UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 2007--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% is required to pass this portion of the NRC operator licensing written examination. All examination papers will be collected 3.0 hours after the examination starts. This examination applies to a typical 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.

_____

Applicant's Signature

RULES AND GUIDELINES 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.

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 time.

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 booklet, then examination aids - steam table booklets, handouts, and scrap paper used during the examination.

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 HANDOUT SHEET

EQUATIONS

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

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

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

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

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

$E = IR$

Eff. = 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

Refer to the drawing of a spring-loaded air-operated valve shown in a throttled position (see figure below).

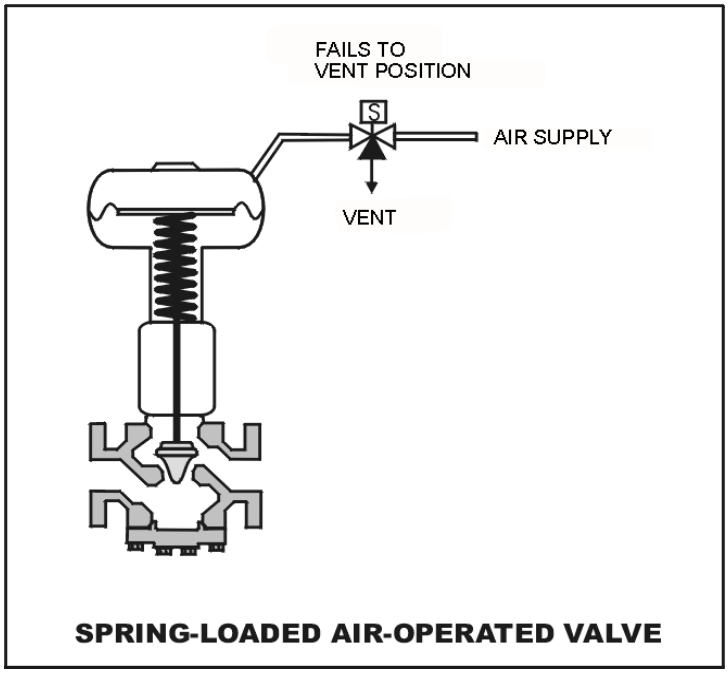
The figure currently depicts normal air supply pressure and an energized solenoid. What will be the valve position following a loss of electrical power to the solenoid?

A. As is

B. More open

C. More closed

D. Varies with system flow



SPRING-LOADED AIR-OPERATED VALVE

QUESTION: 2

A typical check valve is designed to...

A. permit flow in only one direction.

B. prevent system overpressure.

C. isolate system components.

D. perform automatic pump venting.

QUESTION: 3

In a comparison of butterfly valves with ball valves, _____ valves are generally more leak tight in high pressure applications; and _____ valves generally exhibit the lower system pressure drop when fully open.

A. ball; ball

B. ball; butterfly

C. butterfly; ball

D. butterfly; butterfly

QUESTION: 4

Which one of the following will cause indicated volumetric flow rate to be lower than actual volumetric flow rate using a differential pressure flow detector and a calibrated orifice?

A. System pressure decreases.

B. The orifice erodes over time.

C. Debris becomes lodged in the orifice.

D. A leak develops in the low pressure sensing line.

QUESTION: 5

Refer to the drawing of a differential pressure (D/P) level detection system for a reactor vessel at normal operating temperature and pressure (see figure below).

A nuclear power plant uses several differential pressure detectors like the one below to provide multiple channels of reactor vessel water level indication. A hot channel was calibrated when the reactor vessel was at normal operating temperature. A cold channel was calibrated when the reactor vessel was at 160°F.

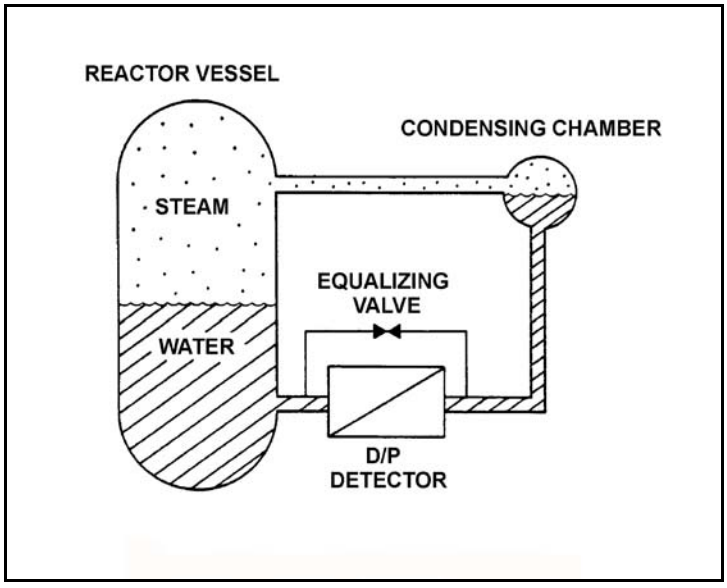
How will the level indications on the two channels compare when the reactor vessel is at 160°F?

