UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
JUNE 2009 -- 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 materials will be collected 3.0 hours after the examination begins. This examination applies to a typical U.S. boiling water reactor (BWR) nuclear power plant.

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

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

_____
Applicant's Signature

RULES AND GUIDELINES FOR THE NRC
GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

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

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

2.   Fill in your individual docket number.

3.   Fill in the name of your facility.

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

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

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

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

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

7.   Scrap paper will be provided for calculations.

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

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

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

11.   Turn in your examination materials, answer sheet on top, followed by the examination copy and the examination aids - steam table booklets, handouts, and scrap paper used during the examination.

12.   After turning in your examination materials, leave the examination area, as defined by the proctor. If after leaving you are found in the examination area while the examination is in progress, your examination may be forfeited.

GENERIC FUNDAMENTALS EXAMINATION
EQUATIONS AND CONVERSIONS HANDOUT SHEET

EQUATIONS

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

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

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

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

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

$E = IR$

Thermal Efficiency = Net Work Out/Energy In

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

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

CONVERSIONS

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1 Mw $= 3.41 \times 10^6$ Btu/hr

1 hp $= 2.54 \times 10^3$ Btu/hr

1 Btu $= 778$ ft-lbf

°C $= (5/9)(°F - 32)$

°F $= (9/5)(°C) + 32$

1 Curie $= 3.7 \times 10^{10}$ dps

1 kg $= 2.21$ lbm

1 gal$_{water} = 8.35$ lbm

1 ft$^3_{water} = 7.48$ gal

QUESTION: 1

Subcooled water is flowing through a throttled valve with the following initial parameters:

- Inlet pressure   = 60 psia
- Outlet pressure = 50 psia
- Flow rate   = 800 gpm

The valve is opened fully and the following parameters currently exist:

- Inlet pressure   = 60 psia
- Outlet pressure = 55 psia

What is the approximate flow rate through the fully open valve?

A. 400 gpm

B. 566 gpm

C. 635 gpm

D. Cannot be determined without additional information.

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

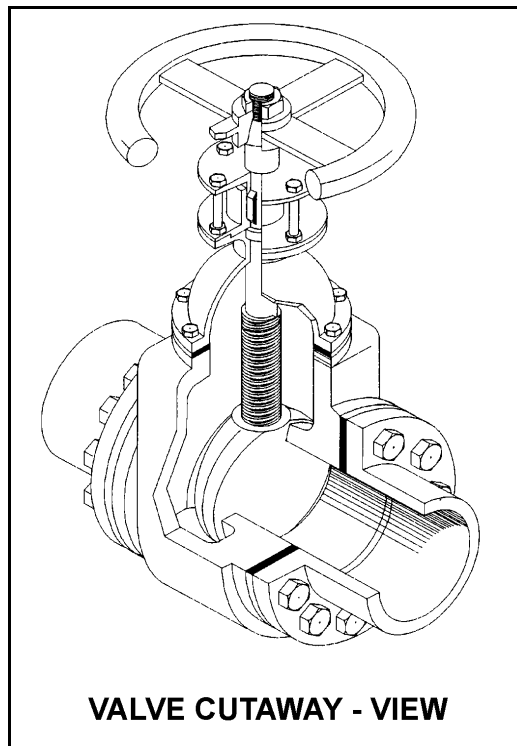B. More closed

C. More open

D. Varies with system flow

SPRING-LOADED AIR-OPERATED VALVE
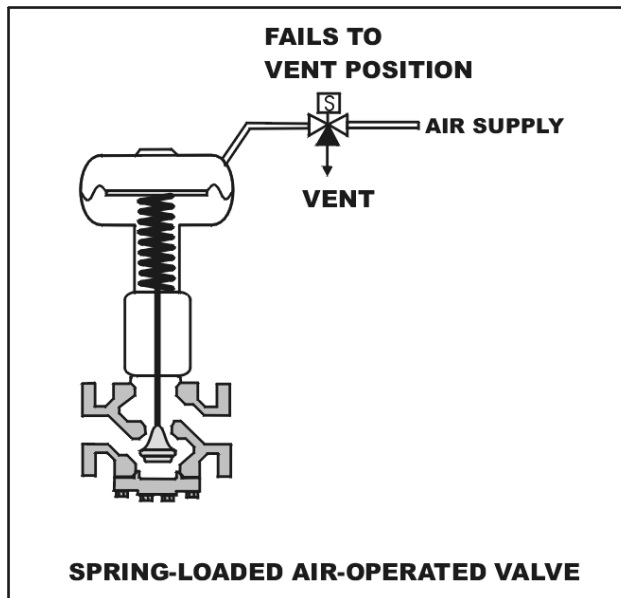
QUESTION: 3

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

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

A. Rising-stem gate valve

B. Rising-stem globe valve

C. Nonrising-stem gate valve

D. Nonrising-stem globe valve

VALVE CUTAWAY - VIEW

QUESTION: 4

Refer to the drawing of a reactor vessel level detection system (see figure below). The differential pressure (D/P) detector was calibrated while the plant was at normal operating conditions.

