UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 2017 BWR – 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)

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

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

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

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

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

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

$1/M = CR_1/CR_x$

$A = \pi r^2$

$F = PA$

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

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

$P = I^2R$

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

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

---

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 completely full water storage tank is being hydrostatically tested to 200 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 6 gpm. The tank is protected by two relief valves that discharge to the atmosphere. The relief valves have the following characteristics:

- Relief valve A opening setpoint is 200 psig with an accumulation of 3.0 percent.
- Relief valve B opening setpoint is 200 psig with an accumulation of 1.5 percent.
- Each valve has linear flow rate characteristics and a maximum discharge flow rate of 9 gpm.

The PDP is inadvertently left running when tank pressure reaches 200 psig.

With the PDP running continuously, what will be the discharge flow rates of the relief valves when tank pressure stabilizes?

	Relief Valve A	Relief Valve B
A.	2 gpm	4 gpm
B.	3 gpm	6 gpm
C.	4 gpm	2 gpm
D.	6 gpm	3 gpm

QUESTION: 2

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

Which one of the following could have caused the shorter 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 twice 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: 3

In a comparison between globe valves and gate valves in the same water system application, globe valves...

A. are less effective at throttling flow.

B. are less effective as pressure regulating valves.

C. produce a smaller pressure decrease when fully open.

D. require less force to open against large differential pressures.

QUESTION: 4

If the steam pressure input to a density-compensated steam flow instrument fails high, the associated flow rate indication will...

A. decrease, because the density input has decreased.

B. increase, because the density input has decreased.

C. decrease, because the density input has increased.

D. increase, because the density input has increased.

QUESTION: 5

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

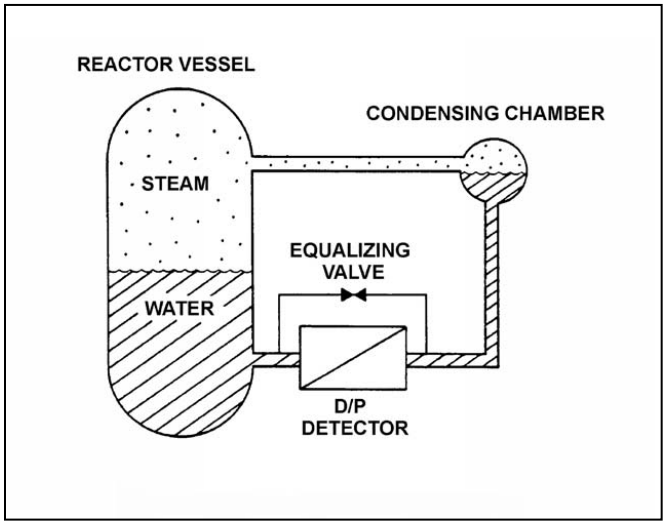
Which one of the following events will result in a reactor vessel level indication that is greater than actual level?

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

B. Reactor vessel pressure increases by 10 psi with no change in actual water level.

C. Actual vessel level increases by 6 inches.

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



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

Fission chamber detectors are used to monitor reactor power/neutron level in a shutdown reactor as well as a reactor operating at rated power (and all power levels in between). At what power level(s) is it necessary to compensate the output of the fission chamber detectors for gamma interactions with the detectors and why?

A. At all power levels, because gamma interactions produce larger detector pulses than neutron interactions.

B. At all power levels, because gamma interactions produce smaller detector pulses than neutron interactions.

C. Only when shutdown or at low power levels, because gamma flux is <u>not</u> proportional to reactor power at low power levels.

D. Only when operating at high power levels, because gamma flux is <u>not</u> proportional to reactor power at high power levels.

QUESTION: 8

The level in a drain collection tank is being controlled by an automatic level controller and level is initially at the controller setpoint. Flow rate into the tank causes tank level to increase. The increasing level causes the controller to fully open a tank drain valve. When level decreases below the setpoint, the controller closes the drain valve. Tank level continues to be controlled in this manner within a narrow band above and below the setpoint.

The controller in this system uses _____ control.

A. on-off

B. proportional

C. proportional plus integral

D. proportional plus integral plus derivative

QUESTION: 9

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

Given:

- The lube oil temperature controller setpoint is 90EF.
- The heat exchanger lube oil outlet temperature is stable at 93EF.
- The temperature control valve is currently 60 percent open.
- The temperature control system uses a direct-acting proportional controller with a 20°F proportional band.

