UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 2016 – FORM A

Please Print

Name: _____

Docket No.: _____

Facility: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO EXAMINEE

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. pressurized water reactor (PWR) nuclear power plant.

SECTION	QUESTIONS	% OF TOTAL	SCORE
COMPONENTS	1 - 22		
REACTOR THEORY	23 - 36		
THERMODYNAMICS	37 - 50		
TOTALS	50		

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

_____

Examinee'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 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 SHEET

EQUATIONS

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

$\ell^* = 1.0 \times 10^{-4}$ sec

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

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

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

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

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

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

$CR_1(1 - K_{eff_1}) = CR_2(1 - K_{eff_2})$

$1/M = CR_1/CR_x$

$A = \pi r^2$

$F = PA$

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

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

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

Thermal Efficiency = Net Work Out/Energy In

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

$g = 32.2\ \text{ft/sec}^2$

$g_c = 32.2$ 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

$℃ = (5/9)(°F - 32)$

$°F = (9/5)(℃) + 32$

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 300 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 4 gpm. The tank is protected by a relief valve that discharges to the atmosphere. The relief valve has the following characteristics:

- The relief valve opening setpoint is 300 psig with an accumulation of 5 percent.
- The relief valve has linear flow characteristics and a maximum rated flow rate of 6 gpm.

The PDP is inadvertently left running when tank pressure reaches 300 psig.

With the PDP still running, at what pressure will the tank stabilize?

A. 305 psig

B. 310 psig

C. 315 psig

D. 320 psig

QUESTION: 2

Which one of the following is a disadvantage associated with using a gate valve, versus a globe valve, to throttle flow in a cooling water system?

A. A gate valve will experience stem leakage unless it is fully opened and backseated.

B. The tortuous flow path through a throttled gate valve body makes flow control difficult.

C. A fully open gate valve will produce a greater system head loss than a fully open globe valve.

D. The turbulent flow created by a throttled gate valve will cause erosion damage to the valve seat.

QUESTION: 3

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 _____ into _____.

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: 4

Refer to the drawing of a pressurizer and differential pressure (D/P) level detection system that was recently calibrated at normal operating conditions (see figure below). Assume that the associated pressurizer level instrument does not use density compensation.

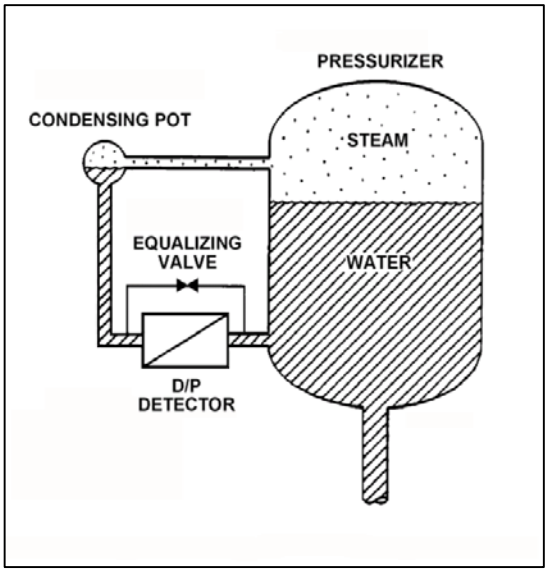
With the nuclear power plant shut down at reduced reactor coolant system temperature and pressure, the pressurizer level instrument will indicate _____ than actual water level because the D/P currently sensed by the D/P detector is _____ than the D/P for the same pressurizer water level at normal operating conditions.

A. lower; smaller

B. lower; larger

C. higher; smaller

D. higher; larger



QUESTION: 5

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.

QUESTION: 6

Given the following conditions:

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

Assuming that the source neutron flux level remains constant, how and why will source range detector outputs change as homogeneous core voiding increases from 0 percent to 50 percent?

A. Increase, because the detectors will experience a higher rate of neutron interactions due to the axial power distribution shifting toward the lower portion of the core.

