

**UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001--FORM A**

Please Print

Name: _____

Facility: _____

Docket No.: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO APPLICANT

Answer all the test items using the answer sheet provided. Each item has equal point value. A score of at least 80% is required to pass this portion of the written licensing examination. All examination papers will be collected 4.0 hours after the examination starts. This examination applies to a typical pressurized water reactor (PWR) power plant.

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

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

Applicant's Signature

RULES AND GUIDELINES FOR THE GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

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

1. Print your name in the blank provided on the cover sheet of the examination.
2. Fill in the name of your facility.
3. Fill in your individual docket number.
4. Fill in your start and stop times at the appropriate time.
5. Two aids are provided for your use during the examination:
 - (1) An equations and conversions sheet contained within the examination copy, and
 - (2) Steam tables provided by your proctor.
6. Place your answers on the answer sheet provided. Credit will only be given for answers properly marked on this sheet. Follow the instructions for filling out the answer sheet.
7. Scrap paper will be provided for calculations.
8. Cheating on the examination will result in the automatic forfeiture of this examination. Cheating could also result in severe penalties.
9. Restroom trips are limited. Only **ONE** examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside of the examination room.
10. After you have completed the examination, sign the statement on the cover sheet indicating that the work is your own and you have neither given nor received any assistance in completing the examination.
11. Turn in your examination materials, answer sheet on top, followed by the examination booklet, then examination aids - steam table booklets, handouts, and scrap paper used during the examination.
12. After turning in your examination materials, leave the examination area, as defined by the proctor. If after leaving you are found in the examination area while the examination is in progress, your examination may be forfeited.

GENERIC FUNDAMENTALS EXAMINATION
EQUATIONS AND CONVERSIONS HANDOUT SHEET

EQUATIONS

$$\dot{Q} = \dot{m}c_p \Delta T \quad P = P_o 10^{SUR(t)}$$

$$\dot{Q} = \dot{m} \Delta h \quad P = P_o e^{(t/\tau)}$$

$$\dot{Q} = UA\Delta T \quad A = A_o e^{-\lambda t}$$

$$\dot{Q} \propto \dot{m}_{\text{Nat Circ}}^3 \quad CR_{S/D} = S/(1 - K_{\text{eff}})$$

$$\dot{Q} \propto \dot{m}_{\text{Nat Circ}}^3 \quad CR_1(1 - K_{\text{eff1}}) = CR_2(1 - K_{\text{eff2}})$$

$$\Delta T \propto \dot{m}_{\text{Nat Circ}}^2 \quad 1/M = CR_1/CR_X$$

$$K_{\text{eff}} = 1/(1 - \rho) \quad A = \pi r^2$$

$$\rho = (K_{\text{eff}} - 1)/K_{\text{eff}} \quad F = PA$$

$$SUR = 26.06/\tau \quad \dot{m} = \rho A \vec{v}$$

$$\tau = \frac{\bar{\beta} - \rho}{\lambda_{\text{eff}} \rho} \quad \dot{W}_{\text{Pump}} = \dot{m} \Delta P v$$

$$\rho = \frac{\ell^*}{\tau} + \frac{\bar{\beta}}{1 + \lambda_{\text{eff}} \tau} \quad E = IR$$

$$\ell^* = 1 \times 10^{-4} \text{ seconds} \quad \text{Eff.} = \text{Net Work Out/Energy In}$$

$$\lambda_{\text{eff}} = 0.1 \text{ seconds}^{-1}$$

$$DRW \propto \phi_{\text{tip}}^2 / \phi_{\text{avg}}^2 \quad g_c = 32.2 \text{ lbm-ft/lbf-sec}^2$$

CONVERSIONS

$$1 \text{ Mw} = 3.41 \times 10^6 \text{ Btu/hr} \quad 1 \text{ Curie} = 3.7 \times 10^{10} \text{ dps}$$

$$1 \text{ hp} = 2.54 \times 10^3 \text{ Btu/hr} \quad 1 \text{ kg} = 2.21 \text{ lbm}$$

$$1 \text{ Btu} = 778 \text{ ft-lbf} \quad 1 \text{ gal}_{\text{water}} = 8.35 \text{ lbm}$$

$$^{\circ}\text{C} = (5/9)(^{\circ}\text{F} - 32) \quad 1 \text{ ft}^3_{\text{water}} = 7.48 \text{ gal}$$

$$^{\circ}\text{F} = (9/5)(^{\circ}\text{C}) + 32$$

**USNRC GENERIC FUNDAMENTALS EXAMINATION
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QUESTION: 1

How will a typical motor-operated valve react to a loss of electrical power to the valve actuator?

- A. Open fully
- B. Close fully
- C. Remain as is
- D. Move to 50% open

QUESTION: 2

An adjustment has just been completed on the packing gland of a pneumatically-operated control valve to stop existing stem leakage. Which one of the following will occur if the technician overtightened the packing gland?

- A. Binding of the valve disk with the valve seat
- B. Separation of the valve disk from the valve stem
- C. Misalignment of valve position limit switches
- D. Increased stroke time from fully open to fully closed

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QUESTION: 3

Which one of the following valves is used to control the direction of fluid flow and prevent backflow in a system?

- A. Safety valve
- B. Relief valve
- C. Divert valve
- D. Check valve

QUESTION: 4

In a comparison between a typical gate valve and a typical globe valve in the same application with both valves fully open, the gate valve has a _____ pressure drop and is normally used in _____ flow applications.

- A. larger; throttling
- B. larger; on/off
- C. smaller; throttling
- D. smaller; on/off

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QUESTION: 5

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

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

- A. zero.
- B. equal to actual flow rate but greater than zero.
- C. lower than actual flow rate.
- D. higher than actual flow rate.

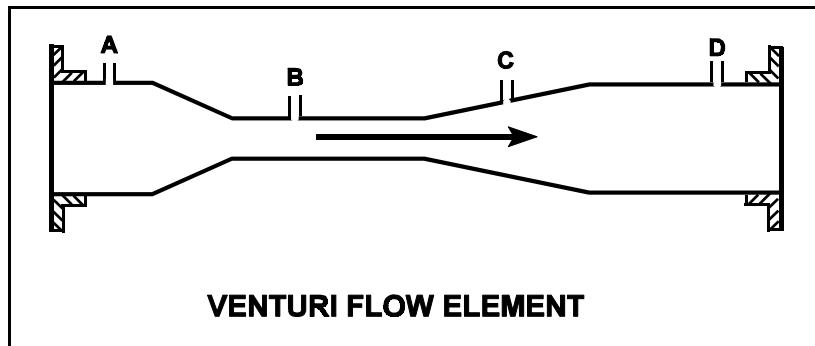
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QUESTION: 6

Refer to the drawing of a venturi flow element (see figure below) with direction of fluid flow indicated by the arrow.

Where should the high pressure tap of a differential pressure flow detector be connected?

- A. Point A
- B. Point B
- C. Point C
- D. Point D



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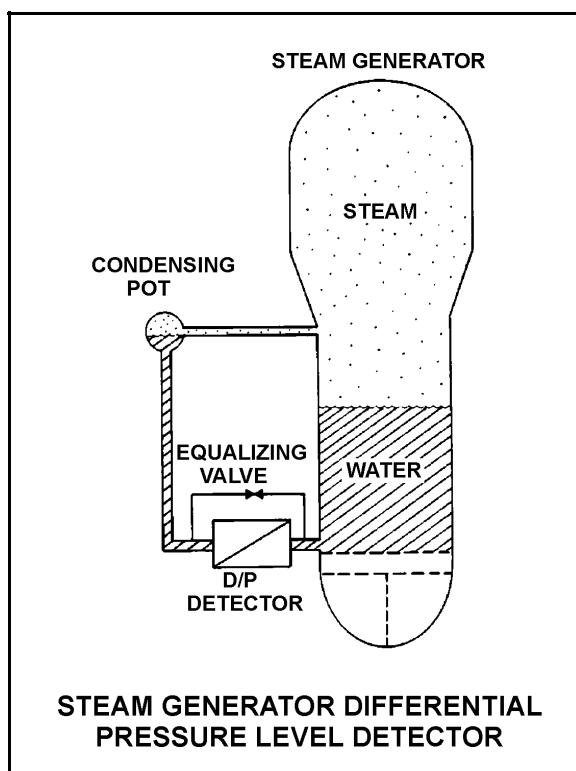
QUESTION: 7

Refer to the drawing of a steam generator (S/G) differential pressure (D/P) level detector (see figure below) that has been calibrated at the current S/G pressure of 400 psia.

