UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
SEPTEMBER 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 cooling water system uses a conventional relief valve (not pilot-operated) with a bench-tested setpoint of 60 psig. The relief valve discharges to a collection tank that is maintained at 5 psig. At what system pressure will the relief valve begin to open?

A. 55 psig

B. 60 psig

C. 65 psig

D. 80 psig

QUESTION: 2

Refer to the drawing of an open system with subcooled water flowing through valves A, B, C and D (see figure below). All valves are initially 50 percent open. The inlet pressure to valve A is constant at 60 psia.

The initial steady-state inlet and outlet pressures for valve B are as follows:

Inlet pressure = 50 psia
Outlet pressure = 35 psia

After a single valve operation, the current steady-state inlet and outlet pressures for valve B are as follows:

Inlet pressure = 48 psia
Outlet pressure = 36 psia

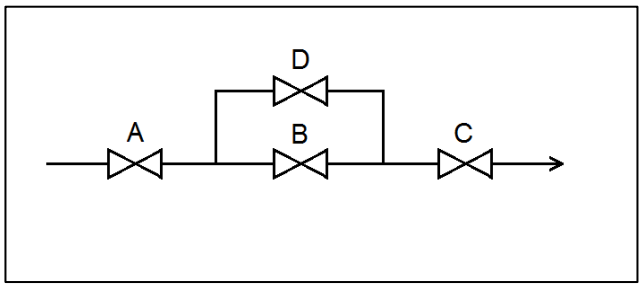
Which one of the following valve operations could be responsible for the difference between the initial and current steady-state inlet and outlet pressures for valve B?

A. Valve A was opened more.

B. Valve B was closed more.

C. Valve C was closed more.

D. Valve D was opened more.



QUESTION: 3

To verify that a manual valve in an operating system is closed, the operator should observe valve position indication and operate the valve handwheel in the...

A. open direction until flow sounds are heard, then close the valve using normal force.

B. close direction using normal force and verify there is no substantial handwheel movement.

C. close direction until it stops, then close it an additional one-half turn using additional force if necessary.

D. open direction until the valve stem moves in the open direction, then close the valve using normal force.

QUESTION: 4

An orifice is being used in an operating cooling water system to measure flow rate. Which one of the following will cause the differential pressure sensed across the orifice to decrease?

A. System flow rate decreases.

B. System pressure decreases.

C. Debris becomes lodged in the orifice.

D. A leak develops in the low pressure sensing line.

QUESTION: 5

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

The water storage tank is 40 feet tall. The level detection system is calibrated to provide a level indication of 30 feet when the tank and reference leg levels are equal.

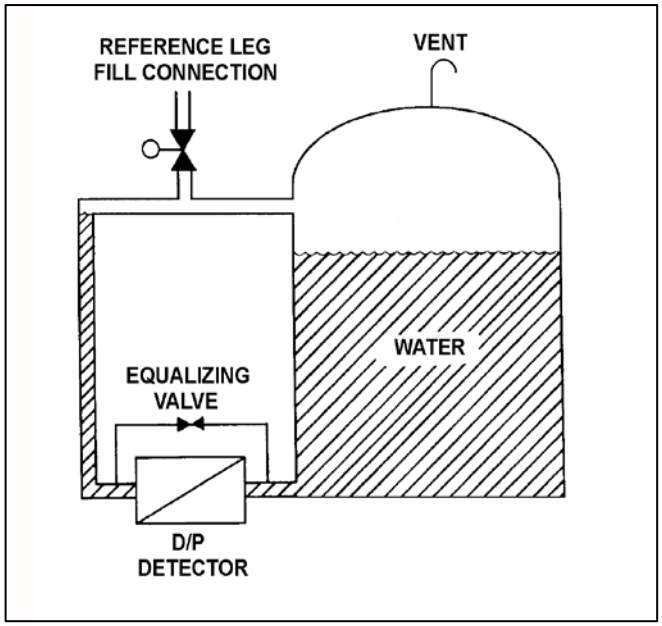
If the tank is completely filled with water, the tank level will indicate...

A. less than 30 feet.

B. 30 feet.

C. greater than 30 feet, but less than 40 feet.

D. 40 feet.



QUESTION: 6

A proportional detector with pulse height discrimination circuitry is being used in a constant field of neutron and gamma radiation to provide source range neutron count rate indication. Assume that the pulse height discrimination setpoint does not change.

If the detector voltage is increased but maintained within the proportional region, count rate indication will increase because...

A. a single neutron- or gamma-induced ionizing event will result in multiple pulses inside the detector.

B. the ratio of the number of neutron-induced pulses to gamma-induced pulses inside the detector will increase.

C. the positive space charge effect will increase and promote the collection of both gamma- and neutron-induced pulses.

D. all detector pulses will increase in amplitude and previously uncounted gamma pulses will be added to the total count rate.