B. Increase, because the detectors will experience a higher rate of neutron interactions due to increasing neutron leakage from the core.

C. Decrease, because the detectors will experience a lower rate of neutron interactions due to a decreasing subcritical multiplication neutron level.

D. Decrease, because the detectors will experience a lower rate of gamma interactions due to decreasing reactor coolant attenuation.

QUESTION: 7

If the turbine shaft speed signal received by a typical turbine governor control system fails high during turbine startup, the turbine governor will cause turbine speed to...

A. increase until an upper limit is reached or the turbine trips on overspeed.

B. increase until the mismatch with the turbine speed demand signal is nulled.

C. decrease until a lower limit is reached or turbine steam flow is isolated.

D. decrease until the mismatch with the turbine speed demand signal is nulled.

QUESTION: 8

Refer to the drawing of a pneumatic control system (see figure below).

An increasing steam generator (SG) water level will decrease the SG level control signal and ultimately reduce the control air pressure applied to the feed control valve.

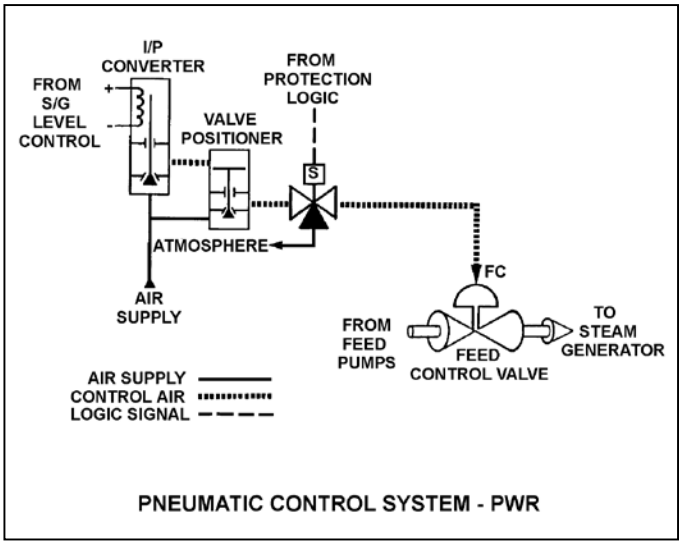
If the level control signal is manually increased, how will the pneumatic control system affect SG level?

A. Level will decrease because the valve positioner will close more, which causes the feed control valve to close more.

B. Level will decrease because the valve positioner will open more, which causes the feed control valve to close more.

C. Level will increase because the valve positioner will close more, which causes the feed control valve to open more.

D. Level will increase because the valve positioner will open more, which causes the feed control valve to open more.



PNEUMATIC CONTROL SYSTEM - PWR

QUESTION: 9

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

The temperature control system uses a direct-acting controller. The temperature of the lube oil leaving the heat exchanger is currently stable at 93EF.

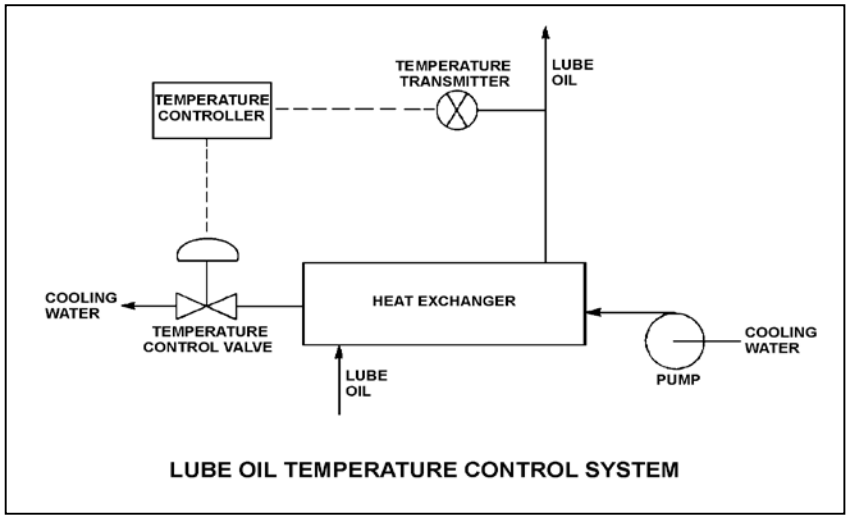
To be compatible with the controller, the temperature control valve must fail _____ on a loss of control air pressure; and for the temperature control system to return the lube oil heat exchanger outlet temperature to 93°F after a large change in lube oil heat loads, the controller must have a/an _____ characteristic.

