UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
SEPTEMBER 2019 PWR – FORM A

DO <u>NOT</u> BEGIN THIS EXAMINATION UNTIL DIRECTED TO DO SO.

<u>Please Print:</u>

Name: _____

Docket No.: <u>55-</u>_____

Facility: _____

Start Time: _____   Stop Time: _____

<u>Instructions to Examinee:</u>

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	<u>50</u>	<u>100</u>	

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:

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

<u>NOTE</u>: 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.

EQUATIONS

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

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

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

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

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

$$1/M = CR_1/CR_x$$

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

$$A = \pi r^2$$

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

$$F = PA$$

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

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

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

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

$$SUR = 26.06/\tau$$

$$P = I^2R$$

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

$$P = IE$$

$$P_A = \sqrt{3}IE$$

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

$$P_T = \sqrt{3}IEpf$$

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

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

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

Thermal Efficiency $=$ Net Work Out/Energy In

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

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

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

$$g = 32.2\ ft/sec^2$$

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

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

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

CONVERSIONS

$1\ MW = 3.41 \times 10^6\ Btu/hr$	$°C = (5/9)(°F - 32)$	$1\ ft^3_{water} = 7.48\ gal$
$1\ hp = 2.54 \times 10^3\ Btu/hr$	$°F = (9/5)(°C) + 32$	$1\ gal_{water} = 8.35\ lbm$
$1\ Btu = 778\ ft\text{-}lbf$	$1\ kg = 2.21\ lbm$	$1\ Curie = 3.7 \times 10^{10}\ dps$

QUESTION: 1

Which one of the following describes saturated water at atmospheric pressure?

A. At the critical point.

B. Below the boiling point.

C. At the boiling point.

D. A quality of 100 percent.

QUESTION: 2

A centrifugal pump is taking suction from an open water storage tank. The pump is located at the base of the tank, takes a suction from the bottom of the tank, and discharges to a pressurized system.

Given:

- The storage tank is filled to a level of 26 feet with 60°F water.
- The pump requires 45 feet of net positive suction head.
- The pump is currently operating at 50 gpm.

Which one of the following describes the current pump status, and how the pump flow rate will be affected as the level in the storage tank decreases?

A. The pump is currently cavitating; pump flow rate will decrease continuously as tank level decreases.

B. The pump is currently cavitating; pump flow rate will remain about the same until the tank empties.

C. The pump is currently not cavitating; pump flow rate will gradually decrease with tank level, and then rapidly decrease when the tank empties.

D. The pump is currently not cavitating; pump flow rate will gradually decrease with tank level, and then rapidly decrease when cavitation begins before the tank empties.

QUESTION: 3

A nuclear power plant is operating with the following conditions:

- Reactor power is 55 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. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction decreases reactor coolant system pressure by 20 psig.

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

D. Core xenon-135 depletes in proportion to the axial and radial power distribution with no control rod motion.

QUESTION: 4

A steam generator transient caused main steam pressure to increase although the actual mass flow rate of main steam remained constant.   If the main steam flow instrument is not density-compensated, the greater main steam pressure will cause indicated main steam mass flow rate to...

A. increase, due to a higher steam velocity.

B. increase, due to a greater steam density.

C. decrease, due to a lower steam velocity.

D. decrease, due to a reduced steam density.

QUESTION: 5

A section of pipe is being hydrostatically tested to 1,400 psig using a positive displacement pump. The operating characteristics of the positive displacement pump are shown in the drawing below.

Which one of the following could cause the difference between the expected and the actual pump performance?

A. Pump internal leakage is greater than expected.

B. Pipe section boundary valve leakage is greater than expected.

C. A relief valve on the pump discharge piping opened prior to its setpoint of 1,400 psig.

D. The available NPSH is smaller than expected, but remains above the required NPSH.
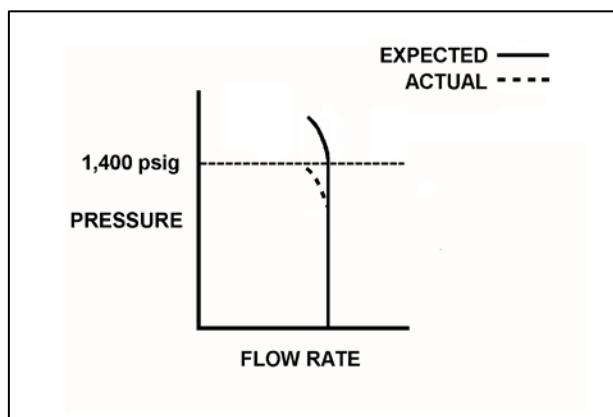
QUESTION: 6

During a 6-month period of continuous 100 percent power operation in the middle of a fuel cycle, the reactor coolant boron concentration must be decreased periodically to compensate for...

A. buildup of fission product poisons and decreasing control rod worth.

B. fuel depletion and buildup of fission product poisons.

C. decreasing control rod worth and burnable poison burnout.

D. burnable poison burnout and fuel depletion.

QUESTION: 7

A nuclear power plant is operating at 85 percent power when the extraction steam to a high pressure feedwater heater is isolated.   After the transient, the operator returns reactor power to 85 percent and stabilizes the plant.   Compared to the conditions just prior to the transient, the current main generator output (MW) is...

