UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 2009 -- FORM A

Please Print

Name: _____

Docket No.: _____

Facility: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO APPLICANT

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

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

$\ell^* = 1 \times 10^{-4}$ 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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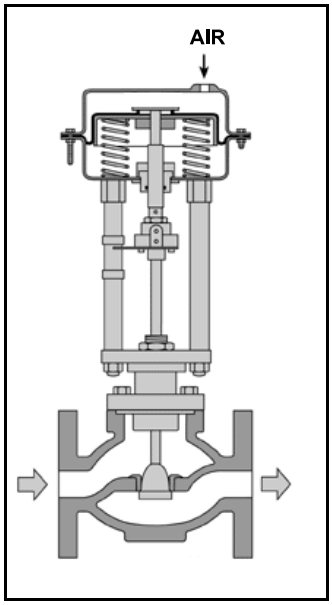
1 Mw = 3.41×10^6 Btu/hr	1 Curie = 3.7×10^{10} dps
1 hp = 2.54×10^3 Btu/hr	1 kg = 2.21 lbm
1 Btu = 778 ft-lbf	1 gal_{water} = 8.35 lbm
°C = (5/9)(°F - 32)	1 ft^3_{water} = 7.48 gal
°F = (9/5)(°C) + 32	

QUESTION: 1

Refer to the drawing of a pneumatically-operated valve (see figure below). The valve actuator may be shown with or without applied air pressure.

Which one of the following describes the type of valve shown, and the fail position on loss of air to the actuator?

	Valve Type	Fail Position
A.	Ball	Open
B.	Ball	Closed
C.	Globe	Open
D.	Globe	Closed



QUESTION: 2

To verify the position of a fully open manual valve in an operating system, the operator should operate the valve handwheel...

A. in the open direction until the valve is backseated one-half turn.

B. to fully close the valve, then open the valve to the fully open position.

C. in the closed direction, then open the valve to its previously open position.

D. to open the valve until it touches the backseat, then close the valve to the desired position.

QUESTION: 3

A cooling water system is cooling a lube oil heat exchanger. Cooling water system surge tank level is being measured using a differential pressure level detector that has been calibrated at the current water temperature in the tank. A leak in the heat exchanger results in lube oil collecting in the surge tank.

Assuming that the temperature of the contents in the surge tank does not change, indicated tank level will be _____ than actual tank level because lube oil is _____ than water.

A. lower; less dense

B. lower; more dense

C. higher; less dense

D. higher; more dense

QUESTION: 4

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

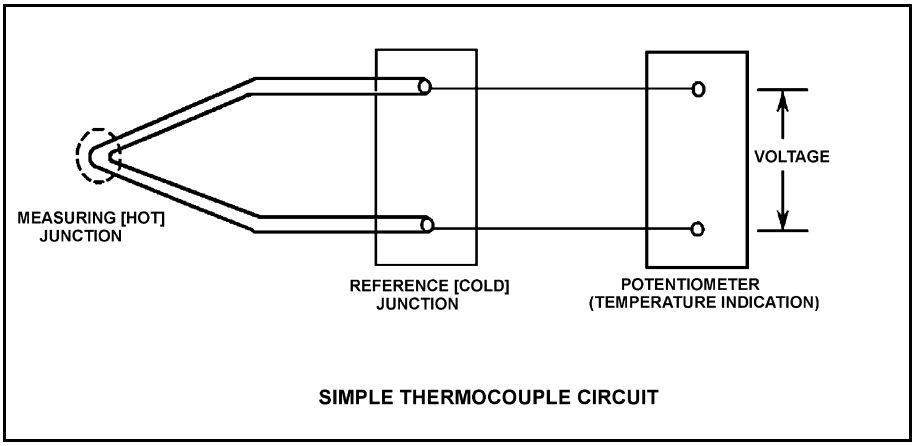
Given that the temperatures at the measuring and reference junctions remain constant, if a ventilation system malfunction causes the temperature of the temperature indication panel to increase by 10°F, indicated temperature will...

A. not be affected.

B. increase by 10°F.

C. decrease by 10°F.

D. change in an unpredictable manner.



SIMPLE THERMOCOUPLE CIRCUIT

QUESTION: 5

Refer to the simplified drawing of a control rod position detector (see figure below).

