**UNITED STATES NUCLEAR REGULATORY COMMISSION**
**BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION**
**SEPTEMBER 2010--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

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

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

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

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

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

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

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

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

1 Btu = 778 ft-lbf

°C = (5/9)(°F - 32)

°F = (9/5)(°C) + 32

1 kg = 2.21 lbm

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

1 $gal_{water}$ = 8.35 lbm

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

QUESTION: 1

A completely full water storage tank is being hydrostatically tested to 100 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 10 gpm. The tank is protected by a safety valve and a relief valve; both valves will discharge to the atmosphere. Each valve has an opening setpoint of 105 psig and a maximum rated discharge flow rate of 6 gpm. The PDP is inadvertently left running when tank pressure reaches 100 psig.

With the PDP still running, tank pressure will stabilize _____ 105 psig; the greater mass flow rate will be coming from the _____ valve.

A. at; safety

B. above; safety

C. at; relief

D. above; relief

QUESTION: 2

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: 3

Refer to the drawing of a water supply pump with two suction sources (see figure below). All motor-operated valves (MOVs) are currently closed.

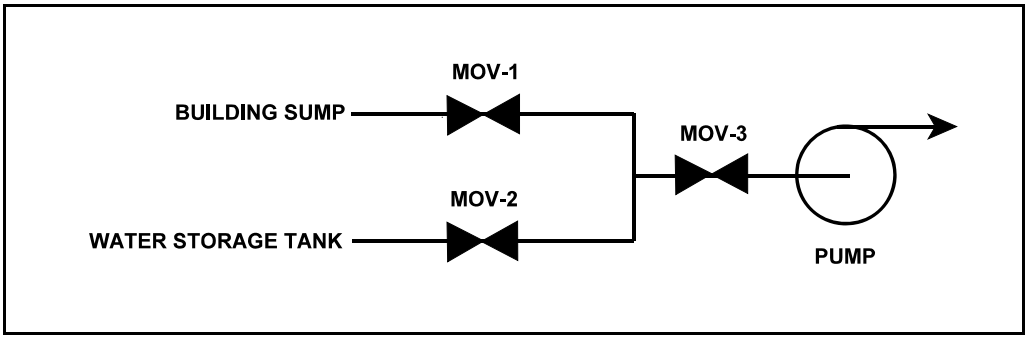
Which one of the following MOV interlocks will permit the pump to take a suction on either the building sump or the water storage tank, while preventing the two sources from being cross-connected?

A. None of the MOVs can be opened unless at least one MOV remains fully closed.

B. None of the MOVs can be opened unless at least two MOVs remain fully closed.

C. Neither MOV-1 nor MOV-2 can be opened unless MOV-3 is fully closed.

D. Neither MOV-1 nor MOV-2 can be opened unless the other source MOV is fully closed.



QUESTION: 4

A steam flow measuring instrument uses density compensation and square root compensation to convert the differential pressure across a flow element to flow rate in lbm/hr.

The purpose of square root compensation in this flow measuring instrument is to convert _____ to _____.

A. volumetric flow rate; mass flow rate

B. volumetric flow rate; differential pressure

C. differential pressure; mass flow rate

D. differential pressure; volumetric flow rate

QUESTION: 5

Refer to the drawing of a reactor vessel differential pressure (D/P) level detection system that was calibrated at 1,000 psia (see figure below).

