

**UNITED STATES NUCLEAR REGULATORY COMMISSION  
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012--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 percent is required to pass this portion of the NRC operator licensing written examination. All examination materials will be collected 3 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 INSTRUCTIONS FOR THE NRC  
GENERIC FUNDAMENTALS EXAMINATION**

During the administration of this examination the following rules apply:

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

NOTE: Numerical answers are rounded to the nearest whole number unless otherwise indicated.

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 times.
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, e.g., steam tables, handouts, and scrap paper.
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**

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

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

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

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

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

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

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

$$\text{SUR} = 26.06/\tau$$

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

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

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

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

$$\text{DRW} \propto \phi_{\text{tip}}^2 / \phi_{\text{avg}}^2$$

$$A = A_0 e^{-\lambda t}$$

$$P = P_0 10^{\text{SUR}(t)}$$

$$P = P_0 e^{(t/\tau)}$$

$$\text{CR}_{\text{S/D}} = S/(1 - K_{\text{eff}})$$

$$\text{CR}_1(1 - K_{\text{eff}1}) = \text{CR}_2(1 - K_{\text{eff}2})$$

$$1/M = \text{CR}_1/\text{CR}_x$$

$$A = \pi r^2$$

$$F = PA$$

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

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

$$P = IE$$

$$P_A = \sqrt{3} IE$$

$$P_T = \sqrt{3} IE \text{ pf}$$

$$P_R = \sqrt{3} IE \sin\theta$$

$$\text{Thermal Efficiency} = \text{Net Work Out}/\text{Energy In}$$

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

$$g_c = 32.2 \text{ lbm-ft/lbf-sec}^2$$

**CONVERSIONS**

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

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

$$1 \text{ Btu} = 778 \text{ ft-lbf}$$

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

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

$$1 \text{ kg} = 2.21 \text{ lbm}$$

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

$$1 \text{ gal}_{\text{water}} = 8.35 \text{ lbm}$$

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

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 1

A completely full water storage tank is being hydrostatically tested to 200 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 8 gpm. The tank is protected by a relief valve and a safety valve that discharge to the atmosphere. The valves have the following characteristics:

- The relief valve opening setpoint is 200 psig with an accumulation of 5 percent.
- The safety valve opening setpoint is 240 psig with a blowdown of 5 percent.
- Both valves have a maximum discharge flow rate of 6 gpm.

The PDP is inadvertently left running when tank pressure reaches 200 psig.

With the PDP still running, the relief valve will be \_\_\_\_\_ open; and the safety valve will be discharging an average flow rate of \_\_\_\_\_.

- A. partially; 6 gpm
- B. partially; 2 gpm
- C. fully; 6 gpm
- D. fully; 2 gpm

QUESTION: 2

Consider a 6-inch globe valve and a 6-inch gate valve in the same water system application. Typically, the valve that requires the most linear disk travel from fully closed to fully open is the \_\_\_\_\_ valve; and the valve that produces the smallest pressure drop when fully open is the \_\_\_\_\_ valve.

- A. gate; gate
- B. gate; globe
- C. globe; gate
- D. globe; globe

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JUNE 2012 BWR--FORM A**

QUESTION: 3

To verify that a manual valve in an operating system is closed, the operator should observe valve position indication and operate the valve handwheel in the...

- A. open direction until flow sounds are heard, then close the valve using normal force.
- B. close direction using normal force and verify there is no substantial handwheel movement.
- C. close direction until it stops, then close it an additional one-half turn using additional force if necessary.
- D. open direction until the valve stem moves in the open direction, then close the valve using normal force.

QUESTION: 4

Consider water flowing through a frictionless venturi with no heat gain or loss.

For the above system, flow rate through the venturi is proportional to the square root of differential pressure. For steam flow, the relationship must be modified to account for changes in steam \_\_\_\_\_ as it flows through the venturi.

- A. velocity
- B. enthalpy
- C. specific volume
- D. internal energy

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 5

A bourdon-tube pressure detector was indicating 50 percent of scale when it was suddenly exposed to a high pressure transient that caused permanent strain to the bourdon tube. The detector remained intact and actual pressure was restored to its original value.

During the pressure transient, the affected pressure indication initially went off-scale high. After the original pressure was restored, the indication was...

- A. unpredictable.
- B. less than 50 percent of scale.
- C. 50 percent of scale.
- D. greater than 50 percent of scale.