With the plant initially at normal operating conditions, a reactor vessel head leak occurred. Reactor vessel pressure decreased by 300 psia, and the ambient air temperature surrounding the reference leg increased by 80°F, where these parameters stabilized.

If the actual reactor vessel water level is 6 feet above the fuel, the reduced reactor vessel pressure will tend to make the indicated water level read _____ than actual; and the increased reference leg temperature will tend to make the indicated water level read _____ than actual.

A. higher; higher

B. higher; lower

C. lower; higher

D. lower; lower
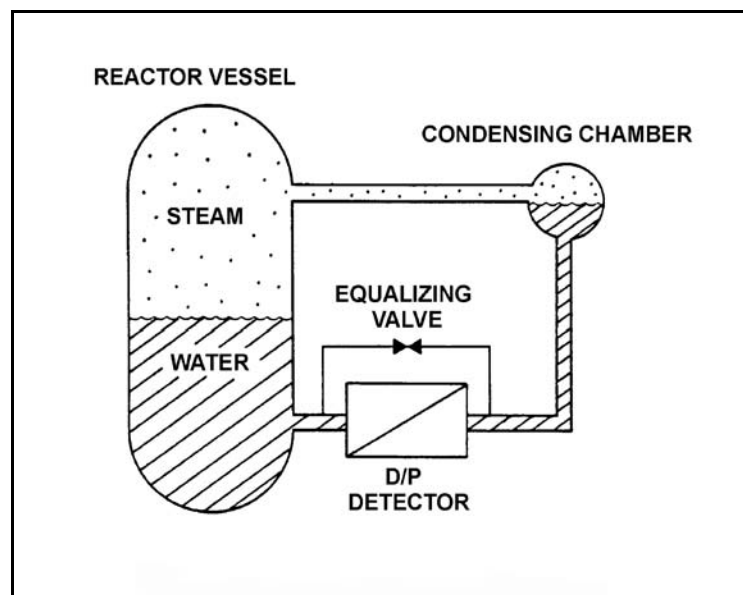
QUESTION: 5

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

What is the effect on the thermocouple reference junctions if the copper extension wires from the reference junction panel to the temperature instrument are replaced with alumel and chromel wires?

A. The reference junctions will be located in the thermocouple connection head.

B. The reference junctions will still be located in the reference junction panel.

C. The reference junctions will be located in the temperature instrument.

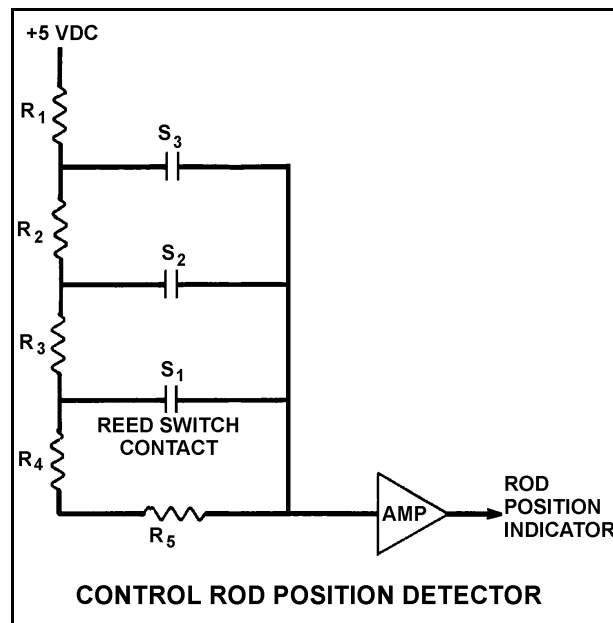D. There will no longer be any reference junctions.
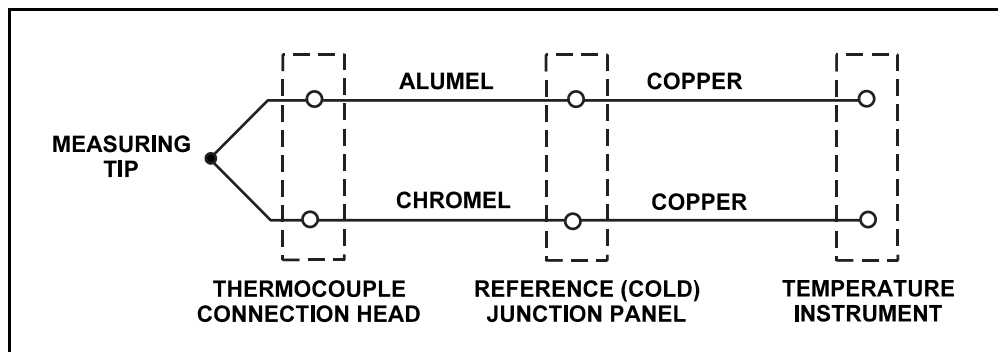
QUESTION: 6

