UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
DECEMBER 2004--FORM A

Please Print

Name: _____

Facility: _____

Docket No.: _____

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 the name of your facility.

3. Fill in your individual docket number.

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 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.

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

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

$g_c = 32.2$ 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 completely full water storage tank is being hydrostatically tested to 100 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 10 gpm. The tank is protected by a safety valve and a relief valve; both valves will discharge to the atmosphere. Each valve has an opening setpoint of 105 psig and a maximum rated discharge flow rate of 6 gpm. The PDP is inadvertently left running when tank pressure reaches 100 psig.

With the PDP still running, tank pressure will stabilize _____ 105 psig; the greater mass flow rate will be coming from the _____ valve.

A. at; safety

B. above; safety

C. at; relief

D. above; relief

QUESTION: 2

Refer to the drawing of a water supply pump with two suction sources (see figure below). All motor-operated valves (MOVs) are currently closed.

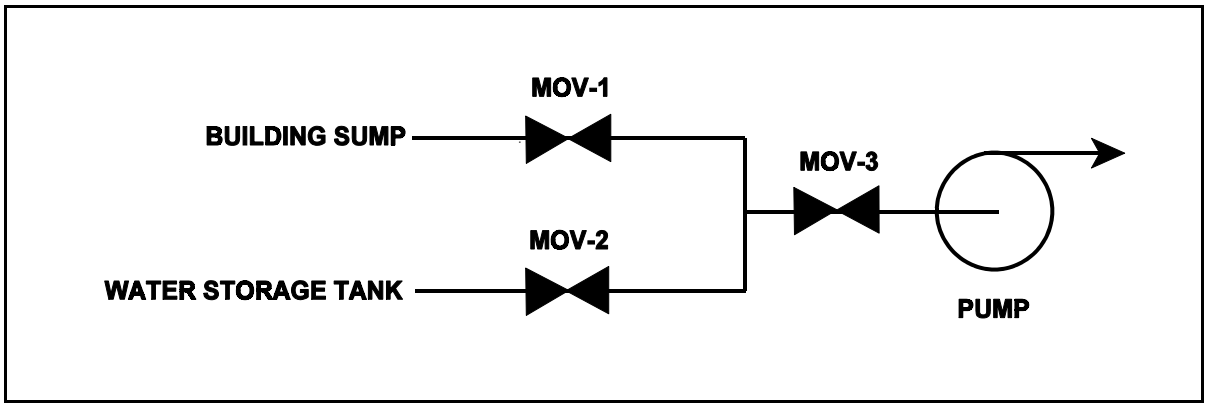
Which one of the following MOV interlocks will permit the pump to take a suction on either the building sump or the water storage tank, while preventing the two sources from being cross-connected?

A. Neither MOV-1 nor MOV-2 can be opened unless MOV-3 is fully closed.

B. None of the MOVs can be opened unless at least one MOV remains fully closed.

C. None of the MOVs can be opened unless at least two MOVs remain fully closed.

D. Neither MOV-1 nor MOV-2 can be opened unless the other source MOV is fully closed.



QUESTION: 3

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

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

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

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

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

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

QUESTION: 4

A cooling water system is operating at a steady-state flow rate of 400 gpm with 60 psid across the flow transmitter venturi. If cooling water flow rate is increased to 600 gpm, differential pressure across the flow transmitter venturi will be approximately...

A. 73 psid.

B. 90 psid.

C. 114 psid.

D. 135 psid.

QUESTION: 5

Refer to the drawing of a water storage tank with two differential pressure (D/P) level indicators (see figure below).

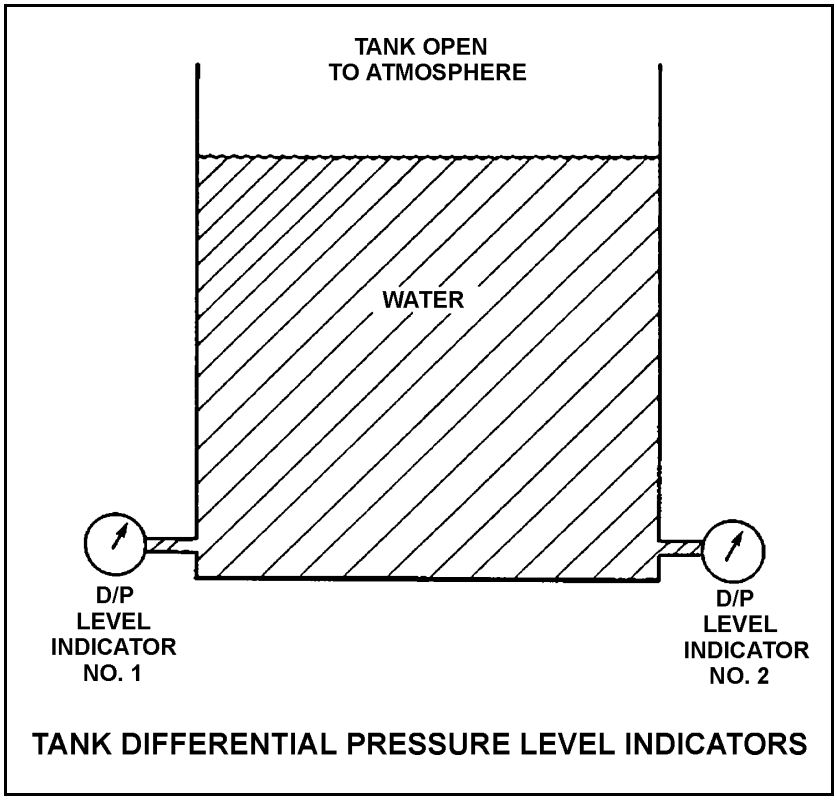
Indicator 1 was calibrated at a tank water temperature of 120°F and indicator 2 was calibrated at 180°F. If tank water temperature is currently 150°F, then indicator...

