UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
SEPTEMBER 2018 PWR – 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)

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

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

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

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

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

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

$1/M = CR_1/CR_x$

$A = \pi r^2$

$F = PA$

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

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

$P = I^2R$

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

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

°C $= (5/9)(°F - 32)$

°F $= (9/5)(°C) + 32$

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

Refer to the drawing of an open system with subcooled water flowing through valves A, B, C and D (see figure below). All valves are initially 50 percent open. The inlet pressure to valve A is constant at 60 psia.

The initial steady-state inlet and outlet pressures for valve B are as follows:

Inlet pressure = 50 psia
Outlet pressure = 35 psia

After a single valve operation, the current steady-state inlet and outlet pressures for valve B are as follows:

Inlet pressure = 48 psia
Outlet pressure = 36 psia

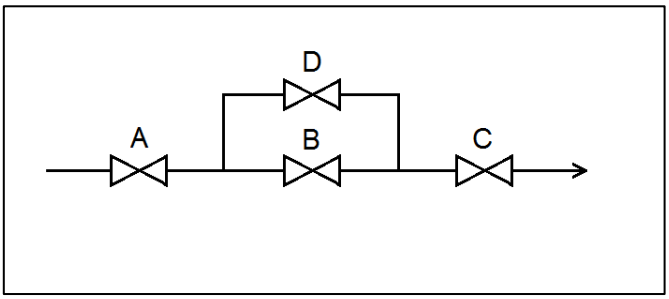
Which one of the following valve operations could be responsible for the difference between the initial and current steady-state inlet and outlet pressures for valve B?

A. Valve A was opened more.

B. Valve B was closed more.

C. Valve C was closed more.

D. Valve D was opened more.



QUESTION: 3

Refer to the drawing of a steam generator (SG) differential pressure (D/P) level detection system (see figure below) that was calibrated at the current SG pressure of 400 psia.

A reactor coolant system heatup has resulted in an increase in SG pressure from 400 psia to 900 psia over 4 hours. The ambient air temperature surrounding the SG has remained constant.

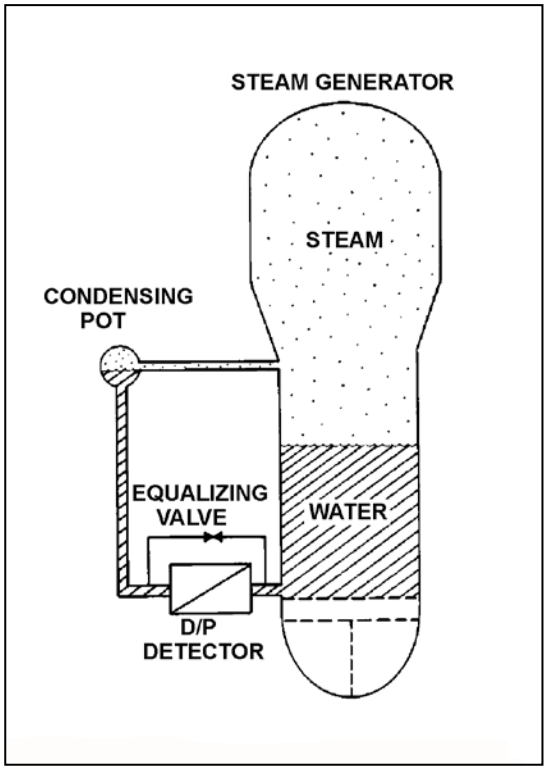
Without density compensation of the level instrumentation, at the end of the heatup SG level indication would indicate _____ than actual level because the density of the water in the _____ has changed significantly.

A. lower; steam generator

B. lower; reference leg

C. higher; steam generator

D. higher; reference leg



QUESTION: 4

In contrast to a thermocouple, a resistance temperature detector...

A. is used in high temperature applications.

B. does not require an external power supply for temperature indication.

C. uses a single type of metal or alloy in the sensing element.

D. is commonly placed in direct contact with the monitored substance.

QUESTION: 5

Given the following conditions:

- The reactor is shut down.
- The reactor coolant system is at normal operating pressure and temperature.
- The BF_3 source range detectors are properly positioned outside the reactor vessel and adjacent to the lower portion of the core.
- All BF_3 source range detectors are indicating approximately 100 cps.
- A sudden loss of coolant accident occurs that causes uniform bulk boiling throughout the reactor vessel and core.