A reactor coolant system heatup has resulted in an increase in S/G pressure from 400 psia to 900 psia over 4 hours. The ambient air temperature surrounding the S/G has remained constant.

Without density compensation of the level instrumentation, at the end of the heatup S/G level indication would indicate _____ than actual level because the density of the water in the _____ has changed significantly.

- A. higher; steam generator
- B. higher; reference leg
- C. lower; steam generator
- D. lower; reference leg



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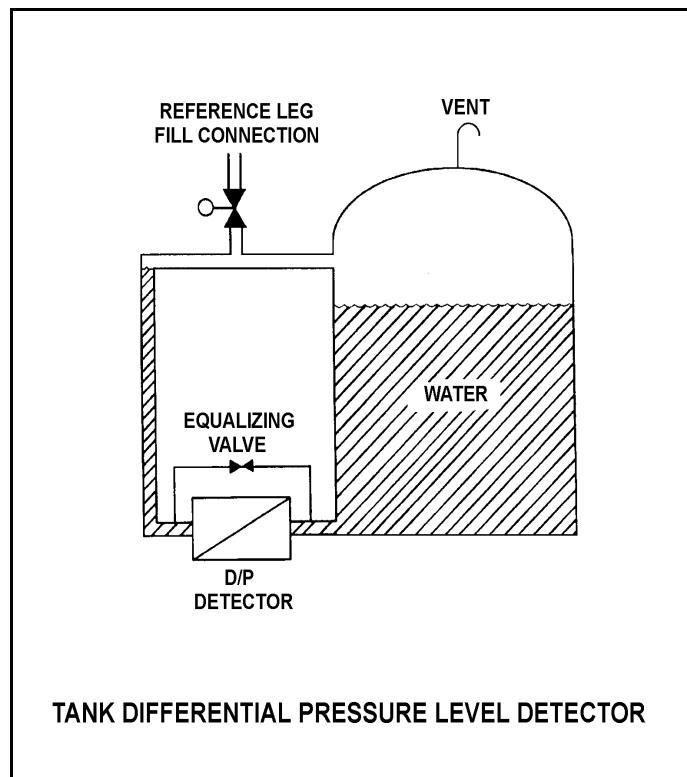
QUESTION: 8

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

The level detector was calibrated with reference leg and tank contents temperature at 70°F. An increase in ambient temperature causes the temperature of the reference leg and tank contents to increase to 110°F.

With the temperature of the reference leg and tank contents stable at 110°F, current level indication will be:

- A. higher than actual due to reference leg spill over.
- B. higher than actual due to expansion of tank contents.
- C. the same as actual due to offsetting density changes in the reference leg and tank contents.
- D. the same as actual due to the reference leg being connected to the upper portion of the tank.



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QUESTION: 9

If the pressure sensed by a bourdon tube increases, the curvature of the detector will _____ because of the greatest force being applied to the _____ curve of the detector.

- A. increase; inner
- B. decrease; inner
- C. increase; outer
- D. decrease; outer

QUESTION: 10

Cooling water system pressure is being monitored by a simple diaphragm pressure detector with its low pressure side vented to the containment. If a main steam break raises containment pressure by 20 psig, system pressure indication will: (Disregard any temperature effect on the detector.)

- A. increase by the square root of 20 psig.
- B. decrease by the square root of 20 psig.
- C. increase by 20 psig.
- D. decrease by 20 psig.

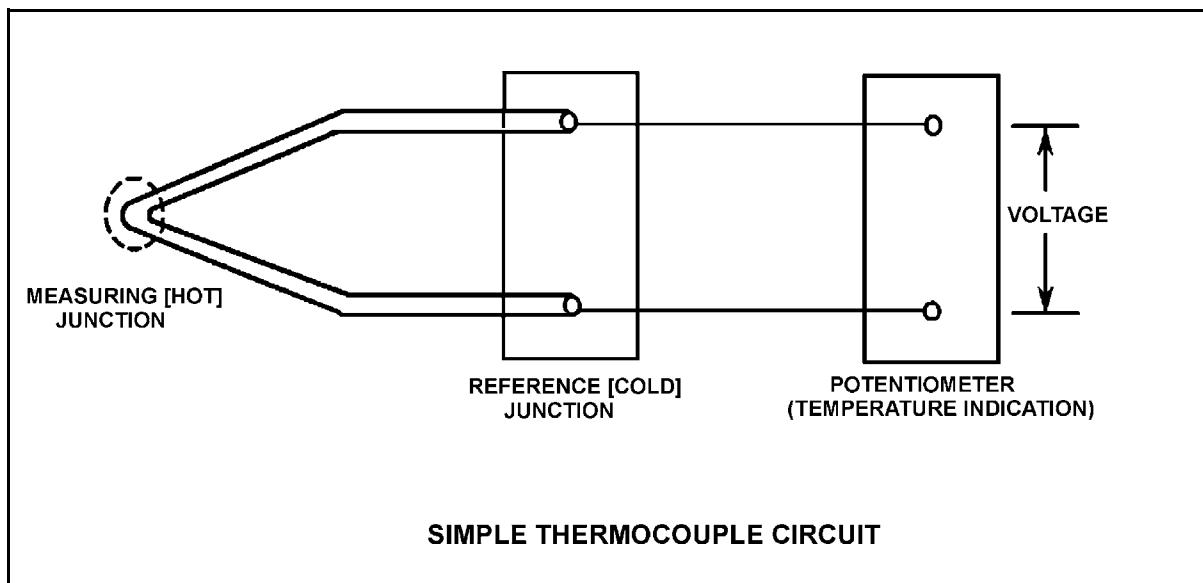
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QUESTION: 11

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

Thermocouple temperature indication is currently 150°F. Reference junction temperature is currently 90°F. Indicator range is from 0°F to 2000°F. If one of the thermocouple extension wires loosens and becomes dislodged from its terminal in the reference junction panel, which one of the following temperature indications will occur?

- A. Minimum instrument reading (0°F)
- B. 60°F
- C. 90°F
- D. Maximum instrument reading (2000°F)



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QUESTION: 12

Given:

- The reactor is shut down.
- The reactor coolant system is at normal operating pressure and temperature.
- The BF_3 source/startup range detectors are properly positioned outside the reactor vessel and adjacent to the lower portion of the core.
- All BF_3 source/startup range detectors are indicating approximately 100 cps.
- A sudden loss of coolant pressure accident occurs that causes bulk boiling and homogeneous core voiding in the reactor vessel.

How and why will source/startup range detector outputs change as homogeneous core voiding increases from 0% to 50%?

- A. Increase, because the detectors will experience a higher rate of neutron interactions due to the axial power distribution shifting toward the lower portion of the core.
- B. Increase, because the detectors will experience a higher rate of neutron interactions due to increasing neutron leakage from the core.
- C. Decrease, because the detectors will experience a lower rate of neutron interactions due to a decreasing subcritical multiplication neutron level.
- D. Decrease, because the detectors will experience a lower rate of gamma interactions due to decreasing reactor coolant attenuation.

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QUESTION: 13

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

- A. Alpha
- B. Beta
- C. Gamma
- D. Neutron

QUESTION: 14

A BF_3 gas-filled detector, operating in the proportional region, is being used to monitor reactor power while shut down. If a complete loss of detector gas pressure occurs, the instrument indication will fail:

- A. upscale.
- B. downscale.
- C. as is.
- D. to midscale.

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QUESTION: 15

An automatic flow controller is being used to position a valve in a cooling water system. A signal from the valve, which is proportional to valve position, is returned to the controller. This signal is referred to as:

- A. gain.
- B. bias.
- C. error.
- D. feedback.

QUESTION: 16

Which one of the following describes a characteristic of pneumatic valve positioners?

- A. They can provide auto and manual demand signals to valve controllers and valve actuators.
- B. They can automatically increase or decrease air pressure to valve actuators to overcome sluggish valve response.
- C. They can either receive or supply air to/from valve controllers, depending on the direction of valve travel.
- D. They can increase air pressure to valve actuators above existing main air header pressure.

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QUESTION: 17

An air-operated isolation valve requires 2,400 lbf applied to the top of the actuator diaphragm to open against spring pressure. The actuator diaphragm has a diameter of 12 inches.

If control air pressure to the valve actuator begins to decrease from 100 psig, which one of the following is the approximate air pressure at which the valve will begin to close?

