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

Condensate depression is the process of...

A. removing condensate from turbine exhaust steam.

B. spraying condensate into turbine exhaust steam.

C. heating turbine exhaust steam above its saturation temperature.

D. cooling turbine exhaust steam below its saturation temperature.

ANSWER: D.

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

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

A. thermal shock.

B. loss of condenser vacuum.

C. condensate depression.

D. fluid compression.

ANSWER: C.

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

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

A. saturated liquid.

B. saturated vapor.

C. subcooled liquid.

D. superheated vapor.

ANSWER: C.

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

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

A. To provide a better condenser vacuum.

B. To maximize overall secondary efficiency.

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

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

ANSWER: C.

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

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

A. 2°F

B. 19°F

C. 25°F

D. 53°F

ANSWER: C.

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

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

A. Increased secondary cycle efficiency

B. Increased feedwater temperature entering the steam generators

C. Increased net positive suction head available to condensate pumps

D. Increased inventory in the main condenser hotwell

ANSWER: C.

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

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

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

ANSWER: D.

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

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

A. 9°F

B. 11°F

C. 13°F

D. 15°F

ANSWER: B.

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

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

A. Less than 2°F

B. 3°F to 5°F

C. 6°F to 8°F

D. 9°F to 11°F

ANSWER: A.

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

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

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

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

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

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

ANSWER: A.

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

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

A. decreasing power from 100% to 25%.

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

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

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

ANSWER: D.

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

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

Which one of the following describes the effect of a 5% decrease in cooling water flow rate through the main condenser?

A. Overall steam cycle thermal efficiency will increase because the work output of the turbine will increase.

B. Overall steam cycle thermal efficiency will increase because condensate depression will decrease.

C. Overall steam cycle thermal efficiency will decrease because the work output of the turbine will decrease.

D. Overall steam cycle thermal efficiency will decrease because condensate depression will increase.

ANSWER: C.

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

A nuclear power plant is operating at 80% of rated power with 5°F of condensate depression in the main condenser. If the condensate depression decreases to 2°F, steam cycle efficiency will _____ and the probability of condensate pump cavitation will _____.

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

ANSWER: D.

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

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

A. 2°F

B. 4°F

C. 8°F

D. 16°F

ANSWER: D.

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

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

A. 6°F

B. 10°F

C. 13°F

D. 17°F

ANSWER: B.

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

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

A. Decrease main condenser hotwell level by 5%.

B. Increase main condenser hotwell level by 5%.

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

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

ANSWER: C.

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

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

A. 280°F

B. 240°F

C. 190°F

D. 170°F

ANSWER: B.

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

A pressurizer power-operated relief valve is stuck partially open with the fluid being discharged into a pressurizer relief tank. The pressurizer pressure is 2200 psia and the relief tank pressure is 5 psig.

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

A. Superheated steam

B. Subcooled liquid

C. Dry saturated steam

D. Wet vapor

ANSWER: D.

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

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

A. Enthalpy

B. Pressure

C. Specific volume

D. Temperature

ANSWER: C.

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

A reactor coolant system is being maintained at 1000 psia. A pressurizer safety/relief valve is slowly discharging to a collection tank, which is maintained at 5 psig.

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

A. 1,210 Btu/lbm

B. 1,193 Btu/lbm

C. 1,178 Btu/lbm

D. 1,156 Btu/lbm

ANSWER: B.

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

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

A. 281°F, saturated

B. 281°F, superheated

C. 332°F, saturated

D. 332°F, superheated

ANSWER: A.

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

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

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

A. 212°F

B. 280°F

C. 330°F

D. 450°F

ANSWER: C.

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

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

A. Enthalpy

B. Pressure

C. Specific volume

D. Temperature

ANSWER: C.

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

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

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

A. 262°F

B. 282°F

C. 302°F

D. 322°F

ANSWER: B.

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

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

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

A. 532°F

B. 370°F

C. 308°F

D. 212°F

ANSWER: C.

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

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

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

A. 228°F

B. 260°F

C. 284°F

D. 320°F

ANSWER: B.

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

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

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

A. 162°F

B. 228°F

C. 259°F

D. 320°F

ANSWER: C.

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

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

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

B. Condensation of turbine exhaust in a main condenser

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

D. Steam flowing through an ideal convergent nozzle

ANSWER: A.

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

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

Pressure: 900 psia
Quality: 98%

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

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

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

A. 254°F, saturated

B. 254°F, superheated

C. 228°F, saturated

D. 228°F, superheated

ANSWER: B.

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

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

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

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

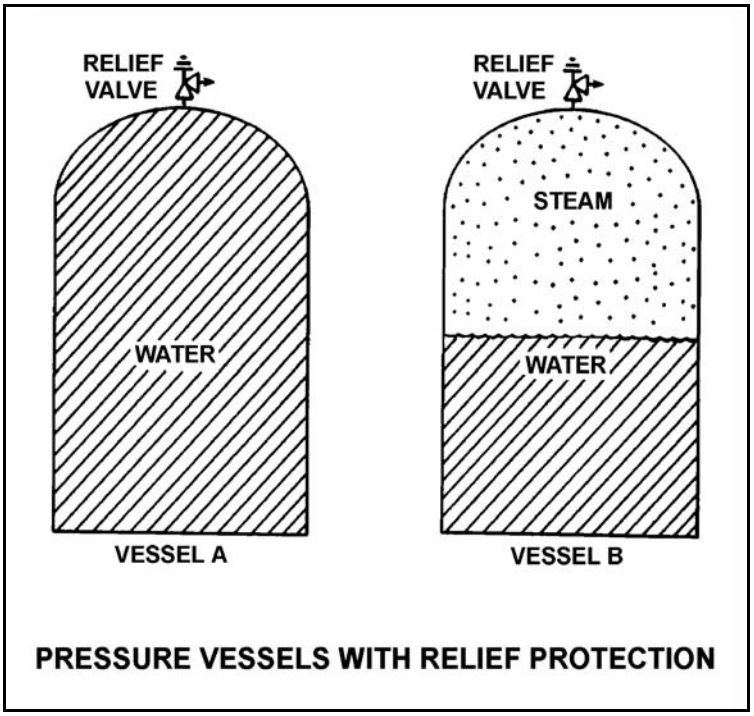
A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: D.



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

A nuclear power plant is operating at 100% 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 440°F.

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

A. 212°F

B. 268°F

C. 322°F

D. 358°F

ANSWER: D.

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

A nuclear power plant is operating at 100% 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 280 psia.
- Steam line temperature is 450°F.

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

A. 212°F

B. 268°F

C. 322°F

D. 378°F

ANSWER: D.

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

A pressurizer safety valve is leaking by, allowing the 100% quality steam in the pressurizer to flow to the pressurizer relief tank (PRT). The reactor has been shut down, and a plant cooldown and depressurization are in progress. PRT pressure is being maintained constant at 20 psig.

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

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

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

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

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

ANSWER: B.

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

Saturated steam (100% 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 no heat gain or loss to/from the steam.

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

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

ANSWER: B.

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

A nuclear power plant is shutdown and steam is escaping to atmosphere through a leak in a main steam line. If main steam line pressure is 300 psia, what is the approximate temperature of the steam as it reaches 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: 193004
KNOWLEDGE: K1.15 [2.8/2.8]
QID: P4040

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

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

A. 267°F, saturated

B. 267°F, superheated

C. 312°F, saturated

D. 312°F, superheated

ANSWER: D.

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

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

Pressure: 900 psia
Quality: 99%

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

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

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

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

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

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

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

ANSWER: D.