UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 2020 – FORM A

DO NOT BEGIN THIS EXAMINATION UNTIL DIRECTED TO DO SO.

Instructions to Examinee:

This examination applies to a typical U.S. pressurized water reactor (PWR) nuclear power plant. There are 50 multiple-choice test items to answer, each having equal point value. There are multiple forms of this examination, each containing the same test items in a random order. Answer all test items using the provided answer sheet, ensuring a single answer is marked for each test item. A score of at least 80 percent is required to pass this portion of the NRC operator licensing written examination. When you have completed the examination, sign your name under the statement at the bottom of this page. All examination materials will be collected 3 hours after the examination begins.

KNOWLEDGE AREA	NUMBER OF TEST ITEMS	PERCENT OF TOTAL	SCORE
COMPONENTS	22	44	
REACTOR THEORY	14	28	
THERMODYNAMICS	14	28	
TOTALS	50	100	

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

_____
Examinee 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. Scrap paper will be provided for calculations.

7. 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.

8. Do not make assumptions regarding conditions that are not specified in the question unless they occur as a consequence of other conditions that are stated in the question. For example, you should not assume operator actions have been taken. Also, this examination tests knowledge of general fundamentals, therefore do not make assumptions based on specific plant procedures.

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

10. 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.

11. 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.

12. 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.

13. 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

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

$\lambda_{eff} = 0.1\ sec^{-1}\ (for\ \rho > 0)$

$DRW \propto \varphi_{tip}^2\ /\ \varphi_{avg}^2$

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

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

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

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

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

$1/M = CR_1/CR_x$

$A = \pi r^2$

$F = PA$

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

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

$P = I^2 R$

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

$P_R = \sqrt{3}IEsin\theta$

Thermal Efficiency = Net Work Out/Energy In

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

$g = 32.2\ ft/sec^2$

$g_c = 32.2\ lbm\text{-}ft/lbf\text{-}sec^2$

CONVERSIONS

$1\ MW = 3.41 \times 10^6\ Btu/hr$ $°C = (5/9)(°F - 32)$ $1\ ft_{water}^3 = 7.48\ gal$

$1\ hp = 2.54 \times 10^3\ Btu/hr$ $°F = (9/5)(°C) + 32$ $1\ gal_{water} = 8.35\ lbm$

$1\ Btu = 778\ ft\text{-}lbf$ $1\ kg = 2.21\ lbm$ $1\ Curie = 3.7 \times 10^{10}\ dps$

QUESTION: 1

A reactor was shut down for 7 days to perform maintenance. Then, a reactor startup was performed, and reactor power was increased from 1 percent to 50 percent over a 2 hour period.

Ten hours after reactor power reaches 50 percent, the xenon-135 concentration will be…

A. increasing toward a downturn.

B. increasing toward an equilibrium value.

C. decreasing toward an equilibrium value.

D. decreasing toward an upturn.

QUESTION: 2

Refer to the drawing of a simple chromel-alumel thermocouple circuit (see figure below).

What is the effect on the thermocouple reference junctions if the chromel and alumel extension wires from the thermocouple connection head to the reference junction panel are replaced with copper wires?

A. There will no longer be any reference junctions.

B. The reference junctions will be located in the temperature instrument.

C. The reference junctions will still be located in the reference junction panel.

D. The reference junctions will be located in the thermocouple connection head.
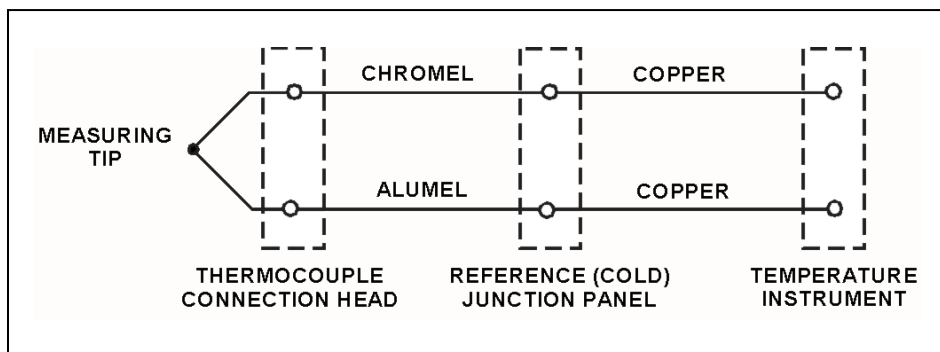
QUESTION: 3

A reactor has been operating at 100 percent power for 3 months following a refueling outage.   If the reactor is operated at 100 percent power for another month without making RCS boron additions or dilutions, the RCS boron concentration will...

