UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
JUNE 2007--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 starts. 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

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

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

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

$E = IR$

Thermal Efficiency = Net Work Out/Energy In

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

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

CONVERSIONS

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

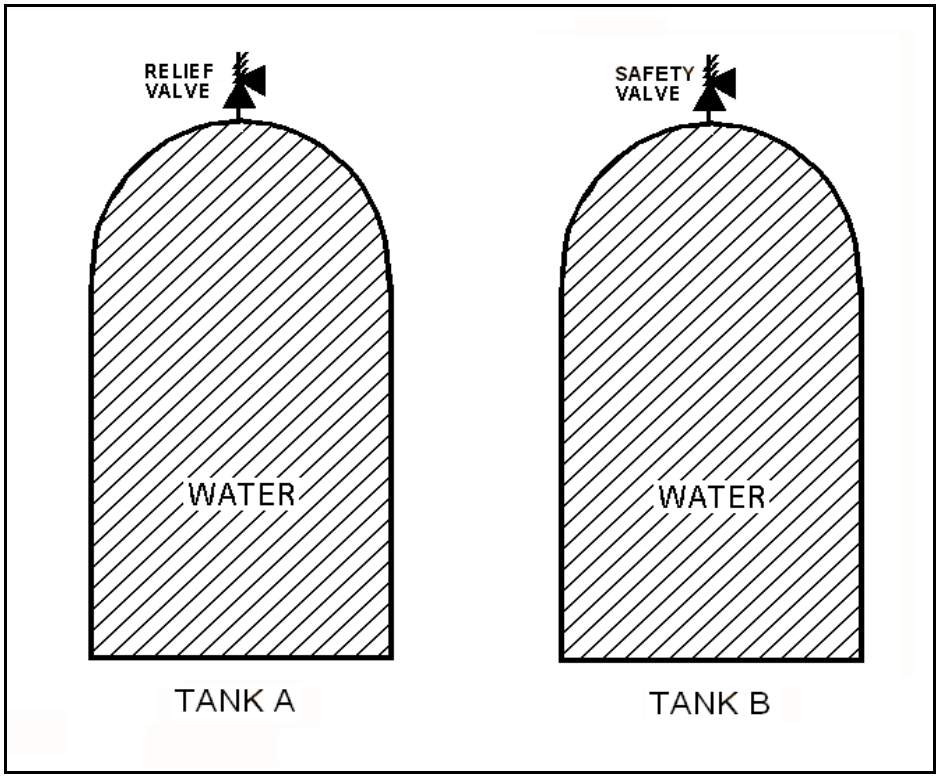
QUESTION: 1

Refer to the drawing of two identical water storage tanks (see figure below). Tank A is protected by a relief valve and Tank B is protected by a safety valve. Each valve has an opening setpoint of 205 psig and a maximum rated discharge flow rate of 8 gpm.

The tanks are being hydrostatically tested to 200 psig. Each tank is being supplied with a smooth and constant flow rate of 2 gpm from separate positive displacement pumps (PDPs). Both PDPs are inadvertently left running when tank pressures reach 200 psig.

With the PDPs running continuously, what will be the resulting status of the relief and safety valves?

	Relief Valve Status	Safety Valve Status
A.	Partially open	Partially open
B.	Partially open	Cycling between fully open and fully closed
C.	Cycling between fully open and fully closed	Partially open
D.	Cycling between fully open and fully closed	Cycling between fully open and fully closed



QUESTION: 2

Which one of the following is a disadvantage associated with using a gate valve, versus a globe valve, to throttle flow in a cooling water system?

A. The tortuous flow path through a throttled gate valve body makes flow control difficult.

B. A gate valve will experience stem leakage unless it is fully opened and backseated.

C. The turbulent flow created by a throttled gate valve will cause erosion damage to the valve seat.

D. A fully open gate valve will produce a greater system head loss than a fully open globe valve.

QUESTION: 3

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

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

DETECTOR	TAPS
X	A and D
Y	B and D
Z	C and D

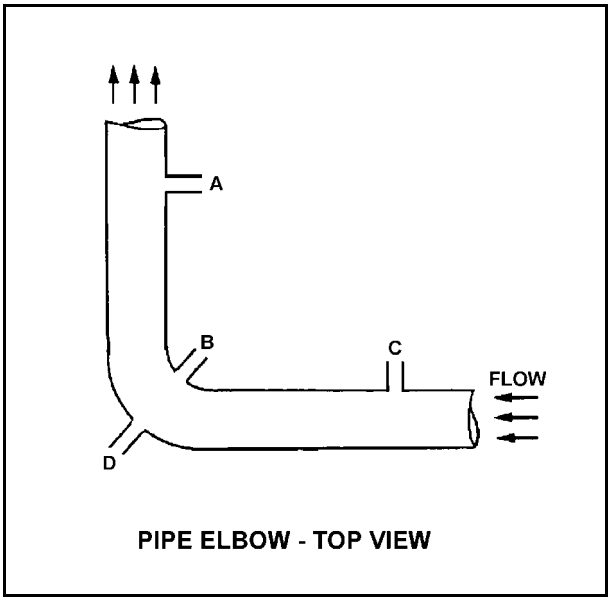
Assuming zero head loss in this section of pipe, how will the detectors be affected if tap B experiences a significant leak? (Assume water system pressure does not change.)

