

**UNITED STATES NUCLEAR REGULATORY COMMISSION  
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002--FORM A**

**Please Print**

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

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

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

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

**INSTRUCTIONS TO APPLICANT**

Answer all the test items using the answer sheet provided. Each item has equal point value. A score of at least 80% is required to pass this portion of the written licensing examination. All examination papers will be collected 4.0 hours after the examination starts. This examination applies to a typical pressurized water reactor (PWR) power plant.

SECTION	QUESTIONS	% OF TOTAL	SCORE
COMPONENTS	1 - 44		
REACTOR THEORY	45 - 72		
THERMODYNAMICS	73 - 100		
TOTALS	100		

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

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

**RULES AND GUIDELINES FOR THE  
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 the name of your facility.
3. Fill in your individual docket number.
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 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. Scratch paper is provided for calculations, which may also be done directly on the examination.
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.
11. Turn in your examination materials, answer sheet on top, followed by the examination booklet, then examination aids - steam table booklets, handouts, and scratch 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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$$\dot{Q} = \dot{m}c_p\Delta T$$

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

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

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

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

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

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

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

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

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

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

$$\lambda_{\text{eff}} = 0.1 \text{ seconds}^{-1}$$

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

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

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

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

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

$$CR_1(1 - K_{\text{eff}1}) = CR_2(1 - K_{\text{eff}2})$$

$$1/M = CR_1/CR_x$$

$$A = \pi r^2$$

$$F = PA$$

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

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

$$E = IR$$

$$\text{Eff.} = \text{Net Work Out/Energy In}$$

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

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

**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 2500 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 that 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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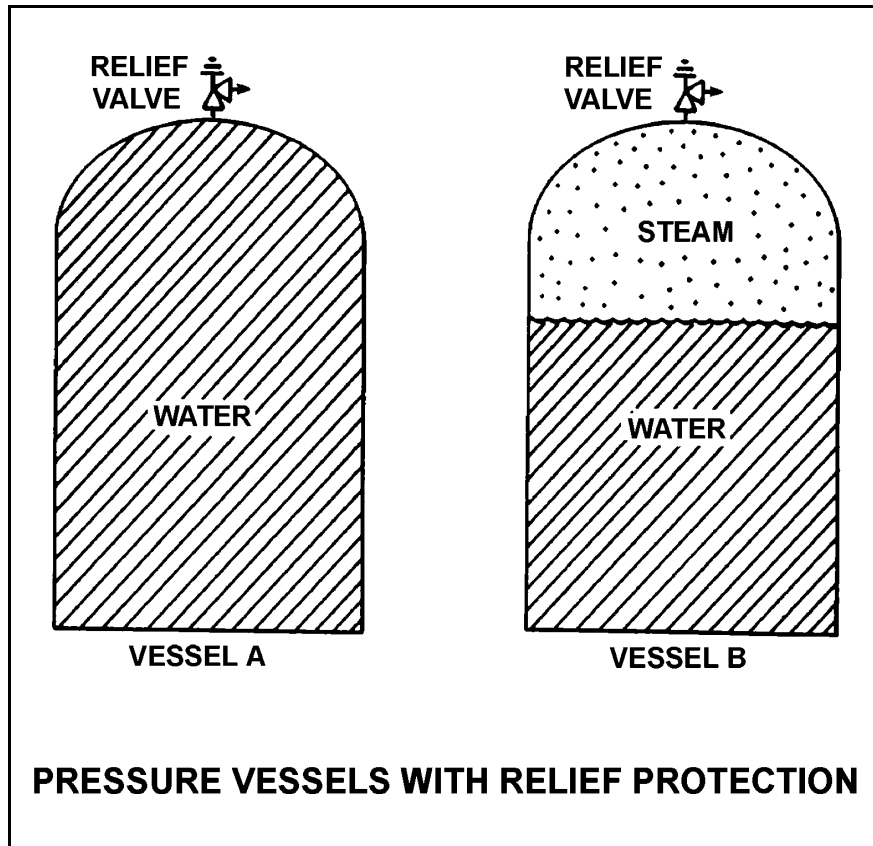
QUESTION: 2

Refer to the drawing of two pressure vessels with relief protection (see figure below).

Vessel A is completely filled with subcooled water and vessel B is in a saturated, two-phase condition. Both vessels are currently pressurized to 50 psig and are protected by identical relief valves.

If both relief valves open simultaneously, the faster pressure reduction will initially occur in vessel \_\_\_\_\_ and the faster mass loss will initially occur in vessel \_\_\_\_\_.

- A. A; A
- B. A; B
- C. B; A
- D. B; B



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QUESTION: 3

An operator attempts to close a fully-open upright manual gate valve to isolate a pump in a cooling water system that has been cooled down for maintenance. However, the operator is unable to rotate the handwheel in the close direction.

Which one of the following could cause this condition?

- A. A hydraulic lock has developed under the valve disk.
- B. A hydraulic lock has developed in the valve bonnet between the valve disk and the packing gland.
- C. The two halves of the valve disk have expanded and are jammed against the valve seats.
- D. The valve disk has jammed against its backseat by the difference in the thermal contraction of the stem and the bonnet.

QUESTION: 4

A typical motor-operated valve has been returned to service following a complete maintenance overhaul of the valve and actuator. The valve was remotely opened and closed to verify operability. The measured valve stroke time in each direction was 15 seconds, which is 25% longer than normal.

Which one of the following could have caused the increased stroke time?

- A. The valve position limit switches were removed and were not reinstalled.
- B. The valve torque limit switches were misadjusted to open at half their normal setpoints.
- C. The valve was packed with improved packing material having a lower friction coefficient.
- D. The valve stem packing gland was overtightened after the packing material was replaced.

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QUESTION: 5

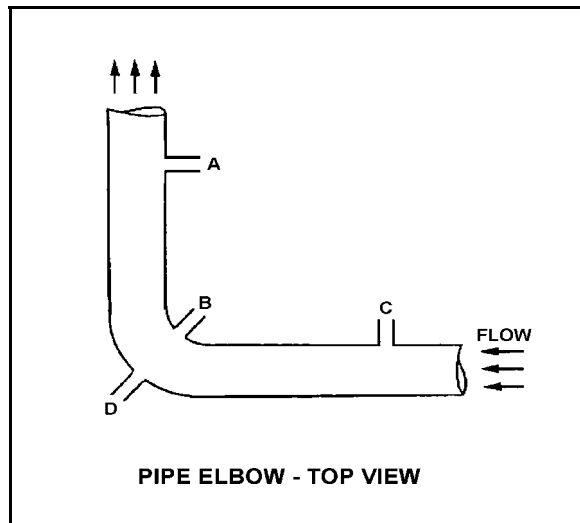
Refer to the drawing of a horizontal pipe elbow (top view) in an operating water system (see figure below).

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

<u>DETECTOR</u>	<u>TAPS</u>
AD	A and D
BD	B and D
CD	C and D

Assuming zero head loss in this section of pipe, how will the detectors be affected if tap D ruptures?

- A. All detectors will fail low.
- B. All detectors will fail high.
- C. Two detectors will fail low and one will fail high.
- D. Two detectors will fail high and one will fail low.



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QUESTION:      6

A cooling water system is operating at steady-state conditions. A calibrated system flow meter indicates 600 gpm with 50 psid across the flow transmitter venturi.

If cooling water flow rate is increased to 900 gpm, differential pressure across the flow transmitter venturi will be approximately:

- A. 63 psid.
- B. 75 psid.
- C. 97 psid.
- D. 112 psid.



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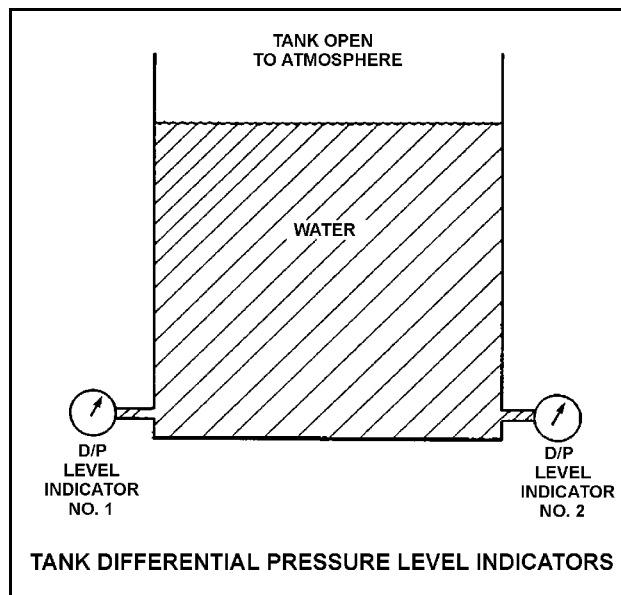
QUESTION: 7

Refer to the drawing of two tank differential pressure (D/P) level indicators (see figure below).

