UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 2018 BWR – FORM A

Please Print

Name: _____

Docket No.: _____

Facility: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO EXAMINEE

Answer all the test items using the answer sheet provided, ensuring a single answer is marked for each test item. Each test item has equal point value. A score of at least 80 percent is required to pass this portion of the NRC operator licensing written examination. All examination materials will be collected 3 hours after the examination begins. This examination applies to a typical U.S. boiling water reactor (BWR) nuclear power plant.

SECTION	QUESTIONS	% OF TOTAL	SCORE
COMPONENTS	1 - 22		
REACTOR THEORY	23 - 36		
THERMODYNAMICS	37 - 50		
TOTALS	50		

All work performed on this examination is my own. I have neither given nor received aid.

_____

Examinee's Signature

RULES AND INSTRUCTIONS FOR THE
NRC GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

NOTE: The term "control rod" refers to the length of neutron absorber material that can be positioned by the operator to change core reactivity.

NOTE: Numerical answers are rounded to the nearest whole number unless otherwise indicated.

1. Print your name in the blank provided on the cover sheet of the examination.

2. Fill in your individual docket number.

3. Fill in the name of your facility.

4. Fill in your start and stop times at the appropriate times.

5. Two aids are provided for your use during the examination:

   (1) An Equations and Conversions Sheet contained within the examination copy, and

   (2) Steam tables and Mollier Diagram provided by your proctor.

6. Place your answers on the answer sheet provided. Credit will only be given for answers properly marked on this sheet. Follow the instructions for filling out the answer sheet.

7. Scrap paper will be provided for calculations.

8. Cheating on the examination will result in the automatic forfeiture of this examination. Cheating could also result in severe penalties.

9. Restroom trips are limited. Only **one** examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside the examination room.

10. After you have completed the examination, sign the statement on the cover sheet indicating that the work is your own and you have neither given nor received any assistance in completing the examination. Either pencil or pen may be used.

11. Turn in your examination materials, answer sheet on top, followed by the examination copy and the examination aids, e.g., steam tables, handouts, and scrap paper.

12. After turning in your examination materials, leave the examination area as defined by the proctor. If after leaving you are found in the examination area while the examination is in progress, your examination may be forfeited.

GENERIC FUNDAMENTALS EXAMINATION
EQUATIONS AND CONVERSIONS SHEET

EQUATIONS

$\dot{Q} = \dot{m}c_p\Delta T$

$\dot{Q} = \dot{m}\Delta h$

$\dot{Q} = UA\Delta T$

$\dot{Q} \propto \dot{m}^3_{\text{Nat Circ}}$

$\Delta T \propto \dot{m}^2_{\text{Nat Circ}}$

$K_{eff} = 1/(1 - \rho)$

$\rho = (K_{eff} - 1)/K_{eff}$

$SUR = 26.06/\tau$

$$\tau = \frac{\bar{\beta}_{eff} - \rho}{\lambda_{eff}\,\rho}$$

$$\rho = \frac{\ell^*}{\tau} + \frac{\bar{\beta}_{eff}}{1 + \lambda_{eff}\,\tau}$$

$\ell^* = 1.0 \times 10^{-4}$ sec

$\lambda_{eff} = 0.1\ \text{sec}^{-1}$ (for small positive ρ)

$DRW \propto \varphi^2_{tip} / \varphi^2_{avg}$

$P = P_o e^{t/\tau}$

$P = P_o 10^{SUR(t)}$

$A = A_o e^{-\lambda t}$

$N = S/(1 - K_{eff})$

$CR_1(1 - K_{eff_1}) = CR_2(1 - K_{eff_2})$

$1/M = CR_1/CR_x$

$A = \pi r^2$

$F = PA$

$\dot{m} = \rho A\vec{v}$

$\dot{W}_{Pump} = \dot{m}\Delta P\upsilon$

$P = I^2R$

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

$P_R = \sqrt{3}IE\sin\theta$

Thermal Efficiency = Net Work Out/Energy In

$$\frac{g(z_2 - z_1)}{g_c} + \frac{(\vec{v}_2^2 - \vec{v}_1^2)}{2g_c} + \upsilon(P_2 - P_1) + (u_2 - u_1) + (q - w) = 0$$

$g = 32.2\ \text{ft/sec}^2$

$g_c = 32.2$ lbm-ft/lbf-sec^2

CONVERSIONS

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1 MW $= 3.41 \times 10^6$ Btu/hr

1 hp $= 2.54 \times 10^3$ Btu/hr

1 Btu $= 778$ ft-lbf

°C $= (5/9)(°F - 32)$

°F $= (9/5)(°C) + 32$

1 kg $= 2.21$ lbm

1 ft^3_{water} $= 7.48$ gal

1 gal_{water} $= 8.35$ lbm

1 Curie $= 3.7 \times 10^{10}$ dps

QUESTION: 1

A completely full water storage tank is being hydrostatically tested to 100 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 10 gpm. The tank is protected by a safety valve and a relief valve; both valves discharge to the atmosphere. Each valve has an opening setpoint of 105 psig and a maximum rated discharge flow rate of 6 gpm. The PDP is inadvertently left running when tank pressure reaches 100 psig.

With the PDP still running, tank pressure will stabilize _____ 105 psig; and the greater mass flow rate will be coming from the _____ valve.