Coils of wire connected to an ac power supply are being used to monitor the position of a control rod in a nuclear reactor. The coils are mounted in a column outside the reactor vessel head such that the steel control rod drive shaft passes upward through the coils as the control rod is withdrawn. Currently, the top of a control rod drive shaft is located between coils A and B as shown. The control rod is to be withdrawn until the top of the control rod drive shaft is located just below coil C.

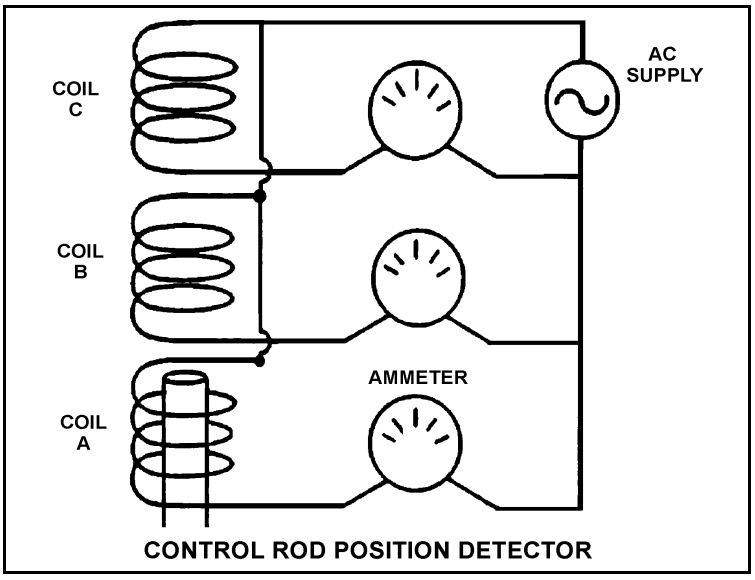
Compared to the initial coil output currents, after the control rod is withdrawn the output current of coil A will be _____; and the output current of coil B will be _____.

A. the same; lower

B. the same; higher

C. higher; lower

D. higher; higher



QUESTION: 6

A nuclear power plant experienced a loss of coolant accident combined with a loss of emergency coolant injection flow. During the accident, the homogeneous void fraction of the coolant in the core and downcomer reached 100%. Then emergency coolant injection flow was restored, which caused a steady reduction in the void fraction as the reactor vessel refilled.

Which one of the following describes the expected trend in excore source/startup range neutron level indication as the homogeneous coolant void fraction decreases from 100% to 20% in the core and downcomer? (Assume the source/startup range neutron detectors are located adjacent to the bottom one-third of the core.)

A. Increase, then decrease

B. Increase continuously

C. Decrease, then increase

D. Decrease continuously

QUESTION: 7

A flow controller has proportional, integral, and derivative control features. Which one of the following lists the effect on the control features when the controller is switched from the automatic mode to the manual mode?

A. Only the derivative feature will be lost.

B. Only the integral and derivative features will be lost.

C. All proportional, integral, and derivative features will be lost.

D. All control features will continue to influence the controller output.

QUESTION: 8

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

The temperature controller is a direct-acting proportional controller. Assume the measured temperature remains within the controller's proportional band.

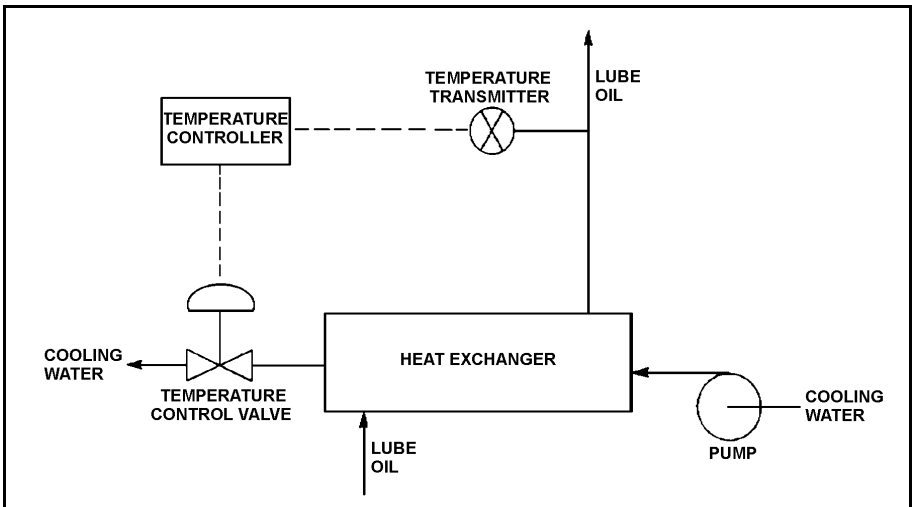
Which one of the following describes the effect of changing the controller's gain from 1.0 to 2.0?