Two D/P level indicators are installed on a large water storage tank. Indicator No. 1 was calibrated at 200°F water temperature and indicator No. 2 was calibrated at 100°F water temperature.

Assuming both indicators are on scale, which indicator will indicate the lower level?

- A. Indicator 1 at all water temperatures
- B. Indicator 2 at all water temperatures
- C. Indicator 1 below 150°F, indicator 2 above 150°F
- D. Indicator 2 below 150°F, indicator 1 above 150°F



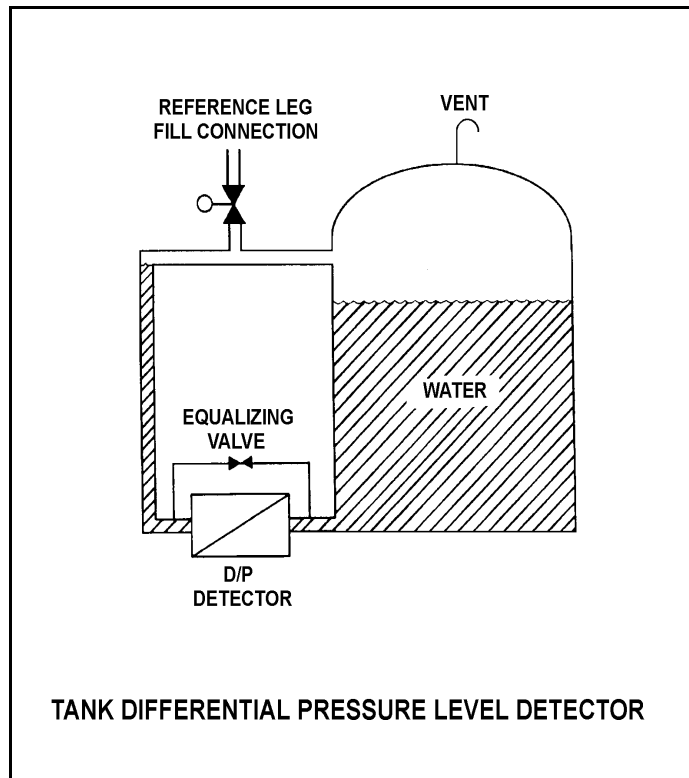
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QUESTION: 8

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

The D/P sensed by the detector is \_\_\_\_\_ proportional to the temperature of the water in the tank if \_\_\_\_\_ is constant. (Assume reference leg and tank water temperatures are initially the same.)

- A. directly; level
- B. inversely; level
- C. directly; mass
- D. inversely; mass



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QUESTION: 9

A bourdon tube works on the principle that when the pressure sensed by the tube decreases, the tube tends to: (Assume detected pressure remains above atmospheric pressure.)

- A. coil due to an increased pressure-induced force on the outside of the tube.
- B. straighten due to an increased pressure-induced force on the outside of the tube.
- C. coil due to the spring action of the metal overcoming the pressure-induced force on the inside of the tube.
- D. straighten due to the spring action of the metal overcoming the pressure-induced force on the inside of the tube.

QUESTION: 10

A properly calibrated 0 to 100 psia diaphragm pressure detector is connected to a pressurized system; the low pressure side of the detector is vented to the atmosphere. The detector is currently producing a system pressure indication of 75 psia.

If the detector diaphragm ruptures, indicated pressure will be approximately:

- A. 0 psia.
- B. 15 psia.
- C. 60 psia.
- D. 90 psia.

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QUESTION: 11

What is the purpose of the reference junction panel that is provided with many thermocouple circuits?

- A. Ensures that thermocouple output is amplified sufficiently for use by temperature indication devices.
- B. Ensures that only temperature changes at the thermocouple measuring junction affect thermocouple temperature indication.
- C. Ensures that electrical noise in the thermocouple extension wires does not affect thermocouple temperature indication.
- D. Ensures that different lengths of thermocouple extension wires do not affect thermocouple temperature indication.

QUESTION: 12

The reactor is shut down at 100 cps in the source/startup range when a loss of coolant accident occurs. How will excore source/startup range neutron level indication change as homogeneous core voiding increases from 80% to 100%?

- A. Increases because  $K_{\text{eff}}$  is increasing.
- B. Decreases because  $K_{\text{eff}}$  is decreasing.
- C. Increases because a larger fraction of the core neutron population is leaking out of the core.
- D. Decreases because a smaller fraction of the core neutron population is leaking out of the core.

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QUESTION: 13

What is the effect on a proportional neutron detector if it is operated at a voltage near the high end of the proportional (true proportional) region on the gas-filled detector characteristic curve?

- A. Neutron pulses will become so large that gamma pulse discrimination is no longer needed, yielding a more accurate neutron count rate.
- B. The positive space charge effect will increase and prevent collection of both gamma and neutron pulses, yielding a less accurate neutron count rate.
- C. A high rate of incident gamma radiation will result in multiple small gamma pulses that combine to look like larger pulses. The larger combined pulses will be counted as neutron pulses, yielding a less accurate neutron count rate.
- D. Detection of any single ionizing event will result in ionizing nearly the entire detector gas volume. The resulting large pulses will prevent the detector from differentiating between radiation types, yielding a less accurate neutron count rate.

QUESTION: 14

Which one of the following types of radiation is the major contributor to the dose indication on a self-reading pocket dosimeter (SRPD)? (also called SRD, PIC, and direct reading dosimeter)

- A. Alpha
- B. Beta
- C. Gamma
- D. Neutron

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QUESTION: 15

If the turbine shaft speed signal received by a typical turbine governor control system fails low during turbine startup, the turbine governor will cause turbine speed to:

- A. decrease to a minimum speed setpoint.
- B. increase, until the mismatch with demanded turbine speed is nulled.
- C. decrease, until the mismatch with demanded turbine speed is nulled.
- D. increase, until an upper limit is reached or the turbine trips on overspeed.

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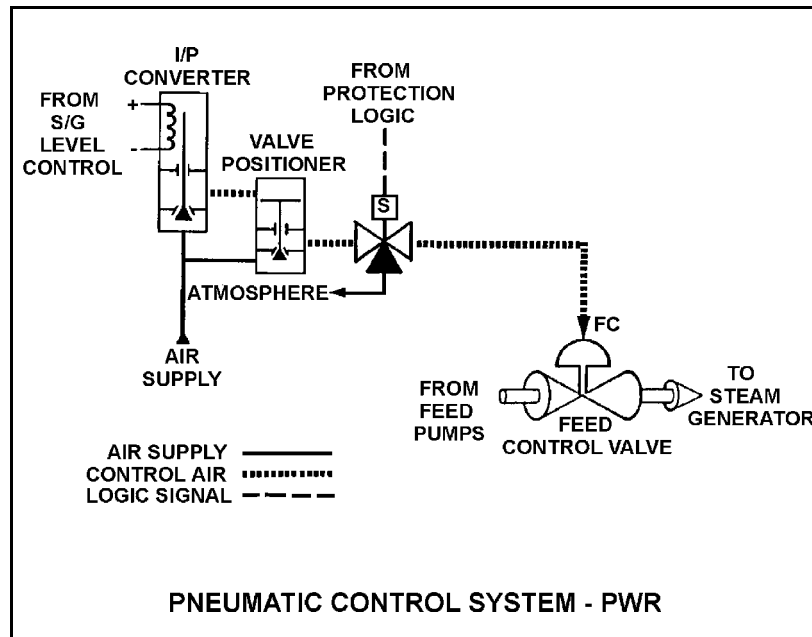
QUESTION: 16

Refer to the drawing of a pneumatic control system (see figure below).

An increasing steam generator (S/G) level will decrease the S/G level control signal and reduce the control air pressure applied to the feed control valve which reduces feedwater flow to the S/G.