A. at; safety

B. above; safety

C. at; relief

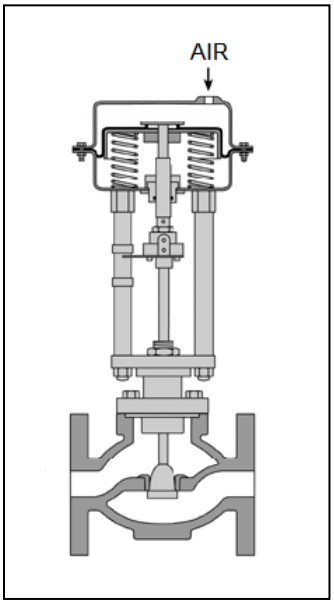
D. above; relief

QUESTION: 2

Refer to the drawing of a pneumatically-operated valve (see figure below). The valve actuator may be shown with or without applied air pressure.

Which one of the following describes the type of valve shown, and the valve's fail position on loss of air to the actuator?

	Valve Type	Fail Position
A.	Ball	Open
B.	Ball	Closed
C.	Globe	Open
D.	Globe	Closed



QUESTION: 3

In a comparison between ball valves and butterfly valves in the same water system application, the valve that typically would allow more leakage when fully closed with a high differential pressure is the _____ valve; and the valve that typically would cause the greater pressure loss when fully open is the _____ valve.

A. ball; butterfly

B. ball; ball

C. butterfly; butterfly

D. butterfly; ball

QUESTION: 4

A main steam flow rate measuring instrument uses a steam pressure input to produce main steam mass flow rate indication. Assuming steam volumetric flow rate does not change, a steam pressure decrease will cause indicated steam mass flow rate to...

A. decrease, because the density of the steam has decreased.

B. increase, because the density of the steam has increased.

C. remain the same, because steam pressure does not affect the mass flow rate of steam.

D. remain the same, because the steam pressure input compensates for changes in steam pressure.

QUESTION: 5

Refer to the drawing of a water storage tank with two differential pressure (D/P) level indicators (see figure below).

Two D/P level indicators are installed on a large water storage tank. Indicator No. 1 was calibrated at 200°F water temperature and indicator No. 2 was calibrated at 100°F water temperature.

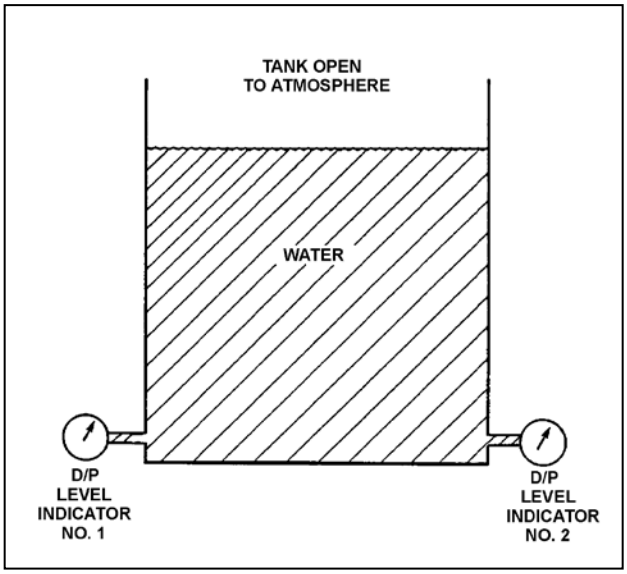
Assuming both indicators are on scale, which indicator will indicate the lower level?

A. Indicator 1 at all water temperatures.

B. Indicator 2 at all water temperatures.

C. Indicator 1 below 150°F, indicator 2 above 150°F.

D. Indicator 2 below 150°F, indicator 1 above 150°F.



QUESTION: 6

Refer to the drawing of a simple chromel-alumel thermocouple circuit (see figure below). Initially, the temperature instrument indicates 350°F.

A steam leak inside the reactor building (RB) increases the temperature of the thermocouple connection head, reference junction panel, and extension wires inside the RB from 120°F to 160°F. The temperature at the location measured by the thermocouple remains the same.

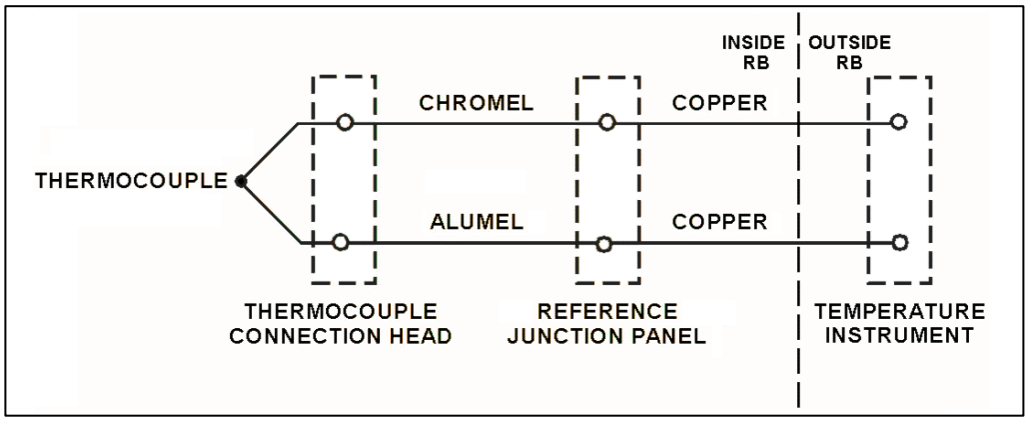
What is the resulting temperature indication?