A. decrease, because boron atoms decompose at normal RCS operating temperatures.

B. decrease, because irradiated boron-10 atoms undergo a neutron-alpha reaction.

C. remain constant, because irradiated boron-10 atoms become stable boron-11 atoms.

D. remain constant, because irradiated boron-10 atoms still have large absorption cross sections for thermal neutrons.
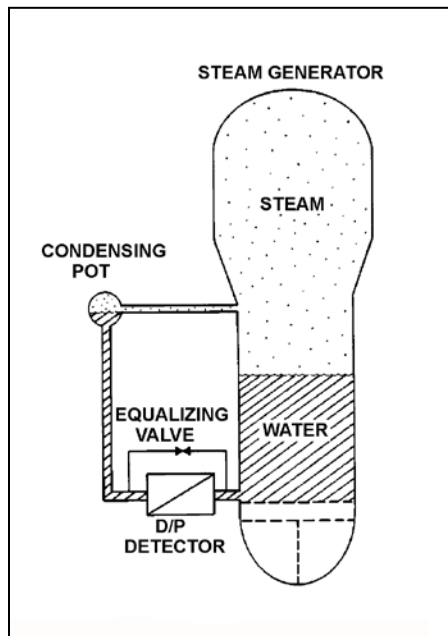
QUESTION: 4

Refer to the drawing of a steam generator differential pressure (D/P) level detection system that was calibrated at normal operating conditions (see figure below).

A reactor coolant system cooldown has decreased steam generator pressures from 900 psia to 400 psia.   Without density compensation of the level instrumentation, at the end of the cooldown the steam generator level indication will be _____ than actual level because the density of the water in the _____ has changed significantly.

A. higher; reference leg

B. higher; steam generator

C. lower; reference leg

D. lower; steam generator

QUESTION: 5

When manually positioning a motor-operated valve, why must care be taken to avoid using excessive valve seating/backseating force?

A. The valve may bind during subsequent operation.

B. The valve stem limit switch settings may become inaccurate.

C. The clutch may <u>not</u> reengage the valve motor when required.

D. The stem position may no longer be an accurate indicator of valve position.

QUESTION: 6

A motor-driven centrifugal pump is operating in an open system with its discharge valve throttled to 50 percent open. If the discharge valve is fully opened, the pump's available net positive suction head (NPSH) will _____; and the pump's required NPSH will _____.

A. remain the same; increase

B. remain the same; remain the same

C. decrease; increase

D. decrease; remain the same

QUESTION: 7

While remotely investigating the condition of a normally-open 480 VAC motor control center (MCC) feeder breaker, an operator observes the following indications:

Green breaker position indicating light is out.
Red breaker position indicating light is lit.
MCC voltmeter indicates 480 VAC.
MCC ammeter indicates zero amperes.

Based on these indications, the operator should report that the feeder breaker is _____ and racked _____.

A. open; in

B. closed; in

C. open; to an unknown position

D. closed; to an unknown position

QUESTION: 8

Refer to the pump performance curves for a centrifugal cooling water pump (see figure below). The pump is being driven by a single-speed AC induction motor. Pump flow rate is being controlled by a throttled discharge flow control valve.

The following initial pump conditions exist:

Pump motor current = 50 amps
Pump flow rate = 400 gpm

What will be the approximate value of pump motor current if the flow control valve is repositioned such that pump flow rate is 800 gpm?

A. Less than 100 amps

B. 200 amps

C. 400 amps

D. More than 500 amps
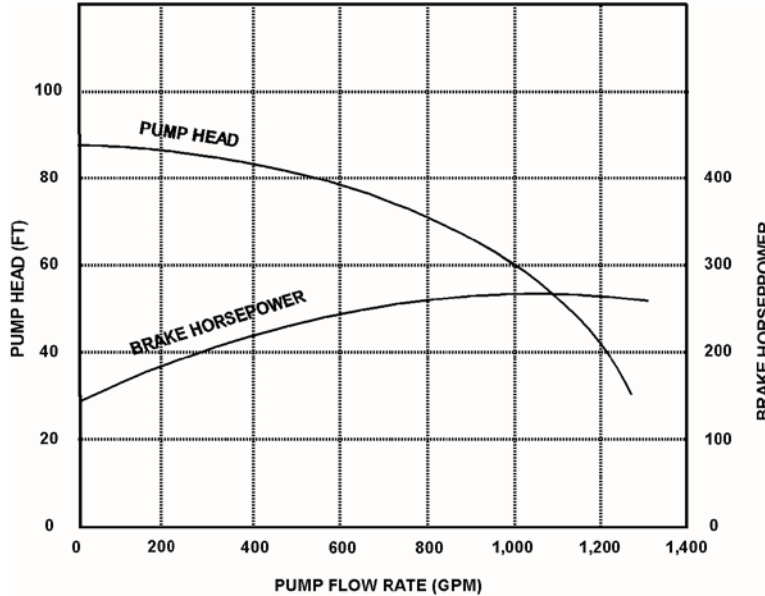
QUESTION: 9

One minute after a reactor trip from steady-state 100 percent reactor power, the greatest xenon-135 production rate will be from _____; and the greatest xenon-135 removal rate will be caused by _____.

