UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 2010--FORM A

Please Print

Name: _____

Docket No.: _____

Facility: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO APPLICANT

Answer all the test items using the answer sheet provided, ensuring a single answer is marked for each test item. Each test item has equal point value. A score of at least 80 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.

_____
Applicant's Signature

RULES AND INSTRUCTIONS FOR THE NRC
GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

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

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 of the examination room.

10. After you have completed the examination, sign the statement on the cover sheet indicating that the work is your own and you have neither given nor received any assistance in completing the examination. Either pencil or pen may be used.

11. Turn in your examination materials, answer sheet on top, followed by the examination copy and the examination aids, 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

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

$\ell^* = 1 \times 10^{-4}$ sec

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

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

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

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

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

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

$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

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

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

$E = IR$

Thermal Efficiency = Net Work Out/Energy In

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

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

CONVERSIONS

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

QUESTION: 1

A surveillance test procedure is being performed on a typical Limitorque® motor-operated valve (MOV) used in an emergency core cooling system (ECCS) application. The declutch lever has been operated to engage the handwheel and the valve is being manually/locally opened by a technician. The MOV breaker is closed as required by the surveillance test procedure. During operation of the valve handwheel, an ECCS actuation signal is received that normally energizes the valve motor and closes the valve.

How will the valve be affected by the actuation signal?

A. The handwheel will disengage and the valve will automatically close.

B. The handwheel will disengage and the valve will remain in the current position.

C. The handwheel will remain engaged and the valve will automatically close.

D. The handwheel will remain engaged and the technician can continue to open the valve.

QUESTION: 2

Which one of the following valves is used to control the direction of fluid flow and prevent backflow in a system?

A. Gate valve

B. Relief valve

C. Globe valve

D. Check valve

QUESTION: 3

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

Assume that the initial temperature of the reference leg and the water in the tank is 100°F, and that reference leg temperature does not change.

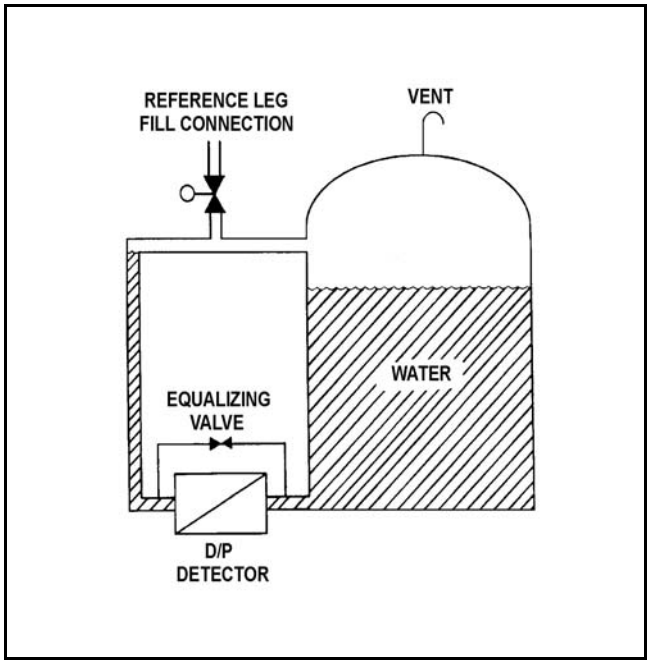
If the temperature of the water in the tank increases by 20°F, the D/P sensed by the detector will _____ if the_____ of the water in the tank is constant.

A. increase; level

B. decrease; level

C. increase; mass

D. decrease; mass



QUESTION: 4

A bourdon tube works on the principle that when the pressure inside the tube decreases, the tube tends to: (Assume detected pressure remains above atmospheric pressure.)