A. The cold channel will indicate higher than the hot channel due to the difference in reference leg water density at the two calibration temperatures.

B. The cold channel will indicate lower than the hot channel due to the difference in reference leg water density at the two calibration temperatures.

C. The cold channel will indicate higher than the hot channel due to the difference in reactor vessel water density at the two calibration temperatures.

D. The cold channel will indicate lower than the hot channel due to the difference in reactor vessel water density at the two calibration temperatures.



QUESTION: 6

What is the most common type of sensor used to provide remote position indication of a valve that is normally either fully open or fully closed?

A. Limit switch

B. Reed switch

C. Servo transmitter

D. Linear variable differential transformer

QUESTION: 7

Which one of the following lists the two types of gas-filled radiation detectors whose outputs will be least affected by a small variation (± 10 volts) in the voltage applied to the detectors? (Assume voltage remains within normal range.)

A. Limited proportional and Geiger Mueller

B. Ion chamber and proportional

C. Proportional and limited proportional

D. Geiger Mueller and ion chamber

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

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

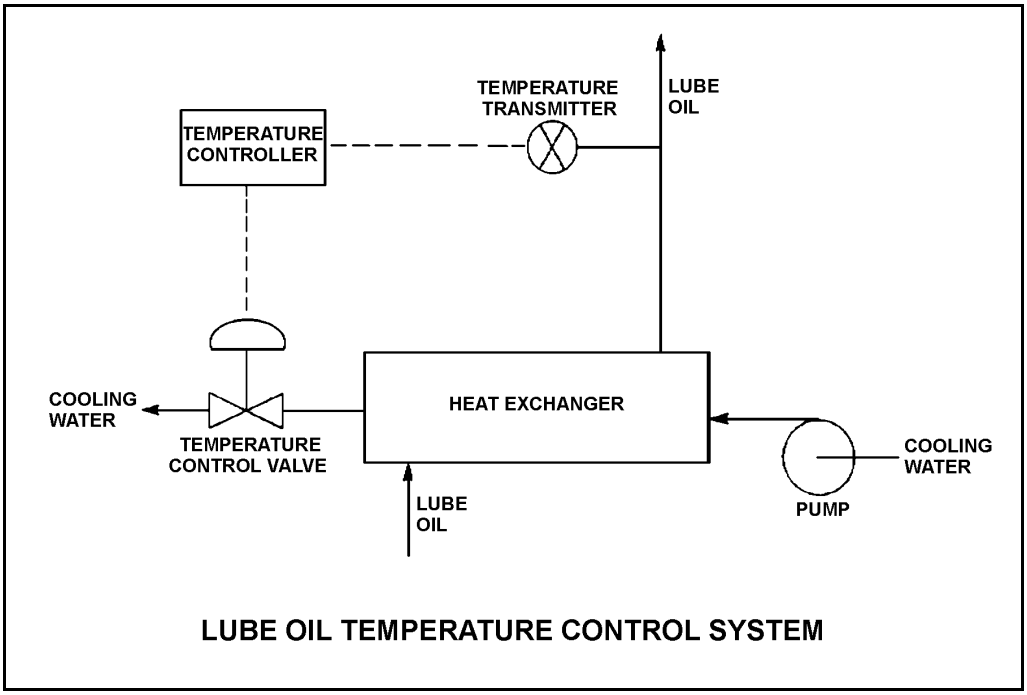
The temperature controller is a direct-acting proportional controller with a gain of 1.0. Which one of the following describes the effect of changing the gain to 2.0?

A. Half the temperature deviation from setpoint will produce a given controller output.

B. Twice the temperature deviation from setpoint will produce a given controller output.

C. The temperature control valve will move half as far for a given change in controller output.

D. The temperature control valve will move twice as far for a given change in controller output.



LUBE OIL TEMPERATURE CONTROL SYSTEM

QUESTION: 10

A variable-speed centrifugal fire water pump is taking a suction on an open storage tank and discharging through a 4-inch diameter fire hose and through a nozzle located 50 feet above the pump.

Which one of the following will cause the pump to operate at shutoff head?

A. The fire hose is replaced with a 6-inch diameter fire hose.

B. The fire hose is replaced with a 2-inch diameter fire hose.

C. Pump speed is increased until steam formation at the eye of the pump prevents pump flow.

D. Pump speed is decreased until pump discharge pressure is insufficient to cause flow.

QUESTION: 11

A flow-limiting venturi in the discharge piping of a centrifugal pump decreases the potential for the pump to experience...

A. runout

B. reverse flow

C. shutoff head

D. water hammer

QUESTION: 12

A centrifugal pump is operating at maximum design flow rate, taking suction on a vented water storage tank and discharging through two parallel valves. Valve "A" is fully open and valve "B" is half open.