A. Half the change in measured temperature will produce the same change in controller input.

B. Twice the change in measured temperature will produce the same change in controller input.

C. The temperature control valve will move half as far for the same change in controller input.

D. The temperature control valve will move twice as far for the same change in controller input.



LUBE OIL TEMPERATURE CONTROL SYSTEM

QUESTION: 9

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

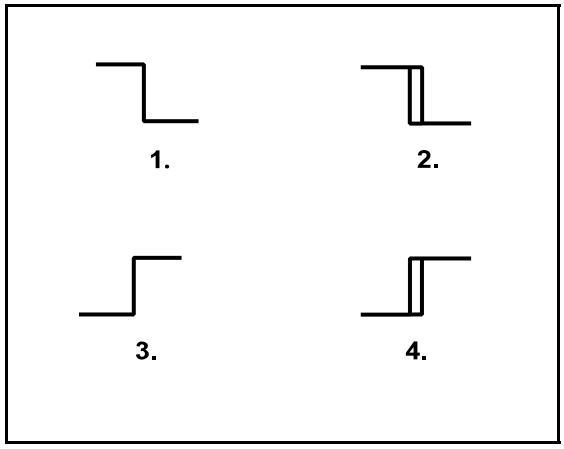
Which one of the following bistable symbols indicates the characteristics of the bistable used in the level controller?

A. 1.

B. 2.

C. 3.

D. 4.



QUESTION: 10

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

Given the following initial conditions:

- Condenser pressure is 1.2 psia.
- Condensate temperature is 96°F.
- Hotwell level is 10 feet above the condensate pump suction.

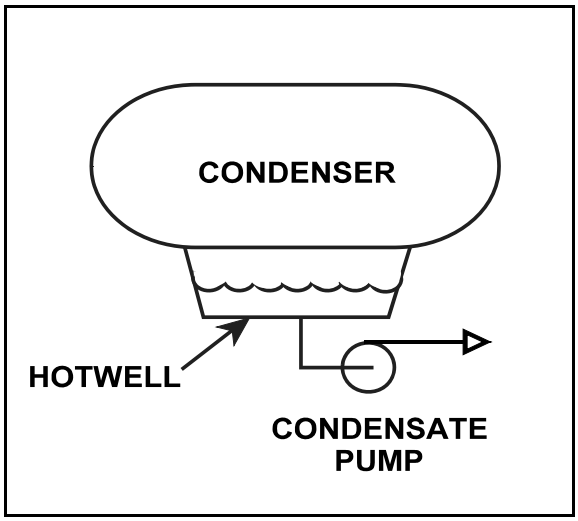
Which one of the following will provide the greatest increase in NPSH available to the condensate pump? (Assume that condenser pressure does not change.)

A. Hotwell level decreases by 6 inches.

B. Hotwell level increases by 6 inches.

C. Condensate temperature decreases by 6°F.

D. Condensate temperature increases by 6°F.



QUESTION: 11

Some large centrifugal pumps are interlocked so that the pump will not start unless its discharge valve is at least 90% fully closed. This interlock is provided to minimize the...

A. pump discharge pressure.

B. heating of the pumped fluid.

C. cavitation at the pump suction.

D. duration of the pump motor starting current.

QUESTION: 12

A typical single-stage radial-flow centrifugal pump is being returned to service following maintenance on its three-phase ac induction 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 pump will rotate in the reverse direction with reduced or no flow rate.

D. The pump will rotate in the normal direction with reduced flow rate.

QUESTION: 13

An ideal (no slip) reciprocating positive displacement pump is operating to provide makeup water to a reactor coolant system that is being maintained at 2,200 psig. The discharge valve of the pump was found to be throttled to 80% open.