A. higher, because increased steam flow to the main turbine caused the main generator to pick up load.

B. lower, because decreased steam flow to the main turbine caused the main generator to reject load.

C. higher, because the steam cycle thermal efficiency has increased.

D. lower, because the steam cycle thermal efficiency has decreased.

QUESTION: 8

Refer to the drawing of a differential pressure (D/P) level detection system for a pressurizer at normal operating temperature and pressure (see figure below).

A nuclear power plant uses several differential pressure detectors like the one below to provide multiple channels of pressurizer water level indication. A hot channel was calibrated when the pressurizer was at normal operating temperature. A cold channel was calibrated when the pressurizer was at 160°F.

How will the level indications on the two channels compare when the pressurizer is at normal operating temperature?

A. The cold channel will indicate higher than the hot channel, due to the difference in reference leg water density at the two calibration temperatures.

B. The cold channel will indicate lower than the hot channel, due to the difference in reference leg water density at the two calibration temperatures.

C. The cold channel will indicate higher than the hot channel, due to the difference in pressurizer water density at the two calibration temperatures.

D. The cold channel will indicate lower than the hot channel, due to the difference in pressurizer water density at the two calibration temperatures.
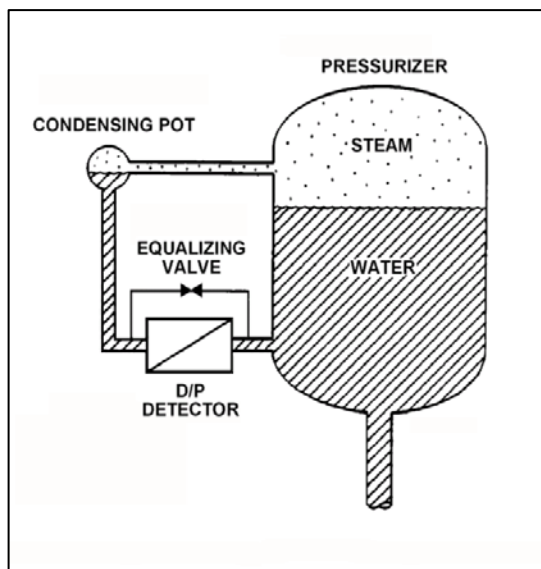
QUESTION: 9

A radial-flow centrifugal cooling water pump is driven by an AC induction motor. The pump can supply cooling water to several heat loads, all of which are in parallel alignment. Initially, the following pump conditions exist:

Pump motor current   = 100 amps
Pump flow rate   = 400 gpm
Pump suction temperature = 70°F

Four hours later, the pump motor is drawing 105 amps. Which one of the following could be responsible for the observed increase in motor current?

A. The temperature of the cooling water being pumped decreased to 60°F with <u>no</u> change in pump volumetric flow rate.

B. The temperature of the cooling water being pumped increased to 80°F with <u>no</u> change in pump volumetric flow rate.

C. Cooling water flow was established to an additional heat load with <u>no</u> change in the temperature of the cooling water being pumped.

D. Cooling water flow was isolated from an out-of-service heat load with <u>no</u> change in the temperature of the cooling water being pumped.

QUESTION: 10

A nuclear power plant is operating at 100 percent power near the end of a fuel cycle when the main turbine trips. If the reactor does <u>not</u> immediately trip, reactor power will initially…

A. increase, due to positive reactivity from the Doppler coefficient.

B. increase, due to positive reactivity from the moderator temperature coefficient.

C. decrease, due to negative reactivity from the Doppler coefficient.

D. decrease, due to negative reactivity from the moderator temperature coefficient.

QUESTION: 11

An open vessel contains 1.0 lbm of water at 120°F and standard atmospheric pressure. Which one of the following will be caused by the addition of 540 Btu to the water?

A. The water temperature will increase to approximately 212°F; and less than 50 percent of the water will vaporize.

B. The water temperature will increase to approximately 212°F; and more than 50 percent of the water will vaporize.

C. The water temperature will increase to significantly higher than 212°F; and less than 50 percent of the water will vaporize.

D. The water temperature will increase to significantly higher than 212°F; and more than 50 percent of the water will vaporize.

QUESTION: 12

Refer to the drawing of two valves used in a high temperature water system (see figure below). Both valves are currently <u>closed,</u> as shown in the figure.

The valve that is more likely to become stuck due to mechanical binding as the valve cools down is number _____; and the valve that is more likely to become stuck due to a pressure lock as the valve heats up is number _____.
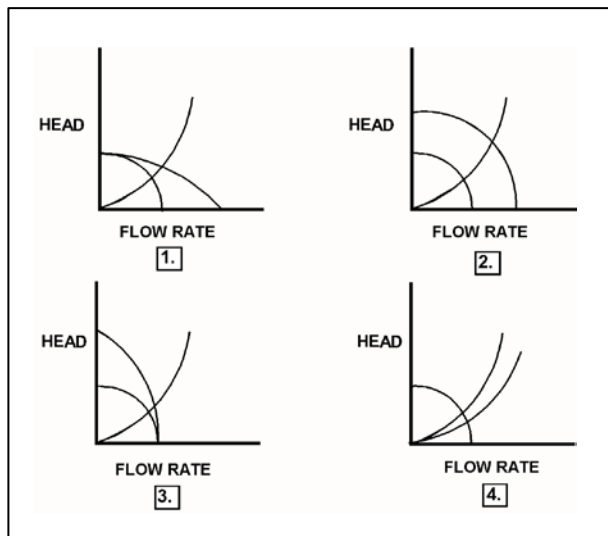
A.   1; 1