Assuming that the source neutron flux level remains constant, how and why will source range detector outputs change as the uniform core voiding increases from 0 percent to 50 percent?

A. Increase, because the detectors will experience a higher rate of neutron interactions due to the axial power distribution shifting toward the lower portion of the core.

B. Increase, because the detectors will experience a higher rate of neutron interactions due to increasing neutron leakage from the core.

C. Decrease, because the detectors will experience a lower rate of neutron interactions due to a decreasing shutdown neutron flux level.

D. Decrease, because the detectors will experience a lower rate of gamma interactions due to decreasing reactor coolant attenuation.

QUESTION: 6

A Geiger-Mueller detector with a "pancake" probe is being used to monitor workers leaving a radiologically controlled area for contamination. The probe is sensitive to alpha, beta, and gamma radiation. The background count rate is 20 cpm. As one worker's shoe is scanned, the count rate increases to 1,000 cpm.

Given the following separate actions:

- When a sheet of paper is placed between the probe and the shoe, the count rate decreases to 400 cpm.
- When a sheet of aluminum foil is placed between the probe and the shoe, the count rate decreases to 20 cpm.

The results of the above actions indicate that the radiation from the shoe contamination consists of…

A. beta only.

B. alpha and beta only.

C. beta and gamma only.

D. alpha, beta, and gamma.

QUESTION: 7

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

A. increase, and then decrease and stabilize above the initial value.

B. increase, and then decrease and stabilize below the initial value.

C. decrease, and then increase and stabilize above the initial value.

D. decrease, and then increase and stabilize below the initial value.

QUESTION: 8

Refer to the drawing of a water storage tank with an automatic level control system (see figure below).

The level control system has the following characteristics:

- The level sensor is direct-acting.
- The controller is reverse-acting.
- The controller uses proportional control.
- The controller's setpoint is 12 feet.
- The controller's proportional band is 6 feet to 18 feet.
- The drain valve will fail open if the actuator loses air pressure.

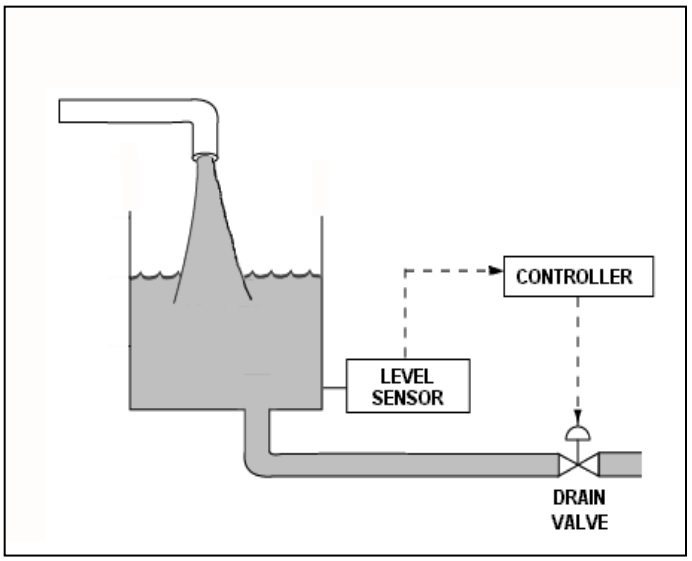
When the tank water level is 15 feet, the controller's output will be _____ percent; and the drain valve will be _____ percent open.

A. 25; 25

B. 25; 75

C. 75; 25

D. 75; 75



QUESTION: 9

What precaution must be observed before transferring a valve controller from the automatic mode to the manual mode of control?

A. Ensure that the automatic and manual valve controller outputs are matched.

B. Ensure that the automatic valve controller output is increasing before transferring to the manual mode of control.

C. Ensure that the automatic valve controller output is decreasing before transferring to the manual mode of control.

D. Ensure that a substantial steady-state deviation is established between the automatic and manual valve controller outputs.

QUESTION: 10

How are the required net positive suction head ($NPSH_R$) and available net positive suction head ($NPSH_A$) for an in-service centrifugal water pump determined?

