UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED 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. pressurized water reactor (PWR) 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

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

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

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

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

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

$E = IR$

Thermal Efficiency = Net Work Out/Energy In

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

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

CONVERSIONS

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1 Mw = 3.41×10^6 Btu/hr	1 Curie = 3.7×10^{10} dps
1 hp = 2.54×10^3 Btu/hr	1 kg = 2.21 lbm
1 Btu = 778 ft-lbf	1 gal_{water} = 8.35 lbm
°C = (5/9)(°F - 32)	1 ft^3_{water} = 7.48 gal
°F = (9/5)(°C) + 32	

QUESTION: 1

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

A stop check valve is a type of check valve that...

A. cannot be shut remotely.

B. can be used to prevent flow in both directions.

C. can be opened manually to allow flow in both directions.

D. contains both a gate valve disk and a check valve disk.

QUESTION: 3

The 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 psi, the cooling water system pressure indication will... (Disregard any temperature effect on the detector.)

A. decrease to 80 psig.

B. decrease by a small, but indeterminate amount.

C. increase to 120 psig.

D. increase by a small, but indeterminate amount.

QUESTION: 4

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

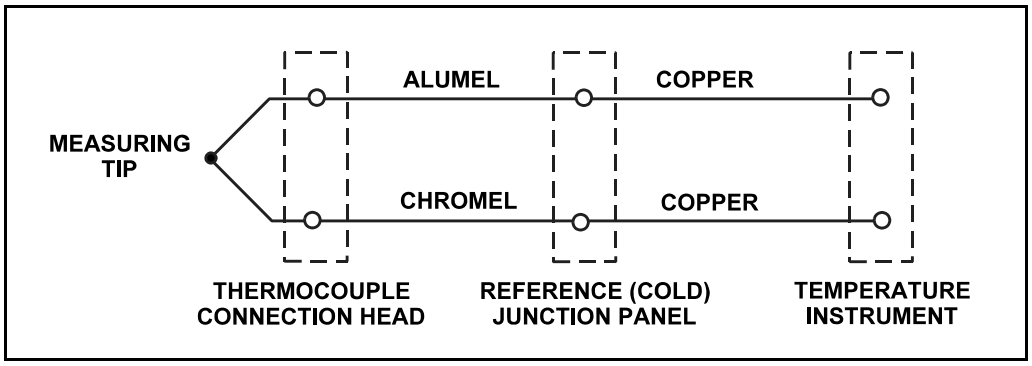
What is the effect on the thermocouple reference junctions if the copper extension wires from the reference junction panel to the temperature instrument are replaced with alumel and chromel wires?

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: 5

A nuclear power plant startup is in progress immediately following a reactor refueling outage. The external nuclear instrumentation (NI) was calibrated at 50% power just prior to the refueling outage and has not been readjusted.

If actual reactor power level is increased to 50% and stabilized, NI power level will indicate _____ than actual reactor power level because, when compared to pre-outage 50% power level operation, _____.