QUESTION: 6

Because of a thermocouple temperature display failure, the millivolt output of a thermocouple circuit is being converted to a temperature value using conversion tables. The tables are based on a thermocouple reference junction temperature of 32°F. The actual reference junction is located in a panel that is currently at 80°F.

The temperature value taken from the conversion tables is 120°F.

What adjustment must be made to the temperature value taken from the conversion tables to calculate the actual temperature at the measuring tip of the thermocouple?

- A. Add 48°F.
- B. Subtract 48°F.
- C. Add 88°F.
- D. Subtract 88°F.

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JUNE 2012 BWR--FORM A**

QUESTION: 7

Which one of the following personal radiation monitoring devices can be charged with DC voltage to “zero” the device prior to use?

- A. Film badge
- B. Alarming dosimeter
- C. Thermoluminescent dosimeter
- D. Self-reading pocket dosimeter

QUESTION: 8

An emergency diesel generator (DG) is operating as the only power source connected to an emergency bus. The governor of the DG is directly sensing DG \_\_\_\_\_ and will directly adjust DG \_\_\_\_\_ flow to maintain a relatively constant DG frequency.

- A. speed; air
- B. speed; fuel
- C. load; air
- D. load; fuel

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JUNE 2012 BWR--FORM A**

QUESTION: 9

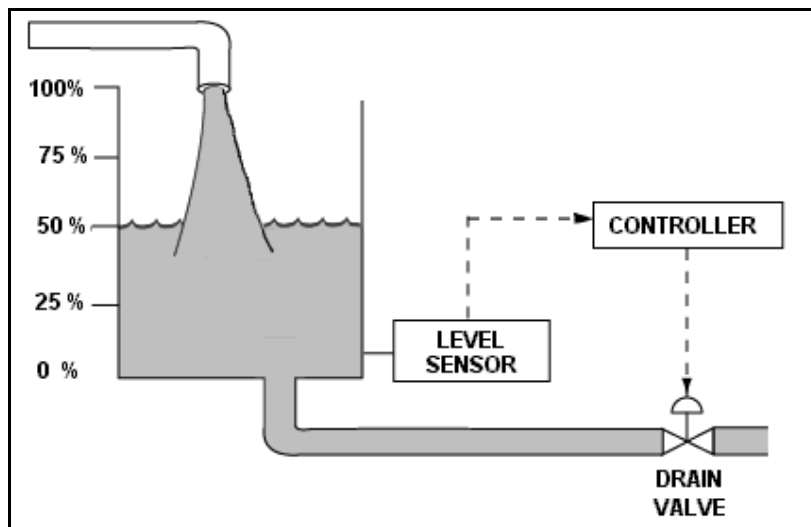
Refer to the drawing of a water storage tank with an automatic level control system (see figure below).

Given:

- The drain valve fails closed on loss of controller output signal.
- The level sensor output signal changes directly with tank water level.

For proper automatic control of tank water level, the controller must be \_\_\_\_\_ and the control loop must be \_\_\_\_\_.

- A. direct-acting; open
- B. direct-acting; closed
- C. reverse-acting; open
- D. reverse-acting; closed





**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 10

A centrifugal pump is used to provide makeup water to a storage tank that is 30 feet high. The pump is located at the base of the tank. The pump can be aligned to fill the tank via a top connection or a bottom connection using piping of equal lengths and diameters. The tank is currently half full.

With the pump in operation, the pump will have the highest discharge pressure if the pump is aligned to fill the tank via the \_\_\_\_\_ connection; and the tank will become full in the least amount of time if the pump is aligned to fill the tank via the \_\_\_\_\_ connection.

- A. top; top
- B. top; bottom
- C. bottom; top
- D. bottom; bottom

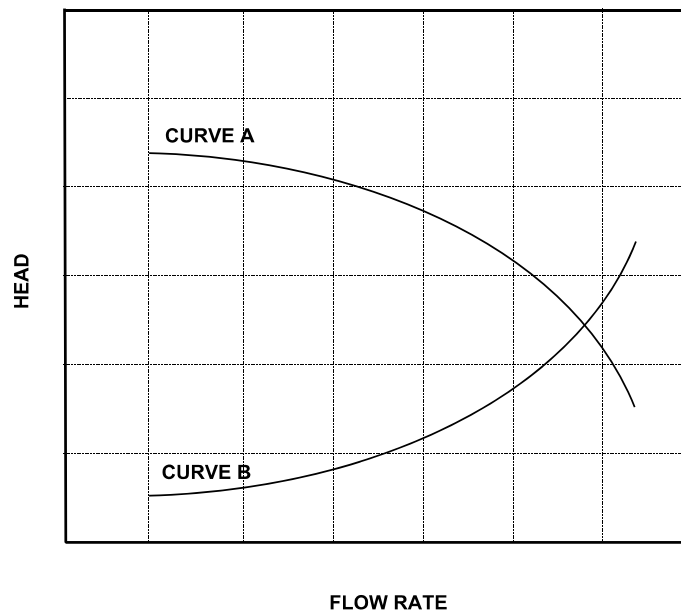
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JUNE 2012 BWR--FORM A**