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

+5 VDC

R_1 S_3

R_2 S_2

R_3 S_1

REED SWITCH
CONTACT

R_4

R_5

AMP

ROD
POSITION
INDICATOR

CONTROL ROD POSITION DETECTOR

QUESTION: 7

Which one of the following types of radiation detectors uses a gas volume for radiation detection and will typically produce the weakest output signal if all detectors are placed in the same gamma radiation field?

A. Geiger-Mueller

B. Ion chamber

C. Proportional counter

D. Scintillation

QUESTION: 8

A flow controller has proportional, integral, and derivative control features. Which one of the following lists the effect on the control features when the controller is switched from the automatic mode to the manual mode?

A. Only the derivative feature will be lost.

B. Only the integral and derivative features will be lost.

C. All proportional, integral, and derivative features will be lost.

D. All control features will continue to influence the controller output.

QUESTION: 9

Which one of the following describes the operation of a typical pneumatic valve positioner?

A. Compares the valve controller demand signal with actual valve position and sends an error signal to the valve controller for adjustment of the demand signal.

B. Compares the valve controller automatic and manual setpoints and sends an error signal to the valve controller to ensure the manual demand signal is tracking the automatic demand signal.

C. Receives a valve position error signal from the valve controller and positions the valve as necessary to null the valve position error signal.

D. Receives a demand signal from the valve controller and supplies the appropriate air pressure to the valve actuator to move the valve to the demanded position.

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

A centrifugal pump is taking suction on an open storage tank that has been filled to a level of 40 feet with 10,000 gallons of 60°F water. The pump is located at the base of the tank, takes a suction from the bottom of the tank, and discharges to a lake.

Given:

• The pump is currently operating at its design flow rate of 200 gpm and a total developed head of 150 feet.
• The pump requires 4 feet of net positive suction head.

How will the centrifugal pump flow rate be affected as the water storage tank level decreases?

A. Flow rate will remain constant until the pump begins to cavitate at a tank level of about 4 feet.

B. Flow rate will remain constant until the pump becomes air bound when the tank empties.

C. Flow rate will gradually decrease until the pump begins to cavitate at a tank level of about 4 feet.

D. Flow rate will gradually decrease until the pump becomes air bound when the tank empties.

QUESTION: 12

A single-stage (single impeller) centrifugal pump and a two-stage (two impellers) centrifugal pump have identical head-capacity curves. The pumps are connected to identical suction and discharge piping in a water system.

Compared to the single-stage pump, the two-stage pump produces the same flow rate at about _____ pump discharge head; and for the same flow rate, the two-stage pump requires _____ net positive suction head.

A. twice the; less

B. twice the; more

C. the same; less

D. the same; more

QUESTION: 13

A section of reactor coolant piping is being hydrostatically tested to 1,400 psig using a positive displacement pump. The operating characteristics of the positive displacement pump are shown below, identifying ideal, expected, and actual pump performance.

Which one of the following could cause the observed difference between the expected and the actual pump performance?

A. Pump internal leakage is greater than expected.

B. Reactor coolant piping boundary valve leakage is greater than expected.

C. Available NPSH has decreased more than expected, but remains slightly above required NPSH.

D. A relief valve on the pump discharge piping has opened prior to its setpoint of 1,400 psig.

POSITIVE DISPLACEMENT PUMP CURVE
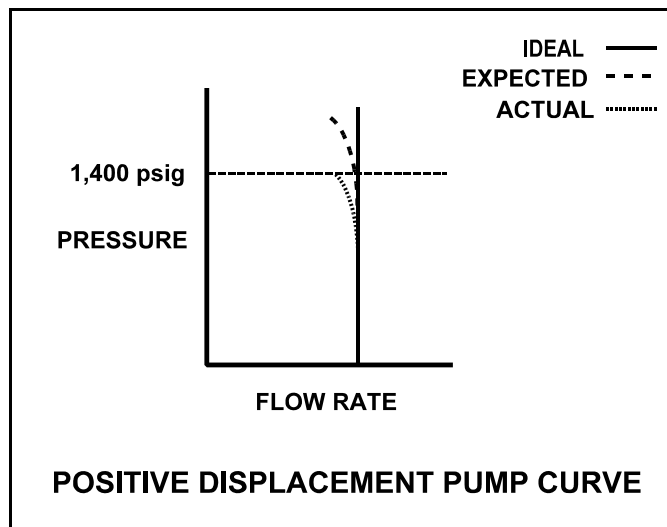
QUESTION: 14

During a surveillance test, a 4,000 KW diesel generator and a 1,000 MW turbine generator at a nuclear power plant are connected to an infinite power grid.