A. 1 will read greater than indicator 2, and indicator 1 will read greater than actual water level.

B. 1 will read greater than indicator 2, and indicator 1 will read less than actual water level.

C. 2 will read greater than indicator 1, and indicator 2 will read greater than actual water level.

D. 2 will read greater than indicator 1, and indicator 2 will read less than actual water level.



TANK DIFFERENTIAL PRESSURE LEVEL INDICATORS

QUESTION: 6

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

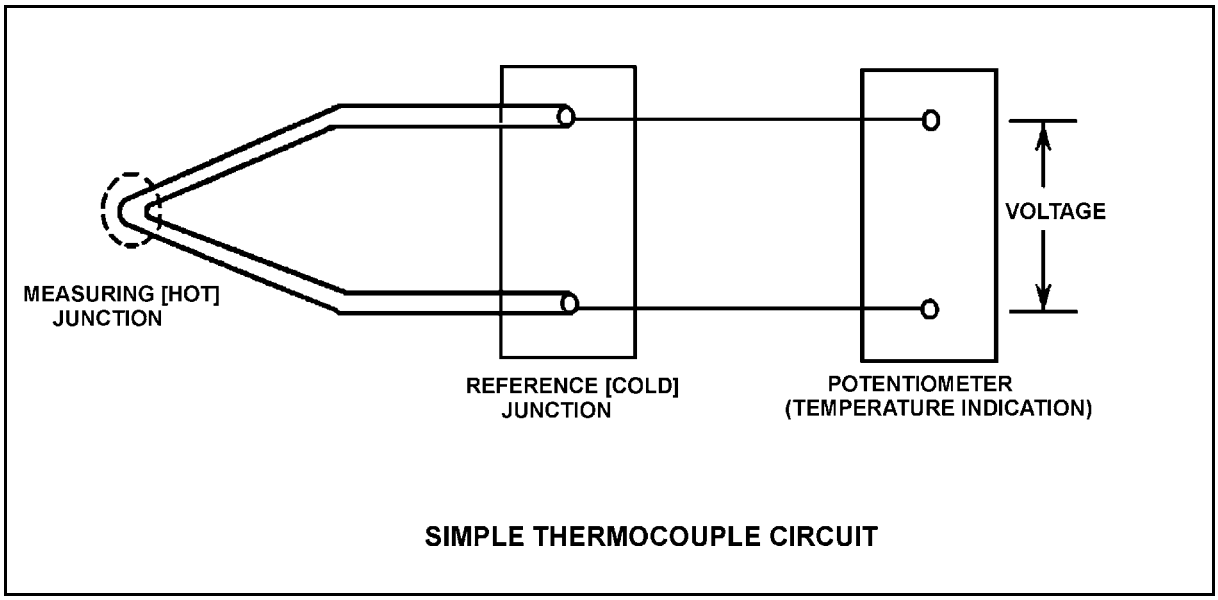
Given that the temperatures at the measuring and reference junctions remain constant, if a ventilation system malfunction causes the temperature of the temperature indication panel to increase by 10°F, indicated temperature will...

A. not be affected.

B. increase by 10°F.

C. decrease by 10°F.

D. change in an unpredictable manner.



SIMPLE THERMOCOUPLE CIRCUIT

QUESTION: 7

A gas-filled radiation detector operating in the proportional region is exposed to a constant gamma radiation field. If the applied voltage is decreased but maintained within the proportional region, the rate of ion collection will...

A. stay approximately the same because all primary ions are collected as long as detector voltage remains in the proportional region.

B. stay approximately the same because the detector is still operating at saturated conditions.

C. decrease because a decreased space charge around the positive electrode reduces gas amplification.

D. decrease because fewer secondary ionizations are occurring in the detector.

QUESTION: 8

Which one of the following describes the response of a direct acting proportional-integral controller, operating in automatic mode, to an increase in the controlled parameter above the controller set point?