A. Both $NPSH_R$ and $NPSH_A$ are calculated using water parameter values at the pump inlet.

B. Both $NPSH_R$ and $NPSH_A$ are determined from pump curves provided by the pump manufacturer.

C. $NPSH_R$ is calculated using water parameter values at the pump inlet, while $NPSH_A$ is determined from pump curves provided by the pump manufacturer.

D. $NPSH_A$ is calculated using water parameter values at the pump inlet, while $NPSH_R$ is determined from pump curves provided by the pump manufacturer.

QUESTION: 11

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: 12

Refer to the drawing of operating curves for a positive displacement pump in a closed water system (see figure below).

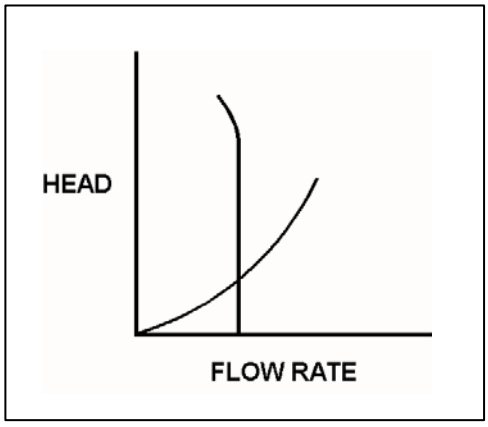
Which one of the following describes the value of the head where the two curves cross?

A. The maximum amount of head that the pump can provide.

B. The amount of pump head that is required to avoid cavitation.

C. The amount of pump head that is converted to kinetic energy in the pump.

D. The amount of pump head that is converted to heat as the water circulates through the system.



QUESTION: 13

A positive displacement pump should be started with its suction valve _____ and its discharge valve _____.

A. throttled; throttled

B. throttled; fully open

C. fully open; throttled

D. fully open; fully open

QUESTION: 14

Refer to the partial drawing of two identical centrifugal pumps in a cooling water system (see figure below). Each pump is driven by an identical three-phase AC induction motor.

The cooling water system is being returned to service following maintenance on the pumps. Pump A was started five minutes ago to initiate flow in the cooling water system. Pump B is about to be started.

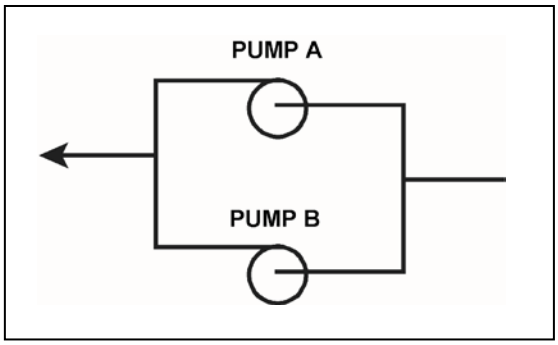
When pump B is started, which one of the following will cause pump B to experience high starting current for a shorter time than usual before stabilizing at a lower running current?

A. Pump B is initially rotating in the reverse direction.

B. The motor coupling for pump B was removed and not reinstalled.

C. The packing gland for pump B was tightened since the pump last operated.

D. The voltage applied to the motor for pump B is 20 percent lower than normal.



QUESTION: 15

Frequent starts of large motors will result in overheating of the motor windings due to high current flow caused by...

A. low electrical resistance of the motor windings.

B. an electrical short circuit between the rotor and stator.

C. high counter electromotive force at low rotor speeds.

D. windage losses between the rotor and stator.

QUESTION: 16

Given the following parameters for an operating lube oil heat exchanger:

Lube oil inlet temperature = 150°F
Lube oil outlet temperature = 105°F
Cooling water inlet temperature = 60°F
Cooling water outlet temperature = 110°F

Considering only counter-flow and parallel-flow heat exchanger designs, the lube oil heat exchanger described above must be…

A. counter-flow, because the lube oil outlet temperature is less than the cooling water outlet temperature.

B. counter-flow, because the change in lube oil temperature is less than the change in cooling water temperature.

C. parallel-flow, because the lube oil outlet temperature is less than the cooling water outlet temperature.

D. parallel-flow, because the change in lube oil temperature is less than the change in cooling water temperature.

QUESTION: 17

A reactor is shut down with core decay heat being removed by the residual heat removal (RHR) system. Assume that only the RHR heat exchangers are removing heat from the reactor coolant system (RCS), and that the RHR system provides complete thermal mixing of the RCS. Also, assume that core decay heat is the only source of heat addition to the RCS.