If the level control signal is manually increased, how will the pneumatic control system affect steam generator level?

- A. Level will increase because the valve positioner will open more.
- B. Level will decrease because the valve positioner will close more.
- C. Level will increase because the valve positioner will close more.
- D. Level will decrease because the valve positioner will open more.



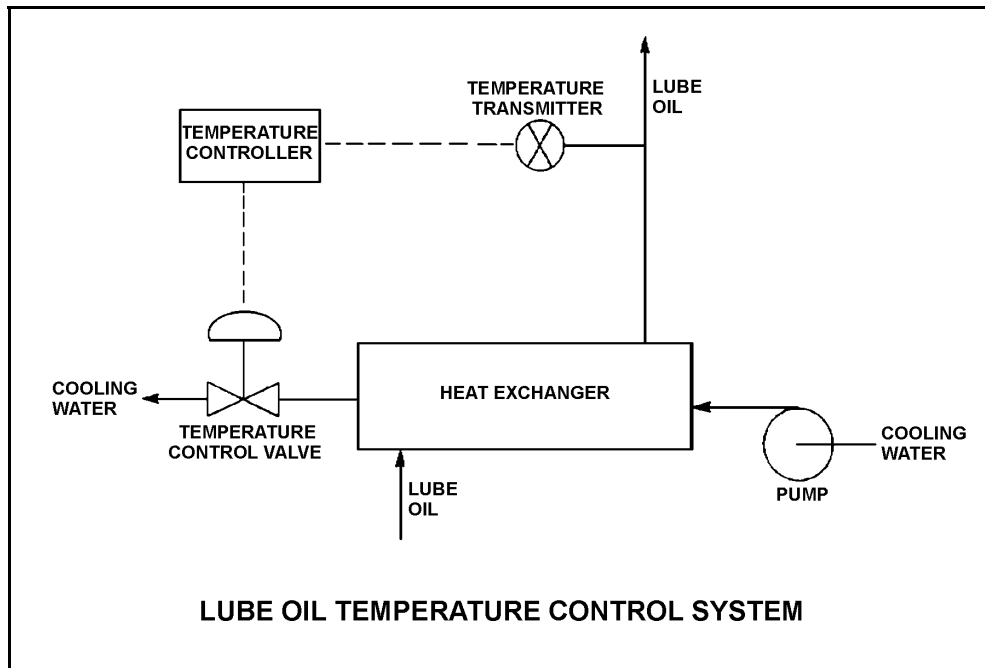
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QUESTION: 17

Refer to the drawing of a lube oil temperature control system (see figure below). The temperature control valve is currently 50% open.

If the cooling water inlet temperature decreases, the temperature controller will throttle the temperature control valve more \_\_\_\_\_, causing cooling water differential temperature through the heat exchanger to \_\_\_\_\_.

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





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QUESTION: 18

A diesel generator (DG) is supplying an isolated electrical bus with the governor operating in the speed droop mode. Assuming the DG does not trip, if a large electrical bus load trips, generator frequency will:

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

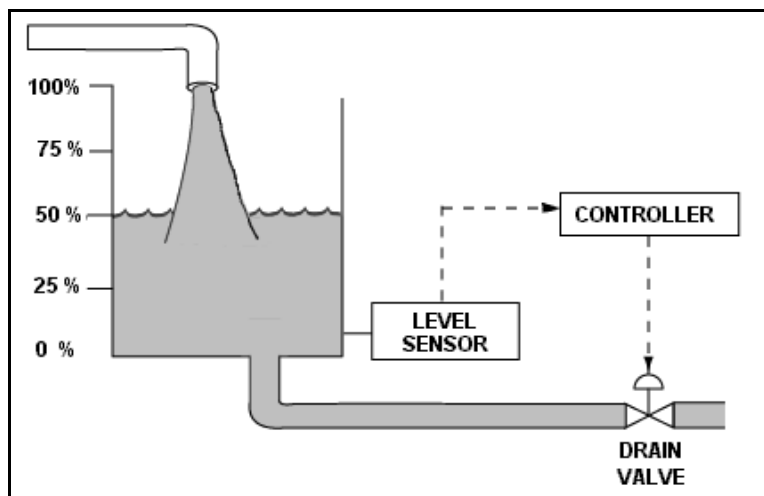
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QUESTION: 19

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 at 50% by a proportional-integral (PI) controller that positions the drain valve. Tank water level is currently stable with 500 gpm entering the tank and the drain valve 50% open.

Tank inlet flow rate suddenly increases to 700 gpm and remains constant. When tank water level stabilizes, level will be \_\_\_\_\_, and the drain valve position will be \_\_\_\_\_.

- A. higher than 50%; more open
- B. higher than 50%; the same
- C. 50%; more open
- D. 50%; the same



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QUESTION: 20

A centrifugal pump is operating at maximum design flow rate, taking suction on a vented water storage tank and discharging to a pond through two parallel discharge valves, A and B. Valve A is fully open and valve B is half open.

Which one of the following will occur if valve B is fully closed?

- A. The pump will operate at shutoff head.
- B. The pump will operate at runout conditions.
- C. The pump available net positive suction head will increase.
- D. The pump required net positive suction head will increase.

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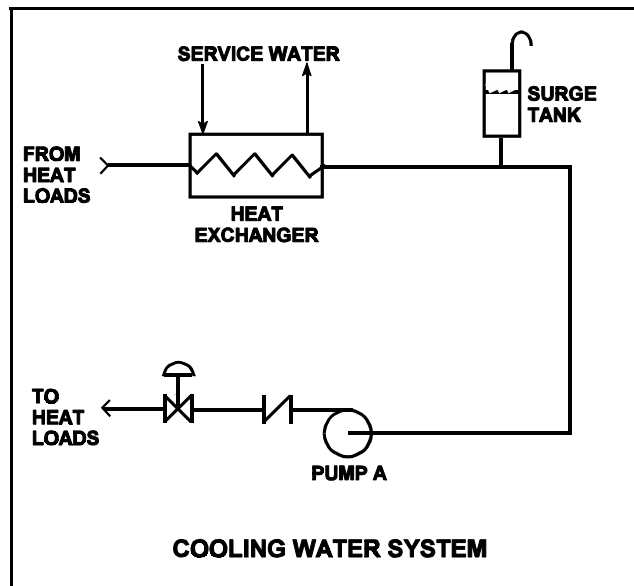
QUESTION: 21

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

The centrifugal pump is circulating water at 180°F with a motor current of 100 amps. After several hours system temperature has decreased such that the water density has increased by 4%.

Assuming pump head does not change, which one of the following is the new pump motor current?

- A. 84 amps
- B. 96 amps
- C. 104 amps
- D. 116 amps



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QUESTION: 22

Many larger centrifugal pumps are started with their discharge valves closed to prevent:

- A. cavitation in the pump.
- B. lifting the discharge relief valve.
- C. loss of recirculation (miniflow).
- D. excessive current in the pump motor.

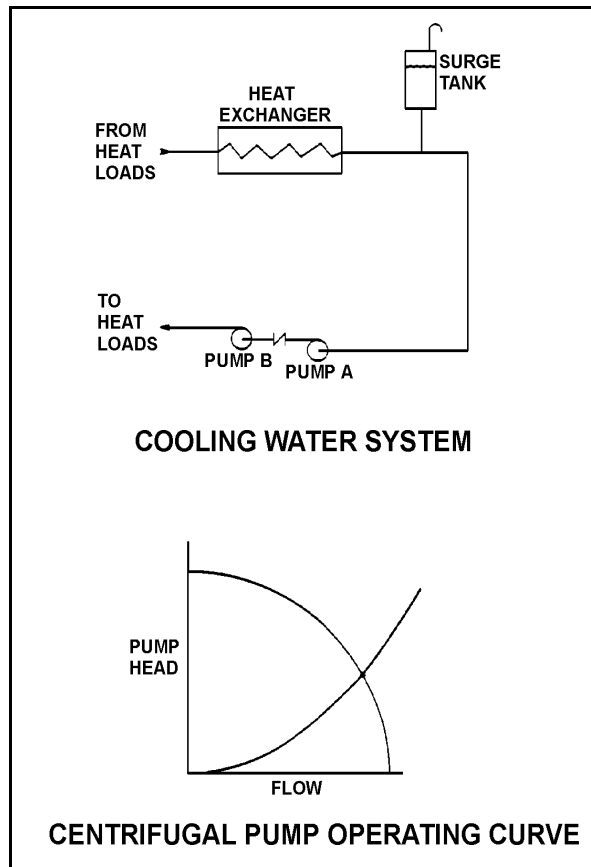
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QUESTION: 23

Refer to the drawing of a cooling water system and the associated centrifugal pump operating curve (see figure below). Pumps A and B are identical single-speed centrifugal pumps and only pump A is operating initially.