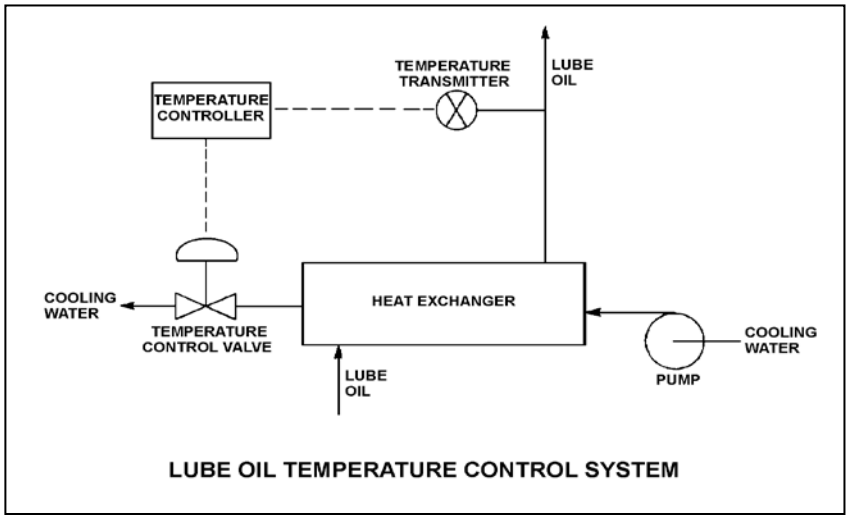
If the controller's proportional band is changed to 30°F, the heat exchanger lube oil outlet temperature will stabilize _____ than 93°F; and the controller output needed to position the temperature control valve to 60 percent open will be _____.

A. lower; the same

B. lower; greater

C. higher; the same

D. higher; greater



LUBE OIL TEMPERATURE CONTROL SYSTEM

QUESTION: 10

Refer to the drawing of a pump with recirculation line (see figure below).

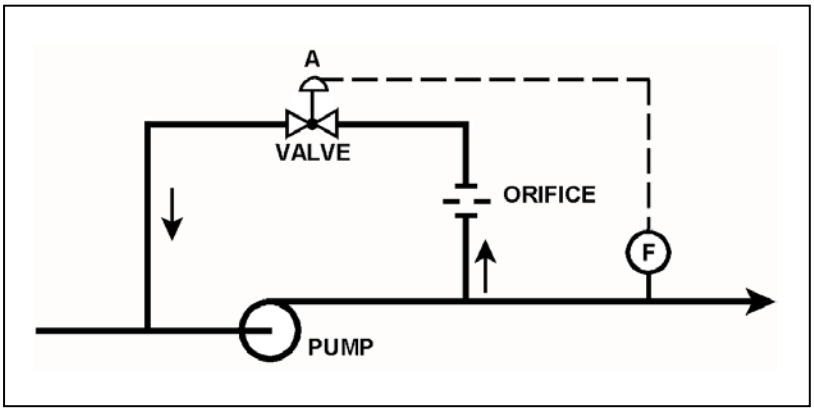
Which one of the following describes the response of the pump if a complete flow blockage occurs in the discharge line just downstream of the flow transmitter?

A. The pump will overheat after a relatively short period of time, due to a loss of both main flow and recirculation flow.

B. The pump will overheat after a relatively long period of time, due to a loss of main flow only.

C. The pump will overheat after a relatively long period of time, due to a loss of recirculation flow only.

D. The pump will be able to operate under these conditions indefinitely, due to sustained main flow.



QUESTION: 11

The discharge valve for a radial-flow centrifugal cooling water pump is closed in preparation for starting the pump.

After the pump is started, the pump suction and discharge pressures stabilize as follows:

Pump suction pressure = 5 psig
Pump discharge pressure = 35 psig

With the discharge valve still closed, if the pump speed is doubled, what will be the new stable pump discharge pressure?

A. 65 psig

B. 120 psig

C. 125 psig

D. 140 psig

QUESTION: 12

In response to a loss of coolant accident, an emergency core cooling pump is taking suction from the bottom of a vented water storage tank and discharging to the downcomer region of a reactor vessel. Which one of the following will cause the pump to operate closer to cavitation?

