UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
DECEMBER 2011--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

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

$A = A_0e^{-\lambda t}$

$P = P_o10^{SUR(t)}$

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

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

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

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

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

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

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

Thermal Efficiency = Net Work Out/Energy In

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

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

CONVERSIONS

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

QUESTION: 1

Given the following pressure specifications for a safety relief valve (SRV):

Setpoint pressure (SRV will start to open):	1,200 psia
Maximum pressure (SRV will be fully open):	1,242 psia
Reseat pressure (SRV will be fully closed):	1,152 psia

Which one of the following is the percent accumulation for the SRV?

A. 2.5 percent

B. 3.0 percent

C. 3.5 percent

D. 4.0 percent

QUESTION: 2

Which one of the following statements describes the flow rate characteristics of a typical globe valve in an operating water system?

A. The first 25 percent of valve disk travel in the open direction will produce a smaller increase in flow rate than the last 25 percent of valve disk travel.

B. The first 25 percent of valve disk travel in the open direction will produce a greater increase in flow rate than the last 25 percent of valve disk travel.

C. The first 25 percent of valve disk travel in the open direction will produce approximately the same increase in flow rate as the last 25 percent of valve disk travel.

D. A globe valve that has been opened to 25 percent of valve disk travel will result in approximately 25 percent of full flow rate.

QUESTION: 3

In a comparison between ball valves and butterfly valves in the same cooling water system application, the valve that would typically experience the greater seat leakage when fully closed and with a large differential pressure is the _____ valve; and the valve that would typically cause the smaller head loss when fully open is the _____ valve.

A. ball; butterfly

B. ball; ball

C. butterfly; butterfly

D. butterfly; ball

QUESTION: 4

Refer to the drawing of a horizontal pipe elbow (top view) in an operating water system (see figure below).

Three separate differential pressure flow detectors are connected to taps A, B, C, and D as follows:

Detector	Taps
X	A and D
Y	B and D
Z	C and D

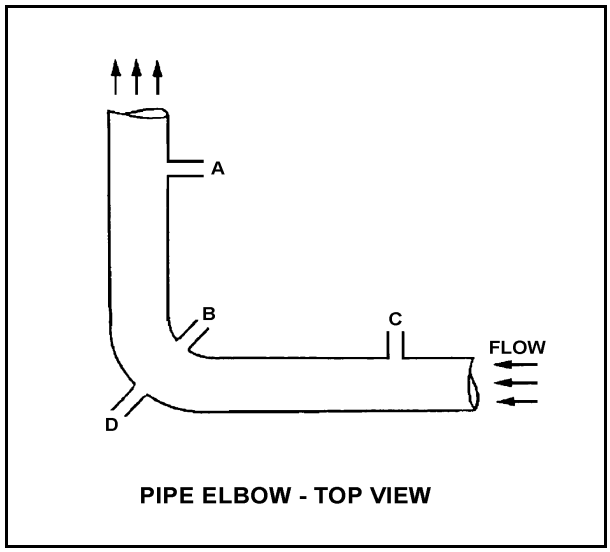
Assuming zero head loss in this section of pipe, how will the detectors be affected if tap D ruptures?

A. All detectors will fail low.

B. All detectors will fail high.

C. Two detectors will fail low and one will fail high.

D. Two detectors will fail high and one will fail low.



PIPE ELBOW - TOP VIEW

QUESTION: 5

Refer to the drawing of a reactor vessel differential pressure (D/P) level detection system (see figure below).

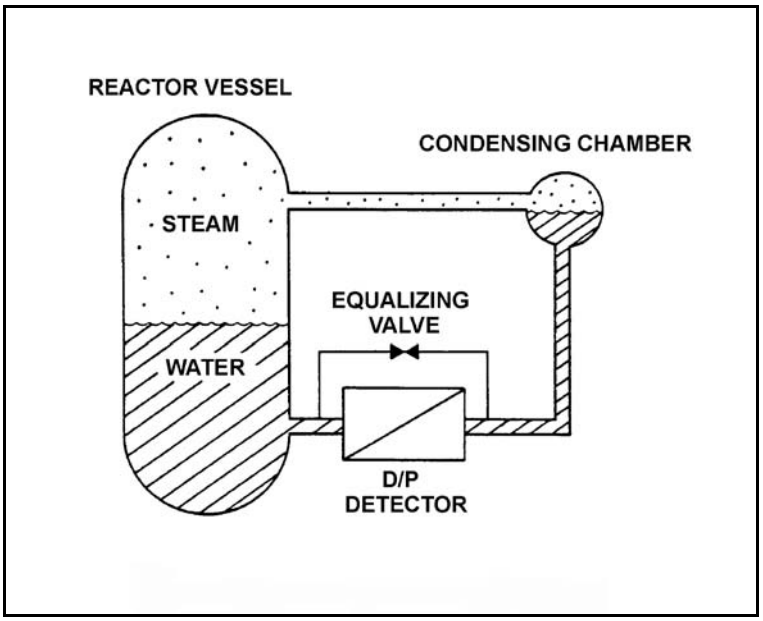
Which one of the following will result in the lowest reactor vessel level indication?