A. All detectors will fail low.

B. All detectors will fail high.

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

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



PIPE ELBOW - TOP VIEW

QUESTION: 4

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

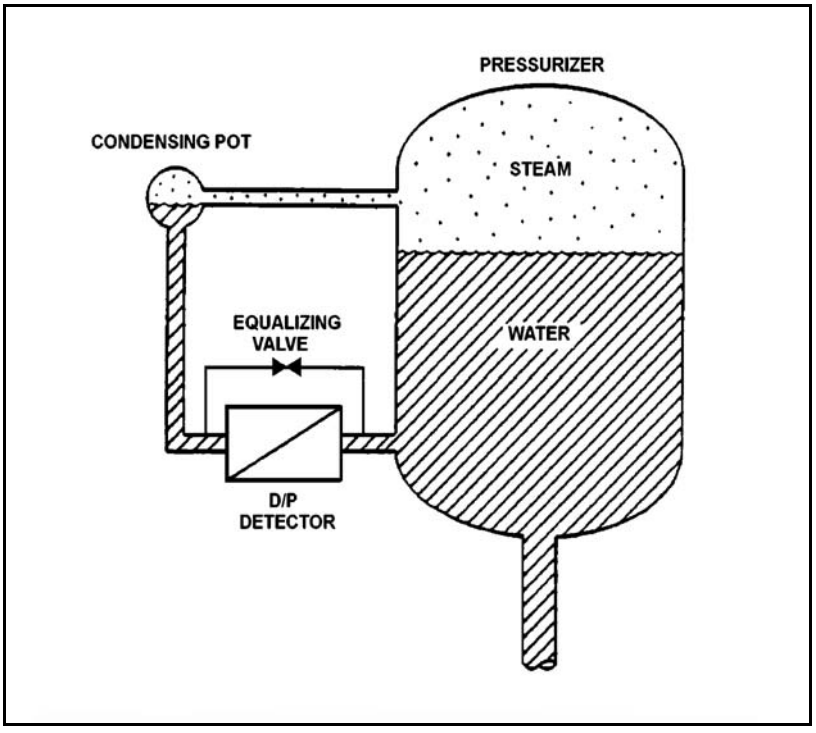
The high pressure side of the detector is connected to the _____; and if the equalizing valve is opened the indicated pressurizer level will be _____ than the actual level.

A. condensing pot; lower

B. condensing pot; higher

C. pressurizer; lower

D. pressurizer; higher



QUESTION: 5

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 different lengths of thermocouple extension wires do not affect thermocouple temperature indication.

C. Ensures that electrical noise in the thermocouple extension wires does not affect thermocouple temperature indication.

D. Ensures that temperature changes away from the thermocouple measuring junction do not affect thermocouple temperature indication.

QUESTION: 6

A beta particle and an alpha particle with equal kinetic energies cause ionization in a gas-filled radiation detector. The detector is operating in the ion chamber region of the gas ionization curve. Which one of the following describes the amplitudes of the detector pulses caused by each type of radiation?

A. The beta particle pulse will be larger in amplitude.

B. The alpha particle pulse will be larger in amplitude.

C. The amplitudes of both pulses will be approximately equal for all detector voltages in the ion chamber region.

D. The amplitudes of both pulses will be approximately equal for all detector voltages in the ion chamber region, as well as all detector voltages outside the ion chamber region.

QUESTION: 7

The difference between the setpoint in an automatic controller and the steady-state value of the controlled parameter is called...

A. offset.

B. gain.

C. deadband.

D. feedback.

QUESTION: 8

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

A. increase, until an upper limit is reached or the turbine trips on overspeed.

B. decrease, until the mismatch with the turbine speed demand signal is nulled.

C. increase, until the mismatch with the turbine speed demand signal is nulled.

D. decrease, until a lower limit is reached or turbine steam flow is isolated.

QUESTION: 9

Refer to the drawing of a pressure bistable in an alarm circuit (see figure below).

The orientation of the bistable symbol indicates the characteristics of the bistable, as is normal for a control circuit diagram. The bistable turns on to actuate an alarm at a system pressure of 100 psig. The bistable has a 5 psig dead band, or neutral zone.

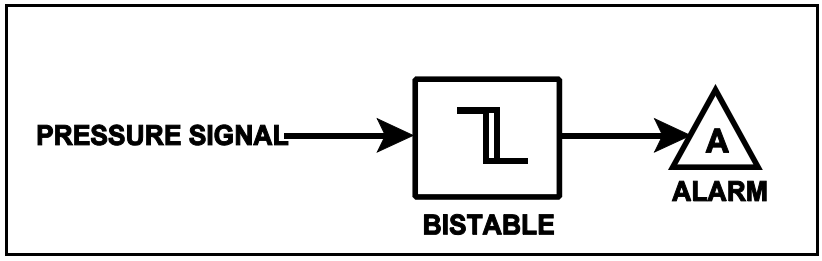
If system pressure is currently 110 psig, which one of the following describes the alarm circuit response as system pressure slowly decreases to 90 psig?

A. The alarm will actuate at 100 psig and will <u>not</u> turn off.

B. The alarm will actuate at 100 psig and will turn off at 95 psig.

C. The alarm is currently actuated and will <u>not</u> turn off.

D. The alarm is currently actuated and will turn off at 95 psig.



QUESTION: 10

A centrifugal pump is started and the following indications are observed:

Oscillating flow
Oscillating discharge pressure
Oscillating amps

These indications are symptoms that the pump is experiencing...

