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

Water is initially saturated with a quality of 50%, when a small amount of heat is added. Assuming the water pressure remains constant and the water remains saturated, water quality will _____ and water 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: K1.07   [2.7/2.8]
QID: B1074   (P674)

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

A. raise the liquid temperature above the boiling point.

B. result in a subcooled liquid.

C. result in vaporization of the liquid.

D. result in a superheated vapor.

ANSWER: C.

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

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

A. increase; remain the same

B. increase; increase

C. remain the same; remain the same

D. remain the same; increase

ANSWER: D.

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

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

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

B. vaporize a portion of the water.

C. increase the density of the water.

D. result in 1°F of superheat.

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.07   [2.7/2.8]
QID: B3374 (P2874)

An open container holds one pound-mass of liquid water at saturated conditions and atmospheric pressure. The addition of 4 BTUS 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 additional water parameters, when paired with the temperature, provides insufficient data 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%, when a small amount of heat is added. Assuming pressure remains constant and the mixture remains saturated, mixture steam quality will _____ and mixture temperature will _____.

A. increase; increase

B. increase; remain the same

C. remain the same; increase

D. remain the same; remain the same

ANSWER: B.

TOPIC: 293003
KNOWLEDGE: K1.09   [2.5/2.6]
QID: B146

Given a constant pressure, any further addition of heat will result in an increase in the temperature of...

A. saturated vapors and subcooled liquids.

B. wet vapors and saturated vapors.

C. saturated liquids and saturated vapors.

D. subcooled liquids and wet vapors.

ANSWER: A.

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

Consider a water/steam mixture with a current quality of 99%. 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

A saturated vapor exists at 800 psia. If 500 Btu/lbm is removed from this saturated vapor at a constant pressure the...

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 steam-water mixture with a current quality of 79%. 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. remain the same; increase

B. remain the same; remain the same

C. increase; increase

D. increase; remain the same

ANSWER: A.

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

Consider a saturated water/steam mixture at 500°F with a quality of 90%. 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 a saturated vapor at 470°F. If the pressure of the vapor remains constant and heat is added, vapor temperature will _____ and vapor 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 shutdown reactor vessel containing a saturated water/vapor mixture at 500°F. The mixture is currently stable with no net heat gain or loss occurring. Reactor vessel water level is 100 inches above the top of the fuel bundles.

If a leak near the bottom of the vessel results in a loss of 10% 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: K1.12   [2.5/2.6]
QID: B141

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

A. 25%

B. 37%

C. 63%

D. 75%

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 steam-water mixture that is in a saturated condition? (Assume the mixture remains saturated.)

A. Temperature will increase.

B. Temperature will decrease.

C. Quality will increase.

D. Quality will decrease.

ANSWER: D.

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

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

A. 24%

B. 27%

C. 73%

D. 76%

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

A. Pressure at 499.96 psia

B. Enthalpy at 977.33 Btu/lbm

C. Entropy at 1.17 Btu/lbm - °R

D. Specific volume at 0.817 ft³/lbm

ANSWER: A.

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

Given an operating nuclear reactor at 985 psig and a feed-water inlet temperature of 400°F, what will be the approximate 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. Temperature of the water will increase.

B. Enthalpy of the water will decrease.

C. Quality of the water will increase.

D. Density of the water will decrease.

ANSWER: B.

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

An open vessel contains one pound-mass of water at 206°F and 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% of the water mass will vaporize.

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

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 water-steam mixture that has an enthalpy of 1,150 Btu/lbm and a quality of 95%?

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

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. 1,189 Btu/lbm

B. 775 Btu/lbm

C. 414 Btu/lbm

D. 388 Btu/lbm

ANSWER: C.

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

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, assuming an initial reactor pressure of 470 psig and a final reactor pressure of 980 psig 2 hours later?

A. 40°F/hr

B. 60°F/hr

C. 80°F/hr

D. 120°F/hr

ANSWER: A.

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: B103

An operator suspects that a steam line temperature instrument reading is <u>not</u> 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%

B. 96%

C. 97%

D. 99%

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

Saturated steam at 250 psia enters turbine X. Superheated steam at 250 psia and 500°F enters turbine Y. Both turbines are 100% 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 water parameters will result in the highest fluid 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 represents the value of enthalpy (h) for steam at 235.3 psig and 500°F?

A. h = 1,201.1, Btu/lbm

B. h = 1,202.2, Btu/lbm

C. h = 1,263.5, Btu/lbm

D. h = 1,286.6, Btu/lbm

ANSWER: C.

