UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
OCTOBER 2002--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. Each item has equal point value. A score of at least 80% is required to pass this portion of the written licensing examination. All examination papers will be collected 4.0 hours after the examination starts. This examination applies to a typical pressurized water reactor (PWR) power plant.

SECTION	QUESTIONS	% OF TOTAL	SCORE
COMPONENTS	1 - 44		
REACTOR THEORY	45 - 72		
THERMODYNAMICS	73 - 100		
TOTALS	100		

All work done on this examination is my own. I have neither given nor received aid.

_____
Applicant's Signature

RULES AND GUIDELINES FOR THE 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

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

$\lambda_{eff} = 0.1\ sec^{-1}$ (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

Refer to the drawing of two identical pressure vessels with identical relief protection (see figure below).

Both vessels have been pressurized to 50 psig and then isolated. Vessel A is completely filled with water at 150°F. Vessel B is in a saturated condition with one-half steam (100% quality) and one-half water (0% quality) by volume.

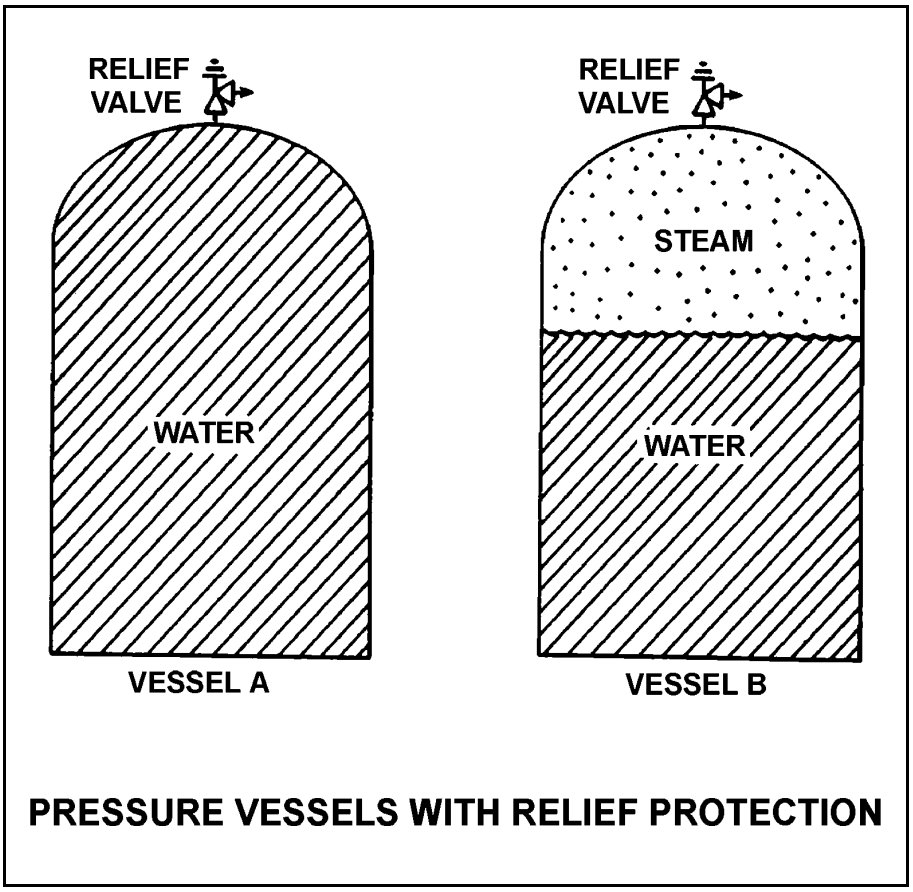
If both relief valves fully open simultaneously, the faster pressure reduction will occur in vessel _____; and if both relief valves close at 40 psig, the greater mass loss will have occurred in vessel _____.

A. A; A

B. A; B

C. B; A

D. B; B



QUESTION: 2

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

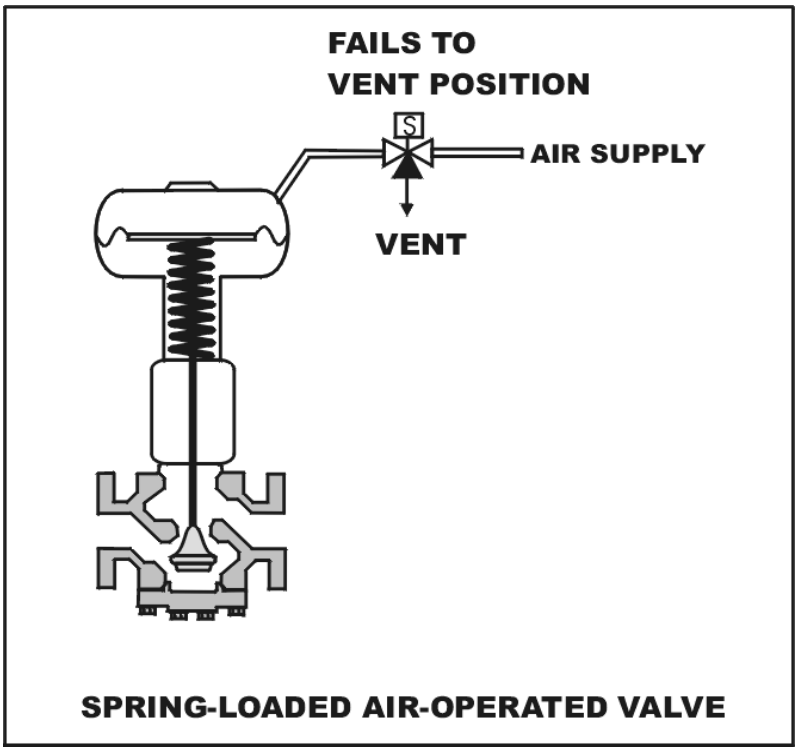
Upon a loss of air pressure, this valve will:

A. go to the fully open position.

B. remain at the current position.

C. go to the fully closed position.

D. go to the midposition.



QUESTION: 3

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

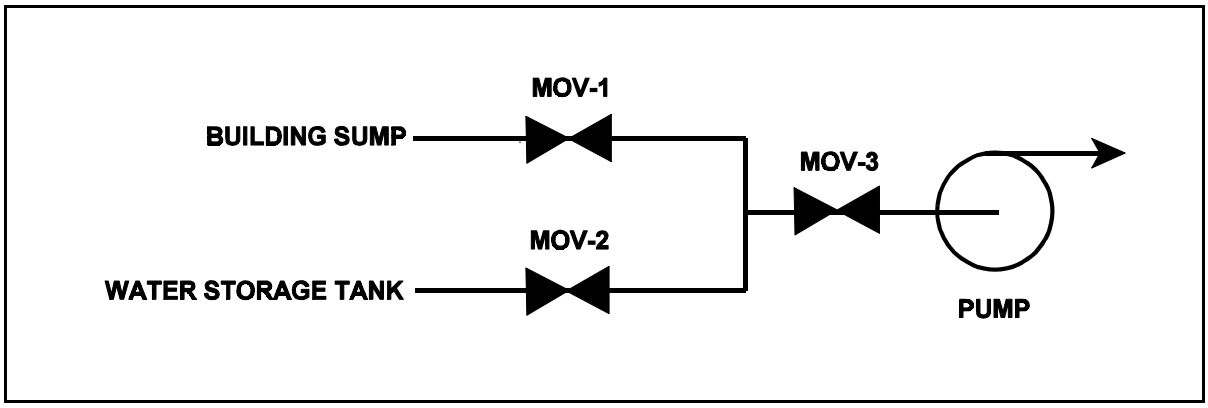
Which one of the following MOV interlocks will permit the pump to take a suction on either the building sump or the water storage tank, while preventing the two sources from being cross-connected?

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: 4

Refer to the cutaway-view drawing of a valve (see figure below).

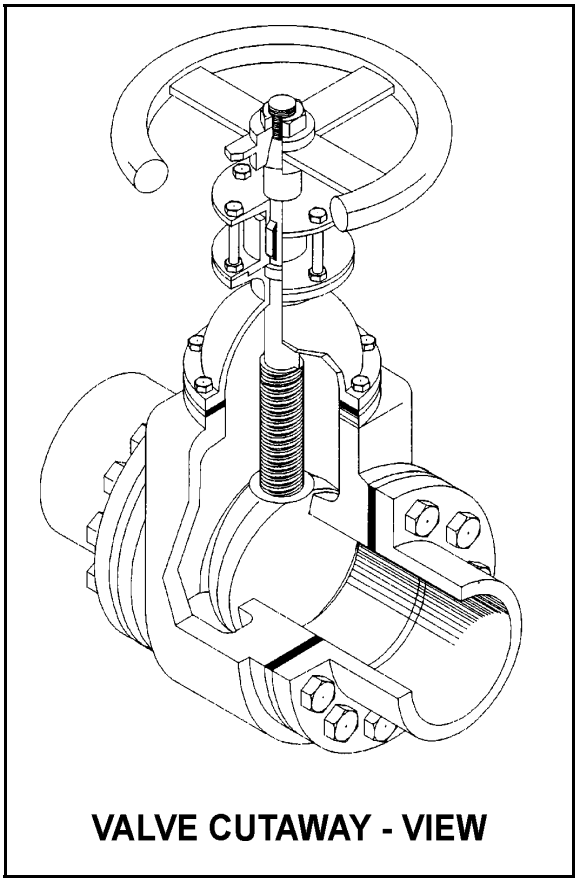
Which one of the following describes the type of valve shown?

A. Rising-stem globe valve

B. Nonrising-stem globe valve

C. Rising-stem gate valve

D. Nonrising-stem gate valve



VALVE CUTAWAY - VIEW

QUESTION: 5

A properly calibrated water flow detector is located several feet below a horizontal pipe containing the detector's sensing element. The detector is removed for inspection and then reconnected to the sensing element with its low-pressure sensing line filled with air and its high-pressure sensing line filled with water.

If the water system is operating, indicated flow rate will be:

A. zero.

B. equal to actual flow rate but greater than zero.

C. lower than actual flow rate.

D. higher than actual flow rate.

QUESTION: 6

Refer to the drawing of a pipe elbow used for flow measurement in a cooling water system (see figure below).

A differential pressure (D/P) flow detector is connected to instrument lines A and B.