A. excessive thrust.

B. cavitation.

C. runout.

D. wear ring failure.

QUESTION: 11

Consider a centrifugal pump that is taking suction from the bottom of an open water storage tank. (See figure below.)

Given:

The tank contains 60°F water.
The eye of the pump impeller is located 50 feet above the bottom of the tank.
The pump requires a minimum net positive suction head of 4 feet.

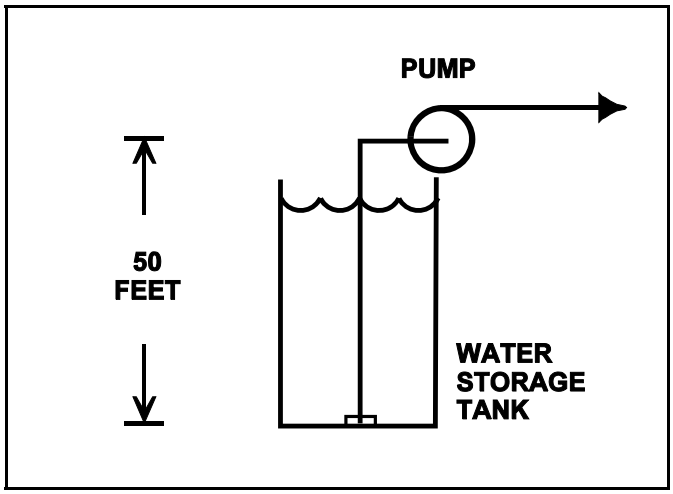
Which one of the following describes the effect on pump operation if tank water level is allowed to continuously decrease?

A. The pump will operate normally until tank water level decreases below approximately 20 feet, at which time the pump will cavitate.

B. The pump will operate normally until tank water level decreases below approximately 16 feet, at which time the pump will cavitate.

C. The pump will operate normally until the pump suction becomes uncovered, at which time the pump will cavitate.

D. The pump will operate normally until the pump suction becomes uncovered, at which time the pump will become air bound.



QUESTION: 12

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

A. Discharge valve fully open to reduce motor power requirements

B. Discharge valve throttled to reduce motor power requirements

C. Discharge valve fully open to ensure adequate pump net positive suction head

D. Discharge valve throttled to ensure adequate pump net positive suction head

QUESTION: 13

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 upstream of the discharge isolation valve.

D. On the pump discharge piping downstream of the discharge isolation valve.

QUESTION: 14

A cooling water system is being returned to service following maintenance on the two identical centrifugal cooling water pumps. The two pumps (see figure below) take suction from a common suction header and discharge to a common discharge header. Each pump is driven by a three-phase ac induction motor.

Pump A was started five minutes ago to initiate flow in the cooling water system. Pump B is about to be started.

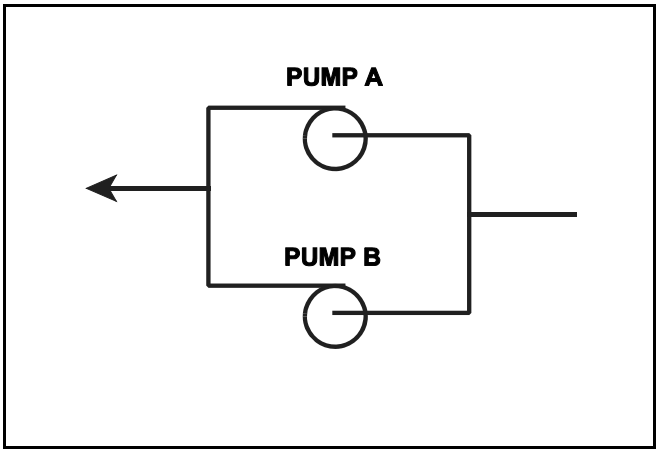
When pump B is started, which one of the following would cause the ammeter for pump B to remain off-scale high for several seconds longer than usual before returning to normal running current indication?

A. The pump packing was removed and not reinstalled.

B. The pump was initially rotating in the reverse direction.

C. Two phases of the motor windings were electrically switched.

D. The coupling between the motor and the pump was removed and not reinstalled.



QUESTION: 15

Frequent start/stop cycling of large ac motors is prohibited to prevent...

A. excessive bearing wear.

B. motor shaft imbalance.

C. overloading electrical buswork.

D. overheating motor windings.

QUESTION: 16

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

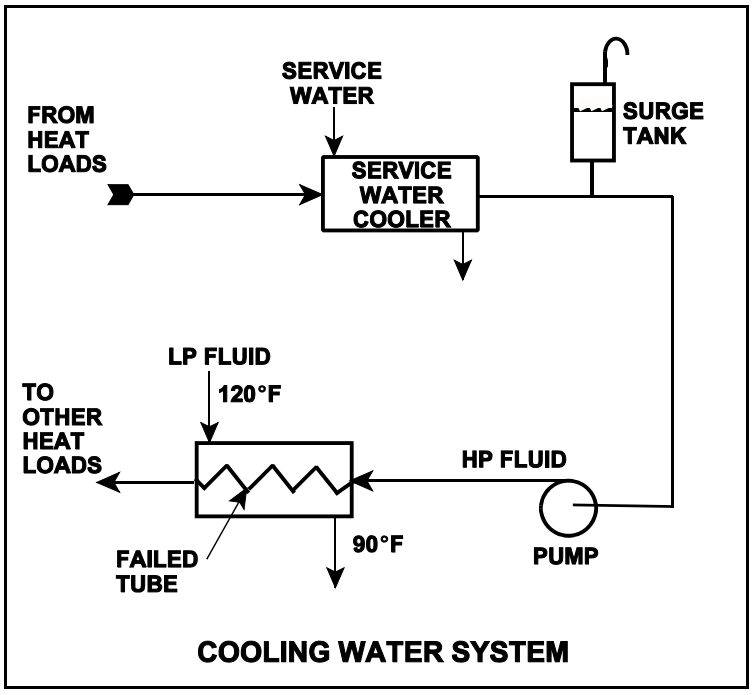
Which one of the following will occur as a result of the indicated tube failure in the heat exchanger?