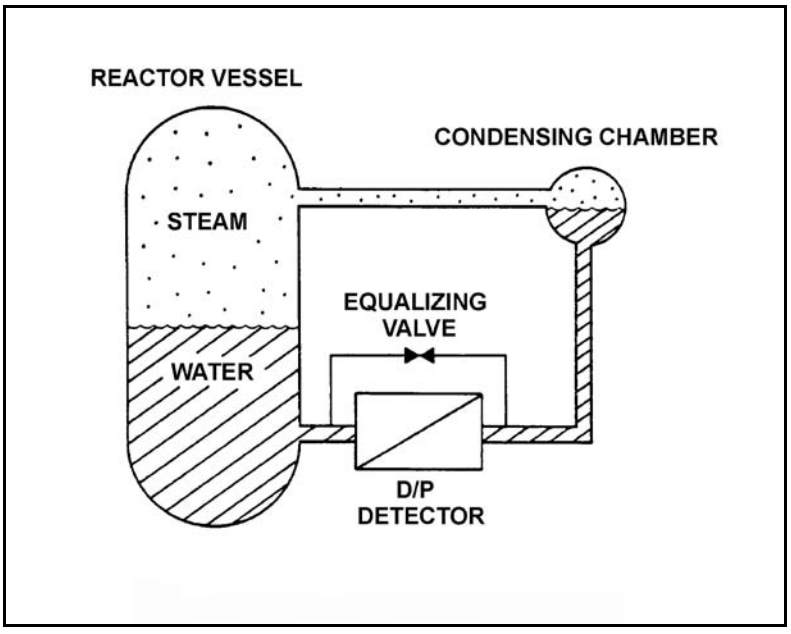
A reactor vessel cooldown has resulted in a decrease in reactor vessel pressure from 1,000 psia to 500 psia over several hours. Without density compensation of the level instrumentation, at the end of the cooldown, reactor vessel level indication would indicate _____ than actual level because the density of the water in the _____ has changed significantly. (Assume the reference leg does <u>not</u> flash to steam.)

A. higher; reactor vessel

B. higher; reference leg

C. lower; reactor vessel

D. lower; reference leg



QUESTION: 6

Because of a thermocouple temperature display failure, the millivolt output of a thermocouple circuit is being converted to temperature using conversion tables. The tables are based on a thermocouple reference junction temperature of 32°F. The reference junction is located in a panel that is maintained at 120°F. Room temperature surrounding the panel is 80°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.

QUESTION: 7

Which one of the following describes the positive space charge effect associated with a gas filled radiation detector?

A. Multiple detector pulses result from a single ionization event because positive ions form a cloud around the negative electrode, which increases the electric field strength, thereby initiating secondary ionizations.

B. Multiple detector pulses result from a single ionization event because positive ions form a cloud around the positive electrode, which increases the electric field strength, thereby initiating secondary ionizations.

C. The pulse amplitude resulting from an ionization event is reduced because positive ions form a cloud around the negative electrode, which reduces the electric field strength, thereby limiting secondary ionizations.

D. The pulse amplitude resulting from an ionization event is reduced because positive ions form a cloud around the positive electrode, which reduces the electric field strength, thereby limiting secondary ionizations.

QUESTION: 8

Consider a direct-acting proportional flow controller that is maintaining flow rate at a value that is offset from the controller setpoint. If the controller's gain is increased, the controller's offset will _____ and the controller's proportional band will _____.

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

QUESTION: 9

What is the purpose of a valve positioner in a typical pneumatic valve control system?

A. Convert the valve controller pneumatic output signal to a mechanical force to position the valve.

B. Convert the valve controller pneumatic output signal to an electrical output to position the valve.

C. Compare valve controller pneumatic output signal to setpoint error, and adjust valve actuator air supply pressure to position the valve.

D. Compare valve controller pneumatic output signal to valve position, and adjust valve actuator air supply pressure to position the valve.

QUESTION: 10

Refer to the drawing of a steam condenser, hotwell, and condensate pump (see figure below).

Given the following:

- The eye of the pump impeller is located 6.0 feet below the bottom of the hotwell.
- Hotwell water level is 6.0 feet.
- Hotwell water temperature is 90°F.
- Condenser pressure is 1.3 psia.
- Fluid velocity and friction head losses are zero.

