UNITED STATES NUCLEAR REGULATORY COMMISSION
GENERIC FUNDAMENTALS EXAMINATION
MARCH 2021 PWR – FORM A

DO NOT BEGIN THIS EXAMINATION UNTIL DIRECTED TO DO SO.

Please Print:

Name: _____

Docket No.: 55-_____

Facility: _____

Start Time: _____ Stop Time: _____

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

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

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

$1/M = CR_1/CR_x$

$A = \pi r^2$

$F = PA$

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

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

$P = I^2R$

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

Thermal Efficiency = Net Work Out/Energy In

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

$g = 32.2$ ft/sec^2

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

CONVERSIONS

1 MW = 3.41 x 10^6 Btu/hr

1 hp = 2.54 x 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 x 10^{10} dps

QUESTION: 1

An outside water storage tank is equipped with submerged heaters. The heaters energize at minimum power when water temperature decreases to 48°F. If water temperature continues to decrease, heater power will increase directly with the temperature deviation from 48°F, regardless of cooldown rate, until maximum power is reached at 40°F. Different cooldown rates have the same effect on heater operation. On cold days, the tank water temperature is usually maintained at about 44°F with the heaters energized at half power.

Which one of the following types of control is used in the heater control circuit to produce these characteristics?

A. Proportional only

B. Proportional plus integral only

C. Proportional plus derivative only

D. Proportional plus integral plus derivative

QUESTION: 2

During a reactor coolant system cooldown, positive reactivity is added to the core if the moderator temperature coefficient is negative. This is partially due to...

A. a decreasing thermal utilization factor.

B. an increasing thermal utilization factor.

C. a decreasing resonance escape probability.

D. an increasing resonance escape probability.

QUESTION: 3

Initially, a centrifugal pump is operating with a fully open discharge valve in a closed water system. Then the discharge valve is closed half way.

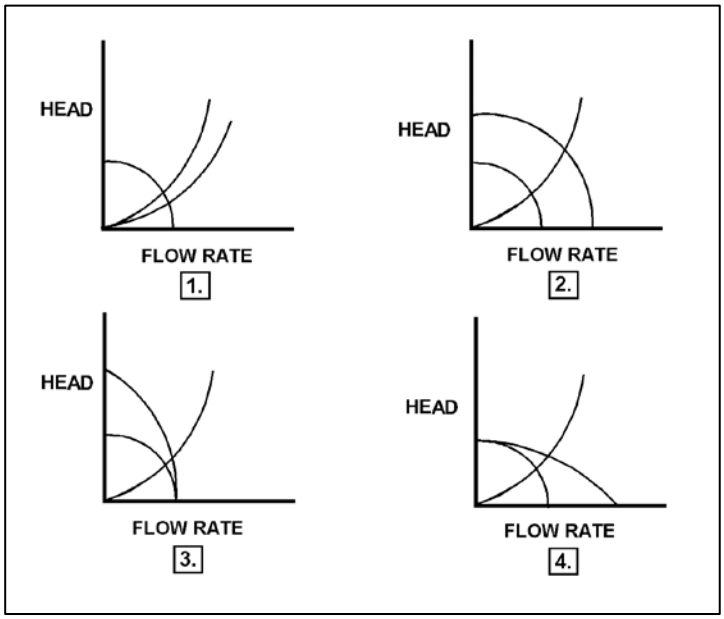
Which set of centrifugal pump and system operating curves shown below depicts the initial and final conditions described above?

A. 1.

B. 2.

C. 3.

D. 4.



QUESTION: 4

Which one of the following will result from operating an AC motor-driven radial-flow centrifugal pump in a water system for an extended period with the discharge valve shut and no recirculation flow?

A. No pump damage, but the motor will overspeed and may be damaged.

B. No pump damage, but the motor will overheat and may be damaged.

C. No motor damage, but the pump will overheat and may be damaged.

D. No motor damage, but the pump will overspeed and may be damaged.

QUESTION: 5

Which one of the following is arranged left to right from the higher pressure to the lower pressure?

