

**UNITED STATES NUCLEAR REGULATORY COMMISSION  
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION  
MARCH 2008--FORM A**

**Please Print**

Name: \_\_\_\_\_

Docket No.: \_\_\_\_\_

Facility: \_\_\_\_\_

Start Time: \_\_\_\_\_ Stop Time: \_\_\_\_\_

**INSTRUCTIONS TO APPLICANT**

Answer all the test items using the answer sheet provided, ensuring a single answer is marked for each test item. Each test item has equal point value. A score of at least 80% is required to pass this portion of the NRC operator licensing written examination. All examination papers will be collected 3.0 hours after the examination begins. This examination applies to a typical pressurized water reactor (PWR) nuclear power plant.

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

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

\_\_\_\_\_  
Applicant's Signature

**RULES AND GUIDELINES FOR THE NRC  
GENERIC FUNDAMENTALS EXAMINATION**

During the administration of this examination the following rules apply:

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

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 time.
5. Two aids are provided for your use during the examination:
  - (1) An equations and conversions sheet contained within the examination copy, and
  - (2) Steam tables and Mollier Diagram provided by your proctor.
6. Place your answers on the answer sheet provided. Credit will only be given for answers properly marked on this sheet. Follow the instructions for filling out the answer sheet.
7. Scrap paper will be provided for calculations.
8. Cheating on the examination will result in the automatic forfeiture of this examination. Cheating could also result in severe penalties.
9. Restroom trips are limited. Only **ONE** examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside of the examination room.
10. After you have completed the examination, sign the statement on the cover sheet indicating that the work is your own and you have neither given nor received any assistance in completing the examination. Either pencil or pen may be used.
11. Turn in your examination materials, answer sheet on top, followed by the examination copy and the examination aids - steam table booklets, handouts, and scrap paper used during the examination.
12. After turning in your examination materials, leave the examination area, as defined by the proctor. If after leaving you are found in the examination area while the examination is in progress, your examination may be forfeited.

**GENERIC FUNDAMENTALS EXAMINATION**  
**EQUATIONS AND CONVERSIONS HANDOUT SHEET**

**EQUATIONS**

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

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

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

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

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

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

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

$$\text{SUR} = 26.06/\tau$$

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

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

$$\ell^* = 1 \times 10^{-4} \text{ sec}$$

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

$$\text{DRW} \propto \phi_{\text{tip}}^2 / \phi_{\text{avg}}^2$$

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

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

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

$$\text{CR}_{\text{S/D}} = S/(1 - K_{\text{eff}})$$

$$\text{CR}_1(1 - K_{\text{eff}1}) = \text{CR}_2(1 - K_{\text{eff}2})$$

$$1/M = \text{CR}_1/\text{CR}_x$$

$$A = \pi r^2$$

$$F = PA$$

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

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

$$E = IR$$

$$\text{Thermal Efficiency} = \text{Net Work Out}/\text{Energy In}$$

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

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

**CONVERSIONS**

---

$$1 \text{ Mw} = 3.41 \times 10^6 \text{ Btu/hr}$$

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

$$1 \text{ Btu} = 778 \text{ ft-lbf}$$

$$^\circ\text{C} = (5/9)(^\circ\text{F} - 32)$$

$$^\circ\text{F} = (9/5)(^\circ\text{C}) + 32$$

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

$$1 \text{ kg} = 2.21 \text{ lbm}$$

$$1 \text{ gal}_{\text{water}} = 8.35 \text{ lbm}$$

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

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QUESTION: 1

A vertical safety valve has a compressed spring assembly that is applying 2,500 lbf to the top of the valve disk in opposition to system pressure. System pressure is being exerted on the underside of the valve disk which is 5 inches in diameter.

Which one of the following is the approximate system pressure at which the safety valve will open? (Neglect the effect of atmospheric pressure.)