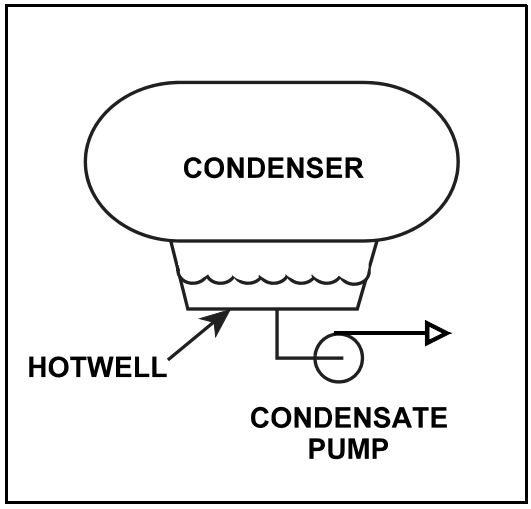
What is the net positive suction head available to the condensate pump?

A. 6.0 feet

B. 7.4 feet

C. 12.0 feet

D. 13.4 feet



QUESTION: 11

A motor-driven centrifugal pump is operating normally in a closed loop cooling water system. When the pump discharge flow control valve is opened further, the pump is unable to provide the desired volumetric flow rate due to cavitation. Which one of the following will enable a higher pump volumetric flow rate before cavitation occurs?

A. Remove the existing motor and install a motor with a lower horsepower rating.

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

C. Remove the existing pump and install a same-capacity pump with a lower minimum net positive suction head requirement.

D. Remove the existing pump and install a same-capacity pump with a higher minimum net positive suction head requirement.

QUESTION: 12

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

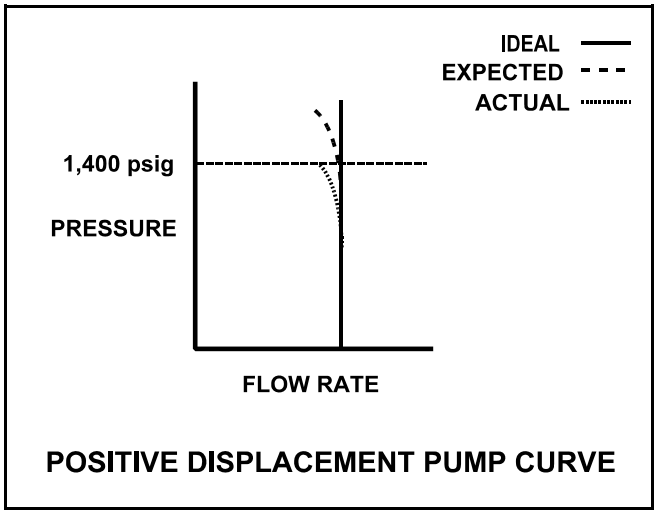
Which one of the following could cause the observed difference between the expected and the actual pump performance?

A. Pump internal leakage is greater than expected.

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

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

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




**POSITIVE DISPLACEMENT PUMP CURVE**

QUESTION: 13

Prior to starting a positive displacement pump, the discharge valve should be open to...

A. prevent rupturing the pump casing.

B. limit the pump motor starting time.

C. ensure the pump casing fills by backflow.

D. reduce pressure fluctuations in the discharge piping.

QUESTION: 14

A large centrifugal pump is driven by a 200 horsepower 4.16 KV ac motor. The motor breaker control circuit contains the following protection devices: instantaneous overcurrent relay, motor thermal overload relay, control power fuses, and an anti-pumping device.

The pump had been manually started and stopped several times during a 5-minute period when the motor breaker unexpectedly tripped. For this situation, which one of the following is the most likely cause of the breaker trip?

A. Instantaneous overcurrent

B. Motor thermal overload

C. Blown control power fuse

D. Anti-pumping device actuation

QUESTION: 15

A main generator is supplying 300 MVAR with a 0.90 power factor. What is the approximate MW load on the main generator?

