UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 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. boiling water reactor (BWR) 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 completely full water storage tank is being hydrostatically tested to 300 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 4 gpm. The tank is protected by a relief valve that discharges to the atmosphere. The relief valve has the following characteristics:

- The relief valve opening setpoint is 300 psig with an accumulation of 5 percent.
- The relief valve has linear flow characteristics and a maximum rated flow rate of 6 gpm.

The PDP is inadvertently left running when tank pressure reaches 300 psig.

With the PDP still running, at what pressure will the tank stabilize?

A. 305 psig

B. 310 psig

C. 315 psig

D. 320 psig

QUESTION: 2

To verify that a manual valve in an operating system is closed, the operator should observe valve position indication and operate the valve handwheel in the...

A. open direction until flow sounds are heard, then close the valve using normal force.

B. close direction using normal force and verify there is no substantial handwheel movement.

C. close direction until it stops, then close it an additional one-half turn using additional force if necessary.

D. open direction until the valve stem moves in the open direction, then close the valve using normal force.

QUESTION: 3

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

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

A. The valve position limit switches were removed and were not reinstalled.

B. The valve torque limit switches were misadjusted to open at half their normal setpoints.

C. The valve stem packing gland was overtightened after the packing material was replaced.

D. The valve was packed with improved packing material having a lower friction coefficient.

QUESTION: 4

A differential pressure detector is being used with an orifice plate to measure water flow rate through a pipe. When the flow detector was last calibrated, the following parameters were observed:

Upstream Pressure = 125 psig
Downstream Pressure = 116 psig

Actual Flow Rate = 100 gpm
Indicated Flow Rate = 100 gpm

Significant erosion of the orifice has occurred since the calibration such that actual flow rate through the orifice has increased to 120 gpm while the upstream and downstream pressures have changed to 110 psig and 106 psig respectively.

What is the approximate flow rate that is currently indicated?

A. 44 gpm

B. 67 gpm

C. 81 gpm

D. 120 gpm

QUESTION: 5

Refer to the drawing of a reactor vessel (RV) differential pressure (D/P) level detection system (see figure below).

A reactor is shutdown with the reactor coolant system being maintained at 100 psia. The level detector has just been calibrated. Suddenly, a rupture in the condensing chamber of the level detector results in a rapid drop of the condensing chamber pressure to atmospheric pressure.

Given the following current conditions:

- The condensing chamber is at atmospheric pressure.
- RV pressure is 98 psia and slowly decreasing.
- Bulk reference leg temperature is 120°F.
- Actual RV level has not changed significantly.

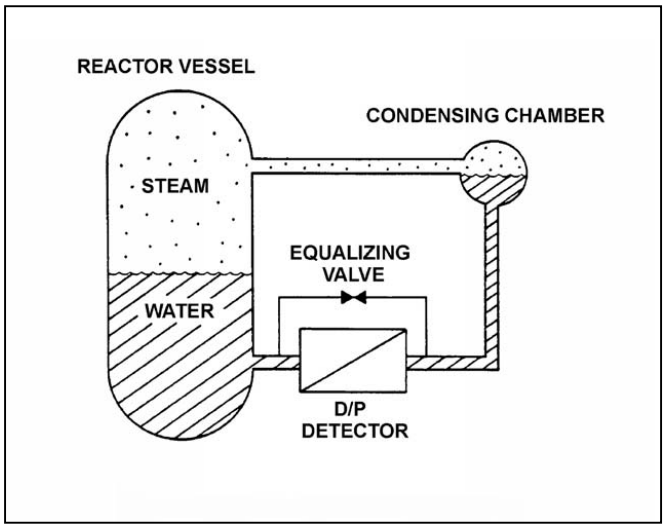
Which one of the following describes the current RV level indication from the detector?