Which one of the following will occur if valve B is fully closed?

A. The pump will operate at shutoff head.

B. The pump will operate at runout conditions.

C. The pump available net positive suction head will increase.

D. The pump required net positive suction head will increase.

QUESTION: 13

Which one of the following conditions will result in the greatest increase in volumetric flow rate in a water system with one positive displacement pump operating at 400 rpm and a discharge pressure of 100 psig?

A. Increasing pump speed to 700 rpm

B. Decreasing pump discharge pressure to 40 psig

C. Starting a second identical positive displacement pump in series with the first

D. Starting a second identical positive displacement pump in parallel with the first

QUESTION: 14

A centrifugal pump is operating at 600 rpm with the following parameters:

Current = 100 amperes
Pump head = 50 psid
Pump flow rate = 880 gpm

What will be the approximate value of pump head if pump speed is increased such that the pump now draws 640 amperes?

A. 93 psid

B. 126 psid

C. 173 psid

D. 320 psid

QUESTION: 15

Which one of the following describes when the highest stator current will be experienced by an ac induction motor?

A. During motor operation at full load

B. During motor operation at zero load

C. Immediately after energizing the motor

D. Immediately after deenergizing the motor

QUESTION: 16

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

Given the following existing conditions:

$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$\dot{m}_{oil}$ = 1.8 x 10^4 lbm/hr
$\dot{m}_{water}$ = 1.65 x 10^4 lbm/hr
$T_{oil\ in}$ = 170°F
$T_{oil\ out}$ = 120°F
$T_{water\ out}$ = 110°F
$T_{water\ in}$ = ?

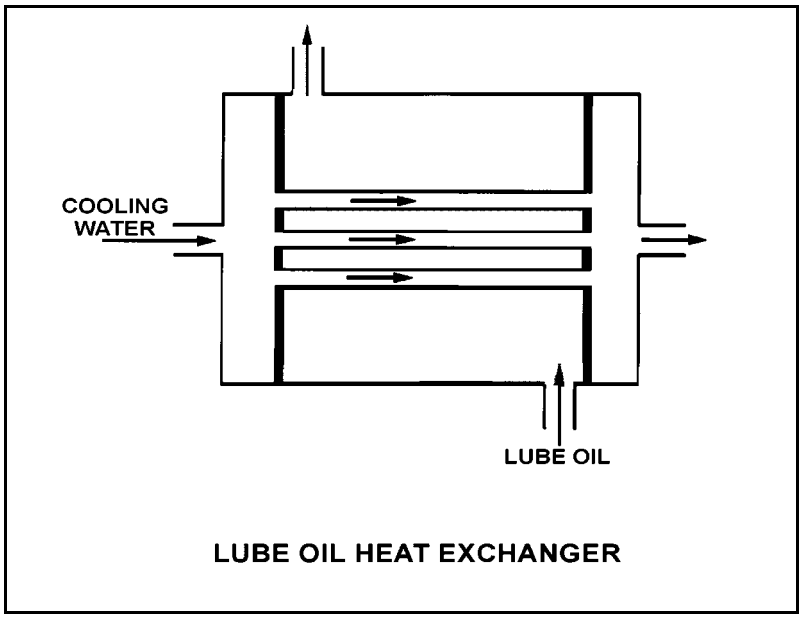
Which one of the following is the cooling water inlet temperature ($T_{water\ in}$) in the heat exchanger?

A. 45°F

B. 50°F

C. 55°F

D. 60°F



QUESTION: 17

Refer to the drawing of two system curves for a typical main condenser cooling water system (see figure below).

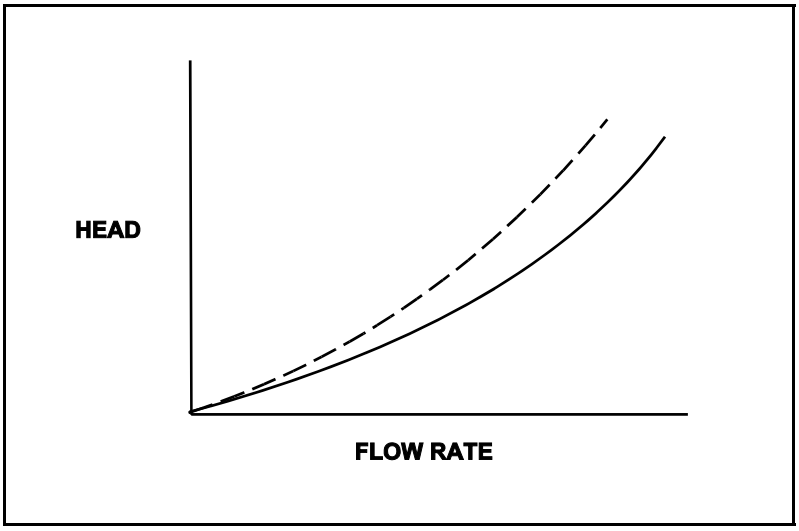
Which one of the following will cause the system curve to shift from the solid curve toward the dashed curve?