QUESTION: 11

Refer to the graph that represents the head-capacity characteristics for a single-speed centrifugal cooling water pump (see figure below).

Which one of the following lists a pair of parameters that could be represented by curves A and B?  
(Note: NPSH = net positive suction head.)

- | <u>Curve A</u>      | <u>Curve B</u>   |
|---------------------|------------------|
| A. Pump Head        | Available NPSH   |
| B. Available NPSH   | Required NPSH    |
| C. Required NPSH    | System Head Loss |
| D. System Head Loss | Pump Head        |



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 12

A centrifugal pump is susceptible to overheating and possible cavitation while operating with its discharge valve closed, unless...

- A. the pump is steam driven.
- B. the suction valve is also closed.
- C. pump seal cooling is provided.
- D. minimum flow protection is provided.

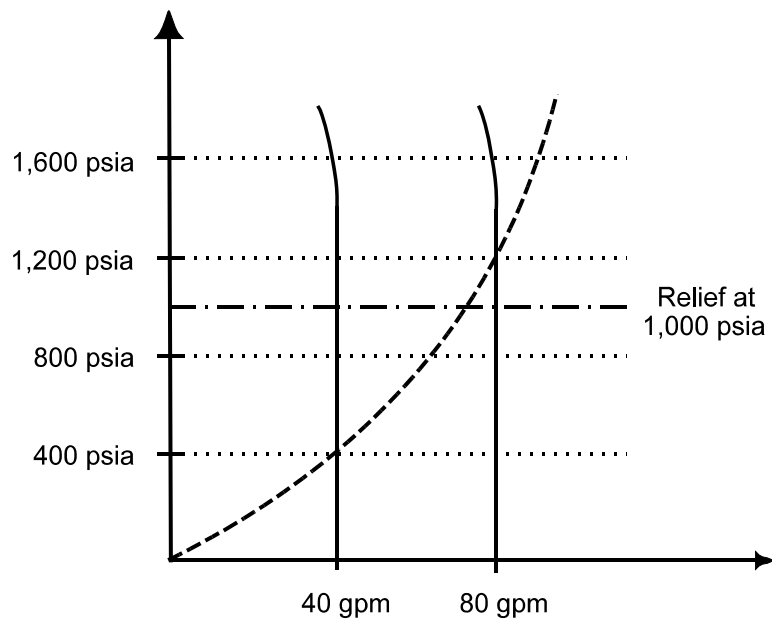
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JUNE 2012 BWR--FORM A**

QUESTION: 13

Use the following drawing of system and pump operating curves for a positive displacement pump with discharge relief valve protection to answer the following question.

A positive displacement pump is initially supplying water at 40 gpm with a pump discharge pressure of 400 psia. Then, pump speed is increased until pump flow rate is 80 gpm. What is the pump discharge pressure at the new pump flow rate of 80 gpm?

- A. 800 psia
- B. 1,000 psia
- C. 1,200 psia
- D. 1,600 psia



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JUNE 2012 BWR--FORM A**

QUESTION: 14

An axial flow ventilation fan is being driven by an AC motor. How will the fan motor current be affected if the volumetric flow rate through the fan is decreased by partially closing a discharge damper?

- A. The motor current will increase in accordance with the centrifugal pump laws.
- B. The motor current will increase, but not in accordance with the centrifugal pump laws.
- C. The motor current will decrease in accordance with the centrifugal pump laws.
- D. The motor current will decrease, but not in accordance with the centrifugal pump laws.

QUESTION: 15

A main generator has the following output parameters:

Power: 830 MW  
Voltage: 25 KV  
Current: 20,000 A

What is the reactive power for this generator?

- A. 36 MVAR
- B. 143 MVAR
- C. 247 MVAR
- D. 330 MVAR

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JUNE 2012 BWR--FORM A**

QUESTION: 16

Which one of the following will reduce the rate of heat transfer between two liquids in a heat exchanger? (Assume single-phase conditions and a constant specific heat for both liquids.)