A. higher; the total core fission rate has increased

B. lower; the total core fission rate has decreased

C. higher; the fission rate in the outer portion of the core has increased

D. lower; the fission rate in the outer portion of the core has decreased

QUESTION: 6

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: 7

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

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

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

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

D. remain constant during and after the load start.

QUESTION: 8

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

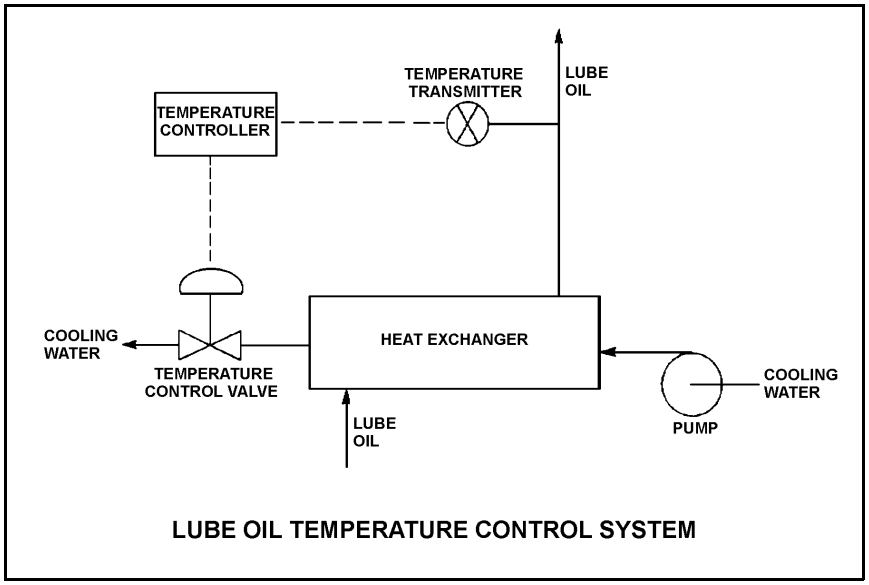
If the temperature transmitter fails high (high temperature output signal), the temperature controller will position the temperature control valve more _____, causing the actual heat exchanger lube oil outlet temperature to _____.

A. open; decrease

B. open; increase

C. closed; decrease

D. closed; increase



LUBE OIL TEMPERATURE CONTROL SYSTEM

QUESTION: 9

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.

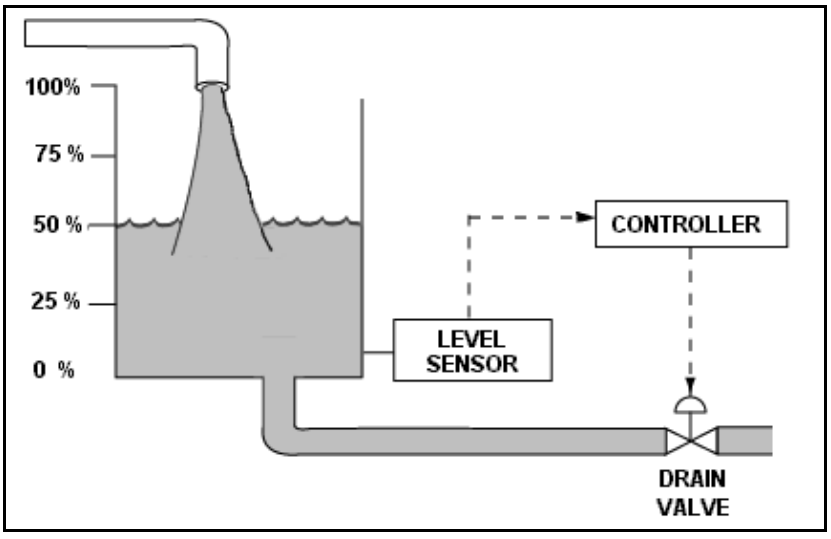
The tank suddenly develops a 200 gpm leak, while the input flow rate remains constant at 500 gpm. After the tank water level stabilizes, level will be _____, and the drain valve position will be _____.

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: 10

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

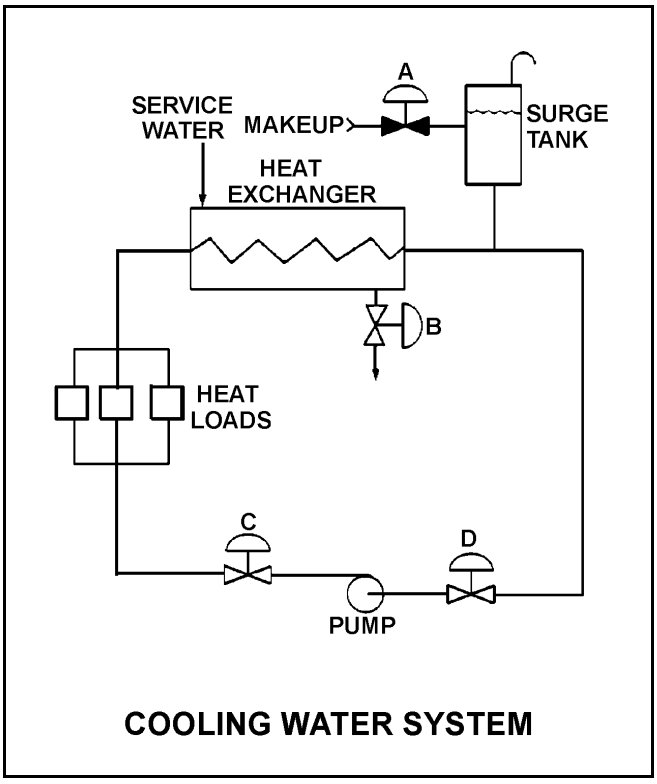
Which one of the following will increase available net positive suction head for the centrifugal pump?