A. fission; xenon-135 decay

B. fission; neutron capture

C. iodine-135 decay; xenon-135 decay

D. iodine-135 decay; neutron capture

QUESTION: 10

A reactor is operating at 80 percent power near the middle of a fuel cycle. The control rods are nearly fully withdrawn and in manual control. Core axial power distribution is peaked below the core midplane.

Which one of the following will increase the core maximum axial peaking (or hot channel) factor? (Assume no operator action is taken unless stated, and that main turbine load and core xenon distribution do not change unless stated.)

A. Turbine load/reactor power is reduced by 10 percent.

B. The controlling bank of control rods is withdrawn 4 inches.

C. Reactor coolant system boron concentration is reduced by 15 ppm.

D. A fully withdrawn control rod located at the edge of the core drops to the bottom of the core.

QUESTION: 11

Refer to the drawing of two lengths of 6-inch diameter pipe, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing

Water at 65°F is flowing at 1,000 gpm through each pipe.   If isolation valves A and B instantly close, the pressure spike experienced by valve A will be _____ the pressure spike experienced by valve B; and the pressure spike will dissipate faster in the _____ length of pipe.

A. equal to; shorter

B. equal to; longer

C. less than; shorter

D. less than; longer

VALVE A

VALVE B
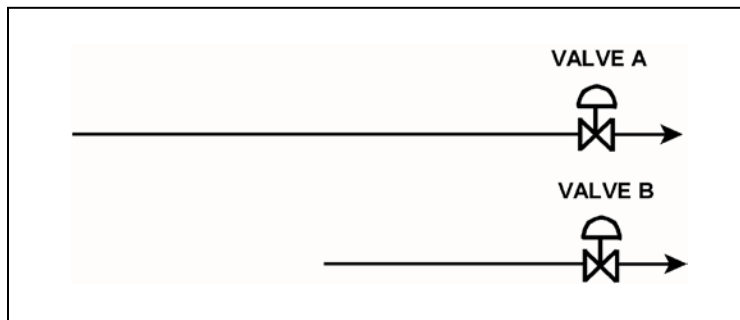
QUESTION: 12

An open vessel contains 1 lbm of saturated water at standard atmospheric pressure.   If pressure remains constant, the addition of 2 Btu to the water will...

A. raise the saturated water temperature above the boiling point.

B. result in subcooled water.

C. result in some of the water vaporizing.

D. result in superheated steam.

QUESTION: 13

A diesel generator (DG) is the only power source connected to an emergency bus.   In this alignment, the governor of the DG directly senses DG _____ and adjusts DG fuel flow to maintain a relatively constant DG _____.

A. voltage; voltage

B. voltage; frequency

C. speed; voltage

D. speed; frequency

QUESTION: 14

Refer to the drawing of a horizontal pipe elbow (top view) in an operating water system (see figure below).

Three separate bellows-type differential pressure flow detectors are connected to taps A, B, C, and D as follows:

Detector	Taps
X	A and D
Y	B and D
Z	C and D

Assuming zero head loss in this section of pipe, how will the detectors be affected if tap B experiences a significant leak?   (Assume water system pressure does not change.)

A. All detectors will fail low.

B. All detectors will fail high.

C. Only one detector will fail, and it will fail low.

D. Only one detector will fail, and it will fail high.

PIPE ELBOW - TOP VIEW
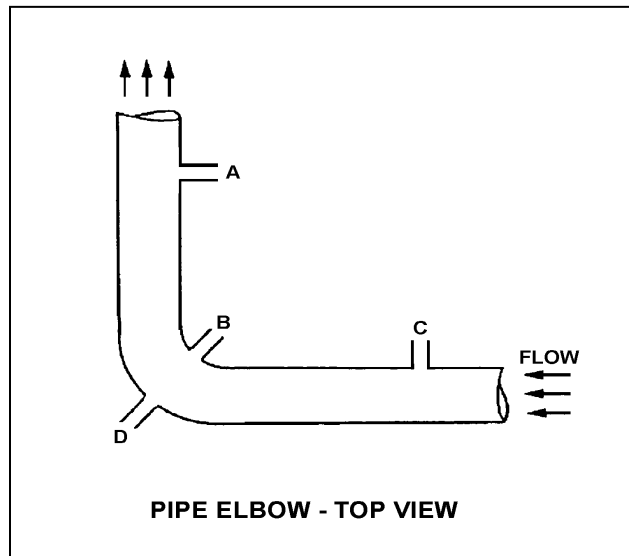
QUESTION: 15

Two reactors are identical except that reactor A is near the end of a fuel cycle and reactor B is near the beginning of a fuel cycle.   Both reactors are critical at 1.0×10^{-5} percent power.

If the same amount of positive reactivity is added to each reactor at the same time, the point of adding heat will be reached first by reactor _____ because it has a _____ effective delayed neutron fraction.