The following stable generator conditions exist:

Diesel Generator	Turbine Generator
700 KW	800 MW
200 KVAR (out)	100 MVAR (out)

A malfunction then occurs, causing the voltage regulator for the turbine generator to slowly and continuously increase the generator field excitation current. If no operator action is taken, the diesel generator output current will _____ until the turbine generator output breaker trips.

A. remain about the same

B. increase continuously

C. initially increase, and then decrease

D. initially decrease, and then increase

QUESTION: 15

A main generator is supplying 300 MVAR to the power grid with a 0.85 power factor. What is the approximate MW load on the main generator?

A. 186 MW

B. 353 MW

C. 484 MW

D. 569 MW

QUESTION: 16

A reactor is shut down with a reactor coolant temperature of $400°F$ and all control rods fully inserted. What is the <u>major</u> adverse consequence resulting from rapidly reducing the reactor coolant temperature to $250°F$?

A. Excessive stress in the ceramic fuel pellets of the reactor core

B. Excessive stress on the reactor vessel wall

C. Uncontrolled reactor criticality

D. Loss of core inlet subcooling

QUESTION: 17

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

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

A. The main condenser tubes are cleaned.

B. The main condenser tubes become increasingly fouled.

C. Cooling water 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.
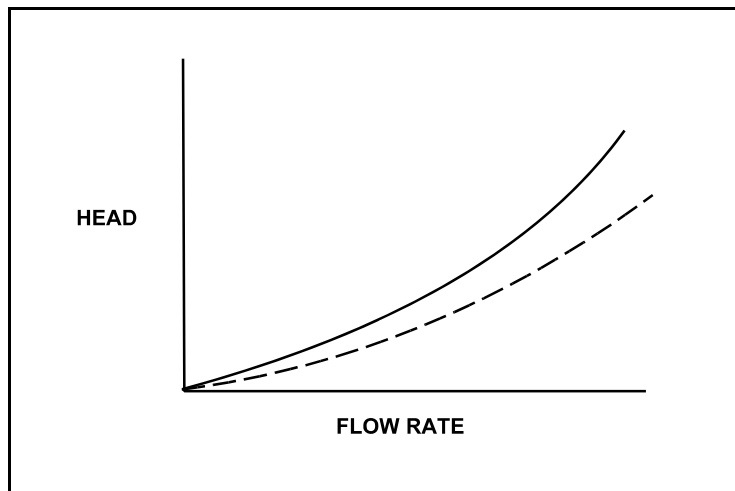
QUESTION: 18

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 available net positive suction head.

D. Decreased condensate pump flow rate.

QUESTION: 19

Channeling in a demineralizer is undesirable because the...

A. ability of the resin bed to remove undesirable ions will decrease and cause outlet conductivity to increase.

B. ability of the resin bed to remove suspended solids will decrease and cause outlet pH to increase.

C. resulting high velocity fluid flow will cause agitation of the resin beads and the release of unwanted ions.

D. resulting high velocity fluid flow can cause significant damage to resin retention elements.

QUESTION: 20

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

A. An increase in suspended solids in the effluent.

B. A decrease in the flow rate through the demineralizer.

C. An increase in the conductivity of the effluent.

D. An increase in the differential pressure across the demineralizer.

QUESTION: 21

While remotely investigating the condition of a normally open feeder breaker to a 480 VAC motor control center (MCC), a control room operator observes the following indications:

    Green breaker position indicating light is out.
    Red breaker position indicating light is lit.
    MCC voltmeter indicates 0 VAC.
    MCC ammeter indicates zero amperes.

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

A. open; in

B. closed; out

C. open; to the test position

D. closed; to the test position

QUESTION: 22

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 are shown open/closed according to the standard convention for control circuit drawings.

Which one of the following will actuate the alarm?