A. The pressure in the reactor vessel increases.

B. The level of the water in the reactor vessel increases.

C. The temperature of the water in the water storage tank increases.

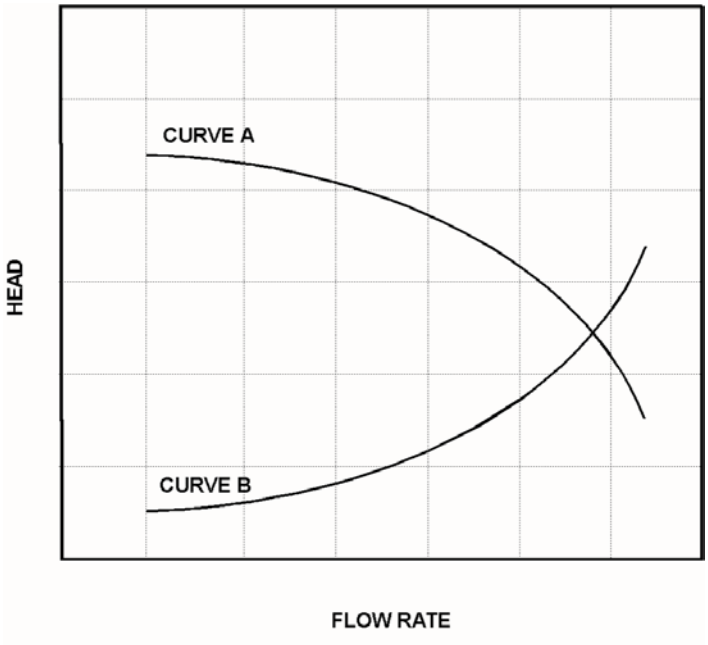
D. The ambient pressure surrounding the water storage tank increases.

QUESTION: 13

Refer to the graph that represents the head-capacity characteristics for a single-speed centrifugal cooling water pump (see figure below).

Which one of the following lists a pair of parameters that could be represented by curves A and B? (Note: NPSH is net positive suction head.)

	Curve A	Curve B
A.	Pump Head	Available NPSH
B.	Available NPSH	Required NPSH
C.	Required NPSH	System Head Loss
D.	System Head Loss	Pump Head



QUESTION: 14

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

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

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

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

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

QUESTION: 15

DELETED

QUESTION: 16

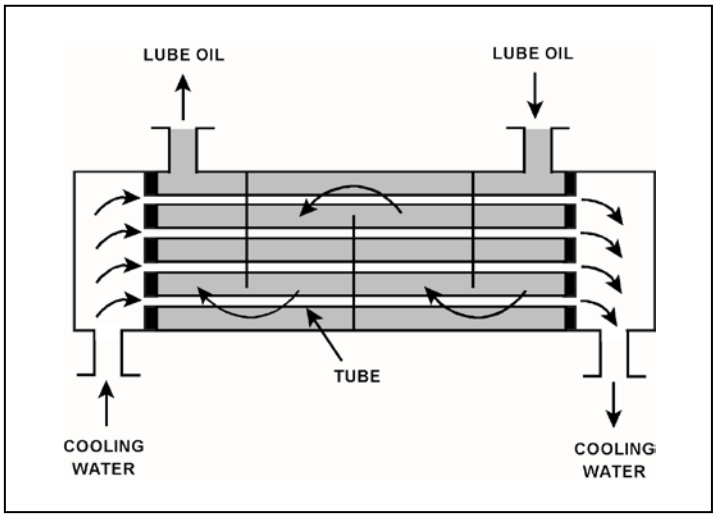
Refer to the drawing of a lube oil heat exchanger (see figure below).

The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature = 130°F
Cooling water inlet temperature = 70°F

Assume that cooling water mass flow rate is less than lube oil mass flow rate, and that both fluids have the same specific heat. Which one of the following pairs of heat exchanger outlet temperatures is <u>not</u> possible?

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	105°F
B.	105°F	105°F
C.	110°F	90°F
D.	115°F	90°F



QUESTION: 17

A nuclear power plant is operating at steady-state 100 percent power when air inleakage causes main condenser vacuum to decrease from 28 inches Hg vacuum to 27 inches Hg vacuum. Assume the main steam inlet pressure, inlet quality, and mass flow rate through the main turbine do not change, and the condenser cooling water inlet temperature and mass flow rate do not change.

When the plant stabilizes, turbine exhaust quality will be _____; and turbine exhaust temperature will be _____.