- A. 5.3 psig
- B. 16.7 psig
- C. 21.2 psig
- D. 66.7 psig

QUESTION: 18

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.

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QUESTION: 19

When shifting from automatic to manual valve control, the manual and automatic controller output signals should be matched to:

- A. ensure the valve will operate in manual upon demand.
- B. ensure valve position indication is accurate in manual.
- C. move the valve to the new position prior to the transfer.
- D. prevent a sudden valve repositioning during the transfer.

QUESTION: 20

An indication of centrifugal pump cavitation is pump:

- A. motor amps high with discharge pressure low.
- B. motor amps high with discharge pressure high.
- C. flow low with discharge pressure low.
- D. flow low with discharge pressure high.

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QUESTION: 21

Which one of the following is an effective method for ensuring that a centrifugal pump remains primed and does not become gas bound during operation and after shutdown?

- A. Install an orifice plate in the discharge piping of the pump.
- B. Install a pump recirculation line from the pump discharge piping to the pump supply piping.
- C. Install the pump below the level of the suction supply.
- D. Install a check valve in the discharge piping of the pump.

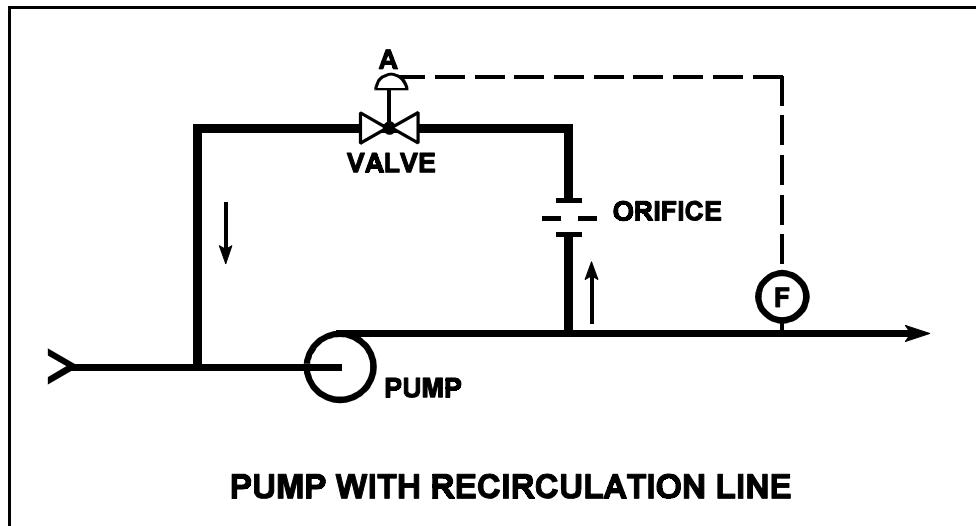
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QUESTION: 22

Refer to the drawing of a pump with a recirculation line (see figure below).

Valve "A" will close when pump:

- A. flow rate increases above a setpoint.
- B. flow rate decreases below a setpoint.
- C. discharge pressure increases above a setpoint.
- D. discharge pressure decreases below a setpoint.



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QUESTION: 23

A centrifugal pump is taking suction on an open storage tank that is 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 through a fire hose.

Given:

- The pump is currently operating at its design flow rate of 200 gpm and a total developed head of 100 feet.
- The pump requires 6 feet of net positive suction head (NPSH).

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 6 feet.
- B. Flow rate will remain constant until the pump begins to cavitate when the tank becomes empty.
- C. Flow rate will gradually decrease until the pump begins to cavitate at a tank level of about 6 feet.
- D. Flow rate will gradually decrease until the pump begins to cavitate when the tank becomes empty.

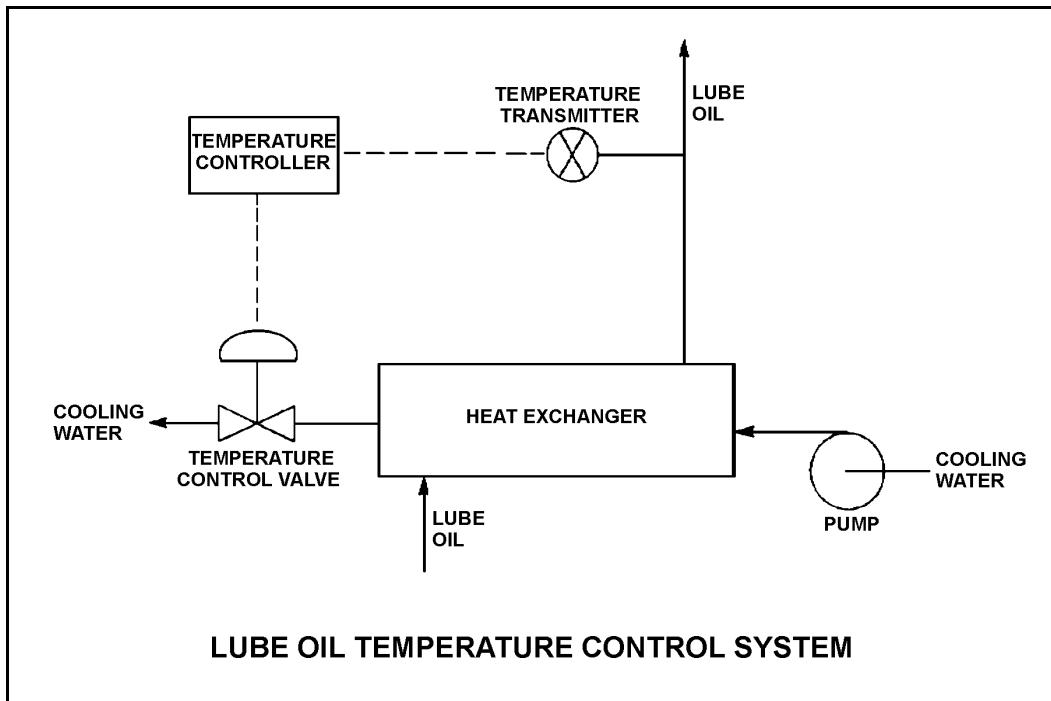
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QUESTION: 24

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



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QUESTION: 25

Which one of the following specifies the proper pump discharge valve position and the basis for that position when starting a large centrifugal pump?

- A. Discharge valve fully open to reduce motor power requirements
- B. Discharge valve throttled to reduce motor power requirements
- C. Discharge valve fully open to ensure adequate pump net positive suction head
- D. Discharge valve throttled to ensure adequate pump net positive suction head

QUESTION: 26

An ideal (no slip) reciprocating positive displacement pump is operating to provide makeup water to a reactor coolant system that is being maintained at 2200 psig. The discharge valve of the pump was found to be throttled to 80% open.

If the discharge valve is subsequently fully opened, pump flow rate will _____ and pump head will _____.

- A. increase; decrease
- B. remain constant; decrease
- C. increase; remain constant
- D. remain constant; remain constant

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QUESTION: 27

A motor-driven centrifugal pump exhibits indications of pump failure while being started in an idle cooling water system. Assuming the pump motor breaker does not trip, which one of the following pairs of indications would be observed if the pump failure is a locked impeller shaft?

- A. Lower than normal running current with zero system flow rate
- B. Lower than normal running current with a fraction of normal system flow rate
- C. Excessive duration of starting current peak with zero system flow rate
- D. Excessive duration of starting current peak with a fraction of normal system flow rate

QUESTION: 28

A diesel generator (D/G) is supplying an electrical bus in parallel with the electrical grid. Assuming D/G terminal voltage and bus frequency do not change, if the D/G governor set point is increased from 60.0 Hz to 60.1 Hz, D/G kVAR load will _____ and D/G amps will _____.

- A. remain the same; increase
- B. remain the same; remain the same
- C. increase; increase
- D. increase; remain the same

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QUESTION: 29

A multi-speed motor-driven centrifugal pump is operating with the following parameters:

Motor current = 27 amps
Pump head = 50 psi
Pump flow rate = 880 gpm

Which one of the following approximates the new value of pump head if pump speed is increased such that the motor current is now 64 amperes?

- A. 89 psi
- B. 119 psi
- C. 211 psi
- D. 281 psi

QUESTION: 30

Which one of the following describes the relationship between the current supplied to an ac induction motor and the amount of heat generation (kW) in the motor windings?

- A. Heat generation is linearly proportional to the current.
- B. Heat generation is proportional to the cube of the current.
- C. Heat generation is proportional to the square of the current.
- D. Heat generation is proportional to the square root of the current.