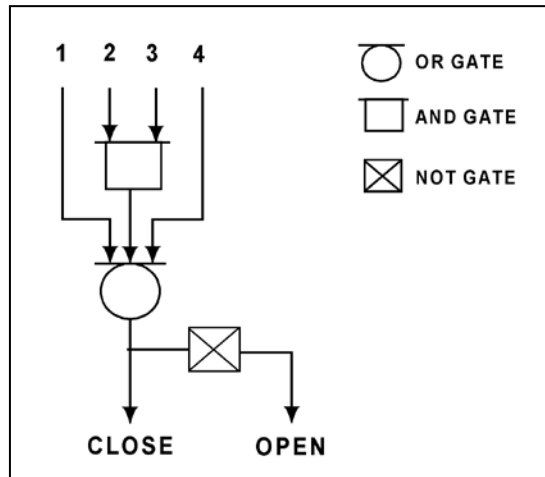A. A; smaller

B. A; larger

C. B; smaller

D. B; larger

QUESTION: 16

Refer to the valve controller logic diagram (see figure below).

Which one of the following combinations of inputs will result in the valve receiving an OPEN signal?

INPUTS

	1.	2.	3.	4.
A.	On	Off	On	On
B.	Off	On	Off	Off
C.	On	Off	Off	On
D.	Off	On	On	Off

QUESTION: 17

A nuclear power plant is operating at 50 percent power with one group of control rods partially inserted into the core. If the moderator temperature decreases by 5°F, the differential control rod worth will become...

A. more negative due to better moderation of neutrons.

B. less negative due to shorter neutron migration lengths.

C. more negative due to increased moderator absorption of neutrons.

D. less negative due to increased resonance absorption of neutrons.

QUESTION: 18

Increasing the coolant flow rate through a reactor core affects the heat transfer rate from the fuel, because a higher coolant flow rate results in a _____ laminar film thickness and a _____ coolant temperature adjacent to the fuel.

A. greater; higher

B. greater; lower

C. smaller; higher

D. smaller; lower

QUESTION: 19

Reactor coolant system (RCS) purification mixed-bed ion exchanger A was removed from service and isolated after several weeks of operation with an RCS boron concentration of 900 ppm.   After it was isolated, ion exchanger A was not processed in any way.

Currently, the RCS boron concentration is 450 ppm.   If ion exchanger A is returned to service, the RCS boron concentration will...

A. remain the same because the resin in ion exchanger A has already become saturated with boron during previous operation.

B. remain the same because the resin in ion exchanger A has no affinity for the boron in the reactor coolant.

C. increase until the volume of water in ion exchanger A mixes completely with the RCS.

D. increase until the resin in ion exchanger A reaches equilibrium with the existing RCS boron concentration.

QUESTION: 20

An ideal (no slip) reciprocating positive displacement pump is operating in an open system to provide makeup water to a coolant system that is being maintained at 800 psig. The pump discharge valve is fully open.

If the pump discharge valve is subsequently throttled to 80 percent open, the pump flow rate will _____; and the pump head will _____.

A. decrease; increase

B. decrease; remain constant

C. remain constant; increase

D. remain constant; remain constant

QUESTION: 21

The manufacturers of shell and U-tube heat exchangers recommend a <u>maximum</u> tube fluid velocity to limit the _____ of the tubes; and a <u>minimum</u> tube fluid velocity to limit the _____ of the tubes.

A. erosion; fouling

B. erosion; thermal contraction

C. thermal expansion; fouling

D. thermal expansion; thermal contraction

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 valve motor control circuit alarm response after the switch is released?