A. 145 MW

B. 270 MW

C. 484 MW

D. 619 MW

QUESTION: 16

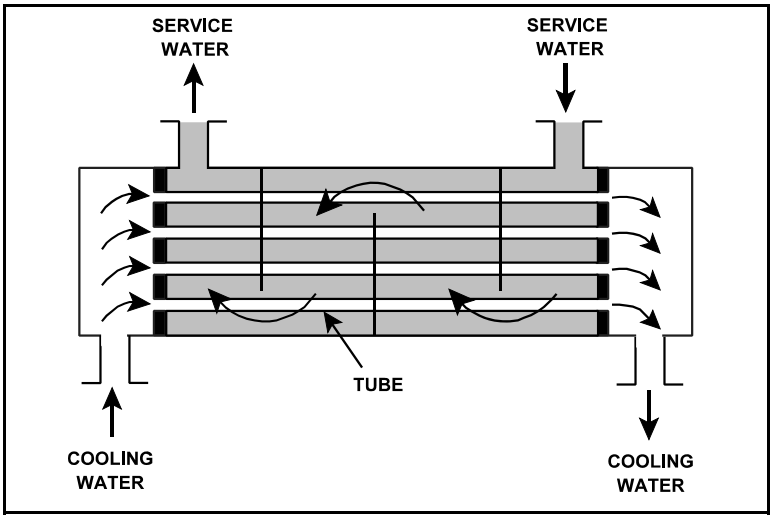
Refer to the drawing of a heat exchanger (see figure below).

The heat exchanger is in service with the following inlet temperatures:

Service water inlet temperature: 130°F
Cooling water inlet temperature: 70°F

Assume that both fluids have the same specific heat, and that service water mass flow rate is greater than cooling water mass flow rate. Which one of the following pairs of heat exchanger outlet temperatures is possible?

| | Service Water Outlet Temp. | Cooling Water Outlet Temp. |
|---|---|---|
| A. | 120°F | 82°F |
| B. | 110°F | 90°F |
| C. | 100°F | 98°F |
| D. | 90°F | 106°F |



QUESTION: 17

A steam-driven turbine exhausts to a condenser. If condenser vacuum increases, the turbine backpressure will _____, and the turbine power output will _____.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 18

A nuclear reactor is shut down at 400 psia during a maintenance outage when all forced core coolant flow is lost. Which one of the following will enhance natural circulation within the reactor vessel?

A. Increasing reactor vessel pressure to 500 psia.

B. Increasing reactor vessel water level above the steam separators.

C. Decreasing reactor vessel pressure to 300 psia.

D. Decreasing reactor vessel water level to just above the top of the core.

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

There is a temperature limit on the water entering a demineralizer because excessively hot water will...

A. decompose the resin beads.

B. increase the potential for channeling.

C. cause the filter element to swell and release the resin.

D. dislodge and wash the resin fines off the filter element.

QUESTION: 21

Which one of the following describes the local overcurrent trip flag indicators for a breaker?