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QUESTION: 31

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.

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QUESTION: 32

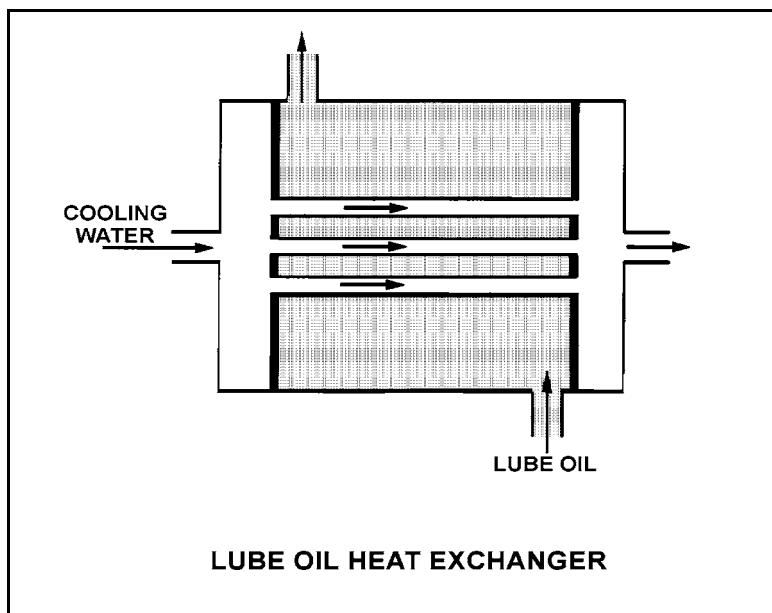
Refer to the drawing of a lube oil heat exchanger (see figure below).

The heat exchanger is operating with the following parameters:

\dot{Q}_{oil}	= $1.0 \times 10^7 \text{ Btu/hr}$
$T_{\text{oil in}}$	= 170°F
$T_{\text{oil out}}$	= 134°F
$T_{\text{water in}}$	= 85°F
$T_{\text{water out}}$	= 112°F
$C_{\text{p-oil}}$	= $1.1 \text{ Btu/lbm-}^\circ\text{F}$
$C_{\text{p-water}}$	= $1.0 \text{ Btu/lbm-}^\circ\text{F}$
\dot{m}_{water}	= ?

Which one of the following is the mass flow rate of the cooling water?

- A. $4.5 \times 10^5 \text{ lbm/hr}$
- B. $3.7 \times 10^5 \text{ lbm/hr}$
- C. $2.5 \times 10^5 \text{ lbm/hr}$
- D. $1.2 \times 10^5 \text{ lbm/hr}$



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QUESTION: 33

Steam has been admitted to a condenser for 25 minutes with no cooling water during a condenser startup. Initiating cooling water at this time will:

- A. reduce the stress on the condenser shell because the shell has been pre-warmed.
- B. reduce the stress on the condenser tubes by gradually cooling the tubes.
- C. induce large thermal stresses on the junctions between the condenser tubes and the tubesheet.
- D. induce large thermal stresses on the condenser shell.

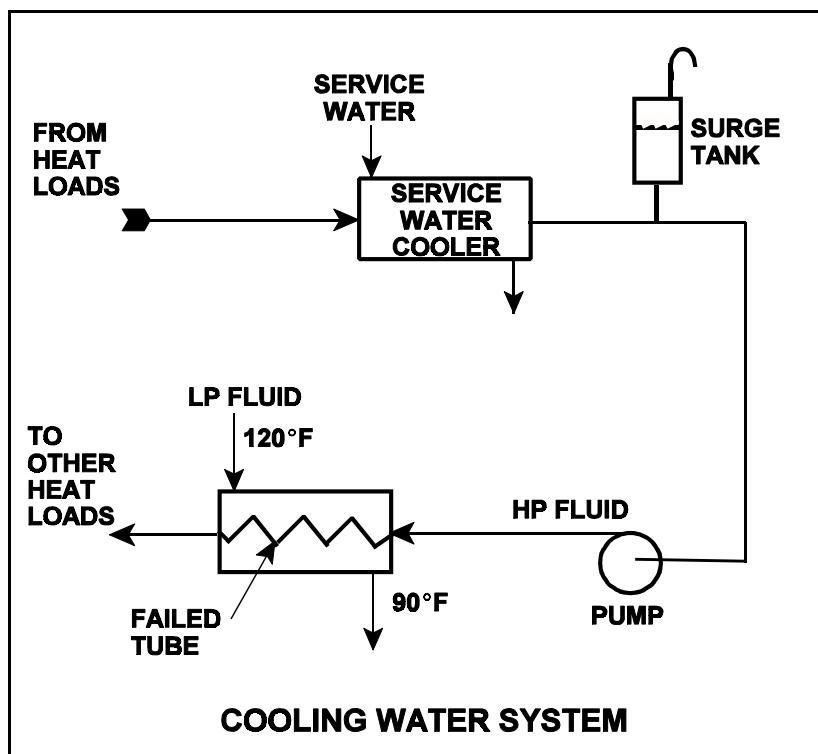
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QUESTION: 34

Refer to the drawing of a 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.



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QUESTION: 35

What percentage of impurities is being removed from the water passing through an ion exchanger if the ion exchanger has a decontamination factor of 25?

- A. 99%
- B. 96%
- C. 88%
- D. 75%

QUESTION: 36

Reactor makeup water is being processed by passing it through a heat exchanger and then a mixed resin demineralizer. Water is currently entering the demineralizer at 90°F with a flow rate of 40 gpm.

Which one of the following changes will result in the lowest level of ionic mineral impurities in the water exiting the demineralizer?

- A. Increase water temperature to 100°F and decrease flow rate to 30 gpm.
- B. Increase water temperature to 100°F and increase flow rate to 50 gpm.
- C. Decrease water temperature to 80°F and decrease flow rate to 30 gpm.
- D. Decrease water temperature to 80°F and increase flow rate to 50 gpm.

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QUESTION: 37

A demineralizer is boron saturated when the demineralizer:

- A. effluent contains a higher boron concentration than the demineralizer influent.
- B. absorbs greater than 20 ppm boron per hour.
- C. influent and effluent boron concentrations are equal.
- D. effluent boron concentration rapidly increases.

QUESTION: 38

Which one of the following available local breaker indications will provide the most reliable and positive indication that a load breaker on a motor control center (MCC) is open? (Assume the following indications and mechanisms are operating properly.)

- A. Load-side ammeter and overcurrent trip flags
- B. Load-side ammeter and load-side voltage
- C. OPEN/CLOSED mechanical flag indication and load-side voltage
- D. OPEN/CLOSED mechanical flag indication and overcurrent trip flags

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QUESTION: 39

Which one of the following will cause a loss of indication from the remote breaker position indicating lights associated with a typical 480 Vac load supply breaker?

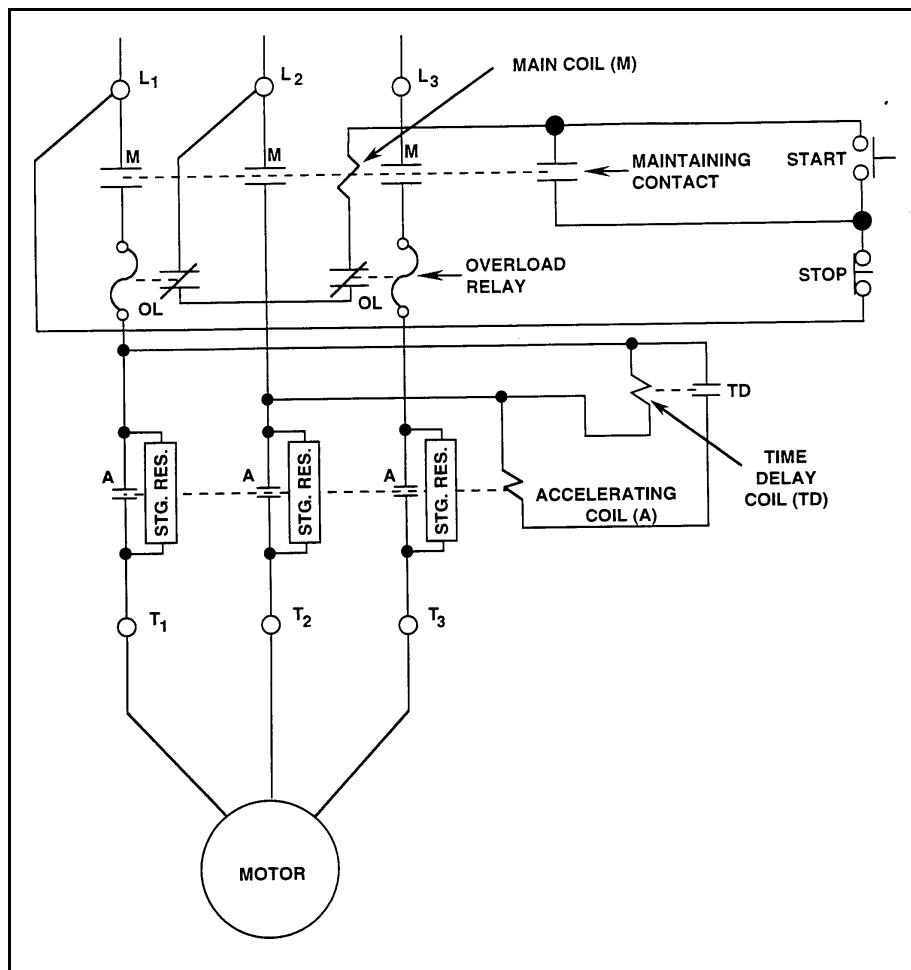
- A. Loss of breaker line voltage
- B. Locally opening the breaker
- C. Burnout of the local breaker position indicating lights
- D. Removing the breaker control power fuses

