases from 1,000 psig to 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 reactor vessel pressure decreases.

D. remain the same, because the safety valve discharge will remain a saturated steam-water mixture at 10 psig.

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B5738 (P5739)

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

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B5938

What happens to the enthalpy of the saturated steam in a reactor vessel (RV) during a reactor heatup as RV pressure increases 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: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B6338 (P6339)

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

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B6438 (P6439)

An open vessel contains 5.0 lbm of saturated water at standard atmospheric pressure. 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

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B6538 (P6540)

A nuclear power plant is operating at power. Steam is escaping to atmosphere through a flange leak in a steam line supplying 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: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B6638 (P6639)

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

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B6938 (P6939)

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

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7038 (P7039)

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

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7138 (P7140)

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

Pressure = 1,050 psia
Quality = 100 percent

The main turbine steam chest pressure is 400 psia. Assuming an ideal throttling process, which one of the following describes the steam in the steam chest?

A. Saturated, 96 percent quality

B. Saturated, 98 percent quality

C. Saturated, 100 percent quality

D. Superheated

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7238 (P7239)

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.

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7338 (P7339)

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.

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7438

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

Given the following current conditions:

Core decay heat rate = 33 MW
RV 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 RV?

A. 100,000 lbm/hr

B. 125,000 lbm/hr

C. 170,000 lbm/hr

D. 215,000 lbm/hr

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7538 (P7539)

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

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7619 (P7619)

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

Pressure = 1,000 psia
Quality = 100 percent

The main turbine steam chest pressure is 50 psia. Which one of the following describes the steam in the steam chest?

A. Saturated, 98 percent quality

B. Saturated, 99 percent quality

C. Saturated, 100 percent quality

D. Superheated

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7629 (P7629)

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 <u>all</u> of the water will boil off.

B. The water temperature will increase, and <u>none</u> of the water will boil off.

C. The water temperature will increase to 212°F, and <u>some</u> of the water will boil off.

D. The water temperature will increase to 216°F and <u>some</u> of the water will boil off.

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7659 (P7659)

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

ANSWER: C.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7679 (P7679)

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

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7689 (P3277)

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

Given:

- Steam line pressure is 280 psia.
- Steam line steam temperature is 450EF.

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

A. 212EF

B. 268EF

C. 322EF

D. 378EF

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7699 (P7699)

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

ANSWER: D.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7719 (P7719)

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

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7759 (P7759)

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

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.23 [2.8/3.1]
QID: B7780 (P7780)

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.

ANSWER: B.