A. 310°F

B. 350°F

C. 390°F

D. 430°F



QUESTION: 7

A loss-of-coolant accident resulted in a reactor scram. The source range monitors (SRMs) were fully inserted and are currently located in a voided section of the core.

If the SRMs are subsequently repositioned below the core water level, the SRM count rate will…

A. increase due to increased thermal neutron flux.

B. increase due to increased neutron migration length.

C. decrease due to decreased thermal neutron flux.

D. decrease due to decreased neutron migration length.

QUESTION: 8

Refer to the drawing of a water storage tank with an automatic level control system (see figure below). The level control system uses a reverse-acting level sensor and a direct-acting controller. The flow rate of water entering the tank is constant, and within the capacity of the drain valve.

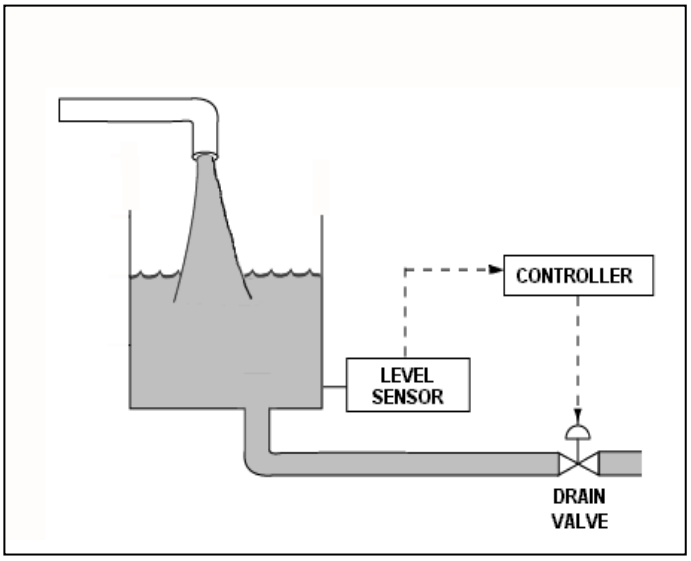
For the level control system to maintain a stable water level in the tank at a value up to 10 percent above or below the controller's setpoint, the controller must have a _____ characteristic; and the drain valve must fail _____ on a loss of air pressure to its actuator.

A. proportional-only; closed

B. proportional-only; open

C proportional-integral; closed

D. proportional-integral; open



QUESTION: 9

What is the purpose of a valve positioner in a typical pneumatic valve control system?

A. Convert the valve controller pneumatic output signal into a mechanical force to position the valve.

B. Convert the valve controller pneumatic output signal into an electrical output to position the valve.

C. Compare the valve controller pneumatic output signal to the valve position, and adjust the valve actuator air supply pressure to position the valve.

D. Compare the valve controller pneumatic output signal to the setpoint error, and adjust the valve actuator air supply pressure to position the valve.

QUESTION: 10

Which one of the following would result from operating a motor-driven centrifugal pump for extended periods with the discharge valve shut and no recirculation flow?

A. No damage, because the pump and motor are designed to operate with the discharge valve shut.

B. Pump overheating, cavitation, and ultimately pump failure.

C. Excessive motor current, damage to motor windings, and ultimately motor failure.

D. Pump and motor overspeed, and tripping on high motor current.

QUESTION: 11

Refer to the drawing of a centrifugal pump taking suction from a reservoir.

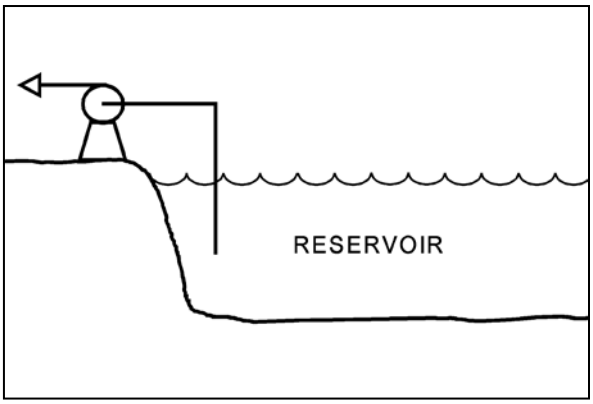
The pump is located on shore, with the eye of the pump 4 feet higher than the reservoir water level. The pump's suction line extends 4 feet below the surface of the reservoir. Which one of the following modifications would increase the pump's available net positive suction head? (Assume the reservoir is at a uniform temperature and ignore any changes in suction line head loss due to friction.)

A. Raise the pump and suction line by 2 feet.

B. Lower the pump and suction line by 2 feet.

C. Lengthen the suction line to take a suction from 2 feet deeper.

D. Shorten the suction line to take a suction from 2 feet shallower.



QUESTION: 12

Refer to the drawing of a radial-flow centrifugal pump with a recirculation line in an open system (see figure below). The recirculation line throttle valve is currently 50 percent open. The pump is currently operating very close to runout.