A. Off scale low, because the bulk of the water in the reference leg has flashed to steam.

B. Off scale high, because the bulk of the water in the reference leg has flashed to steam.

C. Off scale low, because the static pressure on the reference leg is much less than the static pressure in the RV.

D. Off scale high, because the static pressure on the reference leg is much less than the static pressure in the RV.



QUESTION: 6

Because of a thermocouple temperature display failure, the millivolt output of a thermocouple circuit is being converted to a temperature value using conversion tables. The tables are based on a thermocouple reference junction temperature of 32°F. The actual reference junction is located in a panel that is maintained at 120°F. Room temperature surrounding the panel is 80°F.

What adjustment must be made to the temperature value taken from the conversion tables to calculate the actual temperature at the measuring tip of the thermocouple?

A. Add 48°F.

B. Subtract 48°F.

C. Add 88°F.

D. Subtract 88°F.

QUESTION: 7

Quench gases are added to gas-filled radiation detectors that operate in the _____ region; the quench gases prevent a single ionization event from causing _____ in the detector gas volume.

A. ion chamber; multiple discharges

B. ion chamber; secondary ionizations

C. Geiger-Mueller; multiple discharges

D. Geiger-Mueller; secondary ionizations

QUESTION: 8

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

The temperature control system uses a direct-acting controller. The temperature of the lube oil leaving the heat exchanger is currently stable at 93EF.

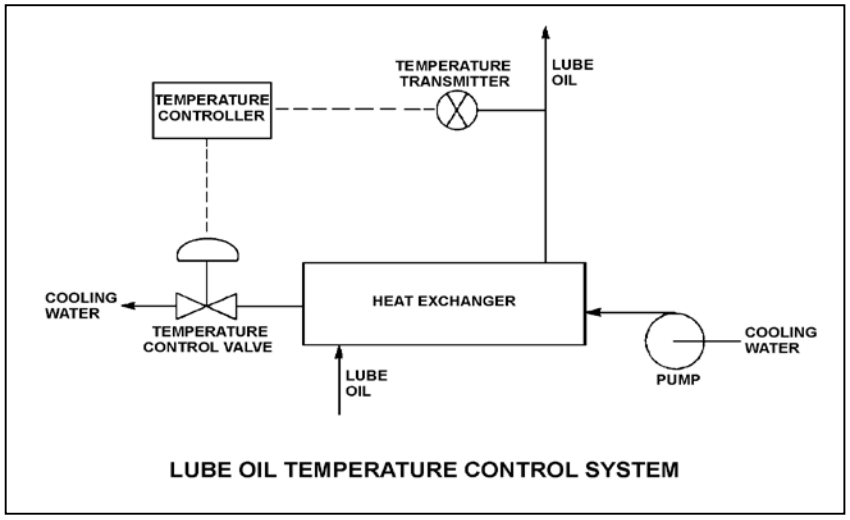
To be compatible with the controller, the temperature control valve must fail _____ on a loss of control air pressure; and for the temperature control system to return the lube oil heat exchanger outlet temperature to 93°F after a large change in lube oil heat loads, the controller must have a/an _____ characteristic.

A. closed; integral

B. closed; derivative

C. open; integral

D. open; derivative



LUBE OIL TEMPERATURE CONTROL SYSTEM

QUESTION: 9

An air-operated isolation valve requires 4,800 pounds-force from its diaphragm actuator and 4 inches of stem travel for proper operation. The valve positioner can supply up to 80 psig of air pressure to the actuator.

What is the minimum surface area of the actuator diaphragm required for proper valve operation?

A. 15 square inches

B. 60 square inches

C. 120 square inches

D. 240 square inches

QUESTION: 10

A motor-driven radial-flow centrifugal pump is used to provide makeup water to a vented storage tank that is 30 feet high. The pump is located at the base of the tank. The pump can be aligned to fill the tank via a top connection or a bottom connection using piping of equal lengths and diameters. The tank is currently empty.

With tank filling underway, the pump motor will have the lowest power demand if the pump is using the _____ connection; and the tank will require the least amount of time to become completely full if the pump is using the _____ connection.

