UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
SEPTEMBER 2016 – FORM A

Please Print

Name: _____

Docket No.: _____

Facility: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO EXAMINEE

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 percent is required to pass this portion of the NRC operator licensing written examination. All examination materials will be collected 3 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.

_____

Examinee's Signature

RULES AND INSTRUCTIONS FOR THE
NRC GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

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

NOTE: Numerical answers are rounded to the nearest whole number unless otherwise indicated.

1. Print your name in the blank provided on the cover sheet of the examination.

2. Fill in your individual docket number.

3. Fill in the name of your facility.

4. Fill in your start and stop times at the appropriate times.

5. Two aids are provided for your use during the examination:

   (1) An Equations and Conversions Sheet contained within the examination copy, and

   (2) Steam tables and Mollier Diagram provided by your proctor.

6. 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 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, e.g., steam tables, handouts, and scrap paper.

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 SHEET

EQUATIONS

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

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

$1/M = CR_1/CR_x$

$A = \pi r^2$

$F = PA$

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

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

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

Thermal Efficiency = Net Work Out/Energy In

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

$g = 32.2\ \text{ft/sec}^2$

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

CONVERSIONS

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1 MW $= 3.41 \times 10^6$ Btu/hr

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

1 Btu $= 778$ ft-lbf

$℃ = (5/9)(°F - 32)$

$°F = (9/5)(℃) + 32$

1 kg $= 2.21$ lbm

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

1 $gal_{water} = 8.35$ lbm

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

QUESTION: 1

A cooling water system uses a conventional relief valve (not pilot-operated) with a bench-tested setpoint of 60 psig. The relief valve discharges to a collection tank that is maintained at 5 psig. At what system pressure will the relief valve begin to open?

A. 55 psig

B. 60 psig

C. 65 psig

D. 80 psig

QUESTION: 2

During a local inspection of a manually operated three-inch gate valve, the valve stem is observed to be flush with the top of the handwheel. Two inches of unthreaded valve stem is visible between the handwheel and the packing gland. The handwheel is mounted to the valve body and valve stem such that the handwheel can be rotated in either direction, but cannot change its axial position.

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

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

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

C. The valve may be in any position because it has a rising stem.

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

QUESTION: 3

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

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

A. differential pressure; mass flow rate

B. differential pressure; volumetric flow rate

C. volumetric flow rate; mass flow rate

D. volumetric flow rate; differential pressure

QUESTION: 4

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

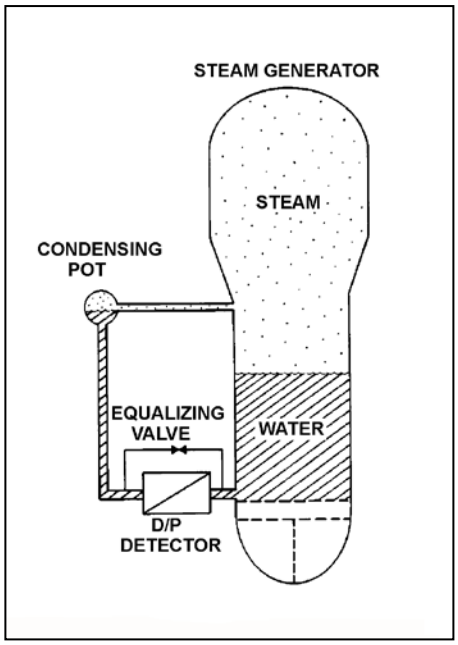
The SG is supplying steam at normal operating temperature and pressure and the level instrumentation has just been calibrated. Which one of the following events will result in a SG level indication that is less than the actual SG level?

A. SG pressure increases by 50 psi.

B. Actual SG water level decreases by 6 inches.

C. The external pressure surrounding the D/P detector decreases by 2 psi.

D. The temperature surrounding the reference leg increases by 20°F.



QUESTION: 5

A simple two-wire resistance temperature detector (RTD) is being used to measure the temperature in a water system. Copper extension wires run from the RTD to a temperature measuring instrument 40 feet away. If the temperature of the extension wires increases, the electrical resistance of the extension wires will _____; and the temperature indication will _____ unless temperature compensation is provided.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 6

Radiation interacting with a gas-filled radiation detector produces primary ion pairs. A primary ion pair consists of an electron and the ion formed by its removal. If the detector voltage is high enough, a primary ion pair can produce secondary ion pairs.