A. coil due to an increased pressure-induced force on the outside of the tube.

B. straighten due to an increased pressure-induced force on the outside of the tube.

C. coil due to the spring action of the metal overcoming the pressure-induced force on the inside of the tube.

D. straighten due to the spring action of the metal overcoming the pressure-induced force on the inside of the tube.

QUESTION: 5

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

The thermocouple, thermocouple connection head, and reference junction panel are located inside a reactor building (RB) while the temperature instrument is located outside the RB. Thermocouple temperature indication is initially 440°F.

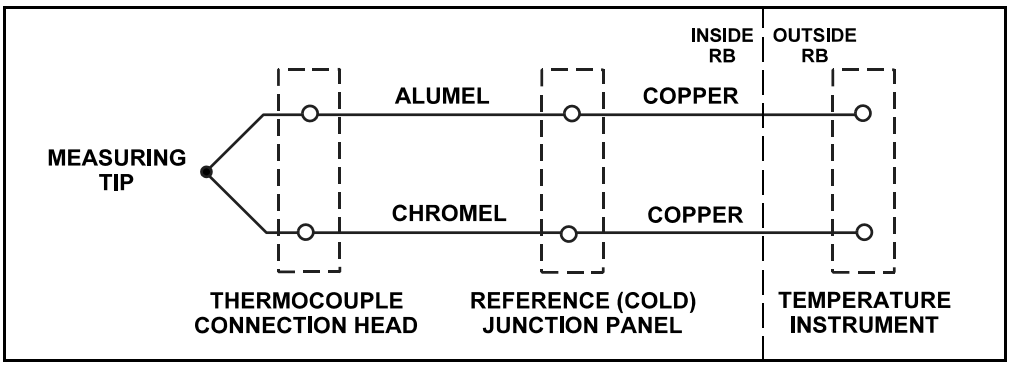
A steam leak inside the RB increases the temperatures of the thermocouple connection head and reference junction panel by 40°F, while the temperature at the measuring tip is unchanged. What is the resulting temperature indication?

A. 400°F

B. 440°F

C. 480°F

D. 520°F



QUESTION: 6

A BF_3 proportional counter is being used to measure neutron level during a reactor startup. Which one of the following describes the method used to ensure that neutron indication is not affected by gamma reactions in the detector?

A. Two counters are used: one sensitive to neutron and gamma and the other sensitive to gamma only. The outputs are electrically opposed to cancel the gamma-induced currents.

B. The BF_3 proportional counter measures neutron flux of such high intensity that the gamma signal is insignificant compared to the neutron signal.

C. In a proportional counter, gamma-induced pulses are of insufficient duration to generate a significant output. Only neutron pulses have sufficient duration to be counted by the detector instrumentation.

D. In a proportional counter, neutron-induced pulses are significantly larger than gamma pulses. The detector instrumentation filters out the smaller gamma pulses.

QUESTION: 7

Which one of the following terms is used to describe the delay between a process parameter change and the sensing of that change by the process controller?

A. Offset

B. Gain

C. Dead time

D. Feedback

QUESTION: 8

An emergency diesel generator (D/G) is operating as the only power source connected to an emergency bus. The governor of the D/G is directly sensing D/G _____ and will directly adjust D/G _____ flow to maintain a relatively constant D/G frequency.

A. speed; fuel

B. speed; air

C. load; fuel

D. load; air

QUESTION: 9

Given:

- A directing-acting proportional pneumatic controller will be used to maintain level in a condensate collection tank by positioning an air-operated flow control valve in the tank drain line.
- The controller's input varies directly with tank condensate level.