A. The alarm will actuate after approximately 8 seconds.

B. The alarm will not actuate until additional operator action is taken.

C. The alarm will continue to actuate for approximately 8 seconds.

D. The alarm will continue to actuate until additional operator action is taken.

VALVE MOTOR CONTROL CIRCUIT
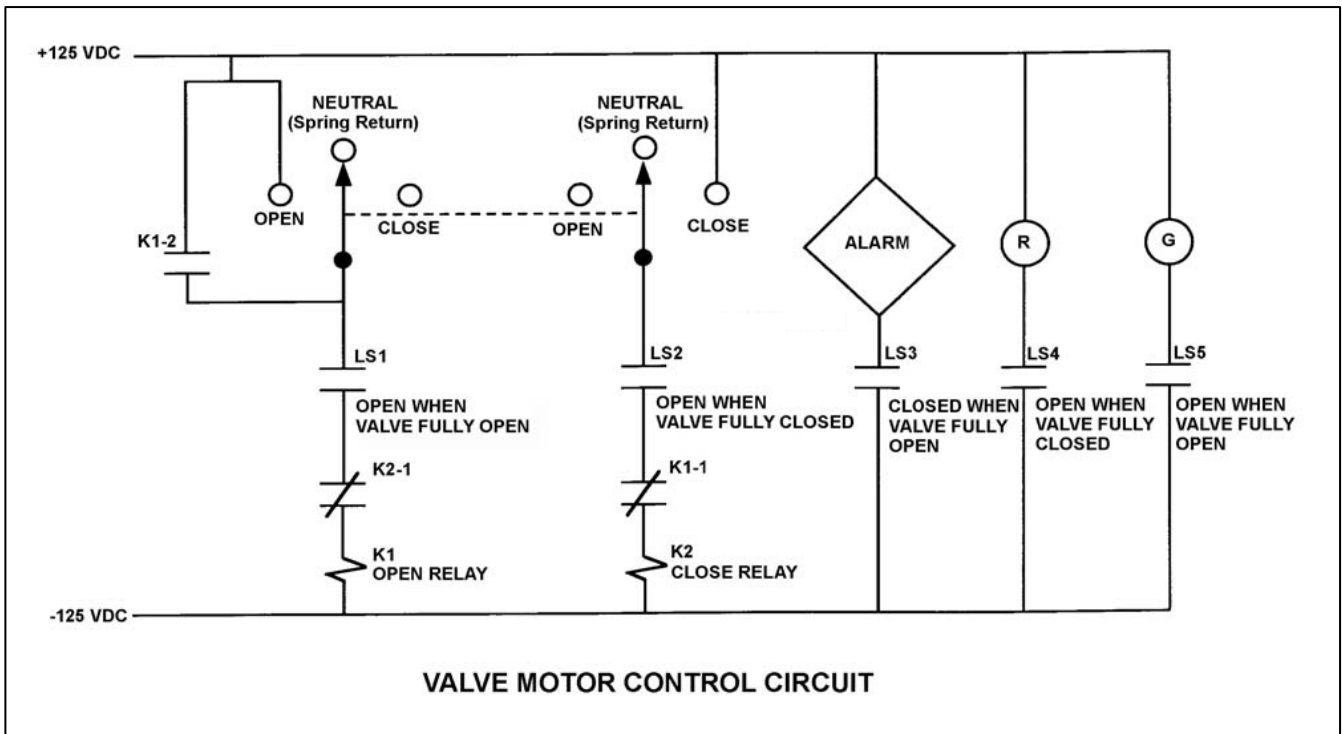
QUESTION: 23

The starting current for a typical AC induction motor is usually much higher than the full-load running current because...

A. starting torque is lower than full-load running torque.

B. starting torque is higher than full-load running torque.

C. rotor speed during start is too low to generate significant counter electromotive force in the stator.

D. rotor current during start is too low to generate significant counter electromotive force in the stator.

QUESTION: 24

A nuclear power plant was operating at steady-state 100 percent power when a loss of offsite power occurred, resulting in a reactor trip and a loss of forced reactor coolant circulation.   Thirty minutes later, reactor coolant system (RCS) hot leg temperature is greater than cold leg temperature and steam generator (SG) levels are stable.

Which one of the following combinations of parameter trends, observed 30 minutes after the trip, indicates that natural circulation is occurring?   (CET = core exit thermocouple)

|	RCS Hot Leg Temperature	RCS Cold Leg Temperature	SG Pressures	RCS CET Subcooling
A.	Decreasing	Stable	Stable	Increasing
B.	Increasing	Decreasing	Increasing	Decreasing
C.	Decreasing	Decreasing	Decreasing	Decreasing
D.	Increasing	Increasing	Decreasing	Increasing

QUESTION: 25

Refer to the drawing of a water storage tank with an automatic level control system (see figure below). The makeup valve will fail closed if its actuator loses air pressure.

Given the following possible combinations of characteristics for the level sensor and controller:

	Level Sensor	Controller
1.	Direct-Acting	Direct-Acting
2.	Direct-Acting	Reverse-Acting
3.	Reverse-Acting	Direct-Acting
4.	Reverse-Acting	Reverse-Acting

Which of the above combinations will work effectively with the makeup valve in the level control system to maintain the desired tank water level?

A. 1 only

B. 1 and 4

C. 2 only

D. 2 and 3
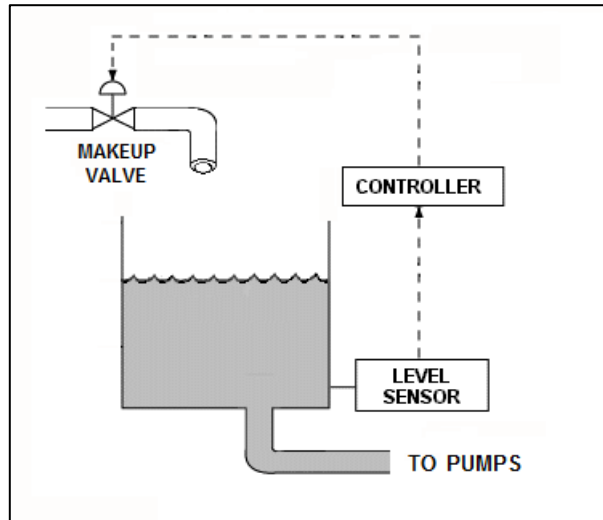
QUESTION: 26

Integral control rod worth can be described as the change in _____ for a _____ change in rod position.