- A. 32 psi
- B. 127 psi
- C. 159 psi
- D. 500 psi

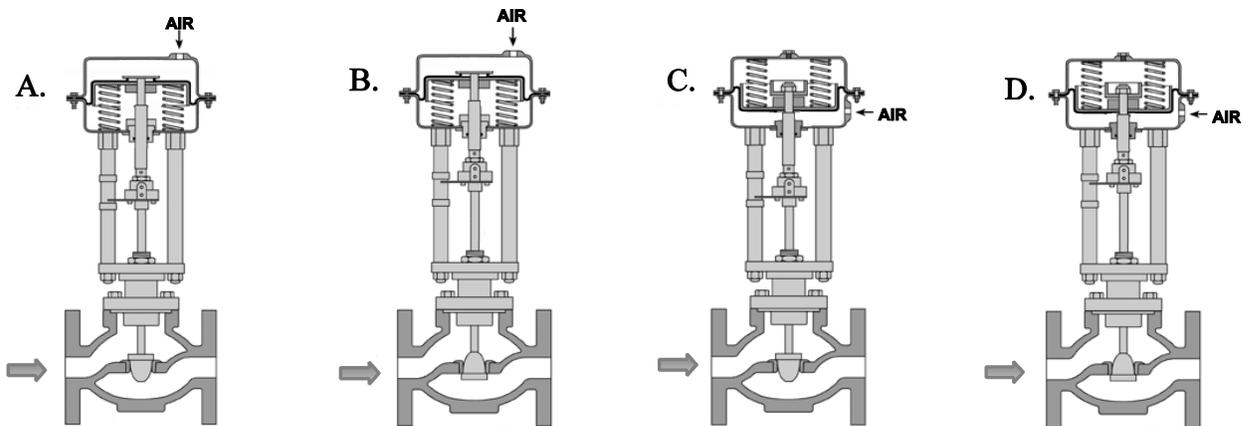
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QUESTION: 2

Refer to the drawing of four air-operated valves (see figure below). **Note:** The valve actuators may be shown with or without air pressure applied.

Which valves are currently shown in their failed (i.e., no air pressure applied to the actuator) positions?

- A. A and B
- B. B and C
- C. C and D
- D. D and A



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QUESTION: 3

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 \_\_\_\_\_ to \_\_\_\_\_.

- A. volumetric flow rate; mass flow rate
- B. volumetric flow rate; differential pressure
- C. differential pressure; mass flow rate
- D. differential pressure; volumetric flow rate

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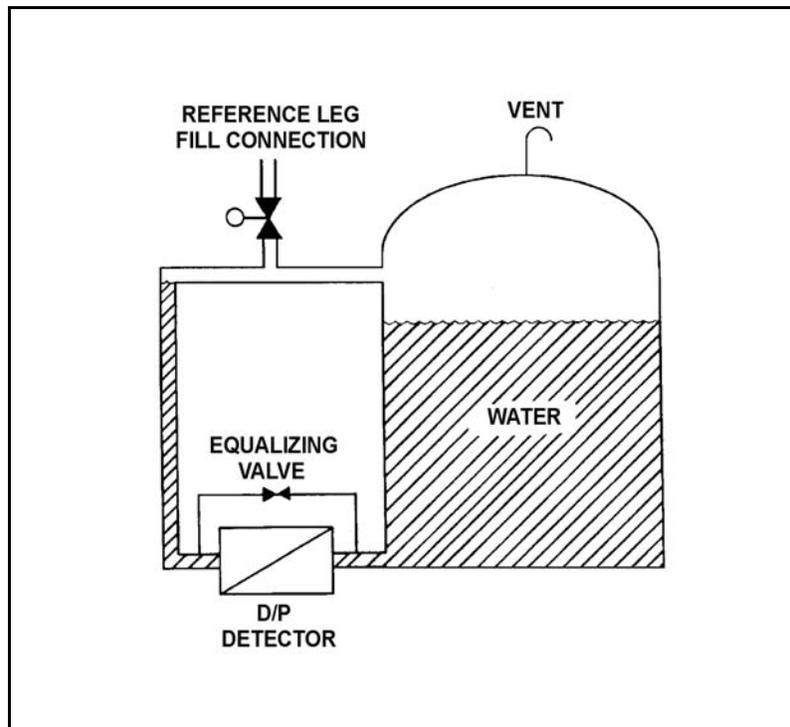
QUESTION: 4

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

Assume the initial temperature of the reference leg and the water in the tank is 100°F, and that reference leg temperature does not change.

If the temperature of the water in the tank increases by 20°F, the D/P sensed by the detector will \_\_\_\_\_ as long as the water \_\_\_\_\_ is maintained constant.

- A. increase; level
- B. decrease; level
- C. increase; mass
- D. decrease; mass