A. lower; lower

B. lower; higher

C. higher; lower

D. higher; higher

QUESTION: 18

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

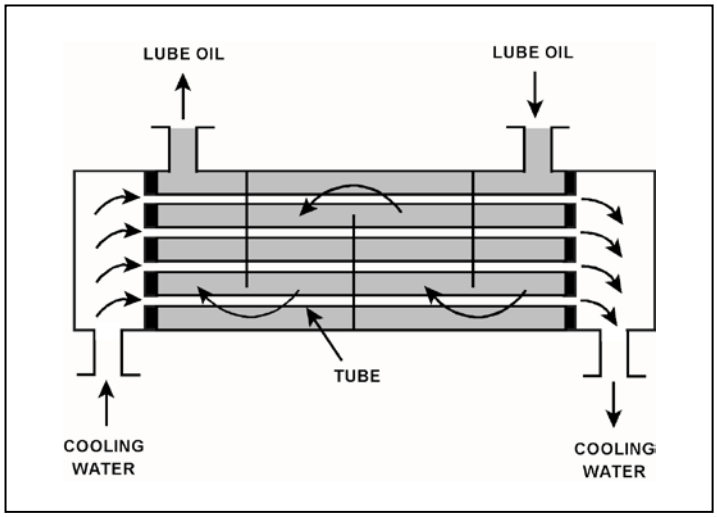
If deposits accumulate on the outside of the cooling water tubes, cooling water outlet temperature will _____; and lube oil outlet temperature will _____. (Assume the lube oil and cooling water inlet temperatures and mass flow rates do not change.)

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease



QUESTION: 19

A condensate demineralizer differential pressure (D/P) gauge indicates 6.0 psid at 50% flow rate. Which one of the following combinations of condensate flow rate and demineralizer D/P observed at various power levels over the next few days indicates an increase in the accumulation of insoluble corrosion products in the demineralizer?

	Condensate Flow Rate	Demineralizer D/P (psid)
A.	100%	23.5
B.	75%	16.5
C.	60%	8.5
D.	25%	1.5

QUESTION: 20

If water containing negatively charged ionic impurities passes through a mixed-bed ion exchanger, the negatively charged ionic impurities will be removed by the _____ exchange resin, with the corresponding release of _____ ions into the water.

A. anion; negative

B. anion; positive

C. cation; negative

D. cation; positive

QUESTION: 21

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

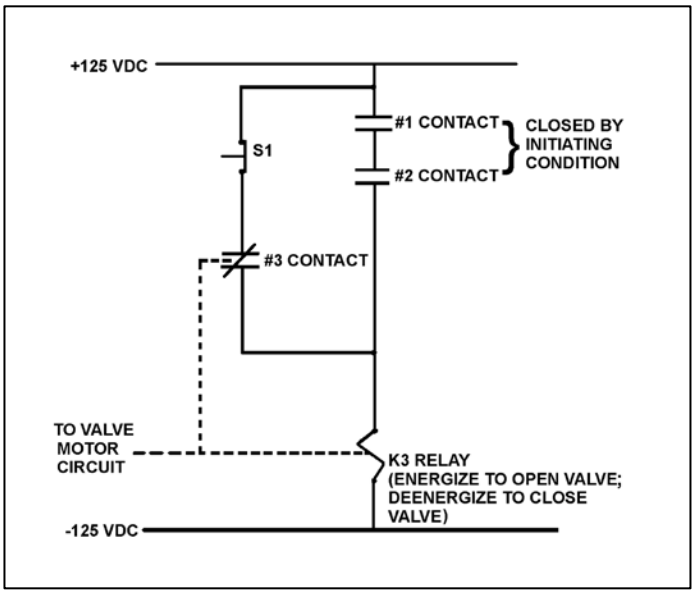
The valve is currently open with the contact configuration as shown. If the S1 pushbutton is depressed, the valve will _____; and when the S1 pushbutton is subsequently released, the valve will _____.

A. remain open; remain open

B. close; remain closed

C. remain open; close

D. close; open



QUESTION: 22

A 480 VAC motor control center supplies a load through a breaker and a manual disconnect switch. Which one of the following sequences will provide the greatest level of personnel safety when deenergizing the load for maintenance and when reenergizing the load after the maintenance?

	DEENERGIZING	REENERGIZING
A.	Open breaker first	Shut breaker first
B.	Open breaker first	Shut disconnect switch first
C.	Open disconnect switch first	Shut breaker first
D.	Open disconnect switch first	Shut disconnect switch first

QUESTION: 23

Which one of the following is the process that produces the majority of prompt neutrons in an operating nuclear plant reactor?

