UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
DECEMBER 2005--FORM A

Please Print

Name: _____

Docket No.: _____

Facility: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO APPLICANT

Answer all the test items using the answer sheet provided, ensuring a single answer is marked for each test item. Each test item has equal point value. A score of at least 80% is required to pass this portion of the NRC operator licensing written examination. All examination papers will be collected 3.0 hours after the examination starts. This examination applies to a typical boiling water reactor (BWR) nuclear power plant.

SECTION	QUESTIONS	% OF TOTAL	SCORE
COMPONENTS	1 - 22		
REACTOR THEORY	23 - 36		
THERMODYNAMICS	37 - 50		
TOTALS	50		

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

_____
Applicant's Signature

RULES AND GUIDELINES FOR THE NRC
GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

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

1. Print your name in the blank provided on the cover sheet of the examination.

2. Fill in your individual docket number.

3. Fill in the name of your facility.

4. Fill in your start and stop times at the appropriate time.

5. Two aids are provided for your use during the examination:

   (1) An equations and conversions sheet contained within the examination copy, and

   (2) Steam tables and Mollier Diagram provided by your proctor.

6. Place your answers on the answer sheet provided. Credit will only be given for answers properly marked on this sheet. Follow the instructions for filling out the answer sheet.

7. Scrap paper will be provided for calculations.

8. Cheating on the examination will result in the automatic forfeiture of this examination. Cheating could also result in severe penalties.

9. Restroom trips are limited. Only **ONE** examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside of the examination room.

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

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

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

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

CONVERSIONS

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1 Mw = 3.41×10^6 Btu/hr

1 hp = 2.54×10^3 Btu/hr

1 Btu = 778 ft-lbf

°C = (5/9)(°F - 32)

°F = (9/5)(°C) + 32

1 Curie = 3.7×10^{10} dps

1 kg = 2.21 lbm

1 gal_{water} = 8.35 lbm

1 ft^3_{water} = 7.48 gal

QUESTION: 1

A vertical safety valve has a compressed spring assembly that is applying 2,500 lbf to the top of the valve disk in opposition to system pressure. System pressure is being exerted on the underside of the valve disk that is 5 inches in diameter.

Which one of the following is the approximate system pressure at which the safety valve will open? (Neglect the effect of atmospheric pressure.)

A. 32 psi

B. 127 psi

C. 159 psi

D. 500 psi

QUESTION: 2

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

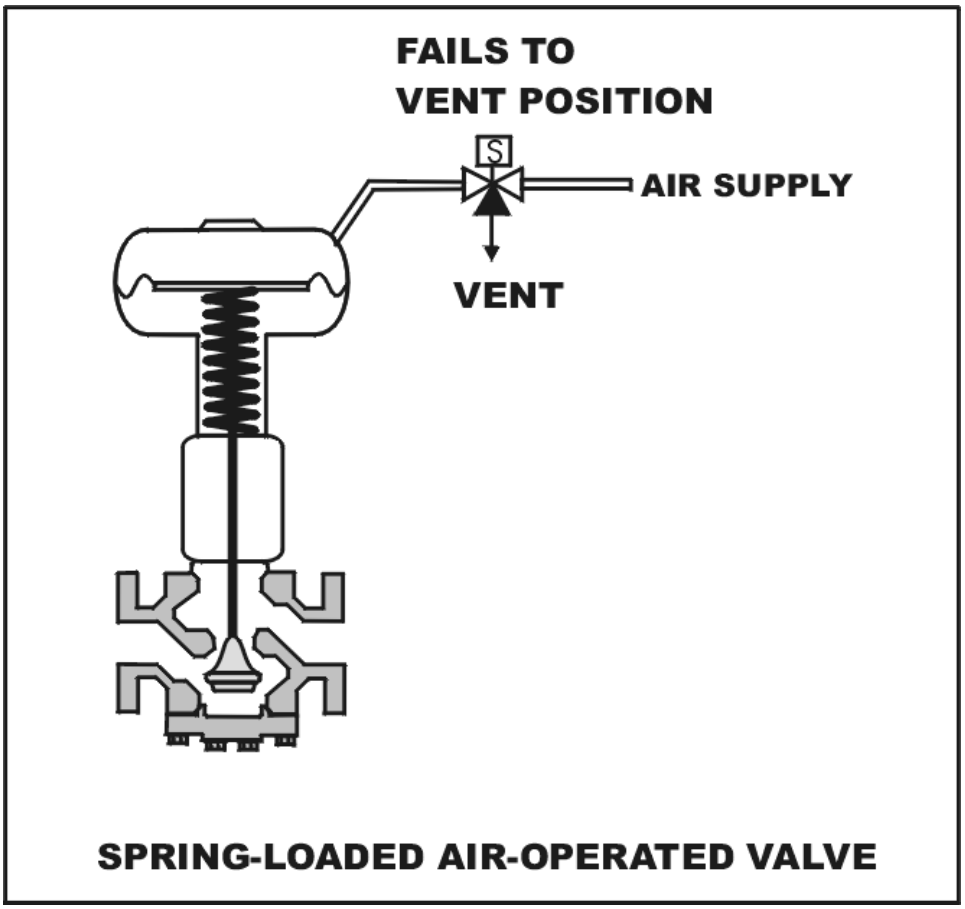
Which one of the following will be the valve position following a reduction in air pressure to the valve actuator caused by a leaking air connection at the valve?