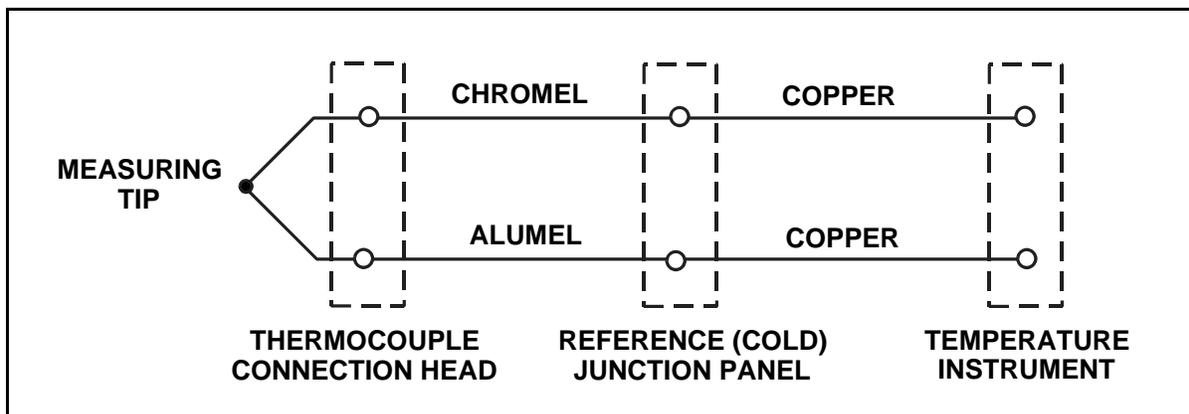
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QUESTION: 5

Refer to the drawing of a 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. The reference junctions will be located in the thermocouple connection head.
- B. The reference junctions will still be located in the reference junction panel.
- C. The reference junctions will be located in the temperature instrument.
- D. There will no longer be any reference junctions.



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QUESTION: 6

A  $\text{BF}_3$  proportional counter is being used to measure neutron level during a reactor startup. Which of the following describes the method used to ensure that neutron indication is not being affected by gamma reactions in the detector?

- A. Two counters are used, one sensitive to neutron and gamma and the other sensitive to gamma only. The outputs are electrically opposed to cancel the gamma-induced currents.
- B. The  $\text{BF}_3$  proportional counter measures neutron flux of sufficient intensity that the gamma signal is insignificant compared to the neutron signal.
- C. In a proportional counter gamma-induced pulses are of insufficient duration to generate a significant log-level amplifier output. Only neutron pulses have sufficient duration to be counted by the detector instrumentation.
- D. In a proportional counter neutron-induced pulses are significantly larger than gamma pulses. The detector instrumentation filters out the smaller gamma pulses.

QUESTION: 7

An automatic flow controller is being used to position a valve in a cooling water system. The controller develops a flow error signal and then increases the magnitude of the signal to drive the valve operator.

The factor by which the magnitude of the flow error signal is increased is referred to as...

- A. bias.
- B. gain.
- C. feedback.
- D. offset.

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QUESTION: 8

A reverse-acting proportional controller is being used to control the temperature of lube oil exiting a heat exchanger. The controller's proportional band is 70°F to 120°F.

Which one of the following will be the controller output when the measured lube oil temperature is 83°F?

- A. 13%
- B. 26%
- C. 74%
- D. 87%

QUESTION: 9

A diesel generator is supplying an isolated electrical bus with the governor operating in the isochronous mode. If a large electrical load is started on the bus, generator frequency will...

- A. initially decrease, then increase and stabilize below the initial value.
- B. initially decrease, then increase and stabilize at the initial value.
- C. initially decrease, then increase and stabilize above the initial value.
- D. remain constant during and after the load start.

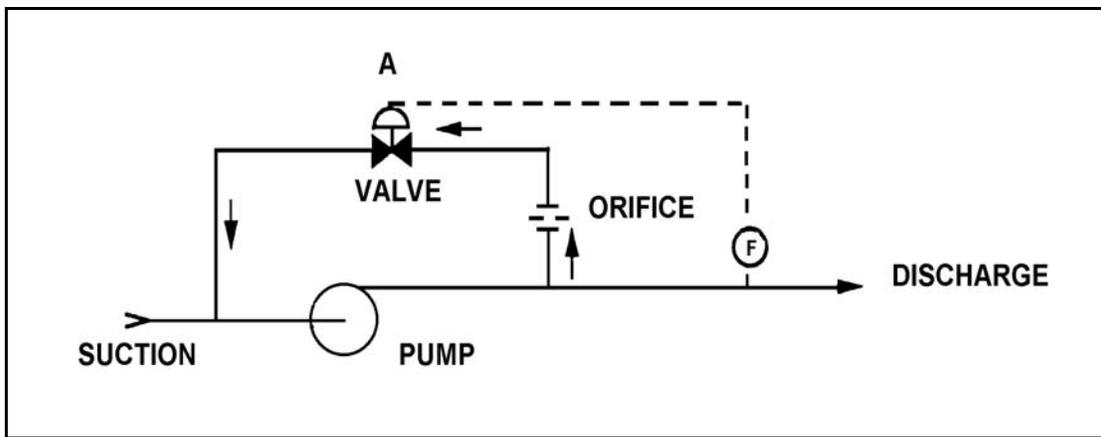
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QUESTION: 10

Refer to the drawing of a pump with a recirculation line (see figure below).