B.   1; 2

C.   2; 1

D.   2; 2
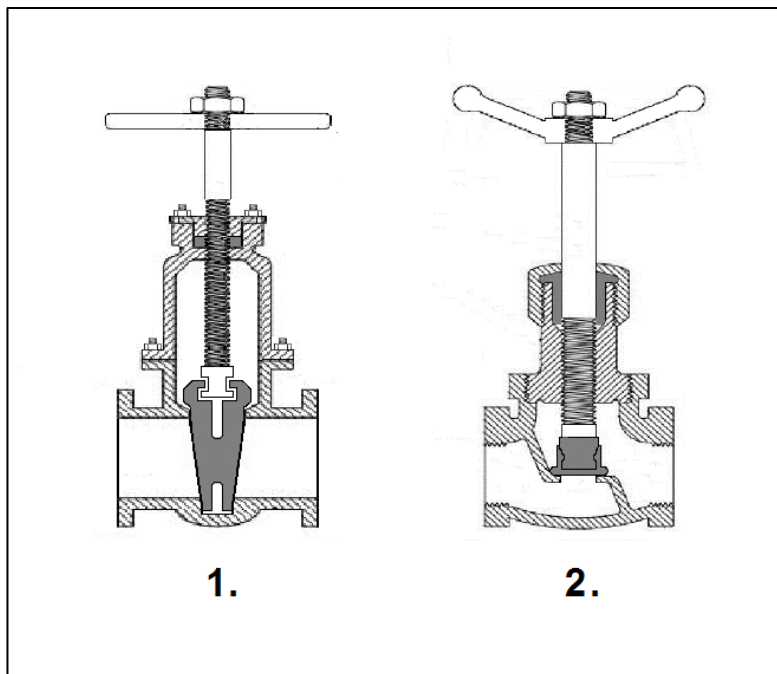
QUESTION: 13

Initially, two identical centrifugal pumps were operating in parallel in a closed system when one pump tripped.

Which set of operating curves shown below depicts the steady-state "before and after" conditions described above?

A. 1.

B. 2.

C. 3.

D. 4.

QUESTION: 14

An air-operated valve requires 3,600 pounds-force from its diaphragm actuator for proper valve operation.   The diameter of the diaphragm is 12 inches.

Which one of the following is the minimum actuator air pressure needed for proper valve operation?

A. 32 psig

B. 47 psig

C. 81 psig

D. 96 psig

QUESTION: 15

Refer to the partial drawing of two identical radial-flow 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 5 minutes ago to initiate flow in the cooling water system.

When pump B is started, which one of the following will cause the ammeter for pump B to stabilize at a higher-than-normal value for the pump configuration?

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

B. There is an obstruction in the discharge piping from pump B.

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

D. The shaft coupling between the motor and pump for pump B was removed and <u>not</u> reinstalled.
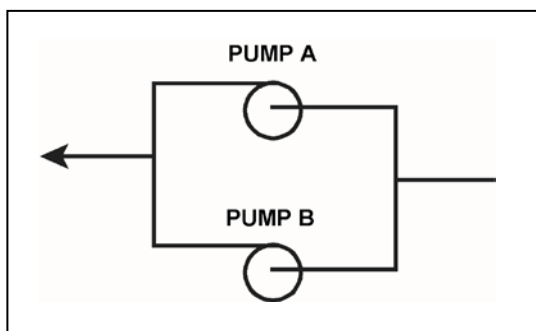
QUESTION: 16

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

A. 2 psig, 20 inches Hg absolute, 8 psia

B. 2 psig, 8 psia, 20 inches Hg absolute

C. 8 psia, 20 inches Hg absolute, 2 psig

D. 8 psia, 2 psig, 20 inches Hg absolute

QUESTION: 17

Given the following steam parameters:

    Pressure = 1,000 psia
    Quality   = 98 percent

The specific enthalpy of the steam would be greater if the pressure of the steam was 100 psia
_____ at the <u>same</u> quality; or if the quality of the steam was 1 percent _____ at the
<u>same</u> pressure.

A. higher; higher

B. higher; lower

C. lower; higher

D. lower; lower

QUESTION: 18

Prolonged exposure of a reactor vessel to a fast neutron flux will cause the nil-ductility transition
temperature to...

A. decrease, due to the propagation of existing flaws.

B. increase, due to the propagation of existing flaws.

C. decrease, due to changes in the material properties of the vessel wall.

D. increase, due to changes in the material properties of the vessel wall.

QUESTION: 19

Which one of the following describes the method of core heat removal during reflux core cooling following a loss of coolant accident?

A. Convection with forced coolant flow.

B. Convection with natural circulation coolant flow.

C. Conduction with stagnant coolant flow.

D. Radiation with total core voiding.

QUESTION: 20

A reactor startup is in progress from a cold shutdown condition. During the reactor coolant heatup phase of the startup, the differential control rod worth will become _____ negative; and during the complete withdrawal of the initial bank of control rods, the differential control rod worth will become _____.