A. Original position

B. More open

C. More closed

D. Varies with system flow



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.

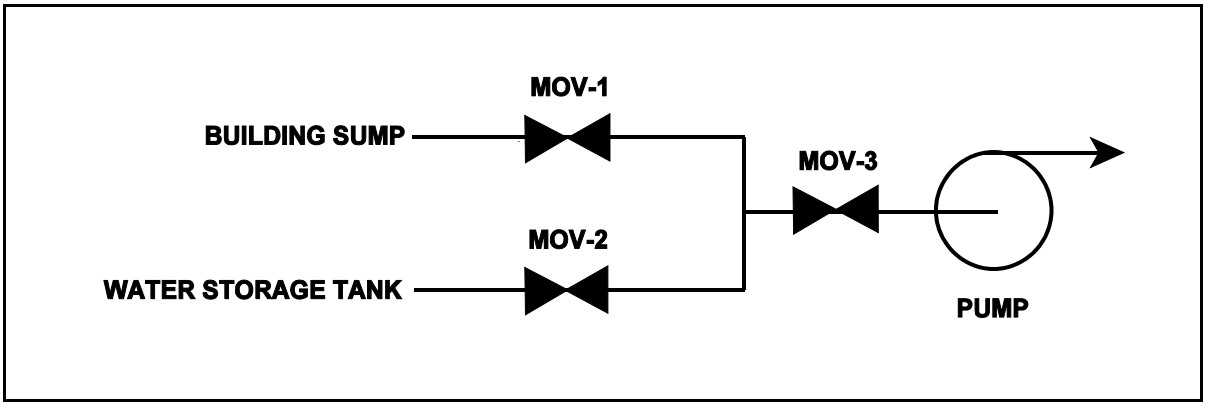
Which one of the following MOV interlocks will permit the pump to take a suction on either the building sump or the water storage tank, while preventing the two sources from being cross-connected?

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

A main steam flow rate differential pressure detector was properly calibrated to produce a main steam flow rate indication of 500,000 lbm/hr with the following initial input conditions:

Detector high pressure input: 1,000 psia
Detector low pressure input: 950 psia

The current detector input conditions are as follows:

Detector high pressure input: 985 psia
Detector low pressure input: 935 psia

Assume that the detector and associated circuitry do not have steam density compensation. Also assume that the main steam quality and volumetric flow rate do not change.

The current main steam flow rate indication is _____ 500,000 lbm/hr; and the current main steam flow rate is _____ 500,000 lbm/hr.

A. equal to; greater than

B. less than; greater than

C. equal to; less than

D. greater than; less than

QUESTION: 5

Refer to the drawing of a differential pressure manometer (see figure below).

The manometer is filled with water and installed across an orifice in a ventilation duct to determine the rate of air flow. The manometer is currently indicating a water level difference of 8 inches at an air flow rate of 300 cubic feet per minute (ft^3/min).

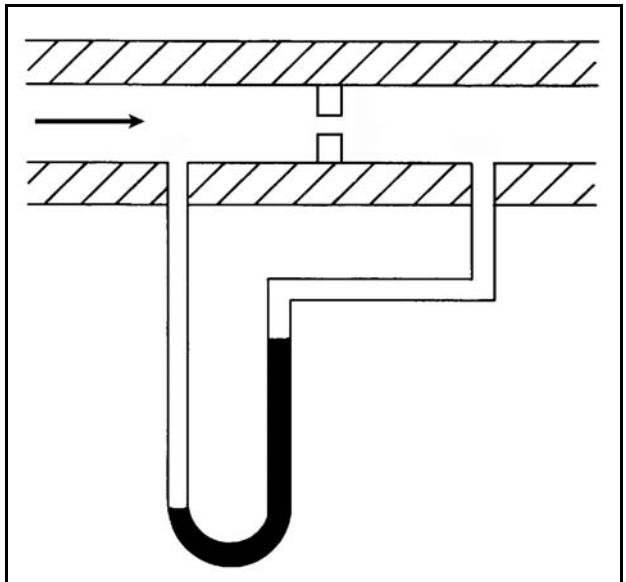
Which one of the following will be the approximate air flow rate when the manometer indicates a water level difference of 4 inches?

A. 75 ft^3/min

B. 150 ft^3/min

C. 188 ft^3/min

D. 212 ft^3/min



DIFFERENTIAL PRESSURE MANOMETER

QUESTION: 6

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 temperature changes away from the thermocouple measuring junction do not 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: 7

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

A. stay approximately the same because all of the primary ions continue to be collected and essentially no secondary ionizations are occurring.