A. top; top

B. top; bottom

C. bottom; top

D. bottom; bottom

QUESTION: 11

A centrifugal pump is taking suction on a water storage tank and discharging through a flow control valve. The pump will have the highest net positive suction head requirement if the pump is operated at a _____ speed with a _____ discharge flow control valve.

A. high; fully open

B. high; throttled

C. low; fully open

D. low; throttled

QUESTION: 12

Refer to the drawing showing two different operating points for the same centrifugal pump operating in the same cooling water system (see figure below).

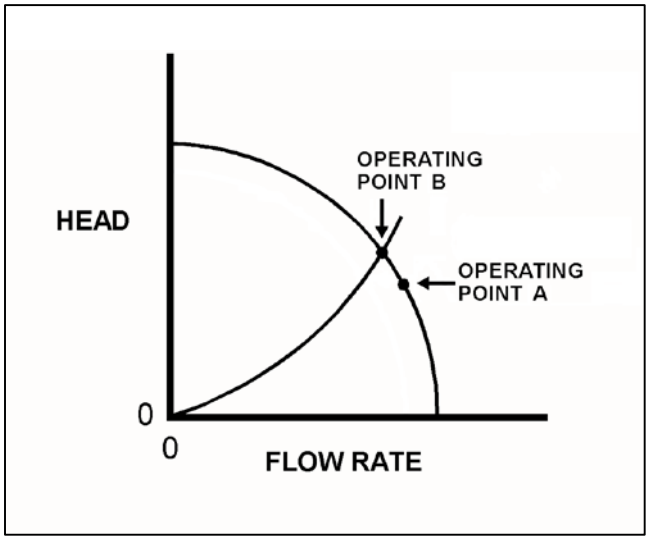
Operating point A was generated from pump data collected two days ago. Operating point B was generated from pump data collected today. Which one of the following would cause the observed difference between operating points A and B?

A. The pump was rotating faster when data was collected for operating point B.

B. The pump was rotating slower when data was collected for operating point B.

C. The pump discharge valve was more open when data was collected for operating point B.

D. The pump discharge valve was more closed when data was collected for operating point B.



QUESTION: 13

A centrifugal pump is operating normally in an open system. If the pump recirculation valve is opened farther, pump discharge pressure will _____; and pump flow rate will _____.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 14

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

20 KV
288 amps
10 MW
0 MVAR

The operator suspects 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: 15

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

If the pumps are started under these conditions, the longer time period required to stabilize motor current will be experienced by the motor for pump _____; and the higher stable motor current will be experienced by the motor for pump _____.

A. A; A

B. A; B

C. B; A

D. B; B

QUESTION: 16

The rate of heat transfer between two liquids in a heat exchanger will increase if the… (Assume single-phase conditions and a constant specific heat for both liquids.)

A. inlet temperature of the hotter liquid decreases by 20°F.

B. inlet temperature of the colder liquid increases by 20°F.

C. flow rates of both liquids decrease by 10 percent.

D. flow rates of both liquids increase by 10 percent.

QUESTION: 17

A nuclear power plant is operating at steady-state 100 percent power. Assuming that condenser cooling water inlet temperature and flow rate do not change, if main condenser vacuum decreases, condensate temperature will...

A. decrease, because condensate subcooling has increased.

B. decrease, because condenser saturation pressure has decreased.

C. increase, because condensate subcooling has decreased.

D. increase, because condenser saturation pressure has increased.

QUESTION: 18

A reactor is shut down at 400 psia when all forced core coolant flow is lost. Which one of the following will enhance natural circulation inside the reactor vessel (RV)?

A. Decrease RV pressure to 300 psia.

B. Increase RV pressure to 500 psia.

C. Decrease RV water level to just above the top of the core.

D. Increase RV water level to just above the steam separators.

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

Water containing dissolved sodium (Na^+) and chloride (Cl^-) ionic impurities is passing through an ion exchanger that contains only anion exchange resin. How are the ionic impurities being affected as the water flows through the ion exchanger?