A. A thermal neutron is absorbed by a fuel nucleus. Almost immediately, the nucleus fissions and emits one or more prompt neutrons.

B. A thermal neutron is absorbed by a fuel nucleus. Almost immediately, the fuel nucleus fissions and produces fission products. During the decay of the fission products, one or more prompt neutrons are emitted.

C. A fast neutron is absorbed by a fuel nucleus. Almost immediately, the nucleus fissions and emits one or more prompt neutrons.

D. A fast neutron is absorbed by a fuel nucleus. Almost immediately, the fuel nucleus fissions and produces fission products. During the decay of the fission products, one or more prompt neutrons are emitted.

QUESTION: 24

A nuclear power plant is currently operating at steady-state 80 percent power near the end of its fuel cycle. During the next 3 days of steady-state power operation, no operator action is taken.

How will K_{eff} be affected during the 3-day period?

A. K_{eff} will gradually increase during the entire period.

B. K_{eff} will gradually decrease during the entire period.

C. K_{eff} will tend to increase, but inherent reactivity feedback will maintain K_{eff} at 1.0.

D. K_{eff} will tend to decrease, but inherent reactivity feedback will maintain K_{eff} at 1.0.

QUESTION: 25

Given the following data for a reactor:

- The average delayed neutron fraction is 0.0068.
- The effective delayed neutron fraction is 0.0065.

The above data indicates that this reactor is operating near the _____ of a fuel cycle; and a typical delayed neutron is _____ likely than a typical prompt neutron to cause another fission in this reactor.

A. beginning; less

B. beginning; more

C. end; less

D. end; more

QUESTION: 26

Which one of the following describes the change in the moderator temperature coefficient (MTC) of reactivity over core life? (Assume 100 percent power for all cases.)

A. Control rod withdrawal results in increased thermal neutron utilization, which results in a less negative MTC at end of fuel cycle (EOC).

B. Fission product poison buildup results in decreased thermal neutron utilization, which results in a more negative MTC at EOC.

C. Burnup of U-235 results in decreased thermal neutron utilization, which results in a more negative MTC at EOC.

D. Decreased voiding in the core results in increased thermal neutron utilization, which results in a less negative MTC at EOC.

QUESTION: 27

If the average temperature of a fuel pellet decreases by 50°F, the microscopic cross-section for absorption of neutrons at a resonance energy of U-238 will _____; and the microscopic cross-sections for absorption of neutrons at energies that are slightly higher or lower than a U-238 resonance energy will _____.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 28

If the void fraction surrounding several centrally-located fuel bundles decreases, the worth of the associated control rods will...

A. increase, because the average neutron energy in the area of the affected control rods increases.

B. increase, because fewer neutrons are resonantly absorbed in the fuel while they are being thermalized, resulting in more thermal neutrons available to be absorbed by the affected control rods.

C. decrease, because the diffusion length of the thermal neutrons decreases, resulting in fewer thermal neutrons reaching the affected control rods.

D. decrease, because neutrons will experience a shorter slowing down length, resulting in a larger fraction of thermal neutrons being absorbed by the fuel and fewer thermal neutrons available to be absorbed by the affected control rods.

QUESTION: 29

The main reason for designing and operating a reactor with a flattened neutron flux distribution is to...

A. provide even burnup of control rods.

B. reduce neutron leakage from the core.

C. achieve a higher average power density.

D. provide more accurate nuclear power indication.

QUESTION: 30

A reactor has been operating at 70 percent power for 20 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. At equilibrium.

B. Increasing toward a peak.

C. Decreasing toward an upturn.

D. Decreasing toward equilibrium.

QUESTION: 31

A reactor scram occurred from steady-state 100 percent power and a reactor startup is currently in progress. Which one of the following sets of initial startup conditions will require the smallest amount of control rod withdrawal to achieve criticality? (BOC-- beginning of fuel cycle; EOC -- end of fuel cycle.)

	Core Age	Time Since Reactor Scram
A.	BOC	12 hours
B.	BOC	40 hours
C.	EOC	12 hours
D.	EOC	40 hours

QUESTION: 32

Refer to the curve of K_{eff} versus core age for an operating reactor (see figure below).

The reactor has been operating at 100 percent power for several weeks and is currently operating between points 2 and 3 on the curve.