A. They actuate prior to breaker tripping to warn of imminent protective action.

B. They indicate breaker overcurrent trip actuation during and after breaker trip actuation.

C. When actuated, they indicate that the associated breaker has failed to trip open.

D. When actuated, they indicate that the breaker overcurrent trip relay has been reset.

QUESTION: 22

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

**Note:** Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

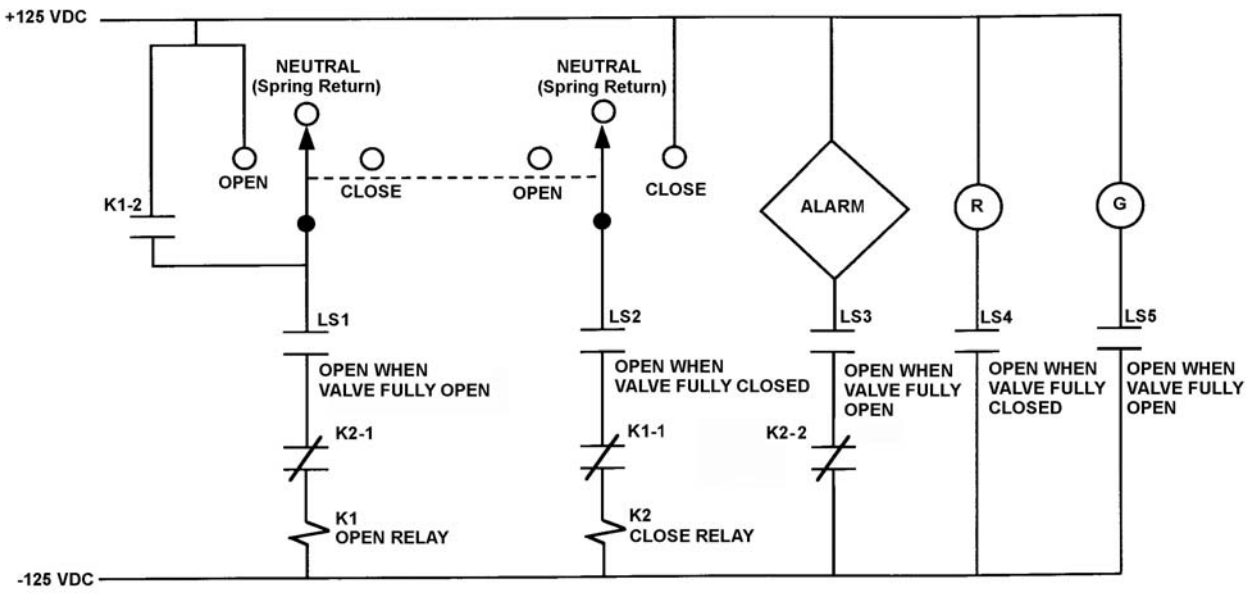
Which one of the following will actuate the alarm?

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

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

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

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




VALVE MOTOR CONTROL CIRCUIT

QUESTION: 23

The term “neutron generation time” is defined as the average time between...

A. neutron absorption and the resulting fission.

B. the production of a delayed neutron and subsequent neutron thermalization.

C. neutron absorption producing a fission and absorption or leakage of resultant neutrons.

D. neutron thermalization and subsequent neutron absorption.

QUESTION: 24

Shutdown margin for an operating nuclear reactor is the amount of reactivity by which a xenon-free reactor at 68°F would be subcritical if all control rods were...

A. withdrawn, assuming an average worth rod remains fully inserted.

B. inserted, assuming an average worth rod remains fully withdrawn.

C. withdrawn, assuming the highest worth rod remains fully inserted.

D. inserted, assuming the highest worth rod remains fully withdrawn.

QUESTION: 25

Which one of the following is the major cause for the change in the core delayed neutron fraction from the beginning to the end of a fuel cycle?

A. Burnup of the burnable poisons.

B. Changes in the fuel composition.

C. Buildup of fission product poisons.

D. Shift in the core axial power distribution.

QUESTION: 26

Consider a one month period of 100 percent power operation near the beginning of a fuel cycle.

During this period of operation, the depletion of U-235 in the fuel tends to make the moderator temperature coefficient _____ negative, and the withdrawal of control rods tends to make the moderator temperature coefficient _____ negative.

A. more; less

B. more; more

C. less; more

D. less; less

QUESTION: 27

Which one of the following isotopes is the most significant contributor to resonance capture of fission neutrons in a nuclear reactor core at the end of a fuel cycle?

A. U-235

B. U-238

C. Pu-239

D. Pu-240

QUESTION: 28

Rod position indication shows that a control rod is at position 22. If the control rod is then moved to position 12, it is being...

A. inserted 30 inches.

B. withdrawn 30 inches.

C. inserted 60 inches.

D. withdrawn 60 inches.

QUESTION: 29

A nuclear reactor is operating at 85 percent power with control rod X-Y inserted 20 percent. Which one of the following will cause the differential rod worth of control rod X-Y to become more negative? (Assume that control rod X-Y remains 20 percent inserted for each case.)