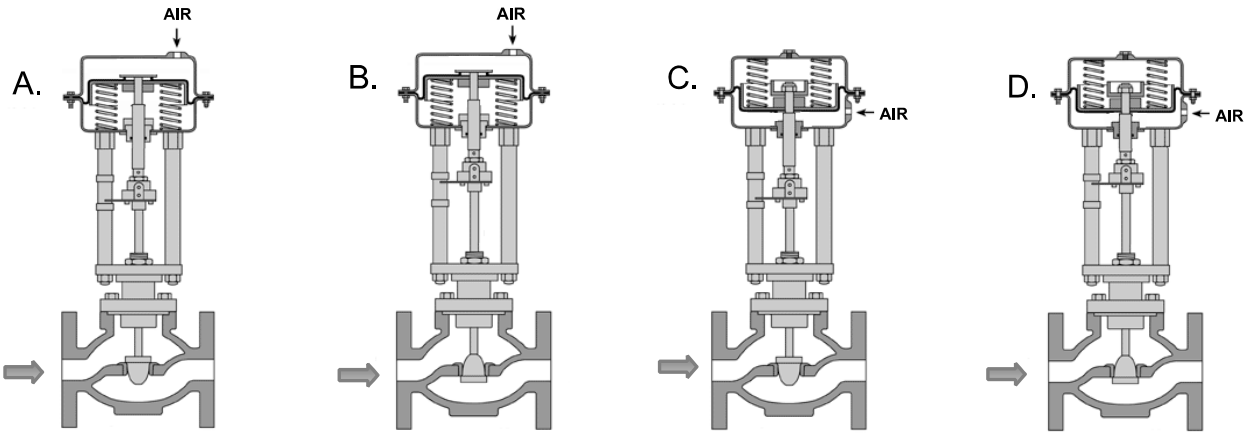
Which of the flow control valves shown below will be compatible with the controller in the above application?

A. A and B

B. B and C

C. C and D

D. D and A



QUESTION: 10

A radial flow centrifugal cooling water pump is driven by an ac induction motor. The pump can supply cooling water to several heat loads, all of which are in parallel alignment. The following pump conditions initially exist:

Pump motor current:	100 amps
Pump flow rate:	400 gpm
Pump suction temperature:	70°F

Four hours later, the motor is drawing 105 amps. Which one of the following could be responsible for the observed increase in motor current?

A. The temperature of the cooling water being pumped decreased to 60°F with no change in pump flow rate.

B. The temperature of the cooling water being pumped increased to 80°F with no change in pump flow rate.

C. Cooling water flow was established to an additional heat load with no change in the temperature of the cooling water being pumped.

D. Cooling water flow was isolated from an out-of-service heat load with no change in the temperature of the cooling water being pumped.

QUESTION: 11

Refer to the drawing of a cooling water system (see figure below).

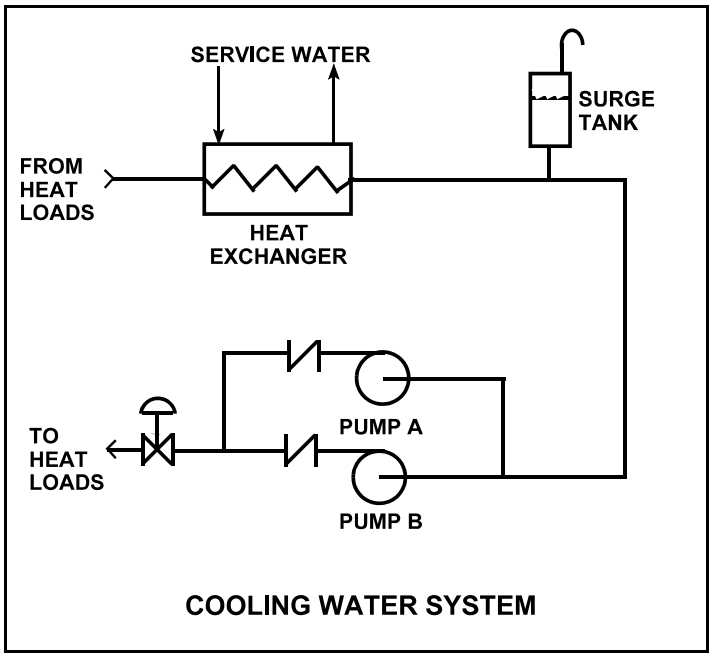
Pumps A and B are identical single-speed centrifugal pumps and both pumps are operating. If pump B trips, after the system stabilizes, system flow rate will be...