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QUESTION: 40

What is the purpose of the Time Delay (TD) coil in the motor controller diagram below?

- A. Ensures the motor cannot be started until the overload relays are reset.
- B. Ensures the motor cannot be started until the accelerating coil is energized.
- C. Allows the motor to come up to speed before placing the starting resistors in the circuit.
- D. Allows the motor to come up to speed before bypassing the starting resistors.



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QUESTION: 41

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: 42

A plant is operating at 80% power in the middle of a fuel cycle. The main generator is connected to the electrical grid with the following initial main generator output parameters:

Frequency: 60 Hz
Voltage: 25 KV
Reactive Load: 300 MVAR (out)
Real Load: 800 MW

A hydraulic oil system malfunction causes the main turbine steam inlet valves to begin to slowly drift closed. Over the next 10 minutes, the main generator real load decreases to 300 MW. Assuming no operator actions were taken during the above 10 minutes, how have the following main generator output parameters been affected?

<u>Frequency</u>	<u>Voltage</u>	Reactive Load
A. Decreased	Decreased	No change
B. Decreased	No change	Decreased
C. No change	No change	No change
D. No change	Decreased	Decreased

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QUESTION: 43

When a typical 4160 volt breaker is racked to the test position, control power is _____ the breaker and the breaker is _____ the load.

- A. available to; connected to
- B. available to; isolated from
- C. removed from; connected to
- D. removed from; isolated from

QUESTION: 44

A 480 Vac motor control center supplies a load through a breaker and a manual disconnect. If both isolation devices are operated to isolate the load, which one of the following sequences will provide the greatest level of personnel safety when deenergizing the load for maintenance and when reenergizing the load after the maintenance?

<u>DEENERGIZING</u>	<u>REENERGIZING</u>
A. Open breaker first	Shut breaker first
B. Open breaker first	Shut disconnect first
C. Open disconnect first	Shut breaker first
D. Open disconnect first	Shut disconnect first

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 45

In a comparison between a delayed neutron and a prompt neutron born from the same fission event, the prompt neutron is more likely to:

- A. require a greater number of collisions to become a thermal neutron.
- B. be captured by U-238 at a resonant energy peak between 1 eV and 1000 eV.
- C. be born with a lower kinetic energy.
- D. cause thermal fission of a U-235 nucleus.

QUESTION: 46

Which one of the following is a reason for installing excess reactivity (k_{excess}) in the core?

- A. To compensate for burnout of Xe-135 and Sm-149 during power changes
- B. To ensure reactor coolant boron concentration is low enough to ensure a negative moderator coefficient
- C. To compensate for the negative reactivity added by the power defect during a power increase
- D. To compensate for the conversion of U-238 to Pu-239 over core life

USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A

QUESTION: 47

Reactors A and B are identical except that reactor A is operating at steady-state 80% power while reactor B is operating at steady-state 100% power. Initial control rod positions are the same for each reactor.

How will the shutdown margins (SDM) compare for the two reactors following a reactor scram? (Assume no post-scram operator actions are taken that would affect SDM.)

- A. Reactor A will have the greater SDM.
- B. Reactor B will have the greater SDM.
- C. When sufficient time has passed to allow both cores to become xenon-free, the SDMs will be equal.
- D. Within a few minutes after the scrams, when all parameters have returned to normal post-scram conditions, the SDMs will be equal.

QUESTION: 48

A reactor is being started for the first time following a refueling outage. Reactor Engineering has determined that during the upcoming fuel cycle $\bar{\beta}_{\text{eff}}$ will range from a maximum of 0.007 to a minimum of 0.005.

Once the reactor becomes critical, control rods are withdrawn to insert a net positive reactivity of 0.1% $\Delta K/K$ into the reactor core. Assuming no other reactivity additions, what will be the approximate stable reactor period for this reactor until the point of adding heat is reached?

- A. 50 seconds
- B. 60 seconds
- C. 70 seconds
- D. 80 seconds

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 49

Which one of the following describes the purpose of a neutron source that is installed in a reactor during refueling for the third fuel cycle?

- A. Ensures shutdown neutron level is large enough to be detected by nuclear instrumentation.
- B. Provides additional excess reactivity to increase the length of the fuel cycle.
- C. Amplifies the electrical noise fluctuations observed in source/startup range instrumentation during shutdown.
- D. Supplies the only shutdown source of neutrons available to begin a reactor startup.

QUESTION: 50

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

- A. Uranium-235
- B. Uranium-238
- C. Samarium-149
- D. Xenon-135

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 51

How does the addition of boric acid to the reactor coolant affect the moderator temperature coefficient in an undermoderated reactor core?

- A. The initially negative MTC becomes more negative.
- B. The initially negative MTC becomes less negative.
- C. The initially positive MTC becomes more positive.
- D. The initially positive MTC becomes less positive.

QUESTION: 52

Differential boron worth ($\Delta K/K/\text{ppm}$) becomes more negative as:

- A. burnable poisons deplete.
- B. boron concentration increases.
- C. moderator temperature increases.
- D. fission product poison concentration increases.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 53

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

- A. 3% power to 5% power
- B. 5% power to 15% power
- C. 15% power to 30% power
- D. 30% power to 60% power

QUESTION: 54

A reactor has been shut down for three weeks with all control rods fully inserted. If a center control rod is fully withdrawn from the core, neutron population will: (Assume the reactor remains subcritical.)

- A. increase and stabilize at a new higher level.
- B. increase, then decrease and stabilize at the original value.
- C. increase, then decrease and stabilize above the original value.
- D. remain the same.

USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A

QUESTION: 55

Which one of the following describes where neutron flux shaping is predominantly used in a reactor core to reduce radial power peaking?

- A. In the center of the core where peaking is caused by a high number density of fuel assemblies.
- B. At the periphery of the core where peaking is caused by moderator reflection of thermal leakage neutrons.
- C. Throughout the core where peaking is caused by uneven burnout of control rod poison material.
- D. Throughout the core where peaking is caused by loading fuel assemblies of various fuel enrichments.

QUESTION: 56

Consider a reactor core with four quadrants: A, B, C, and D. The reactor is operating at steady state 90% power when a fully withdrawn control rod in quadrant C drops to the bottom of the core. Assume that no operator actions are taken and reactor power stabilizes at 88%.

How are the maximum upper and lower core power tilt values (often called quadrant power tilt ratio or azimuthal power tilt) affected?

- A. Upper core value decreases while lower core value increases.
- B. Upper core value increases while lower core value decreases.
- C. Both upper and lower core values decrease.
- D. Both upper and lower core values increase.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 57

Why are the control rod insertion limits power dependent?

- A. Power defect increases as power increases.
- B. Control rod worth decreases as power increases.
- C. Doppler (fuel temperature) coefficient decreases as power increases.
- D. Moderator temperature coefficient increases as power increases.