A. Draining the surge tank to decrease level by 10%.

B. Positioning heat exchanger service water valve "B" more closed.

C. Positioning pump discharge valve "C" more closed.

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



COOLING WATER SYSTEM

QUESTION: 11

Which one of the following contains two reasons for starting a typical radial-flow centrifugal pump with the discharge piping full of water and the discharge valve shut?

A. Prevent pump runout and prevent motor overspeed.

B. Prevent pump runout and ensure lubrication of pump seals.

C. Prevent water hammer and ensure adequate pump recirculation flow.

D. Prevent water hammer and prevent excessive duration of starting current.

QUESTION: 12

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

Given:

- The eye of the pump impeller is located 30 feet below the tank water level.
- The pump has a design shutoff head of 120 feet.
- The required net positive suction head (NPSH) for the pump is 15 feet.
- The tank water temperature is 60°F.

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

A. 106 feet

B. 121 feet

C. 136 feet

D. 151 feet

QUESTION: 13

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

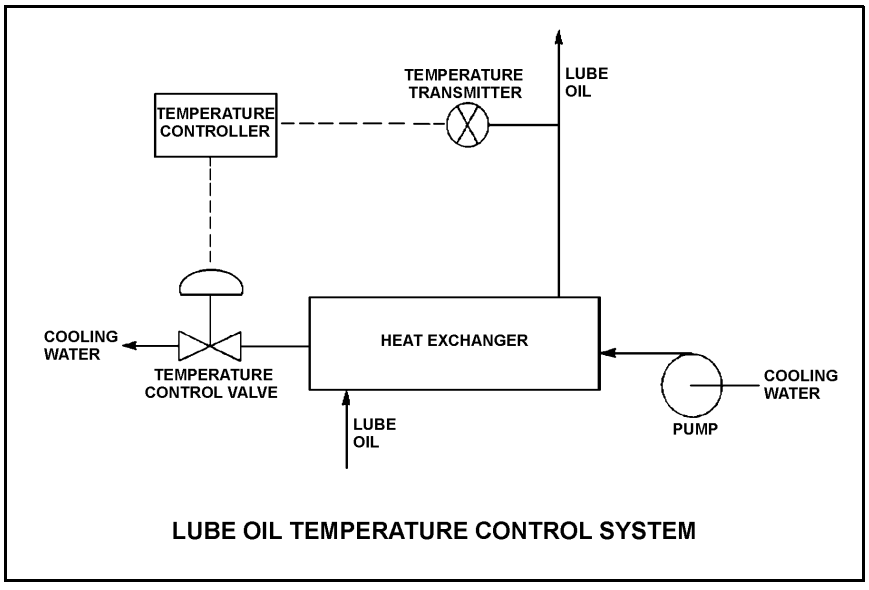
The pump is operating with the temperature control valve one-half open. If the temperature control valve modulates farther closed, system head loss will _____ and pump head will _____.

A. increase, decrease

B. increase, increase

C. decrease, decrease

D. decrease, increase



LUBE OIL TEMPERATURE CONTROL SYSTEM

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

Frequent starts of large motors will result in overheating of the motor windings due to high current flow caused by...