A. High pressure (HP) fluid inventory increases.

B. Pressure in the low pressure (LP) system decreases.

C. Temperature in the low pressure (LP) system increases.

D. Level in the surge tank decreases.



QUESTION: 17

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

Given the following initial parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$) = 75°F
Cooling water outlet temperature ($T_{cw\text{-}out}$) = 95°F
Oil inlet temperature ($T_{oil\text{-}in}$) = 150°F
Oil outlet temperature ($T_{oil\text{-}out}$) = 120°F

Air introduction to the heat exchanger results in some of the heat exchanger tubes becoming uncovered. As a result, $T_{cw\text{-}out}$ decreases to 91°F. Assume the inlet temperatures, mass flow rates, and specific heats of both fluids remain the same.

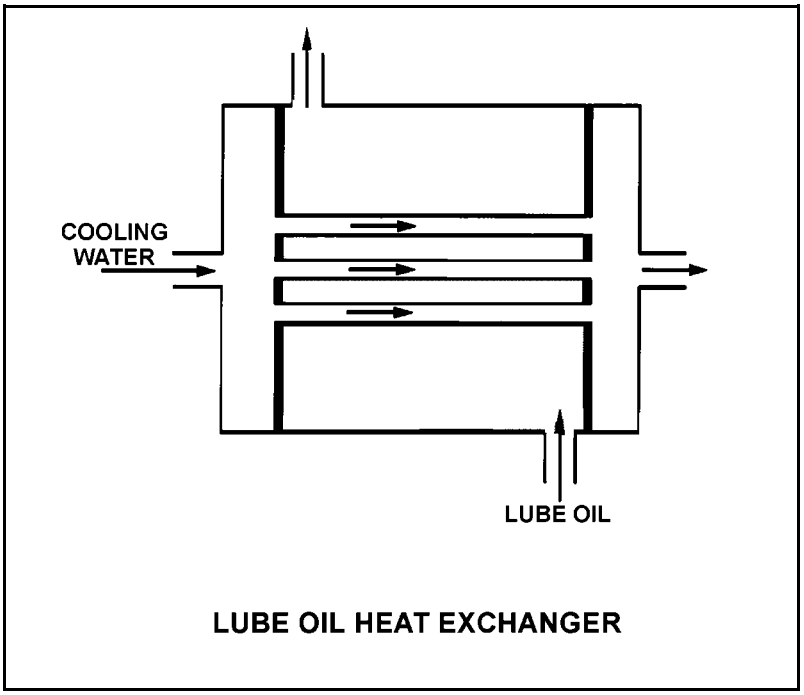
Which one of the following will be the resulting temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

A. 126°F

B. 130°F

C. 134°F

D. 138°F



QUESTION: 18

An operating nuclear power plant uses a mixed-resin deep-bed demineralizer to purify condensate. Condensate temperature gradually increases from 90°F to 110°F while the mass flow rate of condensate through the demineralizer remains the same.

As a result of the condensate temperature increase, the demineralizer will be _____ efficient at removing ionic impurities; and the demineralizer will experience a _____ pressure drop.

A. less; higher

B. less; lower

C. more; higher

D. more; lower

QUESTION: 19

A nuclear power plant was operating at steady-state 100% power when the reactor coolant system experienced a large crud burst. Shortly afterward, the operators began to record parameters for the in-service reactor coolant purification ion exchanger.

Assuming no additional operator actions, what trend will the recorded parameters show during the next few hours?

A. Increasing flow rate through the ion exchanger

B. Increasing pressure drop across the ion exchanger

C. Increasing ion exchanger inlet water conductivity

D. Increasing ion exchanger outlet water conductivity

QUESTION: 20

Two identical 1,000 MW ac electrical generators are operating in parallel, supplying all the loads on a common electrical bus. The generator output breakers provide identical protection for the generators. Generator A and B output indications are as follows:

Generator A	Generator B
28 KV	28 KV
60 Hertz	60 Hertz
150 MW	100 MW
25 MVAR (out)	50 MVAR (out)

A malfunction causes the voltage regulator set point for generator B to slowly and continuously decrease. If no operator action is taken, the electrical current indication for generator B will...

A. decrease continuously until the output breaker for generator A trips on overcurrent.

B. decrease continuously until the output breaker for generator B trips on reverse power.

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.

QUESTION: 21

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 valve position, but relay contacts follow the standard convention for control circuit drawings.