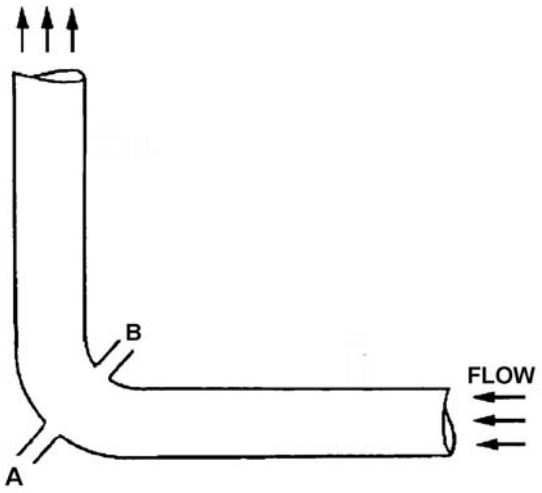
If instrument line A develops a leak, indicated flow rate will _____ due to a _____ measured D/P.

A. increase; larger

B. increase; smaller

C. decrease; larger

D. decrease; smaller



PIPE ELBOW - TOP VIEW

QUESTION: 7

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

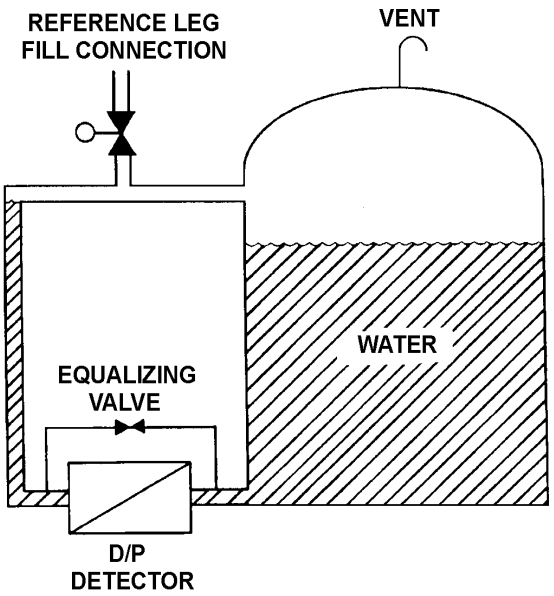
The D/P sensed by the detector varies in the _____ direction as the temperature of the water in the tank if the _____ of the tank water is constant. (Assume reference leg and tank water temperatures are initially the same.)

A. same; level

B. inverse; level

C. same; mass

D. inverse; mass



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

QUESTION: 8

Refer to the drawing of a steam generator (S/G) differential pressure (D/P) level detector (see figure below).

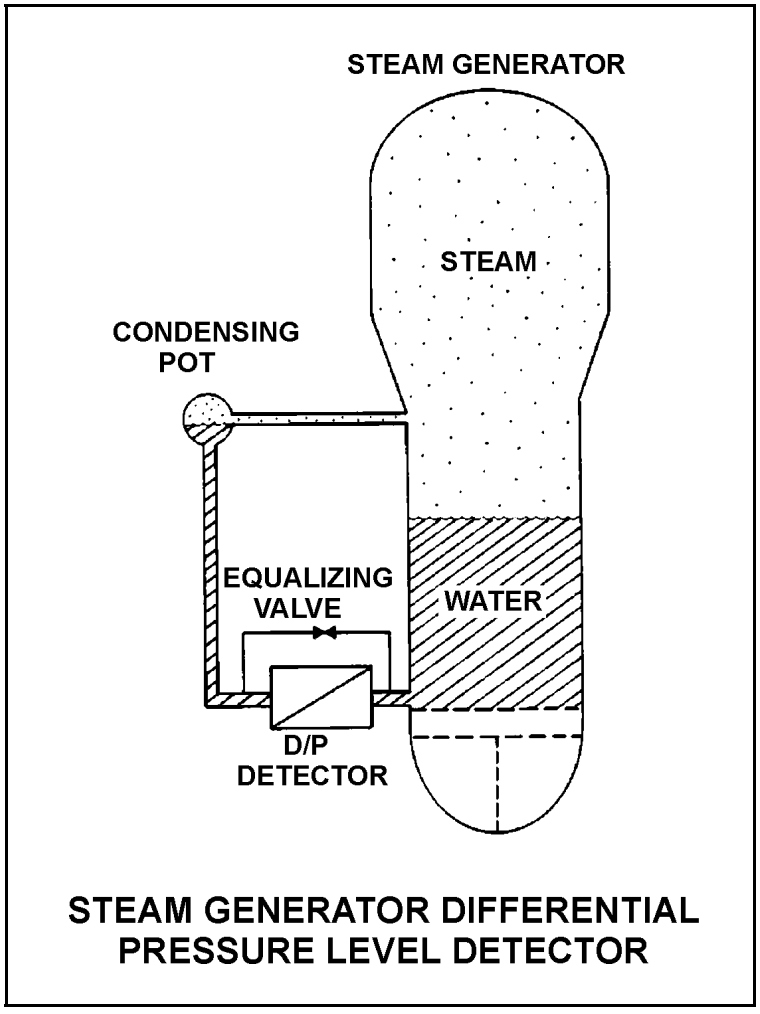
The S/G is at normal operating temperature and pressure with accurate level indication. Which one of the following events will result in a S/G level indication that is lower than actual level?

A. Actual S/G level decreases by 6 inches.

B. The temperature surrounding the reference leg decreases by 20°F.

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

D. S/G pressure decreases by 50 psi with no change in actual water level.



QUESTION: 9

The water pressure within a cooling water system is 100 psig, as indicated by a bourdon tube pressure detector. The cooling water system and the detector are located inside a reactor containment building. The pressure detector case is vented to the containment building, which is currently at atmospheric pressure.

If a steam line rupture raises the containment building pressure by 20 psig, the cooling water system pressure indication will: (Disregard any temperature effect on the detector.)

A. increase to 120 psig.

B. increase by a small, but indeterminate amount.

C. decrease by a small, but indeterminate amount.

D. decrease to 80 psig.

QUESTION: 10

What is the purpose of the reference junction panel that is provided with many thermocouple circuits?

A. Ensures that thermocouple output is amplified sufficiently for use by temperature indication devices.

B. Ensures that only temperature changes at the thermocouple measuring junction affect thermocouple temperature indication.

C. Ensures that electrical noise in the thermocouple extension wires does not affect thermocouple temperature indication.

D. Ensures that different lengths of thermocouple extension wires do not affect thermocouple temperature indication.

QUESTION: 11

Refer to the simplified drawing of a control rod position detector circuit (see figure below).

A magnet on the control rod extension (or drive) shaft sequentially closes individual reed switches mounted vertically adjacent to the control rod drive housing. A constant +5 dc volts is supplied to the input of the resistor network at resistor R_1.

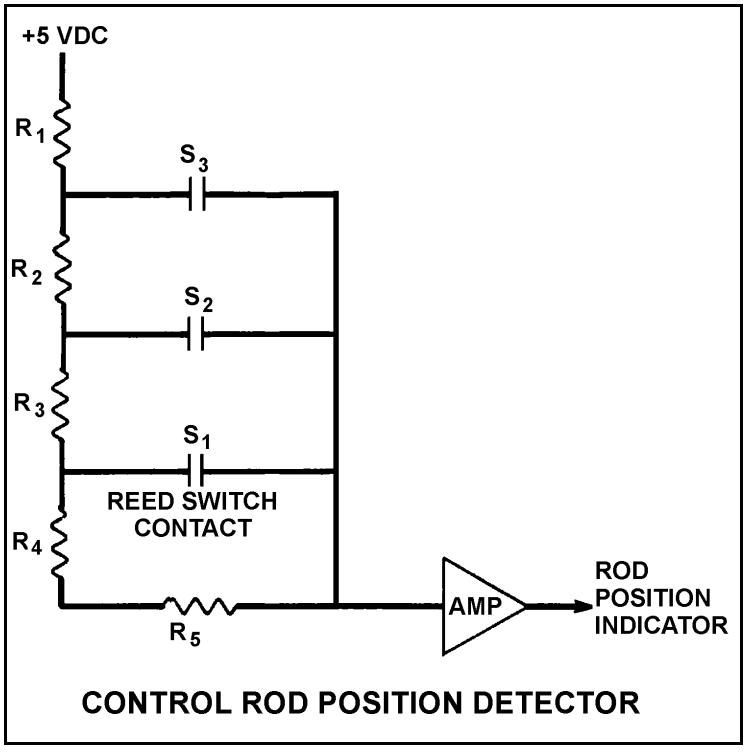
A control rod is initially fully inserted such that all reed switch contacts are open; then the rod is withdrawn until reed switch contact S_1 is closed. Compared to the initial circuit currents, the current through resistor R_5 after the rod withdrawal will be _____, and the output current of the resistor network to the amplifier will be _____.

A. lower, higher

B. lower, lower

C. higher, higher

D. higher, lower



QUESTION: 12

A reactor plant has experienced a loss of coolant accident combined with a loss of emergency coolant injection flow. Homogeneous core voiding has occurred, with the void fraction currently nearing 100%. Now, emergency coolant injection flow is restored, which causes a steady reduction in the core void fraction as the core is refilled.

Which one of the following describes the expected trend in excore source/startup range neutron level indication as the homogeneous core void fraction decreases from 100% to 20% in the core and downcomer? (Assume the source/startup range neutron detectors are located adjacent to the bottom one-third of the core.)

A. Increases, then decreases

B. Increases continuously

C. Decreases, then increases

D. Decreases continuously

QUESTION: 13

A Geiger-Mueller radiation detector is located in a radiation field consisting of beta, gamma, and fast neutron radiation. Assuming each type of radiation enters the detector gas chamber and ionizes the detector gas, which one of the following describes the resulting detector pulse sizes?

A. Beta radiation will produce a larger pulse size than either gamma or fast neutron radiation.

B. Gamma radiation will produce a larger pulse size than either beta or fast neutron radiation.

C. Fast neutron radiation will produce a larger pulse size than either beta or gamma radiation.

D. Beta, gamma, and fast neutron radiation will produce pulse sizes that are equal in magnitude.

QUESTION: 14

Which one of the following types of radiation is the major contributor to the dose indication on a self-reading pocket dosimeter (SRPD)? (also called SRD, PIC, and direct reading dosimeter)

A. Alpha

B. Beta

C. Gamma

D. Neutron

QUESTION: 15

An automatic flow controller is being used to position a valve in a cooling water system. The controller develops a flow error signal and then increases the magnitude of the signal to drive the valve operator.