A. The main condenser tubes are cleaned.

B. The main condenser tubes become increasingly fouled.

C. Cooling water system flow rate is increased by 25% by starting an additional cooling water pump.

D. Cooling water system flow rate is decreased by 25% by stopping one of the operating cooling water pumps.



QUESTION: 18

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

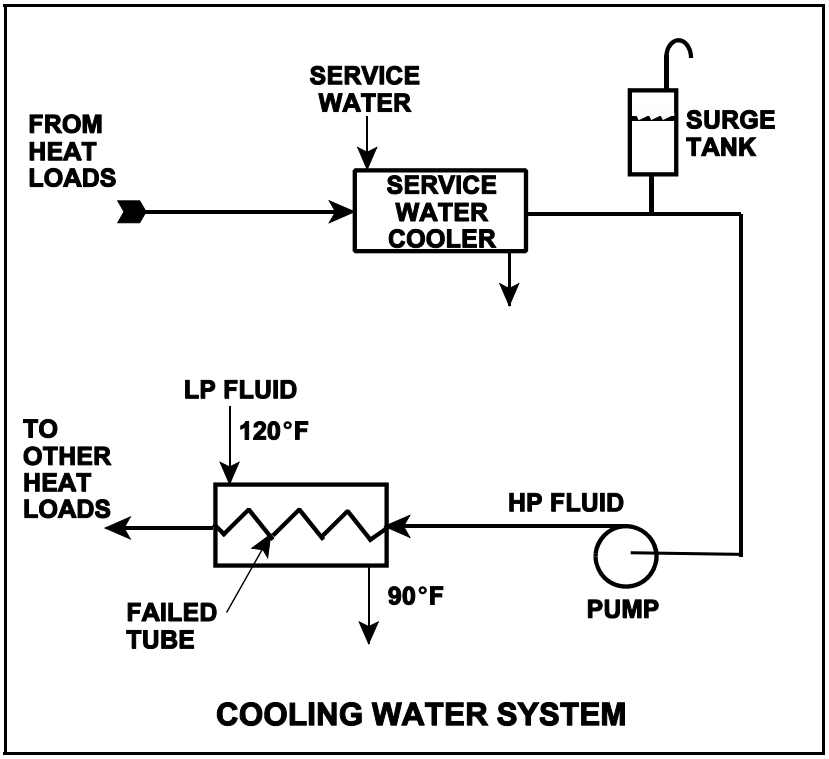
Which one of the following effects would occur as a result of the failed tube in the heat exchanger?

A. Level in the surge tank increases.

B. Flow in the low pressure system reverses.

C. Pressure in the low pressure system decreases.

D. Low pressure fluid heat exchanger outlet temperature decreases.



QUESTION: 19

Which one of the following describes the process of backwashing a mixed-resin deep bed demineralizer?

A. Alternating the flow of dilute acidic and caustic solutions through the demineralizer to remove suspended solids and colloidal matter

B. Alternating the flow of dilute acidic and caustic solutions through the demineralizer to remove ionic impurities

C. Reversing flow of pure water through the demineralizer to remove suspended solids and colloidal matter

D. Reversing flow of pure water through the demineralizer to remove ionic impurities

QUESTION: 20

Which one of the following is an indication of resin exhaustion in a demineralizer:

A. An increase in the conductivity of the effluent

B. A decrease in the flow rate through the demineralizer

C. An increase in suspended solids in the effluent

D. An increase in the differential pressure across the demineralizer

QUESTION: 21

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

Note: Relay contacts are shown open/closed according to the standard convention for control circuit drawings.