A. low electrical resistance of the motor windings.

B. an electrical short circuit between the rotor and stator.

C. high counter electromotive force at low rotor speeds.

D. windage losses between the rotor and stator.

QUESTION: 16

A main turbine-generator is operating at 80% load with the following initial steady-state temperatures for the main turbine lube oil heat exchanger:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

After six months of main turbine operation, the following final steady-state lube oil heat exchanger temperatures are observed:

$T_{oil\ in}$ = 179°F
$T_{oil\ out}$ = 119°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Assume that the final cooling water and lube oil flow rates are the same as the initial flow rates, and that the specific heat values for the cooling water and lube oil do not change.

Which one of the following could be responsible for the differences between the initial and final heat exchanger steady-state temperatures?

A. The heat exchanger tubes have become fouled with scale.

B. The temperature of the cooling water source has increased.

C. The final main turbine-generator load is higher than the initial load.

D. The final main turbine-generator load is lower than the initial load.

QUESTION: 17

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

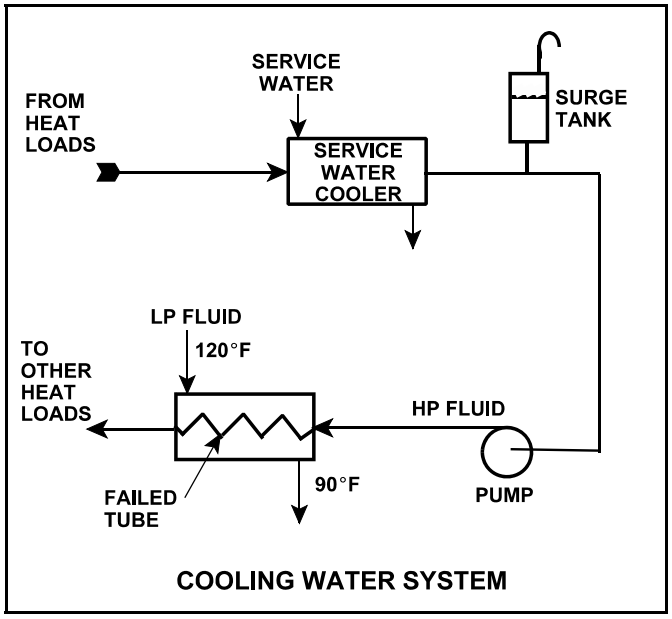
Which one of the following will occur as a result of the indicated tube failure in the heat exchanger?

A. High pressure (HP) fluid inventory increases.

B. Pressure in the low pressure (LP) system decreases.

C. Temperature in the low pressure (LP) system increases.

D. Level in the surge tank decreases.



QUESTION: 18

Reactor coolant is flowing through a mixed-bed ion exchanger. The ion exchanger is boron saturated. Which one of the following describes a condition that will result in the boron concentration of the ion exchanger outlet water being greater than the boron concentration of the inlet water?

A. An increase in reactor coolant ionic impurities with higher relative affinities for the resin exchange sites will displace borate ions from the resin exchange sites.

B. An increase in reactor coolant suspended solids with greater mass than the borate ions will mechanically remove borate ions from the resin exchange sites.

C. A decrease in the temperature of the inlet water will lower the relative affinity of the resin for the borate ions, which releases borate ions from the resin exchange sites.

D. A decrease in the flow rate through the ion exchanger will lower the retention capacity of the resin, which releases borate ions from the resin exchange sites.

QUESTION: 19

After 12 months of operation at 100% power, a nuclear reactor is shut down 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 oxygen-16 dissolved in the reactor coolant.

C. Increased radioactive nitrogen-16 dissolved in the reactor coolant.

D. Increased radioactive corrosion products suspended in the reactor coolant.

QUESTION: 20

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

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

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

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

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

QUESTION: 21

Refer to the simplified drawing of an electrical distribution system (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.