A. With the valve partially closed, the control switch is taken to the CLOSE position.

B. With the valve partially closed, the control switch is taken to the OPEN position.

C. With the valve fully open, the control switch is taken to the CLOSE position.

D. With the valve fully open, the control switch is taken to the OPEN position.

VALVE CONTROL CIRCUIT
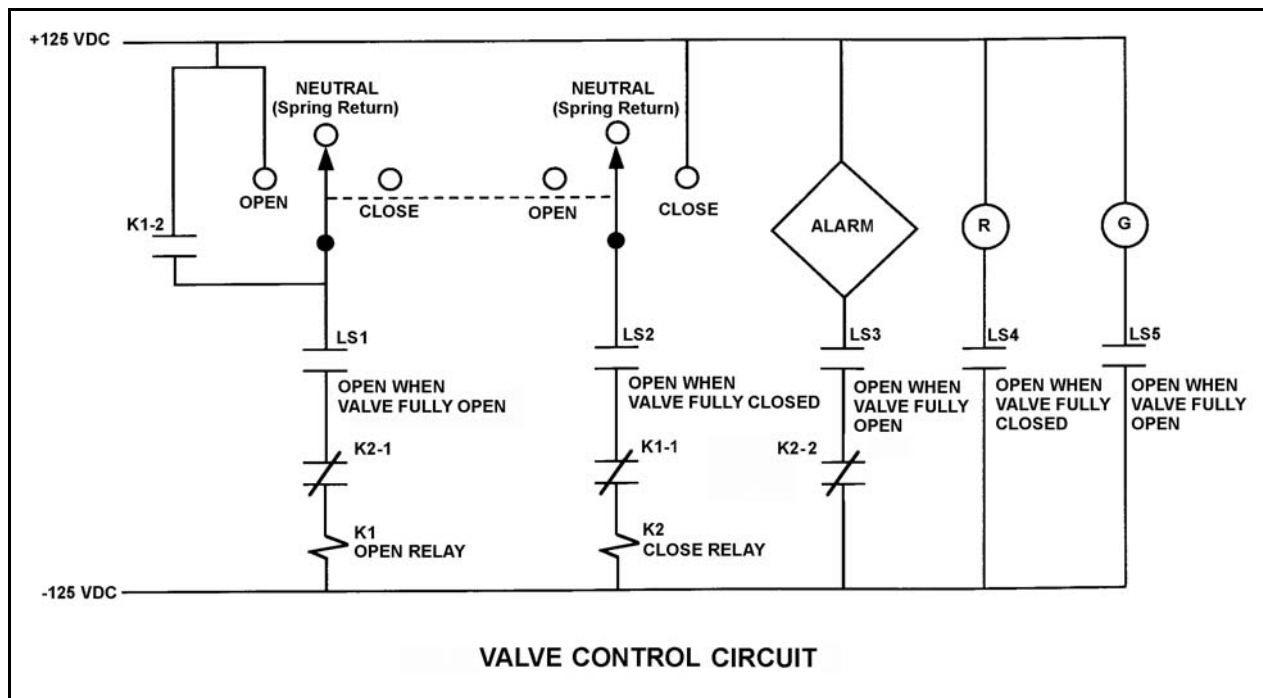
QUESTION: 23

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

A. hydrogen atom in a water molecule.

B. oxygen atom in a water molecule.

C. helium atom in the fuel pin fill gas.

D. zirconium atom in the fuel clad.

QUESTION: 24

A nuclear power plant is currently operating at equilibrium 80% power near the end of its fuel cycle. During the next 3 days of equilibrium power operation no operator action is taken.

How will core K_{eff} be affected during the 3-day period?

A. Core K_{eff} will gradually increase during the entire period.

B. Core K_{eff} will gradually decrease during the entire period.

C. Core K_{eff} will tend to increase, but inherent reactivity feedback will maintain K_{eff} at 1.0.

D. Core K_{eff} will tend to decrease, but inherent reactivity feedback will maintain K_{eff} at 1.0.
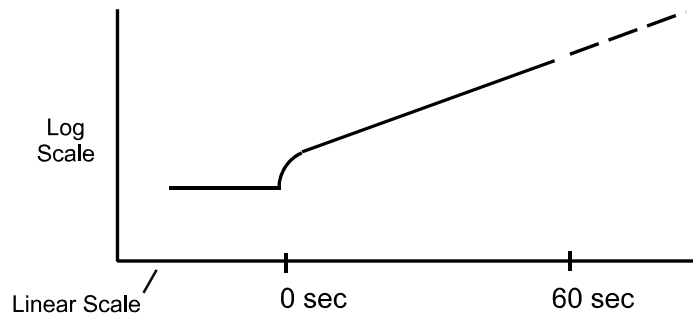
QUESTION: 25

Refer to the partially labeled nuclear reactor response curve shown below for a reactor that was initially subcritical in the source range and remained below the point of adding heat. A small amount of positive reactivity was added at time = 0 sec.

The response curve shows _____ versus time for a reactor that is currently (at time = 60 sec) _____.

A. reactor period; exactly critical

B. reactor period; supercritical

C. reactor fission rate; exactly critical

D. reactor fission rate; supercritical

QUESTION: 26

Which one of the following describes the net reactivity effect of a moderator temperature decrease in an overmoderated reactor core?