A. more than one-half the original flow.

B. one-half the original flow.

C. less than one-half the original flow.

D. the same; only the pump head will change.



QUESTION: 12

Refer to the drawing of four sets of centrifugal pump operating curves (see figure below). Each set of curves shows a combination of two pump/system operating conditions.

Initially, a centrifugal pump is operating with a partially open discharge valve in a closed system. The discharge valve is then opened fully.

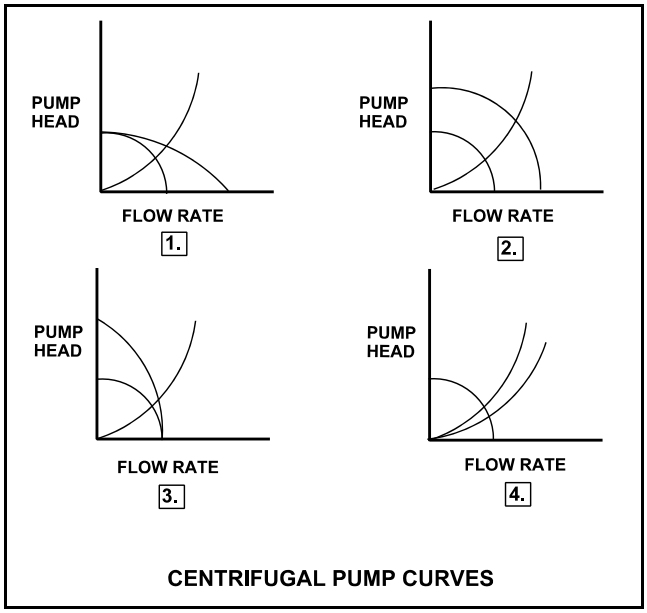
Which set of operating curves depicts the "before" and "after" conditions described above?

A. 1.

B. 2.

C. 3.

D. 4.



QUESTION: 13

Which one of the following specifies the proper pump discharge valve position and the basis for that position when starting a large radial-flow centrifugal pump?

A. Discharge valve fully open to reduce motor power requirements.

B. Discharge valve throttled to reduce motor power requirements.

C. Discharge valve fully open to ensure adequate pump net positive suction head.

D. Discharge valve throttled to ensure adequate pump net positive suction head.

QUESTION: 14

A thermal overload device for a large motor protects the motor from...

A. sustained overcurrent by opening the motor breaker or motor line contacts.

B. sustained overcurrent by opening contacts in the motor windings.

C. instantaneous overcurrent by opening the motor breaker or motor line contacts.

D. instantaneous overcurrent by opening contacts in the motor windings.

QUESTION: 15

A nuclear power plant is operating at 80 percent power in the middle of a fuel cycle. The main turbine-generator is connected to an infinite power grid with the following main generator output parameters:

Real Load:	830 MW
Reactive Load:	248 MVAR (out)
Voltage:	25,000 VAC
Current:	20,000 Amps

Which one of the following will significantly increase main generator output current without a significant change in main generator real load?

A. Increasing the main turbine speed control setpoint.

B. Increasing the main generator voltage regulator setpoint.

C. A 10 percent decrease in typical power grid electrical loads.

D. A 10 percent increase in typical power grid electrical loads.

QUESTION: 16

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

A. temperature of the hotter liquid is decreased by 20°F.

B. temperature of the colder liquid is increased by 20°F.

C. flow rates of both liquids are decreased by 10 percent.

D. flow rates of both liquids are increased by 10 percent.

QUESTION: 17

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

Given the following initial parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$) = 75°F
Cooling water outlet temperature ($T_{cw\text{-}out}$) = 95°F
Oil inlet temperature ($T_{oil\text{-}in}$) = 150°F
Oil outlet temperature ($T_{oil\text{-}out}$) = 120°F

Air introduction to the heat exchanger results in some of the heat exchanger tubes becoming uncovered. As a result, $T_{cw\text{-}out}$ decreases to 91°F. Assume the inlet temperatures, mass flow rates, and specific heats of both fluids remain the same.