A. The reactor pressure increases by 100 psig.

B. The D/P cell equalizing valve leaks by.

C. The reference leg flashes to steam.

D. The temperature of the reference leg decreases by 20°F.



QUESTION: 6

What is the purpose of the reference junction panel that is provided with many thermocouple circuits?

A. Ensures that thermocouple output is amplified sufficiently for use by temperature indication devices.

B. Ensures that temperature changes away from the thermocouple measuring junction do not affect thermocouple temperature indication.

C. Ensures that electrical noise in the thermocouple extension wires does not affect thermocouple temperature indication.

D. Ensures that different lengths of thermocouple extension wires do not affect thermocouple temperature indication.

QUESTION: 7

Two identical fission chamber neutron detectors, operating in the proportional region, are being used to monitor core neutron flux during a reactor startup. Detector A has developed a small leak that caused its argon fill gas pressure to decrease to approximately 25 percent of the gas pressure in detector B. When the reactor reaches criticality, the neutron flux indication produced by detector B will be _____ than the neutron flux indication produced by detector A, primarily because the higher gas pressure in detector B results in _____ .

A. greater; more neutron-induced fissions in detector B

B. smaller; fewer neutron-induced fissions in detector B

C. greater; more ionizations in the detector B fill gas

D. smaller; fewer ionizations in the detector B fill gas

QUESTION: 8

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

A direct-acting proportional temperature controller is being used to control the heat exchanger lube oil outlet temperature. When the lube oil outlet temperature matches the controller setpoint of 90°F, the controller output signal is 50 percent.

Current lube oil outlet temperature is stable at 100°F with the controller output signal at 70 percent.

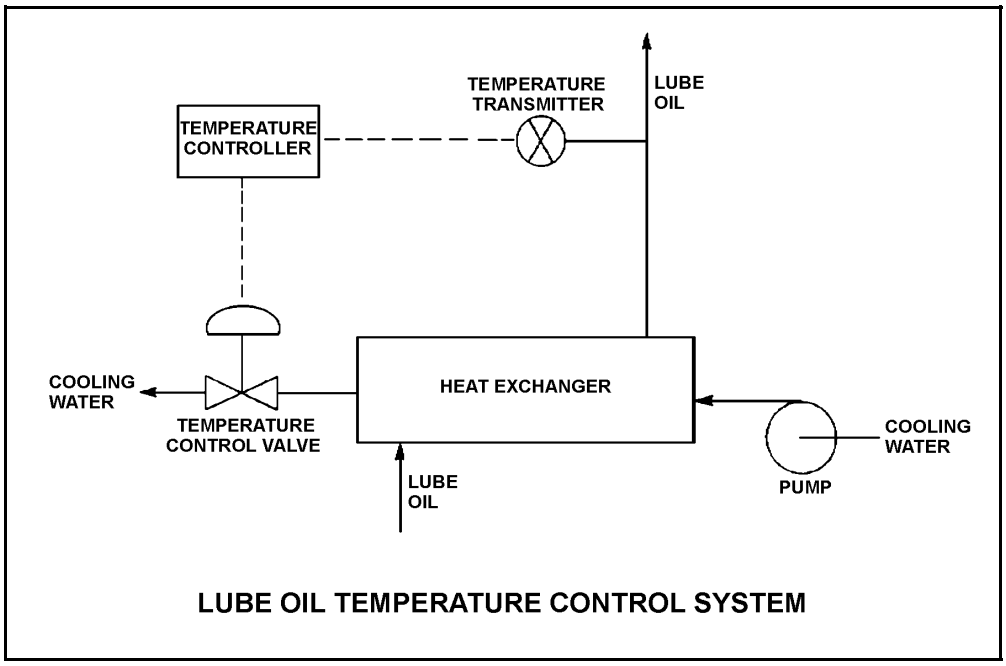
What is the temperature proportional band for this controller?