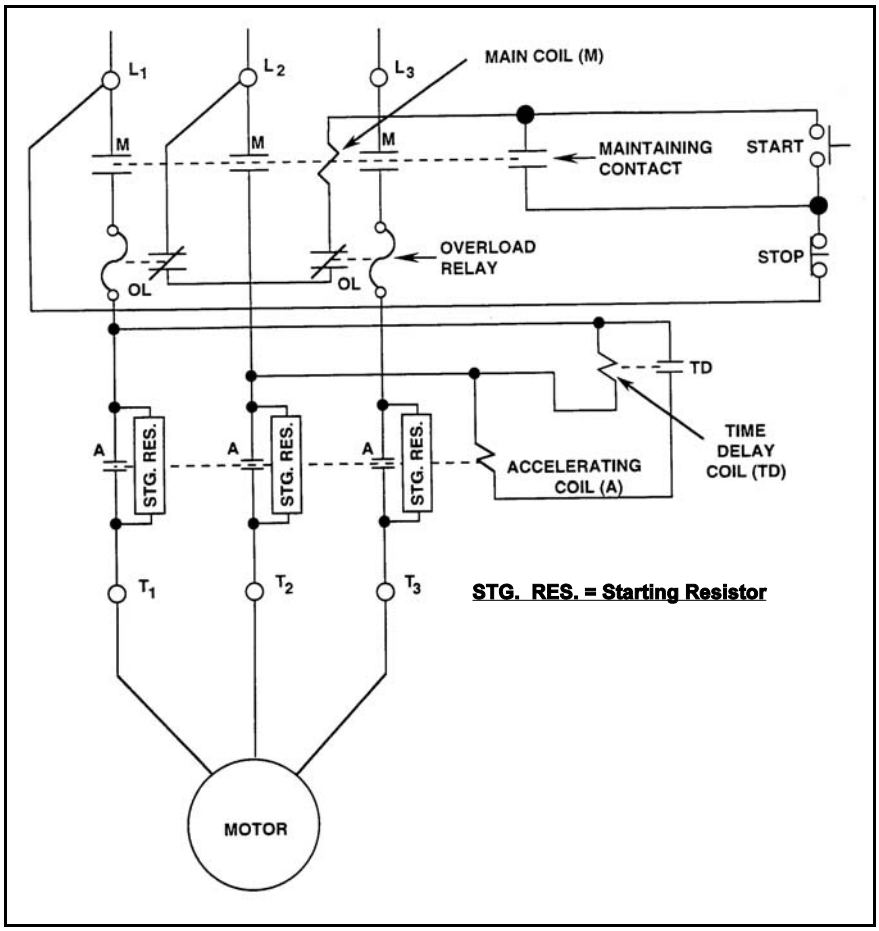
The motor has been idle for several days when it is decided to start the motor. What is the status of the starting resistors before and after the motor START pushbutton is depressed?

A. Initially bypassed; bypass is removed immediately after the START pushbutton is depressed.

B. Initially bypassed; bypass is removed following a preset time delay after the START pushbutton is depressed.

C. Initially inserted in the motor circuit; bypassed immediately after the START pushbutton is depressed.

D. Initially inserted in the motor circuit; bypassed following a preset time delay after the START pushbutton is depressed.



QUESTION: 22

A main generator is about to be connected to an infinite power grid. Generator output frequency is slightly higher than grid frequency and generator output voltage is equal to grid voltage.

Which one of the following situations will exist when the main generator electrical conditions stabilize immediately after the generator output breaker is closed? (Assume no additional operator actions are taken.)

A. Generator output current will be 0.

B. Generator power factor will be 0.

C. Generator output MVAR will be 0.

D. Generator output MW will be 0.

QUESTION: 23

A fission neutron will typically lose the most energy when it interacts with a/an...

A. hydrogen atom in a water molecule.

B. oxygen atom in a water molecule.

C. helium atom in the fuel pin fill gas.

D. zirconium atom in the fuel clad.

QUESTION: 24

With K_{eff} = 0.985, how much positive reactivity is required to make the reactor exactly critical?

A. 1.487% ΔK/K

B. 1.500% ΔK/K

C. 1.523% ΔK/K

D. 1.545% ΔK/K

QUESTION: 25

A nuclear reactor is initially critical in the source range during a reactor startup when a control rod is notched inward. Reactor period stabilizes at -180 seconds. Assuming reactor period remains constant, how long will it take for source range count rate to decrease by one-half?

A. 90 seconds

B. 125 seconds

C. 180 seconds

D. 260 seconds

QUESTION: 26

Refer to the drawing of microscopic cross section for absorption versus neutron energy for a resonance peak in U-238 in a nuclear reactor operating at 80% power (see figure below).

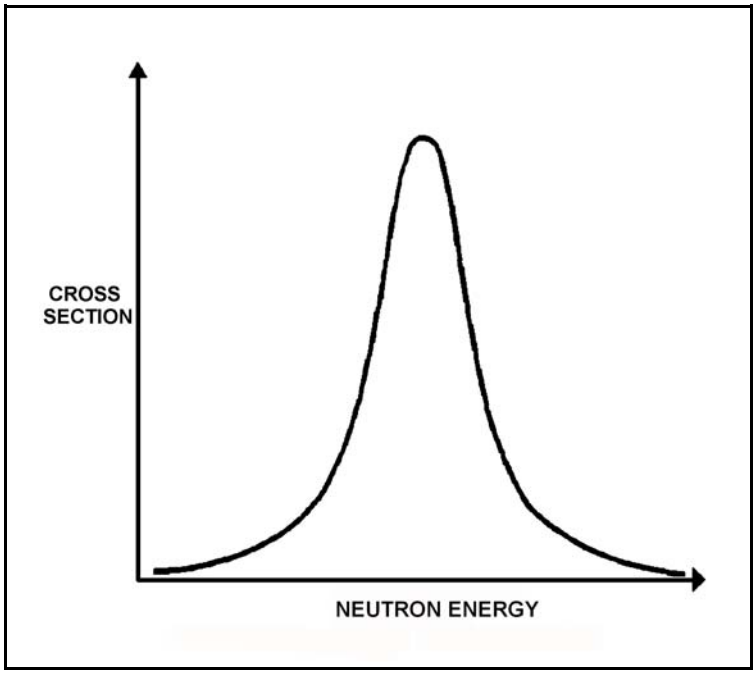
If reactor power is increased to 100%, the height of the curve will _____ and the area under the curve will _____.