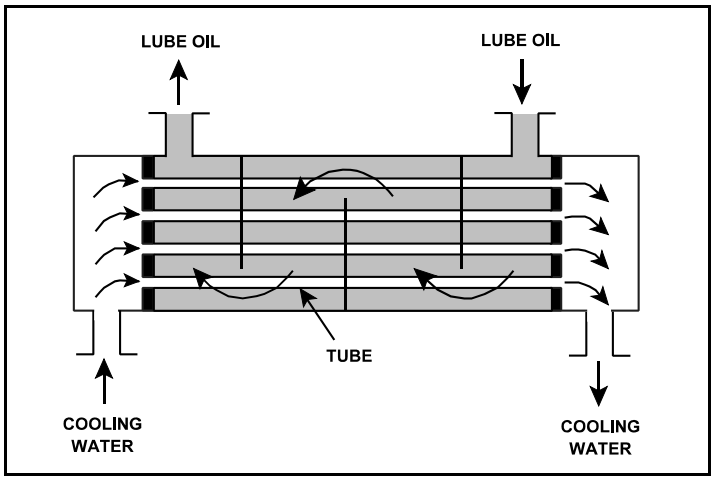
Which one of the following will be the resulting temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

A. 126°F

B. 130°F

C. 134°F

D. 138°F



QUESTION: 18

A mixed-bed ion exchanger is being used to process reactor coolant letdown. The ion exchanger is boron-saturated for the existing reactor coolant conditions.

Reactor coolant letdown temperature at the inlet to the ion exchanger increases by 15°F, while remaining within the normal temperature range. As a result of the temperature increase, the total number of boron atoms occupying the ion exchange sites will _____, and the boron concentration (ppm) in the ion exchanger effluent will _____.

A. increase; decrease

B. increase; increase

C. decrease; decrease

D. decrease; increase

QUESTION: 19

A nuclear power plant was operating at steady-state 100 percent power when the reactor coolant system experienced a large crud burst. After 20 minutes, the operators began to record parameters for the in-service reactor coolant purification ion exchanger.

Assuming no additional operator actions, what trend will the recorded parameters show during the next few hours?

A. Increasing flow rate through the ion exchanger.

B. Increasing pressure drop across the ion exchanger.

C. Increasing ion exchanger inlet water conductivity.

D. Increasing ion exchanger outlet water conductivity.

QUESTION: 20

Which one of the following is an unsafe practice if performed when working on or near energized electrical equipment?

A. Cover exposed energized circuits with insulating material to prevent inadvertent contact.

B. Have a person standing by to deenergize the equipment in the event of an emergency.

C. Use two hands for balance and to prevent dropping tools onto energized equipment.

D. Stand on insulating rubber material to prevent yourself from being grounded.

QUESTION: 21

A diesel generator (DG) was initially operating at 80 percent of rated load supplying an isolated electrical bus when a malfunction caused the DG output breaker to trip. The breakers for all of the bus loads--all of which are large motors--remained closed, preparing the motors to restart upon restoration of power to the bus.

The DG output breaker has been repaired. With all of the bus load breakers still closed, which one of the following will occur when the DG output breaker is closed to reenergize the bus?

A. The DG will become lightly loaded.

B. The DG will return directly to its initial load.

C. The DG will experience slight overload conditions.

D. The DG will experience severe overload conditions.

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

In a comparison between a delayed neutron and a prompt neutron produced from the same fission event, the prompt neutron is more likely to...