A. The controller will develop an output signal that continues to increase until the controlled parameter equals the controller set point, at which time the output signal stops increasing.

B. The controller will develop an output signal that will remain directly proportional to the difference between the controlled parameter and the controller set point.

C. The controller will develop an output signal that continues to increase until the controlled parameter equals the controller set point, at which time the output signal becomes zero.

D. The controller will develop an output signal that will remain directly proportional to the rate of change of the controlled parameter.

QUESTION: 9

A diesel generator is supplying an isolated electrical bus with the governor operating in the isochronous mode. If a large electrical load is started on the bus, generator frequency will...

A. initially decrease, then increase and stabilize below the initial value.

B. initially decrease, then increase and stabilize at the initial value.

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

D. remain constant during and after the load start.

QUESTION: 10

Which one of the following describes pump cavitation?

A. Vapor bubbles are formed in the eye of the pump and collapse as they enter higher pressure regions of the pump.

B. Vapor bubbles are produced when the localized pressure exceeds the vapor pressure at the existing temperature.

C. Vapor bubbles are discharged from the pump where they impinge on downstream piping and cause water hammer.

D. Vapor bubbles are formed when the enthalpy difference between pump discharge and pump suction exceeds the latent heat of vaporization.

QUESTION: 11

Refer to the drawing of an operating cooling water system (see figure below). As depicted in the drawing, only two of the three system heat loads are currently in service.

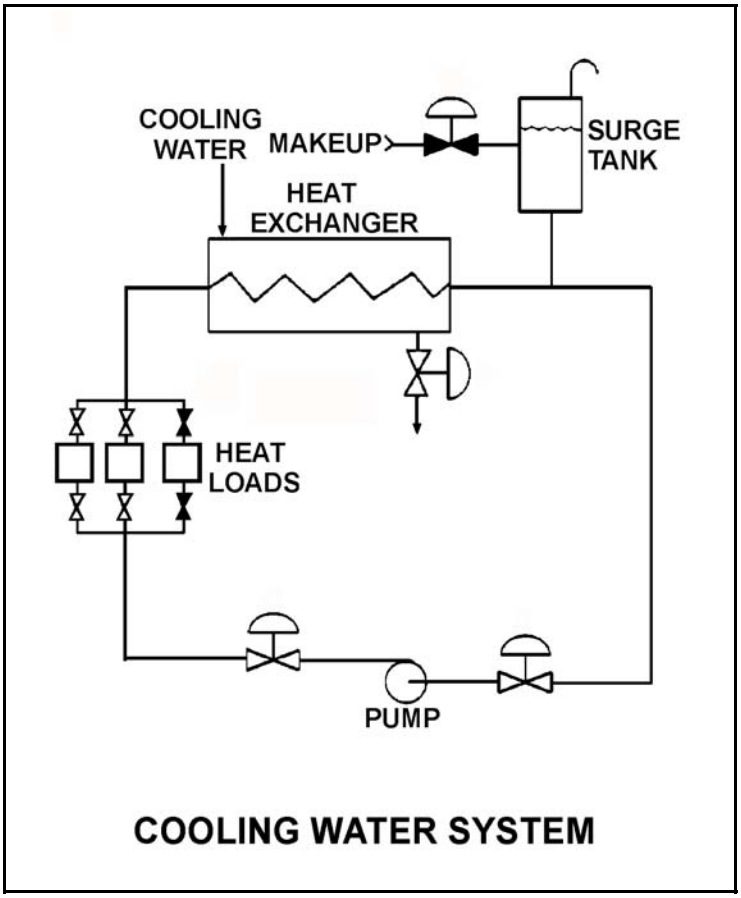
Which one of the following changes to the cooling water system will result in a higher cooling water pump flow rate and a reduced pump discharge head?

A. Increase pump speed by 20%.

B. Decrease pump speed by 20%.

C. Isolate one of the two in-service heat loads.

D. Place the third system heat load in service.



QUESTION: 12

A single-speed centrifugal pump is needed to supply river water to a storage facility. The pump must be capable of providing a very high flow rate at a low discharge pressure. Which one of the following types of centrifugal pumps is best suited for this application?

A. Single-stage, axial flow

B. Single-stage, radial flow

C. Multiple-stage, axial flow

D. Multiple-stage, radial flow

QUESTION: 13

A centrifugal firewater pump is operating to pressurize a fire main. The pump takes suction from a water reservoir. A fire hose connected to the fire main is being used to suppress an elevated fire.

Given:

- The pump eye is located 5 feet above the reservoir water level.
- The pump has a design shutoff head of 120 feet.
- The required net positive suction head (NPSH) for the pump is 15 feet.
- The reservoir water temperature is 60°F.

At which one of the following elevations above the pump eye will the fire hose spray nozzle first be unable to provide flow? (Disregard all sources of system frictional head loss.)

A. 111 feet

B. 116 feet

C. 121 feet

D. 126 feet

QUESTION: 14

The starting current in a typical ac induction motor is much higher than the full-load running current because...