If the valve is subsequently fully opened, pump flow rate will _____ and pump head will _____.

A. increase; decrease

B. remain constant; decrease

C. increase; remain constant

D. remain constant; remain constant

QUESTION: 14

When a motor-driven centrifugal pump is started, the motor ammeter reading immediately increases to, and stabilizes at, many times the normal operating value. Which one of the following describes a possible cause for the ammeter response?

A. The pump was started with a fully closed discharge valve.

B. The pump was started with a fully open discharge valve.

C. The pump shaft seized upon start and did not rotate.

D. The pump shaft separated from the motor shaft upon start.

QUESTION: 15

A nuclear power plant startup is in progress. The main generator has just been connected to the power grid with the following generator indications:

10 MW
0 MVAR
288 amps
20,000 volts

The operator suspects that the main generator is operating under reverse power conditions and attempts to increase generator load (MW) normally. If the main generator is operating under reverse power conditions when the operator attempts to increase generator load, generator MW will initially _____; and generator amps will initially _____.

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

QUESTION: 16

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

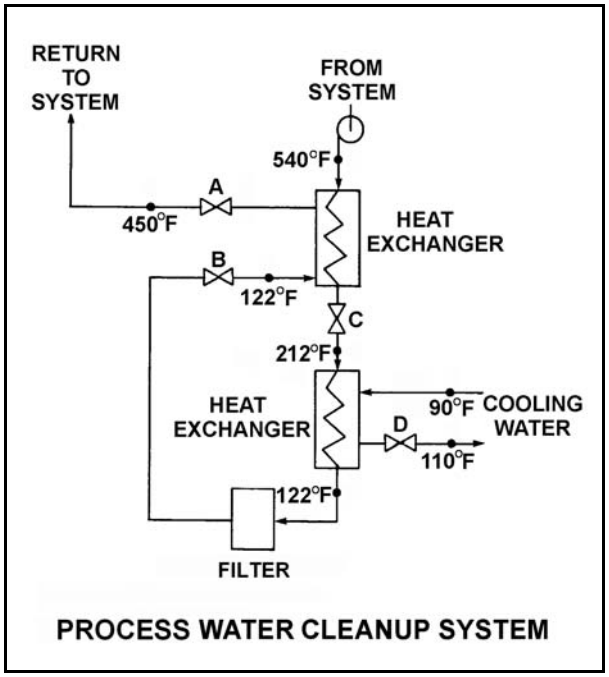
Assume there is no heat loss from the process water cleanup system to the surroundings and the process water flow rate does not change. If valve D closes fully, what will be the final steady-state temperature of the process water flowing through the filter?

A. 212°F

B. 302°F

C. 450°F

D. 540°F



PROCESS WATER CLEANUP SYSTEM

QUESTION: 17

Steam has been admitted to a main condenser for 25 minutes with no cooling water. Initiating full cooling water flow rate at this time will...

A. reduce the stress on the condenser shell by rapidly cooling the shell.

B. reduce the stress on the condenser tubes by rapidly cooling the tubes.

C. induce large thermal stresses on the condenser shell.

D. induce large thermal stresses on the junctions between the condenser tubes and the tubesheet.

QUESTION: 18

A condensate demineralizer differential pressure (D/P) gauge indicates 4.0 psid at 50% flow rate. Which one of the following combinations of condensate flow and demineralizer D/P observed at various power levels over the next few days indicates an increase in the accumulation of insoluble corrosion products in the demineralizer?

	Condensate Flow Rate	Demineralizer D/P (psid)
A.	25%	0.9
B.	60%	6.3
C.	75%	8.7
D.	100%	15.6

QUESTION: 19

A PWR nuclear power plant has two identical mixed resin reactor coolant ion exchangers, A and B, which operated in parallel service continuously for two weeks of power operation immediately after a refueling outage. Then, ion exchanger A was removed from service while ion exchanger B remained in service. After 10 months of continuous operation at full power, it is necessary to place ion exchanger A in service and remove ion exchanger B from service.

Which one of the following describes why the effluent from ion exchanger A initially will be drained to a collection facility prior to fully placing the ion exchanger in service?