A. cause fast fission of a U-238 nucleus.

B. be captured by a U-238 nucleus at a resonance energy between 1 eV and 1000 eV.

C. be captured by a Xe-135 nucleus.

D. cause thermal fission of a U-235 nucleus.

QUESTION: 24

A thermal neutron is about to interact with a U-238 nucleus in an operating nuclear reactor core. Which one of the following describes the most likely interaction and the effect on core 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

The following data applies to a nuclear reactor core just prior to a refueling shutdown.

Nuclide	Delayed Neutron Fraction	Fraction of Total Fission Rate
U-235	0.0065	0.64
U-238	0.0148	0.07
Pu-239	0.0021	0.29

During the refueling, one-third of the fuel assemblies were offloaded and replaced with new fuel assemblies consisting of uranium having an average U-235 enrichment of 3.5 percent by weight.

Which one of the following describes how the above data will change as a result of completing the refueling outage?

A. The delayed neutron fraction for U-235 will decrease.

B. The delayed neutron fraction for Pu-239 will decrease.

C. The fraction of the total fission rate attributed to U-235 will increase.

D. The fraction of the total fission rate attributed to Pu-239 will increase.

QUESTION: 26

A nuclear reactor is exactly critical at the point of adding heat during a xenon-free reactor startup near the beginning of core life. Reactor power is ramped to 50 percent over the next 4 hours.

During the power increase, most of the positive reactivity added by the operator is necessary to overcome the negative reactivity associated with the...

A. buildup of core Xe-135.

B. increased fuel temperature.

C. burnout of burnable poisons.

D. increased reactor coolant temperature.

QUESTION: 27

Differential boron worth (ΔK/K/ppm) becomes more negative as...

A. burnable poisons deplete.

B. boron concentration increases.

C. moderator temperature increases.

D. fission product poison concentration increases.

QUESTION: 28

Criticality has been achieved during a xenon-free nuclear reactor startup. The core neutron flux level is low in the intermediate range with a stable 0.5 dpm startup rate (SUR). The operator begins inserting control rods in an effort to stabilize the core neutron flux level near its current value. The operator stops inserting control rods when the SUR indicates exactly 0.0 dpm.

Immediately after the operator stops inserting the control rods, the SUR will become _____; and the core neutron flux level will _____.

A. positive; increase exponentially

B. positive; increase linearly

C. negative; decrease exponentially

D. negative; decrease linearly

QUESTION: 29

A nuclear reactor is operating at 85 percent power with all control rods fully withdrawn. Assuming that reactor power does not change, which one of the following compares the effects of partially inserting (50 percent) a single center control rod to the effects of dropping (full insertion) the same control rod?

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

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

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

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

QUESTION: 30

A nuclear reactor has been operating at 100 percent power for eight weeks when a reactor trip occurs. The reactor is critical 6 hours later and power is increased to 100 percent over the next 6 hours.

What is the status of core xenon-135 concentration when power reaches 100 percent?

A. Increasing toward an equilibrium value.

B. Burning out faster than it is being produced.

C. Increasing toward a peak value.

D. At equilibrium.

QUESTION: 31

Which one of the following describes the change in core xenon-135 concentration immediately following a power increase from equilibrium conditions?

A. Initially decreases due to the increased rate of xenon-135 radioactive decay.

B. Initially decreases due to the increased absorption of thermal neutrons by xenon-135.

C. Initially increases due to the increased xenon-135 production from fission.

D. Initially increases due to the increased iodine-135 production from fission.

QUESTION: 32

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

A. Faster near EOL due to faster changes in boron concentration.

B. Faster near EOL due to greater control rod worth.

C. Faster near BOL due to faster changes in boron concentration.

D. Faster near BOL due to greater control rod worth.

QUESTION: 33

Refer to the drawing of a 1/M plot with curves A and B (see figure below). Assume that each axis has linear units.