A. closed; integral

B. closed; derivative

C. open; integral

D. open; derivative



LUBE OIL TEMPERATURE CONTROL SYSTEM

QUESTION: 10

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

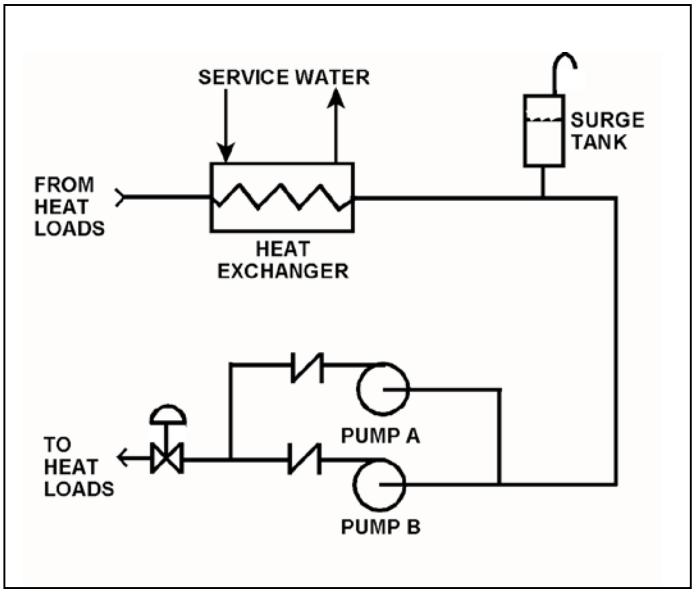
Pumps A and B are identical single-speed centrifugal pumps and both pumps are initially operating when pump B trips. After the system stabilizes, system flow rate will be...

A. more than one-half the original flow.

B. one-half the original flow.

C. less than one-half the original flow.

D. the same; only the pump head will change.



QUESTION: 11

A motor-driven radial-flow centrifugal pump is used to provide makeup water to a vented 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 empty.

With tank filling underway, the pump motor will have the lowest power demand if the pump is using the _____ connection; and the tank will require the least amount of time to become completely full if the pump is using the _____ connection.

A. top; top

B. top; bottom

C. bottom; top

D. bottom; bottom

QUESTION: 12

Refer to the drawing showing two different operating points for the same centrifugal pump operating in the same cooling water system (see figure below).

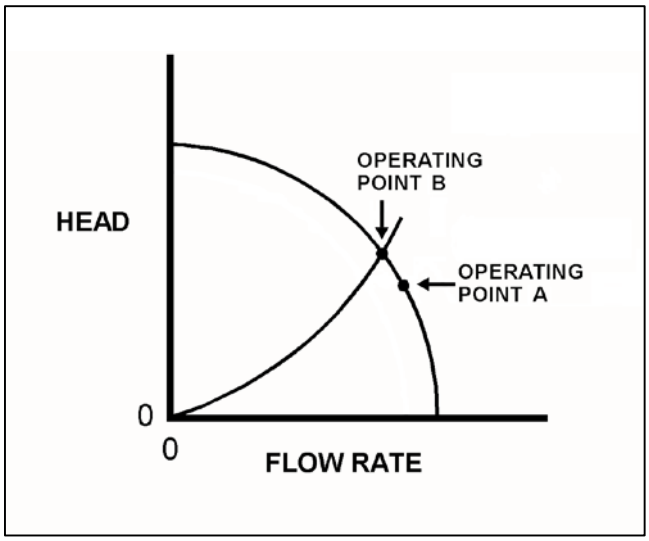
Operating point A was generated from pump data collected two days ago. Operating point B was generated from pump data collected today. Which one of the following would cause the observed difference between operating points A and B?