Valve "A" will open when pump...

- A. discharge pressure increases above a setpoint.
- B. discharge pressure decreases below a setpoint.
- C. flow rate increases above a setpoint.
- D. flow rate decreases below a setpoint.



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QUESTION: 11

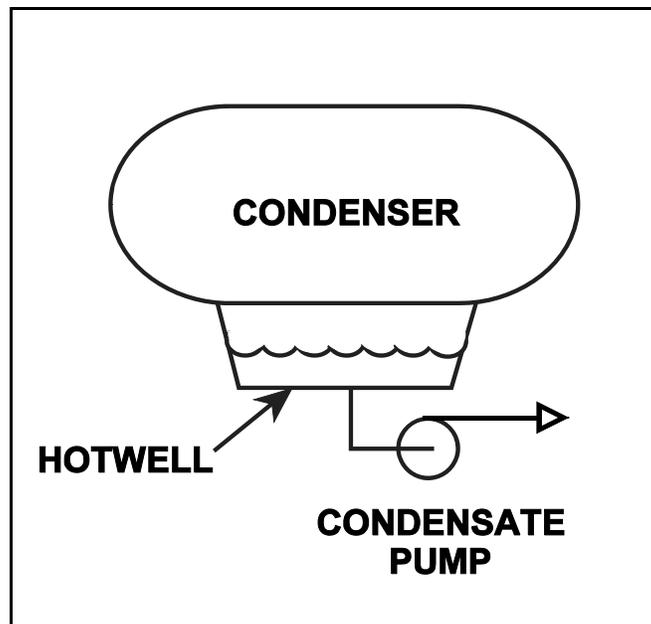
Refer to the drawing of a steam condenser, hotwell, and condensate pump (see figure below).

Given the following:

- The eye of the pump impeller is located 6.0 feet below the bottom of the hotwell.
- The pump requires 10.0 ft-lbf/lbm of net positive suction head (NPSH).
- Condenser pressure is 1.2 psia.
- Hotwell water temperature is 90°F.
- Fluid velocity and friction head losses are zero.

What is the minimum hotwell water level necessary to provide the required NPSH?

- A. 1.2 feet
- B. 2.8 feet
- C. 4.0 feet
- D. 5.2 feet



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QUESTION: 12

A typical radial-flow centrifugal pump is operating at rated conditions in an open system with all valves fully open. If the pump discharge valve is throttled to 50% closed, pump discharge pressure will \_\_\_\_\_ and pump motor current will \_\_\_\_\_.

- A. decrease; decrease
- B. decrease; increase
- C. increase; increase
- D. increase; decrease

QUESTION: 13

A pump is needed to supply fuel oil from a day tank to a diesel engine fuel injection system. The pump must maintain a nearly constant flow rate with a minimum of discharge pressure fluctuations as system pressure varies between 200 psig and 1,900 psig.

Which one of the following types of pumps would typically be used in this application?

- A. Axial flow centrifugal
- B. Radial flow centrifugal
- C. Rotary positive displacement
- D. Reciprocating positive displacement

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QUESTION: 14

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

Voltage:	22 KV
Frequency:	60 Hertz
Load--Real:	600 MW
Load--Reactive:	100 MVAR (VARs out)
Power Factor:	0.986

Which one of the following contains a combination of manual adjustments to the main generator voltage regulator and speed control setpoints such that each adjustment will initially result in a decrease in main generator amps?

- |    | <u>Voltage<br/>Setpoint</u> | <u>Speed<br/>Setpoint</u> |
|----|-----------------------------|---------------------------|
| A. | Increase                    | Increase                  |
| B. | Increase                    | Decrease                  |
| C. | Decrease                    | Increase                  |
| D. | Decrease                    | Decrease                  |

QUESTION: 15

If the speed of a variable speed centrifugal pump is increased to cause pump flow rate to double, pump motor current will...