A. 2 psig, 26 inches Hg absolute, 10 psia

B. 2 psig, 12 inches Hg absolute, 10 psia

C. 20 psia, 26 inches Hg absolute, 2 psig

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

QUESTION: 6

To minimize the possibility of water hammer when initiating flow in a system, the operator should...

A. vent the system prior to initiating flow.

B. vent the system only after flow has been initiated.

C. fully open the pump discharge valve prior to starting a pump.

D. rapidly open the pump discharge valve after the pump is running.

QUESTION: 7

Reactors A and B are identical except that reactor A is operating at steady-state 80 percent power, while reactor B is operating at steady-state 100 percent power. Initial control rod positions are the same for both reactors.

How will the shutdown margins (SDM) compare for the two reactors following a reactor trip? (Assume no post-trip operator actions are taken that would affect SDM.)

A. Immediately after the reactor trip, reactor A will have the greater SDM.

B. Immediately after the reactor trip, reactor B will have the greater SDM.

C. When sufficient time has passed to allow both cores to become xenon-free, the SDMs will be equal.

D. Within a few minutes after the reactors have tripped, when all parameters have returned to normal post-trip conditions, the SDMs will be equal.

QUESTION: 8

For coolant flowing past a fuel rod, which one of the following is a characteristic of subcooled nucleate boiling, but not bulk boiling?

A. $T_{Cladding}$ equals T_{Sat}.

B. $T_{Cladding}$ is greater than T_{Sat}.

C. $T_{Bulk\ Coolant}$ equals T_{Sat}.

D. $T_{Bulk\ Coolant}$ is less than T_{Sat}.

QUESTION: 9

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

Given:

- The cooling water inlet temperature is constant.
- The lube oil inlet temperature is constant.
- The lube oil mass flow rate is constant.

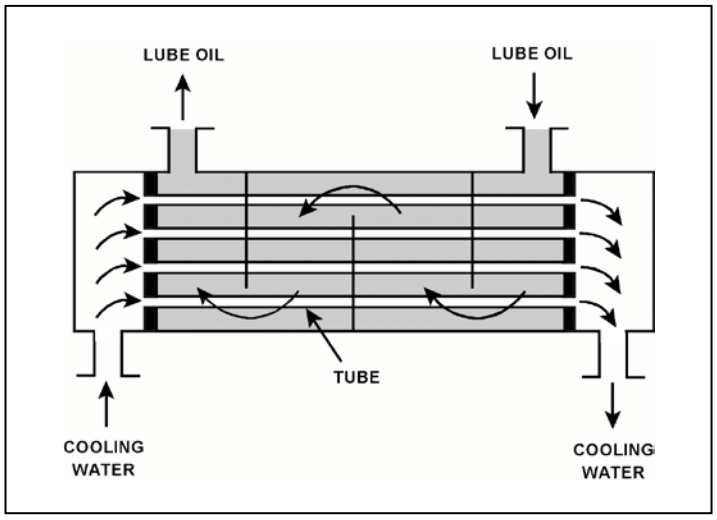
If the cooling water mass flow rate increases, the lube oil outlet temperature will _____; and the cooling water outlet temperature will _____.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease



QUESTION: 10

Refer to the drawing of a lube oil temperature control system (see figure below).

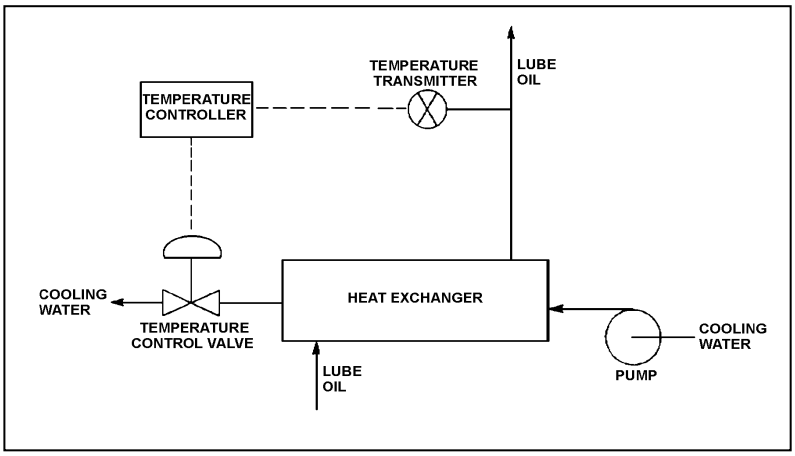
If the temperature transmitter fails high (high temperature output signal), the temperature controller will position the temperature control valve more _____; which causes the actual heat exchanger lube oil outlet temperature to _____.