The factor by which the magnitude of the flow error signal is increased is referred to as:

A. bias.

B. gain.

C. feedback.

D. offset.

QUESTION: 16

Refer to the drawing of a pressure bistable in an alarm circuit (see figure below).

The orientation of the bistable symbol indicates the characteristics of the bistable, as is normal for a control circuit diagram. The bistable turns on to actuate an alarm at a system pressure of 100 psig. The bistable has a 5 psig dead band, or neutral zone.

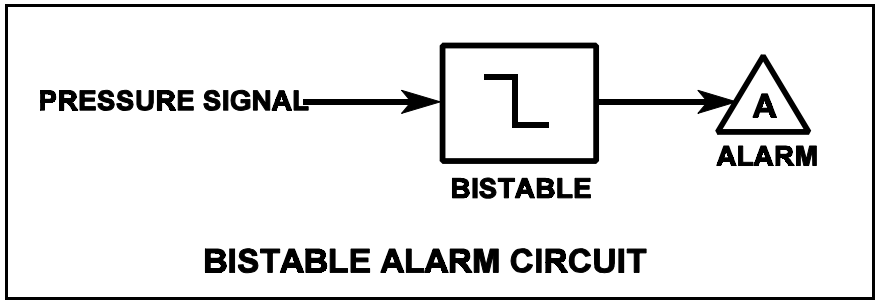
If system pressure is currently 110 psig, which one of the following describes the alarm circuit response as system pressure slowly decreases to 90 psig?

A. The alarm will actuate at 100 psig and will not turn off.

B. The alarm will actuate at 100 psig and will turn off at 95 psig.

C. The alarm is currently actuated and will not turn off.

D. The alarm is currently actuated and will turn off at 95 psig.



BISTABLE ALARM CIRCUIT

QUESTION: 17

Refer to the drawing of a pneumatic control system (see figure below).

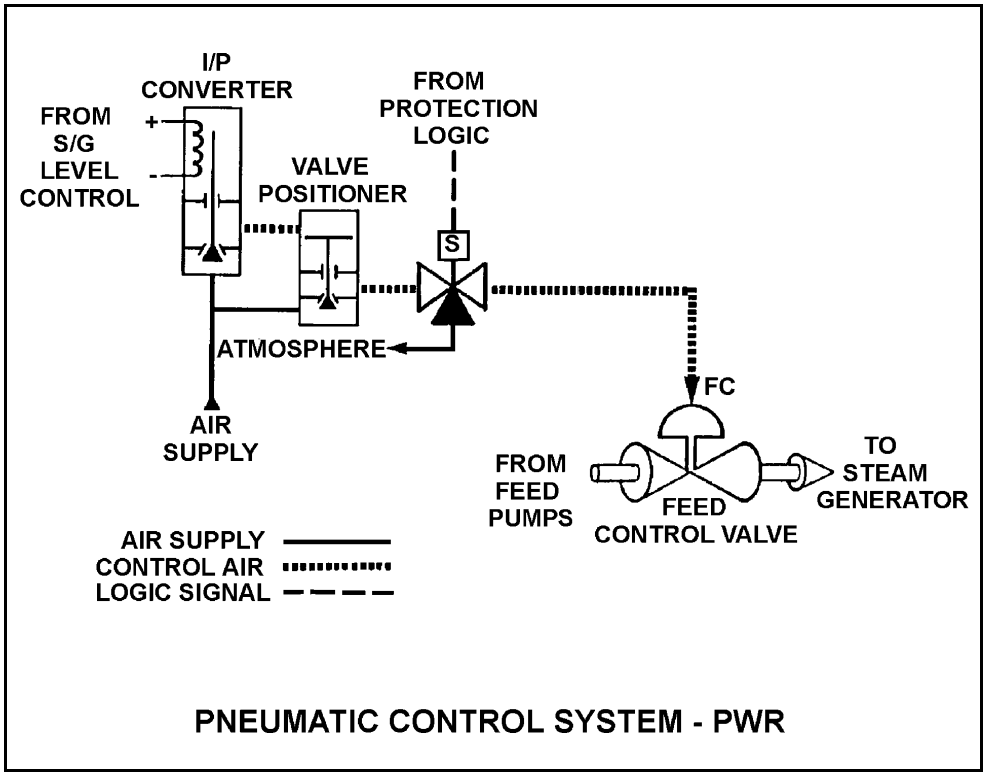
The purpose of the valve positioner is to convert:

A. a small control air pressure into a proportionally larger air pressure to adjust valve position.

B. a large control air pressure into a proportionally smaller air pressure to adjust valve position.

C. pneumatic force into mechanical force to adjust valve position.

D. mechanical force into pneumatic force to adjust valve position.



PNEUMATIC CONTROL SYSTEM - PWR

QUESTION: 18

What may be damaged if an operator attempts to manually disengage the motor on a motor-operated valve while the motor is operating?

A. Motor

B. Clutch

C. Limit switches

D. Torque switches

QUESTION: 19

Refer to the drawing of a water storage tank with a level control system (see figure below).

The tank water level is being automatically controlled by a proportional-only controller with a setpoint of 50%. Tank water level is currently stable at 50% with 500 gpm entering the tank and the drain valve 50% open.

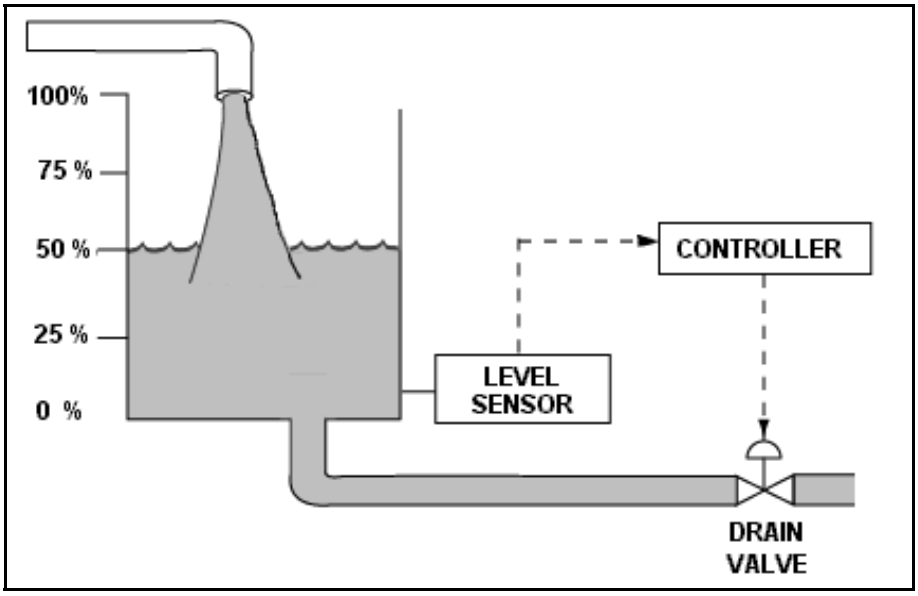
The tank suddenly develops a constant 200 gpm leak, while the input flow rate remains constant at 500 gpm. After the tank water level stabilizes, level will be _____, and the drain valve position will be _____.

A. 50%; more than 50% open

B. 50%; less than 50% open

C. below 50%; more than 50% open

D. below 50%; less than 50% open



QUESTION: 20

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

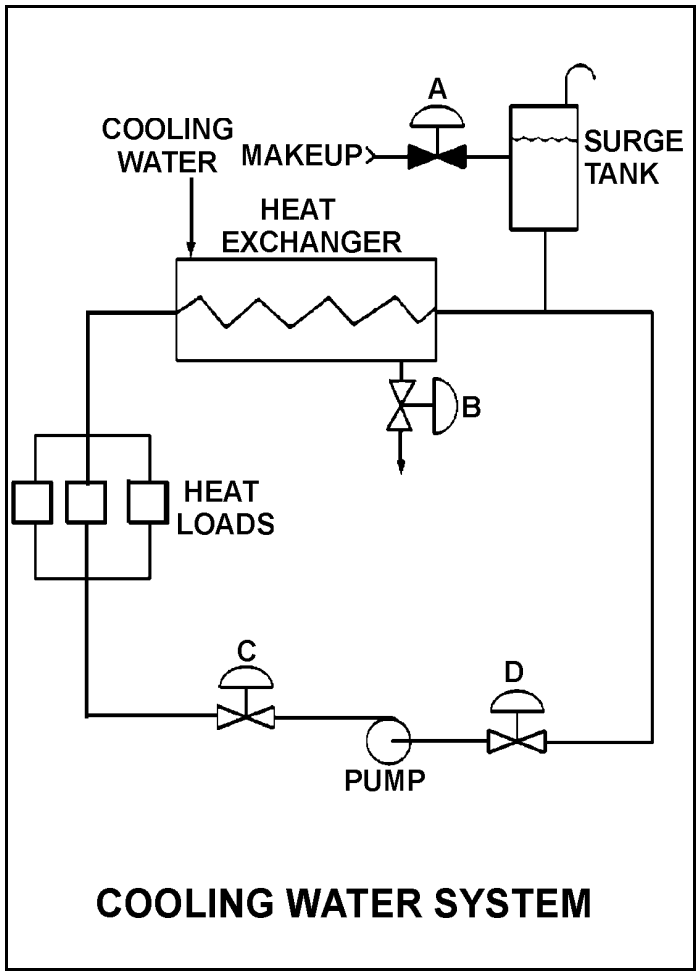
The available net positive suction head for the centrifugal pump will be increased by:

A. opening surge tank makeup valve "A" to raise tank level.

B. throttling heat exchanger cooling water valve "B" closed.

C. throttling pump discharge valve "C" more open.

D. throttling pump suction valve "D" more closed.



QUESTION: 21

Refer to the drawing of a cooling water system and the associated centrifugal pump operating curve (see figure below) in which pumps A and B are identical single-speed centrifugal pumps and only pump A is operating.