Given the following information:

Reactor core rated thermal power	=	2,950 MW
Core decay heat rate	=	0.5% rated thermal power
RHR system heat removal rate	=	5.3×10^7 Btu/hr
RHR and reactor coolant c_p	=	1.05 Btu/lbm-°F
Combined RCS and RHR inventory	=	425,000 lbm

Which one of the following actions will establish a reactor cooldown rate between 20°F /hour and 30°F/hour?

A. Increase RHR heat exchanger flow rate to increase the cooldown rate by 10°F/hour.

B. Increase RHR heat exchanger flow rate to increase the cooldown rate by 20°F/hour.

C. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 10°F/hour.

D. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 20°F/hour.

QUESTION: 18

Reactor coolant system (RCS) purification mixed-bed ion exchanger A was removed from service and isolated after several weeks of operation when the RCS boron concentration was 900 ppm. Currently, with ion exchanger B in service, the RCS boron concentration is 450 ppm. If ion exchanger B is isolated and ion exchanger A is immediately returned to service, RCS boron concentration will...

A. remain the same because the resin in ion exchanger A has already become saturated with boron during previous operation.

B. remain the same because the resin in ion exchanger A has no affinity for the boron in the reactor coolant.

C. increase until the volume of water in ion exchanger A mixes completely with the RCS.

D. increase until the resin in ion exchanger A reaches equilibrium with the existing RCS boron concentration.

QUESTION: 19

A demineralizer should be removed from service if the demineralizer differential pressure is _____ than the established limit, or if the demineralizer decontamination factor is _____ than the established limit.

A. less; less

B. less; greater

C. greater; less

D. greater; greater

QUESTION: 20

Refer to the drawing of a valve motor control circuit (see figure below).

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.

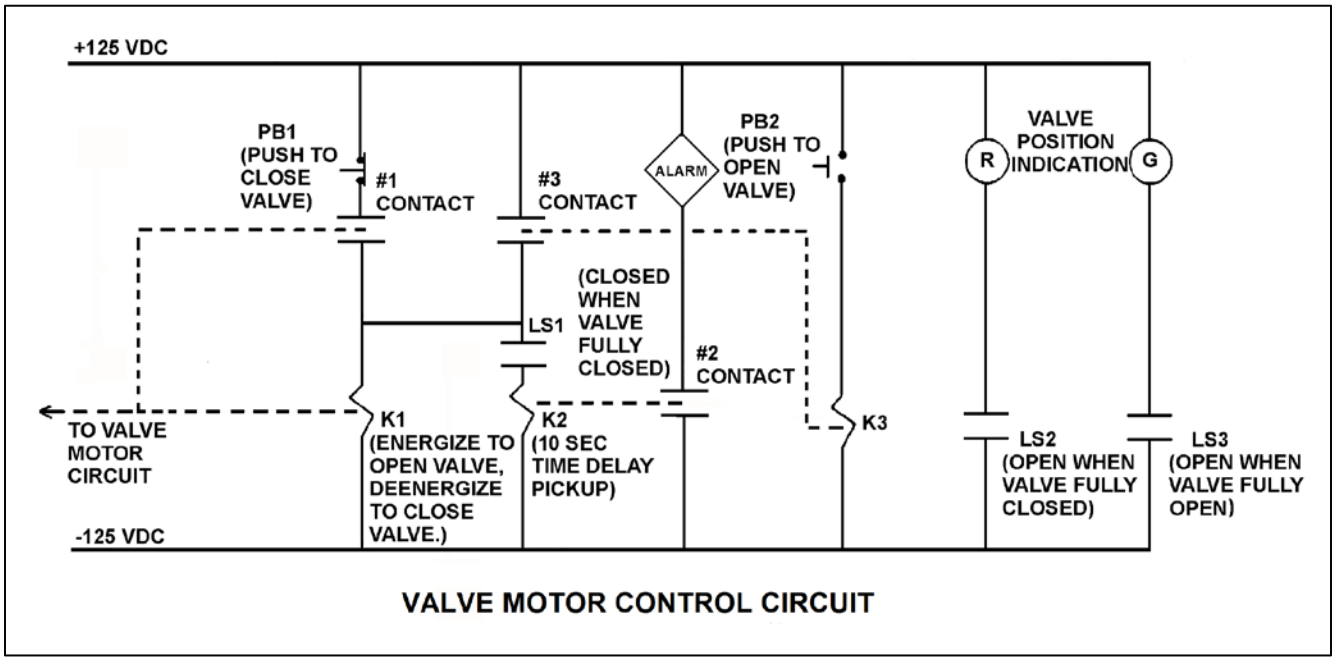
Pushbutton PB2 has been momentarily depressed and then released, and the valve is currently at mid-stroke and moving to the open position. Under these conditions, which one of the following describes the position of contacts #1, #2, and #3?