QUESTION: 58

A fission product poison can be differentiated from all other fission products in that a fission product poison:

- A. will be produced in direct proportion to the fission rate in the core.
- B. will remain radioactive for thousands of years after the final reactor criticality.
- C. will depress the power production in some core locations and cause peaking in others.
- D. will migrate out of the fuel pellets and into the reactor coolant via pinhole defects in the clad.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 59

A reactor has been operating at full power for several weeks. Xenon-135 is being directly produced as a fission product in approximately _____ % of all fissions.

- A. 0.3
- B. 3.0
- C. 30
- D. 100

QUESTION: 60

Xenon-135 is removed from an operating reactor by neutron capture and radioactive decay to:

- A. iodine-135.
- B. cesium-135.
- C. tellurium-135.
- D. lanthanum-135.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 61

A reactor has been operating at 100% power for three weeks when a reactor trip occurs. Which one of the following describes the concentration of Xe-135 in the core 24 hours after the trip?

- A. At least 2 times the concentration at the time of the trip and decreasing
- B. Less than 1/2 the concentration at the time of the trip and decreasing
- C. At or approaching a peak value
- D. Approximately the same as at the time of the trip

QUESTION: 62

After a reactor shutdown from equilibrium xenon conditions, the maximum xenon reactivity (height of the xenon peak) is _____ preshutdown power level.

- A. directly proportional to
- B. inversely proportional to
- C. dependent on but not directly proportional to
- D. independent of

USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A

QUESTION: 63

A plant has been operating at 100% power for two months when a reactor trip occurs. Shortly after the reactor trip a reactor startup is commenced. Six hours after the trip, reactor power is at 2%. To maintain power stable at 2% over the next hour, the operator must add:

- A. positive reactivity because core xenon-135 is building up.
- B. negative reactivity because core xenon-135 is building up.
- C. positive reactivity because core xenon-135 is decaying away.
- D. negative reactivity because core xenon-135 is decaying away.

QUESTION: 64

A reactor is near the end of its fuel cycle. Reactor power and coolant temperature are being allowed to "coast down."

Why is RCS boron dilution no longer used to compensate for fuel depletion?

- A. RCS boron concentration has become so high that a very large amount of boron must be added to produce a small increase in boron concentration.
- B. The reactivity worth of the boron has decreased so much that a very large amount of water must be added to the RCS to make a small positive reactivity addition to the core.
- C. Boron concentration has become so low that a very large amount of water must be added to the RCS to produce a small decrease in boron concentration.
- D. The reactivity worth of the boron has increased so much that reactivity changes from RCS boron dilution cannot be safely controlled by the operator.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 65

A reactor is currently subcritical with a normal reactor startup in progress. Control rod withdrawal has just been initiated. Which one of the following contains the parameter(s)s that will be adjusted by the operator to make the reactor critical?

- A. Control rod position only
- B. RCS boron concentration and control rod position only
- C. Moderator temperature, RCS boron concentration, and control rod position
- D. RCS flow rate, RCS boron concentration, and control rod position

QUESTION: 66

With $K_{eff} = 0.985$, how much reactivity must be added to make a reactor exactly critical?

- A. 1.54% $\Delta K/K$
- B. 1.52% $\Delta K/K$
- C. 1.50% $\Delta K/K$
- D. 1.48% $\Delta K/K$

USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A

QUESTION: 67

A reactor is critical at $10^{-6}\%$ power. Control rods are withdrawn for 2 seconds and then stopped, resulting in a stable 0.2 dpm startup rate (SUR).

If control rods were inserted (instead of withdrawn) for 2 seconds with the reactor initially critical at $10^{-6}\%$, the stable SUR would have been: (Assume equal absolute values of reactivity are added in both cases.)

- A. faster than -0.2 dpm, because, compared to power increases, reactor power decreases result in smaller delayed neutron fractions.
- B. faster than -0.2 dpm, because, compared to power increases, reactor power decreases are less limited by delayed neutrons.
- C. slower than -0.2 dpm, because, compared to power increases, reactor power decreases result in larger delayed neutron fractions.
- D. slower than -0.2 dpm, because, compared to power increases, reactor power decreases are more limited by delayed neutrons.

QUESTION: 68

A reactor is critical below the point of adding heat (POAH). The operator adds enough reactivity to attain a startup rate of 0.5 decades per minute. Which one of the following will decrease first when the reactor reaches the POAH?

- A. Pressurizer level
- B. Reactor coolant temperature
- C. Reactor power
- D. Startup rate

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 69

A reactor is stable at the point of adding heat (POAH) with the average reactor coolant temperature at 550°F during a plant startup. Control rods are then withdrawn a few inches to increase steam generator steaming rate.

When the reactor stabilizes, reactor power will be _____ and average reactor coolant temperature will be _____ 550°F.

- A. above the POAH; equal to
- B. above the POAH; greater than
- C. at the POAH; equal to
- D. at the POAH; greater than

QUESTION: 70

A refueling outage has just been completed in which one-third of the core was replaced with new fuel assemblies. A reactor startup has been performed to mark the beginning of the sixth fuel cycle and power is being increased to 100%.

Which one of the following pairs of reactor fuels will be providing the greatest contribution to core heat production when the reactor reaches 100% power?

- A. U-235 and U-238
- B. U-238 and Pu-239
- C. U-235 and Pu-239
- D. U-235 and Pu-241

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 71

A plant is operating at 60% power in the middle of a fuel cycle with manual rod control when a turbine control system malfunction closes the turbine control valves an additional 5 percent. Which one of the following is responsible for the initial reactor power decrease?

- A. The rate of neutron absorption by core Xe-135 initially increases.
- B. The rate of neutron absorption in the moderator initially increases.
- C. The rate of neutron absorption at U-238 resonant energies initially increases.
- D. The rate of neutron absorption by the boron in the reactor coolant initially increases.

QUESTION: 72

During a core refueling, fuel assemblies with higher enrichments of U-235 were installed to prolong the fuel cycle from 12 months to 16 months. What is a possible consequence of offsetting all the excess positive reactivity of the new fuel with a higher concentration of boron in the reactor coolant?

- A. Boron will precipitate out of the reactor coolant during a cooldown.
- B. An RCS temperature decrease will result in a negative reactivity addition.
- C. Power changes requiring dilution of RCS boron will take longer.
- D. The differential boron worth will become positive.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 73

A water storage tank is vented to atmosphere. The tank is located at sea level and contains 100,000 gallons of 80°F water. A pressure gauge at the bottom of the tank reads 5.6 psig. What is the approximate water level in the tank?

- A. 13 feet
- B. 17 feet
- C. 21 feet
- D. 25 feet

QUESTION: 74

Which one of the following changes will result in increased subcooling of the condensate water in the condenser hotwell?

- A. Isolate one bay of the condenser circulating water system
- B. Increase circulating water temperature
- C. Decrease circulating water flow
- D. Decrease the main turbine steam flow rate

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 75

A steam line is carrying saturated steam vapor at 500 psia and 467°F. Approximately how much heat addition to the steam vapor is necessary to achieve 60°F of superheat?

- A. 31 Btu/lbm
- B. 45 Btu/lbm
- C. 58 Btu/lbm
- D. 71 Btu/lbm

QUESTION: 76

A plant is operating at 80% power with 5°F of condensate depression in the main condenser. If the condensate depression increases to 10°F, plant efficiency will _____ and the probability of condensate pump cavitation will _____.

- A. increase; increase
- B. increase; decrease
- C. decrease; increase
- D. decrease; decrease

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

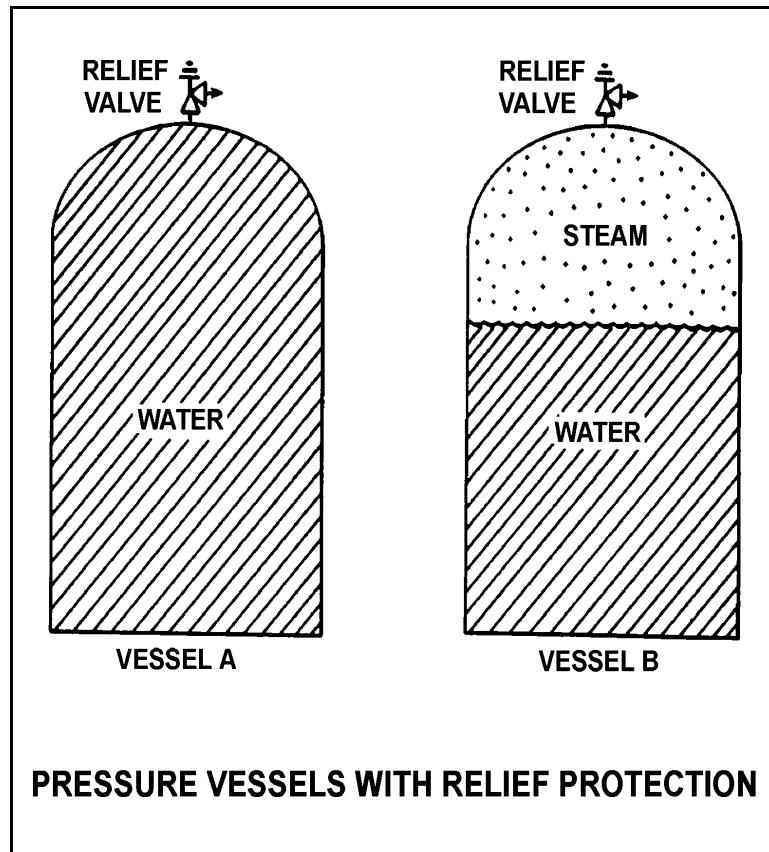
QUESTION: 77

Refer to the drawing of two 1,000 ft³ pressure vessels with relief protection (see figure below).