A. starting torque is much lower than running torque.

B. starting torque is much higher than running torque.

C. rotor current during start is too low to generate significant counter electromotive force (CEMF) in the stator.

D. rotor speed during start is too low to generate significant CEMF in the stator.

QUESTION: 15

Two identical 1,000 MW electrical generators are operating in parallel supplying the same isolated electrical bus. The generator output breakers provide identical protection for the generators. Generator A and B output indications are as follows:

Generator A	Generator B
22 KV	22 KV
60.2 Hertz	60.2 Hertz
800 MW	800 MW
50 MVAR (out)	25 MVAR (in)

A malfunction causes the voltage regulator for generator B to slowly and continuously increase the terminal voltage for generator B. If no operator action is taken, generator B output current will...

A. increase continuously until the output breaker for generator A trips on overcurrent.

B. increase continuously until the output breaker for generator B trips on overcurrent.

C. initially decrease, and then increase until the output breaker for generator A trips on overcurrent.

D. initially decrease, and then increase until the output breaker for generator B trips on overcurrent.

QUESTION: 16

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

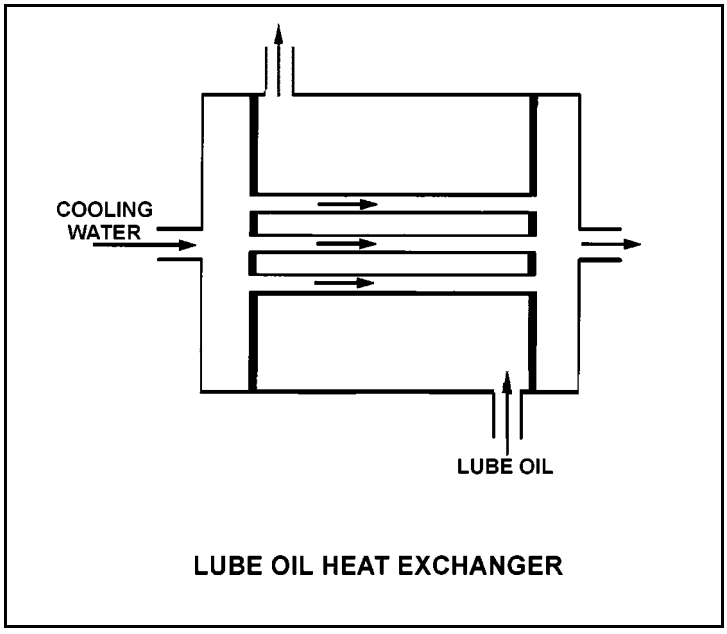
Increasing the oil flow rate through the heat exchanger will cause the oil outlet temperature to _____ and the cooling water outlet temperature to _____.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease



LUBE OIL HEAT EXCHANGER

QUESTION: 17

A nuclear reactor is shut down at 400 psia during a maintenance outage when all forced decay heat removal is lost. Which one of the following will enhance natural circulation within the reactor vessel?

A. Increasing reactor vessel pressure to 500 psia.

B. Increasing reactor vessel water level above the steam separators.

C. Decreasing reactor vessel pressure to 300 psia.

D. Decreasing reactor vessel water level to just above the top of the core.

QUESTION: 18

After starting a large motor-driven centrifugal cooling water pump, the pump dishcarge valve should be opened slowly to minimize the...

A. potential for a water hammer.

B. potential for pump cavitation.

C. motor running current requirements.

D. net positive suction head requirements.

QUESTION: 19

The decontamination factor (or demineralization factor) of a condensate demineralizer has just been determined to be 5.0, based on conductivity measurements.

If condensate having a conductivity of 20 μmho/cm is flowing into this demineralizer, which one of the following is the conductivity of the condensate at the outlet of the demineralizer?

A. 0.4 μmho/cm

B. 4.0 μmho/cm

C. 10.0 μmho/cm

D. 100.0 μmho/cm

QUESTION: 20

How does demineralizer differential pressure indicate the condition of a demineralizer resin bed?

A. Low differential pressure indicates flow blockage in the demineralizer.

B. Low differential pressure indicates that the demineralizer resin bed is exhausted.

C. High differential pressure indicates flow blockage in the demineralizer.

D. High differential pressure indicates that the demineralizer resin bed is exhausted.

QUESTION: 21

Refer to the drawing of a motor and its control circuit (see figure below). (Note: Relay contacts follow the standard convention for control circuit drawings.)