A. Core Xe-135 builds up in the lower half of the core.

B. An adjacent control rod is fully withdrawn from the core.

C. Reactor vessel pressure drifts from 900 psig to 880 psig.

D. Fuel temperature increases as fission product gases accumulate in nearby fuel rods.

QUESTION: 30

A nuclear reactor was operating at 100 percent power for two weeks when power was reduced to 50 percent over a 1-hour period. In order to maintain reactor power stable during the next 24 hours, which one of the following incremental control rod manipulations will be required?

A. Insert rods slowly during the entire period.

B. Insert rods slowly at first, then withdraw rods slowly.

C. Withdraw rods slowly during the entire period.

D. Withdraw rods slowly at first, then insert rods slowly.

QUESTION: 31

Given:

- A nuclear reactor was operating at 100 percent power for six weeks when a scram occurred.
- A reactor startup was performed and criticality was reached 16 hours after the scram.
- Two hours later, the reactor is currently at 30 percent power.

If no operator actions occur during the next hour, reactor power will _____ because core Xe-135 concentration is _____.

A. increase; decreasing

B. increase; increasing

C. decrease; decreasing

D. decrease; increasing

QUESTION: 32

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

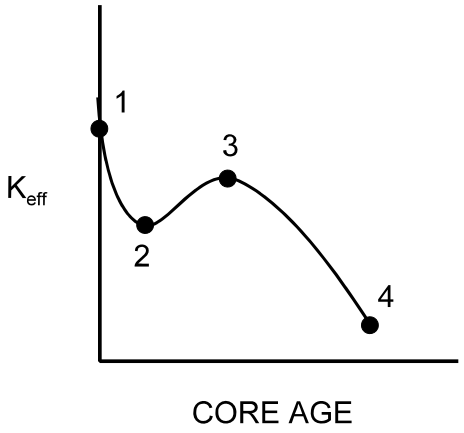
The change in $K_{eff}$ from point 2 to point 3 is caused by...

A. depletion of fuel.

B. depletion of control rods.

C. burnout of burnable poisons.

D. burnout of fission product poisons.



QUESTION: 33

The following data were obtained at steady-state conditions during a nuclear reactor startup:

| Control Rod Units Withdrawn | Source Range Count Rate (cps) |
|---|---|
| 10 | 360 |
| 15 | 400 |
| 20 | 450 |
| 25 | 514 |
| 30 | 600 |
| 35 | 720 |
| 40 | 900 |

Assuming uniform differential rod worth, at what approximate control rod position will criticality occur?

A. 50 units withdrawn

B. 60 units withdrawn

C. 70 units withdrawn

D. 80 units withdrawn

QUESTION: 34

A nuclear reactor is initially critical in the source range. Then a constant rate addition of positive reactivity commences and lasts for 120 seconds. Assume reactor power remains below the point of adding heat for the entire 120 second time interval.

During the 120 second time interval, reactor period will initially shorten and then continue to shorten with a/an _____ rate; and reactor power will initially increase and then continue to increase with a/an _____ rate.

A. decreasing; increasing

B. decreasing; decreasing

C. increasing; increasing

D. increasing; decreasing

QUESTION: 35

A nuclear power plant is initially operating at 100 percent power with 100 percent core flow rate. Reactor power is reduced to 90 percent by inserting control rods. (Recirculating pump speed remains constant.)

What is the effect of the power reduction on core flow rate?

A. Core flow rate will increase due to a decrease in recirculation ratio.

B. Core flow rate will increase due to a decrease in two-phase flow resistance.

C. Core flow rate will decrease due to an increase in recirculation ratio.

D. Core flow rate will decrease due to an increase in two-phase flow resistance.

QUESTION: 36

A nuclear power plant has been operating at 100 percent power for several weeks when a reactor scram occurs. How much time will be required for core decay heat production to decrease to one percent following the scram?