- A. remain constant.
- B. increase two-fold (double).
- C. increase four-fold.
- D. increase eight-fold.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 16

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

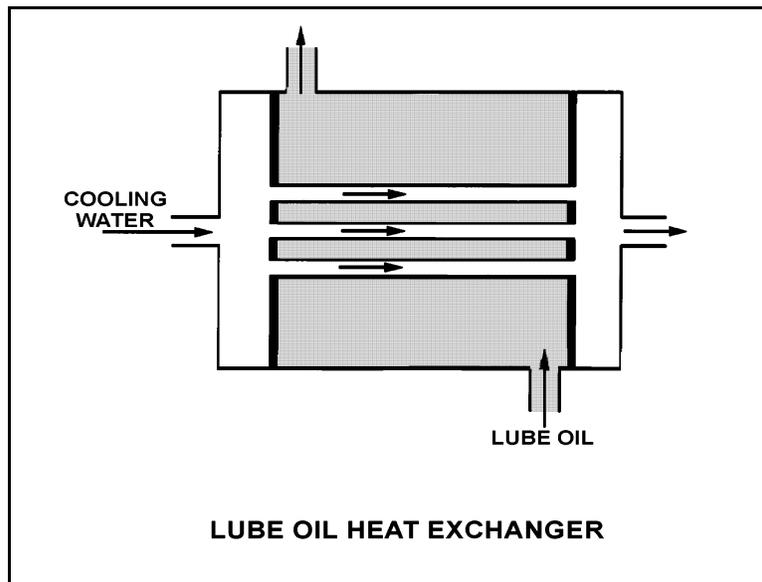
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 130°F

Cooling water inlet temperature: 70°F

Given that cooling water mass flow rate is greater than lube oil mass flow rate, which one of the following pairs of heat exchanger outlet temperatures is not possible? (Neglect any difference between the fluid specific heat capacities.)

- |    | <u>Lube Oil<br/>Outlet Temp</u> | <u>Cooling Water<br/>Outlet Temp</u> |
|----|---------------------------------|--------------------------------------|
| A. | 90°F                            | 105°F                                |
| B. | 90°F                            | 100°F                                |
| C. | 110°F                           | 95°F                                 |
| D. | 110°F                           | 85°F                                 |



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QUESTION: 17

A nuclear power plant is operating at steady-state 100% power when air leakage causes main condenser vacuum to decrease from 28 inches Hg to 27 inches Hg. Assume the steam inlet quality and mass flow rate of steam through the main turbine remain unchanged, and that condenser cooling water inlet temperature and flow rate do not change.

When the plant stabilizes, turbine exhaust quality will be \_\_\_\_\_ and turbine exhaust temperature will be \_\_\_\_\_.

- A. higher; higher
- B. higher; lower
- C. lower; higher
- D. lower; lower

QUESTION: 18

A higher- than-expected differential pressure across an operating mixed-resin demineralizer can be caused by...

- A. exhaustion of the cation exchange resin.
- B. channeling through the resin bed.
- C. insufficient resin backwash.
- D. decreased demineralizer inlet conductivity.

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QUESTION: 19

A nuclear power plant has been operating normally at 100% 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 demineralizer will cause an increase in reactor coolant boron concentration in the demineralizer effluent?

- A. Increase the temperature of the reactor coolant being processed from 95°F to 105°F.
- B. Decrease the temperature of the reactor coolant being processed from 105°F to 95°F.
- C. Increase the flow rate of reactor coolant being processed from 75 gpm to 100 gpm.
- D. Decrease the flow rate of reactor coolant being processed from 75 gpm to 50 gpm.