Both vessels are in saturated conditions at 281 °F and approximately 35 psig. Vessel A is completely filled with saturated water. Vessel B contains one-half saturated steam (100% quality) volume and one-half saturated water (0% quality) volume. Both vessels are protected by identical relief valves.

If both relief valves begin to leak at a rate of 0.1% of design flow, the higher temperature fluid will initially be leaving the relief valve of vessel _____. And, if 50 lbm of fluid is released through both relief valves, the larger pressure decrease will occur in vessel _____.

- A. A; A
- B. A; B
- C. B; A
- D. B; B



**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 78

A reactor plant is operating normally at 60% power when heating steam (supplied by the main steam system) to the moisture separator/reheaters (MSR) is isolated. The reactor plant is stabilized with heating steam still isolated.

Assuming that the steam flow rate (lbm/hr) through the main turbine is unchanged, what effects will the loss of MSR heating steam have on the steam plant?

- A. Main turbine efficiency will not change appreciably, but the high pressure element of the main turbine will be subjected to a significant increase in moisture impingement.
- B. Main turbine efficiency will not change appreciably, but the low pressure elements of the main turbine will be subjected to a significant increase in moisture impingement.
- C. Main turbine efficiency will decrease by several percent, and the high pressure element of the main turbine will be subjected to a significant increase in moisture impingement.
- D. Main turbine efficiency will decrease by several percent, and the low pressure elements of the main turbine will be subjected to a significant increase in moisture impingement.

QUESTION: 79

A sudden stop of fluid flow in a piping system, due to rapid closure of an isolation valve, will most likely result in:

- A. check valve slamming.
- B. pump runout.
- C. water hammer.
- D. pressurized thermal shock.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 80

A 47 gpm leak to atmosphere has developed from a cooling water system that is operating at 150 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 75 psig?

- A. 23.5 gpm
- B. 33.2 gpm
- C. 36.5 gpm
- D. 37.3 gpm

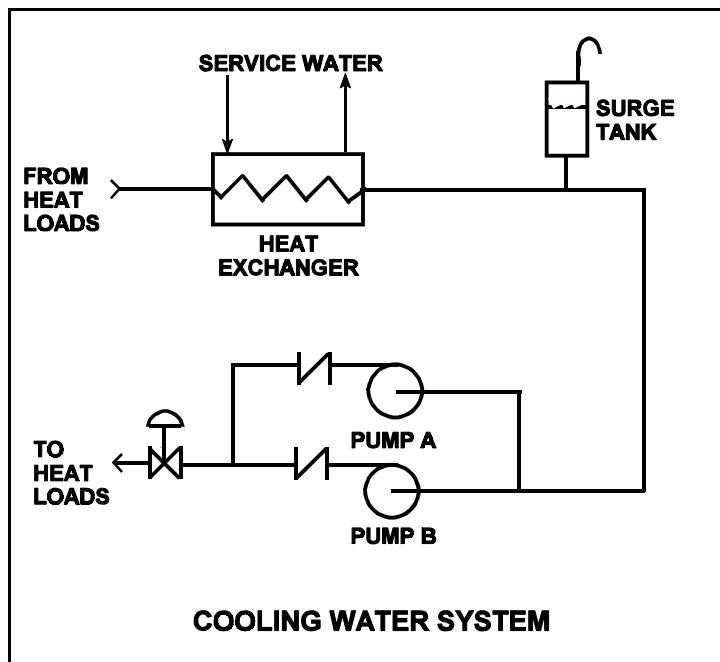
**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 81

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

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

- A. Starting pump B
- B. Positioning the discharge valve to 40% open
- C. Lowering the water level in the surge tank by 2 feet
- D. Decreasing heat exchanger service water flow rate by 10%



USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A

QUESTION: 82

A density-compensated flow instrument is being used to measure mass flow rate in a steam system. If the pressure of the steam decreases, indicated mass flow rate will: (Assume volumetric flow rate is constant.)

- A. increase for all steam conditions.
- B. decrease for all steam conditions.
- C. increase, but only if the steam is saturated (not superheated).
- D. decrease, but only if the steam is saturated (not superheated).

QUESTION: 83

A four-loop reactor plant uses four identical reactor coolant pumps (RCPs) to supply reactor coolant flow through the reactor core. The plant is currently operating at 20% power with all RCPs in operation.

Which one of the following describes the stable RCS flow rate through the reactor core following the trip of one RCP? (Assume no operator actions are taken and the reactor does not scram.)

- A. Less than 75% of the original flow rate
- B. Exactly 75% of the original flow rate
- C. Greater than 75% of the original flow rate
- D. Unpredictable without pump curves for the RCPs

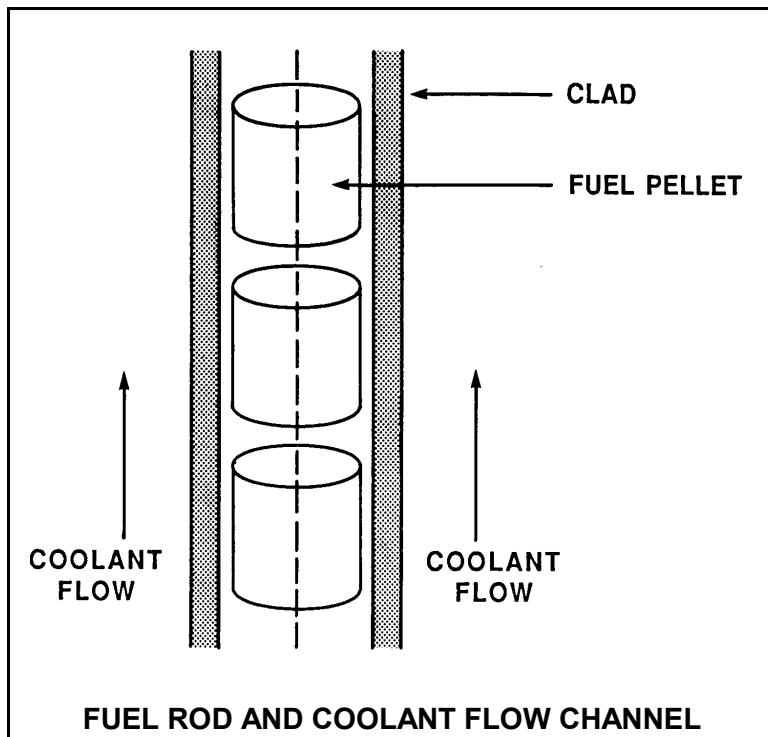
**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 84

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

Which one of the following is the primary method of heat transfer through the gap between the reactor fuel and the fuel clad?

- A. Conduction
- B. Convection
- C. Radiation
- D. Natural circulation



**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 85

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

- A. The feed water temperature used in the heat balance calculation was 20°F higher than actual feed water temperature.
- B. The reactor coolant pump heat input term was omitted from the heat balance calculation.
- C. The feed water flow rate used in the heat balance calculation were 10% lower than actual flow rates.
- D. The ambient heat loss term was omitted from the heat balance calculation.

QUESTION: 86

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

- A. Increases only
- B. Increases, then decreases
- C. Decreases only
- D. Decreases, then increases

USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A

QUESTION: 87

A plant is operating with the following initial conditions:

- Reactor power is 55% in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will decrease the steady-state departure from nucleate boiling ratio?