B. stay approximately the same because detector operation in the ionization chamber region is characterized by complete ionization of the detector gas.

C. decrease because fewer primary ionizations are occurring in the detector as detector voltage decreases.

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

QUESTION: 8

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

The controller in this system uses _____ control.

A. on-off

B. proportional

C. proportional plus integral

D. proportional plus integral plus derivative

QUESTION: 9

Refer to the drawing of a temperature bistable in a bistable 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 temperature of 130°F. The bistable has a 5°F dead band, or neutral zone.

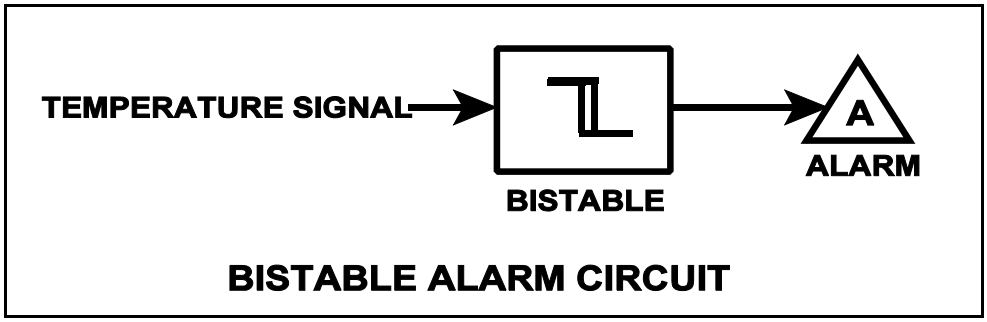
If the current temperature is 150°F, which one of the following describes the alarm response as temperature slowly decreases to 110°F?

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

B. The alarm will actuate at 130°F and will not turn off.

C. The alarm is currently actuated and will turn off at 125°F.

D. The alarm will actuate at 130°F and will turn off at 125°F.



BISTABLE ALARM CIRCUIT

QUESTION: 10

Which one of the following describes pump cavitation?

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

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

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

D. Vapor bubbles are discharged from the pump where they collapse on downstream piping and cause localized water hammers.

QUESTION: 11

Refer to the drawing below of a centrifugal pump taking suction from the bottom of an open storage tank containing water at 66°F. Pump and water level elevations are indicated in the figure. Assume standard atmospheric pressure.

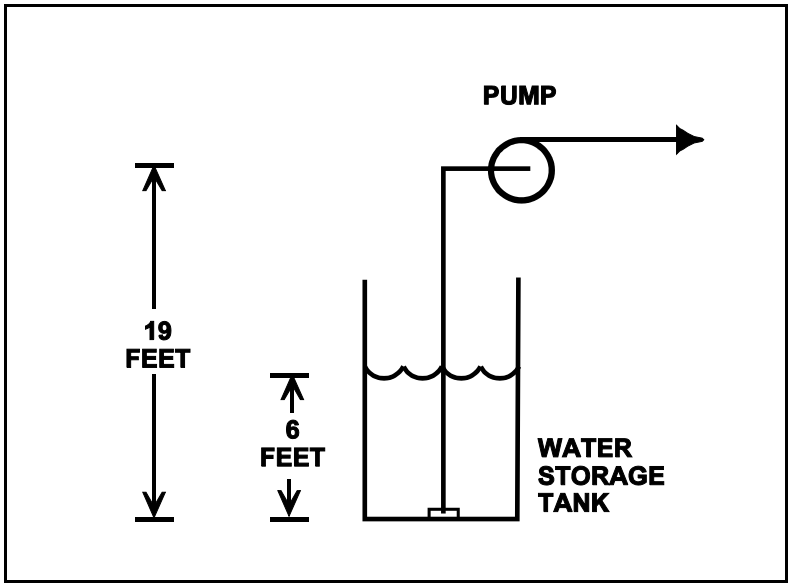
Assuming that pump suction fluid velocity head loss is negligible, what is the approximate value of net positive suction head available to the pump.

A. 6 feet

B. 13 feet

C. 20 feet

D. 25 feet



QUESTION: 12

A motor-driven centrifugal pump is operating in an open system with its discharge valve throttled to 50%. How will the pump be affected if the discharge valve is fully opened?

A. Total developed head decreases, and motor current decreases.

B. Total developed head increases, and available net positive suction head decreases.

C. The potential for pump cavitation decreases, and pump differential pressure decreases.

D. Available net positive suction head decreases, and pump differential pressure decreases.

QUESTION: 13

Which one of the following describes the proper location for a relief valve that will be used to prevent exceeding the design pressure of a positive displacement pump and associated piping?

A. On the pump suction piping upstream of the suction isolation valve.

B. On the pump suction piping downstream of the suction isolation valve.

C. On the pump discharge piping upstream of the discharge isolation valve.

D. On the pump discharge piping downstream of the discharge isolation valve.

QUESTION: 14

Select the option that correctly fills in the blanks.