A. Positive reactivity will be added because fewer neutrons will be captured by the moderator.

B. Positive reactivity will be added because fewer neutrons will be absorbed at resonance energies while slowing down.

C. Negative reactivity will be added because more neutrons will be captured by the moderator.

D. Negative reactivity will be added because more neutrons will be absorbed at resonance energies while slowing down.

QUESTION: 27

Factors that affect the probability of resonance absorption of a neutron by a nucleus include...

A. kinetic energy of the nucleus, kinetic energy of the neutron, and excitation energy of the nucleus.

B. kinetic energy of the neutron, excitation energy of the nucleus, and excitation energy of the neutron.

C. excitation energy of the nucleus, excitation energy of the neutron, and kinetic energy of the nucleus.

D. excitation energy of the neutron, kinetic energy of the nucleus, and kinetic energy of the neutron.

QUESTION: 28

Criticality has been achieved during a xenon-free nuclear reactor startup. The core neutron flux level is low in the intermediate range and a stable positive 60-second reactor period has been established. The operator begins inserting control rods in an effort to stabilize the core neutron flux level near its current value. The operator stops inserting control rods exactly when the reactor period indicates infinity.

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

A. positive; increase exponentially

B. positive; increase linearly

C. negative; decrease exponentially

D. negative; decrease linearly

QUESTION: 29

A nuclear reactor is operating at 50% power at the beginning of a fuel cycle. Assuming the reactor does not scram, which one of the following compares the effects of dropping a deep control rod out of the core to the effects of dropping the same control rod if it is shallow?

A. Dropping a deep control rod causes a greater change in shutdown margin.

B. Dropping a deep control rod causes a smaller change in shutdown margin.

C. Dropping a deep control rod causes a greater change in axial power distribution.

D. Dropping a deep control rod causes a greater change in radial power distribution.

QUESTION: 30

Which one of the following lists the proper order of substances from the <u>largest</u> to the <u>smallest</u> microscopic cross sections for absorption of thermal neutrons?

A. B-10, U-235, Xe-135

B. B-10, Xe-135, U-235

C. Xe-135, U-235, B-10

D. Xe-135, B-10, U-235

QUESTION: 31

A nuclear reactor scram occurred <u>one hour</u> ago following several months of operation at 100% power. Reactor vessel pressure is being maintained at 800 psia and the source range count rate is currently 400 cps. If no operator action is taken, how will the source range count rate respond during the next 24 hours?

A. The count rate will remain about the same.

B. The count rate will decrease for the entire period.

C. The count rate will initially decrease and then increase.

D. The count rate will initially increase and then decrease.

QUESTION: 32

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

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

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

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

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

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

QUESTION: 33

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

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

A. small; fuel enrichment

B. small; reactivity

C. large; fuel enrichment

D. large; reactivity
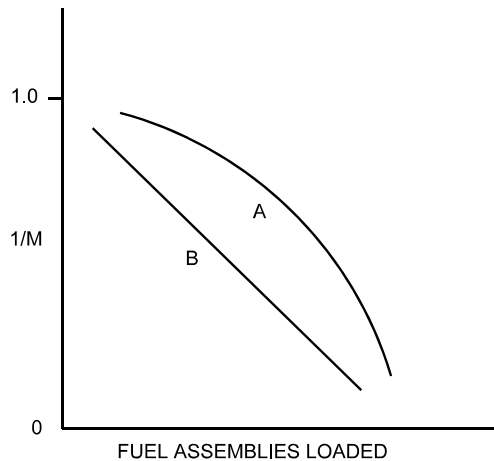
QUESTION: 34

A nuclear reactor is initially stable at the point of adding heat (POAH) with a reactor coolant temperature of 160°F during the reactor heat-up and pressurization phase of a reactor startup. Control rods are withdrawn a few notches to raise reactor power and establish a heat-up rate. Assume no core voiding occurs unless otherwise stated.

If no further control rod withdrawal occurs, reactor power will initially increase, and then...

A. remain stable until voiding begins to occur.

B. continue to increase until the control rods are reinserted.

C. decrease and stabilize at a subcritical power level.

D. decrease and stabilize at the POAH.

QUESTION: 35

With a nuclear reactor on a constant period of 30 minutes, which one of the following power changes requires the least amount of time to occur?

A. $1.0 \times 10^{-8}\%$ to $6.0 \times 10^{-8}\%$

B. $1.0 \times 10^{-7}\%$ to $2.0 \times 10^{-7}\%$

C. $2.0 \times 10^{-7}\%$ to $3.5 \times 10^{-7}\%$

D. $4.0 \times 10^{-7}\%$ to $6.0 \times 10^{-7}\%$

QUESTION: 36

A nuclear power plant is initially operating at 100% power when a control rod fully inserts into the core. Assume the reactor does <u>not</u> scram. With <u>no</u> operator action, reactor power will initially decrease and then...