Pump B is then started. After the system stabilizes, system flow rate will be:

- A. the same as the initial flow rate.
- B. less than twice the initial flow rate.
- C. twice the initial flow rate.
- D. more than twice the initial flow rate.



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QUESTION: 24

A typical single-stage radial-flow centrifugal pump is being returned to service following maintenance on its ac motor. Which one of the following will occur when the pump is started if two of the three motor power leads were inadvertently swapped during restoration?

- A. The motor breaker will trip on instantaneous overcurrent.
- B. The motor will not turn and will emit a humming sound.
- C. The motor will rotate in the reverse direction with reduced or no flow rate.
- D. The motor will rotate in the normal direction with reduced flow rate.

QUESTION: 25

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

- A. On the pump suction piping upstream of the suction isolation valve
- B. On the pump suction piping downstream of the suction isolation valve
- C. On the pump discharge piping downstream of the discharge isolation valve
- D. On the pump discharge piping upstream of the discharge isolation valve

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QUESTION: 26

Which one of the following describes single-speed pump operating characteristics?

- A. Centrifugal pumps deliver a variety of flow rates at a constant head.
- B. Centrifugal pumps deliver a constant head over a variety of flow rates.
- C. Positive displacement pumps deliver a variety of flow rates at a constant head.
- D. Positive displacement pumps deliver a constant flow rate over a variety of heads.

QUESTION: 27

During a locked reactor coolant pump (RCP) rotor event, RCP current will:

- A. increase due to the increased rotor torque.
- B. increase due to the increased stator counter electromotive force (CEMF).
- C. decrease due to the decreased pump flow.
- D. decrease due to the increased rotor CEMF.



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QUESTION: 28

A diesel generator (D/G) is supplying an electrical bus in parallel with an infinite power grid. Assuming D/G terminal voltage and bus frequency do not change, if the D/G governor set point is increased from 60.0 Hz to 60.1 Hz, D/G kVAR load will \_\_\_\_\_ and D/G amps will \_\_\_\_\_.

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

QUESTION: 29

A centrifugal pump has a flow rate of 3,000 gpm and a current requirement of 200 amps. If the pump speed is reduced such that the flow rate is 2,000 gpm, what is the final current requirement at the new lower speed? (Assume a constant motor voltage.)

- A. 59 amps
- B. 89 amps
- C. 133 amps
- D. 150 amps

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QUESTION: 30

Two identical 4160 Vac induction motors are connected to identical centrifugal pumps in identical but separate cooling water systems. Each motor is rated at 200 hp. The discharge valve for pump A is fully shut and the discharge valve for pump B is fully open.

If each motor is then started, the longest time period required to stabilize motor current will be experienced by motor \_\_\_\_\_ and the higher stable motor current will be experienced by motor \_\_\_\_\_.

- A. A; A
- B. A; B
- C. B; A
- D. B; B

QUESTION: 31

A large centrifugal pump is driven by a 200 horsepower 4.16 kV ac motor. The motor breaker control circuit contains the following protection devices: instantaneous overcurrent relay, motor thermal overload relay, control power fuses, and an anti-pumping device.

The pump had been manually started and stopped several times during a 5-minute period when the motor breaker unexpectedly tripped. In this situation, which one of the following is the most likely cause of the breaker trip?

- A. Instantaneous overcurrent
- B. Motor thermal overload
- C. Blown control power fuse
- D. Anti-pumping device actuation

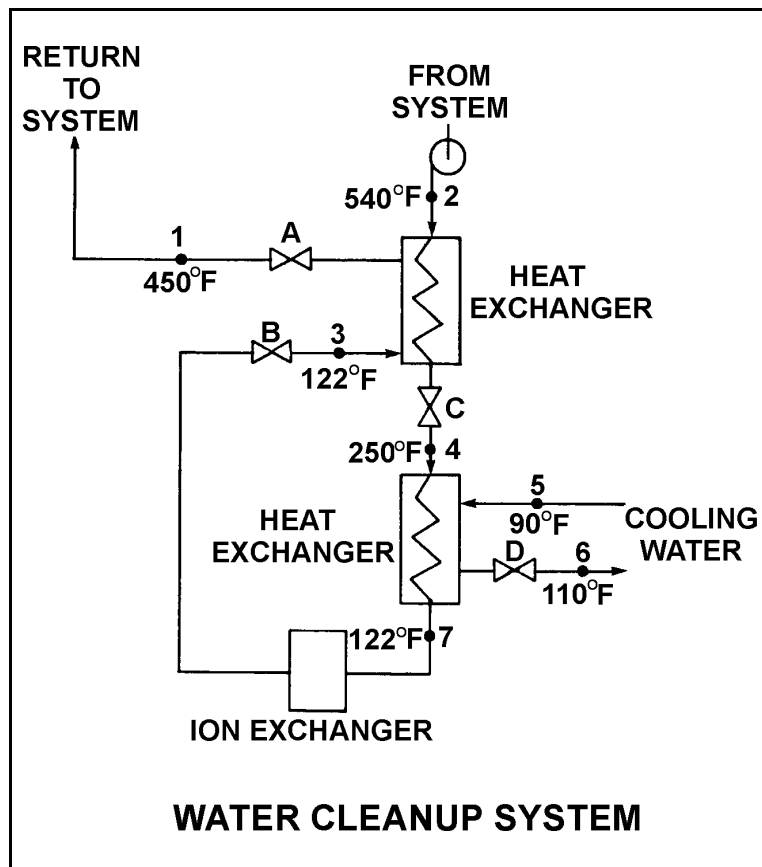
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QUESTION: 32

Refer to the drawing of a water cleanup system (see figure below). All valves are identical and are initially 50% open.

To raise the temperature at point 7, the operator should adjust valve \_\_\_\_\_ in the close direction.

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



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QUESTION: 33

The major thermodynamic concern resulting from rapidly cooling a reactor vessel is:

- A. thermal shock.
- B. stress corrosion.
- C. loss of shutdown margin.
- D. loss of subcooling margin.

QUESTION: 34

Which one of the following will occur to reduce the heat transfer rate in a parallel-flow heat exchanger as scaling increases on the exterior surface of the tubes? (Assume no operator actions.)

- A. Delta-T across the tubes will decrease.
- B. Surface area of the tubes will decrease.
- C. Thermal conductivity of the tubes will decrease.
- D. Flow through the heat exchanger tubes will decrease.

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QUESTION: 35

What percentage of impurities is being removed from the water passing through an ion exchanger if the ion exchanger has a decontamination factor of 25?

- A. 99%
- B. 96%
- C. 88%
- D. 75%

QUESTION: 36

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

- A. The rate of resin depletion will increase.
- B. The number of ion exchange sites will decrease.
- C. The flow rate of water through the demineralizer will increase.
- D. The removal rate of unwanted ions from the process water system will decrease.

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QUESTION: 37

Which one of the following indicates that a demineralizer receiving 75 gpm of reactor coolant is boron-saturated?

- A. The decontamination factor of the demineralizer is less than 1.0.
- B. The decontamination factor of the demineralizer is greater than 1.0.
- C. Following a reactor coolant temperature increase, demineralizer effluent boron concentration exceeds influent boron concentration.
- D. Following a reactor coolant temperature increase, demineralizer influent boron concentration exceeds effluent boron concentration.

QUESTION: 38

Which one of the following describes the normal operation of a local breaker overcurrent trip flag indicator?

- A. Actuates when no lockout is present; satisfies an electrical interlock to remotely close a breaker.
- B. Actuates when a breaker overcurrent trip has occurred; can be manually reset when the overcurrent condition clears.
- C. Actuates when a breaker has failed to trip on an overcurrent condition; can be manually reset when the overcurrent condition clears.
- D. Actuates to cause a breaker trip when the overcurrent trip setpoint is reached; can be remotely reset when the overcurrent condition clears.