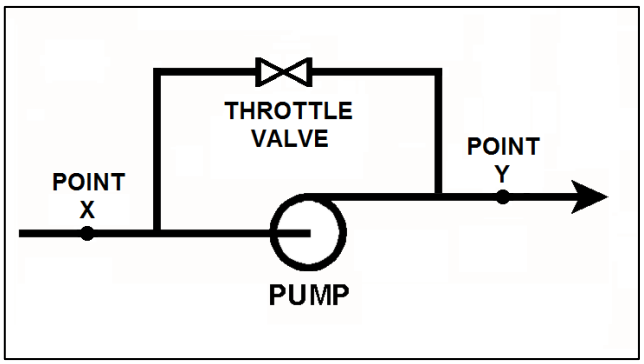
To move pump operation farther away from runout, without reducing the pump's available net positive suction head, an orifice can be installed at point _____; or the pump's recirculation line throttle valve can be positioned more _____.

A. X; open

B. X; closed

C. Y; open

D. Y; closed



QUESTION: 13

A positive displacement pump should be started with its suction valve _____ and its discharge valve _____.

A. throttled; throttled

B. throttled; fully open

C. fully open; throttled

D. fully open; fully open

QUESTION: 14

Initially, an AC induction motor is operating with the following steady-state conditions:

Motor current	= 25 amps
Average stator winding temperature	= 140°F
Ambient temperature	= 90°F

Assume the stator winding electrical resistance, motor heat transfer properties, and ambient temperature do not change. If a change in motor load causes the motor current to increase to 50 amps, which one of the following will be the new steady-state average stator winding temperature?

A. 190°F

B. 200°F

C. 280°F

D. 290°F

QUESTION: 15

A main generator is connected to an infinite power grid with the following generator output parameters:

22 KV
60 Hertz
575 MW
100 MVAR (out)

Which one of the following contains a combination of minor adjustments to the main generator voltage regulator and speed control setpoints such that <u>each</u> adjustment will cause the main generator to operate at a power factor farther from 1.0? (Assume the generator power factor remains less than 1.0.)

	Voltage Setpoint	Speed Setpoint
A.	Increase	Increase
B.	Increase	Decrease
C.	Decrease	Increase
D.	Decrease	Decrease

QUESTION: 16

Which one of the following will reduce the heat transfer rate between two liquids in a heat exchanger? (Assume single-phase conditions and a constant specific heat for both liquids.)

A. The inlet temperatures of both liquids decrease by 20°F.

B. The inlet temperatures of both liquids increase by 20°F.

C. The inlet temperature of the hotter liquid increases by 20°F.

D. The inlet temperature of the colder liquid increases by 20°F.

QUESTION: 17

A reactor is shut down with the residual heat removal (RHR) system in service. Assume that only the RHR heat exchangers are removing heat from the reactor vessel (RV), and the RHR system provides complete thermal mixing in the RV. Also, assume that core decay heat is the only source of heat addition to the RV coolant.

Given the following current information:

Reactor core rated thermal power	=	2,950 MW
Core decay heat rate	=	0.6 percent of rated thermal power
RHR system heat removal rate	=	4.7×10^7 Btu/hr
RHR and RV coolant c_p	=	1.05 Btu/lbm-°F
Combined RV and RHR coolant mass	=	450,000 lbm

Which one of the following actions will establish an RV coolant heatup rate between 10°F/hour and 20°F/hour?

A. Increase RHR heat exchanger flow rate to reduce the heatup rate by 10°F/hour.

B. Increase RHR heat exchanger flow rate to reduce the heatup rate by 110°F/hour.

C. Decrease RHR heat exchanger flow rate to increase the heatup rate by 10°F/hour.

D. Decrease RHR heat exchanger flow rate to increase the heatup rate by 110°F/hour.

QUESTION: 18

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

The heat exchanger was initially placed in continuous service 6 months ago. During the 6-month period of operation, mineral deposits have accumulated inside the heat exchanger tubes.

The following parameters are currently stable at their initial values:

- Lube oil mass flow rate
- Lube oil inlet temperature
- Lube oil outlet temperature
- Cooling water inlet temperature

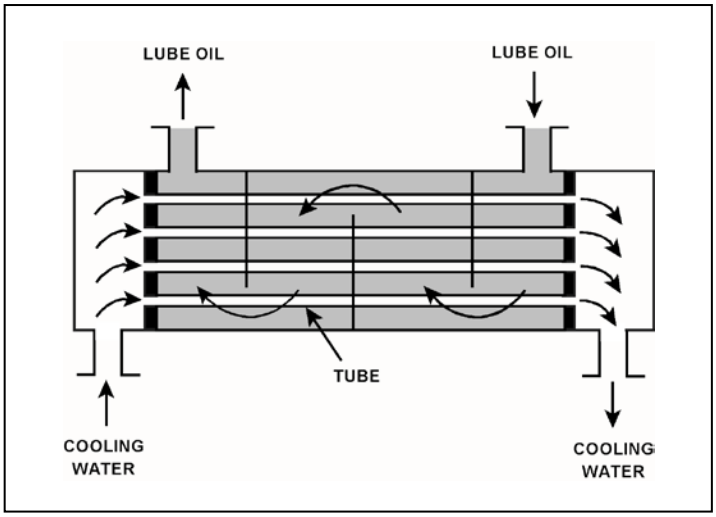
Compared to their initial values, the current cooling water outlet temperature is _____; and the current cooling water mass flow rate is _____.