A. increase; increase

B. increase; remain the same

C. decrease; decrease

D. decrease; remain the same



QUESTION: 27

Which one of the following describes how and why the void coefficient of reactivity changes as void fraction increases during a control rod withdrawal at power?

A. Becomes less negative due to the increased absorption of neutrons by U-238.

B. Becomes less negative due to a greater fraction of neutrons lost to leakage from the core.

C. Becomes more negative due to the reduction in the fast fission contribution to the neutron population.

D. Becomes more negative due to a greater fractional loss of moderator for a 1% void increase at higher void fractions.

QUESTION: 28

Which one of the following materials is used in control rods primarily for thermal neutron absorption?

A. Boron

B. Carbon

C. Gadolinium

D. Stainless Steel

QUESTION: 29

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

A. provide even burnup of control rods.

B. reduce neutron leakage from the core.

C. allow a higher average power density.

D. provide more accurate nuclear power indication.

QUESTION: 30

A nuclear reactor has been operating at 100% power for two months. A manual reactor scram is required for a test. The scram will be followed immediately by a reactor startup with criticality scheduled to occur 8 hours after the scram.

The greater assurance that fission product poison reactivity will permit criticality during the startup will exist if the reactor is operated at _____ power for one week prior to the scram and if criticality is rescheduled for _____ hours after the scram.

A. 80%; 6

B. 80%; 10

C. 90%; 6

D. 90%; 10

QUESTION: 31

A nuclear reactor is initially operating at 100% power with equilibrium core xenon-135. Power is decreased to 75% over a 1-hour period and stabilized. No subsequent operator actions are taken.

Considering only the reactivity effects of core xenon-135 changes, which one of the following describes reactor power 30 hours after the power change?

A. Less than 75% and increasing slowly

B. Less than 75% and decreasing slowly

C. Greater than 75% and increasing slowly

D. Greater than 75% and decreasing slowly

QUESTION: 32

Just prior to a refueling outage the control rod density at 100% power is relatively low. However, immediately following the outage the control rod density at 100% power is much higher.

Which one of the following contributes to the need for a much higher 100% power control rod density at the beginning of a fuel cycle (BOC) compared with the end of a fuel cycle (EOC)?

A. The negative reactivity from burnable poisons is greater at BOC than at EOC.

B. The negative reactivity from fission product poisons is smaller at BOC than at EOC.

C. The positive reactivity from the fuel in the core is smaller at BOC than at EOC.

D. The positive reactivity from a unit withdrawal of a typical control rod is greater at BOC than at EOC.

QUESTION: 33

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

Which one of the following describes the change in count rate resulting from a short control rod withdrawal with K_{eff} at 0.95 as compared to an identical control rod withdrawal with K_{eff} at 0.99? (Assume reactivity additions are equal, and the reactor remains subcritical.)

A. Both the prompt jump in count rate and the increase in stable count rate will be the same.

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

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

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

QUESTION: 34

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

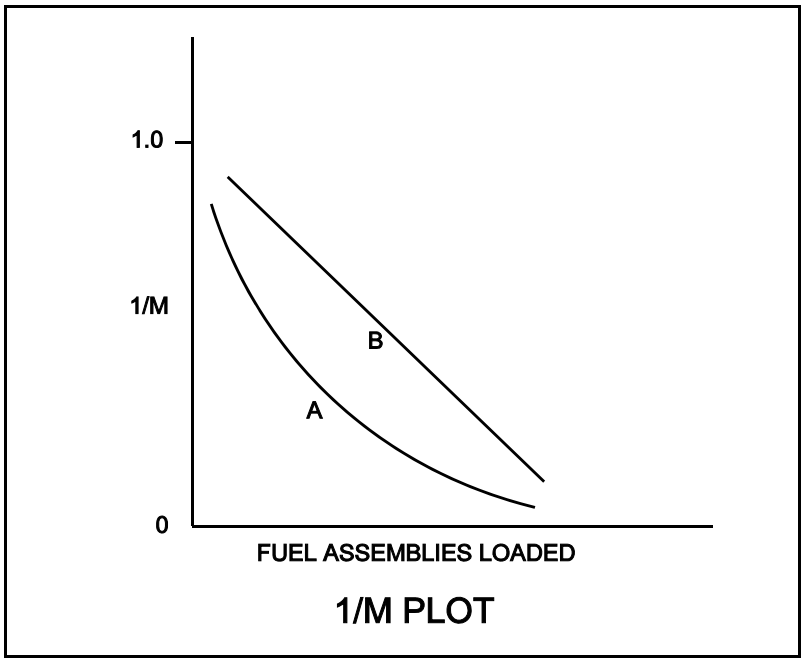
Curve A would result if each fuel assembly loaded during the early stages of the refueling caused a relatively _____ fractional change in source range count rate compared to the later stages of the refueling; curve B would result if each fuel assembly contained equal _____.