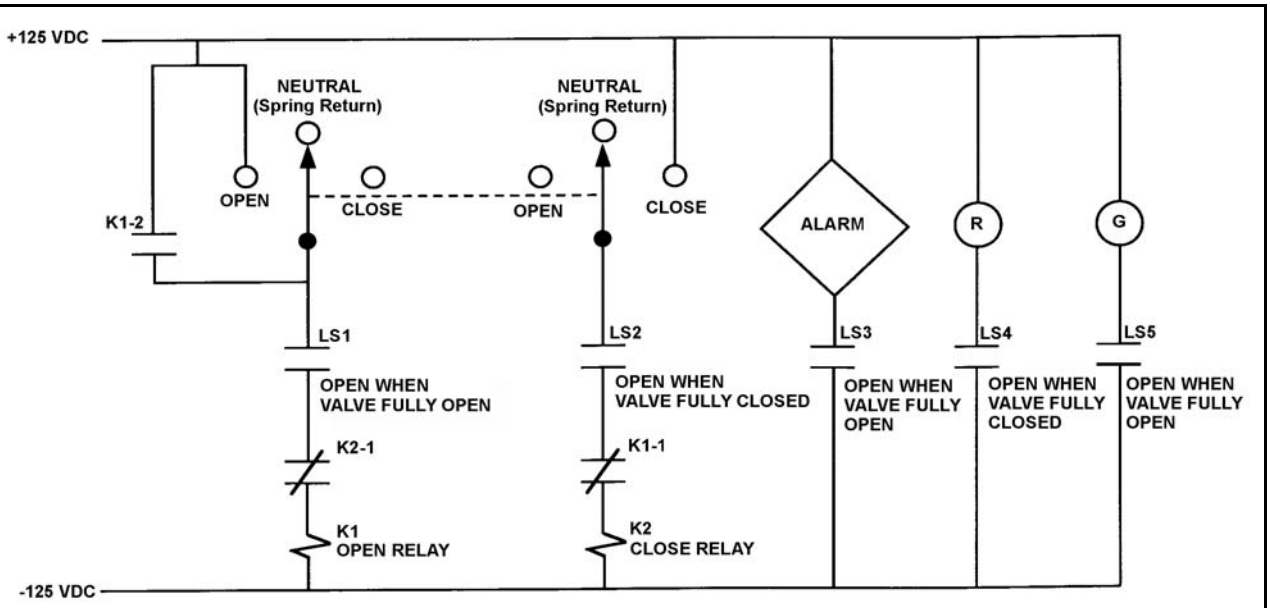
The operator takes the control switch to "Close". Two seconds later, after verifying the valve is closing, the operator releases the control switch. Which one of the following describes the valve motor control circuit alarm response after the switch is released?

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

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

C. The alarm will actuate after approximately 8 seconds.

D. The alarm will <u>not</u> actuate until additional operator action is taken.



VALVE MOTOR CONTROL CIRCUIT

QUESTION: 22

Given the following indications for an open 4160 Vac breaker:

- The local OPEN/CLOSED mechanical flag indicates open
- A breaker overcurrent trip flag is actuated on one phase
- The line-side voltmeter indicates 4160 Vac
- The load-side voltmeter indicates 0 volts

Assuming no operator actions were taken since the breaker opened, which one of the following could have caused the breaker to open?

A. A ground fault caused an automatic breaker trip.

B. A loss of control power caused an automatic breaker trip.

C. An operator opened the breaker locally.

D. An operator opened the breaker from a remote location.

QUESTION: 23

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

A. delayed

B. prompt

C. thermal

D. spontaneous

QUESTION: 24

A nuclear reactor was initially operating at steady-state 100% power when it was shut down and cooled down to 200°F over a three-day period. During the cooldown reactor coolant boron concentration was increased by 80 ppm.

Given the following absolute values of reactivities added during the shutdown and cooldown, assign a (+) or (−) as appropriate and choose the current value of core reactivity.

Control rods = ( ) 6.75% ΔK/K
Xenon = ( ) 2.50% ΔK/K
Power defect = ( ) 2.00% ΔK/K
Boron = ( ) 1.25% ΔK/K
Cooldown = ( ) 0.50% ΔK/K

A. -0.5% ΔK/K

B. -3.0% ΔK/K

C. -7.0% ΔK/K

D. -8.0% ΔK/K

QUESTION: 25

A nuclear power plant was initially shutdown with a stable source range count rate of 30 cps. Using many small additions of positive reactivity, a total of 0.1% ΔK/K was added to the core and stable source range count rate is currently 60 cps.

What was the stable source range count rate after 0.05% ΔK/K was added to the core?

A. 40 cps

B. 45 cps

C. 50 cps

D. 55 cps

QUESTION: 26

Which one of the following contains the pair of nuclides that are the most significant contributors to the total resonance capture in the core near the end of a fuel cycle?

A. Pu-239 and U-235

B. Pu-239 and Pu-240

C. U-238 and Pu-240

D. U-238 and Pu-239

QUESTION: 27

With higher concentrations of boron in the reactor coolant, the core neutron flux distribution shifts to _____ energies where the absorption cross-section of boron is _____.

A. lower; lower

B. lower; higher

C. higher; lower

D. higher; higher

QUESTION: 28

A nuclear reactor is operating at 75% power in the middle of a fuel cycle. Which one of the following actions will cause the greatest shift in reactor power distribution toward the top of the core? (Assume control rods remain fully withdrawn.)

A. Decrease reactor power by 25%.

B. Decrease reactor coolant boron concentration by 10 ppm.

C. Decrease average reactor coolant temperature by 5°F.

D. Decrease reactor coolant system operating pressure by 15 psia.

QUESTION: 29

A nuclear reactor is operating at equilibrium full power when a single control rod fully inserts (from the fully withdrawn position). Reactor power is returned to full power with the control rod still fully inserted.