A. To avoid an undesired increase in reactor coolant pH.

B. To avoid an undesired decrease in reactor coolant pH.

C. To avoid an undesired increase in reactor coolant boron concentration.

D. To avoid an undesired decrease in reactor coolant boron concentration.

QUESTION: 20

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 are shown open/closed according to the standard convention for control circuit drawings.

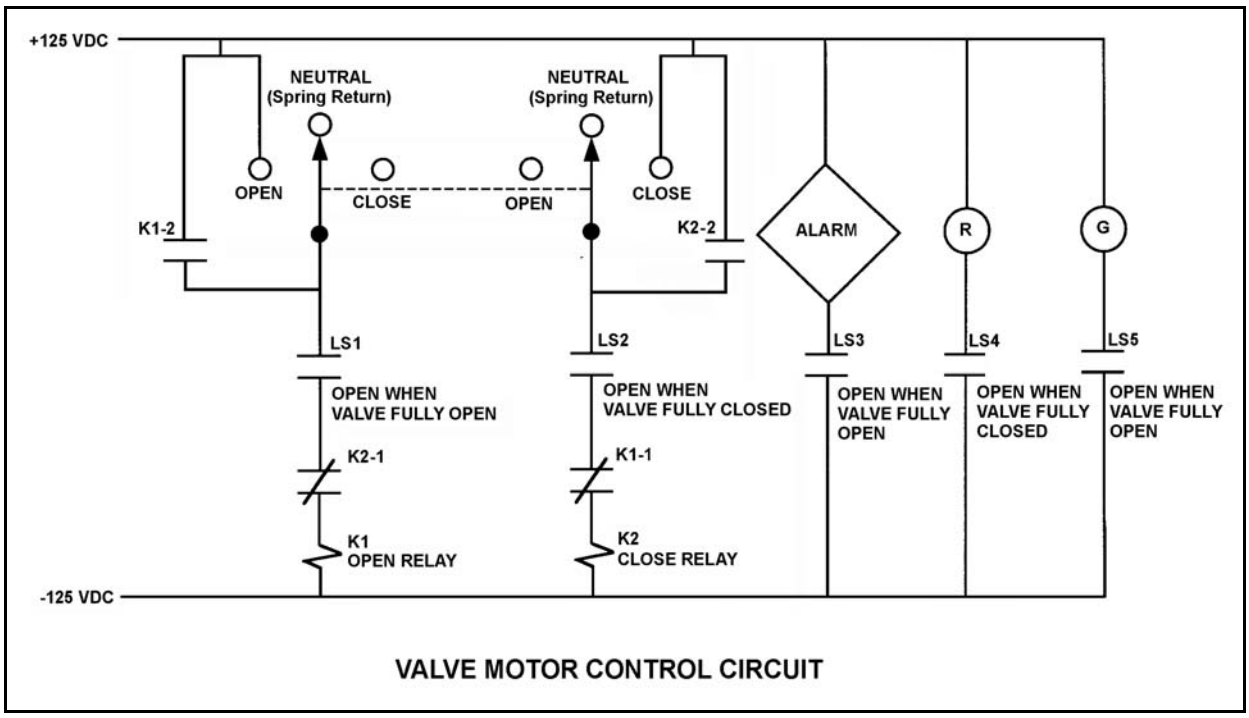
The operator takes the control switch to "Close" momentarily and the valve begins to close. Five seconds later, the operator takes the switch to "Open" momentarily and then releases the switch. Which one of the following describes the valve response after the switch is released?

A. The valve will stop closing and remain partially open.

B. The valve will stop closing and then go fully open.

C. The valve will close fully and remain fully closed.

D. The valve will close fully and then go fully open.



VALVE MOTOR CONTROL CIRCUIT

QUESTION: 21

A 480 VAC motor is supplied power via an electrical disconnect in series with a circuit breaker. Which one of the following describes the proper operations to isolate power to the motor?

A. Open the disconnect first, then the breaker.

B. Open the breaker first, then the disconnect.

C. Open the breaker and disconnect at the same time.

D. Sequence is not important as long as the motor is operating.

QUESTION: 22

Given the following indications for an open 4,160 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 4,160 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

When determining the shutdown margin for an operating nuclear reactor, how many control rods are assumed to remain <u>fully</u> withdrawn?