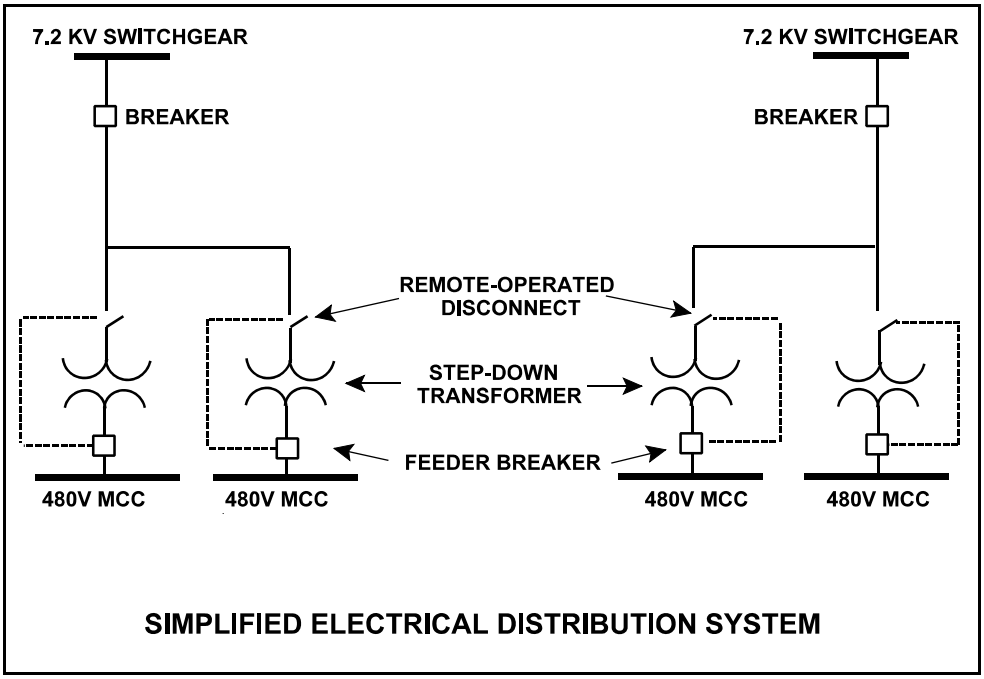
Which one of the following describes the purpose served by the interlock?

A. Prevent damage to the disconnect.

B. Prevent damage to the transformer.

C. Prevent damage to the feeder breaker.

D. Prevent damage to the 480 V MCC.



SIMPLIFIED ELECTRICAL DISTRIBUTION SYSTEM

QUESTION: 22

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: 23

Delayed neutrons are neutrons that...

A. have reached thermal equilibrium with the surrounding medium.

B. are expelled as thermal neutrons.

C. are expelled at a lower average kinetic energy than most other fission neutrons.

D. are responsible for the majority of U-235 fissions.

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

Reactor power increases from 1.0×10^{-8}% to 5.0×10^{-7}% in two minutes. What is the average startup rate?

A. 0.95 dpm

B. 0.90 dpm

C. 0.85 dpm

D. 0.82 dpm

QUESTION: 26

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: 27

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: 28

A nuclear reactor is operating at 60% power near the end of a fuel cycle with the controlling group of control rods inserted 5% into the core. Which one of the following will cause group differential rod worth to become less negative? (Consider only the direct effect of the indicated change.)

A. Burnable poison rods become increasingly depleted.

B. Core Xe-135 concentration decreases toward an equilibrium value.

C. Reactor coolant temperature is allowed to decrease from 575°F to 570°F.

D. Reactor power is decreased to 50% using control rods for control of RCS temperature.

QUESTION: 29

If core quadrant power distribution (sometimes called quadrant power tilt or azimuthal tilt) is maintained within design limits, which one of the following conditions is most likely?

A. Axial power distribution is within design limits.

B. Radial power distribution is within design limits.

C. Nuclear instrumentation is indicating within design accuracy.

D. Departure from nucleate boiling ratio is within design limits.

QUESTION: 30

Which one of the following exhibits the greatest microscopic cross section for absorption of a thermal neutron in an operating nuclear reactor core?