QUESTION: 7

A Geiger-Mueller detector with a "pancake" probe is being used to monitor workers leaving a radiologically controlled area for contamination. The probe is sensitive to alpha, beta, and gamma radiation. The background count rate is 20 cpm. As one worker's shoe is scanned, the count rate increases to 1,000 cpm.

Given the following separate actions:

- When a sheet of paper is placed between the probe and the shoe, the count rate decreases to 400 cpm.
- When a sheet of aluminum foil is placed between the probe and the shoe, the count rate decreases to 20 cpm.

The results of the above actions indicate that the radiation from the shoe contamination consists of…

A. beta only.

B. alpha and beta only.

C. beta and gamma only.

D. alpha, beta, and gamma.

QUESTION: 8

Refer to the drawing of a water storage tank with an automatic level control system (see figure below).

The level control system has the following characteristics:

- The level sensor is direct-acting.
- The controller is reverse-acting.
- The controller uses proportional control.
- The controller's setpoint is 12 feet.
- The controller's proportional band is 6 feet to 18 feet.
- The drain valve will fail open if the actuator loses air pressure.

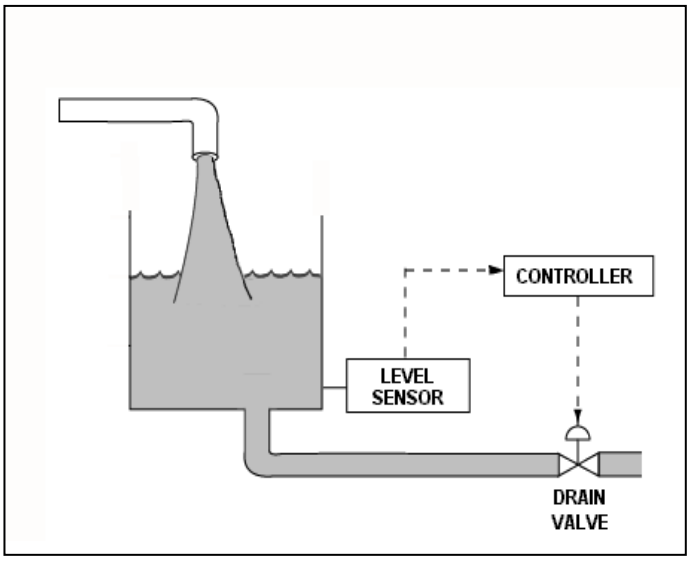
When the tank water level is 15 feet, the controller's output will be _____ percent; and the drain valve will be _____ percent open.

A. 25; 25

B. 25; 75

C. 75; 25

D. 75; 75



QUESTION: 9

Refer to the drawing of four bistable symbols (see figure below).

A temperature controller uses a bistable that turns on to actuate a warning light when the controlled temperature reaches a high setpoint. The bistable turns off to extinguish the warning light when the temperature decreases to 5°F below the high setpoint.

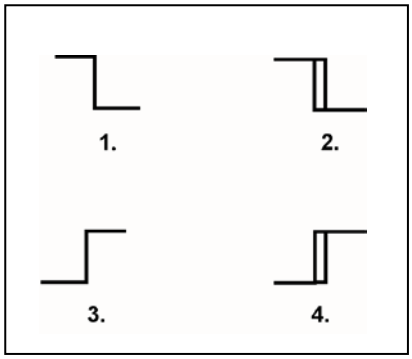
Which one of the following bistable symbols indicates the characteristics of the bistable?

A. 1.

B. 2.

C. 3.

D. 4.



QUESTION: 10

A centrifugal pump is operating with the following parameters in a closed system:

Pump head = 50 psid
Flow rate = 200 gpm
Power input = 3 KW

Pump speed is increased and flow rate increases to 400 gpm. Which one of the following is the value of the new power consumption?

A. 6 KW

B. 9 KW

C. 24 KW

D. 27 KW

QUESTION: 11

Initially, a centrifugal pump is operating at normal discharge pressure and flow conditions with the pump discharge valve fully open. Then, the discharge valve is throttled to the 50 percent open position. Which one of the following parameter changes will occur when the discharge valve is throttled?

A. Pump motor current decreases.

B. Pump flow rate increases.

C. Pump discharge head decreases.

D. Available net positive suction head decreases.

QUESTION: 12

How are the required net positive suction head ($NPSH_R$) and available net positive suction head ($NPSH_A$) for an in-service centrifugal water pump determined?

A. Both $NPSH_R$ and $NPSH_A$ are calculated using water parameter values at the pump inlet.

B. Both $NPSH_R$ and $NPSH_A$ are determined from pump curves provided by the pump manufacturer.

C. $NPSH_R$ is calculated using water parameter values at the pump inlet, while $NPSH_A$ is determined from pump curves provided by the pump manufacturer.