A. reactor power; total

B. reactivity; unit

C. reactor power; unit

D. reactivity; total

QUESTION: 27

Which one of the following is arranged from the lowest pressure to the highest pressure?

A. 2 psig, 12 inches Hg absolute, 8 psia

B. 2 psig, 18 inches Hg absolute, 8 psia

C. 12 psia, 20 inches Hg absolute, 2 psig

D. 12 psia, 30 inches Hg absolute, 2 psig

QUESTION: 28

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 (dry saturated steam) in the pressurizer.   Pressurizer power-operated relief valve (PORV) tailpipe temperature has been steadily rising.   PORV downstream pressure is 40 psia.

Which one of the following will be the approximate PORV tailpipe temperature and phase of the escaping fluid if a PORV is leaking by?

A. 267°F, saturated

B. 267°F, superheated

C. 312°F, saturated

D. 312°F, superheated

QUESTION: 29

The nil-ductility transition temperature is the temperature above which...

A. a large compressive stress can result in brittle fracture.

B. a metal exhibits more ductile tendencies.

C. the probability of brittle fracture increases.

D. no appreciable deformation occurs prior to failure.

QUESTION: 30

Prior to a scheduled nuclear power plant shutdown, the reactor coolant system was chemically shocked to induce a crud burst.   What effect will the crud burst have on the letdown purification ion exchangers?

A. Decreased radiation levels around the ion exchangers.

B. Increased flow rate through the ion exchangers.

C. Decreased ion exchanger outlet conductivity.

D. Increased pressure drop across the ion exchangers.

QUESTION: 31

A typical alpha particle produces free electrons in a gas-filled radiation detector <u>primarily</u> by…

A. colliding with gas nuclei.

B. colliding with bound electrons.

C. electrostatic attraction of gas nuclei.

D. electrostatic attraction of bound electrons.

QUESTION: 32

Refer to the drawing that shows a graph of fission rate versus time (see figure below). Both axes have linear scales.

Which one of the following events, initiated at 0 seconds, would cause the reactor response shown on the graph?

A. A step addition of positive reactivity to a reactor that is initially subcritical in the source range, and remains subcritical for the duration of the 120-second interval shown.

B. A step addition of positive reactivity to a reactor that is initially critical in the source range, and remains below the point of adding heat for the duration of the 120-second interval shown.

C. A step addition of positive reactivity to a reactor that is initially critical in the power range, and remains in the power range for the duration of the 120-second interval shown.

D. A constant rate of positive reactivity addition to a reactor that is initially critical in the power range, and remains in the power range for the duration of the 120-second interval shown.
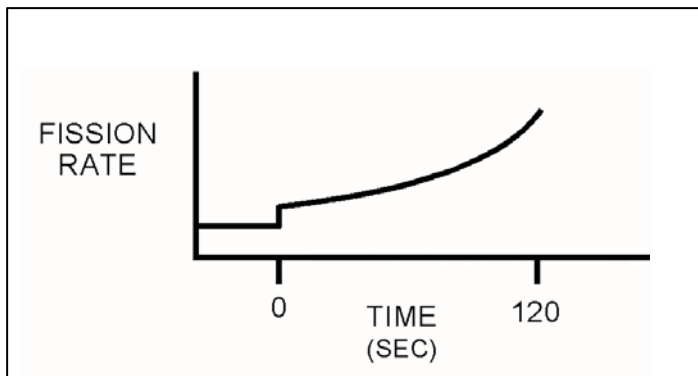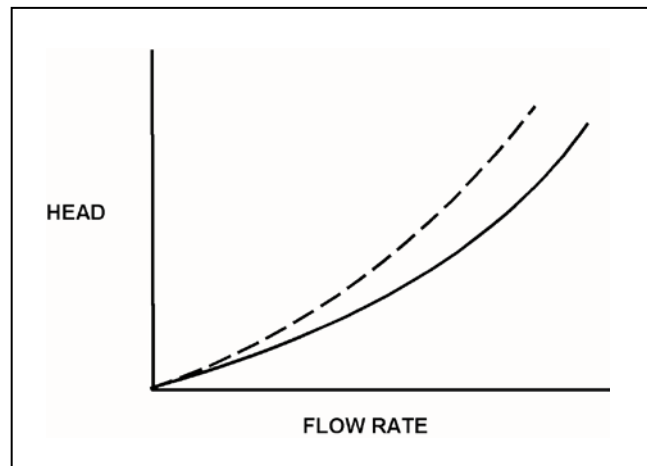
QUESTION: 33

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: 34

A nuclear power plant is operating at a steady-state power level, with the steam generators supplying dry saturated steam to the main steam lines.

Given:

    Total main steam flow rate $= 4 \times 10^6$ lbm/hr
    Condensate temperature $= 95°F$
    Feedwater temperature $= 450°F$
    Main steam pressure $= 960$ psia
    Steam cycle thermal efficiency $= 38$ percent

What is the approximate rate of heat rejection in the main condenser?