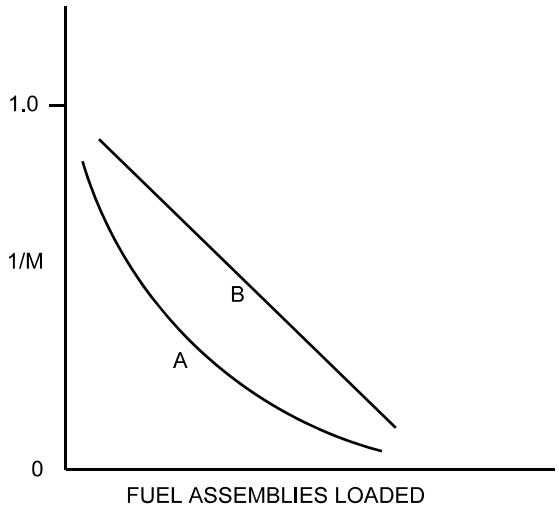
Curve A would result if each fuel assembly loaded during the early stages of the refueling caused a relatively _____ fractional change in source range count rate compared to the later stages of the refueling; curve B would result if each fuel assembly contained equal _____.

A. small; fuel enrichment

B. small; reactivity

C. large; fuel enrichment

D. large; reactivity



QUESTION: 34

A nuclear 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 in which each listed indication supports 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

Refer to the drawing that shows a graph of startup rate versus time (see figure below) for a nuclear reactor. Both axes have linear scales.

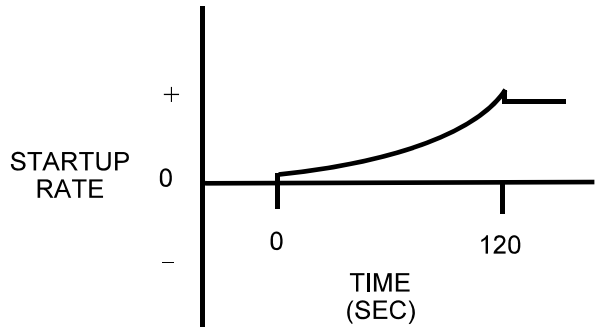
Which one of the following events, initiated at 0 seconds, would cause the startup rate response shown on the graph?

A. A step addition of positive reactivity to a reactor that is initially critical in the source range. Reactor power enters the power range at 120 seconds.

B. A step addition of positive reactivity to a reactor that is initially stable in the power range. A step addition of negative reactivity is inserted at 120 seconds.

C. A controlled constant rate of positive reactivity addition to a reactor that is initially critical in the source range and remains below the point of adding heat. The positive reactivity addition ends at 120 seconds.

D. A controlled constant rate of positive reactivity addition to a reactor that is initially stable in the power range and remains in the power range. The positive reactivity addition ends at 120 seconds.



QUESTION: 36

A nuclear reactor has been shutdown for several weeks when a loss of all ac power results in a loss of forced decay heat removal flow.

Given the following information, what will be the average reactor coolant heatup rate during the 20 minutes immediately after decay heat removal flow is lost? Assume that only ambient losses are removing heat from the reactor coolant system (RCS), and that natural circulation provides adequate thermal mixing.

Reactor rated thermal power:	2,800 MWt
Decay heat rate:	0.2% rated thermal power
RCS ambient heat loss rate:	2.4 MWt
RCS c_p:	1.1 Btu/lbm-°F
RCS inventory (less pressurizer):	325,000 lbm

A. Less than 25°F/hour

B. 26 to 50°F/hour

C. 51 to 75°F/hour

D. More than 76°F/hour

QUESTION: 37

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

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

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

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

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

QUESTION: 38

Consider a steam-water mixture with a current quality of 79 percent. If pressure remains constant and heat is added to the mixture, the temperature of the mixture will _____ and the quality of the mixture will _____. (Assume the mixture remains saturated.)

A. increase; increase

B. increase; remain the same

C. remain the same; increase

D. remain the same; remain the same

QUESTION: 39

Saturated steam (100 percent quality) is flowing through a reheater. The reheater inlet and outlet pressures are both 260 psia. If the reheater adds 60.5 Btu/lbm to the steam, what is the temperature of the steam exiting the reheater?