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QUESTION: 39

Two identical 1000 MW electrical generators are operating in parallel supplying the same isolated electrical bus. The generator output breakers also provide identical protection for the generators. Generator A and B output indications are as follows:

<u>Generator A</u>	<u>Generator B</u>
22 KV	22 KV
60.2 Hertz	60.2 Hertz
800 MW	800 MW
50 MVAR (out)	25 MVAR (in)

A malfunction causes the voltage regulator for generator B to slowly and continuously increase the terminal voltage for generator B. If no operator action is taken, generator B output current will:

- A. increase continuously until the output breaker for generator A trips on overcurrent.
- B. increase continuously until the output breaker for generator B trips on overcurrent.
- C. initially decrease, and then increase until the output breaker for generator A trips on overcurrent.
- D. initially decrease, and then increase until the output breaker for generator B trips on overcurrent.

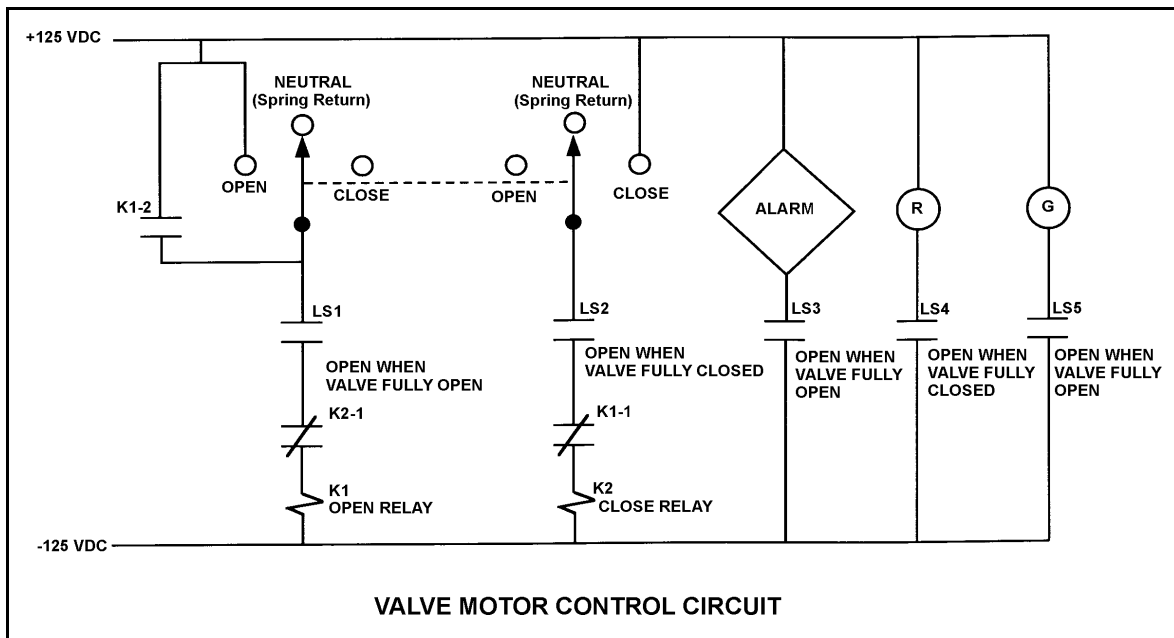
**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 40

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully open and has a 10-second stroke time. (Note: Limit switch (LS) contacts are shown open regardless of stated valve position, but relay contacts follow the standard convention for control circuit drawings.)

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

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





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QUESTION: 41

A motor control center 480 Vac breaker supplies a load via a manual disconnect. Which one of the following sequences for deenergizing the load will provide the greatest level of personnel safety?

- A. Open the disconnect first, then the breaker.
- B. Open the breaker first, then the disconnect.
- C. Any sequence is acceptable provided the current is less than 50 amps.
- D. Any sequence is acceptable provided the voltage is less than 600 volts.

QUESTION: 42

A main generator is being prepared for paralleling with a power grid. Which one of the following indicates that the main generator and grid voltages are in phase?

- A. The voltage of the generator is equal to the voltage of the grid.
- B. The frequency of the generator is equal to the frequency of the grid.
- C. The synchroscope is turning slowly in the clockwise direction.
- D. The synchroscope is passing through the 12 o'clock position.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 43

Which one of the following functions or capabilities would remain following a loss of control power to a typical 480 Vac bus feeder breaker?

- A. Remote bus voltage indication
- B. Remote breaker position indication
- C. Remote breaker control capability
- D. Breaker closing spring automatic recharging capability

QUESTION: 44

The following indications are observed in the control room for a normally-open breaker that directly starts/stops a 480 Vac motor:

Red position indicating light is on.  
Green position indicating light is off.  
Load current indicates 50 amps.  
Supply voltage indicates 480 volts.

What is the condition of the breaker?

- A. Open and racked in
- B. Closed and racked in
- C. Open and racked to "test" position
- D. Closed and racked to "test" position

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 45

In a comparison between a delayed neutron and a prompt neutron born from the same fission event, the prompt neutron is more likely to:

- A. be born with a lower kinetic energy.
- B. cause thermal fission of a U-235 nucleus.
- C. require a greater number of collisions to become a thermal neutron.
- D. be captured by U-238 at a resonant energy peak between 1 eV and 1000 eV.

QUESTION: 46

A 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 stable shutdown margin?

- 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.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 47

With  $K_{\text{eff}}$  equal to 0.983, how much reactivity must be added to make the reactor exactly critical?  
(Round answer to nearest 0.01%  $\Delta K/K$ .)

- A. 1.70%  $\Delta K/K$
- B. 1.73%  $\Delta K/K$
- C. 3.40%  $\Delta K/K$
- D. 3.43%  $\Delta K/K$

QUESTION: 48

A xenon-free shutdown reactor plant is slowly cooling down due to an unisolable steam leak. When the cooldown started at 400°F, the readings on all source range nuclear instruments were 80 counts per second (cps). After one hour, when the reactor coolant temperature reached 350°F, source range count rate was 160 cps on all source range instruments.

Assume that the moderator temperature coefficient remains constant throughout the cooldown, and no operator action is taken. What will be the status of the reactor when reactor coolant temperature reaches 290°F?

- A. Subcritical, with source range count rate below 320 cps
- B. Subcritical, with source range count rate above 320 cps
- C. Supercritical, with source range count rate below 320 cps
- D. Supercritical, with source range count rate above 320 cps

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 49

Which one of the following pairs of neutron reactions produces the largest contribution to the intrinsic source neutron level after the first fuel cycle? (Neglect any contribution from an installed neutron source.)

- A. Alpha-neutron reactions and spontaneous fission
- B. Spontaneous fission and photo-neutron reactions
- C. Photo-neutron reactions and beta-neutron reactions
- D. Beta-neutron reactions and alpha-neutron reactions

QUESTION: 50

Which one of the following will directly result in a less negative fuel temperature coefficient? (Consider only the effect of the change in the listed parameters.)

- A. Increase in fuel burnup
- B. Increase in void fraction
- C. Decrease in fuel temperature
- D. Decrease in moderator temperature

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 51

Which one of the following contains the nuclides responsible for most of the resonance capture of fission neutrons in the core at the beginning of the sixth fuel cycle? (Assume that each refueling replaces one-third of the fuel.)

- A. U-235 and Pu-239
- B. U-235 and U-238
- C. U-238 and Pu-239
- D. U-238 and Pu-240

QUESTION: 52

As compared to the moderator temperature coefficient (MTC) of reactivity at the beginning of core life, the MTC at the end of core life is: (Assume 100% power for all cases.)

- A. more negative because as U-235 depletes, more fission neutrons are able to escape resonance capture.
- B. less negative because as U-238 depletes, more fission neutrons are able to escape resonance capture.
- C. more negative because as reactor coolant boron concentration decreases, the thermal utilization of fission neutrons increases.
- D. less negative because as control rods are withdrawn from the core, the thermal utilization of fission neutrons increases.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 53

A reactor has been taken critical following a four day shutdown at the beginning of core life. Reactor power is ramped to 50% over the next 4 hours.

During the power increase, most of the positive reactivity added by the operator is necessary to overcome the negative reactivity associated with the:

- A. buildup of core Xe-135.
- B. increased fuel temperature.
- C. burnout of burnable poisons.
- D. increased reactor coolant temperature.