A. more; more negative initially and then less negative

B. more; less negative initially and then more negative

C. less; more negative during the entire withdrawal

D. less; less negative during the entire withdrawal

QUESTION: 21

Initially, a reactor was operating at steady-state 70 percent power. Then, reactor power was increased to 100 percent over a 1 hour period.   To keep reactor coolant system temperature stable during the next 2 hours, the operator must gradually _____ the control rods or _____ the reactor coolant boron concentration.

A. insert; increase

B. insert; decrease

C. withdraw; increase

D. withdraw; decrease

QUESTION: 22

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

Which one of the following will occur as a result of the indicated tube failure in the heat exchanger?   (HP = high pressure; LP = low pressure)

A. HP fluid inventory will increase.

B. Level in the surge tank will decrease.

C. Pressure in the LP system will decrease.

D. Temperature in the LP system will increase.
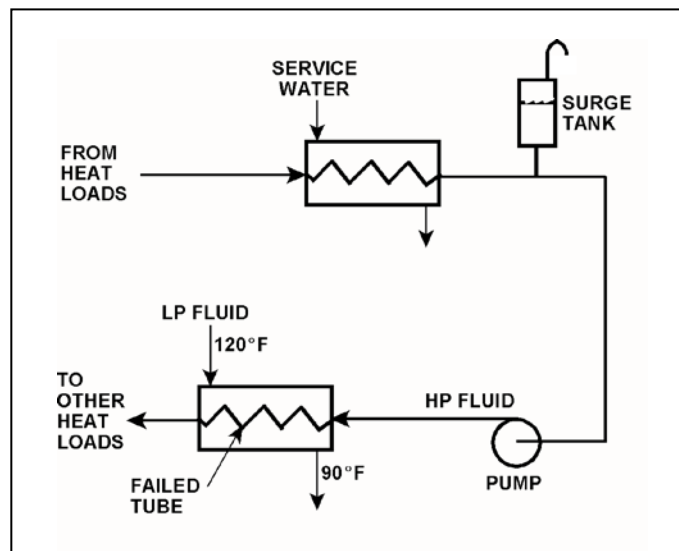
QUESTION: 23

Refer to the drawing of an operating reactor coolant system (RCS) purification system with a mixed-bed ion exchanger (see figure below).

Initially, a nuclear power plant is operating at 100 percent power in the middle of a fuel cycle with reactor coolant flowing through the purification system at 120 gpm.   Then, valve C is repositioned to reduce the reactor coolant flow rate to 60 gpm.

If no other valves are repositioned, the boron concentration of the reactor coolant returning to the RCS will…

A. increase, because the ion exchanger is less effective at removing boron atoms from the reactor coolant at higher reactor coolant temperatures.

B. increase, because the ion exchanger is less effective at removing boron atoms from the reactor coolant at lower reactor coolant temperatures.

C. decrease, because the ion exchanger is more effective at removing boron atoms from the reactor coolant at higher reactor coolant temperatures.

D. decrease, because the ion exchanger is more effective at removing boron atoms from the reactor coolant at lower reactor coolant temperatures.
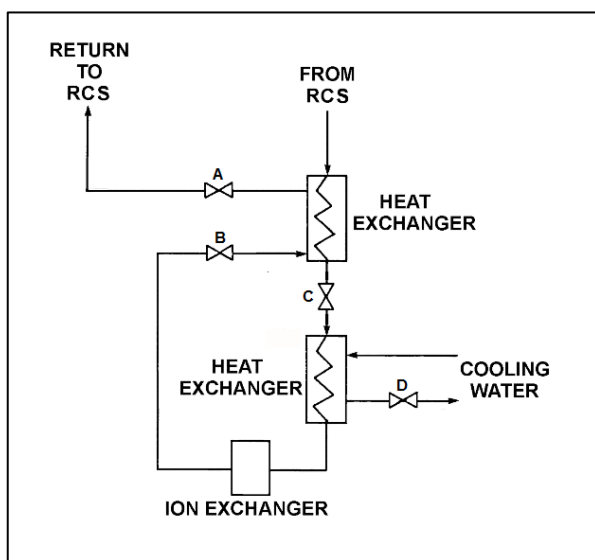
QUESTION: 24

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 in-service reactor coolant letdown ion exchangers?

A. Decreased ion exchanger outlet conductivity.

B. Decreased pressure drop across the ion exchangers.

C. Increased flow rate through the ion exchangers.

D. Increased radiation levels around the ion exchangers.

QUESTION: 25

How does the addition of boric acid to the reactor coolant affect the moderator temperature coefficient (MTC) in an undermoderated reactor?

A. The initially negative MTC becomes more negative.

B. The initially negative MTC becomes less negative.

C. The initially positive MTC becomes more positive.

D. The initially positive MTC becomes less positive.

QUESTION: 26

A reactor was restarted following a refueling outage and is currently at the point of adding heat. Which one of the following describes the change in axial power distribution as reactor power is increased to 5 percent by control rod withdrawal?