A. A single control rod of the highest reactivity worth

B. A symmetrical pair of control rods of the highest reactivity worth

C. A single control rod of average reactivity worth

D. A symmetrical pair of control rods of average reactivity worth

QUESTION: 25

A reactor is initially critical below the point of adding heat (POAH) and remains below the POAH. Consider the following two cases:

Case 1: An operator adds positive 1.0×10^{-4} $\Delta K/K$ reactivity to the reactor.
Case 2: An operator adds negative 1.0×10^{-4} $\Delta K/K$ reactivity to the reactor.

The time required for reactor power to change by a factor of 10 will be greater in case ___ because delayed neutrons are more effective at slowing reactor power changes when reactor power is _____.

A. 1; increasing

B. 1; decreasing

C. 2; increasing

D. 2; decreasing

QUESTION: 26

A nuclear power plant is being returned to operation following a one-month refueling outage. Fuel preconditioning requires reactor power to be increased from 10% to 100% power gradually over an 8 hour period.

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

A. fuel burnup.

B. xenon buildup.

C. fuel temperature increase.

D. moderator temperature increase.

QUESTION: 27

A nuclear power plant is operating at steady-state 100% power. Given the following initial parameters, select the final reactor coolant boron concentration required to decrease average coolant temperature by 6°F. (Assume no change in control rod position or reactor/turbine power.)

Initial boron concentration	= 500 ppm
Moderator temperature coefficient	= -0.012% ΔK/K per °F
Differential boron worth	= -0.008% ΔK/K per ppm
Inverse boron worth	= -125 ppm/% ΔK/K

A. 509 ppm

B. 504 ppm

C. 496 ppm

D. 491 ppm

QUESTION: 28

A nuclear reactor startup is in progress from a cold shutdown condition. During the RCS heatup phase of the startup, control rod differential reactivity worth (ΔK/K per inch insertion) becomes _____ negative; and during the complete withdrawal of the initial bank of control rods, control rod differential reactivity worth becomes _____.

A. more; more negative and then less negative

B. more; less negative and then more negative

C. less; more negative during the entire withdrawal

D. less; less negative during the entire withdrawal

QUESTION: 29

A nuclear reactor has been taken critical following a refueling outage and is currently at the point of adding heat during a normal reactor startup. Which one of the following describes the change in core axial power distribution as reactor power is increased to five percent by control rod withdrawal?

A. Shifts toward the bottom of the core.

B. Shifts toward the top of the core.

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

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

QUESTION: 30

A nuclear reactor has been operating at 50% power for one week when power is ramped in 4 hours to 100%. Which one of the following describes the new equilibrium core xenon-135 concentration?

A. Twice the 50% power concentration.

B. Less than twice the 50% power concentration.

C. More than twice the 50% power concentration.

D. Remains the same because it is independent of power.

QUESTION: 31

A nuclear reactor is initially operating at 80% power with equilibrium core xenon-135. Power is increased to 100% over a 2-hour period and average reactor coolant temperature is adjusted to 585°F using manual rod control. Rod control is left in Manual and no subsequent operator actions are taken.

Considering only the reactivity effects of core xenon-135 changes, which one of the following describes the average reactor coolant temperature 24 hours after the power change is completed?

A. Less than 585°F and decreasing slowly.

B. Less than 585°F and increasing slowly.

C. Greater than 585°F and decreasing slowly.

D. Greater than 585°F and increasing slowly.

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

After taking critical data during a reactor startup, the operator establishes a positive 48-second reactor period to increase reactor power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize power at the POAH? (Assume $\overline{\beta}_{eff} = 0.00579$.)

A. -0.010% ΔK/K

B. -0.012% ΔK/K

C. -0.10% ΔK/K

D. -0.12% ΔK/K

QUESTION: 34

A refueling outage has just been completed in which one-third of the core was replaced with new fuel assemblies. A reactor startup has been performed to mark the beginning of the sixth fuel cycle and reactor power is being increased to 100%.

Which one of the following pairs of reactor fuels will be providing the greatest contribution to core heat production when the reactor reaches 100% power?

A. U-235 and U-238

B. U-235 and Pu-239

C. U-235 and Pu-241

D. U-238 and Pu-239

QUESTION: 35

A nuclear reactor is exactly critical just below the point of adding heat when a single control rod drops into the core. Assuming no operator or automatic actions occur, when the plant stabilizes, reactor power will be _____ and average reactor coolant temperature will be _____.