A. closed; increase

B. closed; decrease

C. open; increase

D. open; decrease



QUESTION: 11

A steam flow measuring instrument uses density compensation and square root extraction to convert the differential pressure across the flow element to flow rate in lbm/hr.

The purpose of density compensation in this flow measuring instrument is to convert _____ into _____.

A. steam pressure; mass flow rate

B. steam velocity; volumetric flow rate

C. volumetric flow rate; mass flow rate

D. differential pressure; volumetric flow rate

QUESTION: 12

For which of the following ideal processes, if any, is the steam inlet enthalpy equal to the steam outlet enthalpy? (Assume horizontal flow in each process.)

(A) Dry saturated steam flowing through a pressure reducing valve.
(B) Dry saturated steam flowing through a fixed convergent nozzle.

A. (A) only

B. (B) only

C. Both (A) and (B)

D. Neither (A) nor (B)

QUESTION: 13

A reactor has been operating at 80 percent power for four weeks with the controlling rod group inserted 15 percent from the fully withdrawn position.

Which one of the following will be significantly affected by withdrawing the controlling rod group an additional 5 percent? (Assume steady-state reactor power does not change.)

A. Total xenon-135 reactivity

B. Axial power distribution

C. Radial power distribution

D. Quadrant (azimuthal) power distribution

QUESTION: 14

Given the following information for a water relief valve:

- The relief valve discharges to standard atmospheric pressure.
- The relief valve will be fully open at 200 psig inlet pressure.
- At 200 psig inlet pressure, the relief valve flow rate is 98 gpm.
- The water passing through the relief valve remains subcooled at all times.

What will the approximate relief valve discharge flow rate be if inlet pressure reaches 300 psig?

A. 98 gpm

B. 120 gpm

C. 147 gpm

D. 221 gpm

QUESTION: 15

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 boron additions or dilutions, the reactor coolant boron concentration will...

A. decrease, because boron atoms decompose at normal 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: 16

Reactors A and B are identical, except that reactor A has an effective delayed neutron fraction of 0.007, while reactor B has an effective delayed neutron fraction of 0.006. Initially, both reactors are critical at 1.0×10^{-8} percent power when +0.1 %ΔK/K is instantly added to both reactors.

Five minutes after the reactivity additions, reactor _____ will be at the higher power level; and reactor _____ will have the higher startup rate.

A. A; A

B. A; B

C. B; A

D. B; B

QUESTION: 17

Initially, a reactor is critical at 1.0×10^{-8} percent power near the middle of a fuel cycle.

Consider the effects of prompt and delayed neutrons on reactor control for the following two cases:

Case 1: Positive 1.0×10^{-2} $\Delta K/K$ is instantly added to the reactor.
Case 2: Positive 1.0×10^{-3} $\Delta K/K$ is instantly added to the reactor.

For Case 1, the rate of power change is determined primarily by the average lifetime of the _____ neutrons; and for Case 2, the rate of power change is determined primarily by the average lifetime of the _____ neutrons. (Consider only the power changes that occur below the point of adding heat.)

A. prompt; delayed

B. prompt; prompt

C. delayed; delayed

D. delayed; prompt

QUESTION: 18

A main generator is about to be connected to an infinite power grid by closing a generator output breaker. Which one of the following conditions will cause the main generator to immediately become a reactive load on the grid when the generator output breaker is closed?