A. lower; greater

B. lower; smaller

C. higher; greater

D. higher; smaller



QUESTION: 19

High differential pressure in a demineralizer could be caused by all of the following except...

A. crud buildup.

B. high flow rate.

C. resin exhaustion.

D. resin overheating.

QUESTION: 20

The cation exchange resin in a mixed-bed demineralizer removes undesirable _____ ions from solution while releasing desirable _____ ions into solution.

A. negative; negative

B. negative; positive

C. positive; negative

D. positive; positive

QUESTION: 21

Given the following indications for an open 4,160 VAC breaker:

All phase overcurrent trip flags are reset.
The control power fuses indicate blown.
The line-side voltmeter indicates 4,160 VAC.
The load-side voltmeter indicates 0 VAC.

Assuming no operator actions were taken since the breaker opened, which one of the following could have caused the breaker to open?

A. A ground fault caused an automatic breaker trip.

B. A loss of control power caused an automatic breaker trip.

C. An operator tripped the breaker manually at the breaker cabinet.

D. An operator tripped the breaker manually from a remote location.

QUESTION: 22

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

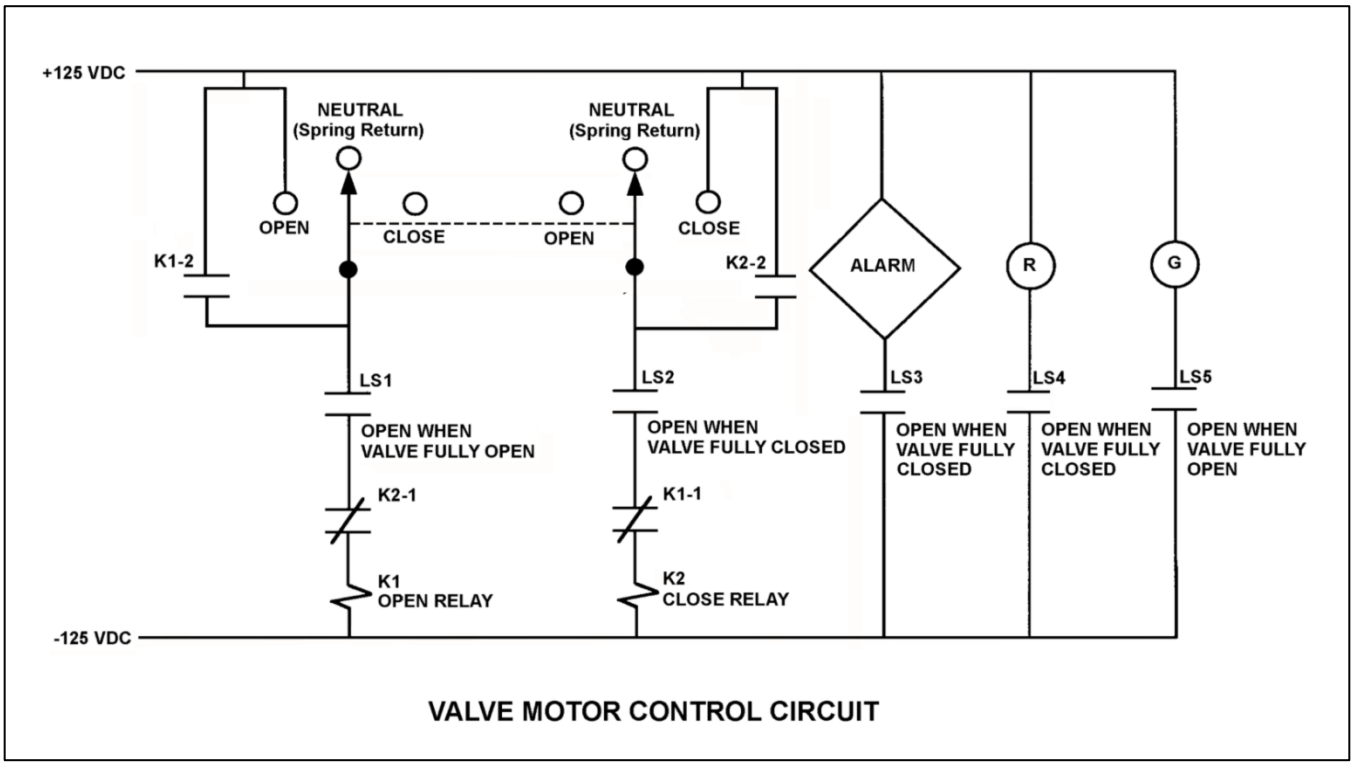
The operator takes the control switch to OPEN. Two seconds later, after verifying the valve is opening, the operator releases the control switch. Which one of the following describes the alarm response after the control switch is released?

A. The alarm will activate after approximately 8 seconds.

B. The alarm will <u>not</u> activate until additional operator action is taken.

C. The alarm will remain activated for approximately 8 seconds, and then deactivate.

D. The alarm will remain activated until additional operator action is taken.



VALVE MOTOR CONTROL CIRCUIT

QUESTION: 23

In a comparison between a prompt neutron and a delayed neutron produced from the same fission event, the delayed neutron requires _____ collisions in the moderator to become thermal; and is _____ likely to cause fission of a U-238 nucleus. (Assume that both neutrons remain in the core.)