QUESTION: 20

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

- A. OFF position directly to the ON position; trip latch reset is not required.
- B. OFF position to the midposition to reset the trip latch, and then to the ON position.
- C. midposition directly to the ON position; trip latch reset is not required.
- D. midposition to the OFF position to reset the trip latch, and then to the ON position.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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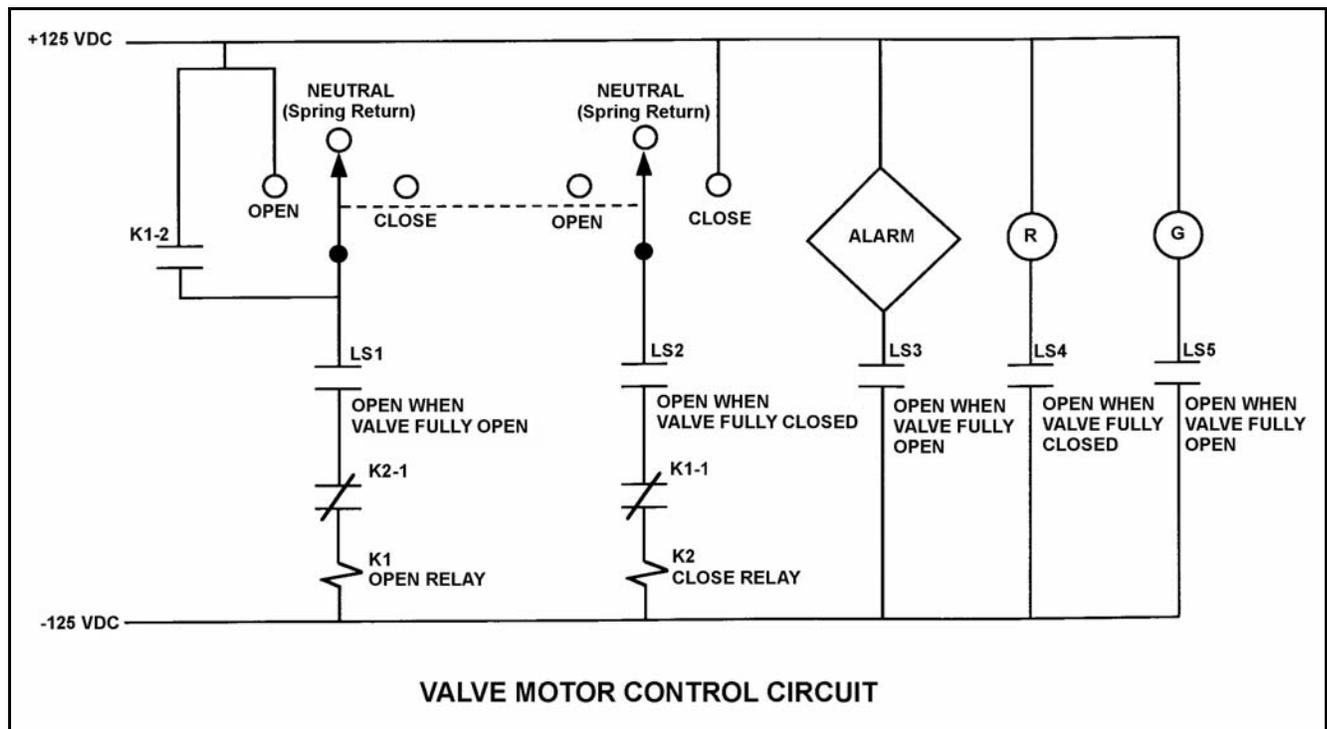
QUESTION: 21

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.

Which one of the following describes the valve response if the control switch is taken to the “Open” position for two seconds and then released?

- A. The valve will not move.
- B. The valve will open fully.
- C. The valve will begin to open and then stop moving.
- D. The valve will begin to open and then close fully.



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 22

A main generator is about to be connected to an infinite power grid. Closing the generator output breaker with generator and grid voltages matched, but with generator frequency lower than grid frequency will initially result in the generator...

- A. picking up a portion of the grid real load.
- B. picking up a portion of the grid reactive load.
- C. experiencing reverse power conditions.
- D. experiencing overspeed conditions.

QUESTION: 23

Which one of the following types of neutrons in a nuclear reactor is more likely to cause fission of a U-238 nucleus in the reactor fuel? (Assume that each type of neutron remains in the reactor core until it interacts with a U-238 nucleus.)

- A. Thermal neutron
- B. Prompt fission neutron beginning to slow down
- C. Delayed fission neutron beginning to slow down
- D. Neutron at a U-238 resonance energy

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 24

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 50%
- Rod control is in manual
- Reactor coolant system (RCS) boron concentration is 600 ppm

Disregarding the effects of fission product poisons, which one of the following will result in a decrease in the available shutdown margin once the plant stabilizes?

- A. Reactor power is reduced to 45% with final RCS boron concentration at 620 ppm.
- B. Reactor power is increased to 55% with final RCS boron concentration at 580 ppm.
- C. Control rods are withdrawn 3 inches with no change in steady-state reactor power or RCS boron concentration.
- D. Control rods are inserted 3 inches with no change in steady-state reactor power or RCS boron concentration.

QUESTION: 25

Which characteristic of delayed neutrons is primarily responsible for enhancing the stability of a nuclear reactor following a reactivity change?

- A. They are born at a lower average energy than prompt neutrons.
- B. They are more likely to experience resonance absorption than prompt neutrons.
- C. They comprise a smaller fraction of the total neutron flux than prompt neutrons.
- D. They require more time to be produced following a fission event than prompt neutrons.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 26

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

- A. a decrease in the thermal utilization factor.
- B. an increase in the thermal utilization factor.
- C. a decrease in the resonance escape probability.
- D. an increase in the resonance escape probability.

QUESTION: 27

Which one of the following will cause the Doppler power coefficient to become more negative?

- A. Increased clad creep
- B. Increased pellet swell
- C. Lower power level
- D. Higher reactor coolant boron concentration

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QUESTION: 28

During normal full power operation, the differential control rod worth is less negative at the top and bottom of the core compared to the center regions due to the effects of...

- A. reactor coolant boron concentration.
- B. neutron flux distribution.
- C. xenon concentration.
- D. fuel temperature distribution.