A. Sodium ions are being exchanged, but the chloride ions are unaffected.

B. Chloride ions are being exchanged, but the sodium ions are unaffected.

C. Sodium ions are being exchanged, and chloride ions are being removed by filtration.

D. Chloride ions are being exchanged, and sodium ions are being removed by filtration.

QUESTION: 21

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

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

A. open; out

B. closed; out

C. open; to the TEST position

D. closed; to the TEST position

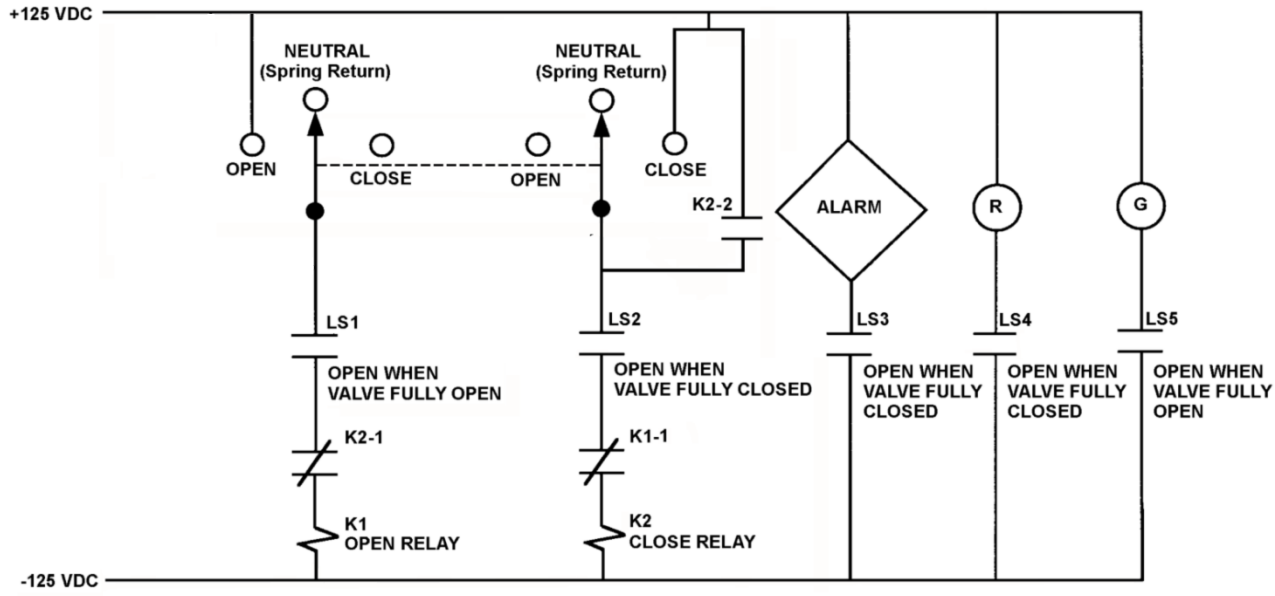
QUESTION: 22

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully open and has an 8-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. All contacts are functional, except for contact K2-2 which has failed open.

An operator takes the control switch to CLOSE. Four seconds later, the operator releases the control switch. When the valve stops moving, what will be the status of the alarm and the red (R) and green (G) indicating lights?

	Alarm	Red Ind. Light	Green Ind. Light
A.	On	On	On
B.	On	Off	Off
C.	Off	On	Off
D.	Off	Off	On



VALVE MOTOR CONTROL CIRCUIT

QUESTION: 23

The ideal moderator has a _____ macroscopic absorption cross section for thermal neutrons and a _____ average logarithmic energy decrement.

A. large; small

B. large; large

C. small; small

D. small; large

QUESTION: 24

A 1.5 MeV neutron is about to interact with a U-238 nucleus in an operating reactor. Which one of the following describes the most likely interaction and its effect on K_{eff}?