A. The synchroscope is turning slowly in the clockwise direction.

B. The synchroscope is turning slowly in the counterclockwise direction.

C. The voltage on the generator side of the output breaker is slightly lower than grid voltage.

D. The voltage on the generator side of the output breaker is slightly higher than grid voltage.

QUESTION: 19

A nuclear power plant has been operating at steady-state 100 percent power for one month, and with the same reactor coolant boron concentration for the last 24 hours.

Which one of the following changes associated with an in-service reactor coolant letdown ion exchanger will increase the reactor coolant boron concentration in the ion exchanger effluent?

A. Increase the flow rate of reactor coolant being processed from 75 gpm to 100 gpm.

B. Decrease the flow rate of reactor coolant being processed from 75 gpm to 50 gpm.

C. Increase the temperature of the reactor coolant being processed from 95°F to 105°F.

D. Decrease the temperature of the reactor coolant being processed from 105°F to 95°F.

QUESTION: 20

A reactor has been operating at a constant 50 percent power level for 15 hours following a one-hour 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: 21

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, thermal efficiency will _____; and if the temperature of the feedwater entering the steam generators is increased, thermal efficiency will _____.

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

QUESTION: 22

An ideal auxiliary steam turbine exhausts to the atmosphere. The steam turbine is supplied with dry saturated steam at 900 psia. Which one of the following is the maximum specific work (Btu/lbm) that can be extracted from the steam by the steam turbine?

A. 283 Btu/lbm

B. 670 Btu/lbm

C. 913 Btu/lbm

D. 1,196 Btu/lbm

QUESTION: 23

An open container holds 1.0 lbm of saturated water at standard atmospheric pressure. The addition of 1.0 Btu to the water will…

A. raise the temperature of the water by 1°F.

B. vaporize a portion of the water.

C. increase the density of the water.

D. result in 1°F of superheat.

QUESTION: 24

During a local inspection of a manually-operated 12-inch gate valve, the valve stem is observed to extend outward from the valve handwheel by 1 inch. The entire external valve stem is threaded, except for a 1-inch section that becomes smooth just before the valve stem enters the packing gland.

Which one of the following describes the position of the gate valve?

A. The valve is fully open, or nearly fully open.

B. The valve is fully closed, or nearly fully closed.

C. The valve may be in any position, because it is a rising stem gate valve.

D. The valve may be in any position, because it is a non-rising stem gate valve.

QUESTION: 25

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 the pulse height discrimination threshold does not change.

If the detector voltage is decreased significantly, but maintained within the proportional region, the detector count rate indication will _____; and the detector will become _____ susceptible to the positive space charge effect.

A. decrease; less

B. decrease; more

C. remain the same; less

D. remain the same: more

QUESTION: 26

The power range nuclear instruments were adjusted to 100 percent based on a calculated heat balance. Which one of the following would cause indicated reactor power to be lower than actual reactor power?

A. The feedwater temperature used in the heat balance calculation was 10°F lower than actual feedwater temperature.

B. The reactor coolant pump heat input term was omitted from the heat balance calculation.

C. The feedwater flow rate used in the heat balance calculation was 10 percent lower than actual feedwater flow rate.

D. The steam pressure used in the heat balance calculation was 50 psi lower than actual steam pressure.

QUESTION: 27

A reactor startup is in progress. Control rod withdrawal was stopped several minutes ago to assess criticality. Which one of the following is a combination of indications that together support a declaration that the reactor has reached criticality?

A. Startup rate is stable at 0.0 DPM; source range count rate is stable.

B. Startup rate is stable at 0.2 DPM; source range count rate is stable.

C. Startup rate is stable at 0.0 DPM; source range count rate is slowly increasing.

D. Startup rate is stable at 0.2 DPM; source range count rate is slowly increasing.

QUESTION: 28

Which one of the following specifies the proper pump discharge valve position, and the basis for that position, when starting a large motor-driven radial-flow centrifugal pump?