A. 90°F to 140°F

B. 90°F to 115°F

C. 65°F to 140°F

D. 65°F to 115°F



LUBE OIL TEMPERATURE CONTROL SYSTEM

QUESTION: 9

An air-operated isolation valve requires 3,600 lbf applied to the top of the actuator diaphragm to open. The actuator diaphragm has a diameter of 9 inches and the valve stem travels 3 inches from fully open to fully closed.

If control air pressure to the valve actuator begins to increase from 0 psig, which one of the following is the air pressure at which the valve will begin to open?

A. 14 psig

B. 57 psig

C. 81 psig

D. 127 psig

QUESTION: 10

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

A. Prevent pump runout and prevent motor overspeed.

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

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

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

QUESTION: 11

Which one of the following describes a reason for designing centrifugal pumps with suction nozzles that are larger than their discharge nozzles?

A. Increases total pump head by increasing the velocity head at the suction of the pump.

B. Increases the differential pressure across the pump by decreasing pump head loss.

C. Increases pump available net positive suction head by decreasing head loss at the pump suction.

D. Increases pump capacity by decreasing turbulence at the suction of the pump.

QUESTION: 12

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

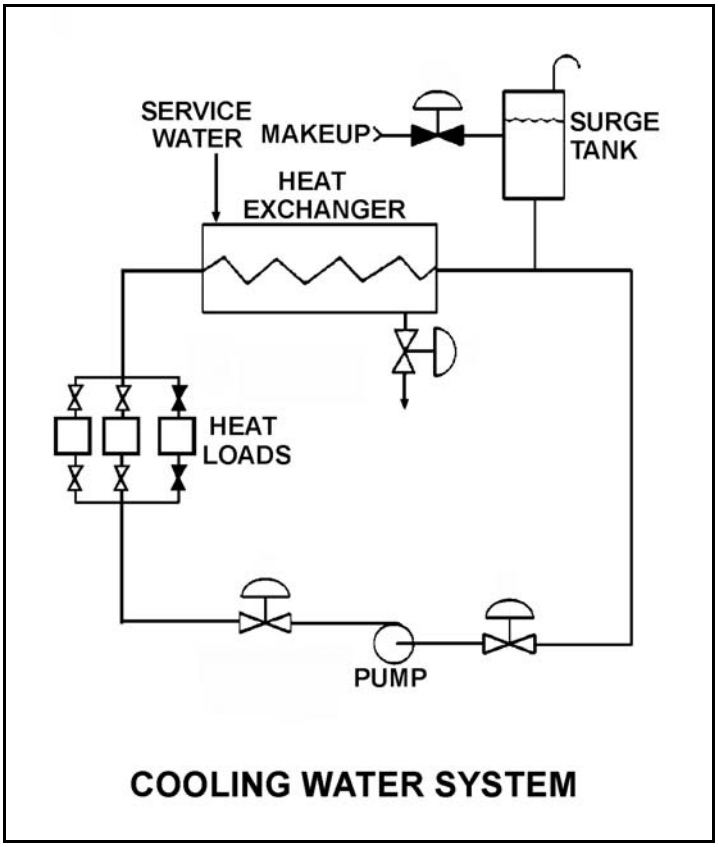
The pump is unable to achieve its rated volumetric flow rate due to cavitation. Which one of the following will enable the pump to achieve a higher volumetric flow rate before cavitation occurs?

A. Decrease the service water flow rate.

B. Operate the system at a lower pressure.

C. Move the surge tank connection closer to the suction of the pump.

D. Remove the existing pump motor and install a motor with a higher horsepower rating.



QUESTION: 13

Water enters a positive displacement pump at 50 psig and 90°F. What is the available net positive suction head for the pump?

A. 80 feet

B. 114 feet

C. 133 feet

D. 148 feet

QUESTION: 14

An AC motor-driven centrifugal pump is operating with a flow rate of 3,000 gpm and a motor current of 150 amps. If the pump speed is reduced such that the flow rate is 2,000 gpm, what is the final motor current at the new lower speed? (Assume a constant motor voltage.)

A. 44 amps

B. 59 amps

C. 67 amps

D. 100 amps

QUESTION: 15

A main generator is operating in parallel with an infinite power grid. If the current supplied to the generator field is slowly and continuously increased, the generator will experience high current due to: (Assume no generator protective actuations occur.)