A. The pump was rotating faster when data was collected for operating point B.

B. The pump was rotating slower when data was collected for operating point B.

C. The pump discharge valve was more open when data was collected for operating point B.

D. The pump discharge valve was more closed when data was collected for operating point B.



QUESTION: 13

Which one of the following describes the proper location for a relief valve that will be used to prevent exceeding the design pressure of a positive displacement pump and associated piping?

A. On the pump suction piping upstream of the suction isolation valve.

B. On the pump suction piping downstream of the suction isolation valve.

C. On the pump discharge piping upstream of the discharge isolation valve.

D. On the pump discharge piping downstream of the discharge isolation valve.

QUESTION: 14

Refer to the pump performance curves for a centrifugal cooling water pump (see figure below). The pump is being driven by a single-speed AC induction motor. Pump flow rate is being controlled by a throttled discharge flow control valve.

The following initial pump conditions exist:

Motor current = 10 amps
Pump flow rate = 200 gpm

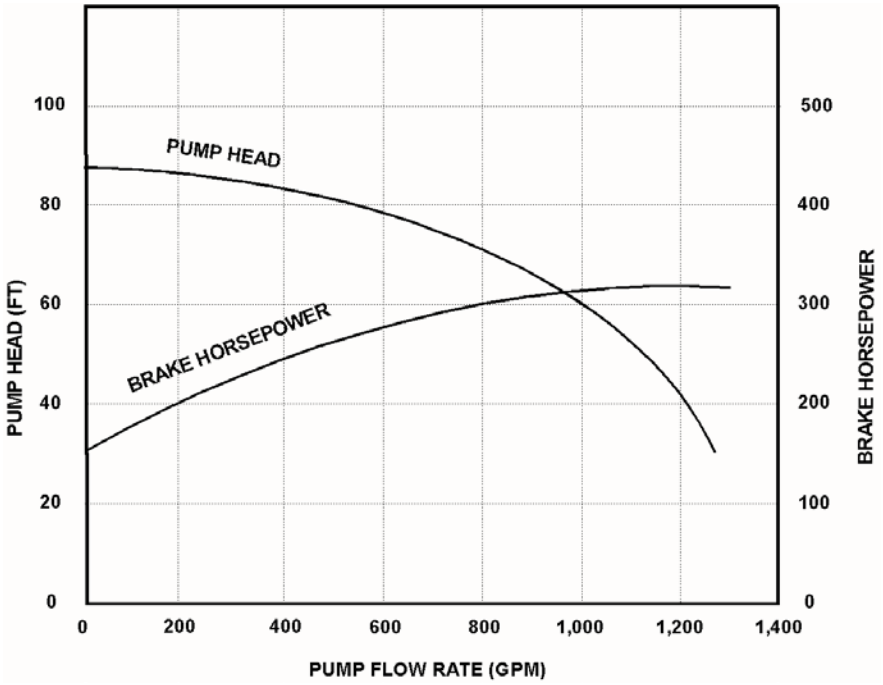
What will be the approximate value of pump motor current if the flow control valve is repositioned such that pump flow rate increases to 800 gpm?

A. 15 amps

B. 40 amps

C. 160 amps

D. Greater than 200 amps



QUESTION: 15

A large centrifugal pump is driven by a 200 horsepower AC induction 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 tripped. Which one of the following is the most likely cause of the breaker trip?

A. Motor thermal overload.

B. Instantaneous overcurrent.

C. Blown control power fuse.

D. Anti-pumping device actuation.

QUESTION: 16

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 approximate 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: 17

A nuclear power plant was initially operating at steady-state 50 percent power with 50 gpm of main condenser cooling water inleakage through a cooling water tube rupture. Power was then increased, and is currently stable at 60 percent.