- A reactor trip occurs and one control rod remains fully withdrawn from the core.
- A pressurizer malfunction increases reactor coolant system pressure by 20 psig.
- The operator increases reactor coolant boron concentration by 5 ppm with no rod motion.
- Core Xe-135 depletes in proportion to the axial and radial power distribution with no rod motion.

QUESTION: 88

During full power operation, critical heat flux is most likely to occur in a:

- centrally-located fuel assembly with installed instrumentation.
- centrally-located fuel assembly without installed instrumentation.
- peripherally-located fuel assembly with installed instrumentation.
- peripherally-located fuel assembly without installed instrumentation.

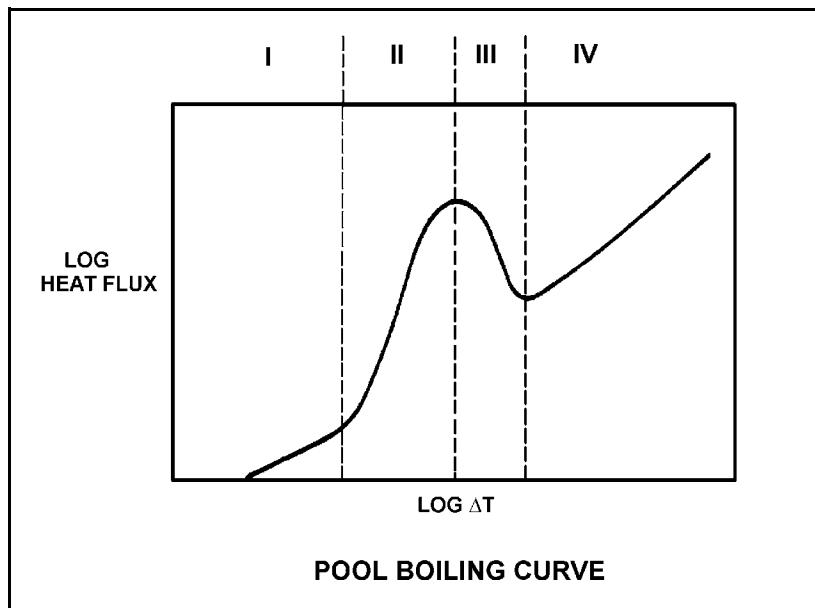
**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 89

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

Which one of the following regions represents the most unstable heat transfer?

- A. I
- B. II
- C. III
- D. IV



**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 90

Single-phase coolant flow resistance (head loss) in a reactor core is proportional to coolant _____ and inversely proportional to _____.

- A. temperature; fuel assembly length
- B. temperature; coolant channel cross-sectional area
- C. velocity; fuel assembly length
- D. velocity; coolant channel cross-sectional area

QUESTION: 91

Adequate core bypass flow is needed to:

- A. prevent stratification of reactor coolant inside the reactor vessel.
- B. provide reactor coolant pump minimum flow requirements.
- C. cool excore nuclear instrument detectors.
- D. equalize temperature between the vessel and upper vessel head.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 92

The reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0% rated thermal power. Stable natural circulation flow rate is 800 gpm.

When decay heat generation decreases to 0.5% rated thermal power, stable natural circulation flow rate will be approximately:

- A. 400 gpm.
- B. 565 gpm.
- C. 635 gpm.
- D. 696 gpm.

QUESTION: 93

The reactor is shut down at normal operating temperature and pressure with all reactor coolant pumps stopped. Stable natural circulation cooling is in progress with 50°F of RCS subcooling. Which one of the following, if increased, will not affect natural circulation flow rate?

- A. Reactor coolant pressure
- B. Time after reactor trip
- C. Feed water flow rate
- D. Steam generator pressure

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 94

A reactor is operating at 80% of rated thermal power with power distribution peaked both radially and axially in the center of the core. Reactor power is then increased to 100% over the next two hours using only reactor coolant boron adjustments for reactivity control.

Neglecting any effect from changes in core Xe-135, when power is stabilized at 100%, the value of the core maximum radial peaking factor will be _____ and the value of the core maximum axial peaking factor will be _____.

- A. higher; lower
- B. higher; higher
- C. the same; lower
- D. the same; higher

USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A

QUESTION: 95

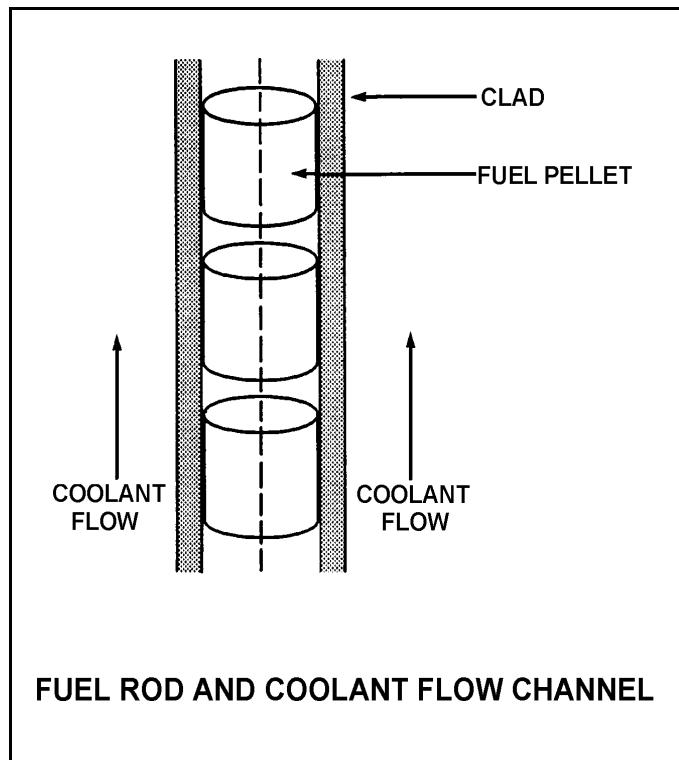
Refer to the drawing of a fuel rod and coolant flow channel (see figure below).

The reactor is shut down at the beginning of a fuel cycle with the following average parameter values:

$$\begin{aligned} T_{\text{coolant}} &= 440^{\circ}\text{F} \\ T_{\text{fuel centerline}} &= 780^{\circ}\text{F} \end{aligned}$$

If the total fuel-to-coolant thermal conductivity doubles over core life, what will the fuel centerline temperature be with the same coolant temperature and reactor decay heat conditions at the end of the fuel cycle?

- A. 610°F
- B. 580°F
- C. 550°F
- D. 520°F



**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 96

Brittle fracture of the reactor coolant system pressure boundary is most likely to occur at:

- A. 120°F and 2200 psig.
- B. 120°F and 400 psig.
- C. 400°F and 2200 psig.
- D. 400°F and 400 psig.

QUESTION: 97

A reactor is shut down for refueling following 18 months of operation at an average power level of 85%. During the shutdown, a reactor vessel metal specimen is removed from the reactor vessel for testing. The testing determines that the nil-ductility transition (NDT) temperature of the specimen has decreased from 44°F to 42°F since the last refueling.

Which one of the following conclusions is warranted?

- A. The test results are credible and the reactor vessel is more likely to experience brittle fracture now than after the last refueling.
- B. The test results are credible and the reactor vessel is less likely to experience brittle fracture now than after the last refueling.
- C. The test results are questionable because the specimen NDT temperature would not decrease during the described 18-month period of operation.
- D. The test results are questionable because the specimen NDT temperature would decrease by more than 2°F during the described 18-month period of operation.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 98

Which one of the following is the most limiting component for establishing reactor coolant system heatup/cooldown rate limits?

- A. Pressurizer
- B. Reactor vessel
- C. Fuel rod
- D. Steam generator

QUESTION: 99

A plant heatup is in progress using reactor coolant pumps. The heatup stress applied to the reactor vessel is:

- A. tensile across the entire wall.
- B. tensile at the inner wall and compressive at the outer wall.
- C. compressive across the entire wall.
- D. compressive at the inner wall and tensile at the outer wall.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
JUNE 2001 PWR--FORM A**

QUESTION: 100

A plant is shut down with the reactor coolant system at 1200 psia and 350°F. Which one of the following would be most likely to cause pressurized thermal shock of the reactor vessel?

- A. A rapid depressurization followed by a rapid heatup
- B. A rapid depressurization followed by a rapid cooldown
- C. A rapid cooldown followed by a rapid pressurization
- D. A rapid heatup followed by a rapid pressurization

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

**JUNE 2001 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY**

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