QUESTION: 29

With a nuclear power plant operating normally at full power, a 5°F decrease in moderator temperature will cause the differential control rod worth to become...

- A. more negative due to better moderation of neutrons.
- B. less negative due to shorter neutron migration length.
- C. more negative due to increased neutron absorption in moderator.
- D. less negative due to increased resonance absorption of neutrons.

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QUESTION: 30

Following a two-week shutdown, a nuclear reactor is taken critical and ramped to full power in 6 hours. How long will it take to achieve an equilibrium xenon condition after the reactor reaches full power?

- A. 70 to 80 hours
- B. 40 to 50 hours
- C. 8 to 10 hours
- D. 1 to 2 hours

QUESTION: 31

A nuclear power plant is being returned to operation following a one-month refueling outage. Fuel preconditioning requires reactor power to be increased from 10% to full power gradually over a one week period.

During this slow power increase, most of the positive reactivity added by the operator is required to overcome the negative reactivity from...

- A. fuel burnup.
- B. xenon buildup.
- C. fuel temperature increase.
- D. moderator temperature increase.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 32

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

- A. decrease because irradiated boron-10 atoms undergo a neutron-alpha reaction.
- B. decrease because boron atoms decompose at normal RCS operating temperatures.
- 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: 33

During a nuclear reactor startup, the first reactivity addition caused the source range count rate to increase from 20 to 40 cps. The second reactivity addition caused the count rate to increase from 40 to 160 cps.

Which one of the following statements accurately compares the two reactivity additions?

- A. The first reactivity addition was larger.
- B. The second reactivity addition was larger.
- C. The first and second reactivity additions were equal.
- D. There is not enough data given to determine the relationship of reactivity values.

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QUESTION: 34

Why are control rod insertion limits established for power operation?

- A. To minimize the worth of a postulated dropped control rod.
- B. To maintain a negative moderator temperature coefficient in the reactor.
- C. To provide adequate shutdown margin after a reactor trip.
- D. To ensure sufficient positive reactivity is available to compensate for the remaining power defect.

QUESTION: 35

A nuclear reactor is currently operating in the source range with a stable period of 90 seconds. The core effective delayed neutron fraction ( $\bar{\beta}_{\text{eff}}$ ) is 0.006. How much additional positive reactivity must be added to establish a stable period of 60 seconds?

- A. 0.00026  $\Delta K/K$
- B. 0.00034  $\Delta K/K$
- C. 0.00068  $\Delta K/K$
- D. 0.00086  $\Delta K/K$

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QUESTION: 36

After one month of operation at 100% reactor power, the fraction of thermal power being produced from the decay of fission products in the operating nuclear reactor is...

- A. greater than 10%.
- B. greater than 5% but less than 10%.
- C. greater than 1% but less than 5%.
- D. less than 1%.

QUESTION: 37

A water storage tank is enclosed to prevent vapors from escaping to the environment. The tank is also pressurized to prevent boiling. A differential pressure detector with a dry reference leg is used to measure the tank level.

To achieve the greatest accuracy of measurement, the low pressure side of the detector should sense which one of the following?

- A. The pressure at the bottom of the tank
- B. The pressure of the atmosphere surrounding the tank
- C. The pressure of a column of water external to the tank
- D. The pressure of the vapor space at the top of the tank

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QUESTION: 38

A pressurizer is operating in a saturated condition at 636°F. If a sudden pressurizer level decrease of 10% occurs, pressurizer pressure will \_\_\_\_\_ and pressurizer temperature will \_\_\_\_\_.

- A. remain the same; decrease
- B. remain the same; remain the same
- C. decrease; decrease
- D. decrease; remain the same

QUESTION: 39

A reactor trip occurred 10 minutes ago due to a loss of coolant accident. Emergency coolant injection is in progress and pressurizer level is increasing. Current pressurizer conditions are as follows:

Pressurizer liquid temperature	= 540°F
Pressurizer vapor temperature	= 607°F
Pressurizer pressure	= 1,410 psia
Pressurizer level	= 60%

Given these conditions, the pressurizer liquid is \_\_\_\_\_ and the pressurizer vapor is \_\_\_\_\_.

- A. saturated; saturated
- B. saturated; superheated
- C. subcooled; saturated
- D. subcooled; superheated

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QUESTION: 40

A nuclear power plant is being maintained at 2,220 psig. A pressurizer safety/relief valve is leaking saturated steam (100% quality) to a collection tank which is being held at 20 psig.

Neglecting heat losses to ambient, which one of the following is the approximate temperature of the fluid downstream of the relief valve?