D. $NPSH_A$ is calculated using water parameter values at the pump inlet, while $NPSH_R$ is determined from pump curves provided by the pump manufacturer.

QUESTION: 13

Which one of the following describes the proper location for a relief valve that will be used to prevent exceeding the design pressure of a positive displacement pump and associated piping?

A. On the pump suction piping upstream of the suction isolation valve.

B. On the pump suction piping downstream of the suction isolation valve.

C. On the pump discharge piping upstream of the discharge isolation valve.

D. On the pump discharge piping downstream of the discharge isolation valve.

QUESTION: 14

Refer to the partial drawing of two identical centrifugal pumps in a cooling water system (see figure below). Each pump is driven by an identical three-phase AC induction motor.

The cooling water system is being returned to service following maintenance on the pumps. Pump A was started five minutes ago to initiate flow in the cooling water system. Pump B is about to be started.

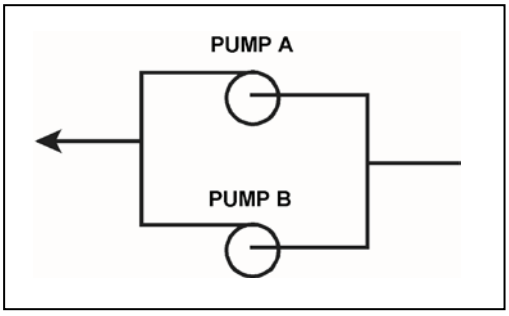
When pump B is started, which one of the following will cause pump B to experience high starting current for a shorter time than usual before stabilizing at a lower running current?

A. Pump B is initially rotating in the reverse direction.

B. The motor coupling for pump B was removed and not reinstalled.

C. The packing gland for pump B was tightened since the pump last operated.

D. The voltage applied to the motor for pump B is 20 percent lower than normal.



QUESTION: 15

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

25 KV
20,000 amps
830 MW
248 MVAR (out)

Which one of the following will significantly increase main generator output amperage without a significant change in main generator MW output? (Assume the generator power factor remains less than 1.0.)

A. Increasing the main turbine speed control setpoint.

B. Increasing the main generator voltage regulator setpoint.

C. A 10 percent decrease in power grid electrical loads.

D. A 10 percent increase in power grid electrical loads.

QUESTION: 16

Given the following parameters for an operating lube oil heat exchanger:

Lube oil inlet temperature = 150°F
Lube oil outlet temperature = 105°F
Cooling water inlet temperature = 60°F
Cooling water outlet temperature = 110°F

Considering only counter-flow and parallel-flow heat exchanger designs, the lube oil heat exchanger described above must be…

A. counter-flow, because the lube oil outlet temperature is less than the cooling water outlet temperature.

B. counter-flow, because the change in lube oil temperature is less than the change in cooling water temperature.

C. parallel-flow, because the lube oil outlet temperature is less than the cooling water outlet temperature.

D. parallel-flow, because the change in lube oil temperature is less than the change in cooling water temperature.

QUESTION: 17

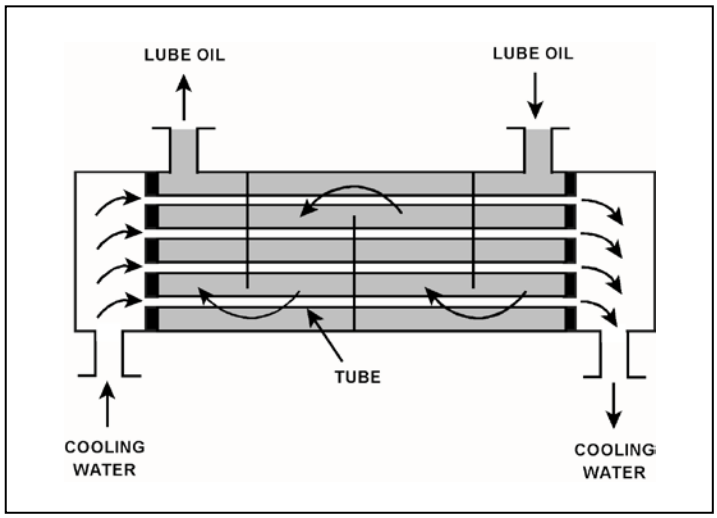
Refer to the drawing of a lube oil heat exchanger (see figure below).

The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature = 130°F
Cooling water inlet temperature = 70°F

Given that cooling water mass flow rate is greater than lube oil mass flow rate, which one of the following pairs of heat exchanger outlet temperatures is <u>not</u> possible? (Assume both fluids have the same specific heat.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	90°F	105°F
B.	90°F	100°F
C.	110°F	95°F
D.	110°F	85°F



QUESTION: 18

Refer to the drawing of two system curves for a typical main condenser cooling water system (see figure below).