QUESTION: 54

A reactor is exactly critical at the point of adding heat (POAH) during a reactor startup at the end of core life. Control rods are manually withdrawn for 5 seconds and then stopped.

Assuming only ambient heat removal from the reactor coolant system (RCS), when conditions stabilize, reactor power will be \_\_\_\_\_ the POAH and RCS average temperature will be \_\_\_\_\_.

- A. at; the same
- B. at; higher
- C. greater than; the same
- D. greater than; higher

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 55

The purposes of using control rod bank overlap are to:

- A. provide a more uniform axial flux distribution and to provide a more uniform differential rod worth.
- B. provide a more uniform differential rod worth and to ensure the rod insertion limits are not exceeded.
- C. ensure the rod insertion limits are not exceeded and to maintain individual and group rod position within allowable tolerances.
- D. maintain individual and group rod position indicators within allowable tolerances and to provide a more uniform axial flux distribution.

QUESTION: 56

A reactor has been operating at 100% power for 3 weeks, with all control rods fully withdrawn, shortly after a refueling outage. Which one of the following describes why most of the power is being produced in the lower half of the core?

- A. There is a greater concentration of Xe-135 in the upper half of the core.
- B. The fuel loading in the lower half of the core contains a higher U-235 enrichment.
- C. Reactor coolant boron is adding more negative reactivity in the upper half of the core.
- D. The moderator temperature coefficient of reactivity is adding more negative reactivity in the upper half of the core.



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 57

As long as core quadrant power distribution (azimuthal tilt) is maintained within design limits, which one of the following conditions is most likely?

- A. Axial power distribution is within design limits.
- B. Radial power distribution is within design limits.
- C. Nuclear instrumentation is indicating within design accuracy.
- D. Departure from nucleate boiling ratio is within design limits.

QUESTION: 58

A reactor has been operating at full power for several weeks. Xenon-135 is being directly produced as a fission product in approximately \_\_\_\_\_% of all fissions.

- A. 0.3
- B. 3.0
- C. 30
- D. 100

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 59

Reactors A and B are operating at steady-state 100% power with equilibrium core Xe-135. The reactors are identical except that reactor A is operating near the end of core life and reactor B is operating near the beginning of core life.

Which reactor is experiencing the most negative reactivity from equilibrium core Xe-135?

- A. Reactor A due to the greater concentration of equilibrium core Xe-135
- B. Reactor A due to the lower competition from the fuel for thermal neutrons
- C. Reactor B due to the greater concentration of equilibrium core Xe-135
- D. Reactor B due to the lower competition from the fuel for thermal neutrons

QUESTION: 60

Which one of the following combinations of core age (beginning of core life (BOL) or end of core life (EOL)) and long-term power history (20% or 100%) will require the greatest amount of positive reactivity addition to attain reactor criticality during peak core Xe-135 conditions after a reactor trip from equilibrium core Xe-135 conditions?

- A. EOL and 20% power
- B. EOL and 100% power
- C. BOL and 20% power
- D. BOL and 100% power

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 61

A reactor has been operating at 100% power for several weeks with a symmetrical axial power distribution that is peaked at core midplane. Reactor power is reduced to 50% using boration to control reactor coolant temperature while maintaining control rods fully withdrawn.

During the power reduction, the axial power distribution will:

- A. shift toward the top of the core.
- B. shift toward the bottom of the core.
- C. peak at the top and the bottom of the core.
- D. remain symmetrical and peaked at the core midplane.

QUESTION: 62

A reactor has been operating at 70% power for 26 hours following a one-hour power reduction from steady-state 100% power. Which one of the following describes the current core xenon-135 concentration?

- A. At equilibrium
- B. Increasing toward a peak
- C. Decreasing toward an upturn
- D. Decreasing toward equilibrium

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 63

After a reactor shutdown from 100% power equilibrium xenon conditions, the maximum xenon negative reactivity (height of the xenon peak) is \_\_\_\_\_ preshutdown power level.

- A. independent of
- B. exactly proportional to
- C. inversely proportional to
- D. dependent on but not exactly proportional to

QUESTION: 64

A reactor has been shut down for 8 hours following a loss of offsite power. A reactor coolant system (RCS) cooldown on single-phase natural circulation is in progress.

Compared to adding boric acid to the RCS during forced circulation, adding boric acid during natural circulation requires \_\_\_\_\_ time to achieve complete mixing in the RCS; and, once completely mixed at a given coolant temperature, a 1 ppm increase in RCS boron concentration during natural circulation will cause a/an \_\_\_\_\_ change in core reactivity.

- A. more; smaller
- B. more; equal
- C. less; smaller
- D. less; equal

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 65

During a reactor startup, the first reactivity addition caused the count rate to increase from 20 to 30 cps. The second reactivity addition caused the count rate to increase from 30 to 60 cps. Assume  $k_{\text{eff}}$  was 0.97 prior to the first reactivity addition.

Which one of the following statements describes the magnitude of the reactivity additions?

- A. The first and second reactivity additions were approximately the same.
- B. The first reactivity addition was approximately 50% larger than the second.
- C. The second reactivity addition was approximately 50% larger than the first.
- D. There is not enough data given to determine the relationship of reactivity values.

QUESTION: 66

A nuclear plant was operating at steady-state 100% power near the end of a fuel cycle when a reactor trip occurred. Reactor coolant temperature is being maintained at normal no-load temperature in anticipation of commencing a reactor startup.

Four hours after the trip, with reactor coolant temperature still at normal no-load temperature, which one of the following will cause the fission rate in the reactor core to increase?

- A. The operator fully withdraws the shutdown control rods.
- B. Reactor coolant temperature is allowed to increase by 3°F.
- C. Reactor coolant boron concentration is increased by 10 ppm.
- D. An additional two hours is allowed to pass with no other changes in plant parameters.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 67

A reactor startup is in progress with a stable source range count rate and the reactor is near criticality. Which one of the following statements describes count rate characteristics during and after a 5-second control rod withdrawal? (Assume the reactor remains subcritical.)

- A. There will be no change in count rate until criticality is achieved.
- B. The count rate will rapidly increase (prompt jump) to a stable higher value.
- C. The count rate will rapidly increase (prompt jump) then gradually increase and stabilize at a higher value.
- D. The count rate will rapidly increase (prompt jump) then gradually decrease and stabilize at the previous value.

QUESTION: 68

A reactor is critical at  $10^{-6}\%$  power. Control rods are withdrawn for 2 seconds and then stopped, resulting in a stable 0.2 dpm startup rate (SUR).

If control rods had been inserted (instead of withdrawn) for 2 seconds with the reactor initially critical at  $10^{-6}\%$ , the stable SUR would have been: (Assume equal absolute values of reactivity are added in both cases.)

- A. slower than -0.2 dpm, because, compared to power increases, reactor power decreases are more limited by delayed neutrons.
- B. faster than -0.2 dpm, because, compared to power increases, reactor power decreases are less limited by delayed neutrons.
- C. slower than -0.2 dpm, because, compared to power increases, reactor power decreases result in larger delayed neutron fractions.
- D. faster than -0.2 dpm, because, compared to power increases, reactor power decreases result in smaller delayed neutron fractions.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 69

A reactor is critical below the point of adding heat (POAH). The operator adds enough reactivity to attain a startup rate of 0.5 decades per minute. Which one of the following will decrease first when the reactor reaches the POAH?

- A. Startup rate
- B. Reactor power
- C. Pressurizer level
- D. Reactor coolant temperature

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 70

A reactor is operating with the following initial conditions:

Power level	= 100%
Coolant boron	= 620 ppm
Coolant temperature	= 587°F

After a load decrease reactor conditions are as follows:

Power level	= 80%
Coolant boron	= 650 ppm
Coolant temperature	= 577°F

All parameters were at normal steady-state values before and after the power change.

Given the following, how much reactivity was added by control rod movement during the load decrease?  
(Assume fission product poison reactivity does not change.)

Differential boron worth	= $-1.0 \times 10^{-2}\% \Delta K/K/ppm$
Total power coefficient	= $-1.5 \times 10^{-2}\% \Delta K/K/\%$
Moderator temperature coefficient	= $-2.0 \times 10^{-2}\% \Delta K/K/^\circ F$

- A. -0.0%  $\Delta K/K$
- B. -0.2%  $\Delta K/K$
- C. -0.6%  $\Delta K/K$
- D. -0.8%  $\Delta K/K$



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 71

A plant is operating at 60% power in the middle of a fuel cycle with manual rod control when a turbine control system malfunction closes the turbine control valves an additional 5 percent. Which one of the following is responsible for the initial reactor power decrease?