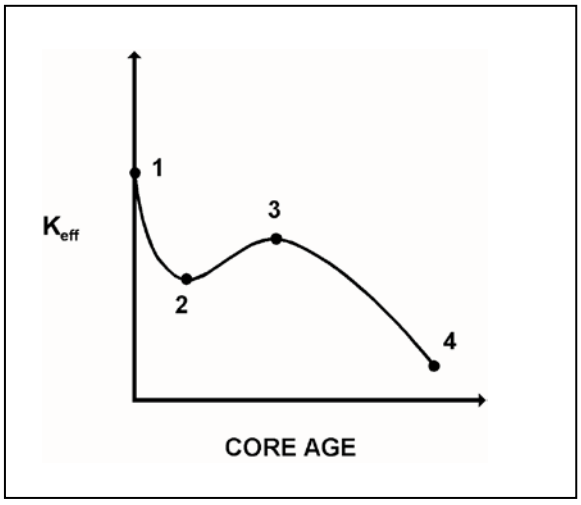
Assuming reactor recirculation flow rate remains the same, what incremental control rod operation(s) will be needed to maintain 100 percent power until point 3 is reached?

A. Withdrawal for the entire period.

B. Withdrawal at first, then insertion.

C. Insertion for the entire period.

D. Insertion at first, then withdrawal.



QUESTION: 33

Reactors A and B are identical except that reactor A is operating near the beginning of a fuel cycle, while reactor B is operating near the end of a fuel cycle. Both reactors have the same slightly positive value for K_{eff}.

If both reactors pass through 1.0×10^{-6} percent reactor power at the same time, which reactor, if any, will reach the point of adding heat (POAH) first, and why?

A. Reactor A, because it has the shorter reactor period.

B. Reactor B, because it has the shorter reactor period.

C. Both reactors will reach the POAH at the same time because they both have the same value for reactor period.

D. Both reactors will reach the POAH at the same time because they are both supercritical by the same amount of positive reactivity.

QUESTION: 34

Initially, a nuclear power plant is operating at steady-state 100 percent power and 100 percent core flow rate. Then, reactor power is reduced to 90 percent by inserting control rods. (Assume that recirculation pump speed and valve positions do <u>not</u> change.)

What is the effect of the power reduction on core flow rate?

A. Core flow rate will increase, due to a decrease in recirculation ratio.

B. Core flow rate will increase, due to a decrease in two-phase flow resistance.

C. Core flow rate will decrease, due to an increase in recirculation ratio.

D. Core flow rate will decrease, due to an increase in two-phase flow resistance.

QUESTION: 35

A reactor was operating for several months at steady-state 100 percent power when a reactor scram occurred. Which one of the following lists the two factors most responsible for the value of the core neutron flux level one hour after the scram?

A. K_{eff} and the rate of source neutron production.

B. K_{eff} and the effective delayed neutron fraction.

C. The decay rates of the delayed neutron precursors and the rate of source neutron production.

D. The decay rates of the delayed neutron precursors and the effective delayed neutron fraction.

QUESTION: 36

A nuclear power plant had been operating at 100 percent power for six months when a reactor scram occurred. Which one of the following describes the source(s) of core heat generation 30 minutes after the reactor scram?

A. Fission product decay is the only significant source of core heat generation.

B. Delayed neutron-induced fission is the only significant source of core heat generation.

C. Fission product decay and delayed neutron-induced fission are both significant sources and produce approximately equal rates of core heat generation.

D. Fission product decay and delayed neutron-induced fission are both insignificant sources and generate core heat at rates that are less than the rate of ambient heat loss from the core.

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, 60°F, and the same constant water level. The tanks are located within a sealed containment structure that is being maintained at standard atmospheric pressure. All level detectors have been calibrated and are producing the same level indication.