Compared to the initial axial neutron flux shape, the current flux shape will have a...

A. minor distortion, because a fully inserted control rod has zero reactivity worth.

B. minor distortion, because the fully inserted control rod is an axially uniform poison.

C. major distortion, because the upper and lower core halves are loosely coupled.

D. major distortion, because power production along the length of the rod drastically decreases.

QUESTION: 30

A nuclear reactor has been operating at a constant power level for 15 hours following a rapid power reduction from 100% to 50%. Which one of the following describes the current core xenon-135 concentration?

A. Increasing toward a peak.

B. Decreasing toward an upturn.

C. Increasing toward equilibrium.

D. Decreasing toward equilibrium.

QUESTION: 31

Given:

- A nuclear reactor was operating at 100% power for six weeks when a reactor trip occurred.
- A reactor startup was performed and criticality was reached 16 hours after the trip.
- Two hours later, the reactor is currently at 30% power with control rods in Manual.

If no operator actions are taken over the next hour, average reactor coolant temperature will _____ because core Xe-135 concentration is _____.

A. decrease; increasing

B. decrease; decreasing

C. increase; increasing

D. increase; decreasing

QUESTION: 32

Just prior to a refueling outage the 100% power reactor coolant boron concentration was 50 ppm. Immediately following the outage the 100% power boron concentration was 1,000 ppm.

Assume that burnable poisons were installed during the outage. Also assume that control rods were fully withdrawn from the core at 100% power for both cases.

Which one of the following contributes to the need for a much higher 100% power reactor coolant boron concentration at the beginning of a fuel cycle (BOC) compared with the end of a fuel cycle (EOC)?

A. The negative reactivity from burnable poisons is greater at BOC than at EOC.

B. The negative reactivity from fission product poisons is smaller at BOC than at EOC.

C. The positive reactivity from the fuel in the core is smaller at BOC than at EOC.

D. The positive reactivity from a unit withdrawal of a typical control rod is greater at BOC than at EOC.

QUESTION: 33

The following data were obtained at steady-state conditions during a nuclear reactor startup:

ROD POSITION (UNITS WITHDRAWN)	COUNT RATE (CPS)
10	360
15	400
20	450
25	514
30	600
35	720
40	900

Assuming a uniform differential rod worth, at what approximate rod position will criticality occur?

A. 50 units withdrawn

B. 60 units withdrawn

C. 70 units withdrawn

D. 80 units withdrawn

QUESTION: 34

A nuclear reactor startup is in progress near the end of a fuel cycle. Reactor power is 5×10^{-3}% and increasing slowly with a stable 0.3 dpm startup rate. Assuming no operator action, no reactor trip, and no steam release, what will reactor power be after 10 minutes?

A. Below the point of adding heat (POAH).

B. At the POAH.

C. Above the POAH but less than 50%.

D. Greater than 50%.

QUESTION: 35

A nuclear power plant is operating at 100% power near the end of a fuel cycle with all control systems in manual. The reactor operator inadvertently adds 100 gallons of boric acid (4% by weight) to the reactor coolant system (RCS).

Which one of the following will occur as a result of the boric acid addition? (Assume a constant main generator output.)

A. Pressurizer level will decrease and stabilize at a lower value.

B. RCS pressure will increase and stabilize at a higher value.

C. Reactor power will decrease and stabilize at a lower value.

D. Average RCS temperature will increase and stabilize at a higher value.

QUESTION: 36

A nuclear reactor startup is in progress and criticality has just been achieved. After recording critical rod height, the operator withdraws control rods for 20 seconds to establish a stable positive 0.5 dpm startup rate. One minute later (prior to the point of adding heat) the operator inserts the same control rods for 25 seconds. (Assume the positive and negative reactivity insertion rates are the same.)

During the control rod insertion, the startup rate will become...

A. negative during the entire period of control rod insertion.

B. negative shortly after the control rods pass through the critical rod height.

C. negative just as the control rods pass through the critical rod height.

D. negative shortly before the control rods pass through the critical rod height.

QUESTION: 37

Refer to the drawing of a differential pressure manometer (see figure below).

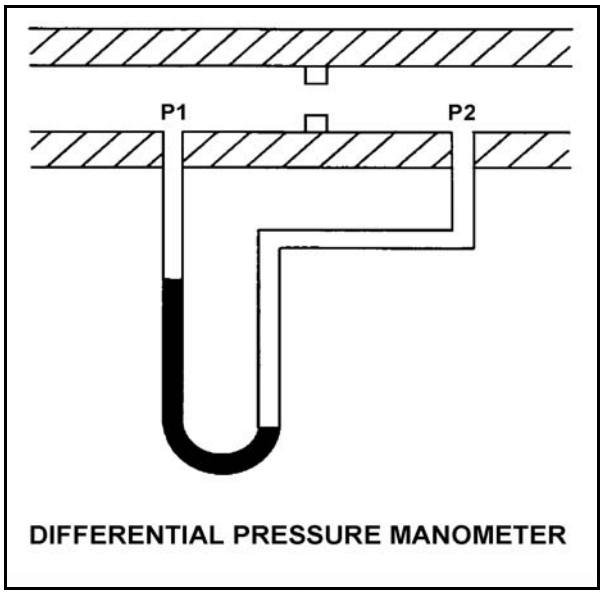
A differential pressure manometer containing water is installed across an orifice in a ventilation duct to determine the direction of airflow. P1 and P2 are pressures sensed in the ventilation duct.
With the conditions shown in the drawing, P1 pressure is _____ than P2 pressure, and airflow is to the _____.