A. #1 closed; #2 open; #3 open

B. #1 open; #2 closed; #3 closed

C. #1 open; #2 closed; #3 open

D. #1 closed; #2 open; #3 closed



VALVE MOTOR CONTROL CIRCUIT

QUESTION: 21

A main generator is about to be connected to an infinite power grid. Generator voltage is slightly higher than grid voltage and the synchroscope is rotating slowly in the clockwise direction. The generator breaker is closed just as the synchroscope pointer reaches the 3 o'clock position.

Which one of the following is most likely to occur after the breaker is closed?

A. The breaker will open due to overcurrent.

B. The breaker will open due to reverse power.

C. The breaker will remain closed and the generator will supply only MW to the grid.

D. The breaker will remain closed and the generator will supply both MW and MVAR to the grid.

QUESTION: 22

While remotely investigating the condition of a typical normally-open motor control center (MCC) feeder breaker, an operator observes the following indications:

Green breaker position indicating light is lit.
Red breaker position indicating light is out.
MCC voltmeter indicates zero volts.
MCC ammeter indicates zero amperes.

Based on these indications, the operator can accurately report that the breaker is open and racked to _____ position.

A. the OUT

B. the IN

C. the TEST

D. an unknown

QUESTION: 23

Delayed neutrons are fission neutrons that...

A. have an average lifetime of about 80 seconds.

B. have an average kinetic energy of about 2 MeV.

C. are responsible for less than one percent of all fissions.

D. are in thermal equilibrium with the surrounding medium.

QUESTION: 24

A reactor is currently operating at steady-state 100 percent power near the beginning of a fuel cycle (BOC). When the same reactor is operating at steady-state 100 percent power near the end of a fuel cycle (EOC), how will the BOC and EOC shutdown margins compare? Assume the control rods are fully withdrawn, and the total reactivity worths of the control rods are the same at BOC and EOC.

A. The EOC shutdown margin will be more negative because the power defect will add less positive reactivity immediately after a reactor trip near the EOC.

B. The EOC shutdown margin will be less negative because the power defect will add more positive reactivity immediately after a reactor trip near the EOC.

C. The EOC shutdown margin will be more negative because xenon-135 will add more negative reactivity immediately after a reactor trip near the EOC.

D. The EOC shutdown margin will be less negative because xenon-135 will add less negative reactivity immediately after a reactor trip near the EOC.

QUESTION: 25

Given the following stable initial conditions for a reactor:

Power level = 1.0×10^{-8} percent
K_{eff} = 0.999
Core $\overline{\beta}_{eff}$ = 0.006

What will the stable startup rate be following an addition of positive 0.2 %ΔK/K reactivity to the reactor? (Assume the stable startup rate occurs before the reactor reaches the point of adding heat.)

A. 0.24 DPM

B. 0.33 DPM

C. 0.52 DPM

D. 1.30 DPM

QUESTION: 26

Which one of the following isotopes is the most significant contributor to the resonance capture of fission neutrons in a reactor at the end of a fuel cycle?

A. U-235

B. U-238

C. Pu-239

D. Pu-240

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. less; fewer

B. less; more

C. more; fewer

D. more; more

QUESTION: 28

A reactor is operating at 60 percent power near the end of a fuel cycle with the controlling group of control rods inserted 5 percent into the core. Which one of the following will cause the group differential rod worth to become <u>less</u> negative? (Consider only the direct effect of the indicated change.)

A. Burnable poison rods become increasingly depleted.

B. Core Xe-135 concentration decreases toward an equilibrium value.

C. Reactor coolant temperature is allowed to decrease from 575°F to 570°F.

D. The group of control rods is inserted an additional 0.5 percent.

QUESTION: 29

A reactor has been operating at 80 percent power for four weeks with the controlling rod bank/group inserted 10 percent from the fully withdrawn position.