A. the same; the same

B. the same; lower

C. lower; the same

D. lower; lower

QUESTION: 36

Which one of the following describes the process for inserting control rods during a normal reactor shutdown?

A. Control rods are inserted in reverse order one bank at a time to maintain acceptable power distribution.

B. Control rods are inserted in reverse order one bank at a time to maintain a rapid shutdown capability from the remainder of the control rods.

C. Control rods are inserted in reverse order in a bank overlapping sequence to maintain a relatively constant differential control rod worth.

D. Control rods are inserted in reverse order in a bank overlapping sequence to limit the amount of positive reactivity added during a rod ejection accident.

QUESTION: 37

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

A. 2 psig, 12 inches Hg absolute, 8 psia

B. 2 psig, 18 inches Hg absolute, 8 psia

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

D. 12 psia, 30 inches Hg absolute, 2 psig

QUESTION: 38

Given the following:

- A saturated steam-water mixture with an inlet quality of 40% is flowing through a moisture separator.
- The moisture separator is 100% efficient for removing water.

How much water 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: 39

What happens to the enthalpy of the saturated steam in a steam generator (SG) as heat addition to the feedwater increases SG pressure from 100 psia to 1,000 psia?

A. The enthalpy increases during the entire pressure increase.

B. The enthalpy initially increases and then decreases.

C. The enthalpy decreases during the entire pressure increase.

D. The enthalpy initially decreases and then increases.

QUESTION: 40

Refer to the drawing of two 1,000 ft^3 pressure vessels with relief protection (see figure below).

Both vessels are in saturated conditions at 281°F and approximately 35 psig. Vessel A is completely filled with saturated water. Vessel B contains one-half saturated steam (100% quality) volume and one-half saturated water (0% quality) volume. Both vessels are protected by identical relief valves.

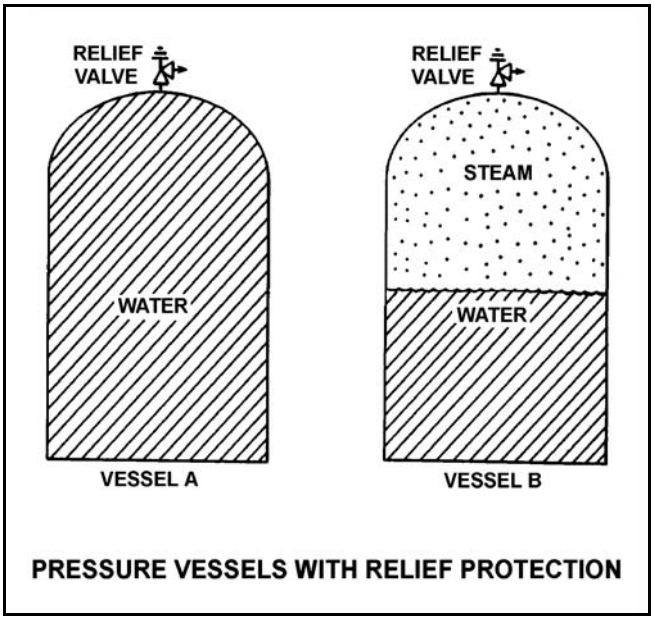
If both relief valves begin to leak at a rate of 0.1% of design flow, the higher temperature fluid will initially be leaving the relief valve of vessel _____. And, if 100 lbm of fluid is released through both relief valves, the larger pressure decrease will occur in vessel _____.

A. A; A

B. A; B

C. B; A

D. B; B



PRESSURE VESSELS WITH RELIEF PROTECTION

QUESTION: 41

Which one of the following actions will result in a decrease in overall nuclear power plant thermal efficiency?

A. Increasing steam quality by adding additional heat to the steam prior to entering the turbine.

B. Increasing the temperature of the feed water entering the steam generator.

C. Decreasing the amount of condensate depression in the main condenser.

D. Decreasing the amount of turbine steam extracted for feed water heating.

QUESTION: 42

The volumetric flow rate of cooling water entering a heat exchanger is 500 gpm.

Given the following:

Cooling water pressure entering and leaving the heat exchanger is 10 psig.
Cooling water inlet temperature is 90°F.
Cooling water outlet temperature is 160°F.
Heat exchanger inlet and outlet piping have the same diameter.