A. Uranium-235

B. Boron-10

C. Samarium-149

D. Xenon-135

QUESTION: 31

A nuclear reactor trip occurred one hour ago following several months of operation at 100% power. Reactor coolant temperature is being maintained at 550°F 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

Which one of the following correctly compares the rates at which reactor power can be safely increased from 80% to 100% at the beginning of a fuel cycle (BOC) and at the end of a fuel cycle (EOC)?

A. Slower at EOC due to a lower maximum rate of reactor coolant boron dilution.

B. Slower at EOC due to a less negative control rod worth.

C. Slower at BOC due to a lower maximum rate of reactor coolant boron dilution.

D. Slower at BOC due to a less negative control rod worth.

QUESTION: 33

During a nuclear reactor startup, the first positive reactivity addition caused the count rate to increase from 20 cps to 30 cps. The second positive reactivity addition caused the count rate to increase from 30 cps to 60 cps. Assume K_{eff} was 0.97 prior to the first reactivity addition.

Which one of the following statements describes the magnitude of the reactivity additions?

A. The first reactivity addition was approximately 50% larger than the second.

B. The second reactivity addition was approximately 50% larger than the first.

C. The first and second reactivity additions were approximately equal.

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

QUESTION: 34

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

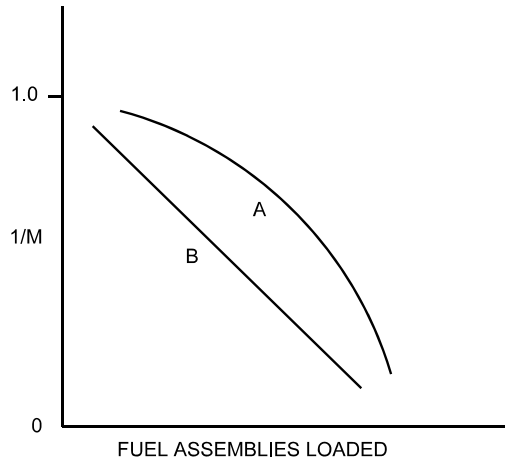
Curve A would result if each fuel assembly loaded during the early stages of core refueling caused a relatively _____ fractional change in source range count rate compared to the later stages of the refueling; curve B would result if each fuel assembly contained equal _____.

A. small; fuel enrichment

B. small; reactivity

C. large; fuel enrichment

D. large; reactivity



QUESTION: 35

A nuclear reactor is critical at a stable power level below the point of adding heat (POAH) when a small amount of positive reactivity is added. Which one of the following reactivity coefficient(s) will stabilize reactor power at the POAH?

A. Moderator temperature only

B. Fuel temperature only

C. Moderator temperature and fuel temperature

D. Fuel temperature and moderator voids

QUESTION: 36

Nuclear reactors A and B are identical and have been operated at 100% power for six months when a reactor trip occurs simultaneously on both reactors. All reactor A control rods fully insert. One reactor B control rod sticks fully withdrawn.

When compared to reactor B, after five minutes the core fission rate in reactor A will be _____, and the reactor period in reactor A will be _____.

A. the same; shorter

B. the same; the same

C. lower; shorter

D. lower; the same

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 currently 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.