A. generator reverse power.

B. excessive generator MW.

C. excessive generator MVAR in.

D. excessive generator MVAR out.

QUESTION: 16

The rate of heat transfer between two liquids in a heat exchanger will be <u>increased</u> if the: (Assume single-phase conditions and a constant specific heat for each liquid.)

A. flow rate of the colder liquid is decreased by 10 percent.

B. flow rate of the hotter liquid is increased by 10 percent.

C. inlet temperature of both liquids is decreased by 20°F.

D. inlet temperature of both liquids is increased by 20°F.

QUESTION: 17

Given the following parameter values for a feedwater heater:

- Feedwater inlet temperature: 320°F
- Feedwater inlet pressure: 1,000 psia
- Feedwater mass flow rate: 1.0×10^6 lbm/hr
- Extraction steam pressure: 500 psia

Assume that the extraction steam enters the heater as a dry saturated vapor and leaves the heater as a saturated liquid at 500 psia.

Which one of the following is the mass flow rate of extraction steam required to increase feedwater temperature to 380°F?

A. 5.2×10^4 lbm/hr

B. 7.9×10^4 lbm/hr

C. 8.4×10^4 lbm/hr

D. 8.9×10^4 lbm/hr

QUESTION: 18

During normal plant operation at 100 percent power, a main condenser develops an air leak that degrades vacuum at a rate of 1 inch Hg/min. Assuming the plant continues to operate at 100 percent power, condenser hotwell temperature will...

A. increase, because condensation of turbine exhaust steam is occurring at a higher temperature.

B. increase, because more work is being extracted from the steam by the turbine.

C. decrease, because condensation of turbine exhaust steam is occurring at a lower temperature.

D. decrease, because less work is being extracted from the steam by the turbine.

QUESTION: 19

A demineralizer is being used in a water purification system. How will the accumulation of suspended solids in the demineralizer affect the performance of the demineralizer?

A. The rate of resin depletion will increase.

B. The flow rate of water through the demineralizer will increase.

C. The differential pressure across the demineralizer will decrease.

D. The rate of unwanted ion removal from the system will decrease.

QUESTION: 20

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

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

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

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

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

QUESTION: 21

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

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

Based on these indications, the operator can accurately report that the breaker is open and racked to _____ position.

A. the OUT

B. the IN

C. the TEST

D. an unknown

QUESTION: 22

If a main generator output breaker is closed when the generator output is 5 degrees out of phase with the local power grid, the main generator will experience a sudden _____ stress; if the breaker remains closed and no additional operator action is taken, the main generator will _____ with the grid.

A minor; remain out of phase

B. minor; become locked into phase

C. potentially damaging; remain out of phase

D. potentially damaging; become locked into phase

QUESTION: 23

Which one of the following is a characteristic of a prompt neutron?

A. Expelled with an average kinetic energy of 0.5 MeV.

B. Usually emitted by the excited nucleus of a fission product.

C. Accounts for more than 99 percent of fission neutrons.

D. Released an average of 13 seconds after the fission event.

QUESTION: 24

A nuclear reactor is operating at full power at the beginning of a fuel cycle. A neutron has just been absorbed by a U-238 nucleus at a resonance energy of 6.7 electron volts.

Which one of the following describes the most likely reaction for the newly formed U-239 nucleus and the effect of this reaction on K_{excess}?

A. Decays over several days to Pu-239, which increases K_{excess}.

B. Decays over several days to Pu-240, which increases K_{excess}.

C. Immediately undergoes fast fission, which decreases K_{excess}.

D. Immediately undergoes thermal fission, which decreases K_{excess}.

QUESTION: 25

Given the following data for the fuel in an operating nuclear reactor core:

Nuclide	Delayed Neutron Fraction	Cross section for thermal fission	Fraction of Total Fission Rate
U-235	0.0065	531 barns	0.58
U-238	0.0148	< 1 barn	0.06
Pu-239	0.0021	743 barns	0.32
Pu-241	0.0049	1009 barns	0.04

What is the core delayed neutron fraction for this reactor?

A. 0.0044

B. 0.0055

C. 0.0063

D. 0.0071

QUESTION: 26

Which one of the following conditions will cause the moderator temperature coefficient (MTC) to become more negative? (Consider only the direct effect of the indicated change on MTC.)