A. Fully open, to reduce motor starting power requirements.

B. Throttled, to reduce motor starting power requirements.

C. Fully open, to ensure adequate pump net positive suction head.

D. Throttled, to ensure adequate pump net positive suction head.

QUESTION: 29

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: 30

Refer to the drawing of a flow control valve and valve actuator in a control loop (see figure below).

In addition to the components in the figure, the control loop includes the following:

- Sensor
- Controller
- Valve positioner

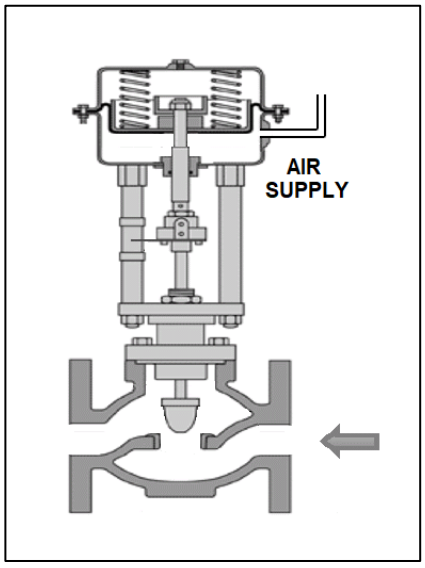
Currently, the flow control valve is 50 percent open, the position demanded by the controller. If the air supply line to the valve actuator shears off, the valve positioner will…

A. override the valve actuator, and lock the valve in its current position.

B. override the valve actuator, and move the valve to the demanded position.

C. increase the flow rate of air to the sheared air supply line, with no effect on valve position.

D. decrease the flow rate of air to the sheared air supply line, with no effect on valve position.



QUESTION: 31

Refer to the graph of neutron flux versus time (see figure below) for a nuclear power plant reactor that experienced a reactor trip from extended full power operation at 0 seconds.

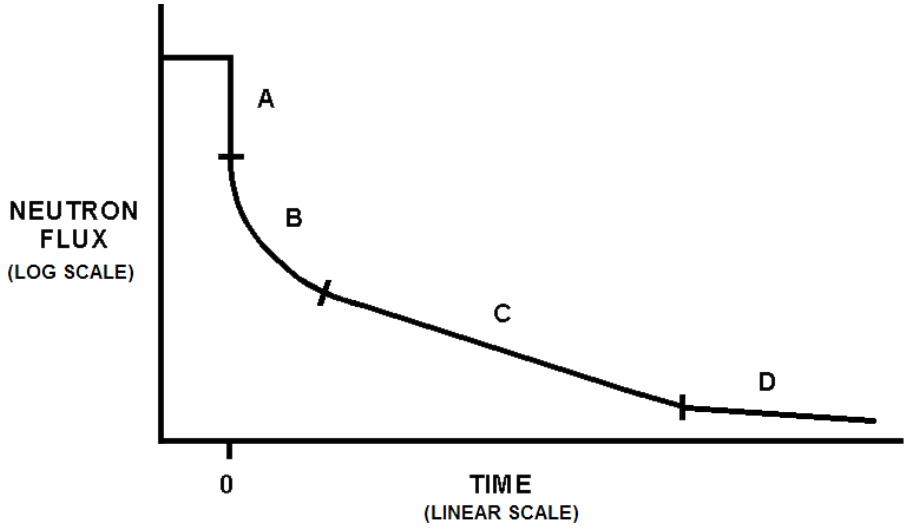
Which section(s) of the curve has/have a slope that is primarily determined by the production rate of delayed neutrons?

A. B only

B. B and C

C. C only

D. C and D



QUESTION: 32

Refer to the drawing of a bellows-type pressure detector (see figure below).