A. Shifts toward the bottom of the core.

B. Shifts toward the top of the core.

C. Shifts from the center of the core toward the top and bottom of the core.

D. Shifts from the top and bottom of the core toward the center of the core.

QUESTION: 27

A PWR nuclear power plant has 2 steam generators (SG). Feedwater enters <u>each</u> SG at 3.3×10^6 lbm/hr with an enthalpy of 419 Btu/lbm. Steam exits <u>each</u> steam generator at 800 psia with 100 percent steam quality.

Ignoring all other heat gains and losses, what is the reactor core thermal power?

A. 667 MW

B. 755 MW

C. 1,334 MW

D. 1,510 MW

QUESTION: 28

A nuclear power plant has been operating at 100 percent power for 2 months when a reactor trip occurs. Two months after the reactor trip, 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 count rate 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: 29

Refer to the drawing of a cooling water system in which both centrifugal pumps A and B are operating (see figure below).

An operator stops pump B, but the pump B check valve fails to close.   In comparison to normal operation with only pump A running, operation with the failed pump B check valve will result in pump A flow rate being _____ than normal; and heat exchanger flow rate being _____ than normal.

A. higher; higher

B. higher; lower

C. lower; higher

D. lower; lower
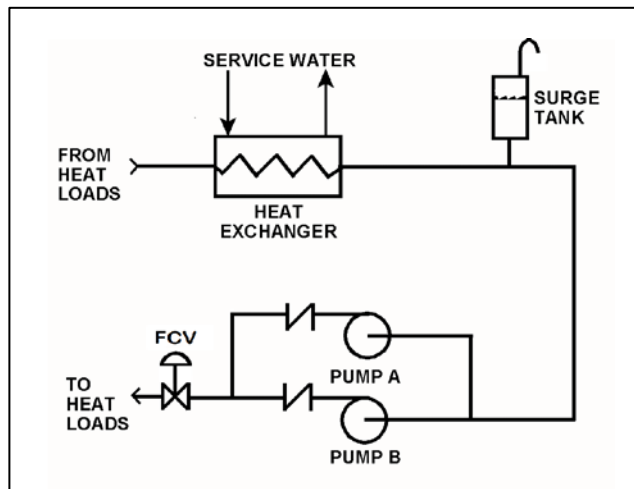
QUESTION: 30

As a reactor approaches criticality during a reactor startup, it takes longer to reach an equilibrium source range count rate after each control rod withdrawal due to the increased...

A. length of time required to complete a neutron generation.

B. number of neutron generations required to reach a stable neutron level.

C. length of time from neutron birth to absorption.

D. fraction of delayed fission neutrons being produced.

QUESTION: 31

Refer to the drawing of a cooling water system using 10-inch diameter pipe (see figure below). Only centrifugal pump A is operating and the flow control valve (FCV) is 80 percent open.

Which one of the following actions will increase the total head loss in the system?

A. Increase the system flow rate by starting centrifugal pump B.

B. Increase the system flow rate by opening the flow control valve more.

C. Replace a 20 foot section of 10-inch diameter pipe with a 10 foot section of 10-inch diameter pipe.

D. Replace a 20 foot section of 10-inch diameter pipe with a 20 foot section of 12-inch diameter pipe.
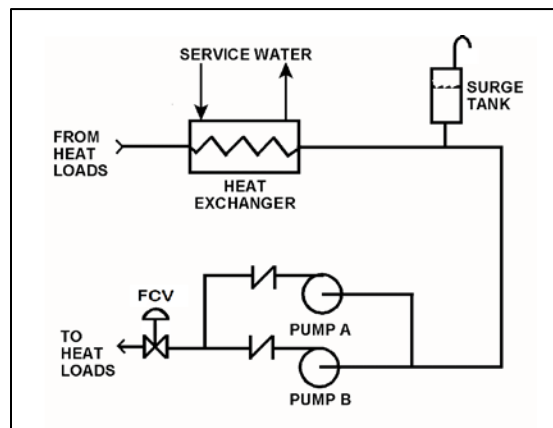
QUESTION: 32

Given the following:

- Initially, reactor power is 1.0×10^{-3} percent and increasing with a constant startup rate of 0.1 DPM.
- The steam dump system is maintaining steam generator pressures at 1,000 psia.
- The point of adding heat is 1.0 percent power.
- The power coefficient is -1.0×10^{-4} $\Delta K/K$/percent power.
- The effective delayed neutron fraction is 0.006.
- No operator actions or automatic protective actions occur.

In 40 minutes, reactor power will be approximately...

A. 3 percent and stable.

B. 3 percent and increasing.

C. 10 percent and stable.

D. 10 percent and increasing.

QUESTION: 33

Initially, a reactor is subcritical with the effective multiplication factor (K_{eff}) equal to 0.998.   After a brief withdrawal of control rods, K_{eff} equals 1.002.   The reactor is currently...

A. prompt critical.

B. supercritical.

C. exactly critical.

D. subcritical.

QUESTION: 34

An <u>axial</u> flow ventilation fan is being driven by an AC motor. The fan is operating at 90 percent of rated flow rate with its discharge damper partially closed. How will the fan motor current change if its discharge damper is fully opened?