Which one of the following will be most affected by inserting the controlling bank/group an additional 5 percent? (Assume steady-state reactor power does not change.)

A. Axial power distribution

B. Radial power distribution

C. Total xenon-135 reactivity

D. Quadrant (azimuthal) power distribution

QUESTION: 30

A reactor has been shut down for 5 days to perform maintenance. A reactor startup is performed, and power is ramped to 75 percent over a 16-hour period.

When power reaches 75 percent, the concentration of xenon-135 will be...

A. decreasing toward an upturn.

B. increasing toward a peak value.

C. decreasing toward an equilibrium value.

D. increasing toward an equilibrium value.

QUESTION: 31

Initially, a nuclear power plant is operating at steady-state 100 percent reactor power in the middle of a fuel cycle. Then, the operators decrease main generator load to 90 percent over a one-hour period while adding boric acid to the reactor coolant system. After the required amount of boric acid is added, reactor power is 90 percent and average reactor coolant temperature is 582°F. All control rods remain fully withdrawn and in manual control.

If no other operator actions are taken, which one of the following describes the average reactor coolant temperature after an additional hour?

A. Higher than 582°F and increasing slowly.

B. Higher than 582°F and decreasing slowly.

C. Lower than 582°F and increasing slowly.

D. Lower than 582°F and decreasing slowly.

QUESTION: 32

A major reason for installing burnable poisons in a reactor is to…

A. decrease the amount of fuel required to produce a given amount of heat.

B. decrease the amount of fuel required to produce a given duration of plant operation.

C. allow more fuel to be loaded to prolong a fuel cycle.

D. absorb neutrons that would otherwise be lost from the core.

QUESTION: 33

A reactor startup is in progress with the reactor currently subcritical.

Which one of the following describes the change in source range count rate resulting from a short control rod withdrawal with K_{eff} at 0.95 compared to an identical control rod withdrawal with K_{eff} at 0.98? (Assume the reactivity additions are equal and the reactor remains subcritical.)

A. Both the prompt jump in count rate and the increase in stable count rate will be the same for both values of K_{eff}.

B. Both the prompt jump in count rate and the increase in stable count rate will be smaller with K_{eff} at 0.95.

C. The prompt jump in count rate will be smaller with K_{eff} at 0.95, but the increase in stable count rates will be the same.

D. The prompt jump in count rates will be the same, but the increase in stable count rate will be smaller with K_{eff} at 0.95.

QUESTION: 34

A reactor startup is in progress. Control rod withdrawal was stopped several minutes ago to assess criticality. Which one of the following is a combination of indications that together support a declaration that the reactor has reached criticality?

A. Startup rate is stable at 0.0 DPM; source range count rate is stable.

B. Startup rate is stable at 0.2 DPM; source range count rate is stable.

C. Startup rate is stable at 0.0 DPM; source range count rate is slowly increasing.

D. Startup rate is stable at 0.2 DPM; source range count rate is slowly increasing.

QUESTION: 35

A reactor was operating for several months at 100 percent power when a reactor trip occurred. Which one of the following is primarily responsible for the startup rate value 2 minutes after the trip?

A. The K_{eff} in the core.

B. The rate of source neutron production in the core.

C. The effective delayed neutron fraction in the core.

D. The decay rates of the delayed neutron precursors in the core.

QUESTION: 36

After one month of operation at 100 percent power, the fraction of rated thermal power being produced from the decay of fission products in a reactor is...

A. greater than 10 percent.

B. greater than 5 percent, but less than 10 percent.

C. greater than 1 percent, but less than 5 percent.

D. less than 1 percent.

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.