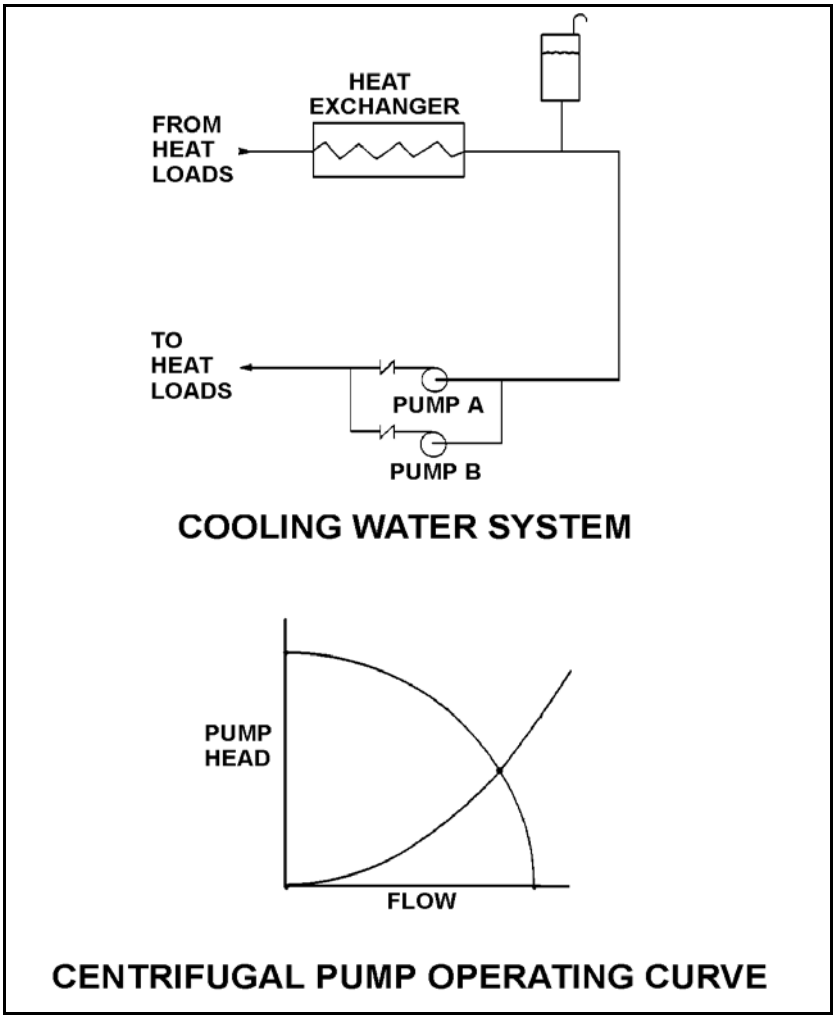
If pump B is started, system flow rate will be _____ and common pump discharge pressure will be _____.

A. the same; higher

B. higher; the same

C. the same; the same

D. higher; higher



QUESTION: 22

Which one of the following describes centrifugal pump runout conditions?

A. High discharge pressure, low flow, high power demand

B. High discharge pressure, high flow, low power demand

C. Low discharge pressure, low flow, low power demand

D. Low discharge pressure, high flow, high power demand

QUESTION: 23

A centrifugal firewater pump is operating normally to pressurize a fire main. The pump takes suction on a water reservoir. The reservoir water level and the pump are both at sea level.

Given:

- The pump has a shutoff head of 100 feet.
- The required net positive suction head (NPSH) for the pump is 15 feet.
- The reservoir water temperature is 60°F.

What is the highest elevation (referenced to sea level) of a fire hose nozzle at which the firewater pump will be able to provide flow? (Disregard head loss in the fire main and fire hose.)

A. 115 feet

B. 100 feet

C. 85 feet

D. 67 feet

QUESTION: 24

Which one of the following describes a reason for designing centrifugal pumps with suction nozzles that are larger than their discharge nozzles?

A. Increases total pump head by increasing the velocity head at the suction of the pump.

B. Increases the differential pressure across the pump by decreasing pump head loss.

C. Increases pump available net positive suction head by decreasing head loss at the pump suction.

D. Increases pump capacity by decreasing turbulence at the suction of the pump.

QUESTION: 25

A positive displacement pump is pumping to a system operating at 100 psig. Assume a constant pump speed, zero pump slip, and a pump backpressure that remains within normal pump operating limits.

If system pressure increases to 200 psig, the pump head will _____ and pump flow rate will _____.

A. increase; remain the same

B. increase; decrease

C. remain the same; remain the same

D. remain the same; decrease

QUESTION: 26

A positive displacement pump should be started with its suction valve _____ and its discharge valve _____.

A. fully open; throttled

B. fully open; fully open

C. throttled; throttled

D. throttled; fully open

QUESTION: 27

A reactor plant is operating at 100% power when a reactor coolant pump (RCP) malfunction occurs. Thirty seconds after the malfunction, which one of the following can be used by an operator to determine whether the malfunction is a locked RCP rotor or a sheared RCP rotor? (Assume no operator action is taken.)

A. Reactor trip status

B. Loop flow indications

C. RCP ammeter indications

D. Loop differential temperature indications

QUESTION: 28

A main generator that is connected to an infinite power grid has the following indications:

100 MWe
0 MVAR
2,900 amps
20,000 Vac

If main generator excitation is reduced, amps will _____ and MWe will _____.

A. decrease; decrease

B. increase; decrease

C. decrease; remain the same

D. increase; remain the same

QUESTION: 29

A centrifugal pump is operating with the following parameters:

Pump speed = 1800 rpm
Pump head = 100 psid
Motor current = 10 amps

What will be the new value of pump head if the speed is increased such that the current requirements are now 640 amps?

A. 400 psid

B. 800 psid

C. 1200 psid

D. 1600 psid

QUESTION: 30

The starting current in an ac motor is significantly higher than the full-load running current because:

A. motor torque production is highest during motor start.

B. work performed by the motor is highest during motor start.

C. little counter electromotive force is induced onto the rotor during motor start.

D. little counter electromotive force is induced onto the stator during motor start.

QUESTION: 31

A large centrifugal pump is driven by a 200 horsepower 4.16 kV ac motor. The motor breaker control circuit contains the following protection devices: instantaneous overcurrent relay, motor thermal overload relay, control power fuses, and an anti-pumping device.

The pump had been manually started and stopped several times during a 5-minute period when the motor breaker unexpectedly tripped. In this situation, which one of the following is the most likely cause of the breaker trip?

A. Instantaneous overcurrent

B. Motor thermal overload

C. Blown control power fuse

D. Anti-pumping device actuation

QUESTION: 32

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

Valves A, B, and C are fully open. Valve D is 20% open. All temperatures are as shown. Valve D is then quickly opened to 100%.

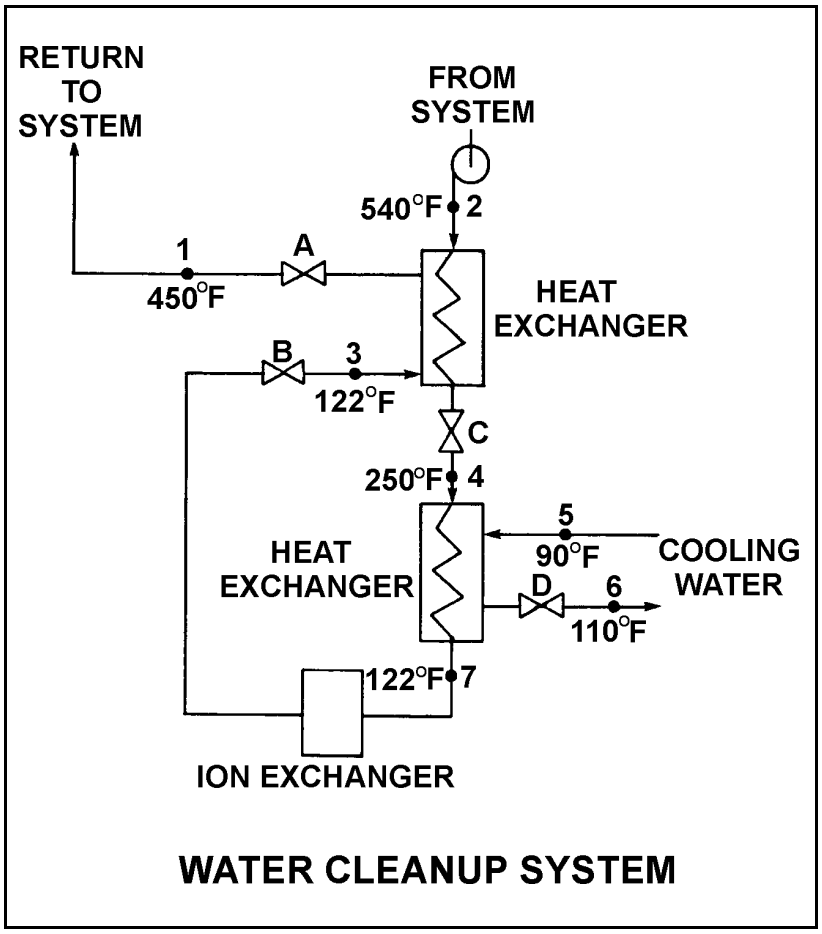
The temperature at point:

A. 3 will increase.

B. 4 will decrease.

C. 5 will decrease.

D. 7 will increase.



QUESTION: 33

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

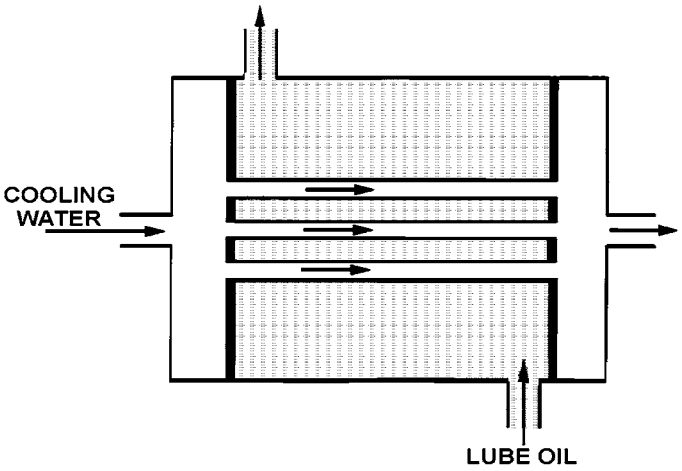
If deposits accumulate on the outside of the cooling water tubes, cooling water outlet temperature will _____ and oil outlet temperature will _____. (Assume oil and cooling water inlet temperatures and flow rates remain the same.)