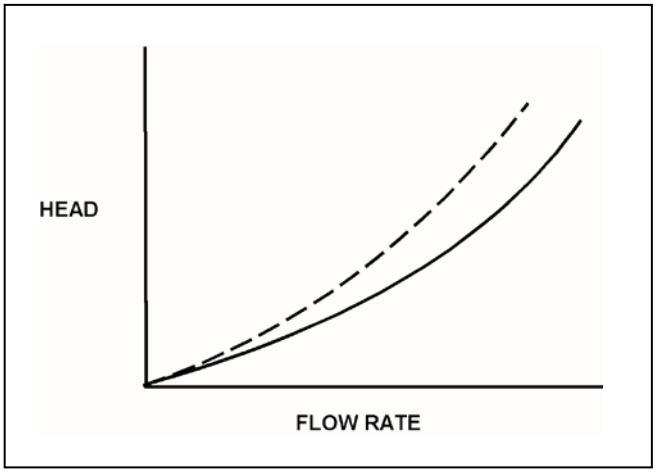
Which one of the following will cause the system curve to shift from the solid curve toward the dashed curve?

A. The main condenser tubes are cleaned.

B. The main condenser tubes become increasingly fouled.

C. Cooling water system flow rate is increased by 25 percent by starting an additional cooling water pump.

D. Cooling water system flow rate is decreased by 25 percent by stopping one of the operating cooling water pumps.



QUESTION: 19

A demineralizer is being used in a water purification system. How will the accumulation of suspended solids in the demineralizer affect the performance of the demineralizer?

A. The rate of resin depletion will increase.

B. The flow rate of water through the demineralizer will increase.

C. The differential pressure across the demineralizer will decrease.

D. The rate of unwanted ion removal from the system will decrease.

QUESTION: 20

Water containing dissolved sodium (Na^+) and chloride (Cl^-) ionic impurities is passing through an ion exchanger that contains only anion exchange resin. How are the ionic impurities being affected as the water flows through the ion exchanger?

A. Sodium ions are being exchanged, but the chloride ions are unaffected.

B. Chloride ions are being exchanged, but the sodium ions are unaffected.

C. Sodium ions are being exchanged, and chloride ions are being removed by filtration.

D. Chloride ions are being exchanged, and sodium ions are being removed by filtration.

QUESTION: 21

Which one of the following results from a loss of control power to a breaker supplying a motor?

A. The motor ammeter indication will be zero regardless of actual breaker position.

B. The breaker position will remotely indicate closed regardless of actual position.

C. The breaker will trip open due to the actuation of its protective trip device.

D. The charging motor will not recharge the closing spring after the breaker closes.

QUESTION: 22

Refer to the simplified drawing of an electrical distribution system showing 7.2 KV switchgear, step-down transformers, and 480 V motor control centers (MCCs) (see figure below).

The high voltage side of each step-down transformer has a remote-operated disconnect to allow transformer maintenance while keeping the other transformers in service. The control circuit for each disconnect is position-interlocked with the associated MCC feeder breaker.

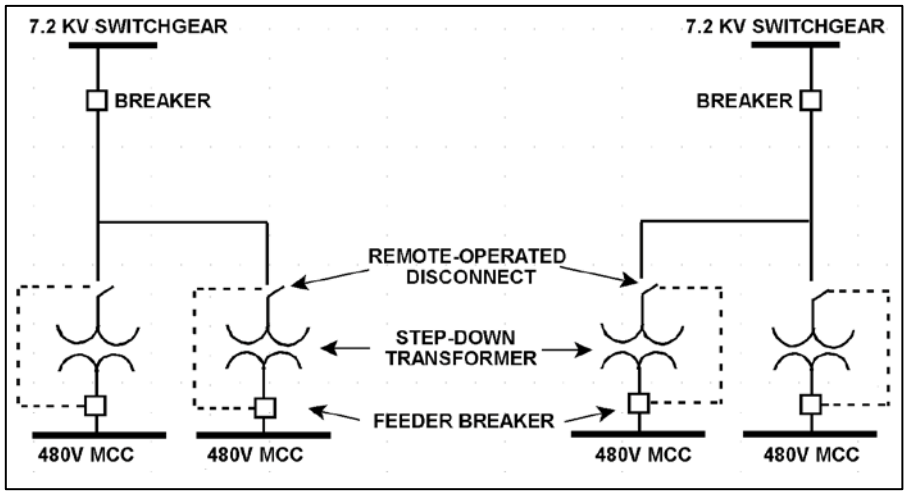
Which one of the following describes the purpose served by the interlock?