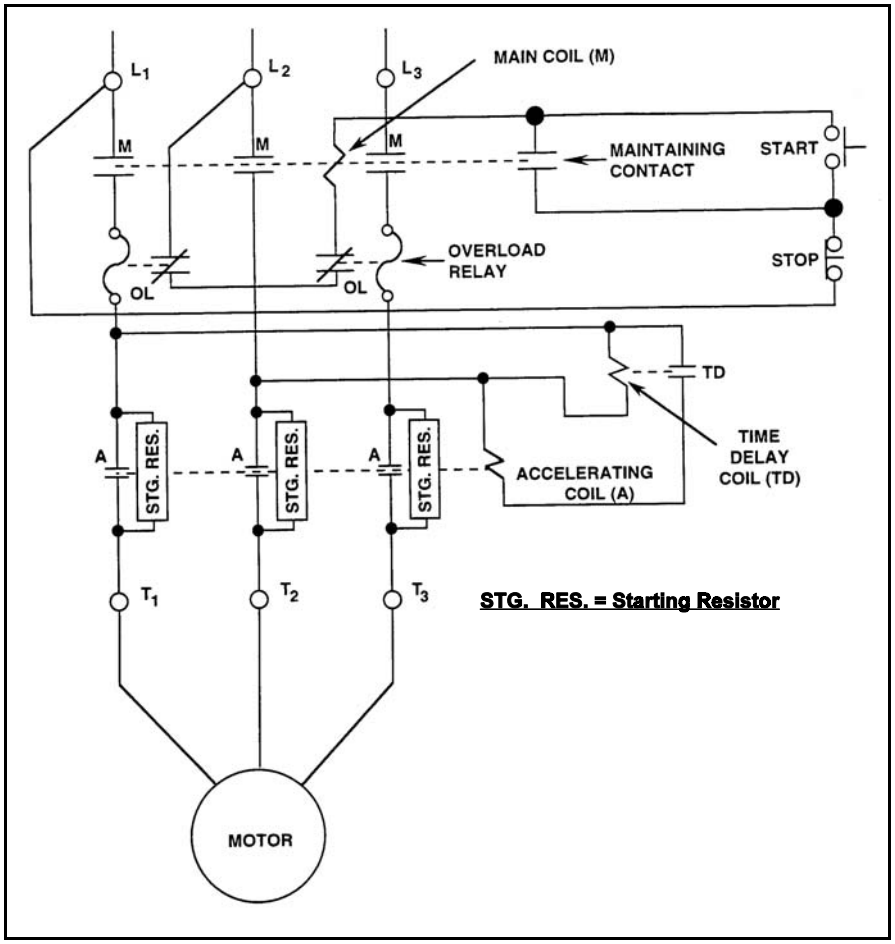
How are the starting resistors employed before and after the motor is energized?

A. Inserted before the motor is energized; simultaneously bypassed after the motor gains speed.

B. Inserted before the motor is energized; sequentially bypassed as the motor gains speed.

C. Bypassed before the motor is energized; simultaneously inserted after the motor gains speed.

D. Bypassed before the motor is energized; sequentially inserted as the motor gains speed.



QUESTION: 22

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

A. Use insulated tools to prevent inadvertent contact with adjacent equipment.

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

C. Attach a metal strap from your body to a nearby neutral ground to ensure that you are grounded.

D. Have a person standing by with the ability to remove you from the equipment in the event of an emergency.

QUESTION: 23

A fast neutron will lose the greatest amount of energy during a scattering reaction in the moderator if it interacts with...

A. an oxygen nucleus.

B. a hydrogen nucleus.

C. a deuterium nucleus.

D. an electron surrounding a nucleus.

QUESTION: 24

Twelve hours ago, a nuclear reactor scrammed from 100% steady state power due to an instrument malfunction. All systems operated normally. Given the following absolute values of reactivities added since the scram, assign a (+) or (-) as appropriate and choose the current value of core reactivity.

Xenon	= ( ) 2.0% ΔK/K
Fuel temperature	= ( ) 2.5% ΔK/K
Control rods	= ( ) 14.0% ΔK/K
Voids	= ( ) 4.5% ΔK/K

A. -5.0% ΔK/K

B. -9.0% ΔK/K

C. -14.0% ΔK/K

D. -23.0% ΔK/K

QUESTION: 25

A nuclear reactor is shutdown with a K_{eff} of 0.96 and a stable source range indication of 50 counts per second (cps) when a reactor startup is commenced. Which one of the following will be the stable source range indication when K_{eff} reaches 0.995?

A. 400 cps

B. 800 cps

C. 4,000 cps

D. 8,000 cps

QUESTION: 26

A nuclear reactor is shut down with the reactor vessel head removed. The core is covered by 23 feet of refueling water at a temperature of 100°F.

Which one of the following will increase core K_{eff} if the reactor is at the end of core life, but will decrease core K_{eff} if the reactor is at the middle of core life?

A. A fresh neutron source is installed in the core.

B. Refueling water temperature is increased to 105°F.

C. A spent fuel assembly is replaced with a new fuel assembly.

D. Movable incore source range instrumentation is repositioned to increase source range count rate.

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

A nuclear reactor core consists of fuel bundles and control rods that are 12 feet in length. A new rod position is indicated for every 3 inches of rod motion.