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

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

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

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

QUESTION: 37

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

P1 and P2 are pressures sensed in the ventilation duct. With the conditions shown, P1 is _____ than P2; and airflow is to the _____.

A. less; left

B. less; right

C. greater; left

D. greater; right

DIFFERENTIAL PRESSURE MANOMETER
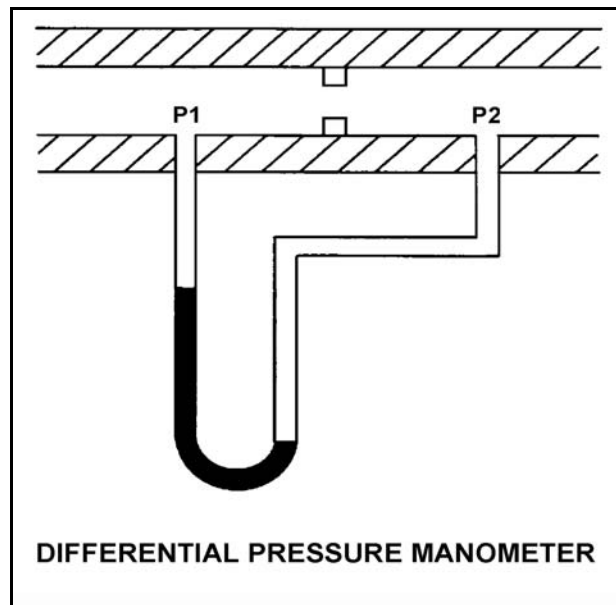
QUESTION: 38

Given a set of steam tables with the following parameters for saturated steam-water mixtures:

- Pressure
- Enthalpy
- Specific volume
- Entropy
- Temperature

One can determine the _____ of a saturated steam-water mixture given only the _____.

A. temperature; enthalpy

B. temperature; pressure

C. pressure; entropy

D. pressure; specific volume

QUESTION: 39

Refer to the drawing of a steam-jet air ejector (see figure below) in normal operation with the steam attaining supersonic velocity.

Steam flowing from C to D undergoes a pressure _____ and a velocity _____.

A. decrease; decrease

B. decrease; increase

C. increase; increase

D. increase; decrease

STEAM-JET AIR EJECTOR
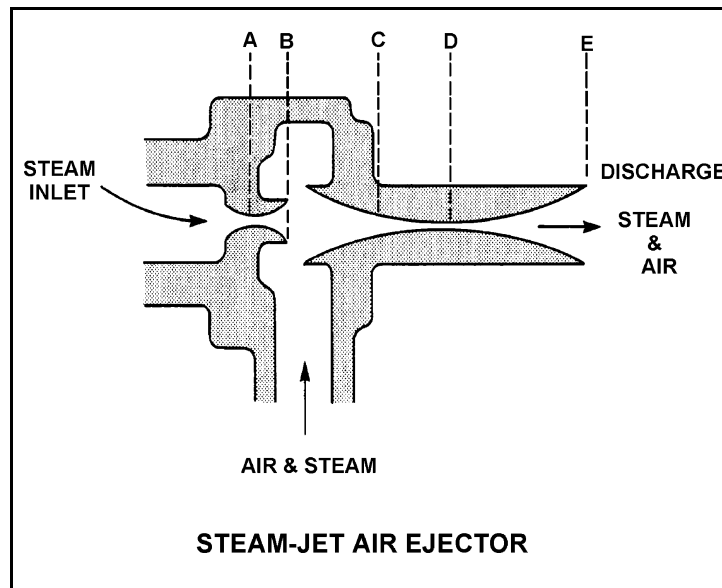
QUESTION: 40

A nuclear power plant is operating at 80% of rated power with 10°F of condensate subcooling. Which one of the following initially will increase the steam cycle thermodynamic efficiency? (Assume main condenser vacuum does <u>not</u> change unless stated otherwise.)

A. Isolating heating steam to a feedwater heater.

B. Decreasing main condenser cooling water flow rate.

C. Decreasing main condenser cooling water temperature.

D. Decreasing main condenser vacuum (increasing pressure).

QUESTION: 41

A nuclear power plant is operating at full power when a 200 gpm reactor coolant leak occurs, which results in a reactor scram and initiation of emergency coolant injection. Reactor vessel pressure stabilizes at 900 psia and all injection pumps are operating with all pump miniflow paths isolated. The shutoff heads for the pumps are as follows:

    High pressure coolant injection (HPCI) pumps: 800 psia
    Low pressure coolant injection (LPCI) pumps: 200 psia

Which pumps are currently threatened for operability and why?