- A. The inlet temperatures of both liquids are decreased by 20°F.
- B. The inlet temperatures of both liquids are increased by 20°F.
- C. The inlet temperature of the colder liquid is increased by 20°F.
- D. The inlet temperature of the hotter liquid is increased by 20°F.

QUESTION: 17

The discharge valve for a large operating centrifugal pump should be positioned slowly to minimize the...

- A. potential for causing water hammer.
- B. change in available net positive suction head.
- C. mechanical wear on the valve seat and stem packing.
- D. differential pressure stress exerted on the valve disk and stem.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 18

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

The heat exchanger was operating with the following initial parameters:

Cooling water inlet temperature ( $T_{cw-in}$ )	= 71 °F
Cooling water outlet temperature ( $T_{cw-out}$ )	= 91 °F
Oil inlet temperature ( $T_{oil-in}$ )	= 175 °F
Oil outlet temperature ( $T_{oil-out}$ )	= 125 °F

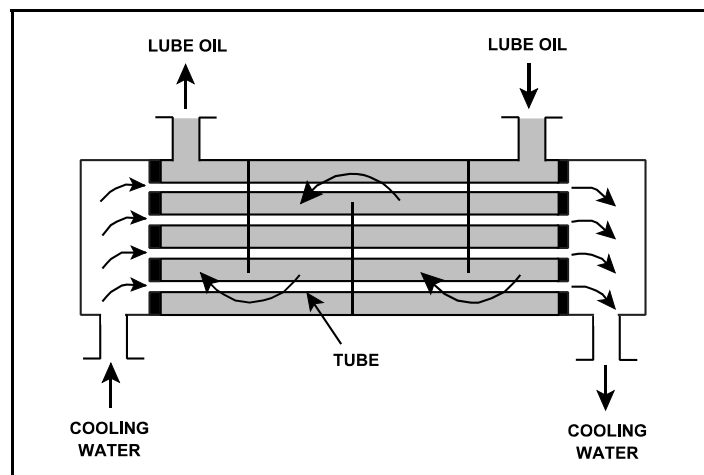
The heat exchanger was vented, resulting in the following current parameters:

Cooling water inlet temperature ( $T_{cw-in}$ )	= 71 °F
Cooling water outlet temperature ( $T_{cw-out}$ )	= 95 °F
Oil inlet temperature ( $T_{oil-in}$ )	= 175 °F
Oil outlet temperature ( $T_{oil-out}$ )	= ?

Assume that the mass flow rates and specific heats of both fluids were unchanged.

Which one of the following is the current lube oil outlet temperature ( $T_{oil-out}$ )?

- A. 115 °F
- B. 120 °F
- C. 130 °F
- D. 135 °F



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 19

A higher than expected differential pressure across an operating mixed-resin demineralizer can be caused by...

- A. exhaustion of the cation exchange resin.
- B. channeling through the resin bed.
- C. insufficient resin backwash.
- D. decreased demineralizer inlet conductivity.

QUESTION: 20

Water containing dissolved sodium ( $\text{Na}^+$ ) and chloride ( $\text{Cl}^-$ ) ionic impurities is passing through an ion exchanger that contains only cation exchange resin. How are the ionic impurities being affected as the water flows through the ion exchanger?

- A. Sodium ions are being exchanged, but the chloride ions are unaffected.
- B. Chloride ions are being exchanged, but the sodium ions are unaffected.
- C. Sodium ions are being exchanged, and chloride ions are being removed by filtration.
- D. Chloride ions are being exchanged, and sodium ions are being removed by filtration.



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 21

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

- Green breaker position indicating light is out.
- Red breaker position indicating light is lit.
- MCC voltmeter indicates 480 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; in
- C. open; to an unknown position
- D. closed; to an unknown position

QUESTION: 22

A 480 VAC motor is supplied power via an electrical disconnect in series with a circuit breaker. Which one of the following describes the proper operations to isolate power to the motor?

- A. Open the disconnect first, then the breaker.
- B. Open the breaker first, then the disconnect.
- C. Open the device that is closest to the motor first.
- D. Open the device that is closest to the power source first.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 23

Which one of the following will decrease the ability of the coolant to moderate neutrons in a nuclear reactor operating at saturated conditions?

- A. Decreasing coolant temperature.
- B. Decreasing feedwater inlet temperature.
- C. Decreasing reactor vessel pressure.
- D. Increasing reactor recirculation system flow rate.