A. 405°F

B. 450°F

C. 465°F

D. 500°F

QUESTION: 40

Saturated steam (100 percent quality) at 1,000 psia is being supplied to the inlet of a partially-open steam throttle valve on a main turbine. Pressure in the steam chest downstream of the throttle valve is 150 psia. Assume a typical throttling process with no heat gain or loss to/from the steam.

When compared to the conditions at the inlet to the throttle valve, which one of the following describes the conditions in the steam chest for specific enthalpy and entropy?

	Steam Chest Specific Enthalpy	Steam Chest Specific Entropy
A.	About the same	About the same
B.	About the same	Significantly higher
C.	Significantly lower	About the same
D.	Significantly lower	Significantly higher

QUESTION: 41

Turbine X and turbine Y are ideal steam turbines that exhaust to a condenser at 1.0 psia. Turbine X is driven by saturated steam (100 percent quality) at 900 psia. Turbine Y is driven by superheated steam at 500 psia and 620°F.

The greatest amount of work is being performed by turbine _____, and the greatest moisture content exists in the exhaust of turbine _____.

A. X; Y

B. X; X

C. Y; Y

D. Y; X

QUESTION: 42

The primary reason for slowly opening the discharge valve of a large motor-driven centrifugal cooling water pump after starting the pump is to minimize the...

A. net positive suction head requirements.

B. potential for a water hammer.

C. motor running current requirements.

D. potential for pump cavitation.

QUESTION: 43

Two centrifugal pumps and two positive displacement pumps are able to be cross connected to provide flow in a system. Each pump will produce 100 gpm at 1,000 psig and each pump has a design maximum pressure of 1,500 psig.

If system pressure is 1,200 psig, which one of the following will produce the greatest system flow rate?

A. Two positive displacement pumps in series.

B. Two positive displacement pumps in parallel.

C. Two centrifugal pumps in series.

D. Two centrifugal pumps in parallel.

QUESTION: 44

Which one of the following describes a heat transfer flow path in which conduction is the most significant mode of heat transfer?

A. From the reactor fuel to the core barrel during core uncovery.

B. From the main turbine exhaust steam to the atmosphere via main condenser cooling water and a cooling tower during normal operation.

C. From the reactor fuel to the steam outlet of the steam generators during a station blackout.

D. From a fuel pellet to the fuel clad via the fuel rod fill gas during normal operation.

QUESTION: 45

Subcooled water enters the bottom of an operating nuclear reactor core. As the water flows upward past the fuel assemblies, steam voids appear at the surface of a few fuel rods and are swept away.

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

A. higher; more

B. higher; less

C. lower; more

D. lower; less

QUESTION: 46

How does critical heat flux vary from the bottom to the top of a nuclear reactor core during normal full power operation?

A. Increases continuously.

B. Increases, then decreases.

C. Decreases continuously.

D. Decreases, then increases.

QUESTION: 47

Which one of the following describes the conditions in a fuel coolant channel 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: 48

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

A. At the top of the fuel assembly.

B. At the bottom of the fuel assembly.

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

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

QUESTION: 49

A PWR core consists of 50,000 fuel rods; each fuel rod has an active length of 12 feet. The core is producing 1,800 MW of thermal power. If the nuclear heat flux hot channel factor, $F_Q(z)$, (also called the total core peaking factor) is 1.5, what is the maximum local linear power density being produced in the core?

A. 4.5 kW/ft

B. 6.0 kW/ft

C. 9.0 kW/ft

D. 12.0 kW/ft

QUESTION: 50

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

A. A high reactor fast neutron flux rather than a high gamma flux.

B. A high reactor vessel material ductility rather than a high material strength.

C. A rapid 100°F reactor heatup at a high temperature rather than a low temperature.

D. A rapid 100°F reactor cooldown at a high temperature rather than a low temperature.

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

MARCH 2010 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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