Assume the size of the cooling water tube rupture does not change, and the main condenser cooling water inlet pressure and inlet temperature do not change.

When compared to the flow rate of main condenser cooling water inleakage at 50 percent power, the flow rate of cooling water inleakage at 60 percent power is _____ because the main condenser pressure at 60 percent power is _____.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

QUESTION: 18

A mixed-bed ion exchanger is being used to process reactor coolant letdown. The ion exchanger is boron-saturated for the existing reactor coolant conditions. Which one of the following describes a system change and resulting effect that will cause the boron concentration in the ion exchanger outlet water to be greater than the boron concentration in the inlet water?

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

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

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

D. A decrease in reactor coolant boron concentration will cause captured borate ions to be released to re-establish chemical equilibrium at the resin exchange sites.

QUESTION: 19

A demineralizer should be removed from service if the demineralizer differential pressure is _____ than the established limit, or if the demineralizer decontamination factor is _____ than the established limit.

A. less; less

B. less; greater

C. greater; less

D. greater; greater

QUESTION: 20

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.

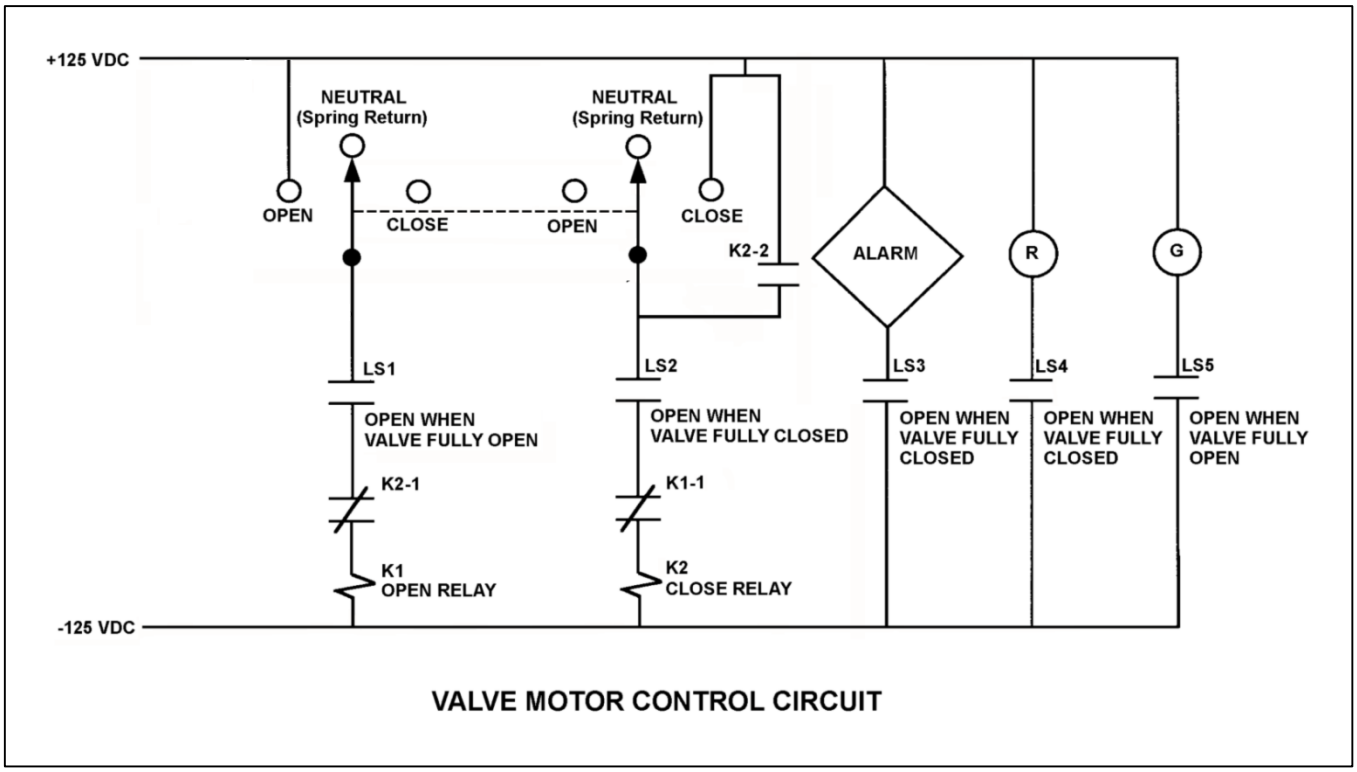
QUESTION: 21

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully open and has an 8-second stroke time.

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. All contacts are functional, except for contact K2-2 which has failed open.

An operator takes the control switch to CLOSE. Four seconds later, the operator releases the control switch. When the valve stops moving, what will be the status of the alarm and the red (R) and green (G) indicating lights?

	Alarm	Red Ind. Light	Green Ind. Light
A.	On	On	On
B.	On	Off	Off
C.	Off	On	Off
D.	Off	Off	On



VALVE MOTOR CONTROL CIRCUIT

QUESTION: 22

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: 23

In a comparison between a delayed neutron and a prompt neutron produced from the same fission event, the delayed neutron is more likely to... (Assume that each neutron remains in the core unless otherwise stated.)

A. cause fission of a U-238 nucleus.

B. travel to an adjacent fuel assembly.

C. be absorbed in a B-10 nucleus.

D. leak out of the core.

QUESTION: 24

A reactor is operating at steady-state 80 percent power when the operator adds 10 gallons of concentrated boric acid to the reactor coolant system (RCS). Over the next several minutes, the operator adjusts control rod position as necessary to maintain a constant RCS average temperature.