A. The neutron will be scattered, thereby leaving K_{eff} unchanged.

B. The neutron will be absorbed and the nucleus will fission, thereby decreasing K_{eff}.

C. The neutron will be absorbed and the nucleus will fission, thereby increasing K_{eff}.

D. The neutron will be absorbed and the nucleus will decay to Pu-239, thereby increasing K_{eff}.

QUESTION: 25

A reactor is critical well below the point of adding heat during a plant startup. A small amount of positive reactivity is then added to the core, and a stable positive reactor period is established.

With the stable positive reactor period, the following power levels are observed:

Time	Power Level
0 sec	3.16×10^{-7} percent
90 sec	1.0×10^{-5} percent

Which one of the following will be the reactor power level at time = 120 seconds?

A. 3.16×10^{-5} percent

B. 5.0×10^{-5} percent

C. 6.32×10^{-5} percent

D. 1.0×10^{-4} percent

QUESTION: 26

Consider a one month period of 100 percent power operation near the beginning of a fuel cycle.

During this period of operation, the depletion of U-235 in the fuel tends to make the moderator temperature coefficient _____ negative; and the incremental withdrawal of control rods tends to make the moderator temperature coefficient _____ negative.

A. less; less

B. less; more

C. more; less

D. more; more

QUESTION: 27

A reactor is operating at 60 percent power with the core coolant flow consisting of 80 percent water by volume and 20 percent steam by volume. In this condition, the core void fraction is _____ percent; and if the core void fraction increases by 5 percent, the void coefficient of reactivity will become _____ negative.

A. 20; less

B. 20; more

C. 25; less

D. 25; more

QUESTION: 28

A reactor is initially critical below the point of adding heat with stable reactor vessel temperature and pressure. If control rods are manually inserted for 5 seconds, reactor power will decrease...

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

B. temporarily, then return to the original power level due to the resulting decrease in moderator temperature.

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

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

QUESTION: 29

A reactor is operating at 60 percent power with thermal neutron flux peaked in the bottom half of the core. Partial withdrawal of a deep control rod will primarily affect total (versus local) core power because _____ is relatively high in the area of withdrawal.

A. fuel enrichment

B. thermal neutron flux

C. void content

D. moderator temperature

QUESTION: 30

A reactor has been operating at 100 percent power for one month following a refueling outage with axial neutron flux distribution peaked in the bottom half of the core. An inadvertent reactor scram occurs. The reactor is restarted, with criticality occurring 6 hours after the scram. Reactor power is increased to 60 percent over the next 4 hours and then stabilized.

During the one-hour period immediately after power level is stabilized at 60 percent, the core axial neutron flux peak will be located _____ in the core than the pre-scram peak location; and the core axial neutron flux peak will be moving _____.

A. higher; upward

B. higher; downward

C. lower; upward

D. lower; downward

QUESTION: 31

A reactor is initially operating at 50 percent power with equilibrium xenon-135. Power is level increased to 75 percent over a one-hour period, and no subsequent operator actions are taken. Considering only the reactivity effects of xenon-135 changes, which one of the following describes reactor power 6 hours after the power change?

A. Greater than 75 percent and decreasing slowly.

B. Greater than 75 percent and increasing slowly.

C. Lower than 75 percent and decreasing slowly.

D. Lower than 75 percent and increasing slowly.

QUESTION: 32

Refer to the drawing of K_{eff} versus core age (see figure below).

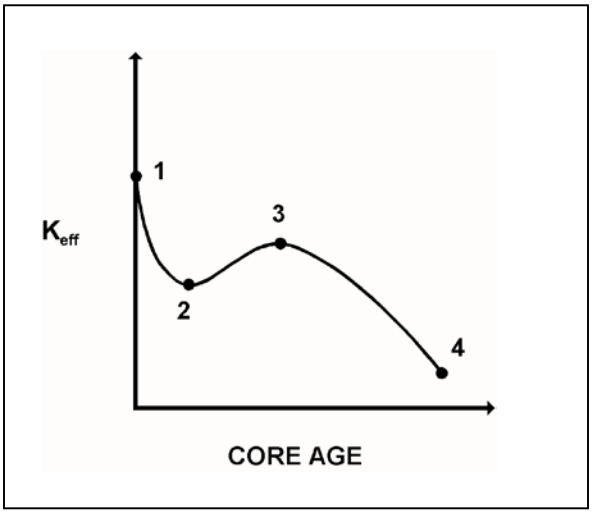
The major cause for the change in K_{eff} from point 1 to point 2 is the…