A. Prevent damage to the disconnect.

B. Prevent damage to the transformer.

C. Prevent damage to the feeder breaker.

D. Prevent damage to the 480V MCC.



QUESTION: 23

A fast neutron will lose the greatest amount of energy during a scattering reaction in the moderator if it interacts with...

A. an oxygen nucleus.

B. a hydrogen nucleus.

C. a deuterium nucleus.

D. an electron orbiting a nucleus.

QUESTION: 24

A reactor is currently operating at steady-state 100 percent power near the beginning of a fuel cycle (BOC). When the same reactor is operating at steady-state 100 percent power near the end of a fuel cycle (EOC), how will the BOC and EOC shutdown margins compare?

A. The EOC shutdown margin will be more negative because the control rods will add more negative reactivity during a reactor scram near the EOC.

B. The EOC shutdown margin will be less negative because the control rods will add less negative reactivity during a reactor scram near the EOC.

C. The EOC shutdown margin will be more negative because xenon-135 will add more negative reactivity immediately after a reactor scram near the EOC.

D. The EOC shutdown margin will be less negative because xenon-135 will add less negative reactivity immediately after a reactor scram near the EOC.

QUESTION: 25

Given the following data for the fuel in an operating reactor:

Nuclide	Delayed Neutron Fraction	Cross Section for Thermal Fission	Fraction of Total Fission Rate
U-235	0.0065	531 barns	0.58
U-238	0.0148	< 1 barn	0.06
Pu-239	0.0021	743 barns	0.32
Pu-241	0.0049	1009 barns	0.04

What is the delayed neutron fraction for this reactor?

A. 0.0044

B. 0.0055

C. 0.0063

D. 0.0071

QUESTION: 26

A reactor is shut down near the end of a fuel cycle with the shutdown cooling system in service. The initial reactor vessel water temperature is 100°F. In this condition, the reactor is overmoderated.

Then, a heatup and pressurization is performed to bring the reactor to normal operating temperature and pressure. The reactor remains subcritical.

During the heatup, K_{eff} will…

A. increase continuously.

B. decrease continuously.

C. initially increase, and then decrease.

D. initially decrease, and then increase.

QUESTION: 27

Refer to the curve of microscopic cross section for absorption versus neutron energy for a 6.7 electron volt (eV) resonance peak in U-238 for a reactor operating at 50 percent power (see figure below).

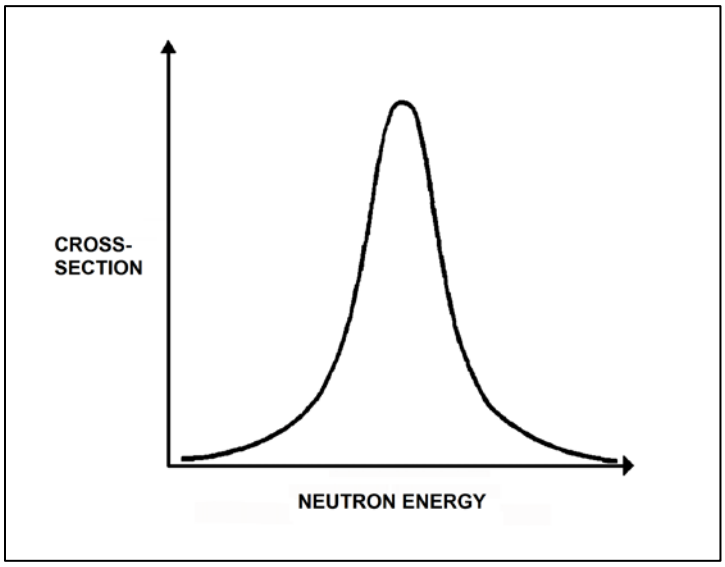
If fuel temperature decreases by 50°F, the area under the curve will _____; and positive reactivity will be added to the core because _____.

A. remain the same; fewer neutrons will be absorbed by U-238 overall

B. remain the same; fewer 6.7 eV neutrons will be absorbed by U-238 at the resonance energy

C. decrease; fewer neutrons will be absorbed by U-238 overall

D. decrease; fewer 6.7 eV neutrons will be absorbed by U-238 at the resonance energy



QUESTION: 28

Which one of the following expresses the relationship between differential rod worth (DRW) and integral rod worth (IRW)?

A. DRW is the IRW at a given rod position.

B. DRW is the square root of the IRW at a given rod position.

C. DRW is the slope of the IRW curve at a given rod position.

D. DRW is the area under the IRW curve at a given rod position.

QUESTION: 29

Which one of the following control rods, when repositioned by two notches, will have the greatest effect on the axial neutron flux shape?