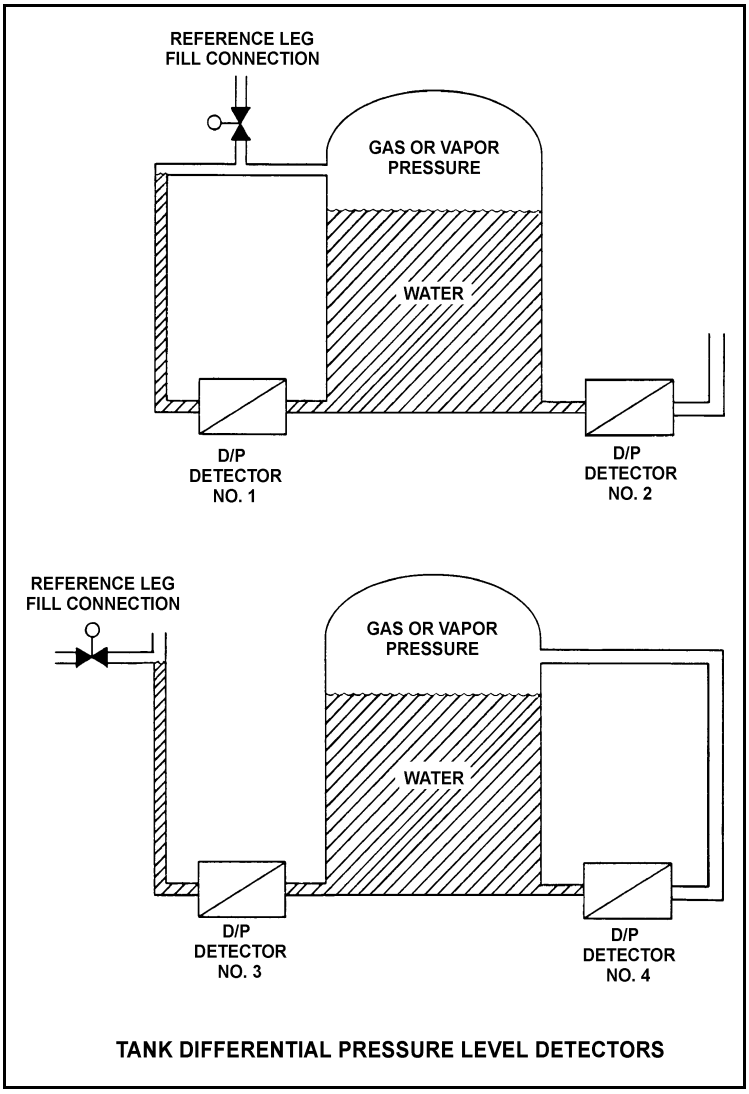
If a leak in the top of each tank causes a complete loss of overpressure, which level detector(s) will produce the lowest level indication?

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

Which one of the following describes the effect of removing heat from a steam-water mixture that is in a saturated condition? (Assume the mixture remains saturated.)

A. Quality will increase.

B. Quality will decrease.

C. Temperature will increase.

D. Temperature will decrease.

QUESTION: 39

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: 40

A pressurizer safety valve is leaking by, allowing the 100% quality steam in the pressurizer to flow to the pressurizer relief tank (PRT). The reactor has been shut down, and a plant cooldown and depressurization are in progress. PRT pressure is being maintained constant at 35 psia.

Which one of the following describes how the safety valve tailpipe temperature will be affected as pressurizer pressure slowly decreases from 1,500 psia to 500 psia? (Assume there is no ambient heat loss from the tailpipe.)

A. Increases, because the entropy of the pressurizer steam will be increasing.

B. Increases, because the enthalpy of the pressurizer steam will be increasing.

C. Decreases, because the mass flow rate of the leaking steam will be decreasing.

D. Decreases, because the temperature of the pressurizer steam will be decreasing.

QUESTION: 41

Consider the thermal efficiency of a nuclear power plant operating at rated power.

If the pressure at which saturated steam is produced in the steam generators is increased, thermal efficiency will _____; and if the temperature of the feedwater entering the steam generators is increased, thermal efficiency will _____.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 42

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

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

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

QUESTION: 43

Which one of the following will <u>decrease</u> the head loss occurring in an operating cooling water system?

A. Starting a second pump in parallel with the operating pump.

B. Shifting two heat exchangers from parallel to series operation.

C. Replacing a 10 foot section of 10-inch diameter pipe with a 20 foot section of 10-inch diameter pipe.

D. Replacing a 20 foot section of 10-inch diameter pipe with a 20 foot section of 12-inch diameter pipe.

QUESTION: 44

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: 45

Which one of the following is an example of significant radiative heat transfer?