A. small; fuel enrichment

B. small; reactivity

C. large; fuel enrichment

D. large; reactivity



QUESTION: 35

A nuclear reactor is critical at 10^{-3}% power during a cold reactor startup at the beginning of core life. Reactor period is stable at positive 60 seconds. Assuming no operator action, no reactor scram, and no steam release, what will be reactor power 10 minutes later?

A. Below the point of adding heat (POAH)

B. At the POAH

C. Approximately 22%

D. Greater than 100%

QUESTION: 36

A nuclear reactor is operating with the following initial conditions:

Power level = 100%
Control rod density = 60%

After a load decrease reactor conditions are as follows:

Power level = 80%
Control rod density = 62%

All parameters attained normal steady-state values before and after the power change.

Given the following:

Total control rod reactivity change = -2.2×10^{-1}% ΔK/K
Power coefficient = -1.5×10^{-2}% ΔK/K/% power

How much reactivity was added by changes in core recirculation flow rate during the load decrease? (Assume fission product poison reactivity does <u>not</u> change.)

A. 0.0% ΔK/K

B. -5.2×10^{-1}% ΔK/K

C. -2.0×10^{-1}% ΔK/K

D. -8.0×10^{-2}% ΔK/K

QUESTION: 37

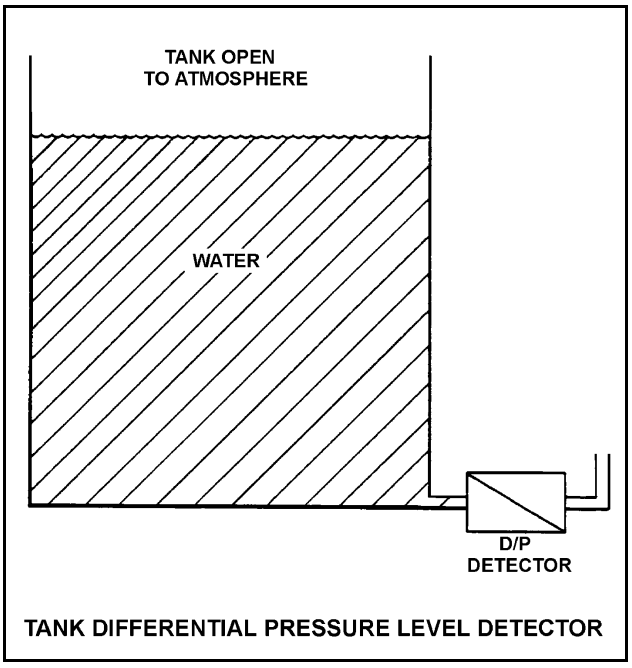
Refer to the drawing of a tank with a differential pressure (D/P) level detector (see figure below). If the tank contains 30 feet of water at 60°F, what is the approximate D/P sensed by the detector?

A. 2 psid

B. 13 psid

C. 20 psid

D. 28 psid



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

QUESTION: 38

A feedwater pump discharges into a 16-inch diameter discharge line. Given the following:

Pump discharge pressure: 950 psia
Feedwater temperature: 300°F
Feedwater velocity: 15.2 ft/sec

What is the feedwater pump discharge flow rate in pounds-mass per hour (lbm/hr)?

A. 1.1×10^6 lbm/hr

B. 4.4×10^6 lbm/hr

C. 1.8×10^7 lbm/hr

D. 5.3×10^7 lbm/hr

QUESTION: 39

A nuclear power plant is operating at 100% power. Which one of the following describes how and why main condenser pressure changes when condenser cooling water flow rate significantly decreases?

A. Increases because main condenser saturation temperature increases.

B. Increases because main condenser condensate subcooling decreases.

C. Decreases because main condenser saturation temperature increases.

D. Decreases because main condenser condensate subcooling decreases.

QUESTION: 40

A nuclear power plant is operating at 85% of rated power when the extraction steam to a high-pressure feedwater heater is isolated. After the transient, the operator returns reactor power to 85% and stabilizes the plant. Compared to conditions just prior to the transient, current main turbine generator output (MWe) is...

A. lower because plant efficiency has decreased.

B. higher because plant efficiency has increased.

C. lower because decreased steam flow causes the turbine generator to reject load.

D. higher because increased steam flow causes the turbine generator to pick up load.

QUESTION: 41

Head loss is the...