To minimize the adverse effects of starting current, an ac induction motor should be started _____ to _____ the stator counter electromotive force (CEMF).

A. unloaded; quickly establish

B. unloaded; delay

C. partially loaded; quickly establish

D. partially loaded; delay

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
200 MW	200 MW
25 MVAR (out)	50 MVAR (out)

A malfunction causes the voltage regulator setpoint for generator B to slowly increase continuously toward a maximum of 25 KV. If no operator action is taken, generator A output current will...

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

B. decrease 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 two system curves for a typical main condenser cooling water system (see figure below).

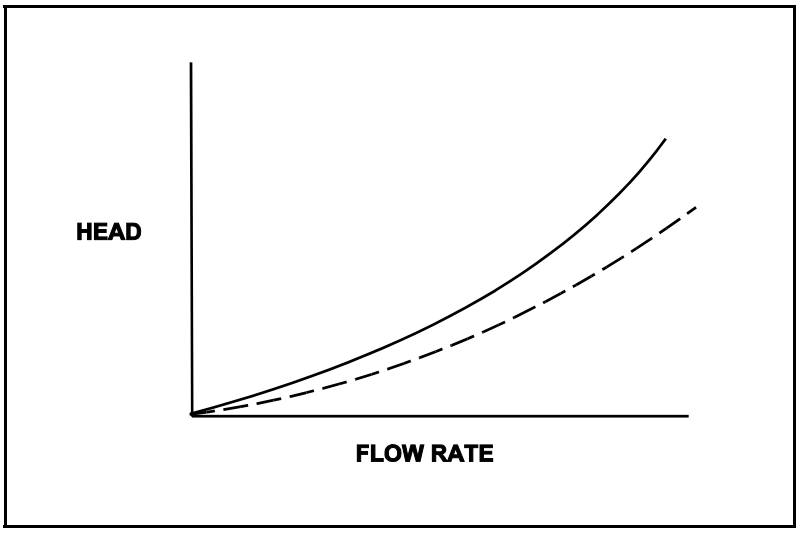
Which one of the following will result in the system curve shifting from the solid curve toward the dashed curve?

A The main condenser tubes are cleaned.

B. The main condenser tubes become increasingly fouled.

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

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



QUESTION: 17

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

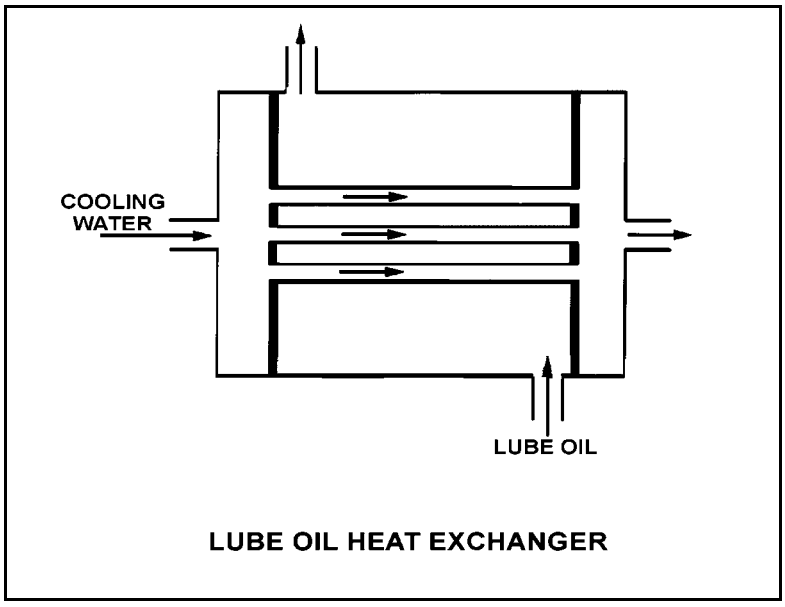
If scaling occurs inside the cooling water tubes, cooling water outlet temperature will _____ and lube oil outlet temperature will _____. (Assume oil and cooling water flow rates remain the same.)

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase



LUBE OIL HEAT EXCHANGER

QUESTION: 18

A nuclear power plant is operating normally at 50% of rated power. Which one of the following will result from a cooling water tube rupture in the main condenser?

A. Increased condenser vacuum

B. Increased conductivity of the condensate

C. Decreased condensate pump net positive suction head

D. Decreased condensate pump flow rate

QUESTION: 19

The purpose of a mixed-bed demineralizer is to...

A. raise the conductivity of water with little effect on pH.

B. reduce the conductivity of water with little effect on pH.

C. increase the pH of water by reducing the number of positively charged ions in it.

D. decrease the pH of water by increasing the number of negatively charged ions in it.

QUESTION: 20

A lower than expected differential pressure across a mixed-bed demineralizer is an indication of...

A. depletion of the resin.

B. channeling through the resin bed.

C. improper resin regeneration.

D. a decrease in inlet conductivity.

QUESTION: 21

Given the following indications for an open 4160 Vac breaker:

All phase overcurrent trip flags are reset.
The control power fuses indicate blown.
The line-side voltmeter indicates 4160 Vac.
The load-side voltmeter indicates 0 volts.