A. The motor current will increase in accordance with the centrifugal pump laws.

B. The motor current will increase, but <u>not</u> in accordance with the centrifugal pump laws.

C. The motor current will decrease in accordance with the centrifugal pump laws.

D. The motor current will decrease, but <u>not</u> in accordance with the centrifugal pump laws.
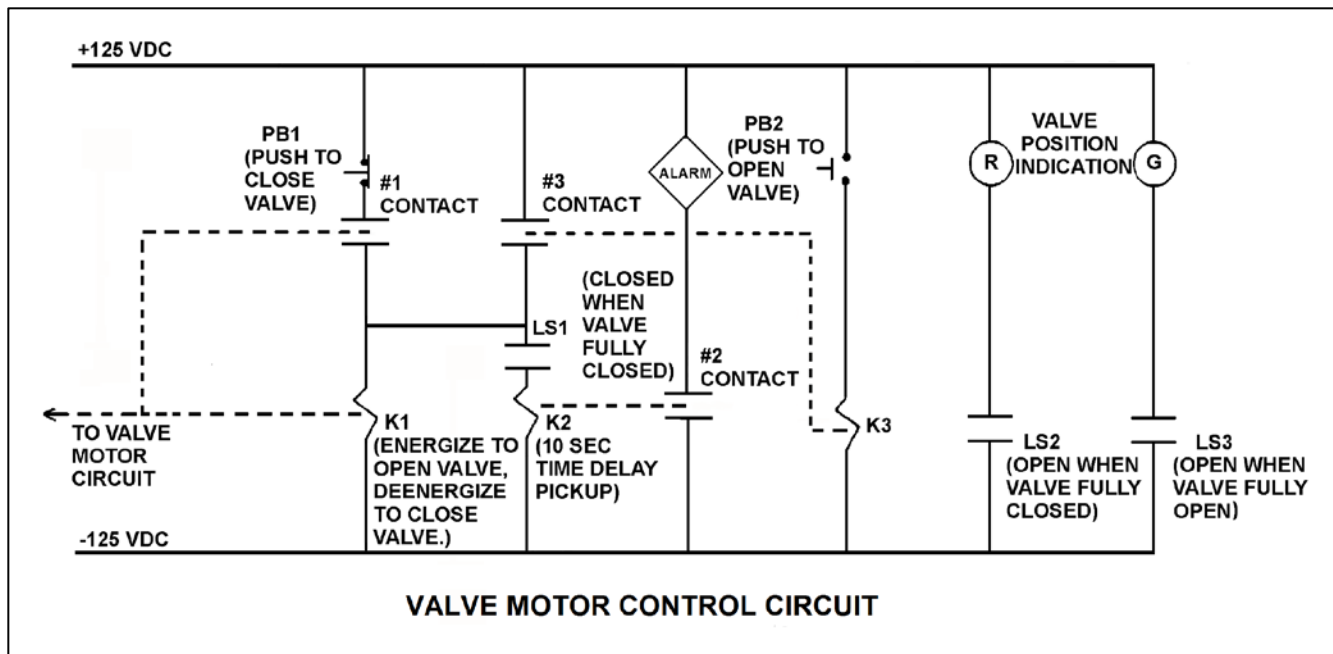
QUESTION: 35

Refer to the drawing of a valve motor control circuit (see figure below).

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.

Which one of the following describes the purpose of the alarm?

A. Alert the operator when the valve motor circuit has been energized for 10 seconds after pushbutton PB2 is depressed.

B. Alert the operator when the valve has not moved off its closed seat within 10 seconds of depressing pushbutton PB2.

C. Alert the operator that the valve is opening by sounding the alarm for 10 seconds after PB2 is depressed.

D. Alert the operator if the valve has not reached full open within 10 seconds of depressing pushbutton PB2.

VALVE MOTOR CONTROL CIRCUIT

QUESTION: 36

Refer to the drawing of a convergent-divergent venturi (see figure below). Subcooled water is flowing through the venturi, and the pipe diameters at P1 and P2 are equal.

Compared to the conditions at the inlet of the venturi (P1), the pressure at the outlet of the venturi (P2) is _____; and the water velocity at the outlet of the venturi is _____.

A. the same; the same

B. the same; slightly lower

C. slightly lower; the same

D. slightly lower; slightly lower
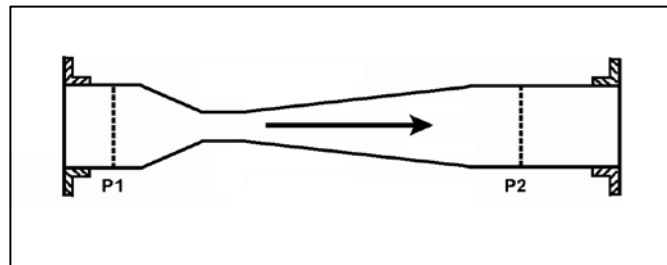
QUESTION: 37

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

The tank water level is being automatically controlled by a proportional-only controller with a level setpoint of 50 percent. Tank water level is currently stable at 50 percent with 500 gpm entering the tank and the drain valve 50 percent open.

If the tank input flow rate suddenly increases to 700 gpm, then after the tank water level stabilizes, the water level will be _____ 50 percent; and the drain valve position will be _____ open.