A. Only the LPCI pumps due to pump overheating

B. All LPCI and HPCI pumps due to pump overheating

C. Only the HPCI pumps due to motor overheating

D. All LPCI and HPCI pumps due to motor overheating

QUESTION: 42

A vented water storage tank contains 60 feet of water at 70°F. A cracked weld at the bottom of the tank results in a leak rate of 12 gpm. If makeup water flow rate is 5 gpm, at what water level will the tank stabilize?

A. 38.7 feet

B. 25.0 feet

C. 10.4 feet

D. 0.0 feet

QUESTION: 43

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

A. The steam pressure used in the heat balance calculation was 50 psi higher than actual steam pressure.

B. The ambient heat loss value used in the heat balance calculation was twice the actual ambient heat loss.

C. The feedwater flow rate used in the heat balance calculation was 10% lower than actual feedwater flow rate.

D. The feedwater temperature used in the heat balance calculation was 20°F higher than actual feedwater temperature.
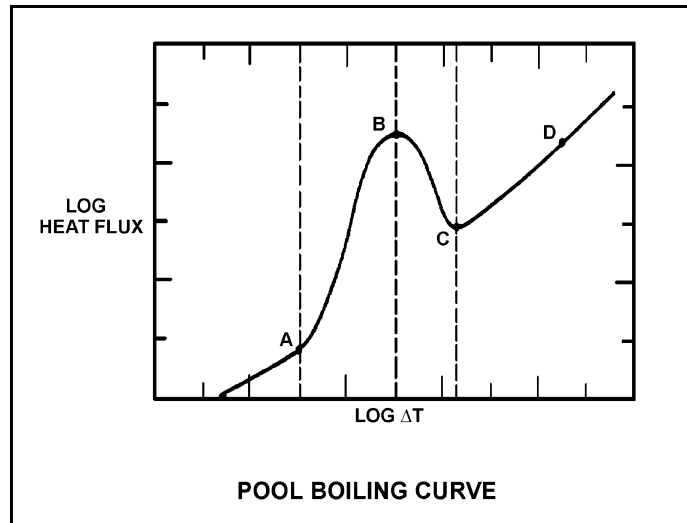
QUESTION: 44

Refer to the drawing of a pool boiling curve (see figure below).

Which one of the points shown marks the smallest ΔT at which stable film boiling can exist?

A. A

B. B

C. C

D. D

POOL BOILING CURVE

QUESTION: 45

Given the following conditions:

    10 lbm mixture of vapor and liquid
    Steam quality = 30%
    Pressure   = 1,000 psia

Which one of the following is the void fraction?

A. 10.1%

B. 11.3%

C. 88.7%

D. 89.9%

QUESTION: 46

Consider the temperature profile from the centerline of a fuel pellet to the centerline of the adjacent
flow channel under 100% power conditions and single-phase cooling. Which one of the following
portions of the temperature profile will have the <u>greatest</u> temperature difference across it at the
beginning of a fuel cycle?

A. Pellet-to-clad gap

B. Zircaloy cladding

C. Cladding corrosion film

D. Flow channel boundary layer

QUESTION: 47

Which one of the following is indicated when the maximum average power ratio (MAPRAT) is greater than 1.0?

A. The linear heat generation rate (LHGR) limit has <u>not</u> been exceeded.

B. The average planar linear heat generation rate (APLHGR) limit has <u>not</u> been exceeded.

C. The LHGR limit has been exceeded.

D. The APLHGR limit has been exceeded.

QUESTION: 48

For what operational condition does the flow biasing correction factor (K_f) adjust the minimum critical power ratio?

A. Operation at less than rated steam flow.

B. Operation at greater than rated steam flow.

C. Operation at less than rated core flow.

D. Operation at greater than rated core flow.

QUESTION: 49

Studies of nuclear fuel rod damage revealed that two essential criteria for pellet-clad interaction fuel damage are cladding stress and a chemical embrittling fission product interaction between two chemical agents and the zircaloy cladding.

What are the two (2) chemical agents?

A. Iodine and cadmium

B. Cadmium and bromine

C. Bromine and ruthenium

D. Ruthenium and iodine

QUESTION: 50

Two identical nuclear reactors have been in operation for the last 10 years. Reactor A has experienced 30 heatup/cooldown cycles with an average power capacity of 60%. Reactor B has experienced 40 heatup/cooldown cycles with an average power capacity of 50%.

Which reactor will have the lowest reactor vessel nil-ductility transition temperature?

A. Reactor A due to the higher average power capacity

B. Reactor A due to the fewer number of heatup/cooldown cycles

C. Reactor B due to the lower average power capacity

D. Reactor B due to the greater number of heatup/cooldown cycles

***FINAL ANSWER KEY ***

JUNE 2009 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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