A. increase; decrease

B. increase; increase

C. decrease; decrease

D. decrease; increase



LUBE OIL HEAT EXCHANGER

QUESTION: 34

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

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

A. higher; higher

B. higher; lower

C. lower; higher

D. lower; lower

QUESTION: 35

Which one of the following will cause a large pressure drop across a demineralizer that is in operation?

A. Channeling of flow through the demineralizer

B. Complete exhaustion of resin beads

C. Accumulation of suspended solids filtered by the resin beads

D. Improper demineralizer venting after resin fill

QUESTION: 36

A power plant has been operating normally at 100% power for one month and with the same reactor coolant boron concentration for the last 24 hours.

Which one of the following changes associated with the in-service reactor coolant demineralizer will cause a reduction in reactor coolant boron concentration in the demineralizer effluent?

A. Increase the temperature of the reactor coolant being processed from 95°F to 105°F.

B. Decrease the temperature of the reactor coolant being processed from 105°F to 95°F.

C. Increase the flow rate of reactor coolant being processed from 75 gpm to 100 gpm.

D. Decrease the flow rate of reactor coolant being processed from 75 gpm to 50 gpm.

QUESTION: 37

After 12 months of operation at 100% power, a reactor is shutdown with a plant cooldown in progress. An operator reports that the general area radiation levels around the operating shutdown cooling pumps have increased significantly since the cooldown started several hours ago.

Which one of the following is a typical cause of these indications, resulting from the cooldown?

A. Increased radioactive tritium in the reactor coolant

B. Increased radioactive nitrogen-16 in the reactor coolant

C. Increased dissolved radioactive oxygen in the reactor coolant

D. Increased suspended radioactive corrosion products in the reactor coolant

QUESTION: 38

Which one of the following will result from a loss of control power to a breaker supplying a motor?

A. The motor ammeter indication will be zero regardless of actual breaker position.

B. The remote indication for breaker position will indicate closed regardless of actual position.

C. The breaker will trip open due to the actuation of a protective trip device.

D. The charging motor will <u>not</u> recharge the breaker closing spring when required.

QUESTION: 39

Two identical 1000 MW electrical generators are operating in parallel supplying the same isolated electrical bus. The generator output breakers also 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: 40

Refer to the drawing of a valve control circuit (see figure below). Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts follow the standard convention for control circuit drawings.

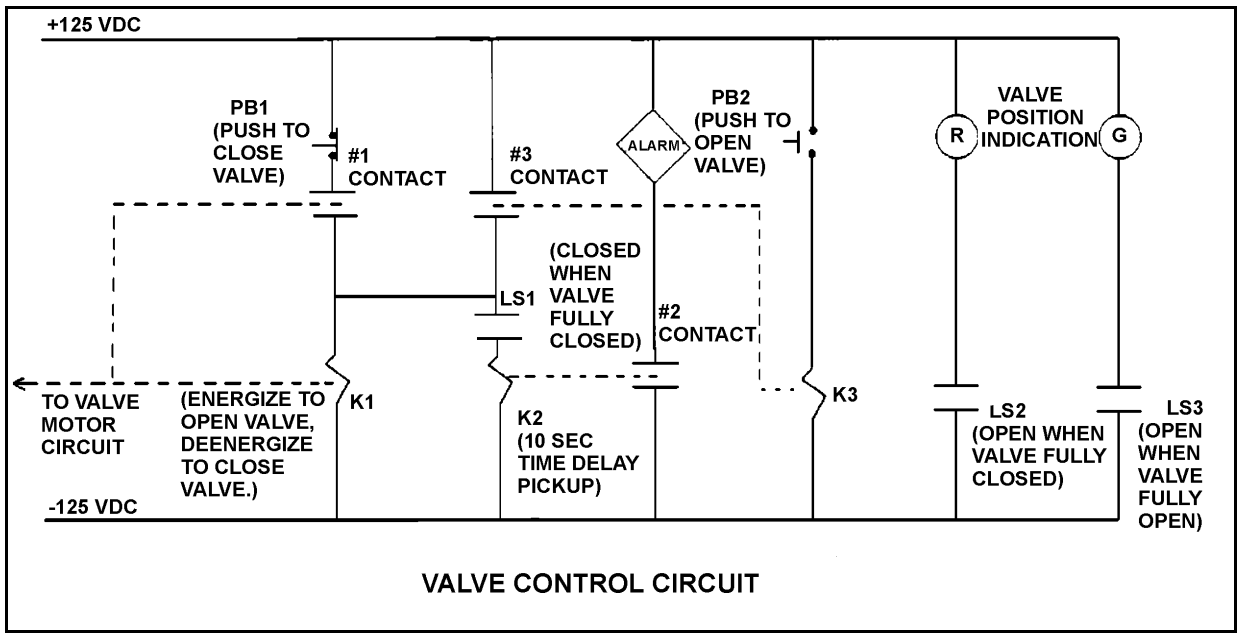
Pushbutton PB2 has been momentarily depressed and then released, and the valve is currently at mid-stroke and moving to the open position. Under these conditions, which one of the following describes the position of contacts #1, #2, and #3?

A. #1 closed; #2 open; #3 open

B. #1 open; #2 closed; #3 closed

C. #1 open; #2 open; #3 open

D. #1 closed; #2 closed; #3 closed



VALVE CONTROL CIRCUIT

QUESTION: 41

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: 42

A typical main generator is being paralleled to the grid. Generator voltage has been properly adjusted and the synchroscope is rotating slowly in the counterclockwise direction.

If the generator breaker is closed just prior to the synchroscope pointer reaching the 12 o'clock position, which one of the following will occur?

A. The breaker will close and the generator will supply MWe to the grid.

B. The breaker will close and the generator will supply MWe and MVAR to the grid.

C. The breaker will close and then open due to an overcurrent trip.

D. The breaker will close and then open due to a reverse power trip.

QUESTION: 43

Refer to the simplified drawing of an electrical distribution system showing 7.2 KV switchgear, step-down transformers, and 480V motor control centers (MCCs) (see figure below).

The high voltage side of each step-down transformer has a remote-operated disconnect to allow transformer maintenance while keeping the other transformers in service. The control circuit for each disconnect is position-interlocked with the associated MCC feeder breaker.

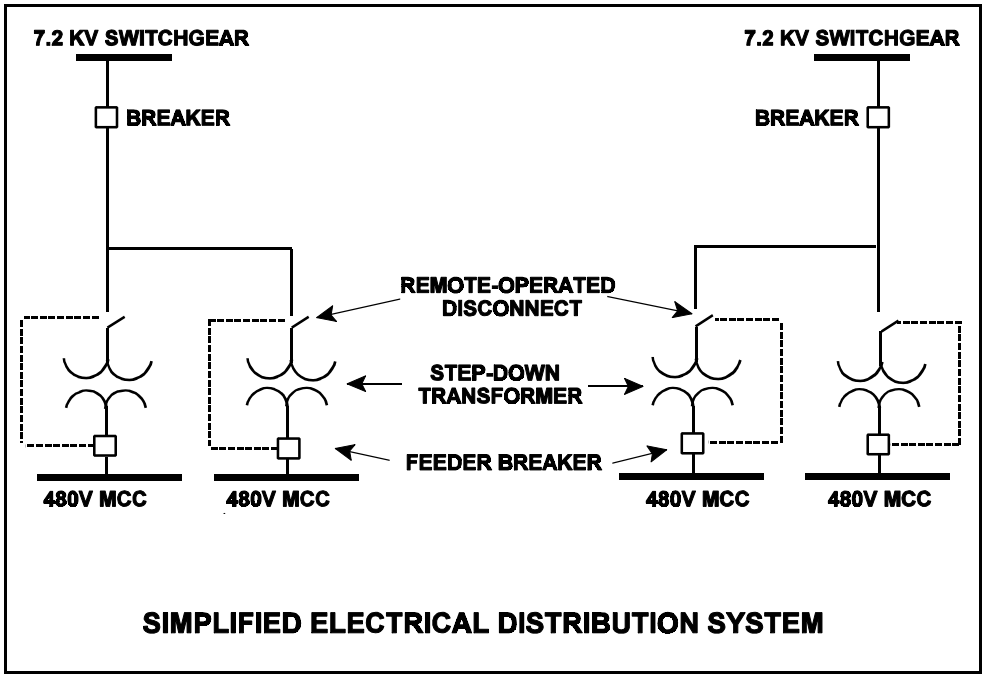
Which one of the following describes the purpose served by the interlock?

A. Prevent damage to the disconnect.

B. Prevent damage to the transformer.

C. Prevent damage to the feeder breaker.

D. Prevent damage to the 480V MCC.



SIMPLIFIED ELECTRICAL DISTRIBUTION SYSTEM

QUESTION: 44

While remotely investigating the condition of a normally-open motor control center (MCC) feeder breaker, an operator observes the following indications:

Green breaker position indicating light is out.
Red breaker position indicating light is lit.
MCC voltmeter indicates normal voltage.
MCC ammeter indicates zero amperes.

Based on these indications, the operator should report that the circuit breaker is _____ and racked _____.

A. open; in

B. closed; in

C. open; out

D. closed; out

QUESTION: 45

During a brief time interval in a typical commercial nuclear reactor operating at the beginning of a fuel cycle, 10^5 delayed neutrons were emitted.

Approximately how many prompt neutrons were emitted in the reactor during this same time interval?

A. 1.5×10^5

B. 6.5×10^6

C. 1.5×10^7

D. 6.5×10^8

QUESTION: 46

A thermal neutron is about to interact with a U-238 nucleus in an operating 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 U-238 will undergo fission, thereby decreasing K_{eff}.

C. The neutron will be absorbed and U-238 will undergo fission, thereby increasing K_{eff}.

D. The neutron will be absorbed and U-238 will undergo radioactive decay to Pu-239, thereby increasing K_{eff}.

QUESTION: 47

Which one of the following is a benefit of installing excess reactivity (K_{excess}) in a reactor core?

A. Ensures that sufficient control rod negative reactivity is available to shut down the reactor.

B. Ensures that the reactor can be made critical during a peak xenon condition after a reactor scram.

C. Ensures that positive reactivity additions result in controllable reactor power responses.

D. Ensures that the U-235 fuel enrichment is the same at the beginning and the end of a fuel cycle..

QUESTION: 48

Reactors A and B are identical except that the reactor cores are at different times in core life. The reactor A effective delayed neutron fraction is 0.007, and the reactor B effective delayed neutron fraction is 0.005. Both reactors are currently subcritical and stable with neutron flux level in the source range.