When secondary ion pairs are formed, they are typically caused by interactions between the primary _____ and the _____ in the detector.

A. ion; gas

B. ion; electrodes

C. electron; gas

D. electron; electrodes

QUESTION: 7

Which one of the following describes the operation of a typical pneumatic valve positioner?

A. Receives a valve position error signal from the valve controller and positions the valve as necessary to null the valve position error signal.

B. Receives a demand signal from the valve controller and supplies the appropriate air pressure to the valve actuator to move the valve to the demanded position.

C. Compares the valve controller demand signal with actual valve position and sends an error signal to the valve controller for adjustment of the demand signal.

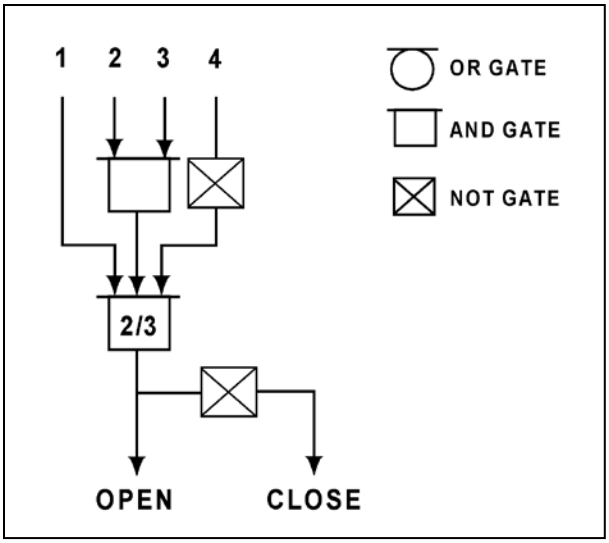
D. Compares the valve controller automatic and manual setpoints and sends an error signal to the valve controller to ensure the manual demand signal is tracking the automatic demand signal.

QUESTION: 8

Refer to the logic diagram for a valve controller (see figure below).

Which one of the following combinations of inputs will result in the valve receiving a CLOSE signal?

	INPUTS			
	1	2	3	4
A.	On	On	On	On
B.	Off	On	On	On
C.	On	Off	Off	Off
D.	Off	On	On	Off



QUESTION: 9

Refer to the drawing of a flow control valve (see figure below) that is located in the drain line from a water storage tank.

The flow control valve is positioned by a tank level controller that can maintain a stable water level anywhere between 10 percent above and 10 percent below the controller setpoint.

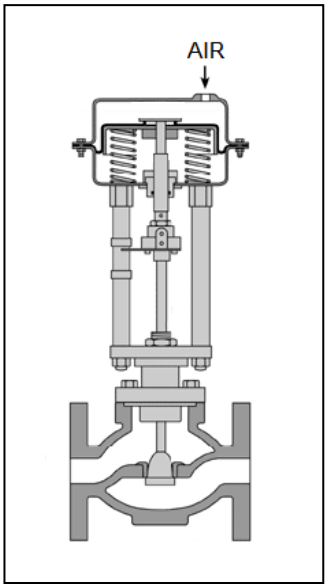
Which one of the following describes the characteristics of the tank level controller?

A. Direct-acting with proportional only control.

B. Direct-acting with proportional plus integral control.

C. Reverse-acting with proportional only control.

D. Reverse-acting with proportional plus integral control.



QUESTION: 10

Which one of the following contains three indications of a vapor-bound motor-operated centrifugal pump that is operating in a cooling water system?

A. Reduced system flow rate, increased pump motor current, and increased pump noise level.

B. Increased pump noise level, fluctuating pump discharge pressure, and reduced system flow rate.

C. Fluctuating pump discharge pressure, reduced system flow rate, and increased pump motor current.

D. Increased pump motor current, increased pump noise level, and fluctuating pump discharge pressure.

QUESTION: 11

A centrifugal pump is needed to take suction on a water storage tank and deliver high pressure water to a water spray system. To minimize axial thrust on the pump shaft, the pump should have _____ stage(s); and to maximize the available NPSH at the impeller inlet, the pump should have a _____ suction impeller.