A. fewer; less

B. fewer; more

C. more; less

D. more; more

QUESTION: 24

A nuclear power plant is currently operating at steady-state 80 percent power near the end of its fuel cycle. During the next 3 days of steady-state power operation, no operator action is taken.

How will K_{eff} be affected during the 3-day period?

A. K_{eff} will gradually increase during the entire period.

B. K_{eff} will gradually decrease during the entire period.

C. K_{eff} will tend to increase, but inherent reactivity feedback will maintain K_{eff} at 1.0.

D. K_{eff} will tend to decrease, but inherent reactivity feedback will maintain K_{eff} at 1.0.

QUESTION: 25

A nuclear power plant has been operating at 100 percent power for two months when a reactor scram occurs. Two months after the reactor scram, with all control rods still fully inserted, a stable count rate of 20 cps is indicated on the source range nuclear instruments.

The majority of the source range detector output is being caused by the interaction of _____ with the detector.

A. intrinsic source neutrons

B. fission gammas from previous power operation

C. fission neutrons from subcritical multiplication

D. delayed fission neutrons from previous power operation

QUESTION: 26

Which one of the following describes the initial reactivity effect of a moderator temperature decrease in an overmoderated reactor?

A. Positive reactivity will be added because fewer neutrons will be captured by the moderator while slowing down.

B. Positive reactivity will be added because fewer neutrons will be absorbed at resonance energies while slowing down.

C. Negative reactivity will be added because more neutrons will be captured by the moderator while slowing down.

D. Negative reactivity will be added because more neutrons will be absorbed at resonance energies while slowing down.

QUESTION: 27

During a reactor power decrease from steady-state 100 percent to steady-state 20 percent, the smallest addition of positive reactivity will be caused by the change in...

A. void percentage.

B. fuel temperature.

C. xenon concentration.

D. moderator temperature.

QUESTION: 28

Which one of the following describes how a one- or two-notch withdrawal of a shallow control rod can cause a power decrease in the associated fuel bundle?

A. The control rod withdrawal may increase its own differential control rod reactivity worth enough to cause a bundle power decrease.

B. The control rod withdrawal may cause a local power increase that increases the void content in the bundle enough to cause a bundle power decrease.

C. The control rod withdrawal may expose fresh burnable poisons having enough negative reactivity to cause a bundle power decrease.

D. The control rod withdrawal may permit enough neutron-absorbing moderator to fill the volume vacated by the control rod to cause a bundle power decrease.

QUESTION: 29

Which one of the following describes the change in magnitude (absolute value) of differential control rod worth during the complete withdrawal of a fully inserted control rod?

A. Increases, then decreases.

B. Decreases, then increases.

C. Increases continuously.

D. Decreases continuously.

QUESTION: 30

A reactor was operating at 100 percent power for one week when power was decreased to 50 percent. Which one of the following describes the equilibrium xenon-135 concentration at 50 percent power?

A. The same as the 100 percent power equilibrium concentration.

B. More than one-half the 100 percent power equilibrium concentration.

C. One-half the 100 percent power equilibrium concentration.

D. Less than one-half the 100 percent power equilibrium concentration.

QUESTION: 31

A reactor scram occurred one hour ago following several months of operation at 100 percent power. Reactor vessel pressure is being maintained at 800 psia and the source range count rate is currently 400 cps. If no operator action is taken, how will the source range count rate respond during the next 24 hours? (Assume a constant source neutron flux.)

A. The count rate will remain about the same.

B. The count rate will decrease for the entire period.

C. The count rate will initially decrease and then increase.

D. The count rate will initially increase and then decrease.

QUESTION: 32

Which one of the following contributes to the need for a much higher 100 percent power control rod density at the beginning of a fuel cycle (BOC) as compared to the end of a fuel cycle (EOC)?

A. The negative reactivity from burnable poisons is greater at BOC.

B. The negative reactivity from fission product poisons is smaller at BOC.

C. The positive reactivity from the fuel in the core is smaller at BOC.

D. The positive reactivity from a unit withdrawal of a typical control rod is greater at BOC.

QUESTION: 33

A reactor is shutdown with a K_{eff} of 0.8. The source range count rate is stable at 800 cps. What percentage of the core neutron population is being contributed directly by neutron-induced fission?

A. 10 percent

B. 20 percent

C. 80 percent

D. 100 percent

QUESTION: 34

A reactor and plant startup is in progress. Reactor power is currently 5.0×10^{-5} percent and increasing, with a constant period of 130 seconds. Reactivity is <u>not</u> changing.

The reactor is currently _____, at a power level that is _____ the point of adding heat.

A. critical; less than

B. critical; greater than

C. supercritical; less than

D. supercritical; greater than

QUESTION: 35

A reactor startup is in progress at the beginning of core life. Reactor power is 5.0×10^{-3} percent and increasing slowly with a stable period of 87 seconds. Assuming no operator action, no reactor scram, and no steam release, what will reactor power be after 10 minutes?

A. Below the point of adding heat (POAH).

B. At the POAH.

C. Above the POAH but less than 49 percent.

D. Approximately 50 percent.

QUESTION: 36

A nuclear power plant is operating at 60 percent power in the middle of a fuel cycle when a turbine control system malfunction opens the turbine steam inlet valves an additional 5 percent. Which one of the following describes the initial reactor power change and the cause for the power change?