A. depletion of fuel.

B. burnout of burnable poisons.

C. initial heatup of the reactor.

D. buildup of fission product poisons.



QUESTION: 33

During a reactor startup, positive reactivity addition X caused the stable source range count rate to increase from 15 cps to 30 cps. Later in the startup, after several more positive reactivity additions, positive reactivity addition Y caused the stable source range count rate to increase from 60 cps to 120 cps.

With the reactor still subcritical, which one of the following statements describes how the magnitudes of positive reactivity additions X and Y compare?

A. Positive reactivity addition X was smaller than positive reactivity addition Y.

B. Positive reactivity addition X was greater than positive reactivity addition Y.

C. Positive reactivity additions X and Y were about equal in magnitude.

D. There is <u>not</u> enough information given to compare the positive reactivity additions.

QUESTION: 34

Reactors A and B are identical except that reactor A has an effective delayed neutron fraction of 0.007 and reactor B has an effective delayed neutron fraction of 0.006. Both reactors are initially critical at 1.0×10^{-8} percent of rated thermal power when +0.1 %ΔK/K is simultaneously added to both reactors.

Five minutes after the reactivity additions, reactor _____ will be at the higher power level; and reactor _____ will have the shorter period.

A. A; A

B. A; B

C. B; A

D. B; B

QUESTION: 35

A nuclear power plant is undergoing a startup with the reactor water initially saturated at 508°F. The main steam isolation valves are closed and reactor criticality has been achieved. The reactor currently has a stable positive 100-second reactor period with reactor power well below the point of adding heat (POAH).

Which one of the following will occur first when reactor power reaches the POAH?

A. Reactor period will lengthen.

B. Reactor power will decrease.

C. Reactor pressure will increase.

D. Reactor water temperature will increase.

QUESTION: 36

A reactor is critical in the source range when a fully withdrawn control rod fully inserts into the core.

If no operator or automatic actions occur, how will the source range count rate respond?

A. Decrease to zero.

B. Decrease to the count rate produced by the source neutron flux.

C. Decrease to a count rate greater than that produced by the source neutron flux.

D. Decrease initially and then slowly increase and stabilize at the critical count rate.

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 the same constant water level with 17 psia gas pressure above the water. The tanks are surrounded by standard atmospheric pressure. The temperature of the water in the tanks and reference legs is 70°F.

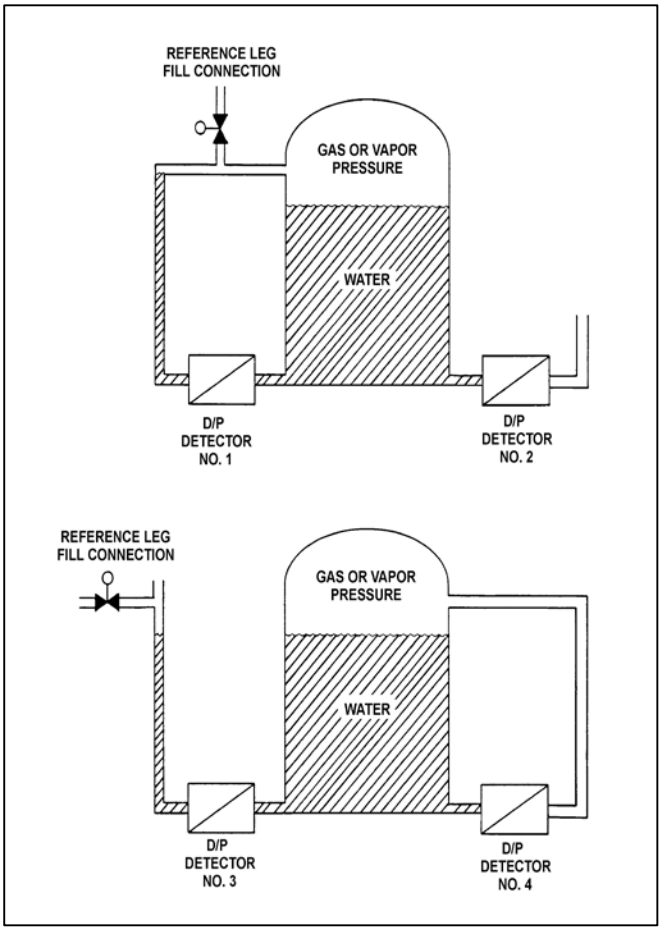
Which one of the level detectors is sensing the greatest D/P?