A. Deep rod at the center of the core.

B. Deep rod at the periphery of the core.

C. Shallow rod at the center of the core.

D. Shallow rod at the periphery of the core.

QUESTION: 30

A reactor has been operating at 50 percent power for 15 hours following a rapid power reduction from steady-state 100 percent power. Which one of the following describes the current xenon-135 concentration?

A. Increasing toward a peak.

B. Decreasing toward an upturn.

C. Increasing toward equilibrium.

D. Decreasing toward equilibrium.

QUESTION: 31

Initially, a reactor is shut down with no xenon-135 in the core. Then, the reactor is taken critical, and 4 hours later power level is low in the intermediate range. The maintenance department has asked that power be maintained constant at this level for approximately 12 hours.

To maintain a constant power level, the control rods will have to be periodically...

A. withdrawn for the duration of the 12 hours.

B. inserted for the duration of the 12 hours.

C. withdrawn for 4 to 6 hours, and then inserted.

D. inserted for 4 to 6 hours, and then withdrawn.

QUESTION: 32

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

A. The negative reactivity from burnable poisons is smaller at EOC.

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

C. The positive reactivity contained in the fuel bundles is smaller at EOC.

D. The positive reactivity from a one-notch withdrawal of a typical control rod is greater at EOC.

QUESTION: 33

Refer to the drawing of a 1/M plot with curves A and B (see figure below). Each axis has linear units.

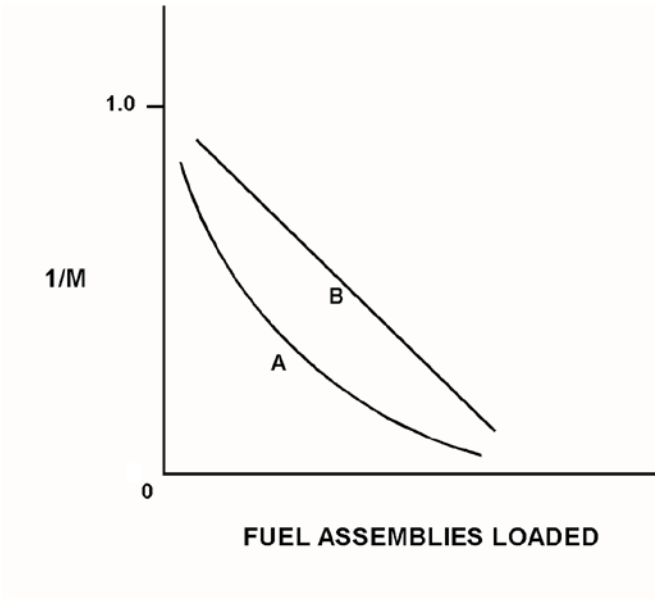
Curve A would result if each fuel assembly loaded during the early stages of the refueling caused a relatively _____ fractional change in source range count rate compared to the later stages of the refueling; curve B would result if each fuel assembly contained equal _____.

A. small; fuel enrichment

B. small; reactivity

C. large; fuel enrichment

D. large; reactivity



QUESTION: 34

Given:

- Reactors A and B are identical except that reactor A has an effective delayed neutron fraction of 0.0068 and reactor B has an effective delayed neutron fraction of 0.0052.
- Reactor A has a stable period of 45 seconds and reactor B has a stable period of 42 seconds.
- Both reactors reach 1.0×10^{-8} percent power at the same instant.

The reactor that is supercritical by the greater amount of positive reactivity is reactor _____; and the first reactor to reach 1.0×10^{-1} percent power will be reactor _____.

A A; A

B. A; B

C. B; A

D. B; B

QUESTION: 35

Initially, a reactor is stable at the point of adding heat (POAH) with a reactor coolant temperature of 160°F. Then, control rods are withdrawn a few notches to raise reactor power and establish a heatup rate. Assume no core voiding occurs unless otherwise stated.

If no further control rod movement occurs, reactor power will initially increase, and then...

A. stabilize until voiding begins to occur.

B. continue to increase until the control rods are reinserted.

C. decrease and stabilize at a subcritical power level.

D. decrease and stabilize at the POAH.

QUESTION: 36

Which one of the following will add the most positive reactivity during a power decrease from 100 percent to 65 percent over a one hour period? (Assume the power change is performed only by changing core recirculation flow rate.)