A. reduction in discharge pressure experienced by a real pump due to slippage.

B. reduction in discharge pressure experienced by a real pump due to mechanical friction.

C. conversion of system fluid pressure and velocity to heat energy as a result of friction.

D. decrease in static pressure in a piping system resulting from decreases in elevation.

QUESTION: 42

Two identical centrifugal pumps (CPs) and two identical positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1,200 psig.

Given the following information:

Centrifugal Pumps

Shutoff head:	1,500 psig
Maximum design pressure:	2,000 psig

Positive Displacement Pumps

Maximum design pressure:	2,000 psig

Which one of the following pump configurations will supply the highest makeup flow rate to the system if system pressure is at 500 psig?

A. Two CPs in series

B. Two CPs in parallel

C. Two PDPs in parallel

D. One CP and one PDP in series (CP supplying PDP)

QUESTION: 43

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

Steam pressure: 500 psia
Steam flow rate: 7.0×10^5 lbm/hr
Steam enthalpy: 1,135 Btu/lbm

Assume the extraction steam condenses to a saturated liquid at 500 psia and then leaves the feedwater heater via a drain line.

Assuming an ideal heat transfer process, what is the heat transfer rate from the extraction steam to the feedwater in the feedwater heater?

A. 3.2×10^8 Btu/hr

B. 4.8×10^8 Btu/hr

C. 5.3×10^8 Btu/hr

D. 7.9×10^8 Btu/hr

QUESTION: 44

A nuclear reactor is operating at full power with a fuel coolant channel that is experiencing each of the following heat transfer mechanisms somewhere along the length of the coolant channel.

Which of the following causes the first reduction in the local fuel clad heat transfer rate as the coolant flows upward through the coolant channel?

A. Stable film boiling

B. Nucleate boiling

C. Partial film boiling

D. Single-phase convection

QUESTION: 45

A nuclear reactor is operating at equilibrium 100% power. Assuming reactor coolant flow rate into the core region does not change, how will core bypass flow rate be affected during a reactor power decrease to 80%?

A. Increase because greater two-phase flow resistance exists in the core at 80% power.

B. Decrease because less two-phase flow resistance exists in the core at 80% 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: 46

Given:

- A nuclear reactor was shutdown 1 week ago from long term operation at 100% power.
- All reactor recirculation pumps are off.
- All reactor head vents are open.
- A shutdown core cooling system is currently in use, maintaining reactor coolant temperature stable at 170°F.
- Reactor coolant temperature is monitored by a detector at the inlet to the in-service shutdown core cooling heat exchanger.

The flow rate from the shutdown core cooling system to the core is inadvertently throttled, resulting in thermal stratification of the reactor coolant in the core. Which one of the following combinations will occur if this thermal stratification is permitted to exist for up to 24 hours?

A. Water in the core will begin to boil, and the in-service shutdown cooling pump will cavitate.

B. The in-service shutdown cooling pump will cavitate, and the jet pumps will cavitate.

C. The jet pumps will cavitate, and reactor coolant temperature will indicate lower than actual core water temperature.

D. Reactor coolant temperature will indicate lower than actual core water temperature, and water in the core will begin to boil.

QUESTION: 47

A nuclear reactor is operating at its licensed limit of 2,200 MWt. The linear heat generation rate (LHGR) limit is 13.0 kW/ft.

Given:

- The reactor core contains 560 fuel bundles.
- Each bundle contains 62 fuel rods, each with an active length of 12.5 feet
- The highest total peaking factors are at the following core locations:

  Location A: 2.9
  Location B: 2.7
  Location C: 2.5
  Location D: 2.3

Which one of the following describes the operating condition of the core relative to the LHGR limit?

A. All locations in the core are operating below the LHGR limit.

B. Only location A has exceeded the LHGR limit while the remainder of the core is operating below the limit.

C. Locations A and B have exceeded the LHGR limit while the remainder of the core is operating below the limit.

D. Locations A, B, and C have exceeded the LHGR limit while the remainder of the core is operating below the limit.

QUESTION: 48

Which one of the following is responsible for the clad failure caused by operating the nuclear reactor above the limit for linear heat generation rate?

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

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

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

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

QUESTION: 49

The fuel thermal time constant specifies the amount of time required for...

A. a fuel bundle to achieve equilibrium temperature following a power change.

B. a fuel pellet to achieve equilibrium temperature following a power change.

C. the fuel centerline temperature to undergo most of its total change following a power change.

D. the fuel cladding temperature to undergo most of its total change following a power change.

QUESTION: 50

Brittle fracture of a low-carbon steel is more likely to occur when the temperature of the steel is _____ the nil ductility temperature, and will normally occur when the applied stress is _____ the steel's yield strength (or yield stress).

A. less than; less than

B. less than; greater than

C. greater than; less than

D. greater than; greater than

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

MARCH 2007 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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