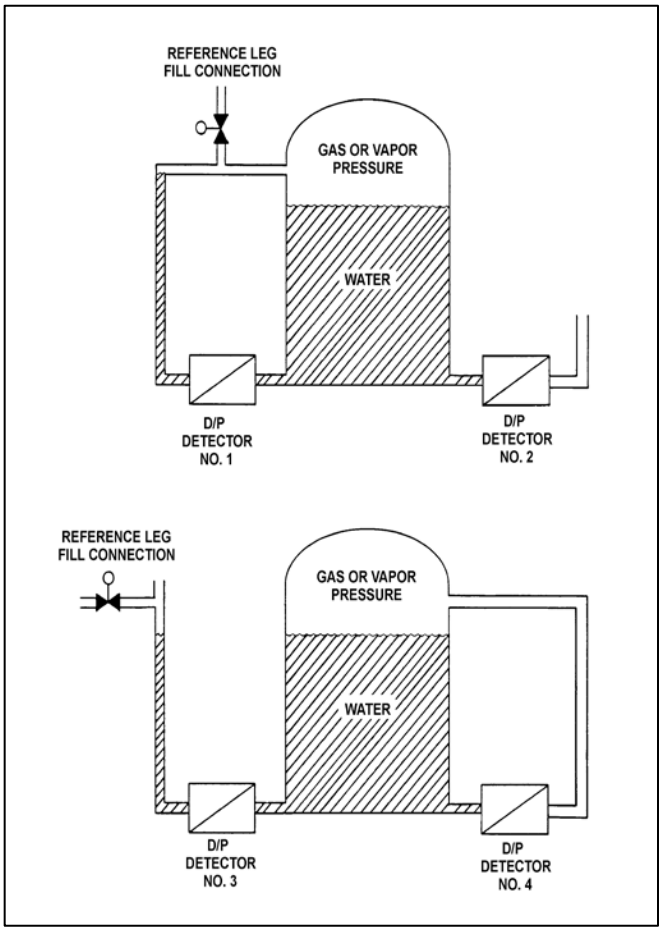
If a leak in the top of each tank causes a complete loss of overpressure, which detector(s) will produce a lower level indication?

A. No. 1 only

B. No. 2 only

C. No. 1 and 4

D. No. 2 and 3



QUESTION: 38

Refer to the drawing of a simple Rankine cycle shown on a Temperature-Entropy (T-S) diagram (see figure below). The starting point for the numbers on the diagram was chosen at random.

Note: A simple Rankine cycle does not include condensate/feedwater heating, turbine exhaust moisture removal, or steam reheat.

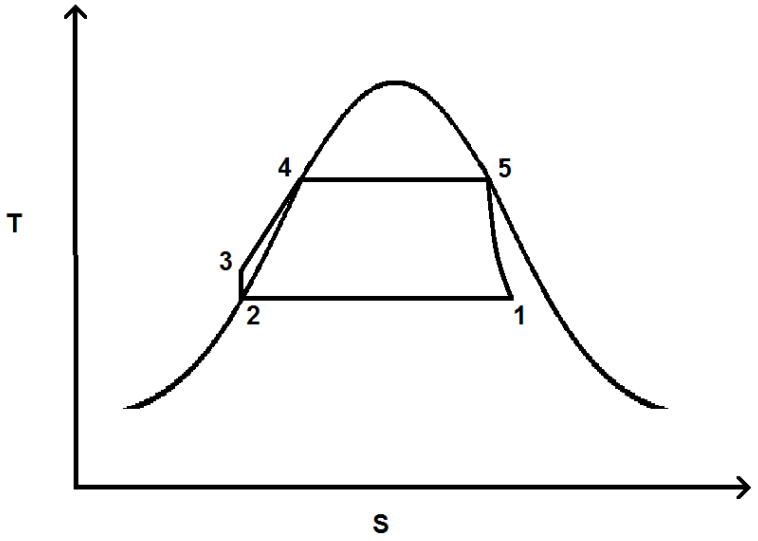
The sequence of numbers that represents the total heat added in the steam generators is _____; and the sequence of numbers that represents the total heat rejected in the main condenser is _____.

A. 2 → 3 → 4; 1 → 2

B. 3 → 4 → 5; 1 → 2

C. 2 → 3 → 4; 5 → 1

D. 3 → 4 → 5; 5 → 1



QUESTION: 39

Which one of the following describes the temperature of a saturated liquid?

A. Below the boiling point.

B. At the boiling point.

C. Above the boiling point.

D. Unrelated to the boiling point.

QUESTION: 40

Which one of the following is the approximate temperature of a saturated steam-water mixture that has an enthalpy of 1,150 Btu/lbm and a quality of 95 percent?