A. 1 to 8 seconds

B. 1 to 8 minutes

C. 1 to 8 hours

D. 1 to 8 days

QUESTION: 37

Refer to the drawing of four differential pressure level detectors (see figure below).

The tanks are identical and being maintained at 30 psia with a water level of 20 feet. They are surrounded by standard atmospheric pressure. The water temperatures in the tanks and reference legs are the same.

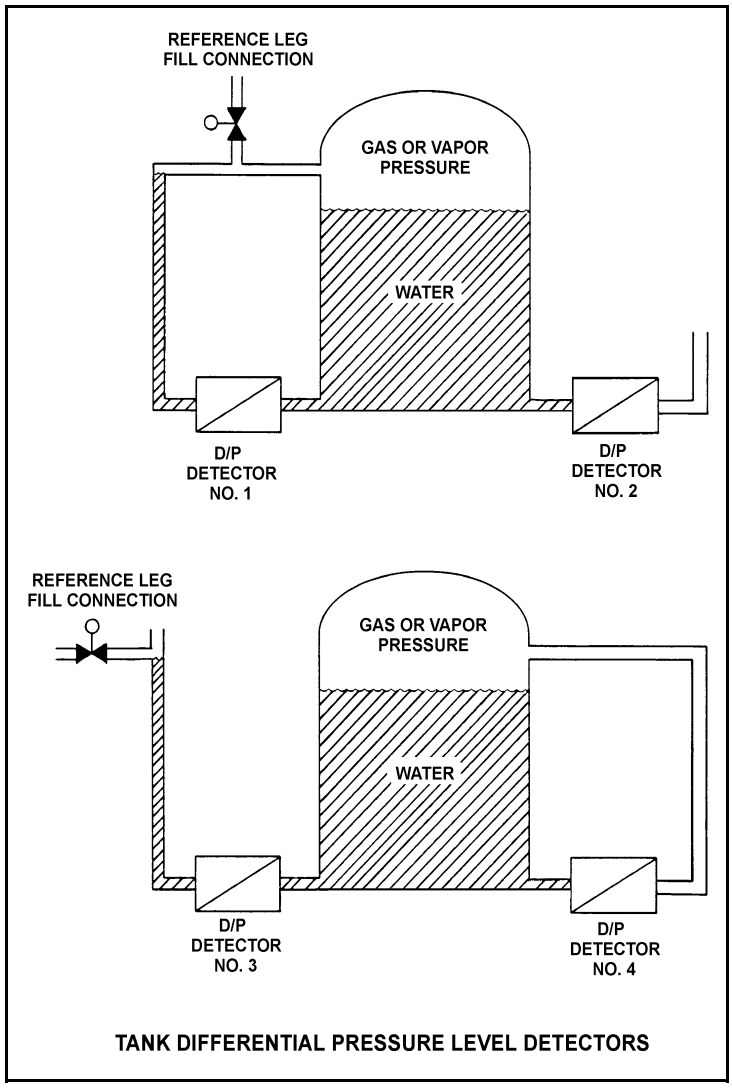
If each detector experiences a ruptured diaphragm, which detector(s) will cause indicated tank level to decrease? (Assume actual tank water level remains constant.)

A. No. 1 only

B. No. 2 only

C. No. 1, 2, and 3

D. No. 2, 3, and 4




TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

QUESTION: 38

A nuclear power plant is operating at power. Steam is escaping to atmosphere through a flange leak in a steam supply line to the low pressure section of the main turbine.

Given:

- Steam line pressure is 200 psia.
- Steam line temperature is 400°F.

Assuming no heat transfer to/from the steam, what is the approximate temperature of the steam as it reaches atmospheric pressure?

A. 212°F

B. 284°F

C. 339°F

D. 375°F

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 approximate 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 turbine decreases, steam cycle efficiency will increase because the...