A. Heat transfer from one fuel rod to an adjacent fuel rod during stable film boiling.

B. Heat transfer from the center to the edge of a fuel pellet at end of core life.

C. Heat transfer from the reactor coolant to the feedwater in a steam generator.

D. Heat transfer from the fuel cladding to the reactor coolant via subcooled nucleate boiling.

QUESTION: 46

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

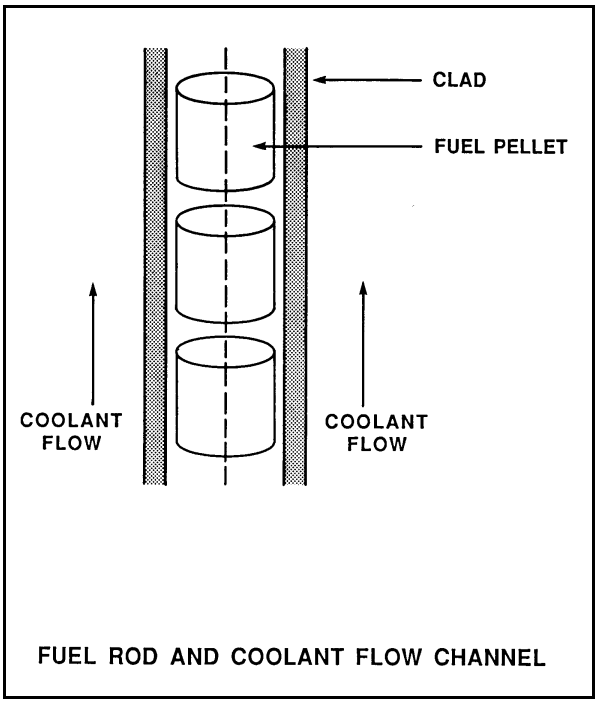
At 100% reactor power, the greatest temperature difference in a fuel channel radial temperature profile will occur across the: (Assume the temperature profile begins at the fuel centerline.)

A. fuel pellet centerline to pellet surface.

B. fuel pellet surface-to-clad gap.

C. zircaloy cladding.

D. flow channel boundary (laminar) layer.



FUEL ROD AND COOLANT FLOW CHANNEL

QUESTION: 47

A nuclear reactor is producing 3,400 MW of thermal output with a vessel ΔT of 60°F and a vessel mass flow rate of 1.4 x 10^8 lbm/hr. If core ΔT is 63.6°F, what is core bypass flow rate? (Assume bypass flow ΔT equals 0°F.)

A. 7.92 x 10^6 lbm/hr

B. 8.40 x 10^6 lbm/hr

C. 1.26 x 10^8 lbm/hr

D. 1.32 x 10^8 lbm/hr

QUESTION: 48

A nuclear power plant is experiencing natural circulation core cooling following a loss of coolant accident. Which one of the following, when it first occurs, marks the beginning of reflux core cooling? (Assume the steam generators contain U-tubes.)

A. Reactor core steam production results in two-phase coolant entering the hot leg and passing through the steam generators.

B. Hot leg steam quality is so high that the steam generators cannot fully condense it and two-phase coolant is returned to the reactor vessel via the cold leg.

C. Hot leg condensation is unable to pass completely through the steam generators to enter the cold legs.

D. The steam generators are no longer able to condense any of the steam contained in the hot leg.

QUESTION: 49

Nuclear reactor core peaking (or hot channel) factors are used to establish a maximum reactor power level such that fuel pellet temperature is limited to prevent _____ and fuel clad temperature is limited to prevent _____ during most analyzed transients and abnormal conditions.

A. fuel pellet melting; fuel clad melting

B. excessive fuel pellet expansion; fuel clad melting

C. fuel pellet melting; excessive fuel clad oxidation

D. excessive fuel pellet expansion; excessive fuel clad oxidation

QUESTION: 50

The thermal stress experienced by the reactor vessel during a reactor coolant system cooldown is...

A. tensile across the entire vessel wall.

B. tensile at the inner wall, compressive at the outer wall of the vessel.

C. compressive across the entire vessel wall.

D. compressive at the inner wall, tensile at the outer wall of the vessel.

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

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

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