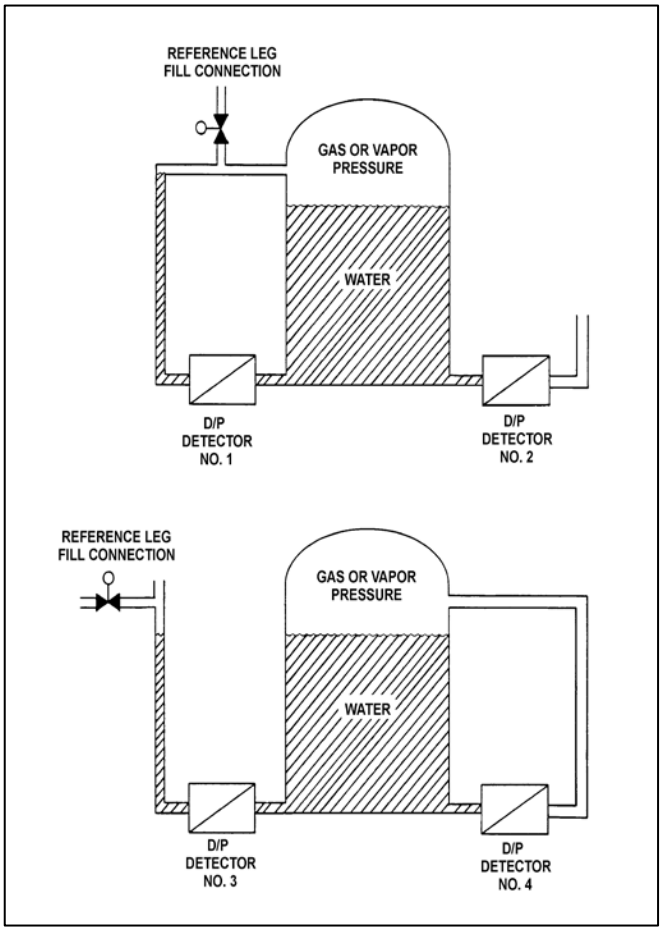
If a ventilation malfunction causes the containment structure pressure to decrease to 13 psia, which detectors will produce the lowest level indications?

A. 1 and 3

B. 2 and 4

C. 1 and 4

D. 2 and 3



QUESTION: 38

Given the following initial conditions for a spent fuel pool:

Spent fuel decay heat rate = 6.0 MW
Spent fuel pool water temperature = 90°F
Spent fuel pool water mass = 2.5×10^6 lbm
Spent fuel pool water specific heat = 1.0 Btu/lbm-°F

If a complete loss of spent fuel pool cooling occurs, approximately how long will it take for spent fuel pool water temperature to reach 212°F? (Assume the spent fuel pool remains in thermal equilibrium, and there is no heat removal from the spent fuel pool.)

A. 6 hours

B. 15 hours

C. 26 hours

D. 51 hours

QUESTION: 39

A nuclear power plant is operating at 90 percent of rated power. Which one of the following effects will result from an improved main condenser vacuum (lower absolute pressure)? (Assume reactor power and main steam mass flow rate are unchanged.)

A. An increase in condensate temperature.

B. An increase in the heat transfer rate in the main condenser.

C. An increase in main turbine efficiency.

D. An increase in condensate subcooling.

QUESTION: 40

Initially, a nuclear power plant was operating at steady-state 85 percent reactor power when the extraction steam to a high-pressure feedwater heater became isolated. Main generator load was returned to its initial value. When the plant stabilizes, reactor power will be _____ than 85 percent; and the steam cycle thermal efficiency will be _____.

A. greater; lower

B. greater; higher

C. less; lower

D. less; higher

QUESTION: 41

Which one of the following describes pump head?

A. The fluid energy contained at the inlet of a pump.

B. The energy added by a pump in excess of shutoff head.

C. The fluid energy required to ensure a pump does not cavitate.

D. The energy added by a pump to increase fluid pressure or velocity.

QUESTION: 42

An operating centrifugal water pump has a 26-inch diameter suction nozzle and a 24-inch diameter discharge nozzle. For this pump, the discharge water velocity is _____ the suction water velocity; and the discharge water volumetric flow rate is _____ the suction water volumetric flow rate. (Assume water is incompressible and the suction and discharge water temperatures are the same.)

A. greater than; greater than

B. greater than; equal to

C. less than; greater than

D. less than; equal to

QUESTION: 43

A nuclear power plant is operating near 100 percent power. Main turbine extraction steam is being supplied to a feedwater heater. Extraction steam parameters are as follows:

Steam pressure = 414 psia
Steam flow rate = 7.5×10^5 lbm/hr
Steam enthalpy = 1,150 Btu/lbm

The extraction steam condenses to saturated water at 414 psia, and then leaves the feedwater heater via a drain line.

What is the heat transfer rate from the extraction steam to the feedwater in the feedwater heater?