- A. The rate of neutron absorption by core Xe-135 initially increases.
- B. The rate of neutron absorption in the moderator initially increases.
- C. The rate of neutron absorption at U-238 resonant energies initially increases.
- D. The rate of neutron absorption by the boron in the reactor coolant initially increases.

QUESTION: 72

A reactor has been operating for one hour at 50% power following six months of operation at steady-state 100% power. What percentage of rated thermal power is currently being generated by reactor decay heat?

- A. 1% to 2%
- B. 3% to 5%
- C. 6% to 8%
- D. 9% to 11%

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 73

Assuming a standard atmospheric pressure of 15 psia, 5 inches of mercury (Hg) vacuum is equivalent to:

- A. 2.5 psia.
- B. 5.0 psia.
- C. 10.0 psia.
- D. 12.5 psia.

QUESTION: 74

Two identical pressurizers are connected to the same location on two identical reactor coolant systems operating at 1000 psia. Pressurizer A volume contains 50% subcooled water (300°F) and 50% nitrogen. Pressurizer B volume contains 50% saturated water and 50% saturated steam.

Which one of the following explains which pressurizer will maintain the highest pressure during a sudden 10% liquid outsurge from each pressurizer?

- A. Pressurizer A due to the subcooled water resulting in a smaller amount of energy being lost during the outsurge
- B. Pressurizer A due to the expansion characteristics of nitrogen being better than the expansion characteristics of saturated steam
- C. Pressurizer B due to vaporizing of saturated water as pressure begins to decrease
- D. Pressurizer B due to the expansion characteristics of saturated steam being better than the expansion characteristics of nitrogen

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 75

Given the following:

1. A saturated steam-water mixture with an inlet quality of 60% is flowing through a moisture separator.
2. The moisture separator is 100% efficient for removing moisture.

How much moisture will be removed by the moisture separator from 50 lbm of the steam-water mixture?

- A. 10 lbm
- B. 20 lbm
- C. 30 lbm
- D. 40 lbm

QUESTION: 76

Main condenser pressure is 1.0 psia. During the cooling process in the condenser, the temperature of the low pressure turbine exhaust decreases to 100°F, at which time it is a:

- A. saturated liquid.
- B. saturated vapor.
- C. subcooled liquid.
- D. superheated vapor.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 77

A single-phase cooling water system is operating at design flow rate. Which one of the following types of energy within the cooling water is increased when the cooling water head is reduced by throttling a flow control valve?

- A. Flow
- B. Kinetic
- C. Internal
- D. Potential

QUESTION: 78

A reactor plant was initially operating normally at 90% reactor power when heating steam (supplied from main turbine extraction steam) to the feedwater heaters was isolated. The plant was stabilized and reactor power was returned to 90%.

As compared to the initial main generator output (MW), the current generator output is:

- A. lower, because the steam cycle is less efficient.
- B. higher, because the steam cycle is less efficient.
- C. lower, because more steam heat energy is available to the main turbine.
- D. higher, because more steam heat energy is available to the main turbine.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 79

An 85 gpm leak has developed in a cooling water system that is operating at 100 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 50 psig?

- A. 60.1 gpm
- B. 51.7 gpm
- C. 42.5 gpm
- D. 33.3 gpm

QUESTION: 80

A centrifugal pump is being returned to service after maintenance. However, the operator fails to vent the pump.

Compared to normal operations, after the pump is started, the operator will see \_\_\_\_\_ flow rate and \_\_\_\_\_ discharge head.

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

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 81

The primary reason for slowly opening the discharge valves of large motor-driven centrifugal cooling water pumps after starting the pumps is to minimize the:

- A. potential for pump cavitation.
- B. potential for a water hammer.
- C. motor running current requirements.
- D. net positive suction head requirements.

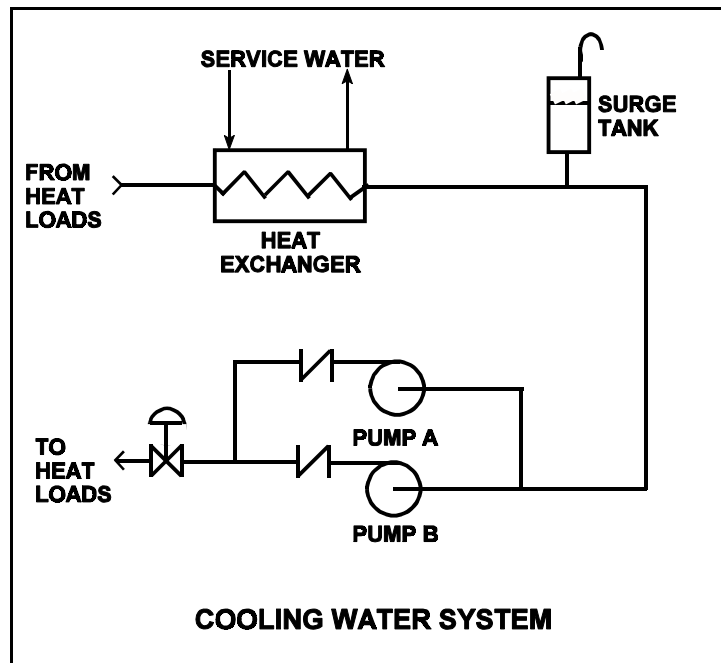
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QUESTION: 82

Refer to the drawing of a cooling water system in which only pump A is operating and the pump discharge valve is currently 50% open (see figure below).

If pump A is cavitating, which one of the following will reduce or eliminate cavitation in pump A?

- A. Starting pump B
- B. Positioning the discharge valve to 75% open
- C. Lowering the water level in the surge tank by 2 feet
- D. Increasing heat exchanger service water flowrate by 10%



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 83

Two identical centrifugal pumps (CPs) and two identical positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1000 psig.

Given the following information:

Centrifugal Pumps

Shutoff head:	1500 psig
Maximum design pressure:	2000 psig

Positive Displacement Pumps

Maximum design pressure:	2000 psig
--------------------------	-----------

Which one of the following pump configurations will supply the highest makeup flow rate to the system if system pressure is at 800 psig?

- A. Two CPs in series
- B. Two CPs in parallel
- C. One PDP and one CP in parallel
- D. One PDP and one CP in series (CP supplying PDP)



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 84

A reactor plant was operating at a steady-state power level with the following main condenser parameters:

Main condenser pressure:	1.2 psia
Cooling water inlet temperature:	60°F
Cooling water outlet temperature:	84°F

As a result of increased condenser air inleakage, the overall heat transfer coefficient of the main condenser decreases by 25%. Main condenser heat transfer rate and cooling water temperatures are unchanged. Which one of the following is the approximate resulting pressure in the main condenser?

- A. 1.7 psia
- B. 2.3 psia
- C. 3.0 psia
- D. 4.6 psia

QUESTION: 85

The power range nuclear instruments have been adjusted to 100% based on a calculated heat balance. Which one of the following will result in indicated reactor power being greater than actual reactor power?

- A. The reactor coolant pump heat input term was omitted from the heat balance calculation.
- B. The water flow rate used in the heat balance calculation were 10% lower than actual flow rates.
- C. The steam pressure used in the heat balance calculation was 50 psi higher than actual steam pressure.
- D. The enthalpy of the feed water was miscalculated to be 10 Btu/lbm higher than actual feed water enthalpy.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
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QUESTION: 86

Which one of the following is an example of radiative heat transfer?

- A. Heat transfer from the center to the edge of a fuel pellet at end of core life
- B. Heat transfer from the reactor coolant to the feedwater in a steam generator
- C. Heat transfer from the fuel cladding to the reactor coolant during stable film boiling
- D. Heat transfer from the fuel cladding to the reactor coolant via subcooled nucleate boiling

QUESTION: 87

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

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 88

Which one of the following is indicated by a rapid increase in the fuel clad-to-coolant  $\Delta T$  and a decrease in heat flux from the fuel?

- A. Bulk boiling is occurring.
- B. Nucleate boiling is occurring.
- C. Critical heat flux is increasing.
- D. Departure from nucleate boiling has been reached.