- A. 162°F
- B. 228°F
- C. 259°F
- D. 320°F

QUESTION: 41

A nuclear power plant is initially operating at 85% reactor power when extraction steam to a high-pressure feedwater heater is isolated. Main generator load is returned to its initial value. When the plant stabilizes, reactor power will be \_\_\_\_\_ than 85% and overall plant thermal efficiency will be \_\_\_\_\_.

- A. greater; lower
- B. greater; higher
- C. less; lower
- D. less; higher

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QUESTION: 42

The possibility of water hammer will be increased by...

- A. maintaining the discharge line filled with liquid on an automatically starting pump.
- B. condensation in a steam line just prior to initiating flow.
- C. warming steam lines prior to initiating steam flow.
- D. slowly closing the discharge valve on an operating pump.

QUESTION: 43

A vented water storage tank contains 60 feet of water at 70°F. A cracked weld at the bottom rim of the tank results in a leak rate of 12 gpm. If makeup water flow rate is 5 gpm, at what water level will the tank stabilize? (Ignore any frictional head losses as the water exits the tank.)

- A. 38.7 feet
- B. 25.0 feet
- C. 10.4 feet
- D. 0.0 feet

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
MARCH 2008 PWR--FORM A**

QUESTION: 44

During steady state power operation, core thermal power can be most accurately determined by multiplying the total mass flow rate of the...

- A. reactor coolant by the change in temperature across the core.
- B. reactor coolant by the change in enthalpy in the steam generators.
- C. feedwater by the change in enthalpy in the steam generators.
- D. feedwater by the change in temperature across the core.

QUESTION: 45

Which one of the following describes why the core heat transfer rate increases when nucleate boiling begins on the surface of a fuel rod?

- A. Steam has a greater thermal conductivity than water.
- B. The formation of steam bubbles increases coolant flow rate along the fuel rod.
- C. Radiative heat transfer begins to supplement convective heat transfer.
- D. Heat transfer by steam bubble formation is more effective than through a liquid film.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
MARCH 2008 PWR--FORM A**

QUESTION: 46

A nuclear reactor is shutdown at normal operating temperature and pressure with all control rods inserted. Which one of the following will decrease the departure from nucleate boiling ratio for this reactor? (Assume the reactor remains shutdown.)

- A. Fully withdrawing a bank of shutdown rods
- B. Diluting RCS boron concentration by 50 ppm
- C. Reducing RCS flowrate by 1%
- D. Increasing RCS pressure by 10 psig

QUESTION: 47

During a plant cooldown and depressurization with forced circulation, reactor coolant system (RCS) loop flow and reactor coolant pump (RCP) current indications become erratic. These abnormal indications are most likely caused by...

- A. RCP cavitation.
- B. RCP runout.
- C. RCS loop water hammer.
- D. RCS hot leg saturation.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
MARCH 2008 PWR--FORM A**

QUESTION: 48

A nuclear reactor is shut down at normal operating temperature and pressure with all reactor coolant pumps stopped. Stable natural circulation cooling is in progress with 50°F of RCS subcooling. Which one of the following, if increased, will not affect natural circulation flow rate?

- A. Reactor coolant pressure
- B. Time after reactor trip
- C. Feed water flow rate
- D. Steam generator pressure

QUESTION: 49

A nuclear reactor is operating at 75% power at the middle of a fuel cycle with radial power distribution peaked in the center of the core. All control rods are fully withdrawn and in manual control.

Assuming all control rods remain fully withdrawn, except as noted, which one of the following will cause the maximum steady-state radial peaking (or hot channel) factor to decrease?

- A. Turbine load/reactor power is reduced by 20%.
- B. A control rod located at the edge of the core drops into the core.
- C. Reactor coolant system boron concentration is reduced by 10 ppm.
- D. The reactor is operated continuously at 75% power for three months.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
MARCH 2008 PWR--FORM A**

QUESTION: 50

Two identical nuclear reactors are currently shut down for refueling. Reactor A has an average lifetime power capacity of 90% and has been operating for 24 years. Reactor B has an average lifetime power capacity of 72% and has been operating for 30 years.

Which reactor, if any, will have the lowest reactor vessel nil ductility transition temperature?

- A. Reactor A because it has produced the greater total number of fissions.
- B. Reactor B because it has produced the fewer total number of fissions.
- C. Both reactors will have approximately the same nil ductility transition temperature because fast neutron irradiation in a shut down core is not significant.
- D. Both reactors will have approximately the same nil ductility transition temperature because each core has produced approximately the same total number of fissions.

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

**MARCH 2008 NRC GENERIC FUNDAMENTALS EXAMINATION  
PRESSURIZED WATER REACTOR - ANSWER KEY**

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