Given:

Reactor A K_{eff} = 0.999
Reactor B K_{eff} = 0.998

If positive 0.003 $\Delta K/K$ is suddenly added to each reactor, how will the resulting stable reactor startup rates (SUR) compare? (Consider only the reactor response while power is below the point of adding heat.)

A. Reactor A stable SUR will be higher because it will have the higher positive reactivity in the core.

B. Reactor B stable SUR will be higher because it has the smaller effective delayed neutron fraction.

C. Reactors A and B will have the same stable SUR because both reactors will remain subcritical.

D. Reactors A and B will have the same stable SUR because both reactors received the same amount of positive reactivity.

QUESTION: 49

Two reactors are identical in every way except that reactor A is at the end of core life and reactor B is at the beginning of core life. Both reactors are operating at 100% power when a reactor trip occurs at the same time on each reactor. The reactor systems for each reactor respond identically to the trip and no operator action is taken.

Ten minutes after the trip, the higher fission rate will exist in reactor _____ because it has a _____ delayed neutron fraction.

A. A; larger

B. B; larger

C. A; smaller

D. B; smaller

QUESTION: 50

Which one of the following contains the pair of nuclides that are the most significant contributors to the total resonance capture in the core near the end of a fuel cycle?

A. Pu-239 and U-235

B. Pu-239 and Pu-240

C. U-238 and Pu-240

D. U-238 and Pu-239

QUESTION: 51

As the reactor coolant boron concentration increases, the moderator temperature coefficient becomes less negative. This is because, at higher boron concentrations, a 1°F increase in reactor coolant temperature at higher boron concentrations results in a larger increase in the:

A. fast fission factor.

B. thermal utilization factor.

C. total nonleakage probability.

D. resonance escape probability.

QUESTION: 52

The following are the initial conditions for a nuclear power plant:

Reactor power is 50%.
Average reactor coolant temperature is 570°F.
Differential boron worth (DBW) is -0.01% ΔK/K per ppm.

After a power increase, current plant conditions are as follows:

Reactor power is 80%.
Average reactor coolant temperature is 582°F.

Which one of the following describes the current DBW in comparison to the initial DBW?

A. The current DBW is more negative because a 1°F increase in reactor coolant temperature will remove more boron-10 atoms from the core.

B. The current DBW is more negative because a 1 ppm increase in reactor coolant boron concentration will add more boron-10 atoms to the core.

C. The current DBW is less negative because a 1°F increase in reactor coolant temperature will remove fewer boron-10 atoms from the core.

D. The current DBW is less negative because a 1 ppm increase in reactor coolant boron concentration will add fewer boron-10 atoms to the core.

QUESTION: 53

Neglecting the effects of core Xe-135, which one of the following power changes requires the greatest amount of positive reactivity addition?

A. 3% power to 10% power

B. 10% power to 25% power

C. 25% power to 65% power

D. 65% power to 100% power

QUESTION: 54

Which one of the following parameters typically has the greatest effect on the shape of a differential rod worth curve?

A. Core radial neutron flux distribution

B. Core axial neutron flux distribution

C. Core xenon distribution

D. Burnable poison distribution

QUESTION: 55

The purposes of using control rod bank overlap are to:

A. provide a more uniform axial power distribution and to provide a more uniform differential rod worth.

B. provide a more uniform differential rod worth and to provide a more uniform radial power distribution.

C. provide a more uniform radial power distribution and to maintain individual and group rod position indicators within allowable tolerances.

D. maintain individual and group rod position indicators within allowable tolerances and to provide a more uniform axial power distribution.

QUESTION: 56

The reactor is operating at 75% power at the middle of core life. Which one of the following actions will cause the greatest shift in reactor power distribution toward the top of the core? (Assume control rods remain fully withdrawn.)

A. Decrease reactor power by 25%.

B. Decrease reactor coolant boron concentration by 10 ppm.

C. Decrease average reactor coolant temperature by 5°F.

D. Decrease reactor coolant system operating pressure by 15 psia.

QUESTION: 57

A comparison of the heat flux in the hottest coolant channel to the average heat flux in the core describes:

A. a core correction calibration factor.

B. a hot channel/peaking factor.

C. a heat flux normalizing factor.

D. an axial/radial flux deviation factor.

QUESTION: 58

A reactor has been operating at 25% power for 24 hours following a 2-hour power reduction from steady-state full power. Which one of the following describes the current status of core xenon-135 concentration?

A. At equilibrium

B. Decreasing toward an upturn

C. Decreasing toward an equilibrium value

D. Increasing toward a peak value

QUESTION: 59

A reactor has been shut down for 5 days to perform maintenance. A reactor startup is performed and power is ramped to 75% over a 16 hour period.

When power reaches 75%, the concentration of core xenon-135 will be:

A. decreasing toward an upturn.

B. increasing toward a peak value.

C. decreasing toward an equilibrium value.

D. increasing toward an equilibrium value.

QUESTION: 60

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

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

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: 61

A reactor that had been operating at 100% power for about two months was shutdown over a 2-hour period. Following the shutdown, core xenon-135 will reach a long-term steady-state concentration in _____ hours.

A. 8 to 10

B. 20 to 25

C. 40 to 50

D. 70 to 80

QUESTION: 62

Fourteen hours after a reactor trip from 100% power equilibrium xenon conditions, the amount of core xenon-135 will be:

A. lower than 100% equilibrium xenon, and will have added a net positive reactivity since the trip.

B. lower than 100% equilibrium xenon, and will have added a net negative reactivity since the trip.

C. higher than 100% equilibrium xenon, and will have added a net positive reactivity since the trip.

D. higher than 100% equilibrium xenon, and will have added a net negative reactivity since the trip.

QUESTION: 63

A plant had been operating at 100% power for two months when a reactor trip occurred. Soon afterward, a reactor startup was performed. Twelve hours after the trip, the startup has been paused with reactor power at 2%.

To maintain reactor power and reactor coolant temperature stable over the next hour, the operator must add _____ reactivity because core xenon-135 concentration will be _____.

A. positive; increasing.

B. negative; increasing.

C. positive; decreasing.

D. negative; decreasing.

QUESTION: 64

Refer to the graph of critical boron concentration for a reactor core following a refueling outage (See figure below.).

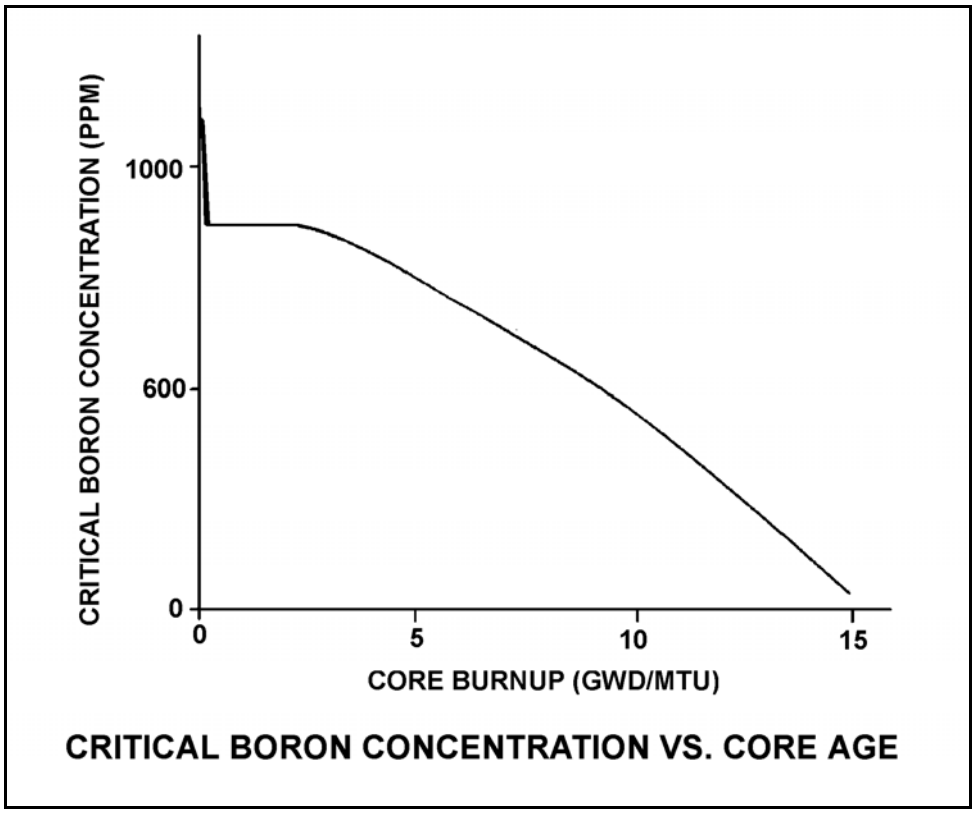
Which one of the following is responsible for the majority of the rapid initial decrease in critical boron concentration?

A. Fuel depletion

B. Fission product buildup

C. Burnable poison burnout

D. Conversion of U-238 to Pu-239



QUESTION: 65

During a reactor startup, the first reactivity addition caused the source range count rate to increase from 20 to 40 cps. The second reactivity addition caused the count rate to increase from 40 to 160 cps.

Which one of the following statements accurately compares the two reactivity additions?