A. equal to; more than 50 percent

B. equal to; 50 percent

C. greater than; more than 50 percent

D. greater than; 50 percent
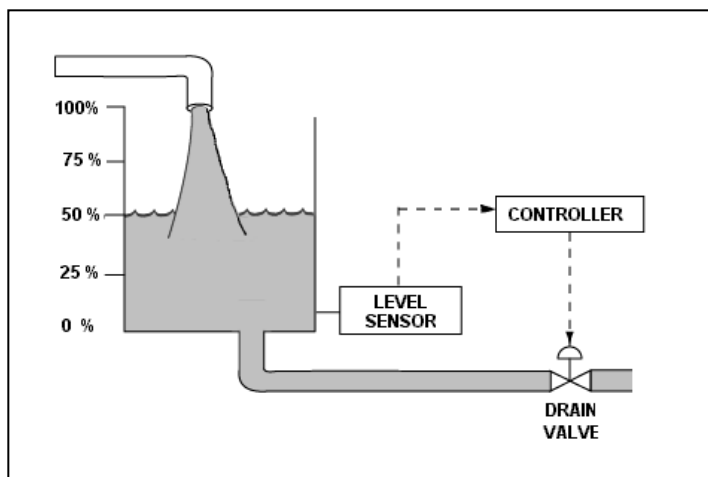
QUESTION: 38

A reactor trip occurred 16 hours ago following several months of operation at 100 percent power. Reactor coolant temperature is being maintained at 557°F.   The source range count rate is 400 cps, and the source neutron production rate is constant.   Assume that <u>no</u> operator action is taken during the next 24 hours.

During the next 24 hours, the source range count rate will…

A. increase for the entire period.

B. decrease for the entire period.

C. initially increase, and then decrease for the rest of the period.

D. initially decrease, and then increase for the rest of the period.

QUESTION: 39

A typical 120 VAC manual circuit breaker tripped due to overload.   To close this circuit breaker, the handle must be moved from the...

A. OFF position directly to the ON position; trip latch reset is <u>not</u> required.

B. midposition directly to the ON position; trip latch reset is <u>not</u> required.

C. OFF position to the midposition to reset the trip latch, and then to the ON position.

D. midposition to the OFF position to reset the trip latch, and then to the ON position.

QUESTION: 40

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

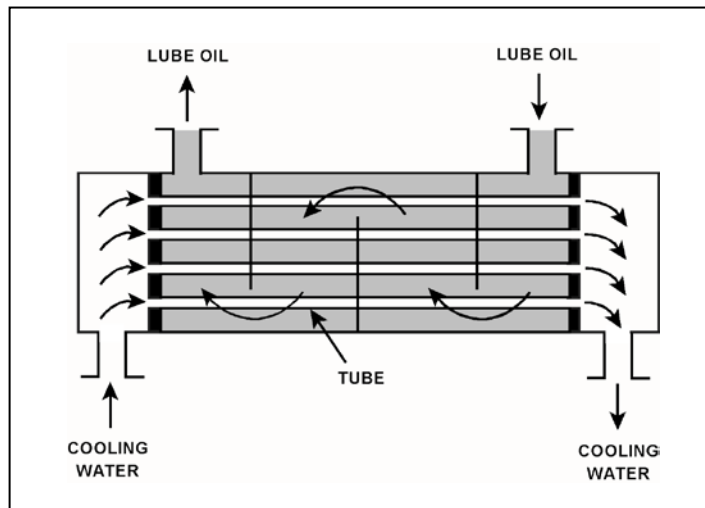B. decrease; decrease

C. increase; increase

D. increase; decrease

QUESTION: 41

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

The rate of heat transfer between the lube oil and cooling water will increase if the cooling water inlet temperature _____; or if the cooling water mass flow rate _____.

A. decreases; decreases

B. decreases; increases

C. increases; decreases

D. increases; increases

QUESTION: 42

A nuclear power plant is operating at 80 percent power with 5°F of condensate depression in the main condenser. If the condensate depression decreases to 2°F, the steam cycle thermal efficiency will _____; and the condensate pumps will operate _____ cavitation.

A. increase; closer to

B. increase; farther from

C. decrease; closer to

D. decrease; farther from

QUESTION: 43

In which usable region(s) of the gas-filled detector ionization curve is the pulse height resulting from the detection of a 1 MeV beta particle the same as a 5 MeV alpha particle?

A. Geiger-Mueller only.

B. Geiger-Mueller and Ionization Chamber.

C. Proportional only.

D. Proportional and Ionization Chamber.

QUESTION: 44

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

Given the following:

- The temperature instrument currently indicates 370°F.
- The reference junction temperature is constant at 120°F.
- The temperature instrument is capable of indicating 32°F to 1,000°F and has just been calibrated.

Which one of the following temperature indications will result if the chromel lead becomes disconnected from its terminal in the thermocouple connection head?