Assuming no operator actions were taken since the breaker opened, which one of the following could have caused the breaker to open?

A. A ground fault caused an automatic breaker trip.

B. A loss of control power caused an automatic breaker trip.

C. An operator tripped the breaker manually at the breaker cabinet.

D. An operator tripped the breaker manually from a remote location.

QUESTION: 22

Refer to the drawing of a valve control circuit for a valve that is initially fully closed (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.)

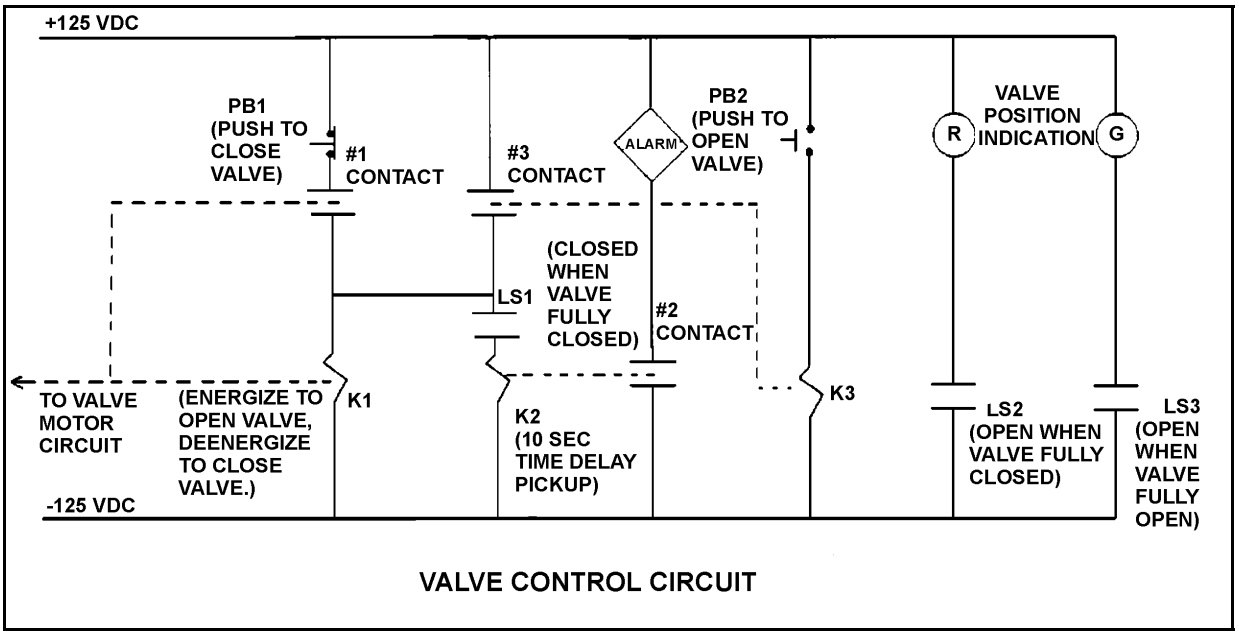
Which one of the following describes when the motor-operated valve will begin to stroke open?

A. At the same time the alarm actuates

B. 10 seconds after PB2 is depressed

C. Immediately after PB2 is depressed

D. Immediately after PB1 is depressed if contact #1 is closed



VALVE CONTROL CIRCUIT

QUESTION: 23

During a brief time interval in a typical commercial nuclear reactor operating at the beginning of a fuel cycle, 1.0×10^3 delayed neutrons were emitted.

Approximately how many prompt neutrons were emitted 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: 24

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

A. The neutron will be scattered, thereby leaving K_{eff} unchanged.

B. The neutron will be absorbed and 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: 25

During a reactor startup, source range count rate is observed to double every 30 seconds. Which one of the following is the approximate reactor period?

A. 80 seconds

B. 67 seconds

C. 56 seconds

D. 43 seconds

QUESTION: 26

Refer to the drawing of microscopic cross section for absorption versus neutron energy for a resonance peak in U-238 (see figure below).