A. a single; single

B. a single; double

C. multiple opposed; single

D. multiple opposed; double

QUESTION: 12

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

Given the following:

- The eye of the pump impeller is located 6.0 feet below the bottom of the hotwell.
- Hotwell water level is 6.0 feet.
- Hotwell water temperature is 90°F.
- Condenser pressure is 1.3 psia.
- Fluid velocity and friction head losses are zero.

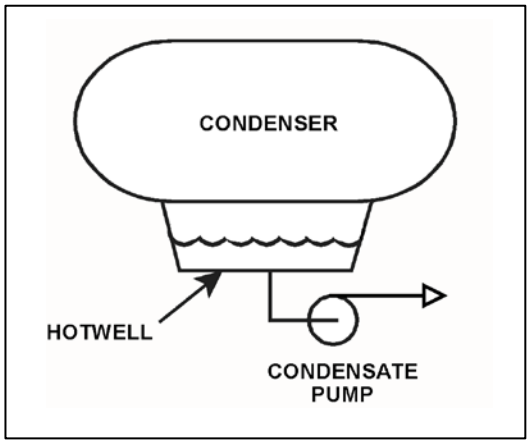
What is the net positive suction head available to the condensate pump?

A. 6.0 feet

B. 7.4 feet

C. 12.0 feet

D. 13.4 feet



QUESTION: 13

Refer to the drawing of pump and system operating curves (see figure below). The drawing shows the operating point for a single-speed centrifugal pump operating in a closed cooling water system using 6-inch diameter piping.

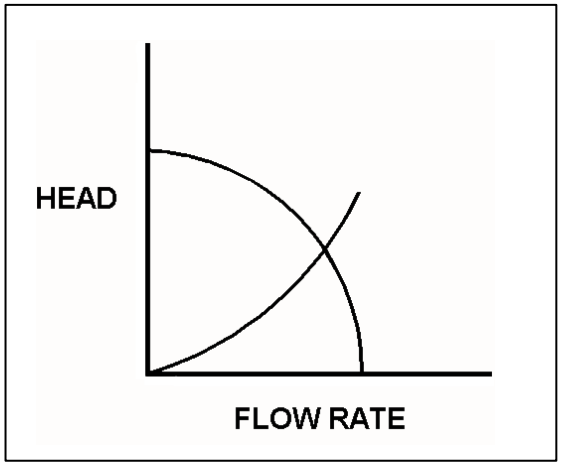
If the cooling water system 6-inch diameter piping were replaced with 8-inch diameter piping, the new operating point would occur at a _____ pump head and a _____ pump flow rate.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher



QUESTION: 14

Consider two identical single-speed AC induction motors, one of which is connected to a radial-flow centrifugal pump and the other to a reciprocating-type positive displacement pump (PDP). Both pumps are taking suction at the same elevation from a vented water storage tank.

Each pump has a maximum design backpressure of 800 psig, and each is operating with the following initial conditions:

Flow rate = 200 gpm
Backpressure = 400 psig
Motor current = 100 amps

If the backpressure for each pump increases to 600 psig, the centrifugal pump will have a _____ flow rate than the PDP; and the centrifugal pump will have a _____ motor current than the PDP.

A. lower; higher

B. lower; lower

C. higher; higher

D. higher; lower

QUESTION: 15

The starting current in an AC motor is significantly higher than the full-load running current because...

A. little counter electromotive force is induced in the rotor windings during motor start.

B. motor torque production is highest during motor start.

C. little counter electromotive force is induced in the stator windings during motor start.

D. work performed by the motor is highest during motor start.

QUESTION: 16

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

The heat exchanger was initially placed in continuous service 6 months ago. During the 6-month period of operation, mineral deposits have accumulated inside the heat exchanger tubes.