A. 341 MW

B. 478 MW

C. 556 MW

D. 823 MW

QUESTION: 35

A neutron that is released 1.0×10^{-10} seconds after the associated fission event is classified as a _____ fission neutron.

A. delayed

B. prompt

C. thermal

D. spontaneous

QUESTION: 36

Which one of the following is the reason for inserting control rods in a predetermined sequence during a normal reactor shutdown?

A. To prevent uneven fuel burnup.

B. To prevent an excessive reactor coolant system cooldown rate.

C. To prevent abnormally high local power peaks.

D. To prevent divergent xenon-135 oscillations.

QUESTION: 37

Refer to the drawing of an operating cooling water system (see figure below).

Which one of the following will increase the mass flow rate in the system with a corresponding increase in the total system head loss?

A. Shifting operating pump A to a higher speed.

B. Positioning the flow control valve (FCV) more open.

C. Replacing a 20 foot length of 10-inch diameter pipe with a 10 foot length of 10-inch diameter pipe.

D. Replacing a 20 foot length of 10-inch diameter pipe with a 20 foot length of 12-inch diameter pipe.
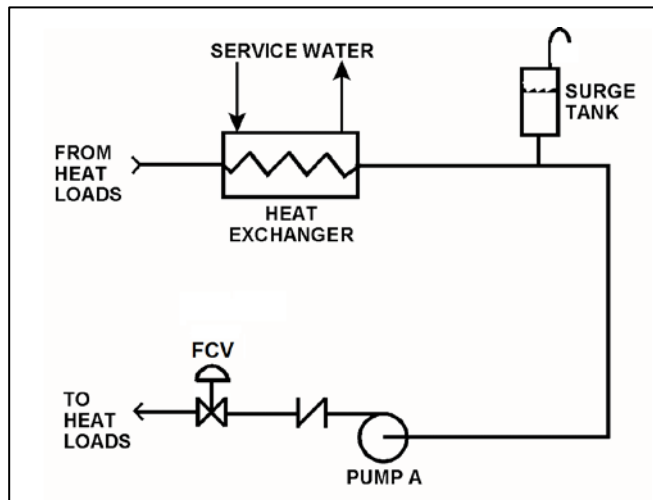
QUESTION: 38

Reactors A and B are identical <u>except</u> that reactor A is operating near the end of a fuel cycle (EOC), while reactor B is operating near the beginning of a fuel cycle (BOC). Currently, both reactors are operating at steady-state 100 percent power with all control rods fully withdrawn. The total reactivity worth of the control rods is the same for both reactors.

Which reactor will have the greater K_{eff} value 5 minutes after a reactor trip, and why?

A. Reactor A, because the xenon-135 negativity reactivity peak is greater after a trip near the EOC.

B. Reactor A, because the power coefficient adds more positive reactivity after a trip near the EOC.

C. Reactor B, because the xenon-135 negativity reactivity peak is greater after a trip near the BOC.

D. Reactor B, because the power coefficient adds more positive reactivity after a trip near the BOC.

QUESTION: 39

A nuclear power plant was operating at full power when a 200 gpm reactor coolant leak caused a reactor trip and initiation of emergency coolant injection. Reactor coolant system pressure stabilized at 1,000 psia.

Currently, all centrifugal injection pumps are operating with all pump recirculation flowpaths isolated. The shutoff heads for the pumps are as follows:

High pressure coolant injection (HPCI) pumps = 2,500 psia
Low pressure coolant injection (LPCI) pumps = 200 psia

If the injection pumps continue operating under these conditions, which pumps are more likely to fail, and why?

A. LPCI pumps, due to pump overheating.

B. LPCI pumps, due to motor overheating.

C. HPCI pumps, due to pump overheating.

D. HPCI pumps, due to motor overheating.

QUESTION: 40

Refer to the drawing showing two operating points for the same centrifugal pump operating in a cooling water system (see figure below).

The pump's operating point can be shifted from point A to point B by…

A. increasing the speed of the pump.

B. decreasing the speed of the pump.

C. closing the pump discharge valve more.

D. opening the pump discharge valve more.
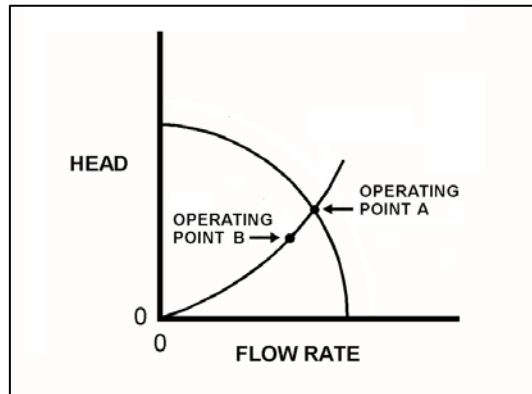
QUESTION: 41

Which one of the following will result from a loss of control power to a motor supply breaker?