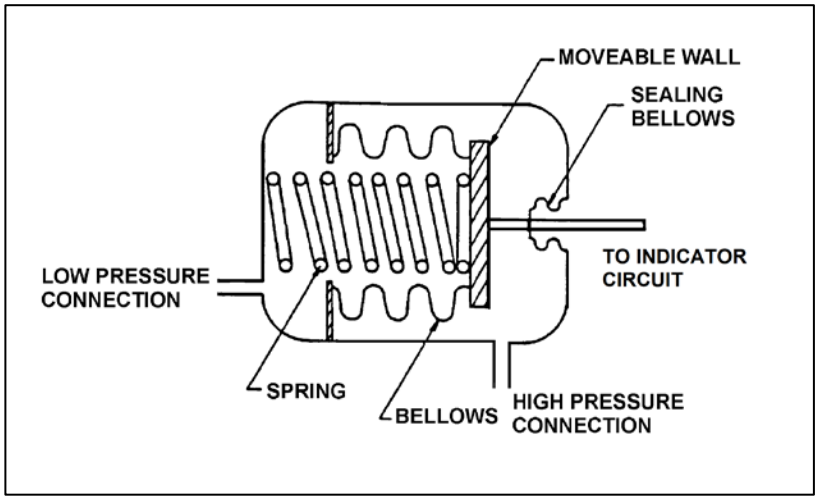
The bellows-type pressure detector is being used to measure reactor vessel pressure. The low-pressure side of the detector is vented to containment atmosphere. An increase in the reactor vessel pressure indication will be caused by either a _____; or a containment pressure _____.

A. broken spring; decrease

B. broken spring; increase

C. ruptured bellows; decrease

D. ruptured bellows; increase



QUESTION: 33

Initially, a reactor is shut down with no xenon-135 in the core. Over the next 4 hours, the reactor is made critical and power level is increased to 25 percent. The shift supervisor has directed that power level and reactor coolant temperature be maintained constant for 12 hours.

To accomplish this objective, control rods will have to be...

A. withdrawn periodically for the duration of the 12 hours.

B. inserted periodically for the duration of the 12 hours.

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

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

QUESTION: 34

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 group 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: 35

A reactor is operating at 80 percent power with all control rods fully withdrawn. Compared to a 50 percent insertion of a group (or bank) of control rods, a 50 percent insertion of a single control rod will cause a _____ increase in the maximum axial peaking factor; and a _____ increase in the maximum radial peaking factor. (Assume reactor power remains constant.)

A. larger; larger

B. larger; smaller

C. smaller; larger

D. smaller; smaller

QUESTION: 36

Which one of the following is most likely to cause cavitation in an operating centrifugal pump?

A. Lowering the suction temperature.

B. Throttling the pump suction valve.

C. Throttling the pump discharge valve.

D. Decreasing the pump speed.

QUESTION: 37

A reactor startup is in progress. The reactor is slightly subcritical with a constant startup rate of 0.0 DPM. If control rods are inserted for a few seconds, the startup rate will become negative initially, and then...

A. gradually become less negative and return to 0.0 DPM.

B. gradually become more negative until source neutrons become the only significant contributor to the neutron population, and then return to 0.0 DPM.

C. stabilize until source neutrons become the only significant contributor to the neutron population, and then return to 0.0 DPM.

D. stabilize at -1/3 DPM until fission neutrons are no longer a significant contributor to the neutron population, and then return to 0.0 DPM.

QUESTION: 38

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: 39

Refer to the drawing of a valve motor control circuit for a valve that is currently fully closed (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.