What is the approximate volumetric flow rate of the cooling water exiting the heat exchanger?

A. 496 gpm

B. 500 gpm

C. 504 gpm

D. 509 gpm

QUESTION: 43

A vented water storage tank contains 64 feet of water at 70°F. A cracked weld at the bottom of the tank results in a leak rate of 12 gpm. At what water level will the leak rate be 3 gpm?

A. 48 feet

B. 32 feet

C. 16 feet

D. 4 feet

QUESTION: 44

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 lower than actual reactor power?

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

B. The feed water flow rate used in the heat balance calculation was 10% higher than actual flow rate.

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

D. The feed water temperature used in the heat balance calculation was 20°F higher than actual feed water temperature.

QUESTION: 45

Refer to the drawing of a pool boiling curve (see figure below).

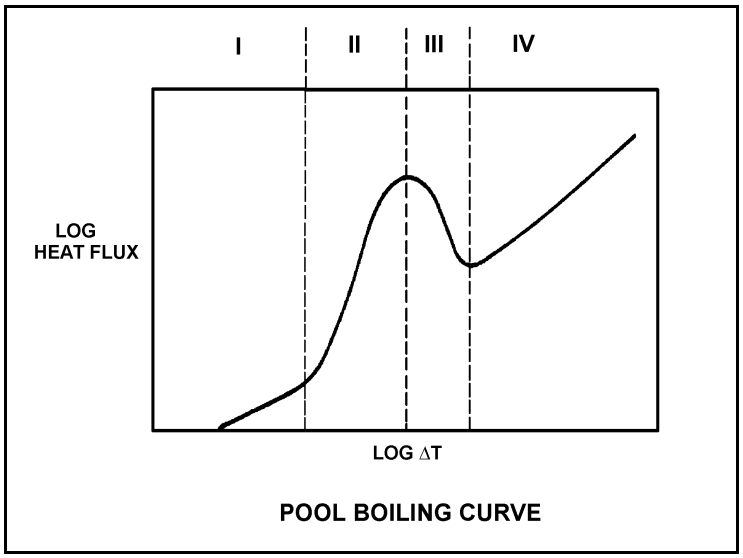
Which region of the curve contains the operating point at which the hottest locations of a nuclear reactor normally operate to transfer heat from the cladding to the coolant at 100% power?

A. Region I

B. Region II

C. Region III

D. Region IV



QUESTION: 46

Subcooled water enters the bottom of an operating nuclear reactor core. As the water flows upward past the fuel assemblies, boiling begins at the surface of a few fuel rods.

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

A. higher; more

B. higher; less

C. lower; more

D. lower; less

QUESTION: 47

A nuclear reactor is operating at 100% steady-state power at the end of core life with all control rods fully withdrawn. At what axial location in a typical fuel assembly will the minimum departure from nucleate boiling ratio occur?

A. At the bottom of the fuel assembly.

B. At the top of the fuel assembly.

C. Between the bottom and the midplane of the fuel assembly.

D. Between the midplane and the top of the fuel assembly.

QUESTION: 48

A nuclear reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0% rated thermal power. Core ΔT has stabilized at 16°F.

When decay heat generation decreases to 0.333% rated thermal power, core ΔT will be approximately...

A. 2°F.

B. 4°F.

C. 8°F.

D. 10°F.

QUESTION: 49

A nuclear reactor is operating at 80% power near the middle of a fuel cycle. All control rods are fully withdrawn and in manual control. Core axial power distribution is peaked below the core midplane.

Which one of the following will significantly decrease the core maximum axial peaking (or hot channel) factor? (Assume no subsequent operator action is taken and that main turbine load and core xenon distribution do not change unless stated.)

A. One bank of control rods is inserted 10%.

B. One control rod fully inserts into the core.

C. Turbine load/reactor power is reduced by 20%.

D. Reactor coolant system boron concentration is reduced by 50 ppm.

QUESTION: 50

During an uncontrolled cooldown of a reactor coolant system, the component most susceptible to pressurized thermal shock is the...

A. reactor vessel.

B. steam generator tube sheet.

C. cold leg accumulator penetration.

D. loop resistance temperature detector penetration.

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

MARCH 2009 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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