A. 3.8×10^7 Btu/hr

B. 8.6×10^7 Btu/hr

C. 5.4×10^8 Btu/hr

D. 7.2×10^8 Btu/hr

QUESTION: 44

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

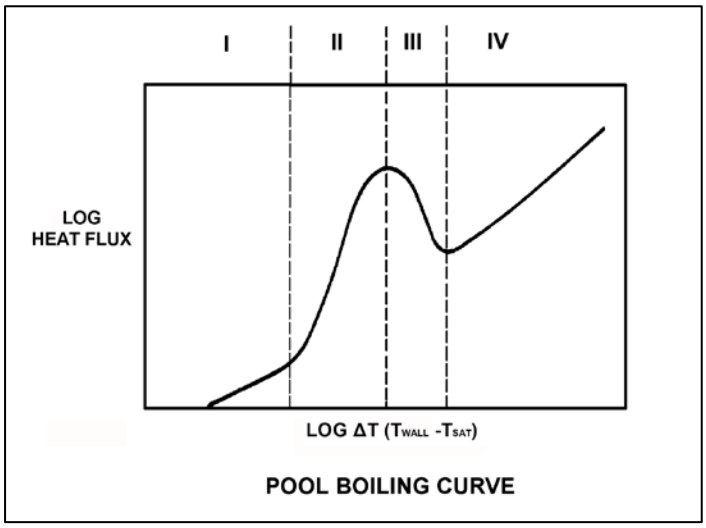
In which region of the curve is nucleate boiling the primary mode of heat transfer?

A. Region I

B. Region II

C. Region III

D. Region IV



QUESTION: 45

A reactor is initially operating at steady-state 70 percent power when recirculation flow rate is increased by 5 percent.

Which one of the following statements describes the initial response of the boiling boundary in the core?

A. It physically moves upward, because each unit quantity of coolant must travel farther through a fuel bundle before vaporizing.

B. It physically moves upward, because each unit quantity of coolant enters the core with a larger subcooled margin.

C. It physically moves downward, because each unit quantity of coolant will vaporize sooner as it travels through a fuel bundle.

D. It physically moves downward, because each unit quantity of coolant enters the core with a smaller subcooled margin.

QUESTION: 46

A reactor was initially operating at steady-state 100 percent power when a loss of offsite power caused a reactor scram and a loss of forced reactor coolant flow. Several minutes later, the occurrence of natural circulation flow will be indicated by a differential _____ across the core plate and coolant flow through the _____ pumps.

A. temperature; recirculation

B. temperature; jet

C. pressure; recirculation

D. pressure; jet

QUESTION: 47

The radial peaking factor for a fuel bundle is expressed mathematically as...

A. $\frac{\text{core average bundle power}}{\text{individual bundle power}}$

B. $\frac{\text{peak nodal power}}{\text{core average nodal power}}$

C. $\frac{\text{core average nodal power}}{\text{peak nodal power}}$

D. $\frac{\text{individual bundle power}}{\text{core average bundle power}}$

QUESTION: 48

Which one of the following is responsible for the fuel cladding failure that results from operating the reactor above the limit for linear heat generation rate?

A. Fission product gas expansion causes fuel rod internal design pressure to be exceeded.

B. Corrosion buildup on the cladding surface reduces heat transfer and promotes transition boiling.

C. The zircaloy-steam reaction causes accelerated oxidation of the cladding at high temperatures.

D. The difference between thermal expansion rates of the fuel pellets and the cladding causes severe stress.

QUESTION: 49

For a reactor operating at 100 percent power, which one of the following combinations of axial power distribution and recirculation system flow rate will result in the smallest critical power ratio in a given fuel bundle? (Assume the maximum linear heat generation rate in the fuel bundle is the same for all cases.)

	Axial Power Distribution	Recirculation System Flow Rate
A.	Top-peaked	Low
B.	Top-peaked	High
C.	Bottom-peaked	Low
D.	Bottom-peaked	High

QUESTION: 50

A reactor is shut down for refueling following 18 months of operation at an average power level of 85 percent. During the shutdown, a reactor vessel metal specimen is removed from the reactor vessel for testing. The testing indicates that the nil-ductility transition (NDT) temperature of the specimen has decreased from 44°F to 32°F since the previous refueling shutdown.

Which one of the following conclusions is warranted?

A. The test results are credible and the reactor vessel is more likely to experience brittle fracture now than after the previous refueling shutdown.

B. The test results are credible and the reactor vessel is less likely to experience brittle fracture now than after the previous refueling shutdown.

C. The test results are questionable because the actual specimen NDT temperature would not decrease during the described 18-month period of operation.

D. The test results are questionable because the actual specimen NDT temperature would decrease by much less than indicated by the test results.

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

MARCH 2017 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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