QUESTION: 24

A nuclear power plant was initially operating at equilibrium 100 percent power just prior to a refueling outage. The plant was shut down, refueled, restarted, and is currently operating at equilibrium 100 percent power. Assume the 100 percent power fission rate did not change.

Which one of the following describes the current plant status as compared to the conditions just prior to the refueling?

- A. The core thermal neutron flux is greater.
- B. The available shutdown margin is smaller.
- C. The control rods are withdrawn farther from the core.
- D. The equilibrium core Xe-135 concentration is smaller.

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JUNE 2012 BWR--FORM A**

QUESTION: 25

Two nuclear reactors are identical in every way except that reactor A is near the end of core life and reactor B is near the beginning of core life. Both reactors are operating at 100 percent power when a reactor scram occurs at the same time on each reactor.

If the reactor systems for each reactor respond identically to the scram and no operator action is taken, a power level of  $10^{-5}$  percent will be reached first by reactor \_\_\_\_\_ because it has a \_\_\_\_\_ delayed neutron fraction.

- A. A; larger
- B. B; larger
- C. A; smaller
- D. B; smaller

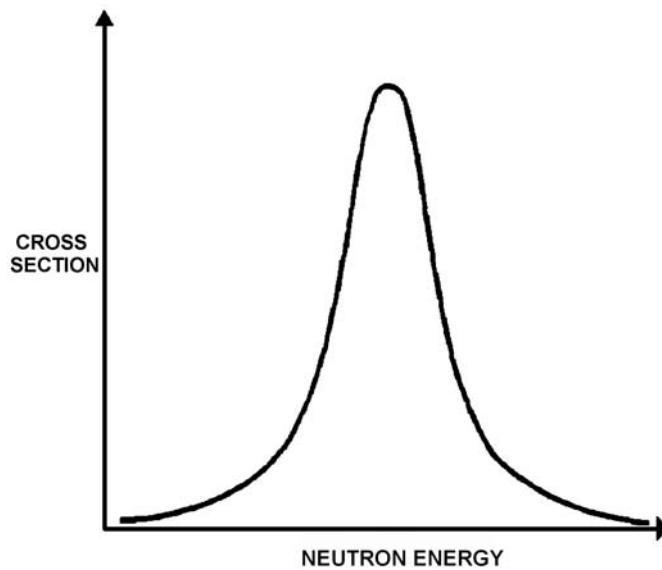
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JUNE 2012 BWR--FORM A**

QUESTION: 26

Refer to the drawing of a curve showing the neutron absorption characteristics of a typical U-238 nucleus at a resonance neutron energy (see figure below). The associated nuclear reactor is currently operating at steady-state 80 percent power.

During a subsequent reactor power decrease to 70 percent, the curve will become \_\_\_\_\_; and the percentage of the core neutron population lost to resonance capture by U-238 will \_\_\_\_\_.

- A. shorter and broader; increase
- B. shorter and broader; decrease
- C. taller and more narrow; increase
- D. taller and more narrow; decrease



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 27

Which one of the following describes why more power is produced in the lower half of a reactor core (versus the upper half) that has been operating at 100 percent power for several weeks near the beginning of a fuel cycle?

- A. Xenon concentration is smaller in the lower half of the core.
- B. The moderator-to-fuel ratio is smaller in the lower half of the core.
- C. Control rods are adding less negative reactivity in the lower half of the core.
- D. The void coefficient is adding less negative reactivity in the lower half of the core.

QUESTION: 28

A nuclear reactor is critical below the point of adding heat (POAH) during a hot reactor startup in the middle of a fuel cycle. Control rods are withdrawn for 20 seconds to establish a positive 30-second reactor period.

In response to the control rod withdrawal, reactor power will increase...

- A. continuously until control rods are reinserted.
- B. and stabilize at a value slightly below the POAH.
- C. temporarily, and then stabilize at the original value.
- D. and stabilize at a value equal to or above the POAH.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 29

A control rod located at notch position \_\_\_\_\_ in the core would be considered a \_\_\_\_\_ control rod.

- A. 36; deep
- B. 36; intermediate
- C. 12; deep
- D. 12; intermediate

QUESTION: 30

A nuclear power plant is being returned to operation following a refueling outage. Fuel preconditioning requires reactor power to be increased from 10 percent to full power gradually over a one week period.

During this slow power increase, most of the positive reactivity added by the operator is required to overcome the negative reactivity from...

- A. fuel burnup.
- B. xenon buildup.
- C. fuel temperature increase.
- D. moderator temperature increase.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 31

Fourteen hours after a reactor scram from 100 percent power equilibrium xenon conditions, the amount of core xenon-135 will be...