A. No. 1

B. No. 2

C. No. 3

D. No. 4



QUESTION: 38

Three days ago, a nuclear power plant experienced a sustained loss of all AC electrical power. Currently, there is turbulent boiling occurring throughout the entire spent fuel pool. Spent fuel assembly temperatures are elevated but stable. Assume the spent fuel pool contains pure water in thermal equilibrium, and boiling is the only means of heat removal from the spent fuel pool.

Given the following current conditions:

Total Spent fuel decay heat rate = 1.4 MW
Spent fuel building pressure = 15.0 psia

What is the approximate rate of water loss occurring from the spent fuel pool?

A. 4,149 lbm/hr

B. 4,924 lbm/hr

C. 18,829 lbm/hr

D. 26,361 lbm/hr

QUESTION: 39

During jet pump operation, high pressure and low velocity fluid flow is supplied to a _____ where the velocity increases and the pressure drops to create a low pressure area in the _____.

A. nozzle; throat

B. nozzle; diffuser

C. diffuser; throat

D. diffuser; nozzle

QUESTION: 40

In a nuclear power plant main turbine, if the moisture content of the inlet steam increases from 0.25 percent to 0.5 percent at the same pressure, the main turbine work output will…

A. increase due to the greater enthalpy of the inlet steam.

B. increase due to the increased momentum transfer from water droplets impacting the turbine blading.

C. decrease due to the lower temperature of the inlet steam.

D. decrease due to the increased braking action from water droplets impacting the turbine blading.

QUESTION: 41

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.

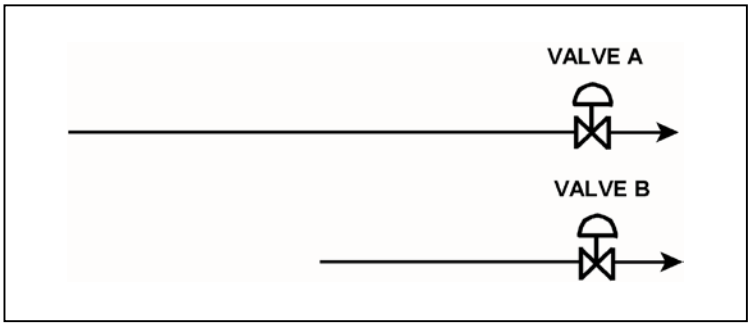
For which case(s), if any, will valve A experience a pressure spike that is greater than the pressure spike at valve B?

A. Case 1 only

B. Case 2 only

C. Both cases

D. Neither case



QUESTION: 42

An AC motor-driven radial-flow centrifugal pump is operating at rated flow and pressure in a cooling water system. A break occurs in the pump discharge piping resulting in a decrease in pump backpressure.

As a result of the break, the pump will operate at a _____ flow rate; and the pump motor will draw _____ electrical power.

A. higher; more

B. higher; less

C. lower; more

D. lower; less

QUESTION: 43

The power range nuclear instruments have been adjusted to 100 percent 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 feedwater temperature used in the heat balance calculation was 10°F lower than actual feedwater temperature.