If a control rod is inserted 75% into the core, it will be located at rod position...

A. 9.

B. 12.

C. 27.

D. 36.

QUESTION: 29

Which one of the following describes the change in magnitude (absolute value) of differential control rod worth during the complete withdrawal of a fully-inserted control rod?

A. Increases, then decreases.

B. Decreases, then increases.

C. Increases continuously.

D. Decreases continuously.

QUESTION: 30

Nuclear reactors A and B are operating at steady-state 100% power with equilibrium core Xe-135. The reactors are identical except that reactor A is operating near the end of core life and reactor B is operating near the beginning of core life.

Which reactor is experiencing the most negative reactivity from equilibrium core Xe-135?

A. Reactor A due to a greater concentration of equilibrium core Xe-135.

B. Reactor A due to lower competition from the fuel for thermal neutrons.

C. Reactor B due to a greater thermal neutron flux in the core.

D. Reactor B due to a smaller accumulation of stable fission product poisons.

QUESTION: 31

A nuclear reactor has been operating at 100% power for two weeks when power is decreased to 10% in 1 hour. Immediately following the power decrease, core xenon-135 concentration will _____ for a period of _____.

A. decrease; 4 to 6 hours

B. increase; 4 to 6 hours

C. decrease; 8 to 11 hours

D. increase; 8 to 11 hours

QUESTION: 32

Just prior to refueling, control rods are nearly fully withdrawn at 100% power. After refueling, the control rods are inserted much farther into the core at 100% power.

Which one of the following is the primary reason for the change in full power control rod position?

A. Reactivity from power defect at beginning of core life (BOL) is much greater than at end of core life (EOL).

B. Reactivity from void coefficient at EOL is much greater than at BOL.

C. The excess reactivity in the core at BOL is much greater than at EOL.

D. The integral control rod worth at EOL is much greater than at BOL.

QUESTION: 33

Refer to the drawing of three 1/M plots labeled A, B, and C (see figure below).

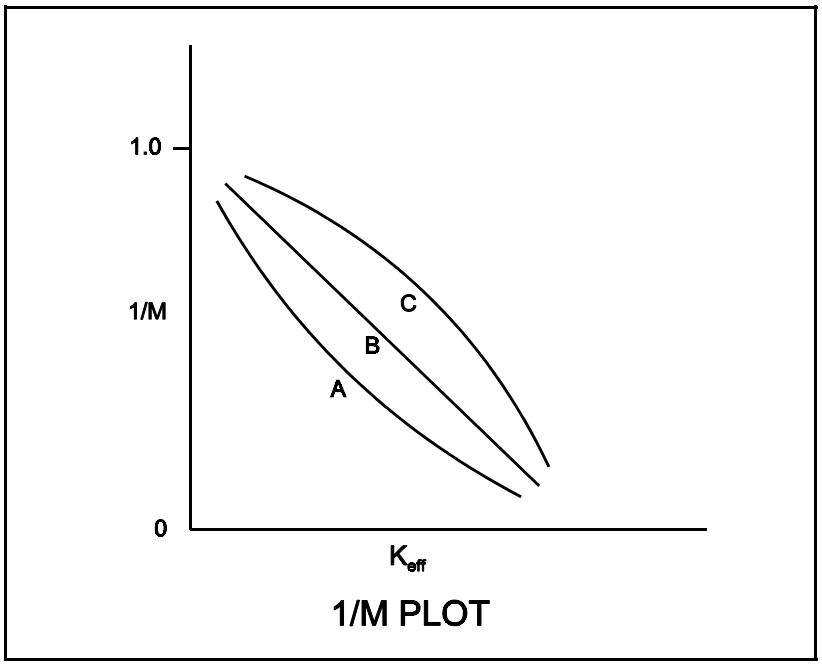
The least conservative approach to criticality is represented by plot _____ and could possibly be the result of recording count rates at _____ time intervals after incremental fuel loading steps compared to the situations represented by the other plots.

A. A; shorter

B. A; longer

C. C; shorter

D. C; longer



QUESTION: 34

A nuclear reactor startup is in progress and criticality has just been achieved. After recording critical rod height, the operator withdraws control rods for 20 seconds to establish a positive 30-second reactor period. One minute later (prior to the point of adding heat) the operator inserts the same control rods for 25 seconds. (Assume the control rod withdrawal and insertion rates are the same.)

During the rod insertion, the reactor period will become...

A. negative during the entire period of control rod insertion.

B. negative shortly after the control rods pass through the critical rod height.

C. negative just as the control rods pass through the critical rod height.

D. negative shortly before the control rods pass through the critical rod height.

QUESTION: 35

A nuclear reactor startup is in progress at the beginning of core life. Reactor power is 5×10^{-2}% and increasing slowly with a stable period of 87 seconds. Assuming no operator action, no reactor scram, and no steam release, what will reactor power be after 10 minutes?