- A. lower than 100 percent equilibrium xenon, and will have added a net positive reactivity since the scram.
- B. lower than 100 percent equilibrium xenon, and will have added a net negative reactivity since the scram.
- C. higher than 100 percent equilibrium xenon, and will have added a net positive reactivity since the scram.
- D. higher than 100 percent equilibrium xenon, and will have added a net negative reactivity since the scram.

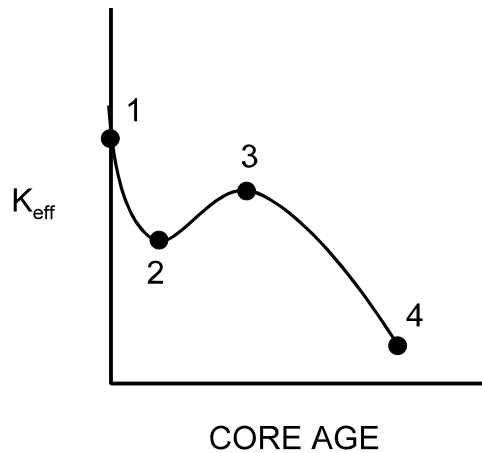
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JUNE 2012 BWR--FORM A

QUESTION: 32

Refer to the drawing of  $K_{\text{eff}}$  versus core age (see figure below).

The major cause for the change in  $K_{\text{eff}}$  from point 3 to point 4 is...

- A. depletion of U-235.
- B. depletion of U-238.
- C. burnout of burnable poisons.
- D. buildup of fission product poisons.





**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 33

A nuclear power plant is shutdown with the following stable initial conditions:

Reactor coolant temperature:	200°F
Reactor vessel pressure:	300 psia
Source range count rate:	140 cps

Control rods are withdrawn to commence a reactor startup. After 50 units of control rod withdrawal, the equilibrium source range count rate is 280 cps.

Assume that each unit of control rod withdrawal has the same reactivity worth. Also assume that the reactor coolant temperature remains constant, reactor power remains below the point of adding heat, and no reactor protection actuations occur.

What will be the status of the reactor after the control rods are withdrawn a total of 75 units?

- A. Subcritical, with equilibrium source range count rate less than 600 cps.
- B. Subcritical, with equilibrium source range count rate greater than 600 cps.
- C. Critical, with equilibrium source range count rate less than 600 cps.
- D. Critical, with equilibrium source range count rate greater than 600 cps.

QUESTION: 34

A nuclear reactor is critical and a reactor coolant heat-up is in progress with coolant temperature currently at 140°F. If the point of adding heat is initially 1 percent reactor power, and reactor power is held constant at 3 percent during the heat-up, which one of the following describes the coolant heat-up rate (HUR) from 140°F to 200°F?

- A. HUR will initially decrease and then increase.
- B. HUR will slowly decrease during the entire period.
- C. HUR will slowly increase during the entire period.
- D. HUR will remain the same during the entire period.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 35

Ignoring 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: 36

A nuclear reactor is critical in the source range when a fully withdrawn control rod fully inserts into the core.

If no operator or automatic actions occur, how will the source range count rate respond?

- A. Decrease to zero.
- B. Decrease to the value of the source neutron strength.
- C. Decrease to a value above the source neutron strength.
- D. Decrease initially and then slowly increase and stabilize at the initial value.

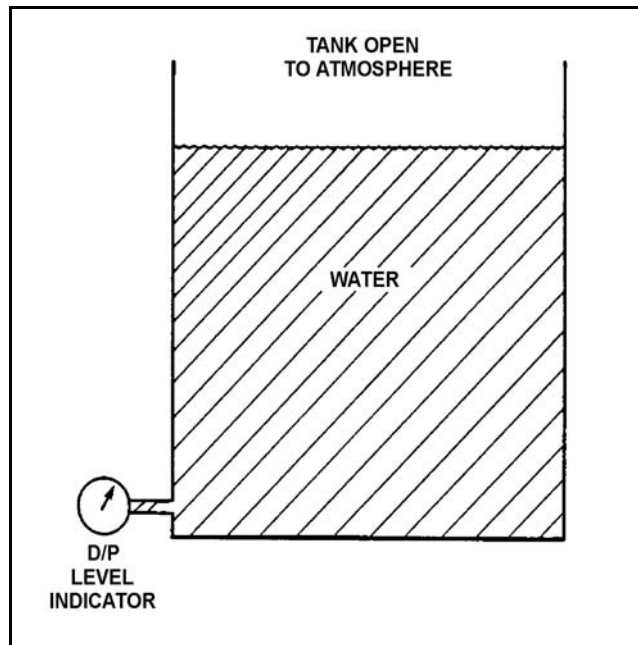
**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 37

Refer to the drawing of a water storage tank with a differential pressure (D/P) level indicator that is vented to atmosphere (see figure below). Both the tank and the level indicator are surrounded by standard atmospheric pressure. Tank water temperature is 70°F.