A. less; left

B. less; right

C. greater; left

D. greater; right



DIFFERENTIAL PRESSURE MANOMETER

QUESTION: 38

Which one of the following steam generator (S/G) pressures will come closest to producing a 50°F reactor coolant system (RCS) subcooling margin with RCS pressure at 1000 psia? (Assume a negligible delta-T across the S/G tubes.)

A. 550 psia

B. 600 psia

C. 650 psia

D. 700 psia

QUESTION: 39

Saturated steam enters a frictionless convergent-divergent nozzle with the following parameters:

Pressure = 850 psia
Velocity = 10 ft/sec

The steam at the throat of the nozzle has a subsonic velocity of 950 ft/sec.

Given that nozzles convert enthalpy to kinetic energy, and assuming no heat transfer to or from the nozzle, what is the enthalpy of the steam at the throat of the nozzle?

A. 1,162 Btu/lbm

B. 1,171 Btu/lbm

C. 1,180 Btu/lbm

D. 1,189 Btu/lbm

QUESTION: 40

Which one of the following explains why condensate subcooling is necessary in a nuclear power plant steam cycle?

A. To provide a better condenser vacuum.

B. To maximize overall secondary efficiency.

C. To provide net positive suction head for the condensate pumps.

D. To minimize turbine blade and condenser tube erosion by entrained moisture.

QUESTION: 41

Turbine X and turbine Y are ideal steam turbines that exhaust to a condenser at 1.0 psia. Turbine X is driven by saturated steam (100% quality) at 500 psia. Turbine Y is driven by saturated steam (100% quality) at 700 psia.

The greatest amount of specific work is being performed by turbine _____; the greatest moisture content exists in the exhaust of turbine _____.

A. X; X

B. X; Y

C. Y; X

D. Y; Y

QUESTION: 42

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

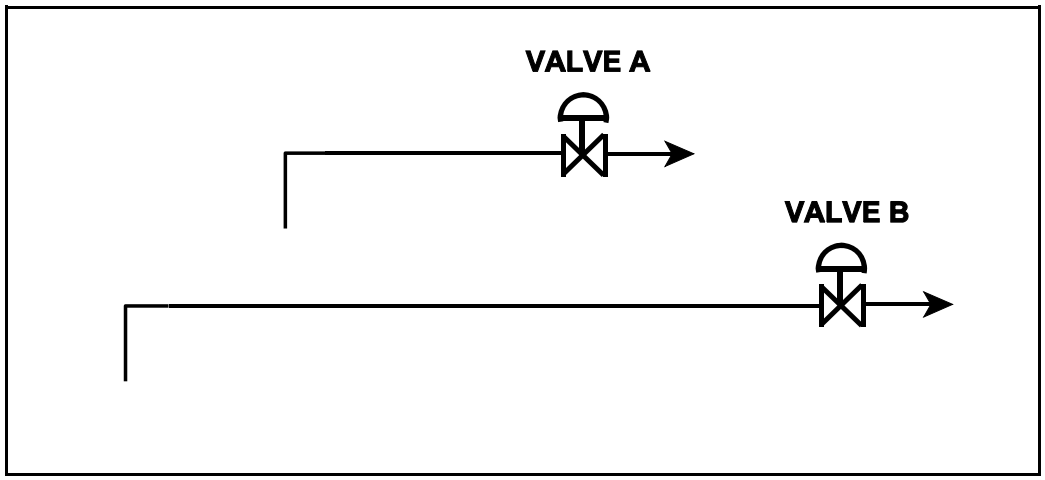
Water at 65°F is flowing at 1,000 gpm through each pipe. If the isolation valves suddenly and simultaneously close, valve A and its associated piping will experience a maximum pressure that is _____ the maximum pressure experienced by valve B and its associated piping. The pressure spike will dissipate quicker in the _____ length of pipe.

A. equal to; shorter

B. equal to; longer

C. less than; shorter

D. less than; longer



QUESTION: 43

Refer to the drawing of a venturi in a main steamline (see figure below). The venturi inlet and outlet pipe diameters are equal.

A main steamline break downstream of the venturi causes the main steam mass flow rate through the venturi to increase. Soon, the steam reaches sonic velocity in the throat of the venturi.

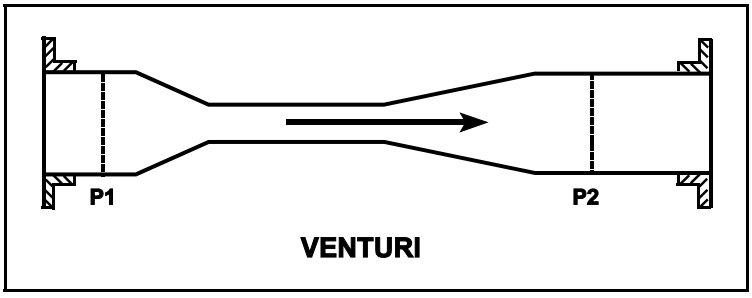
How will the main steam mass flow rate through the venturi be affected as the steam pressure downstream of the venturi continues to decrease?