A. Below the point of adding heat (POAH)

B. At the POAH

C. Above the POAH but less than 49%

D. Approximately 50%

QUESTION: 36

A nuclear power plant is initially operating at 100% power when a control rod fully inserts into the core. Assuming no operator action, reactor power will initially decrease and then...

A. stabilize at a lower power level with the void boundary higher in the core.

B. return to the original power level with the void boundary higher in the core.

C. stabilize at a lower power level with the void boundary lower in the core.

D. return to the original power level with the void boundary lower in the core.

QUESTION: 37

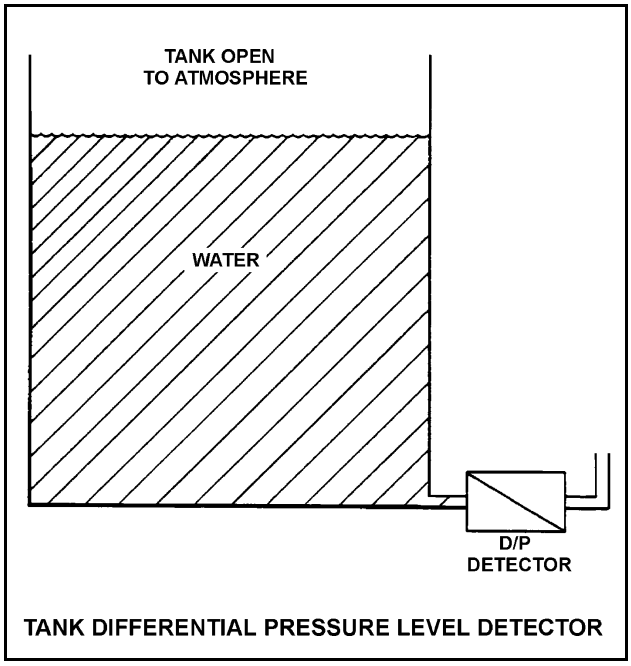
Refer to the drawing of a tank with a differential pressure (D/P) level detector (see figure below). If the tank contains 30 feet of water at 60°F, what is the approximate D/P sensed by the detector?

A. 2 psid

B. 13 psid

C. 20 psid

D. 28 psid



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

QUESTION: 38

Saturated steam undergoes an ideal expansion process in an ideal turbine from 1,000 psia to 28 inches Hg vacuum. Approximately how much specific work is being performed by the turbine?

A. 1,193 Btu/lbm

B. 775 Btu/lbm

C. 418 Btu/lbm

D. 388 Btu/lbm

QUESTION: 39

A nuclear power plant is operating at 100% power when the only in-service steam jet air ejector is inadvertently isolated from the main condenser. The operator verifies circulating water system parameters have not changed. If no operator action is taken over the next 60 minutes, condenser vacuum will...

A. slowly increase (lower absolute pressure).

B. slowly decrease and stabilize at a slightly lower vacuum (higher absolute pressure).

C. slowly and continuously decrease (higher absolute pressure) towards atmospheric pressure.

D. remain essentially the same (constant absolute pressure).

QUESTION: 40

A steam plant main turbine consists of a high-pressure (HP) unit and several low-pressure (LP) units. The main turbine is most likely to experience stress-related failures of the rotor blades in the _____ stages of the _____ unit(s).

A. inlet; HP

B. inlet; LP

C. outlet; HP

D. outlet; LP

QUESTION: 41

Refer to the drawing of four centrifugal pump operating curves (see figure below).

A centrifugal pump is operating in a closed water system and discharging through a heat exchanger. A second heat exchanger, in parallel with the first, is then placed in service.

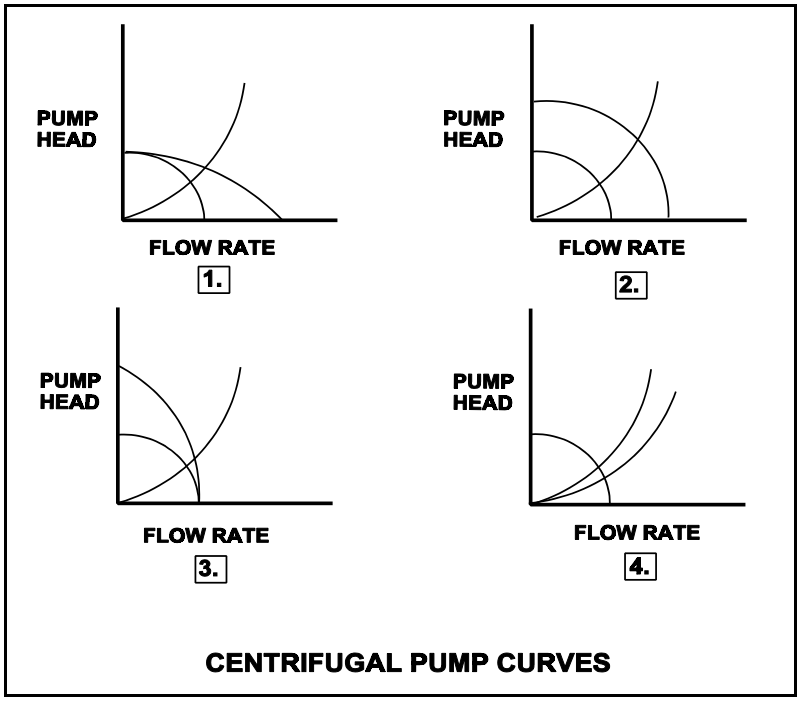
Which set of curves illustrates the initial and final operating conditions?