A. Fuel temperature change

B. Moderator temperature change

C. Fission product poison change

D. Core void fraction change

QUESTION: 37

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

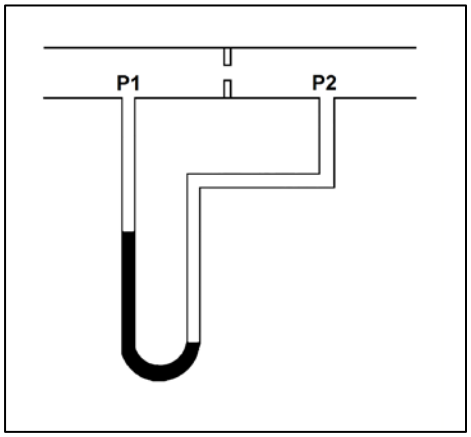
The manometer is installed across an orifice in a ventilation duct to determine the direction of airflow. With the manometer conditions as shown, the pressure at P1 is _____ than P2; and the direction of airflow is _____.

A. less; right to left

B. less; left to right

C. greater; right to left

D. greater; left to right



QUESTION: 38

Refer to the drawing of a simple Rankine cycle shown on a Temperature-Entropy (T-S) diagram (see figure below). The starting point for the numbers on the diagram was chosen at random.

Note: A simple Rankine cycle does <u>not</u> include condensate/feedwater heating, turbine exhaust moisture removal, or steam reheat.

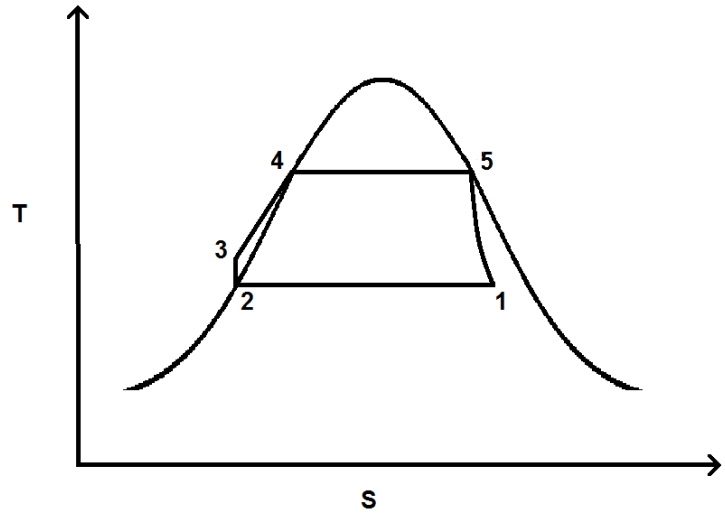
The sequence of numbers that represents the total heat added in the reactor vessel is _____; and the sequence of numbers that represents the total heat rejected in the main condenser is _____.

A. 2 → 3 → 4; 1 → 2

B. 3 → 4 → 5; 1 → 2

C. 2 → 3 → 4; 5 → 1

D. 3 → 4 → 5; 5 → 1



QUESTION: 39

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

QUESTION: 40

Which one of the following explains why the condensation of turbine exhaust steam in a main condenser maintains a vacuum?

A. The entropy of the exhaust steam increases as it condenses.

B. The entropy of the exhaust steam decreases as it condenses.

C. The specific volume of the exhaust steam increases as it condenses.

D. The specific volume of the exhaust steam decreases as it condenses.

QUESTION: 41

Initially, a main turbine is being supplied with inlet steam containing 0.5 percent moisture content. If the inlet steam moisture content decreases to 0.25 percent at the same pressure and mass flow rate, the main turbine work output will…

A. increase, due to the increased temperature of the inlet steam.

B. increase, due to the decreased braking action from water droplets impacting the turbine blading.

C. decrease, due to the decreased enthalpy of the inlet steam.

D. decrease, due to the decreased momentum transfer from water droplets impacting the turbine blading.

QUESTION: 42

Refer to the drawing of four sets of centrifugal pump and system operating curves (see figure below). Each set of curves shows the results of a change in pump and/or system operating conditions.

Initially, a single centrifugal pump is operating in a cooling water system. Another identical centrifugal pump is then started in series with the first.

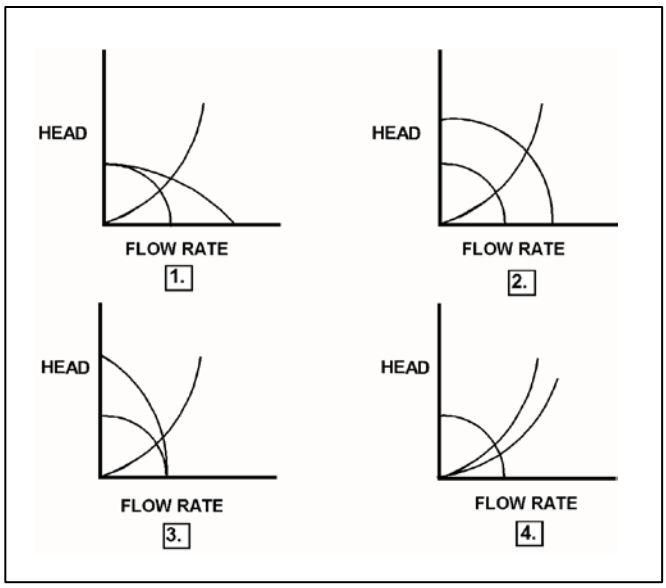
Which set of operating curves depicts the "before" and "after" conditions described above?