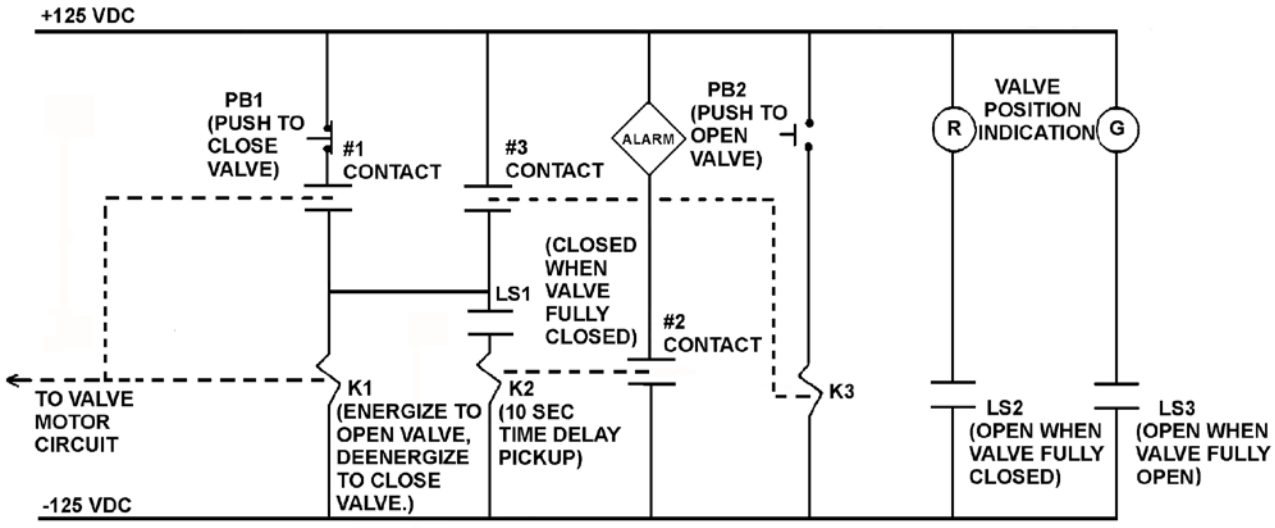
Which one of the following describes when the motor-operated valve will begin to stroke open?

A. At the same time the alarm actuates.

B. 10 seconds after PB2 is depressed.

C. Immediately after PB2 is depressed.

D. Immediately after PB1 is depressed if contact #1 is closed.



VALVE MOTOR CONTROL CIRCUIT

QUESTION: 40

Which one of the following will produce a ground fault in an energized AC motor?

A. A conductive path from one stator winding to a different stator winding.

B. A conductive path from one stator winding to the motor housing.

C. A conductive path between the motor housing and a technician's hand.

D. A conductive path between the motor housing and its steel foundation.

QUESTION: 41

The following are the initial conditions for a nuclear power plant:

- Reactor power is 50 percent.
- Average reactor coolant temperature is 570°F.
- Reactor coolant boron concentration is 400 ppm.

After a power increase, the current plant conditions are as follows:

- Reactor power is 80 percent.
- Average reactor coolant temperature is 582°F.
- Reactor coolant boron concentration is 400 ppm.

Which one of the following describes the current differential boron worth (DBW) in ΔK/K/ppm compared to the initial DBW?

A. The current DBW is more negative because a 1°F increase in reactor coolant temperature will remove more boron-10 atoms from the core.

B. The current DBW is more negative because a 1 ppm increase in reactor coolant boron concentration will add more boron-10 atoms to the core.

C. The current DBW is less negative because a 1°F increase in reactor coolant temperature will remove fewer boron-10 atoms from the core.

D. The current DBW is less negative because a 1 ppm increase in reactor coolant boron concentration will add fewer boron-10 atoms to the core.

QUESTION: 42

Because of a thermocouple temperature display failure, the millivolt output of a thermocouple circuit is being converted to a temperature value using conversion tables. The tables are based on a thermocouple reference junction temperature of 32°F. The actual reference junction is located in a panel that is maintained at 96°F. Room temperature surrounding the panel is 72°F.

What adjustment must be made to the temperature value taken from the conversion tables to calculate the actual temperature at the measuring tip of the thermocouple?

A. Add 40°F.

B. Subtract 40°F.

C. Add 64°F.

D. Subtract 64°F.

QUESTION: 43

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 reactor coolant letdown 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: 44

If the fission rate in a reactor core steadily increases, the mode of heat transfer that occurs immediately after the critical heat flux is reached is called...

A. transition boiling.

B. subcooled nucleate boiling.

C. saturated nucleate boiling.

D. stable film boiling.

QUESTION: 45

A reactor had been operating at 100 percent power for 3 months when a loss of offsite power occurred, causing a reactor trip and a loss of forced reactor coolant flow. If forced reactor coolant flow is not restored, which one of the following describes the relationship between reactor coolant hot leg and cold leg temperatures one hour after the reactor trip?