The following parameters are currently stable at their initial values:

- Cooling water mass flow rate
- Cooling water inlet temperature
- Cooling water outlet temperature
- Lube oil mass flow rate

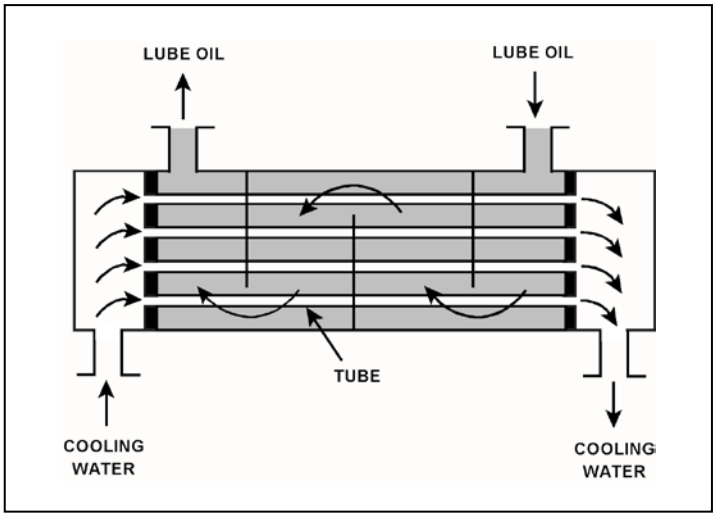
Compared to their initial values, the current lube oil inlet temperature is _____; and the current lube oil outlet temperature is _____.

A. lower; lower

B. lower; higher

C. higher; lower

D. higher; higher



QUESTION: 17

During normal nuclear power plant operation, a main condenser develops an air leak which decreases vacuum at a rate of 1.0 inch Hg/min. Which one of the following will increase because of this condition? (Assume that main turbine steam inlet valve position does not change.)

A. Steam cycle efficiency.

B. Main turbine work output.

C. Condenser hotwell temperature.

D. Low pressure turbine exhaust steam moisture content.

QUESTION: 18

During a nuclear power plant cooldown, the reactor experiences a large crud burst. After 10 minutes, with stable reactor coolant chemistry parameters, the operators begin to record parameters for the in-service reactor coolant purification ion exchanger. The ion exchanger was recently filled with fresh resin.

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 radiation levels around the ion exchanger.

C. Increasing ion exchanger inlet water conductivity.

D. Increasing ion exchanger outlet water conductivity.

QUESTION: 19

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. After a demineralizer inlet temperature increase, demineralizer effluent boron concentration exceeds influent boron concentration.

D. After a demineralizer inlet temperature increase, demineralizer influent boron concentration exceeds effluent boron concentration.

QUESTION: 20

Two identical 1,000 MW generators are operating in parallel, supplying all the loads on an isolated 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 setpoint for generator B to slowly and continuously decrease. If no operator action is taken, the electrical current indication for generator B will...