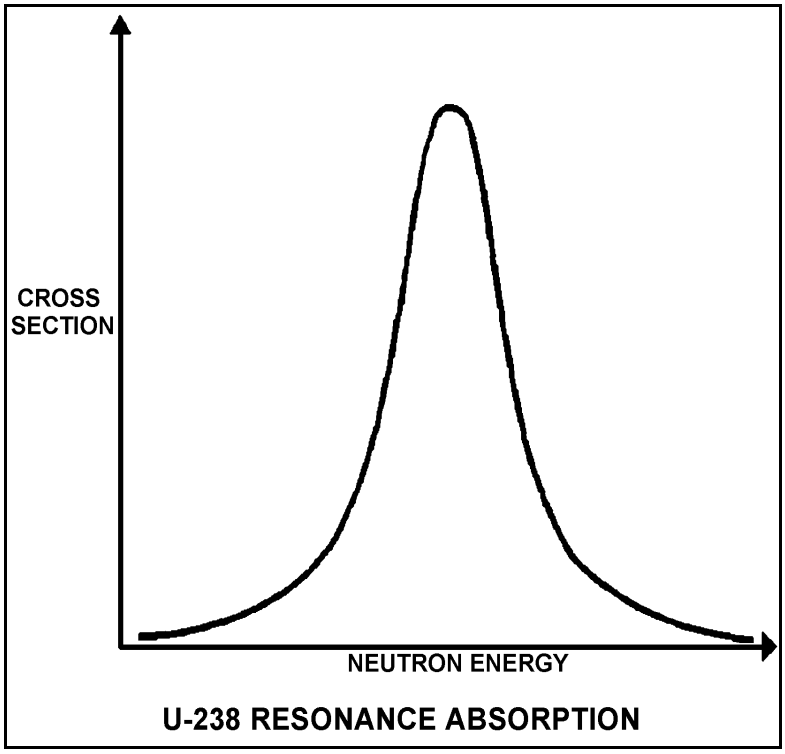
If fuel temperature increases, the area under the curve will _____ and negative reactivity will be added to the core because _____.

A. increase; neutrons of a wider range of energies will be absorbed by U-238

B. increase; more neutrons will be absorbed by U-238 at the resonance neutron energy

C. remain the same; neutrons of a wider range of energies will be absorbed by U-238

D. remain the same; more neutrons will be absorbed by U-238 at the resonance neutron energy



QUESTION: 27

During a nuclear reactor startup with the reactor coolant at 520°F, excessive control rod withdrawal results in a 10 second reactor period with reactor power low in the intermediate range. Without any further operator action, which one of the following coefficients of reactivity will respond first to reduce the rate of the power increase?

A. Pressure

B. Void

C. Moderator

D. Doppler

QUESTION: 28

Rod density is a measure of the total number of control rod notches _____ the core divided by the total number of control rod notches _____ the core.

A. inserted into; available in

B. inserted into; withdrawn from

C. withdrawn from; available in

D. withdrawn from; inserted into

QUESTION: 29

A nuclear reactor is operating at equilibrium full power when a single control rod fully inserts (from the fully withdrawn position). Reactor power is returned to full power with the control rod still fully inserted.

Compared to the initial axial neutron flux shape, the current flux shape will have a...

A. minor distortion, because a fully inserted control rod has zero reactivity worth.

B. minor distortion, because the fully inserted control rod is an axially uniform poison.

C. major distortion, because the upper and lower core halves are loosely coupled.

D. major distortion, because power production along the length of the rod drastically decreases.

QUESTION: 30

A nuclear reactor has been operating at 75% power for two months. A manual reactor scram is required for a test. The scram will be followed immediately by a reactor startup with criticality scheduled to occur 12 hours after the scram.

The greatest assurance that xenon reactivity will permit criticality during the startup will be attained if the reactor is operated at _____ power for 48 hours prior to the scram and if criticality is rescheduled for _____ hours after the scram.

A. 100%; 8

B. 100%; 16

C. 50%; 8

D. 50%; 16

QUESTION: 31

Six hours after a reactor scram from equilibrium full power operation, a nuclear reactor is taken critical and power is immediately stabilized. To maintain the reactor critical at a constant power level for the next hour, the operator must add _____ reactivity because core Xe-135 concentration is _____.

A. negative; increasing

B. negative; decreasing

C. positive; increasing

D. positive; decreasing

QUESTION: 32

Gadolinium (Gd-155 and -157) is used instead of boron (B-10) as the _____ material; when compared to gadolinium, boron has a much _____ cross section for absorbing thermal neutrons.

A. control rod; larger

B. burnable poison; larger

C. control rod; smaller

D. burnable poison; smaller

QUESTION: 33

A refueling outage has just been completed and a reactor startup is being commenced. Which one of the following lists the method(s) used to add positive reactivity during the approach to criticality?

A. Control rods only

B. Recirculation pump flow only

C. Control rods and recirculation pump flow

D. Recirculation pump flow and steaming rate

QUESTION: 34

A nuclear reactor is critical at 10^{-6}% power. Control rods are withdrawn for 5 seconds and then stopped, resulting in a stable reactor period of positive 100 seconds.

If control rods had been inserted (instead of withdrawn) for 5 seconds with the reactor initially critical at 10^{-6}% power, the stable reactor period would have been: (Assume equal absolute values of reactivity are added in both cases.)

A. longer than negative 100 seconds because, compared to power increases, reactor power decreases are more limited by delayed neutrons.

B. shorter than negative 100 seconds because, compared to power increases, reactor power decreases are less limited by delayed neutrons.

C. longer than negative 100 seconds because, compared to power increases, reactor power decreases result in smaller delayed neutron fractions.

D. shorter than negative 100 seconds because, compared to power increases, reactor power decreases result in larger delayed neutron fractions.