A. The first reactivity addition was larger.

B. The second reactivity addition was larger.

C. The first and second reactivity additions were equal.

D. There is not enough data given to determine the relationship of reactivity values.

QUESTION: 66

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

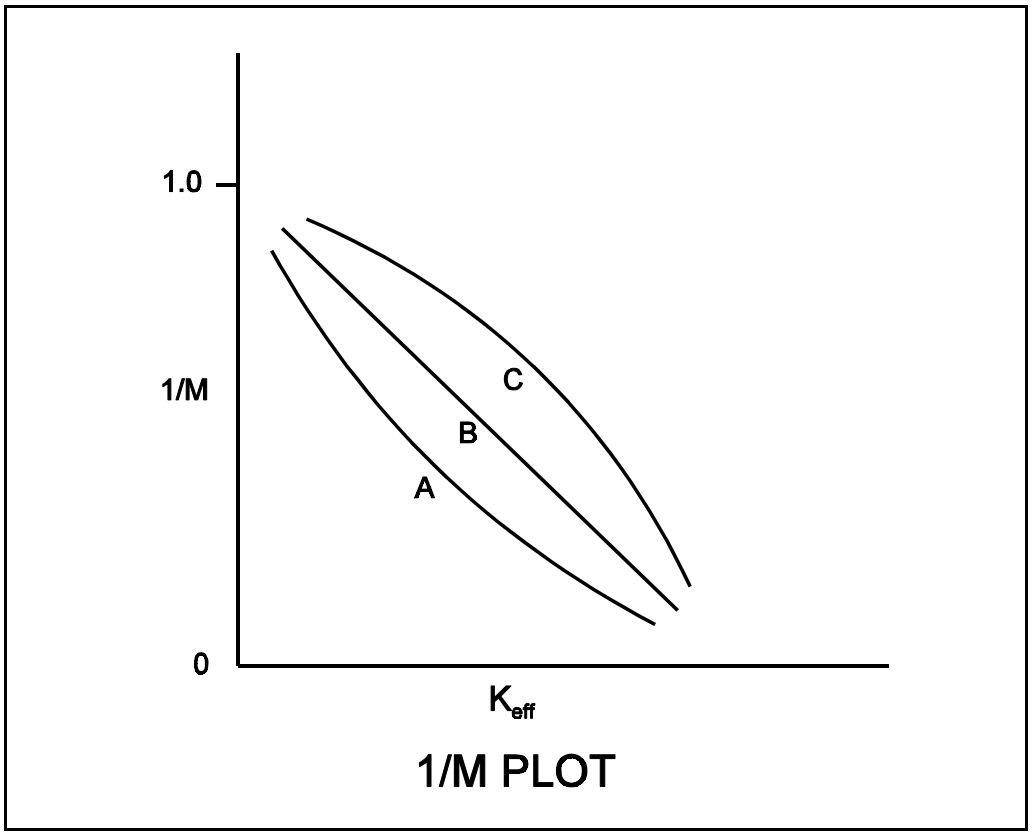
The least conservative approach to criticality is represented by plot _____ and could possibly be the result of recording count rates at _____ time intervals after incremental fuel loading steps than for the situations represented by the other plots.

A. A; shorter

B. A; longer

C. C; shorter

D. C; longer



QUESTION: 67

A reactor startup is in progress for a reactor that is in the middle of a fuel cycle. The reactor is at normal operating temperature and pressure. The main steam isolation valves are open and the main turbine bypass (also called steam dump) valves are closed. The reactor is near criticality.

Reactor startup rate (SUR) is stable at zero when, suddenly, a turbine bypass valve fails open and remains stuck open, dumping steam to the main condenser. The operator immediately ensures no control rod motion is occurring and takes no further action. Assume that the steam generator water levels remain stable, the reactor does not trip, and no other reactor protective actions occur.

As a result of the valve failure, SUR will initially become _____; and reactor power will stabilize _____ the point of adding heat.

A. positive; at

B. positive; above

C. negative; at

D. negative; above

QUESTION: 68

A reactor trip has occurred from 100% reactor power and equilibrium xenon-135 conditions near the end of a fuel cycle. An estimated critical rod position (ECP) has been calculated using the following assumptions:

Criticality occurs 24 hours after trip.
Reactor coolant temperature is 550°F.
Reactor coolant boron concentration is 400 ppm.

Which one of the following will result in criticality occurring at a control rod position that is higher than the calculated ECP?

A. Decreasing reactor coolant system boron concentration to 350 ppm

B. A malfunction resulting in control rod speed being 20% higher than normal speed

C. Moving the time of criticality to 30 hours after the trip

D. Misadjusting the steam dump (turbine bypass) controller such that reactor coolant temperature is being maintained at 553°F

QUESTION: 69

A reactor is exactly critical two decades below the point of adding heat when -0.01% ΔK/K of reactivity is added to the core. If +0.01% ΔK/K is then added to the core 2 minutes later, reactor power will stabilize at:

A. the point of adding heat.

B. the initial power level.

C. somewhat lower than the initial power level.

D. the subcritical multiplication equilibrium level.

QUESTION: 70

How do the following parameters change during a normal ramp of reactor power from 15% to 75%?

	Turbine First-Stage Pressure	Reactor Coolant System Boron Concentration
A.	Increase	Decrease
B.	Decrease	Decrease
C.	Increase	Increase
D.	Decrease	Increase

QUESTION: 71

A reactor is exactly critical below the point of adding heat when a single control rod fully inserts into the core. Assuming no operator or automatic action, reactor power will slowly decrease to:

A. zero.

B. an equilibrium value equal to the source neutron strength.

C. an equilibrium value greater than the source neutron strength.

D. a slightly lower value, then slowly return to the initial value.

QUESTION: 72

After one month of operation at 100% reactor power, the fraction of thermal power being produced from the decay of fission products in the operating reactor is:

A. less than 1%.

B. greater than 1% but less than 5%.

C. greater than 5% but less than 10%.

D. greater than 10%.

QUESTION: 73

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: 74

Two identical pressurizers are connected to the same location on two identical reactor coolant systems operating at 1000 psia. Pressurizer A volume contains 50% saturated water and 50% saturated steam. Pressurizer B volume contains 50% subcooled water (300°F) and 50% nitrogen.

Which one of the following explains which pressurizer will maintain the highest pressure following a sudden 10% liquid outsurge from each pressurizer?

A. Pressurizer A due to vaporizing of saturated water as pressure begins to decrease

B. Pressurizer A due to the expansion characteristics of saturated steam being better than the expansion characteristics of nitrogen

C. Pressurizer B due to the subcooled water resulting in a smaller amount of energy being lost upon the outsurge

D. Pressurizer B due to the expansion characteristics of nitrogen being better than the expansion characteristics of saturated steam

QUESTION: 75

The following stable plant conditions existed just prior to a plant shutdown for maintenance:

Power = 100%
RCS T_{ave} = 572°F
SG T_{stm} = 534°F

During the shutdown, 5% of the total steam generator (SG) tubes were plugged. Which one of the following will be the approximate SG steam pressure when the plant is returned to 100% power? (Assume RCS mass flow rate and RCS T_{ave} are the same as their pre-shutdown 100% power values.)

A. 813 psia

B. 841 psia

C. 870 psia

D. 900 psia

QUESTION: 76

A main condenser is operating at 28 inches of Hg vacuum with a condensate outlet temperature of 92°F. Which one of the following is the approximate amount of condensate depression?

A. 6°F

B. 10°F

C. 13°F

D. 17°F

QUESTION: 77

Saturated steam (100% quality) at 1000 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: 78

Steam turbines X and Y are identical 100% efficient turbines that exhaust to a condenser at 1.0 psia. Saturated steam at 250 psia enters turbine X. A moisture separator/reheater supplies turbine Y with superheated steam at 250 psia and 500°F.

Which one of the following lists the percentage of moisture at the exhaust of turbines X and Y?

	Turbine X	Turbine Y
A.	24.5%	20.5%
B.	26.3%	13.0%
C.	24.5%	13.0%
D.	26.3%	20.5%

QUESTION: 79

Which one of the following describes why large steam lines are gradually warmed instead of suddenly admitting full steam flow?

A. To minimize the possibility of stress corrosion cracking of the steam lines

B. To minimize the total thermal expansion of the steam lines

C. To minimize the potential for water hammer in the steam lines

D. To minimize the heat loss from the steam lines

QUESTION: 80

A centrifugal pump is being returned to service after maintenance. However, the operator fails to vent the pump.

Compared to normal operations, after the pump is started, the operator will see _____ flow rate and _____ discharge head.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

QUESTION: 81

Refer to the drawing of a cooling water system in which only pump A is operating and the pump discharge valve is currently 50% open (see figure below).

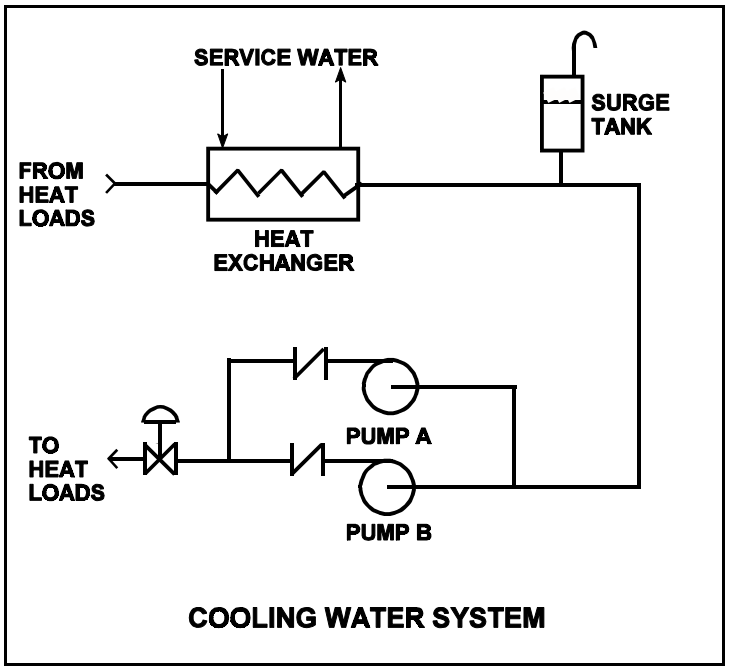
If pump A is cavitating, which one of the following will reduce or eliminate cavitation in pump A?

A. Starting pump B

B. Positioning the discharge valve to 40% open

C. Lowering the water level in the surge tank by 2 feet

D. Decreasing heat exchanger service water flow rate by 10%



QUESTION: 82

A reactor shutdown has been performed because of a leak from the reactor coolant system (RCS) to a steam generator (SG) via a tube leak.

Given the following initial conditions:

SG pressure is 1,000 psia.
RCS pressure is 2,200 psia.
RCS average temperature is 500°F.
Leak rate from the RCS to the SG is 100 gpm.

If RCS pressure is decreased to 1,600 psia, with no other changes in plant parameters, what will be the approximate leak rate from the RCS to the SG?

A. 50 gpm

B. 71 gpm

C. 79 gpm

D. 85 gpm

QUESTION: 83

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 1000 psig.

Given the following information:

Centrifugal Pumps

Shutoff head:	1500 psig
Maximum design pressure:	2000 psig

Positive Displacement Pumps

Maximum design pressure:	2000 psig

Which one of the following pump configurations will supply the lowest makeup flow rate to the cooling water system if system pressure is at 1700 psig?