A. initially decrease, and then increase until the output breaker for generator A trips on overcurrent.

B. initially decrease, and then increase until the output breaker for generator B trips on overcurrent.

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

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

QUESTION: 21

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

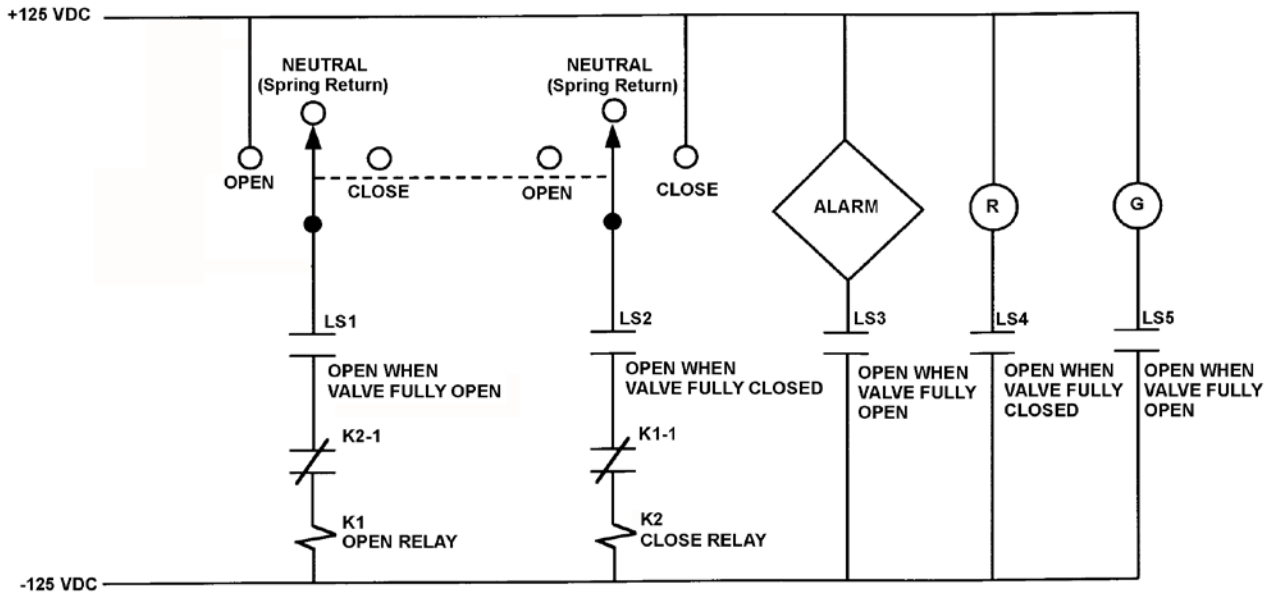
Which one of the following describes the valve response if the control switch is taken to the OPEN position for two seconds and then released?

A. The valve will <u>not</u> move.

B. The valve will open fully.

C. The valve will begin to open and then stop moving.

D. The valve will begin to open and then close fully.



VALVE MOTOR CONTROL CIRCUIT

QUESTION: 22

The following remote indications are observed for a 480 VAC load center supply breaker. (The breaker is normally open.)

Red indicating light is lit.
Green indicating light is out.
Load center voltage indicates 0 volts.
Breaker incoming 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 the TEST position

D. Closed and racked to the TEST position

QUESTION: 23

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

A. Expelled with an average kinetic energy of 0.5 MeV.

B. Accounts for more than 99 percent of fission neutrons.

C. Released an average of 13 seconds after the fission event.

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

QUESTION: 24

Before a fission neutron could migrate out of a fuel pellet, the neutron was absorbed by the nucleus of a uranium atom. The absorption occurred at a neutron energy of 1.5 MeV. If the neutron was absorbed by a U-235 nucleus, the most likely outcome would be _____; if the neutron was absorbed by a U-238 nucleus, the most likely outcome would be _____.

A. fission; fission

B. fission; capture

C. capture; fission

D. capture; capture

QUESTION: 25

The total neutron flux in a shutdown reactor is constant at 5.0×10^3 n/cm^2-sec. If non-fission neutron sources are supplying a constant flux of 1.0×10^2 n/cm^2-sec, what is K_{eff}?

A. 0.98

B. 0.96

C. 0.94

D. Cannot be determined without additional information.

QUESTION: 26

Under which one of the following conditions is a reactor most likely to have a positive moderator temperature coefficient?

A. High reactor coolant temperature at the beginning of a fuel cycle.

B. High reactor coolant temperature at the end of a fuel cycle.

C. Low reactor coolant temperature at the beginning of a fuel cycle.

D. Low reactor coolant temperature at the end of a fuel cycle.

QUESTION: 27

Differential boron worth (ΔK/K/ppm) will become _____ negative as moderator temperature increases because, at higher moderator temperatures, a 1 ppm increase in reactor coolant boron concentration will add _____ boron atoms to the core.

A. more; fewer

B. more; more

C. less; fewer

D. less; more

QUESTION: 28

A reactor is initially critical below the point of adding heat during a reactor startup. If control rods are manually inserted for 5 seconds, reactor power will decrease...

A. to a lower power level determined by subcritical multiplication.

B. temporarily, then return to the original power level due to subcritical multiplication.

C. temporarily, then return to the original power level due to a decrease in moderator temperature.

D. until inherent positive reactivity feedback causes the reactor to become critical at a lower power level.

QUESTION: 29

A reactor is operating at steady-state 75 percent power with all control rods fully withdrawn. Assuming the reactor does <u>not</u> trip, which one of the following compares the effects of dropping (full insertion) a center control rod to the effects of partially inserting (50 percent) the same control rod?