A. 220°F

B. 270°F

C. 360°F

D. 440°F

QUESTION: 41

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 steam cycle thermal 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: 42

Initially, a main turbine is being supplied with inlet steam containing 0.5 percent moisture content. If the inlet steam moisture content decreases to 0.25 percent at the same pressure and mass flow rate, the main turbine work output will…

A. increase, due to the increased temperature of the inlet steam.

B. increase, due to the decreased braking action from water droplets impacting the turbine blading.

C. decrease, due to the decreased enthalpy of the inlet steam.

D. decrease, due to the decreased momentum transfer from water droplets impacting the turbine blading.

QUESTION: 43

A nuclear power plant is recovering from a loss of offsite power that caused all reactor coolant pumps (RCPs) to stop. Pressurizer level indication is off-scale high. The subcooling margin in the reactor coolant loops and reactor vessel is 100°F.

Which one of the following is most likely to occur if the steam generator (SG) temperatures are 50°F higher than their associated reactor coolant system (RCS) loop temperatures when an RCP is restarted?

A. Localized water hammer in the RCS.

B. Pressurized thermal shock to the SGs.

C. A large pressure spike throughout the RCS.

D. Inadvertent lifting of SG atmospheric relief valve.

QUESTION: 44

Refer to the drawing of a venturi in a steam line (see figure below). The venturi inlet and outlet pipe diameters at P1 and P2 are equal.

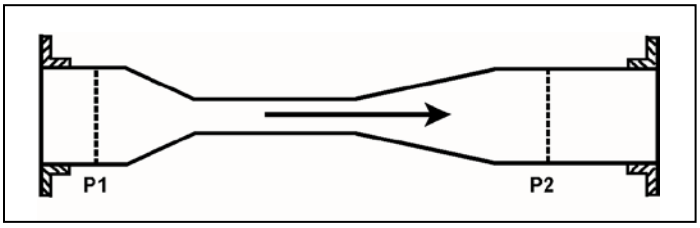
Currently, steam is flowing through the venturi, reaching sonic velocity in the throat of the venturi. If the steam inlet pressure (P1) remains constant while the downstream pressure (P2) decreases, the mass flow rate of the steam will _____; and the velocity of the steam at the venturi outlet will _____.

A. increase; increase

B. increase; remain the same

C. remain the same; increase

D. remain the same; remain the same



QUESTION: 45

The power range nuclear instruments were just adjusted to 100 percent power, as determined by a heat balance calculation. Which one of the following would result in indicated reactor power being greater than actual reactor power?

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

B. The steam pressure used in the heat balance calculation was higher than actual steam pressure.

C. The feedwater flow rate used in the heat balance calculation was lower than actual feedwater flow rate.

D. The feedwater temperature used in the heat balance calculation was higher than actual feedwater temperature.

QUESTION: 46

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

A. Complete steam blanketing of the fuel rod surface.

B. Alternate wetting and drying of the fuel rod surface.

C. Saturated nucleate boiling.

D. Subcooled nucleate boiling.

QUESTION: 47

A 60°F/hour reactor coolant system (RCS) cooldown and depressurization with natural circulation is in progress. After one hour, the RCS subcooling margin will be minimum in the...

A. reactor core.

B. RCS loop hot leg.

C. RCS loop cold leg.

D. reactor vessel head.

QUESTION: 48

A reactor coolant system natural circulation cooldown is in progress with steam release from the steam generator (SG) atmospheric steam relief valves (operated in manual control). Assume feedwater flow rate, SG relief valve position, and core decay heat level are constant.

If high point voiding interrupts natural circulation, SG levels will gradually _____; and core exit thermocouple indications will gradually _____.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 49

A reactor is operating at steady-state conditions in the power range with the following average temperatures in a core plane:

$T_{coolant}$ = 550°F
$T_{fuel\ centerline}$ = 1,680°F

Assume that the fuel rod heat transfer coefficients and reactor coolant temperatures are equal throughout the core plane. If the maximum total peaking factor in the core plane is 2.1, what is the maximum fuel centerline temperature in the core plane?

A. 2,923°F

B. 3,528°F

C. 4,078°F

D. 4,683°F

QUESTION: 50

Which one of the following comparisons results in a higher probability for brittle fracture of a reactor vessel?

A. A reactor coolant pH of 8.5 rather than 9.0.

B. A high oxygen content in the reactor coolant rather than a low oxygen content.

C. A 50°F/hr cooldown rather than a 100°F/hr heatup.

D. A high gamma flux in the reactor rather than a high neutron flux.

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

SEPTEMBER 2018 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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