A. Control rods are inserted from 50 percent rod density to 75 percent rod density.

B. Fuel temperature decreases from 1,500°F to 1,200°F.

C. Recirculation flow increases by 10 percent.

D. Moderator temperature decreases from 500°F to 450°F.

QUESTION: 27

Refer to the drawing of microscopic cross section for absorption versus neutron energy for a 6.7 electron volt (eV) resonance peak in U-238 for a nuclear reactor operating at 50 percent power (see figure below).

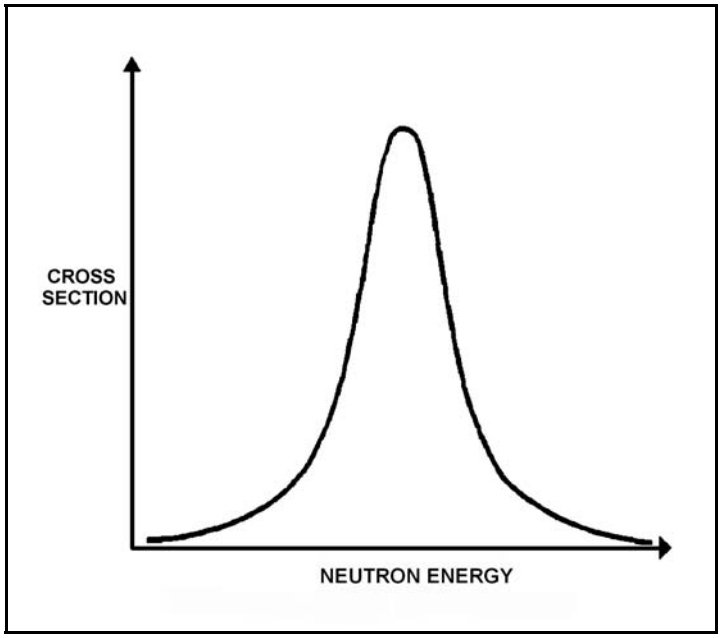
If fuel temperature decreases by 50°F, the area under the curve will _____ and positive reactivity will be added to the core because _____.

A. decrease; fewer neutrons will be absorbed by U-238 overall

B. decrease; fewer 6.7 eV neutrons will be absorbed by U-238 at the resonance energy

C. remain the same; fewer neutrons will be absorbed by U-238 overall

D. remain the same; fewer 6.7 eV neutrons will be absorbed by U-238 at the resonance energy



QUESTION: 28

A nuclear 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. remain the same.

B. increase and stabilize at a new higher level.

C. increase temporarily then return to the original value.

D. increase exponentially until the operator inserts the control rod.

QUESTION: 29

If the void fraction surrounding centrally located fuel bundles decreases, the worth of the associated control rod(s) will...

A. increase, because the average neutron energy in the area of the affected control rod(s) increases.

B. increase, because fewer neutrons are resonantly absorbed in the fuel while they are being thermalized, resulting in more thermal neutrons available to be absorbed by the affected control rod(s).

C. decrease, because the diffusion length of the thermal neutrons decreases, resulting in fewer thermal neutrons reaching the affected control rod(s).

D. decrease, because neutrons will experience a shorter slowing down length, resulting in a larger fraction of thermal neutrons being absorbed by the fuel and fewer thermal neutrons available to be absorbed by the affected control rod(s).

QUESTION: 30

Nuclear reactors A and B are operating at steady-state 100 percent power with equilibrium core Xe-135. The reactors are identical except that reactor A is operating at the end of core life (EOL) and reactor B is operating at the beginning of core life (BOL).

Which reactor core has the greater concentration of Xe-135?

A. Reactor A (EOL) due to the larger 100 percent power thermal neutron flux.

B. Reactor A (EOL) due to the smaller 100 percent power thermal neutron flux.

C. Reactor B (BOL) due to the larger 100 percent power thermal neutron flux.

D. Reactor B (BOL) due to the smaller 100 percent power thermal neutron flux.

QUESTION: 31

A nuclear reactor is initially operating at 100 percent power with equilibrium core xenon-135. Power is decreased to 75 percent over a 1-hour period and stabilized. No subsequent operator actions are taken.

Considering only the reactivity effects of core xenon-135 changes, which one of the following describes reactor power 30 hours after the power change?

A. Less than 75 percent and increasing slowly.

B. Less than 75 percent and decreasing slowly.

C. Greater than 75 percent and increasing slowly.

D. Greater than 75 percent and decreasing slowly.

QUESTION: 32

Refer to the drawing of K_{eff} versus core age for a nuclear reactor core following a refueling outage (see figure below).