A. 1.

B. 2.

C. 3.

D. 4.



QUESTION: 42

Main steam is flowing through a venturi in a main steamline. A main steamline break downstream of the venturi causes the main steam mass flow rate through the venturi to increase. Soon, the steam reaches sonic velocity in the throat of the venturi.

How will the main steam mass flow rate through the venturi be affected as the steam pressure downstream of the venturi continues to decrease?

A. It will continue to increase at a rate that is dependent on the steam velocity in the throat of the venturi.

B. It will continue to increase at a rate that is dependent on the differential pressure across the venturi.

C. It will not continue to increase because the steam velocity cannot increase above sonic velocity in the throat of the venturi.

D. It will not continue to increase because the differential pressure across the venturi cannot increase further once the steam reaches sonic velocity in the throat of the venturi.

QUESTION: 43

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

Steam pressure:	750 psia
Steam flow rate:	7.5×10^5 lbm/hr
Steam enthalpy:	1,150 Btu/lbm

Saturated liquid condensate at 448°F leaves the feedwater heater via a drain line.

What is the approximate 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

If ΔT is the temperature difference between the fuel rod clad and the coolant, which one of the following describes the heat transfer from a fuel rod experiencing departure from nucleate boiling?

A. Steam bubbles begin to form on the fuel rod clad, causing a rapid decrease in the heat flux from the fuel rod for a given ΔT.

B. Steam bubbles completely blanket the fuel rod clad, causing a rapid increase in the heat flux from the fuel rod for a given ΔT.

C. Steam bubbles begin to blanket the fuel rod clad, causing a rapid increase in the ΔT for a given heat flux.

D. Steam bubbles completely blanket the fuel rod clad, causing a rapid decrease in the ΔT for a given heat flux.

QUESTION: 45

Which one of the following describes the relationship between the feedwater mass flow rate entering the reactor vessel and the core mass flow rate at steady-state 100% reactor power?

A. The mass flow rates are about the same as long as the reactor vessel downcomer level is constant.

B. The mass flow rates are about the same as long as the reactor recirculation mass flow rate is constant.

C. The feedwater mass flow rate is much smaller than the core mass flow rate because most of the core mass flow is returned to the reactor vessel downcomer by the steam separators.

D. The feedwater mass flow rate is much larger than the core mass flow rate because the feedwater pump differential pressure is much larger than the core differential pressure.

QUESTION: 46

Two nuclear reactors, A and B, are operating at rated power with neutron flux radially peaked in the center of each core. Reactors A and B are identical except that reactor A has core orificing and reactor B does not. Both reactors have the same control rod pattern and density.

Compared to the outer fuel bundles in reactor B, the outer fuel bundles in reactor A will have the _____ critical power and the _____ coolant flow rate.

A. lowest; lowest

B. lowest; highest

C. highest; lowest

D. highest; highest

QUESTION: 47

Thermal limits are established to protect the nuclear reactor core, and thereby protect the public during nuclear power plant operations which include...

A. normal operations only.

B. normal and abnormal operations only.

C. normal, abnormal, and postulated accident operations only.

D. normal, abnormal, postulated and unpostulated accident operations.

QUESTION: 48

If the linear heat generation rate (LHGR) limiting condition for operation is exceeded, the most probable type of fuel cladding failure is...

A. cracking due to high stress.

B. gross failure due to a lack of cooling.

C. embrittlement due to excessive oxidation.

D. distortion due to inadequate cooling of the clad.

QUESTION: 49

Which one of the following describes the fuel-to-coolant thermal conductivity at the end of core life (EOL) as compared to the beginning of core life (BOL)?

A. Smaller at EOL due to fuel pellet densification.

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

C. Larger at EOL due to reduction in gap between fuel pellets and clad.

D. Larger at EOL due to greater temperature difference between fuel pellets and coolant.

QUESTION: 50

A nuclear reactor is shut down for refueling following 18 months of operation at an average power level of 85%. During the shutdown, a reactor vessel metal specimen was removed from the reactor vessel for testing. The tests determined that the nil-ductility transition (NDT) temperature of the specimen has increased from 42°F to 72°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 specimen NDT temperature would not increase during the described 18-month period of operation.

D. The test results are questionable because the specimen NDT temperature would increase by less than indicated during the described 18-month period of operation.

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

DECEMBER 2004 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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