The D/P level indicator is sensing a differential pressure of 4.0 psi. What is the water level in the tank above the instrument penetration?

- A. 9.2 feet
- B. 16.7 feet
- C. 24.7 feet
- D. 43.2 feet



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 38

An open vessel contains 1.0 lbm of water at 120°F and standard atmospheric pressure. Which one of the following will be caused by the addition of 540 Btu to the water?

- A. The water temperature will increase to approximately 212°F; and less than 50 percent of the water will vaporize.
- B. The water temperature will increase to approximately 212°F; and more than 50 percent of the water will vaporize.
- C. The water temperature will increase to significantly higher than 212°F; and less than 50 percent of the water will vaporize.
- D. The water temperature will increase to significantly higher than 212°F; and more than 50 percent of the water will vaporize.

QUESTION: 39

A nuclear power plant is operating at 100 percent power when the only in-service steam jet air ejector is inadvertently isolated from the main condenser. The operator verifies that condenser cooling water system parameters have not changed. If no operator action is taken over the next 60 minutes, condenser pressure will...

- A. slowly decrease.
- B. slowly increase and stabilize at a slightly higher pressure.
- C. slowly and continuously increase towards atmospheric pressure.
- D. remain the same.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 40

A nuclear power plant has a thermal power rating of 3,200 MW. When the plant operates at 100 percent power the main generator produces 1,200 MW at a 0.95 power factor. Plant modifications are planned that will upgrade the feedwater heaters and moisture separator/reheaters without changing the plant's thermal power rating. If the plant modifications improve plant thermal efficiency by 2 percent, what will be the resulting main generator electrical output at 100 percent power with the same power factor?

- A. 1,204 MW
- B. 1,224 MW
- C. 1,244 MW
- D. 1,264 MW

QUESTION: 41

If the discharge valve of an operating ideal positive displacement pump is repositioned from fully open to 75 percent open, pump head will \_\_\_\_\_ and pump flow rate will \_\_\_\_\_.

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

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 42

An AC motor-driven radial-flow centrifugal pump is operating at rated flow and pressure in a cooling water system. A break occurs in the pump discharge piping resulting in a decrease in pump backpressure.

As a result of the break, the pump will operate at a \_\_\_\_\_ flow rate and the pump motor will draw \_\_\_\_\_ electrical power.

- A. higher; more
- B. higher; less
- C. lower; more
- D. lower; less

QUESTION: 43

Two of the parameters listed below are used for calculating core thermal power using the standard heat balance method. Which one of the following identifies the two parameters?

	<u>Reactor Core Mass Flow Rate</u>	<u>Feedwater Temperature</u>	<u>Reactor Vessel Pressure</u>	<u>Reactor Vessel Water Level</u>
A.	Yes	No	Yes	No
B.	No	Yes	Yes	No
C.	Yes	No	No	Yes
D.	No	Yes	No	Yes

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 44

Which one of the following will initially reduce core inlet subcooling?

- A. Isolate steam to one feedwater heater.
- B. Increase core recirculation mass flow rate.
- C. Increase the mass flow rate of saturated steam returning to the downcomer.
- D. Increase the mass flow rate of saturated water returning to the downcomer.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 45

Refer to the drawing of a section of pipe that contains flowing subcooled water (see figure below).

Given:

Pressure at  $P_1$  is 26 psig.

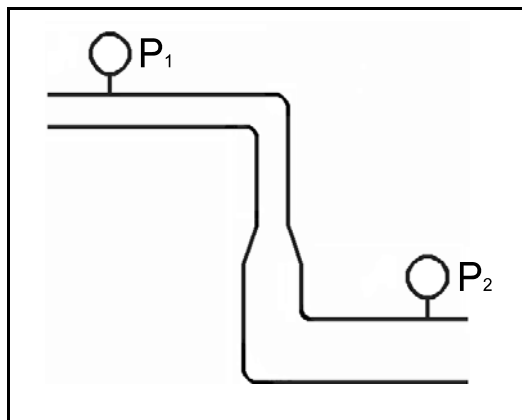
Pressure at  $P_2$  is 34 psig.