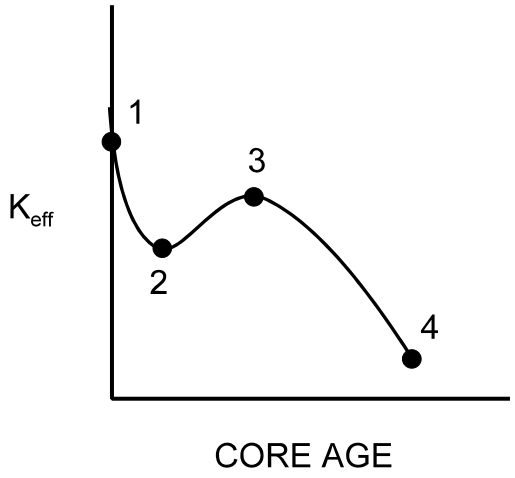
Which one of the following is responsible for the majority of the decrease in K_{eff} from point 1 to point 2?

A. Depletion of fuel.

B. Burnout of burnable poisons.

C. Initial heat-up of the reactor.

D. Buildup of fission product poisons.



QUESTION: 33

A reactor startup is in progress with the reactor currently subcritical.

Which one of the following describes the change in count rate resulting from a short control rod withdrawal with K_{eff} at 0.95 as compared to an identical control rod withdrawal with K_{eff} at 0.99? (Assume reactivity additions are equal, and the reactor remains subcritical.)

A. Both the prompt jump in count rate and the increase in stable count rate will be the same.

B. Both the prompt jump in count rate and the increase in stable count rate will be smaller with K_{eff} at 0.95.

C. The prompt jump in count rate will be smaller with K_{eff} at 0.95, but the increase in stable count rate will be the same.

D. The prompt jump in count rate will be the same, but the increase in stable count rate will be smaller with K_{eff} at 0.95.

QUESTION: 34

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

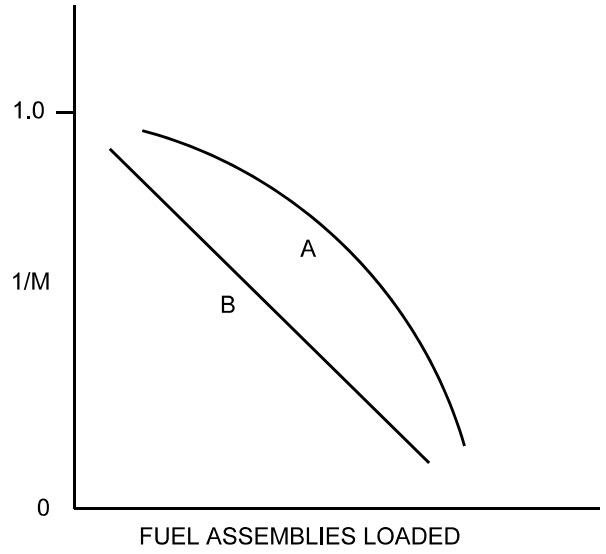
Curve A would result if each fuel assembly loaded during the early stages of core refueling caused a relatively _____ fractional change in source range count rate compared to the later stages of the refueling; curve B would result if each fuel assembly contained equal _____.

A. small; fuel enrichment

B. small; reactivity

C. large; fuel enrichment

D. large; reactivity



QUESTION: 35

Criticality has just been achieved during a reactor startup at 160°F. The main steam isolation valves are closed (*i.e.*, no steam flow from reactor). The operator withdraws control rods as necessary to establish a stable positive 60-second reactor period. No additional operator actions are taken.

How will reactor power and reactor period respond after the control rod withdrawal? (Assume a negative moderator temperature coefficient.)

A. Reactor power will increase and stabilize at the POAH; reactor period will remain nearly constant until the POAH is reached and then stabilize at infinity.

B. Reactor power will increase and stabilize at the POAH; reactor period will decrease slowly until the POAH is reached and then stabilize at infinity.

C. Reactor power will increase and stabilize above the POAH; reactor period will remain nearly constant until the POAH is reached and then stabilize at infinity.

D. Reactor power will increase and stabilize above the POAH; reactor period will decrease slowly until the POAH is reached and then stabilize at infinity.

QUESTION: 36

A nuclear power plant is operating at steady state 100 percent power when a reactor scram occurs. As a result of the scram, the core neutron flux will initially decrease on a period that is much _____ than -80 seconds; the period will become approximately -80 seconds about _____ minutes after the scram.