A. A partially inserted rod causes a greater change in axial power distribution.

B. A partially inserted rod causes a greater change in radial power distribution.

C. A partially inserted rod causes a greater change in shutdown margin.

D. A partially inserted rod causes a smaller change in shutdown margin.

QUESTION: 30

Reactors A and B are operating at steady-state 100 percent power with equilibrium xenon-135. The reactors are identical except that reactor A is operating near the end of core life (EOL) and reactor B is operating near the beginning of core life (BOL).

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

A. Reactor A (EOL), due to a greater equilibrium concentration of xenon-135.

B. Reactor A (EOL), due to lower competition from the fuel for thermal neutrons.

C. Reactor B (BOL), due to a greater thermal neutron flux in the core.

D. Reactor B (BOL), due to a smaller accumulation of fission product poisons.

QUESTION: 31

A reactor has been operating at 50 percent power for 12 hours following a one-hour power reduction from steady-state 100 percent power. Which one of the following describes the current xenon-135 concentration?

A. Increasing toward a peak.

B. Decreasing toward an upturn.

C. Increasing toward equilibrium.

D. Decreasing toward equilibrium.

QUESTION: 32

Which one of the following describes whether reactor power can be increased from 50 percent to 100 percent in a controlled manner faster near the beginning of core life (BOL) or near the end of core life (EOL)? (Assume all control rods are fully withdrawn just prior to beginning the power increase.)

A. Faster near EOL, because faster changes in boron concentration are possible.

B. Faster near EOL, because integral control rod worth is greater.

C. Faster near BOL, because faster changes in boron concentration are possible.

D. Faster near BOL, because integral control rod worth is greater.

QUESTION: 33

During an initial fuel load, the subcritical multiplication factor increases from 1.0 to 8.0. What is the current value of K_{eff}?

A. 0.125

B. 0.5

C. 0.75

D. 0.875

QUESTION: 34

A reactor is subcritical by 1.0 %ΔK/K when the operator dilutes the reactor coolant system boron concentration by 30 ppm. If differential boron worth is -0.025 %ΔK/K/ppm, the reactor is currently...

A. subcritical.

B. critical.

C. supercritical.

D. prompt critical.

QUESTION: 35

A reactor is critical during a xenon-free reactor startup. Reactor power is increasing in the intermediate range with a stable 0.5 dpm startup rate (SUR).

Assuming no operator action is taken that affects reactivity, SUR will remain constant until...

A. fuel temperature begins to increase, then SUR will decrease.

B. reactor coolant temperature begins to increase, then SUR will increase.

C. core xenon-135 production becomes significant, then SUR will increase.

D. delayed neutron production rate exceeds prompt neutron production rate, then SUR will decrease.

QUESTION: 36

Refer to the graph of neutron flux versus time (see figure below) for a nuclear power plant that experienced a reactor trip from steady-state 100 percent power at time = 0 seconds.

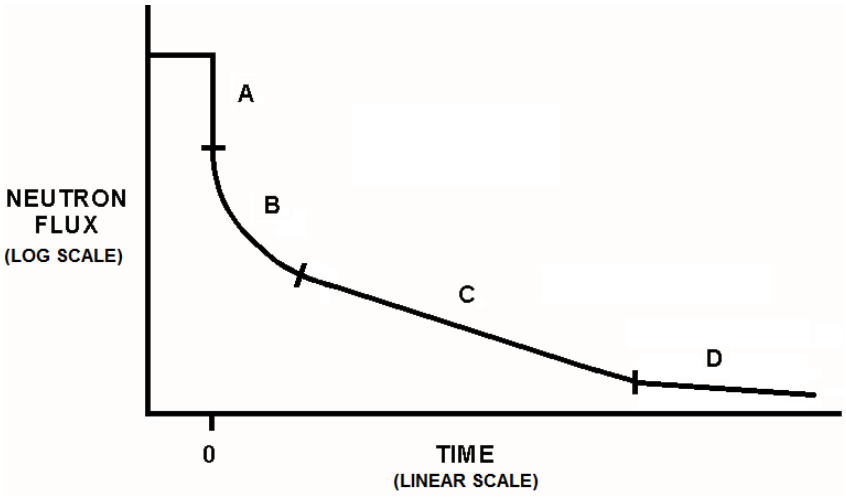
The shape of section A on the graph is primarily determined by a rapid decrease in the production rate of…