QUESTION: 35

A nuclear reactor startup is in progress following a one-month shutdown. Upon reaching criticality, the operator establishes a positive 80-second period and stops control rod motion.

After an additional five minutes, reactor power will be _____ and reactor period will be _____. (Assume reactor power remains below the point of adding heat.)

A. constant; constant

B. constant; increasing

C. increasing; constant

D. increasing; increasing

QUESTION: 36

After taking critical data during a reactor startup, the operator establishes a positive 48-second reactor period to increase power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize power at the POAH? (Assume $\overline{\beta}_{eff}$ = 0.00579.)

A. -0.010% ΔK/K

B. -0.012% ΔK/K

C. -0.10% ΔK/K

D. -0.12% ΔK/K

QUESTION: 37

Refer to the drawing of four identical tank differential pressure (D/P) level detectors (see figure below).

The tanks are identical and are presently at 2 psig overpressure, the same constant water level, and a temperature of 60°F. They are surrounded by atmospheric pressure. All level detectors have been calibrated and are producing the same level indication. A leak in the top of each tank causes a complete loss of overpressure in both tanks.

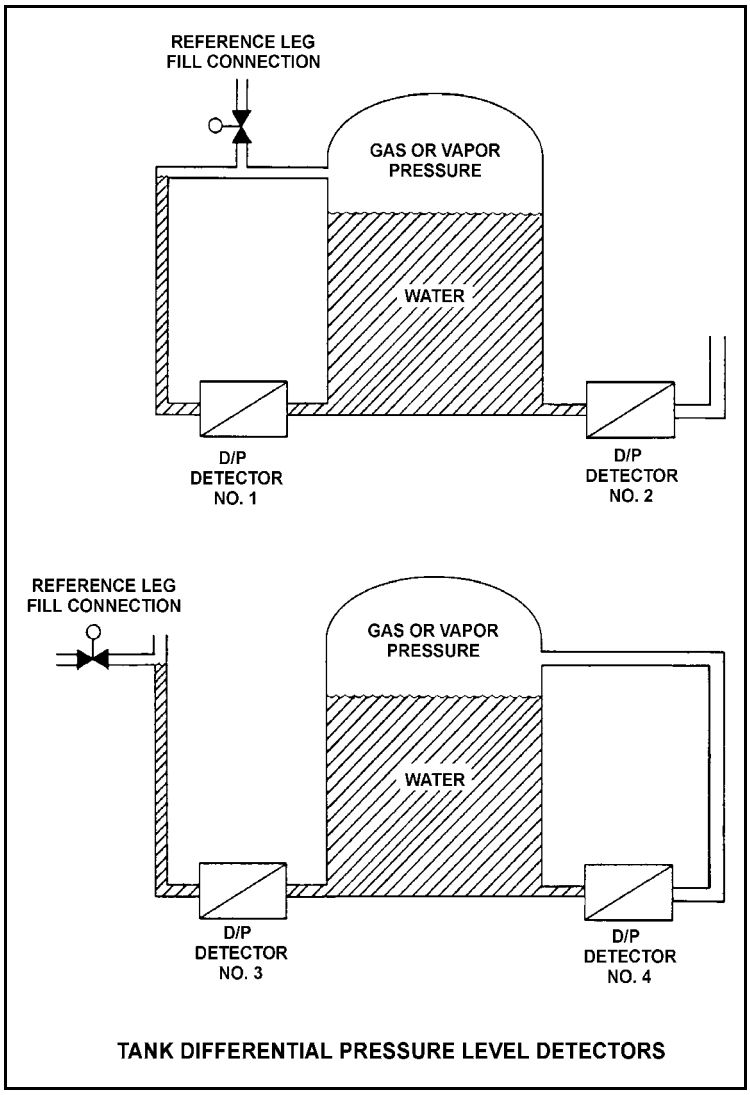
Which level detector(s) will produce the lowest level indication?

A. No. 1 only

B. No. 2 only

C. No. 1 and 4

D. No. 2 and 3



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

QUESTION: 38

Given a constant pressure, any further addition of heat will result in an increase in the temperature of...

A. wet vapors and saturated vapors.

B. subcooled liquids and wet vapors.

C. saturated liquids and saturated vapors.

D. saturated vapors and subcooled liquids.

QUESTION: 39

A nuclear power plant is operating at 90% of rated power. Which one of the following describes the effect of increasing circulating water flow rate through the main condenser?

A. The saturation temperature in the main condenser decreases.

B. The enthalpy of the condensate leaving the main condenser increases.

C. The temperature of the circulating water leaving the main condenser increases.

D. The total rate of heat transfer from the turbine exhaust steam to the circulating water decreases.

QUESTION: 40

A nuclear power plant was initially operating normally at 90% of rated power when heating steam (extracted from the main turbine) was automatically isolated to several feedwater heaters. Reactor power was returned to 90% and the plant was stabilized.

Compared to the initial main generator MW load, the current main generator MW load is...