A. longer; 3

B. longer; 30

C. shorter; 3

D. shorter; 30

QUESTION: 37

An enclosed water storage tank is pressurized with nitrogen to prevent air inleakage. A differential pressure detector with a dry reference leg is used to measure the tank level.

To achieve the greatest accuracy of measurement, the low pressure side of the detector should sense which one of the following?

A. The pressure at the bottom of the tank.

B. The pressure of the atmosphere surrounding the tank.

C. The pressure of a column of water external to the tank.

D. The pressure of the gas space at the top of the tank.

QUESTION: 38

Given the following initial conditions for a spent fuel pool:

- Spent fuel decay heat rate: 5.0 Mw
- Spent fuel pool water temperature: 90°F
- Spent fuel pool water mass: 2.5×10^6 lbm
- Spent fuel pool water specific heat: 1.0 Btu/lbm-°F
- Spent fuel pool surface pressure: 14.7 psia

If a complete loss of spent fuel pool cooling occurs, how long will it take for spent fuel pool water temperature to reach 212°F? (Assume that the spent fuel pool remains in thermal equilibrium, and that there is no heat removal from the spent fuel pool.)

A. 18 hours

B. 31 hours

C. 48 hours

D. 61 hours

QUESTION: 39

A nuclear power plant is operating near rated power with the following initial conditions:

Main steam pressure: 900 psia
Main steam quality: 100 percent, saturated vapor
Main condenser pressure: 1.0 psia

Air leakage into the main condenser results in the main condenser pressure increasing and stabilizing at 2.0 psia. Assume that all main steam parameters (e.g., pressure, quality, and mass flow rate) remain the same and that the main turbine efficiency remains at 100 percent.

Which one of the following is the percent by which the main generator MW output will decrease as a result of the main condenser pressure increase?

A. 5.0 percent

B. 6.3 percent

C. 7.5 percent

D. 8.8 percent

QUESTION: 40

If the moisture content of the steam supplied to a main turbine increases, (assume no change in steam pressure, condenser pressure, or control valve position) turbine work will...

A. decrease, because the enthalpy of the steam being supplied to the turbine has decreased.

B. decrease, because moist steam is more likely to leak between turbine stages.

C. increase, because the enthalpy of the steam being supplied to the turbine has increased.

D. increase, because moist steam is less likely to leak between turbine stages.

QUESTION: 41

A centrifugal water pump was returned to service after maintenance. However, the operator failed to vent the pump.

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

A. lower; lower

B. lower; higher

C. higher; lower

D. higher; higher

QUESTION: 42

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

High pressure coolant injection (HPCI) pumps: 1,200 psia
Low pressure coolant injection (LPCI) pumps: 200 psia

Which pumps are currently threatened for operability and why?

A. LPCI pumps, due to pump overheating.

B. LPCI pumps, due to motor overheating.

C. HPCI pumps, due to pump overheating.

D. HPCI pumps, due to motor overheating.

QUESTION: 43

Which one of the following describes a heat transfer process in which convection is the most significant mode of heat transfer?

A. From the reactor fuel to the core barrel during core uncovery.

B. Through the tube walls in a main condenser during normal operation at 100 percent power.

C. From the reactor fuel to the steam outlet of the reactor vessel during a station blackout.

D. From the fuel pellet centerline to the fuel clad during normal operation at 100 percent power.

QUESTION: 44

If ΔT is the temperature difference between the fuel clad surface and the bulk coolant, which one of the following describes the heat transfer from a fuel rod experiencing departure from nucleate boiling?

A. Steam bubbles begin to blanket the fuel clad surface, causing a rapid increase in the ΔT for a given heat flux.

B. Steam bubbles completely blanket the fuel clad surface, causing a rapid decrease in the ΔT for a given heat flux.

C. Steam bubbles begin to form on the fuel clad surface, causing a rapid decrease in the heat flux from the fuel rod for a given ΔT.

D. Steam bubbles completely blanket the fuel clad surface, causing a rapid increase in the heat flux from the fuel rod for a given ΔT.