A. Hot leg temperature will be greater than cold leg temperature because natural circulation cooling flow occurs in the same direction as forced reactor coolant flow.

B. Hot leg temperature will be less than cold leg temperature because natural circulation cooling flow occurs in the opposite direction as forced reactor coolant flow.

C. Hot leg temperature will be approximately the same as cold leg temperature because only the density of the reactor coolant changes during natural circulation cooling.

D. Hot leg temperature will be approximately the same as cold leg temperature because the reactor does not produce a significant amount of heat one hour after a reactor trip.

QUESTION: 46

A nuclear power plant is operating at steady-state 100 percent power. By the time the main turbine exhaust passes through the upper half of the main condenser tube bundles, all of the exhaust steam has condensed. As the condensate passes through the lower half of the tube bundles, the condensate temperature will…

A. decrease, because the main condenser pressure is slightly greater in the lower half of the tube bundles.

B. decrease, because the cooling water temperature is less than the condensate temperature in the lower half of the tube bundles.

C. remain the same, because the saturation temperatures for the upper and lower halves of the tube bundles are the same.

D. remain the same, because the condensate and cooling water temperatures in the lower half of the tube bundles are the same.

QUESTION: 47

Brittle fracture of the reactor vessel (RV) is most likely to occur during a reactor coolant system _____ when RV temperature is _____ the nil-ductility transition temperature.

A. cooldown; above

B. heatup; above

C. cooldown; below

D. heatup; below

QUESTION: 48

Which one of the following is a characteristic of a prompt neutron?

A. Expelled with an average kinetic energy of about 2.0 MeV.

B. Usually emitted by the excited nucleus of a fission product.

C. Accounts for less than one percent of all fission neutrons.

D. Requires about 0.5 seconds to become a thermal neutron.

QUESTION: 49

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 tank is filled to a level of 26 feet with 60°F water.
- The pump is currently operating at 50 gpm.
- The pump requires 30 feet of net positive suction head.

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 <u>not</u> cavitating; pump flow rate will gradually decrease with tank level and then rapidly decrease when cavitation begins at a lower tank level.

D. The pump is currently <u>not</u> cavitating; pump flow rate will gradually decrease with tank level and then rapidly decrease as the pump becomes air bound when the tank empties.

QUESTION: 50

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

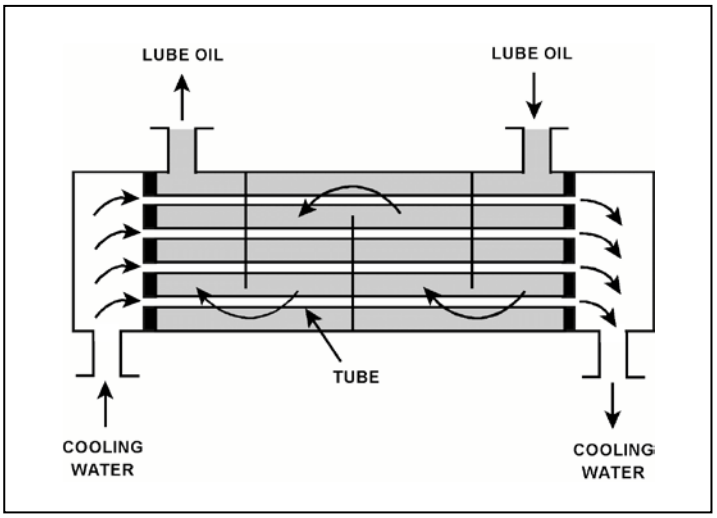
If mineral deposits accumulate on the outside of the cooling water tubes, the cooling water outlet temperature will _____; and the lube oil outlet temperature will _____. (Assume the lube oil and cooling water inlet temperatures and mass flow rates do <u>not</u> change.)

A. increase; decrease

B. increase; increase

C. decrease; decrease

D. decrease; increase



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

NRC GENERIC FUNDAMENTALS EXAMINATION
MARCH 2021 – PWR

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