A. 32°F

B. 120°F

C. 250°F

D. 1,000°F
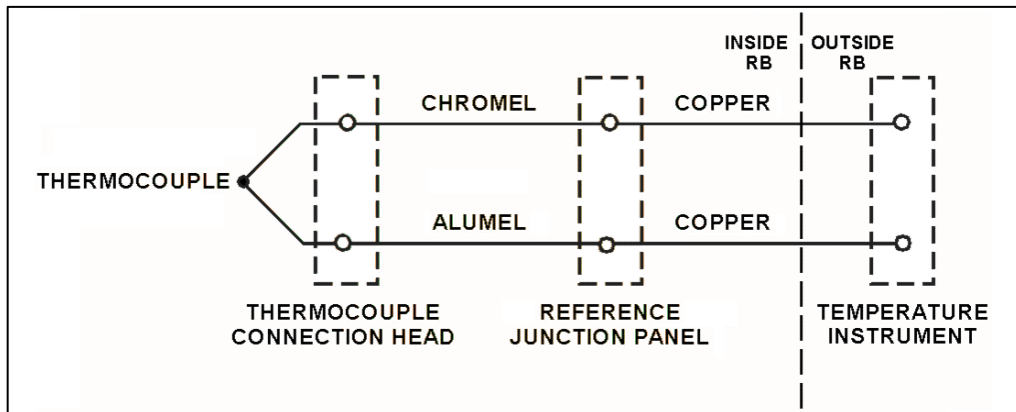
QUESTION: 45

A 480 VAC motor control center supplies a load through a breaker and a manual disconnect switch. Which one of the following sequences will provide the greatest level of personnel safety when de-energizing the load for maintenance, and when re-energizing the load after the maintenance is complete?

DE-ENERGIZING	RE-ENERGIZING
A. Open breaker first	Shut breaker first
B. Open breaker first	Shut disconnect switch first
C. Open disconnect switch first	Shut breaker first
D. Open disconnect switch first	Shut disconnect switch first

QUESTION: 46

How do the following parameters change during a normal ramp of reactor power from 15 percent to 75 percent?

	Main Turbine First Stage Pressure	Reactor Coolant System Boron Concentration
A.	Increases	Decreases
B.	Decreases	Decreases
C.	Increases	Increases
D.	Decreases	Increases

QUESTION: 47

A reactor coolant system (RCS) cooldown on natural circulation is in progress. The cooldown rate is being controlled by releasing steam from the steam generator (SG) atmospheric relief valves in Manual control.

If voids interrupt the RCS natural circulation flow, which one of the following will occur? (Assume feedwater flow rate, SG relief valve positions, and decay heat level are constant.)

A. SG pressure will decrease and core exit thermocouple (CET) temperatures will increase.

B. SG pressure will decrease and CET temperatures will remain constant.

C. SG pressure will increase and CET temperatures will increase.

D. SG pressure will increase and CET temperatures will remain constant.

QUESTION: 48

The water level in a water storage tank is being controlled by an automatic bistable level controller. If water level increases to 70 percent, the controller bistable turns on to open a tank drain valve. When water level decreases to 60 percent, the controller bistable turns off to close the drain valve.

Which one of the following bistable symbols indicates the characteristics of the bistable used in the level controller?

A. 1.

B. 2.

C. 3.

D. 4.
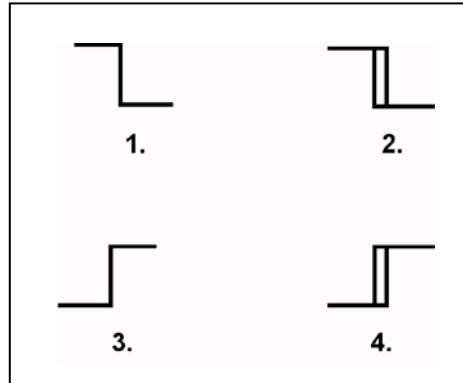
QUESTION: 49

A neutron that is expelled 1.0×10^{-2} seconds after the associated fission event is a _____ neutron.

A. thermal

B. delayed

C. prompt

D. capture

QUESTION: 50

Refer to the curve of microscopic cross section for absorption versus neutron energy for a resonance peak in U-238 (see figure below).

If fuel temperature increases, the area under the curve will _____; and negative reactivity will be added to the core because _____.

A. increase; neutrons of a wider range of energies will be absorbed by U-238

B. increase; more neutrons will be absorbed by U-238 at the resonance neutron energy

C. remain the same; neutrons of a wider range of energies will be absorbed by U-238

D. remain the same; more neutrons will be absorbed by U-238 at the resonance neutron energy
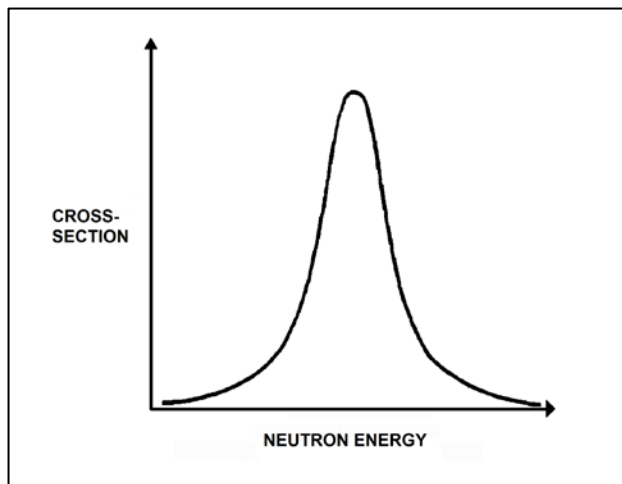
*** FINAL ANSWER KEY ***

NRC GENERIC FUNDAMENTALS EXAMINATION
SEPTEMBER 2019–PWR

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