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 <u>trip</u> open due to the actuation of its protective trip device.

D. The charging motor will <u>not</u> recharge the closing spring after the breaker closes.

QUESTION: 42

Ignoring the effects of changes in fission product poisons, which one of the following reactor power changes requires the greatest amount of positive reactivity addition?

A. 3 percent to 10 percent

B. 10 percent to 25 percent

C. 25 percent to 65 percent

D. 65 percent to 100 percent

QUESTION: 43

The amount of boric acid required to increase the reactor coolant boron concentration by 50 ppm at 1,200 ppm is approximately _____ as the amount of boric acid required to increase the reactor coolant boron concentration by 50 ppm at 100 ppm.

A. the same

B. four times as large

C. eight times as large

D. twelve times as large

QUESTION: 44

Initially, a reactor was shut down with a stable source range count rate of 30 cps. Using many small positive reactivity additions, a total of 0.1 %ΔK/K was added to the reactor. Currently, the source range count rate is stable at 60 cps.

What was the stable source range count rate after only 0.05 %ΔK/K was added to the reactor during the above process?

A. 40 cps

B. 45 cps

C. 50 cps

D. 55 cps

QUESTION: 45

Which one of the following describes a heat transfer process in which convection is the most significant mode of heat transfer?

A. From the fuel rods to the core barrel during core uncovery.

B. Through the tube walls in a steam generator during normal operation at 100 percent power.

C. From the fuel rods to the steam generators 24 hours after a trip of all reactor coolant pumps.

D. From the fuel pellet centerline to the fuel cladding during normal operation at 100 percent power.

QUESTION: 46

Consider the steam cycle thermal efficiency of a nuclear power plant operating at rated power.

If the pressure at which saturated steam is produced in the steam generators is increased, the thermal efficiency will _____; and if the temperature of the feedwater entering the steam generators is increased, the thermal efficiency will _____.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 47

A cooling water system uses a conventional relief valve (not pilot-operated) with a bench-tested setpoint of 45 psig.   The relief valve discharges to a collection tank that is maintained at 5 psi above atmospheric pressure.   At what system pressure will the relief valve begin to open?

A. 40 psig

B. 45 psig

C. 50 psig

D. 65 psig

QUESTION: 48

Refer to the drawing of a simple Rankine cycle shown on a Temperature-Entropy (T-S) diagram (see figure below).   The order of the numbers on the diagram was randomly chosen.

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

The point that represents the water in the main condenser hotwell is number _____; and the point that represents the steam at the outlet of a steam generator is number _____.

A. 3; 1

B. 3; 2

C. 5; 1

D. 5; 2

QUESTION: 49

A reactor is operating with the following conditions:

- Reactor power is 45 percent in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will increase the steady-state departure from nucleate boiling ratio?

A. Core xenon-135 decays with <u>no</u> change in the axial and radial power distributions.

B. A reactor trip occurs and <u>one</u> control rod remains fully withdrawn from the core.

C. The operator decreases reactor coolant boron concentration by 5 ppm with <u>no</u> control rod motion.

D. A pressurizer malfunction decreases reactor coolant system pressure by 20 psig with <u>no</u> control rod motion.

QUESTION: 50

A nuclear power plant is operating at steady-state 90 percent power near the end of a fuel cycle with manual rod control when a turbine control system malfunction <u>opens</u> the main turbine steam inlet valves an additional 5 percent. Reactor power will initially...

A. increase, because the rate of neutron absorption in the moderator initially decreases.

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

C. decrease, because the rate of neutron absorption in the moderator initially increases.

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

*** FINAL ANSWER KEY ***

NRC GENERIC FUNDAMENTALS EXAMINATION
MARCH 2020 – PWR

	FORM A				FORM B		
NO.	ANS.	NO.	ANS.	NO.	ANS.	NO.	ANS.
1	B	26	D	1	B	26	B
2	D	27	D	2	A	27	B
3	B	28	D	3	D	28	B
4	B	29	B	4	D	29	A
5	A	30	D	5	C	30	D
6	C	31	D	6	A	31	A
7	B	32	B	7	B	32	C
8	A	33	B	8	B	33	C
9	C	34	C	9	D	34	A
10	C	35	A	10	B	35	C
11	A	36	C	11	A	36	A
12	C	37	A	12	C	37	B
13	D	38	B	13	C	38	C
14	D	39	A	14	B	39	A
15	A	40	B	15	A	40	D
16	B	41	D	16	D	41	D
17	B	42	C	17	D	42	B
18	D	43	A	18	C	43	A
19	D	44	A	19	A	44	D
20	C	45	C	20	D	45	B
21	A	46	A	21	D	46	B
22	A	47	C	22	A	47	A
23	C	48	A	23	C	48	C
24	A	49	B	24	A	49	D
25	D	50	B	25	B	50	C