A. Decrease, because the rate of neutron absorption in the moderator initially increases.

B. Decrease, because the rate of neutron absorption at U-238 resonance energies initially increases.

C. Increase, because the rate of neutron absorption in the moderator initially decreases.

D. Increase, because the rate of neutron absorption at U-238 resonance energies initially decreases.

QUESTION: 37

Refer to the drawing of a water-filled manometer (see figure below).

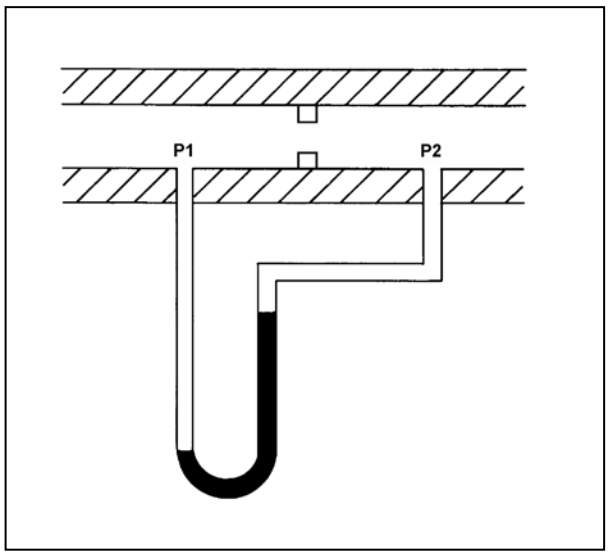
The manometer is installed across an orifice in a ventilation duct to determine the direction of airflow. With the manometer conditions as shown, the pressure at P1 is _____ than P2; and the direction of airflow is _____.

A. greater; left to right

B. greater; right to left

C. less; left to right

D. less; right to left



QUESTION: 38

Refer to the drawing of a section of 6-inch diameter pipe containing subcooled water flowing from left to right at 100 gpm (see figure below). The pipe is frictionless and no heat transfer is occurring. Point B is 10 feet higher in elevation than point A.

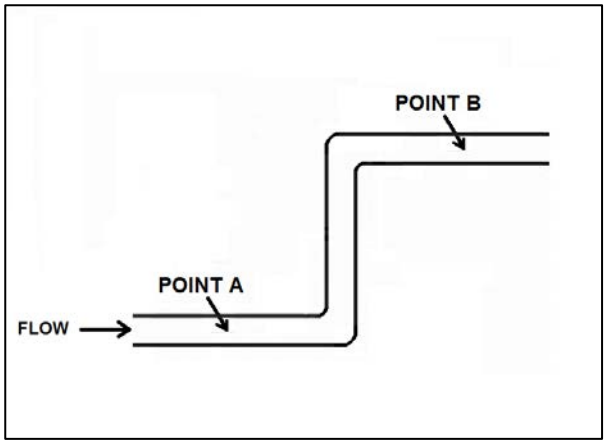
How does the enthalpy of the water at point A compare to point B?

A. The enthalpy of the water at point A is smaller, because some of the water's kinetic energy is converted to enthalpy as it flows to point B.

B. The enthalpy of the water at point A is greater, because some of the water's enthalpy is converted to potential energy as it flows to point B.

C. The enthalpy of the water at points A and B is the same, because the pipe is frictionless and no heat transfer is occurring.

D. The enthalpy of the water at points A and B is the same, because the total energy of the water does not change from point A to point B.



QUESTION: 39

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.

QUESTION: 40

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

QUESTION: 41

If superheating of the inlet steam to a low pressure (LP) turbine is reduced, LP turbine work output will _____; and LP turbine exhaust moisture content will _____. (Assume steam mass flow rate does not change.)

A. remain the same; increase

B. remain the same; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 42

A nuclear power plant is initially operating at steady-state 100 percent power. If an unplanned load rejection causes the main generator load to rapidly decrease to 90 percent, the voids in the two-phase flow in the reactor core will initially _____; which causes indicated reactor vessel water level (measured in the downcomer) to initially _____.

A. shrink; decrease

B. shrink; increase

C. expand; decrease

D. expand; increase

QUESTION: 43

Refer to the drawing of a venturi in a main steam line (see figure below). The venturi inlet and outlet pipe diameters are equal.

A main steam line break downstream of the venturi causes the main steam mass flow rate through the venturi to increase. Soon, the steam reaches sonic velocity in the throat of the venturi.

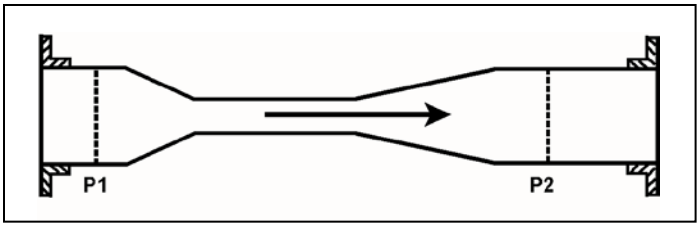
How will the main steam mass flow rate through the venturi be affected as the steam pressure downstream of the venturi continues to decrease?

A. It will continue to increase at a rate that is dependent on the steam velocity in the throat of the venturi.

B. It will continue to increase at a rate that is dependent on the differential pressure (P1 - P2) across the venturi.

C. It will <u>not</u> continue to increase because the steam velocity <u>cannot</u> increase above sonic velocity in the throat of the venturi.