QUESTION: 45

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

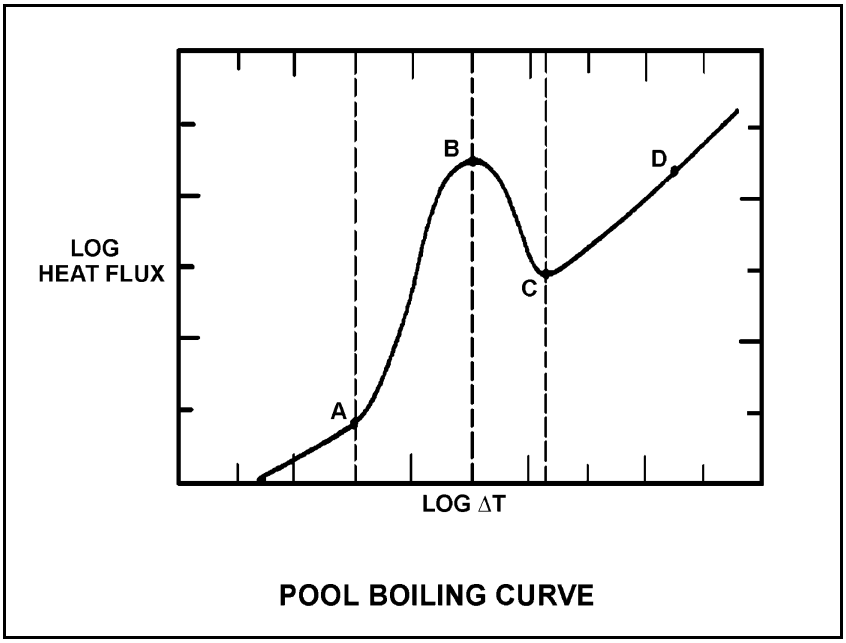
The point at which heat flux stops increasing and the critical heat flux has been reached (point B), marks the beginning of...

A. nucleate boiling.

B. stable film boiling.

C. partial film boiling.

D. single-phase convection.



QUESTION: 46

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

Given:

Pressure at P_1 is 34 psig.
Pressure at P_2 is 20 psig.
Pressure change due to change in velocity is 2 psig.
Pressure change due to change in elevation is 8 psig.

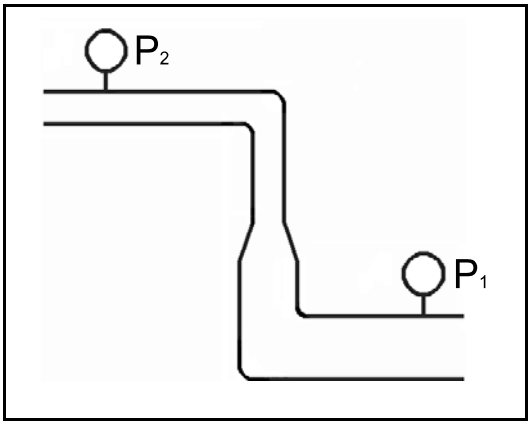
The pressure decrease due to friction head loss between P_1 and P_2 is _____; and the direction of flow is from _____.

A. 2 psig; left to right

B. 2 psig; right to left

C. 4 psig; left to right

D. 4 psig; right to left



QUESTION: 47

The linear heat generation rate (LHGR) for a nuclear reactor core is acceptable if _____ is being maintained at _____.

A. $LHGR_{limit}/LHGR_{measured}$; 0.95

B. $LHGR_{measured}/LHGR_{limit}$; 1.05

C. $LHGR_{limit}/LHGR_{measured}$; 1.10

D. $LHGR_{measured}/LHGR_{limit}$; 1.15

QUESTION: 48

If a nuclear reactor is operating with the minimum critical power ratio (MCPR) at its transient limit (or safety limit), which one of the following is indicated?

A. None of the fuel rods are experiencing critical heat flux.

B. A small fraction of the fuel rods may be experiencing critical heat flux.

C. All radioactive fission products are being contained within the reactor fuel.

D. All radioactive fission products are being contained within either the reactor fuel or the reactor vessel.

QUESTION: 49

Select the purpose of the gap between the fuel pellet and the clad.

A. Prevent contact between the fuel pellets and the clad.

B. Increase heat transfer from the fuel pellet to the clad.

C. Accommodate differential expansion between the fuel pellets and the clad.

D. Reduce diffusion of fission product gases through the clad and into the reactor coolant system.

QUESTION: 50

Which one of the following comparisons yields a higher probability of brittle fracture for a reactor vessel?

A. A high reactor fast neutron flux rather than a high gamma flux.

B. A high reactor vessel material ductility rather than a high material strength.

C. A rapid 100°F reactor heatup at a high temperature rather than a low temperature.

D. A rapid 100°F reactor cooldown at a high temperature rather than a low temperature.

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

DECEMBER 2011 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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