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

A steam/water mixture leaving the nuclear reactor core has the following parameter values:

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

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 steam-water mixture leaving the nuclear reactor core has the following parameter values:

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

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)

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

A. 889 Btu

B. 1,119 Btu

C. 2,666 Btu

D. 3,358 Btu

ANSWER: D.

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

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

    Pressure: 900 psia
    Quality: 98%

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

A. 97%

B. 98%

C. 99%

D. 100%

ANSWER: A.

TOPIC: 293003
KNOWLEDGE: K1.23   [2.8/3.1]
QID: B2275 (P2275)

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

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

A. 3.1×10^8 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 a saturated vapor at 100 psia?

A. 1,119 Btu

B. 1,187 Btu

C. 2,238 Btu

D. 2,374 Btu

ANSWER: C.

TOPIC: 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 saturated steam (100% quality) at 500 psia. Which one of the following lists the approximate specific work output of turbine X and 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 ambient heat loss is required before moisture formation occurs in the steam line?

A. 31 Btu/lbm

B. 45 Btu/lbm

C. 58 Btu/lbm

D. 71 Btu/lbm

ANSWER: A.

TOPIC: 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 a superheated vapor at 400°F and 100 psia?

A. 1,119 Btu

B. 1,159 Btu

C. 2,238 Btu

D. 2,318 Btu

ANSWER: D.

TOPIC: 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:

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

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

A nuclear power plant is operating with a stable 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%

B. 43%

C. 65%

D. 81%

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

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

A. 2 Btu/lbm

B. 4 Btu/lbm

C. 8 Btu/lbm

D. 16 Btu/lbm

ANSWER: A.

TOPIC: 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 valve has the following properties:

   Pressure: 900 psia
   Quality: 99%

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% rated power. Steam is escaping to atmosphere through a flange leak in a steam supply line to the low pressure section of the main turbine.

Given:

- Steam line pressure is 300 psia.
- Steam line temperature is 440ºF.

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

A. 212ºF

B. 268ºF

C. 322ºF

D. 358ºF

ANSWER: D.

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

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

A. 31 Btu/lbm

B. 45 Btu/lbm

C. 58 Btu/lbm

D. 71 Btu/lbm

ANSWER: B.

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

An ideal main turbine generator (MTG) is producing 1000 MW of electrical power while being supplied with 100% 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% quality) to the main condenser.

Given the following:

- Main steam pressure: 1000 psia
- Main condenser vacuum: 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 lbm of water at 100°F and 100 psia to a saturated vapor at 100 psia?

A. 560 Btu

B. 1,120 Btu

C. 2,238 Btu

D. 3,356 Btu

ANSWER: C.

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

Saturated steam (100% quality) at 1000 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 <u>no</u> heat gain or loss to/from the steam.

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

	Steam Chest <u>Specific Enthalpy</u>	Steam Chest <u>Specific Entropy</u>
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 shutdown and steam is escaping to atmosphere through a leak in a main steam line. If main steam line pressure is 300 psia, what is the approximate temperature of the steam as it reaches atmospheric pressure? (Assume the steam in the main steam line has a quality of 100%.)

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

A. 1,547 lbm

B. 2,612 lbm

C. 3,310 lbm

D. 4,245 lbm

ANSWER: A.

TOPIC: 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 saturated steam (100% quality).
  • The exhaust enters and exits the reheater section at 280 psia and a flow rate of 1.0E6 lbm/hr.
  • The main steam heat transfer rate in the reheater section is 42.1E6 Btu/hr.

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

A. 450°F

B. 475°F

C. 500°F

D. 525°F

ANSWER: B.

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

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

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

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

A. 3.1 x 10^8 Btu/hr

B. 3.8 x 10^8 Btu/hr

C. 4.5 x 10^8 Btu/hr

D. 5.2 x 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 full rated 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%

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

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

A. 5,400 Btu

B. 12,600 Btu

C. 29,100 Btu

D. 67,900 Btu

ANSWER: C.

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

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

A. 8°F; 1 percent

B. 8°F; 10 percent

C. 16°F; 1 percent

D. 16°F; 10 percent

ANSWER: A.

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

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

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

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

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

ANSWER: B.

TOPIC: 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 flow rate in pounds-mass per hour (lbm/hr)?

A. 1.1×10^6 lbm/hr

B. 4.4×10^6 lbm/hr

C. 1.8×10^7 lbm/hr

D. 5.3×10^7 lbm/hr

ANSWER: B.

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

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 a main turbine steam inlet valve:

Pressure: 900 psia
Quality: 99%

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

A. 100%

B. 98%

C. 88%

D. 87%

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 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% 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 <u>no</u> heat loss from the safety valve discharge pipe.

Upon discovery of the leak, the reactor is shut down and a plant cooldown and depressurization are commenced. 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.