B. The reactor recirculation pump heat input term was omitted from the heat balance calculation.

C. The feedwater flow rate used in the heat balance calculation was 10 percent lower than actual feedwater flow rate.

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

QUESTION: 44

Forced circulation through a reactor core is required at all times during power operation to prevent...

A. the core from becoming prompt critical due to high fuel and coolant temperatures.

B. exceeding reactor vessel and core design steaming rates.

C. high fuel cladding surface temperatures, which could result in a crack or leak in the cladding.

D. jet pump cavitation, which could reduce the power generated by the core.

QUESTION: 45

Refer to the drawing of a section of pipe that contains flowing subcooled water. (See figure below).

Given:

- Pressure at P_1 is 30 psig.
- Pressure at P_2 is 32 psig.
- Pressure change due to change in velocity is 2 psig.
- Pressure change due to change in elevation is 2 psig.

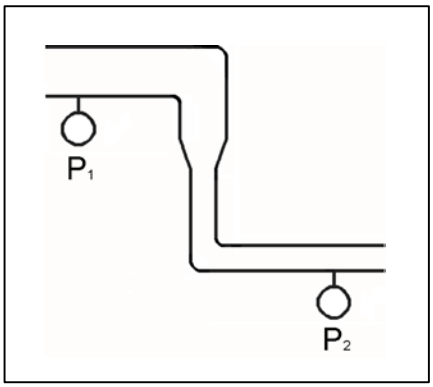
The pressure decrease due to friction head loss between P_1 and P_2 is _____; and the direction of flow is from _____.

A. 2 psig; right to left

B. 2 psig; left to right

C. 6 psig; right to left

D. 6 psig; left to right



QUESTION: 46

A reactor is initially operating at steady-state 100 percent power. Reactor power is decreased to 80 percent while maintaining the total mass flow rate through the core region unchanged. During the power decrease, the core bypass flow rate will…

A. increase, because two-phase flow resistance in the core is greater at 80 percent power.

B. decrease, because two-phase flow resistance in the core is smaller at 80 percent power.

C. remain the same, because core bypass flow rate is dependent only on reactor core flow rate.

D. remain the same, because core bypass flow rate is unaffected by changes in reactor power.

QUESTION: 47

Operating a reactor within the limits specified by the maximum average planar linear heat generation rate (MAPLHGR) prevents...

A. exceeding 1 percent plastic strain in the cladding.

B. exceeding a peak fuel temperature of 2,200°F.

C. the onset of transition boiling in the upper core.

D. exceeding a peak cladding temperature of 2,200°F.

QUESTION: 48

Which one of the following describes the fuel-to-coolant thermal conductivity for a fuel rod at the end of a fuel cycle (EOC) when compared to the beginning of the same fuel cycle (BOC)?

A. Smaller at EOC, due to fuel pellet densification.

B. Smaller at EOC, due to contamination of fill gas with fission product gases.

C. Larger at EOC, due to reduction in gap between the fuel pellets and cladding.

D. Larger at EOC, due to a greater temperature difference between the fuel pellets and coolant.

QUESTION: 49

Bundle critical power ratio must be maintained _____ 1.0; the limit is imposed to prevent fuel damage caused by a rapid increase in the temperature of the _____.

A. greater than; fuel pellets

B. less than; fuel pellets

C. greater than; fuel cladding

D. less than; fuel cladding

QUESTION: 50

Two identical reactors are currently shut down for refueling. Reactor A has an average lifetime capacity factor of 90 percent and has been operating for 16 years. Reactor B has an average lifetime capacity factor of 80 percent and has been operating for 18 years.

Which reactor, if any, will have the lower reactor vessel nil-ductility transition temperature, and why?

A. Reactor A, due to the higher average lifetime capacity factor.

B. Reactor B, due to the lower average lifetime capacity factor.

C. Both reactors will have approximately the same nil-ductility transition temperature because each reactor has produced approximately the same number of fissions.

D. Both reactors will have approximately the same nil-ductility transition temperature because fast neutron irradiation in a shutdown reactor is not significant.

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

MARCH 2016 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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