A. intrinsic source neutrons.

B. prompt fission neutrons.

C. delayed fission neutrons.

D. delayed fission neutron precursors.



QUESTION: 37

Refer to the drawing of two water storage tanks with four differential pressure (D/P) level detectors (see figure below).

The tanks are identical and are being maintained at 2 psig overpressure, the same constant water level, and a temperature of 60°F. They are surrounded by atmospheric pressure.

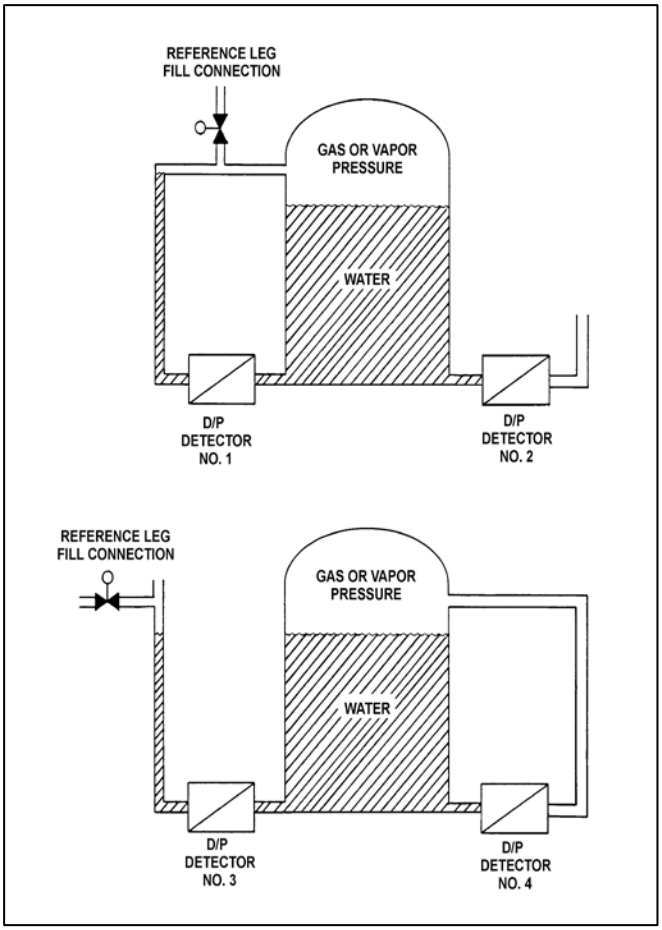
If a leak in the top of each tank causes a complete loss of overpressure, which detector(s) will produce a lower level indication?

A. No. 1 only

B. No. 2 only

C. No. 1 and 4

D. No. 2 and 3



QUESTION: 38

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

Pressurizer liquid temperature = 568°F
Pressurizer vapor temperature = 596°F
Pressurizer pressure = 1,410 psia
Pressurizer level = 60 percent

Given these conditions, the pressurizer liquid is _____; and the pressurizer vapor is _____.

A. saturated; saturated

B. saturated; superheated

C. subcooled; saturated

D. subcooled; superheated

QUESTION: 39

An open vessel contains 1.0 lbm of water at 206°F and standard atmospheric pressure. Which one of the following will be caused by the addition of 3.0 Btu to the water?

A. The water temperature will rise by approximately 3°F.

B. Approximately 3 percent of the water mass will vaporize.

C. The water density will decrease by approximately 3 percent.

D. The water will become superheated by approximately 3°F.

QUESTION: 40

A nuclear power plant was shut down to fix a steam leak from an inlet flange on a steam generator safety valve. A reactor coolant system cooldown is in progress.