A. enthalpy of the steam being supplied to the turbine has increased.

B. mass flow rate of the steam through the turbine has increased.

C. reheat capacity of the turbine extraction steam has increased.

D. the operating temperature of the turbine blades has increased.

QUESTION: 41

A 100 gpm leak to atmosphere has developed from a cooling water system that is operating at 45 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 30 psig?

A. 25 gpm

B. 50 gpm

C. 67 gpm

D. 82 gpm

QUESTION: 42

An ideal positive displacement pump is initially operating with the following parameters:

Suction pressure: 10 psig
Discharge pressure: 25 psig
Flow rate: 100 gpm

A pump discharge valve is throttled such that pump discharge pressure increases to 40 psig. If pump suction pressure does not change, the pump flow rate will...

A. remain constant.

B. decrease in direct proportion to the change in pump differential pressure.

C. decrease in direct proportion to the square of the change in pump differential pressure.

D. decrease in direct proportion to the square root of the change in pump differential pressure.

QUESTION: 43

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

A. The steam and feedwater flow rates used in the heat balance calculation were 10 percent higher than actual flow rates.

B. The operator miscalculated the enthalpy of the steam exiting the reactor vessel to be 10 Btu/lbm higher than actual.

C. The feedwater temperature used in the heat balance calculation was 20°F higher than actual feedwater temperature.

D. The reactor recirculation pump heat input term used in the heat balance was 10 percent lower than actual.

QUESTION: 44

How does the convective heat transfer coefficient vary from the bottom to the top of a fuel rod if subcooled reactor coolant enters the coolant channel and exits as superheated steam?

A. Increases continuously

B. Increases, then decreases

C. Decreases continuously

D. Decreases, then increases

QUESTION: 45

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

A. Flow channel boundary layer

B. Cladding corrosion film

C. Zircaloy cladding

D. Pellet-to-clad gap

QUESTION: 46

Two nuclear reactors, A and B, are operating at the same rated power with neutron flux radially peaked in the center of each core. Reactors A and B 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 A, the center fuel bundle in reactor B will have the _____ critical power and the _____ coolant flow rate.

A. lowest; lowest

B. lowest; highest

C. highest; lowest

D. highest; highest

QUESTION: 47

A nuclear reactor is initially operating at steady state 40 percent power with power distribution peaked both radially and axially in the center of the core. Reactor power is then increased to 70 percent over the next two hours using only reactor recirculation flow rate adjustments for reactivity control. Neglect any effect from changes in reactor poisons.

During the power increase, the location of the maximum core radial peaking factor will _____ of the core, and the location of the maximum core axial peaking factor will _____ of the core.

A. shift to the periphery; move toward the bottom

B. shift to the periphery; move toward the top

C. remain near the center; move toward the bottom

D. remain near the center; move toward the top

QUESTION: 48

A BWR core consists of 30,000 fuel rods. Each fuel rod has an active length of 12 feet. The core is producing 1,800 MW of thermal power. If the total peaking factor for a node is 1.6, what is the maximum local linear power density being produced in the node?

A. 4.0 kW/ft

B. 6.0 kW/ft

C. 8.0 kW/ft

D. 10.0 kW/ft

QUESTION: 49

If reactor feedwater temperature suddenly decreases by 10°F during operation at 75 percent power, critical power will initially _____ and bundle power will initially _____. (Assume the reactor does not scram.)

A. decrease; decrease

B. decrease; increase

C. increase; increase

D. increase; decrease

QUESTION: 50

The total stress on the reactor vessel inner wall is greater during cooldown than heatup because...

A. thermal heatup stress totally offsets pressure stress at the inner wall.

B. both pressure stress and thermal cooldown stress are tensile at the inner wall.

C. the tensile thermal cooldown stress at the inner wall is greater in magnitude than the compressive pressure stress at the same location.

D. thermal cooldown stress and thermal heatup stress are both tensile at the inner wall, but cooldown stress is greater in magnitude.

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

SEPTEMBER 2010 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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