A. higher, because the steam cycle is less efficient.

B. higher, because less steam is being extracted from the main turbine.

C. lower, because the steam cycle is less efficient.

D. lower, because less steam is being extracted from the main turbine.

QUESTION: 41

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

Given the following information:

Centrifugal Pumps

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

Positive Displacement Pumps

Maximum design pressure:	2,000 psig

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

A. Two CPs in series

B. Two CPs in parallel

C. Two PDPs in parallel

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

QUESTION: 42

A length of pipe in a cooling water system uses a reducer fitting to decrease the pipe diameter from 6 inches to 4 inches. The flow rate in the 6-inch diameter section of pipe is 200 gpm. What is the flow rate in the 4-inch diameter section of pipe?

A. 133 gpm

B. 200 gpm

C. 300 gpm

D. 450 gpm

QUESTION: 43

A nuclear power plant was operating at a steady-state power level with the following main condenser parameters:

Main condenser pressure:	1.2 psia
Cooling water inlet temperature:	60°F
Cooling water outlet temperature:	84°F

As a result of increased condenser air inleakage, the overall heat transfer coefficient of the main condenser decreases by 25%. Main condenser heat transfer rate and cooling water temperatures are unchanged. Which one of the following is the approximate resulting pressure in the main condenser?

A. 1.7 psia

B. 2.3 psia

C. 3.0 psia

D. 4.6 psia

QUESTION: 44

A nuclear reactor is currently shutdown after several months of operation at full power. The shutdown cooling system is in operation, maintaining an average reactor coolant temperature of 280°F. A pressure control malfunction causes RCS pressure to slowly and continuously decrease from 100 psia while reactor coolant temperature remains constant. (Assume a normal reactor coolant flow direction through the core.)

Which one of the following describes where nucleate boiling will first occur?

A. At a scratch on the surface of a fuel rod near the top of a fuel assembly.

B. At a scratch on the surface of a fuel rod near the bottom of a fuel assembly.

C. In the bulk fluid of a coolant channel near the top of a fuel assembly.

D. In the bulk fluid of a coolant channel near the bottom of a fuel assembly.

QUESTION: 45

Carry-under is most damaging to which one of the following components?

A. Main turbine

B. Moisture separator (turbine)

C. Recirculation pump

D. Moisture separator (reactor vessel)

QUESTION: 46

A nuclear reactor was shutdown from steady-state 100% power operation 10 days ago. Five minutes ago, a station blackout occurred that caused the complete loss of forced coolant circulation through the core. The following conditions currently exist:

- Reactor pressure vessel (RPV) pressure indicates 0 psig.
- Main steam isolation valves are closed.
- Reactor head vents are open with no steam issuing.
- Average reactor coolant temperature is 150°F.
- Differential temperature between the upper and lower RPV heads is 20°F and increasing.

Over the next hour or so, with no operator action, which one of the following will occur as natural circulation becomes established in the RPV?

A. RPV pressure will slowly increase and stabilize at about 10 psig, and the differential temperature between the upper and lower RPV heads will stabilize at a value greater than 0°F.

B. RPV pressure will slowly increase and stabilize at about 10 psig, and the differential temperature between the upper and lower RPV heads will stabilize at 0°F.

C. RPV pressure will remain near 0 psig, and the differential temperature between the upper and lower RPV heads will stabilize at a value greater than 0°F.

D. RPV pressure will remain near 0 psig, and the differential temperature between the upper and lower RPV heads will stabilize at 0°F.

QUESTION: 47

The axial peaking factor for a node of a fuel bundle is defined as...

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

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

C. $\frac{\text{bundle average nodal power}}{\text{nodal power}}$

D. $\frac{\text{nodal power}}{\text{bundle average nodal power}}$

QUESTION: 48

The amount of heat stored in the fuel, resulting from the operating kW/foot existing in the fuel prior to a scram, is measured by the...

A. average planar linear heat generation rate (APLHGR).

B. linear heat generation rate (LHGR) multiplied by the total peaking factor.

C. core fraction of limiting power density.

D. APLHGR-to-MAPLHGR ratio.

QUESTION: 49

During normal power operation a reactor pressure increase causes critical power to _____ because the latent heat of vaporization for the reactor coolant _____.

A. increase; decreases

B. decrease; decreases

C. increase; increases

D. decrease; increases

QUESTION: 50

Two identical nuclear reactors are currently shut down for refueling. Reactor A has achieved an average lifetime power capacity of 60% while operating for 12 years. Reactor B has achieved an average lifetime power capacity of 60% while operating for 15 years.

Which reactor, if any, will have the lower reactor vessel nil ductility transition temperature?

A. Reactor A because it has produced the fewer total number of fissions.

B. Reactor B because it has produced the greater total number of fissions.

C. Both reactors will have approximately the same nil ductility transition temperature because they have equal average lifetime power capacities.

D. Both reactors will have approximately the same nil ductility transition temperature because the fission rate in a shut down core is not significant.

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

DECEMBER 2005 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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