Given the following current steam conditions at the safety valve inlet:

- Steam pressure is 500 psia.
- Steam quality is 99 percent.

Assuming no heat transfer to/from the steam, what is the approximate temperature of the leaking steam as it reaches atmospheric pressure?

A. 212°F

B. 308°F

C. 330°F

D. 467°F

QUESTION: 41

If the moisture content of the steam supplied to a main turbine increases, turbine work will... (Assume the total mass flow rate does not change.)

A. decrease, because the enthalpy of the moist steam being supplied to the turbine has decreased.

B. decrease, because moist steam is more likely to leak between turbine stages.

C. increase, because the enthalpy of the moist steam being supplied to the turbine has increased.

D. increase, because moist steam is less likely to leak between turbine stages.

QUESTION: 42

Refer to the drawing of two lengths of 16-inch diameter pipe, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing.

Water is flowing at 10,000 gpm through each pipe when both isolation valves instantly close. Consider two cases:

Case 1: The water temperature upstream of both valves is 65°F.
Case 2: The water temperature is 65°F upstream of valve A, and 85°F upstream of valve B.

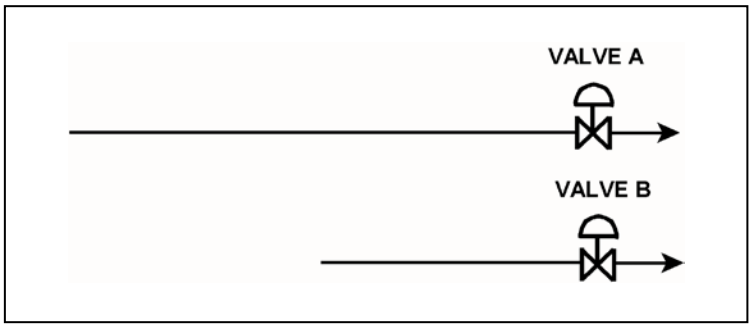
For which case(s), if any, will valve A experience a pressure spike that is greater than the pressure spike at valve B?

A. Case 1 only

B. Case 2 only

C. Both cases

D. Neither case



QUESTION: 43

A nuclear power plant is initially operating at steady-state 80 percent power. If a control system malfunction causes main generator load to rapidly increase to 90 percent, the voids in the two-phase flow in the steam generator tube bundle region will initially _____; which causes indicated steam generator water level (measured in the downcomer) to initially _____.

A. shrink; decrease

B. shrink; increase

C. expand; decrease

D. expand; increase

QUESTION: 44

Which one of the following pairs of fluids undergoing heat transfer in identical heat exchangers will yield the <u>smallest</u> heat exchanger overall heat transfer coefficient?

A. Oil to water.

B. Air to water.

C. Steam to water.

D. Water to water.

QUESTION: 45

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

A. Heat transfer from the fuel pellet to the fuel cladding via direct contact.

B. Heat transfer from the reactor coolant to the feedwater in a steam generator.

C. Heat transfer from the center to the edge of a fuel pellet at end of core life.

D. Heat transfer from the fuel cladding to the reactor coolant through a stable vapor layer.

QUESTION: 46

Subcooled reactor coolant enters the bottom of a fuel assembly and exits the top of the fuel assembly as a saturated steam-water mixture. How does the convective heat transfer coefficient change as the coolant travels upward through the fuel assembly?

A. Increases only

B. Increases, then decreases

C. Decreases only

D. Decreases, then increases

QUESTION: 47

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

- Reactor power is 45 percent 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 increases reactor coolant system pressure by 20 psig with no control rod motion.

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

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

QUESTION: 48

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: 49

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

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

A. Turbine load/reactor power is reduced by 10 percent.

B. The controlling bank of control rods is withdrawn 4 inches.

C. Reactor coolant system boron concentration is reduced by 15 ppm.

D. A fully withdrawn control rod located at the edge of the core drops to the bottom of the core.

QUESTION: 50

A reactor is shutdown with the shutdown cooling system maintaining reactor coolant temperature at 240°F immediately following an uncontrolled rapid 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 *****

SEPTEMBER 2016 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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