A. 1.

B. 2.

C. 3.

D. 4.



QUESTION: 43

Refer to the drawing of a venturi in a steam line (see figure below). The venturi inlet and outlet pipe diameters at P1 and P2 are equal.

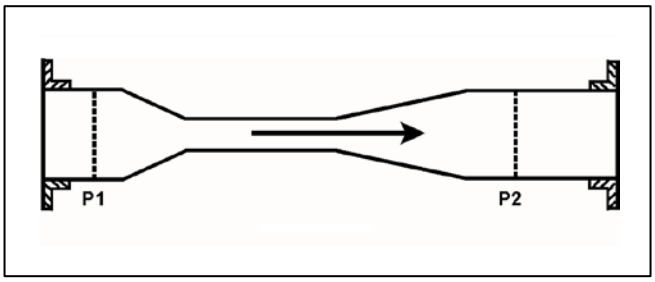
Currently, steam is flowing through the venturi, reaching sonic velocity in the throat of the venturi. If the steam inlet pressure (P1) remains constant while the downstream pressure (P2) decreases, the mass flow rate of the steam will _____; and the velocity of the steam at the venturi outlet will _____.

A. increase; increase

B. increase; remain the same

C. remain the same; increase

D. remain the same; remain the same



QUESTION: 44

The power range nuclear instruments were just adjusted to 100 percent power, as determined by a heat balance calculation. Which one of the following would result in indicated reactor power being lower than actual reactor power?

A. The reactor recirculation pump heat input term was omitted from the heat balance calculation.

B. The feedwater temperature used in the heat balance calculation was 20°F lower than actual feedwater temperature.

C. The reactor vessel pressure used in the heat balance calculation was 30 psia higher than actual reactor vessel pressure.

D. The steam and feedwater flow rates used in the heat balance calculation were 10 percent higher than actual flow rates.

QUESTION: 45

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 approach the onset of transition boiling? (Assume reactor power does not change unless stated.)

A. Recirculation flow rate increases.

B. Reactor pressure decreases.

C. Feedwater temperature increases.

D. Fuel bundle power decreases.

QUESTION: 46

Refer to the drawing of a core recirculation jet pump (see figure below).

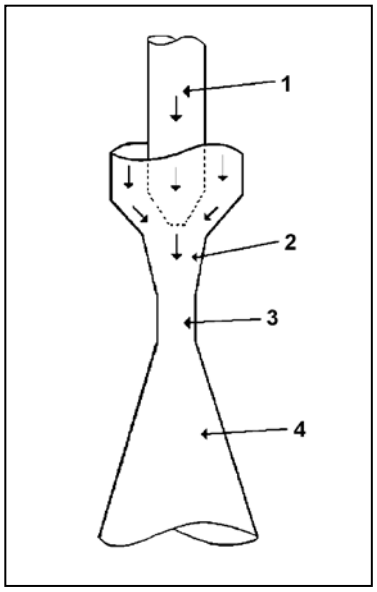
During normal operation, the lowest pressure will exist at point _____; and the highest velocity will occur at point _____.

A. 3; 3

B. 3; 4

C. 4; 3

D. 4; 4



QUESTION: 47

The presence of embrittling isotopes is one of the initiating factors of pellet-cladding interaction. Which one of the following describes the primary source of the embrittling isotopes?

A. Created during fission of the reactor fuel.

B. Introduced during the fuel manufacturing process.

C. Migrates from the reactor coolant through the cladding.

D. Produced as corrosion products inside the fuel rod.

QUESTION: 48

Gross cladding failure is avoided during a design basis loss of coolant accident by operating below the limit for...

A. total peaking factor.

B. linear heat generation rate.

C. operating critical power ratio.

D. average planar linear heat generation rate.

QUESTION: 49

In a reactor operating at 100 percent power, reactor pressure suddenly increases. Which one of the following is the most limiting thermal limit for this situation?

A. Critical power ratio.

B. Linear heat generation rate.

C. Average planar linear heat generation rate.

D. Preconditioning interim operating management recommendations.

QUESTION: 50

Which one of the following comparisons will result in a higher probability for brittle fracture of the reactor vessel?

A. A high gamma flux in the reactor rather than a high neutron flux.

B. A high oxygen content in the reactor coolant rather than a low oxygen content.

C. A high material strength in the reactor vessel rather than a high material ductility.

D. A rapid 100°F reactor cooldown at a high temperature rather than at a low temperature.

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

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

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