A. It will continue to increase at a rate that is dependent on the steam velocity in the throat of the venturi.

B. It will continue to increase at a rate that is dependent on the differential pressure (P1 - P2) across the venturi.

C. It will <u>not</u> continue to increase because the steam velocity <u>cannot</u> increase above sonic velocity in the throat of the venturi.

D. It will <u>not</u> continue to increase because the differential pressure (P1 - P2) across the venturi <u>cannot</u> increase further once the steam reaches sonic velocity in the throat of the venturi.



QUESTION: 44

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

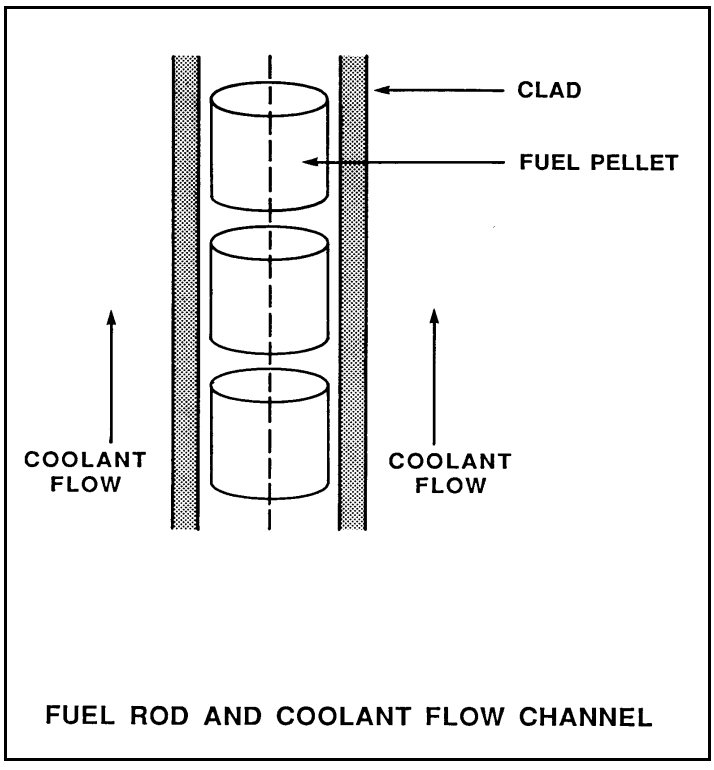
Which one of the following is the primary method of heat transfer through the gap between the reactor fuel and the fuel clad?

A. Conduction

B. Convection

C. Radiation

D. Natural circulation



FUEL ROD AND COOLANT FLOW CHANNEL

QUESTION: 45

Subcooled water enters the bottom of an operating nuclear reactor core that is experiencing a significant overpower transient. As the water flows upward past the fuel assemblies, boiling occurs at the surface of a few fuel assemblies.

If the coolant had remained subcooled, average fuel temperature would have been _____ because single-phase convection is a _____ efficient method of heat transfer than boiling.

A. higher; more

B. higher; less

C. lower; more

D. lower; less

QUESTION: 46

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

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

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

A. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction decreases reactor coolant system pressure by 20 psig with no rod motion.

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

D. Core Xe-135 builds up in proportion to the axial and radial power distribution with automatic rod control.

QUESTION: 47

How does critical heat flux (CHF) vary with core height during normal full power operation?

A. CHF increases from the bottom to the top of the core.

B. CHF decreases from the bottom to the core midplane, then increases from the midplane to the top of the core.

C. CHF decreases from the bottom to the top of the core.

D. CHF increases from the bottom to the core midplane, then decreases from the midplane to the top of the core.

QUESTION: 48

Which one of the following must be present to assure adequate core cooling following a small loss-of-coolant accident?

A. Emergency cooling injection flow rate on scale.

B. Pressurizer level in the indicating range.

C. Subcooling margin greater than zero.

D. Pressurizer pressure greater than safety injection actuation setpoint.

QUESTION: 49

A nuclear reactor is operating at 3,400 MW thermal power. The core maximum power density limit is 12.2 kW/ft.

Given:

- The reactor core contains 198 fuel assemblies.
- Each fuel assembly contains 262 fuel rods, each with an active length of 12.0 feet
- The highest total peaking factors measured in the core are as follows:

  Location A: 2.5
  Location B: 2.4
  Location C: 2.3
  Location D: 2.2

Which one of the following describes the operating conditions in the core relative to the maximum power density limit?

A. All locations in the core are operating below the maximum power density limit.

B. Location A has exceeded the maximum power density limit while the remainder of the core is operating below the limit.

C. Locations A and B have exceeded the maximum power density limit while the remainder of the core is operating below the limit.

D. Locations A, B, and C have exceeded the maximum power density limit while the remainder of the core is operating below the limit.

QUESTION: 50

A nuclear reactor is shutdown with the shutdown cooling system maintaining reactor coolant temperature at 240°F immediately following an uncontrolled cooldown from 500°F. If reactor coolant temperature is held constant at 240°F, which one of the following describes the change in tensile stress on the inner wall of the reactor vessel (RV) over the next few hours?

A. Decreases, because the temperature gradient across the RV wall will decrease.

B. Increases, because the temperature gradient across the RV wall will decrease.

C. Decreases, because the inner RV wall temperature will approach the nil-ductility transition temperature.

D. Increases, because the inner RV wall temperature will approach the nil-ductility transition temperature.

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

JUNE 2007 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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