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

B. One PDP and one CP in parallel

C. Two CPs in series

D. Two CPs in parallel

QUESTION: 84

The transfer of heat from the reactor fuel pellets to the fuel cladding during normal plant operation is an example of _____ heat transfer.

A. conduction

B. convection

C. radiant

D. two-phase

QUESTION: 85

The power range nuclear instruments have been adjusted to 100% based on a calculated heat balance. Which one of the following will result in indicated reactor power being lower than actual reactor power?

A. The feed water temperature used in the heat balance calculation was 20°F lower than actual feed water temperature.

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

C. The ambient heat loss value used in the heat balance calculation was only half the actual ambient heat loss.

D. The feed water flow rates used in the heat balance calculation were 10% higher than actual flow rates.

QUESTION: 86

Subcooled reactor coolant flows into the bottom of a fuel assembly coolant channel and exits the top of the channel as a saturated steam-water mixture with a 98% moisture content. How does the overall heat transfer coefficient in the coolant channel change as the coolant travels upward along the channel?

A. Increases only

B. Increases, then decreases

C. Decreases only

D. Decreases, then increases

QUESTION: 87

Which one of the following is most likely to result in fuel clad damage?

A. Operating at 110% of reactor vessel design pressure

B. Actuation of the reactor protection system during a reactor accident

C. Operating at a power level that exceeds the critical heat flux

D. Operating with subcooled nucleate boiling occurring in a fuel assembly

QUESTION: 88

If a reactor is being operated with DNBR at its limit, which one of the following is indicated?

A. None of the fuel rods are experiencing critical heat flux.

B. A small fraction of the fuel rods may be experiencing critical heat flux.

C. All radioactive fission products are being contained within the reactor fuel.

D. All radioactive fission products are being contained within either the reactor fuel or the reactor vessel.

QUESTION: 89

A nuclear plant maintains reactor coolant system (RCS) cold leg temperature (T_{cold}) at 557°F from 0% to 100% power. At 100% power, the reactor differential temperature (T_{hot} - T_{cold}) is 60°F.

If this plant also maintains RCS pressure constant at 2235 psig, which one of the following is the RCS subcooling margin at 50% power?

A. 30°F

B. 36°F

C. 66°F

D. 96°F

QUESTION: 90

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of a fuel cycle (see figure below).

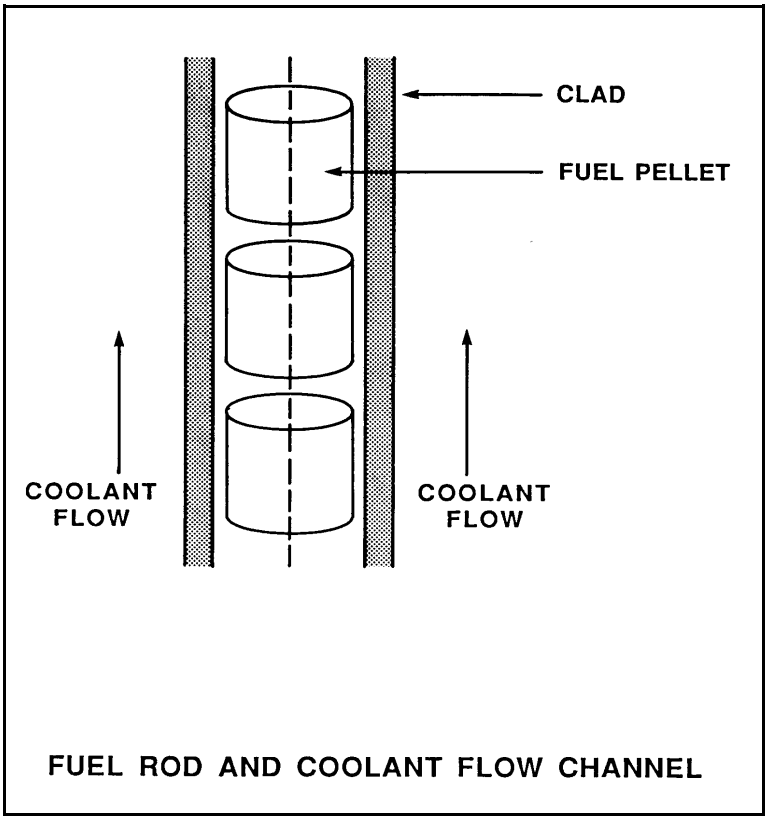
At 100% reactor power, the greatest temperature difference in a fuel channel radial temperature profile will occur across the: (Assume the temperature profile begins at the fuel centerline.)

A. fuel centerline to fuel surface.

B. fuel-to-clad gap.

C. zircaloy cladding.

D. flow channel boundary (laminar) layer.



FUEL ROD AND COOLANT FLOW CHANNEL

QUESTION: 91

During a plant cooldown and depressurization with forced circulation, reactor coolant system (RCS) loop flow and reactor coolant pump (RCP) current indications become erratic. This is most likely caused by:

A. RCP cavitation.

B. RCP runout.

C. RCS loop water hammer.

D. RCS hot leg saturation.

QUESTION: 92

A reactor had been operating at a constant power level for the last two weeks when a loss of all ac power occurred, thereby causing a reactor trip and a loss of forced reactor coolant flow. Natural circulation reactor coolant flow developed and stabilized 30 minutes after the trip.

Which one of the following combinations of initial reactor power and post-trip steam generator pressure will result in the lowest stable natural circulation flow rate 30 minutes after the trip?
(Assume constant steam generator water levels.)

	INITIAL REACTOR POWER	POST-TRIP STEAM GENERATOR PRESSURE
A.	100%	1100 psia
B.	25%	1100 psia
C.	100%	1000 psia
D.	25%	1000 psia

QUESTION: 93

A reactor coolant system natural circulation cooldown is in progress via the steam generator (SG) atmospheric steam relief valves (operated in manual control). Assume feed flow rate, relief valve position, and decay heat level are constant.

If high point voiding interrupts natural circulation, SG levels will gradually _____; and core exit thermocouple indications will gradually _____.

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

QUESTION: 94

A reactor is operating at 80% power at the beginning of a fuel cycle. All control rods are fully withdrawn and in manual control. Moderator temperature coefficient is negative. Core power distribution is peaked below the core midplane.

Which one of the following will significantly decrease the core maximum axial peaking (or hot channel) factor? (Assume no subsequent operator action is taken and that turbine load and core xenon distribution do not change unless stated.)

A. One bank of control rods is inserted 10%.

B. One control rod fully inserts into the core.

C. Turbine load/reactor power is reduced by 20%.

D. Reactor coolant system boron concentration is reduced by 50 ppm.

QUESTION: 95

The linear power density thermal limit is designed to prevent melting of the _____ during normal reactor plant operation; the limit is dependent on the axial and radial peaking factors, of which, the _____ peaking factor is the most limiting.

A. fuel clad; axial

B. fuel clad; radial

C. fuel pellets; axial

D. fuel pellets; radial

QUESTION: 96

The reference temperature for nil-ductility transition (RT_{NDT}) is the temperature above which:

A. a large compressive stress can result in brittle fracture.

B. a metal exhibits more ductile tendencies.

C. the probability of brittle fracture increases.

D. no appreciable deformation occurs prior to failure.

QUESTION: 97

Which one of the following operating limitations is designed to prevent brittle fracture of the reactor vessel?

A. Maximum setpoint for the pressurizer safety valves

B. Maximum differential pressure between the RCS and the steam generators

C. Maximum RCS pressure vs. RCS temperature for a given RCS heatup rate

D. Maximum differential temperature between the RCS and the pressurizer

QUESTION: 98

A 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 is removed from the reactor vessel for testing. The testing indicates that the nil-ductility transition (NDT) temperature of the specimen has decreased from 44°F to 32°F since the last refueling.

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 last refueling.

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

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

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

QUESTION: 99

Which one of the following would be most likely to cause pressurized thermal shock of the reactor vessel?

A. Starting a reactor coolant pump in an idle loop with the associated steam generator temperature less than RCS loop temperature.

B. Starting a reactor coolant pump in an idle loop with the associated steam generator temperature greater than RCS loop temperature.

C. Continuous emergency coolant injection to the RCS during and after a complete and unisolable rupture of a steam generator steam outlet nozzle.

D. Continuous emergency coolant injection to the RCS during and after a complete and unisolable rupture of a reactor vessel coolant outlet nozzle.

QUESTION: 100

Which one of the following describes the thermal stress placed on the reactor vessel during a cooldown of the reactor coolant system?

A. Tensile at the inner wall, compressive at the outer wall

B. Compressive at the inner wall, tensile at the outer wall

C. Tensile across the entire wall

D. Compressive across the entire wall

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

OCTOBER 2002 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

FORM A	FORM B	ANS	FORM A	FORM B	ANS	FORM A	FORM B	ANS	FORM A	FORM B	ANS
1	29	B	26	54	B	51	79	B	76	4	B
2	30	C	27	55	C	52	80	D	77	5	B
3	31	D	28	56	D	53	81	C	78	6	A
4	32	D	29	57	D	54	82	B	79	7	C
5	33	D	30	58	D	55	83	A	80	8	C
6	34	D	31	59	B	56	84	A	81	9	B
7	35	A	32	60	B	57	85	B	82	10	B
8	36	B	33	61	D	58	86	C	83	11	D
9	37	D	34	62	A	59	87	D	84	12	A
10	38	B	35	63	C	60	88	B	85	13	C
11	39	A	36	64	B	61	89	D	86	14	A
12	40	A	37	65	D	62	90	D	87	15	C
13	41	D	38	66	D	63	91	D	88	16	B
14	42	C	39	67	D	64	92	B	89	17	C
15	43	B	40	68	A	65	93	A	90	18	A
16	44	A	41	69	C	66	94	C	91	19	A
17	45	A	42	70	D	67	95	B	92	20	B
18	46	B	43	71	A	68	96	D	93	21	C
19	47	D	44	72	B	69	97	C	94	22	C
20	48	A	45	73	C	70	98	A	95	23	D
21	49	D	46	74	A	71	99	C	96	24	B
22	50	D	47	75	B	72	100	C	97	25	C
23	51	B or C	48	76	A	73	1	B	98	26	C
24	52	C	49	77	B	74	2	A	99	27	C
25	53	A	50	78	C	75	3	D	100	28	A