Pressure change due to change in velocity is 2 psig.

Pressure change due to change in elevation is 8 psig.

The pressure decrease due to friction head loss between  $P_1$  and  $P_2$  is \_\_\_\_\_ and the direction of flow is from \_\_\_\_\_.

- A. 2 psig; left to right
- B. 2 psig; right to left
- C. 4 psig; left to right
- D. 4 psig; right to left





**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 46

Two nuclear reactors, A and B, are operating at 100 percent power with thermal neutron flux radially peaked in the center of each core. The reactors are identical except that reactor A has core orificing and reactor B does not. Both reactors have the same control rod pattern and density.

Compared to the center fuel bundle in reactor B, the center fuel bundle in reactor A will have the \_\_\_\_\_ exit steam quality and the \_\_\_\_\_ critical power.

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

QUESTION: 47

Linear heat generation rate is the...

- A. ratio of the average power per fuel rod divided by the associated fuel bundle power.
- B. ratio of the power produced in a given fuel bundle divided by total core thermal power.
- C. sum of the power produced by all fuel rods in a given fuel bundle at a specific planar cross section.
- D. sum of the power per unit area for each unit area of the fuel cladding for a unit length of a fuel rod.

**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

QUESTION: 48

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

Given the following initial core parameters:

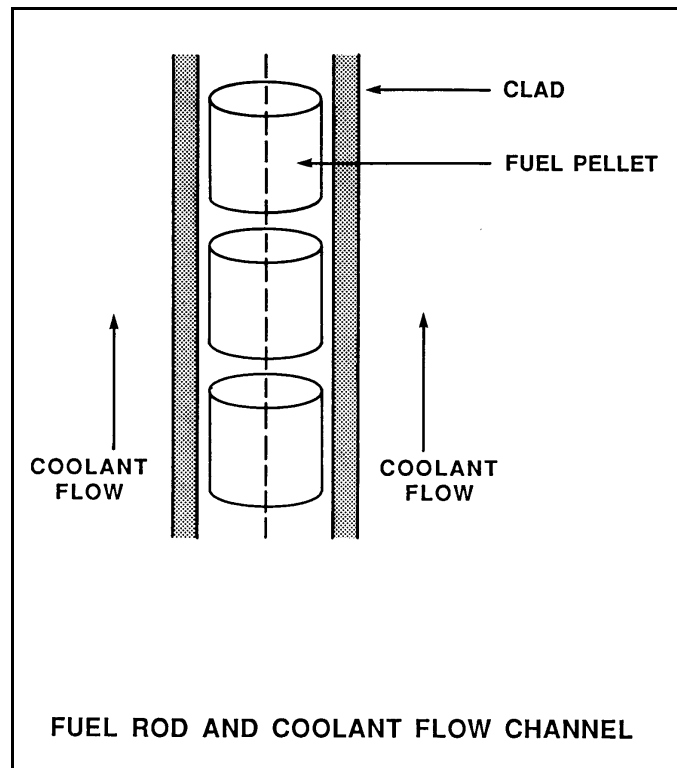
Reactor power = 50 percent

$T_{\text{coolant}} = 550^{\circ}\text{F}$

$T_{\text{fuel centerline}} = 2,750^{\circ}\text{F}$

What will the fuel centerline temperature be if, over core life, the total fuel-to-coolant thermal conductivity doubles? (Assume reactor power and  $T_{\text{coolant}}$  are constant.)

- A.  $1,100^{\circ}\text{F}$
- B.  $1,375^{\circ}\text{F}$
- C.  $1,525^{\circ}\text{F}$
- D.  $1,650^{\circ}\text{F}$



**USNRC GENERIC FUNDAMENTALS EXAMINATION  
JUNE 2012 BWR--FORM A**

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 chemical agents?

- A. Cadmium and bromine
- B. Bromine and ruthenium
- C. Iodine and cadmium
- D. Ruthenium and iodine

QUESTION: 50

A pressure stress on the reactor vessel wall is...

- A. tensile across the entire wall.
- B. compressive across the entire wall.
- C. tensile on the inner wall, compressive on the outer wall.
- D. compressive on the inner wall, tensile on the outer wall.

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

**JUNE 2012 NRC GENERIC FUNDAMENTALS EXAMINATION  
BOILING WATER REACTOR - ANSWER KEY**

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