QUESTION: 89

Which one of the following describes the conditions in a fuel channel that is experiencing transition boiling?

- A. Complete steam blanketing of the fuel rod surface
- B. Alternate wetting and drying of the fuel rod surface
- C. Steam bubbles form and collapse on the fuel rod surface
- D. Steam bubbles form on the fuel rod surface and are swept away by subcooled bulk coolant

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 90

If a reactor is being operated with DNBR at its limit, which one of the following is indicated?

- A. None of the fuel rods are experiencing critical heat flux.
- B. A small fraction of the fuel rods may be experiencing critical heat flux.
- C. All radioactive fission products are being contained within the reactor fuel.
- D. All radioactive fission products are being contained within either the reactor fuel or the reactor vessel.

QUESTION: 91

Which one of the following is most likely to result in steam bubble formation in a reactor vessel head while maintaining a 60°F subcooling margin in the hottest RCS hot leg?

- A. Performing a 25°F/Hr RCS heatup on forced circulation
- B. Performing a 50°F/Hr RCS heatup on forced circulation
- C. Performing a 25°F/Hr RCS cooldown on natural circulation
- D. Performing a 50°F/Hr RCS cooldown on natural circulation

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 92

Single-phase coolant flow resistance (head loss) in a reactor core is proportional to coolant \_\_\_\_\_ and inversely proportional to \_\_\_\_\_.

- A. velocity; fuel assembly length
- B. temperature; fuel assembly length
- C. velocity; coolant channel cross-sectional area
- D. temperature; coolant channel cross-sectional area

QUESTION: 93

During the reflux boiling method of core cooling, the steam that is generated in the core is condensed in the \_\_\_\_\_ side of a steam generator and flows back into the core via the \_\_\_\_\_.

- A. hot leg; hot leg
- B. cold leg; hot leg
- C. hot leg; cold leg
- D. cold leg; cold leg

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 94

The linear power density thermal limit is designed to prevent melting of the \_\_\_\_\_ during normal reactor plant operation; the limit is dependent on the axial and radial peaking factors, of which, the \_\_\_\_\_ peaking factor is the most limiting.

- A. fuel clad; axial
- B. fuel clad; radial
- C. fuel pellets; axial
- D. fuel pellets; radial

USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A

QUESTION: 95

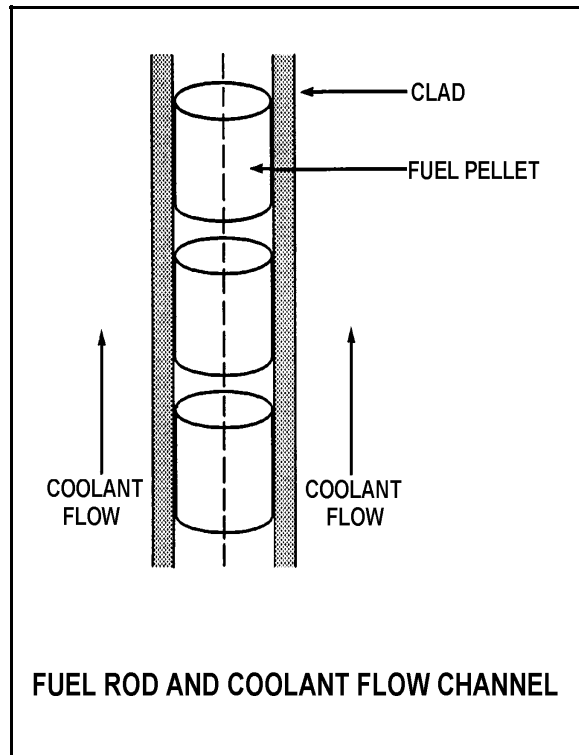
Refer to the drawing of a fuel rod and coolant flow channel at the beginning of core life (see figure below).

Given the following initial core parameters:

Reactor power = 50%  
 $T_{\text{coolant}} = 550^{\circ}\text{F}$   
 $T_{\text{fuel centerline}} = 2750^{\circ}\text{F}$

What will the fuel centerline temperature be if, over core life, the total fuel-to-coolant thermal conductivity doubles? (Assume reactor power and  $T_{\text{coolant}}$  are constant.)

- A.  $1100^{\circ}\text{F}$
- B.  $1375^{\circ}\text{F}$
- C.  $1525^{\circ}\text{F}$
- D.  $1650^{\circ}\text{F}$



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 96

Which one of the following increases the probability of brittle fracture of a pressure vessel wall?

- A. A compressive stress rather than a tensile stress
- B. Performing a 100°F/hr cooldown rather than a 100°F/hr heatup
- C. Using materials fabricated from stainless steel rather than carbon steel
- D. A high reactor coolant temperature rather than a low reactor coolant temperature

QUESTION: 97

Which one of the following operating limitations is designed to prevent brittle fracture of the reactor vessel and other reactor coolant system (RCS) components?

- A. Maximum setpoint for pressurizer safety valves
- B. Maximum differential pressure between RCS and steam generator
- C. Maximum RCS pressure vs. temperature for given RCS heatup rate
- D. Maximum differential temperature between RCS and steam generator



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 98

Two identical reactors have been in operation for the last 10 years. Reactor A has experienced 40 heatup/cooldown cycles with an average power capacity of 50%. Reactor B has experienced 30 heatup/cooldown cycles with an average power capacity of 60%.

Which reactor will have the lowest reactor vessel nil-ductility transition temperature?

- A. Reactor A due to the lower average power capacity
- B. Reactor A due to the greater number of heatup/cooldown cycles
- C. Reactor B due to the higher average power capacity
- D. Reactor B due to the fewer number of heatup/cooldown cycles

QUESTION: 99

Which one of the following would be most likely to cause pressurized thermal shock of the reactor vessel?

- A. Starting a reactor coolant pump in an idle loop with the associated steam generator temperature less than RCS loop temperature.
- B. Starting a reactor coolant pump in an idle loop with the associated steam generator temperature greater than RCS loop temperature.
- C. Continuous emergency coolant injection to the RCS during and after a complete and unisolable rupture of a main steam line.
- D. Continuous emergency coolant injection to the RCS during and after a complete and unisolable rupture of a reactor vessel coolant outlet nozzle.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
FEBRUARY 2002 PWR--FORM A**

QUESTION: 100

A plant heatup is in progress using reactor coolant pumps. The heatup stress applied to the reactor vessel is:

- A. tensile across the entire wall.
- B. tensile at the inner wall and compressive at the outer wall.
- C. compressive across the entire wall.
- D. compressive at the inner wall and tensile at the outer wall.

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

**FEBRUARY 2002 NRC GENERIC FUNDAMENTALS EXAMINATION  
PRESSURIZED WATER REACTOR - ANSWER KEY**

FORM		ANS	FORM		ANS	FORM		ANS	FORM		ANS
A	B		A	B		A	B		A	B	
1	29	B	26	54	D	51	79	D	76	4	C
2	30	A	27	55	A	52	80	C	77	5	B/C
3	31	D	28	56	C	53	81	B	78	6	A
4	32	D	29	57	A	54	82	B	79	7	A
5	33	A	30	58	D	55	83	A/B	80	8	A
6	34	D	31	59	B	56	84	D	81	9	B
7	35	B	32	60	D	57	85	B	82	10	D
8	36	DELETED	33	61	A	58	86	A	83	11	B
9	37	C	34	62	C	59	87	B	84	12	A
10	38	B	35	63	B	60	88	B	85	13	A
11	39	B	36	64	B/D	61	89	A	86	14	C
12	40	B	37	65	C	62	90	D	87	15	D
13	41	C	38	66	B	63	91	D	88	16	D
14	42	C	39	67	D	64	92	B	89	17	B
15	43	D	40	68	C	65	93	A	90	18	B
16	44	A	41	69	B	66	94	A	91	19	D
17	45	C	42	70	D	67	95	C	92	20	C
18	46	D	43	71	A	68	96	A	93	21	A
19	47	C	44	72	B	69	97	A	94	22	D
20	48	C	45	73	C	70	98	A	95	23	D
21	49	C	46	74	B	71	99	C	96	24	B
22	50	D	47	75	B	72	100	B	97	25	C/D
23	51	B	48	76	D	73	1	D	98	26	A
24	52	C	49	77	A/B	74	2	C	99	27	C
25	53	D	50	78	D	75	3	B	100	28	D