D. It will <u>not</u> continue to increase because the differential pressure (P1 - P2) across the venturi <u>cannot</u> increase further once the steam reaches sonic velocity in the throat of the venturi.



QUESTION: 44

Given the following data for a steam condenser:

Total tube area	= 500,000 ft^2
Cooling water flow rate	= 200,000 gpm
Condenser pressure	= 1.0 psia
Specific heat of cooling water (c_p)	= 1.0 Btu/lbm-°F
Cooling water inlet temperature	= 60°F
Cooling water outlet temperature	= 80°F
Steam condensing rate	= 3,000,000 lbm/hr
Mass of cooling water	= 8.34 lbm/gal

What is the condenser heat load (MW)?

A. 587 MW

B. 629 MW

C. 671 MW

D. 733 MW

QUESTION: 45

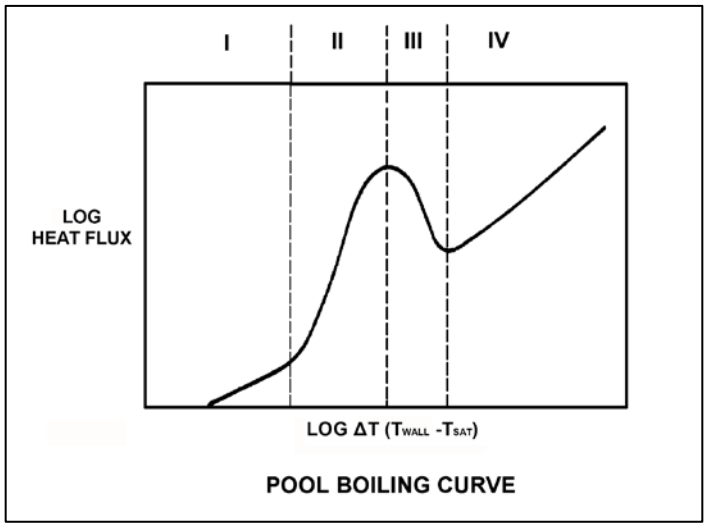
Refer to the drawing of a pool boiling curve (see figure below). In which region(s) of the curve does a reactor normally operate to transfer heat from the fuel cladding to the coolant at 100 percent power?

A. Regions II and III

B. Region II only

C. Regions I and II

D. Region I only



QUESTION: 46

A reactor is operating at steady-state 90 percent power. Which one of the following will cause the two-phase coolant flowing upward in a fuel bundle to initially move away from the onset of transition boiling? (Assume reactor power does not change unless stated.)

A. Recirculation flow rate decreases.

B. Reactor pressure increases.

C. Feedwater temperature decreases.

D. Fuel bundle power increases.

QUESTION: 47

A reactor is initially operating at steady-state 40 percent power with power distribution peaked both radially and axially in the center of the core. Reactor power is then increased to 70 percent over the next two hours using only reactor recirculation flow rate adjustments for reactivity control. Ignore any effect from changes in reactor poisons.

During the power increase, the location of the maximum core radial peaking factor will _____ of the core; and the location of the maximum core axial peaking factor will _____ of the core.

A. shift to the periphery; move toward the bottom

B. shift to the periphery; move toward the top

C. remain near the center; move toward the bottom

D. remain near the center; move toward the top

QUESTION: 48

Which one of the following operations is most likely to cause significant pellet-cladding interaction?

A. Increasing reactor power from 20 percent to 50 percent near the beginning of a fuel cycle.

B. Increasing reactor power from 20 percent to 50 percent near the end of a fuel cycle.

C. Increasing reactor power from 70 percent to 100 percent near the beginning of a fuel cycle.

D. Increasing reactor power from 70 percent to 100 percent near the end of a fuel cycle.

QUESTION: 49

Consider a new fuel rod operating at a constant power level for several weeks. During this period, fuel pellet densification in the fuel rod causes the heat transfer rate from the fuel pellets to the cladding to _____; this change causes the average fuel temperature in the fuel rod to _____.

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

QUESTION: 50

The nil-ductility transition temperature of the reactor vessel (RV) is the temperature...

A. above which the RV metal will elastically deform as RV pressure decreases.

B. above which the RV metal loses its ability to elastically deform as RV pressure increases.

C. below which the RV metal will elastically deform as RV pressure decreases.

D. below which the RV metal loses its ability to elastically deform as RV pressure increases.

***** FINAL ANSWER KEY *****

MARCH 2018 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

FORM A	FORM B	ANS.	FORM A	FORM B	ANS.
1	15	B	26	40	C
2	16	D	27	41	D
3	17	C	28	42	B
4	18	A	29	43	A
5	19	B	30	44	B
6	20	A	31	45	C
7	21	A	32	46	B
8	22	B	33	47	C
9	23	C	34	48	C
10	24	B	35	49	B
11	25	B	36	50	B
12	26	D	37	1	A
13	27	D	38	2	B
14	28	D	39	3	B
15	29	B	40	4	A
16	30	D	41	5	C
17	31	A	42	6	A
18	32	A	43	7	C
19	33	C	44	8	A
20	34	D	45	9	C
21	35	C	46	10	C
22	36	D	47	11	D
23	37	A	48	12	D
24	38	D	49	13	A
25	39	C	50	14	D