When the plant stabilizes, the shutdown margin will be _____; and axial power distribution will have shifted toward the _____ of the core.

A. the same; top

B. the same; bottom

C. greater; top

D. greater; bottom

QUESTION: 25

A nuclear power plant has been operating at 100 percent power for two months when a reactor trip occurs. Two months after the reactor trip, with all control rods still fully inserted, a stable count rate of 20 cps is indicated on the source range nuclear instruments.

The majority of the source range detector output is being caused by the interaction of _____ with the detector.

A. intrinsic source neutrons

B. fission gammas from previous power operation

C. fission neutrons from subcritical multiplication

D. delayed fission neutrons from previous power operation

QUESTION: 26

Factors that affect the probability of resonance absorption of a neutron by a nucleus include...

A. excitation energy of the neutron, kinetic energy of the nucleus, and kinetic energy of the neutron.

B. kinetic energy of the neutron, excitation energy of the nucleus, and excitation energy of the neutron.

C. excitation energy of the nucleus, excitation energy of the neutron, and kinetic energy of the nucleus.

D. kinetic energy of the nucleus, kinetic energy of the neutron, and excitation energy of the nucleus.

QUESTION: 27

Ignoring the effects of changes in fission product poisons, which one of the following power changes requires the smallest amount of positive reactivity addition?

A. 2 percent to 5 percent

B. 5 percent to 15 percent

C. 15 percent to 30 percent

D. 30 percent to 50 percent

QUESTION: 28

Which one of the following expresses the relationship between differential rod worth (DRW) and integral rod worth (IRW)?

A. IRW is the slope of the DRW curve.

B. IRW is the inverse of the DRW curve.

C. IRW is the sum of the DRWs between the initial and final control rod positions.

D. IRW is the sum of the DRWs of all control rods at a specific control rod position.

QUESTION: 29

A reactor is operating at steady-state 100 percent power when a single control rod fully inserts from the fully withdrawn position. After the initial transient, the operator returns the reactor to 100 percent power with the control rod still fully inserted.

Compared to the initial axial neutron flux shape, the current axial neutron flux shape will have a...

A. minor distortion, because a fully inserted control rod has zero reactivity worth.

B. minor distortion, because the fully inserted control rod is an axially uniform poison.

C. major distortion, because the upper and lower core halves are loosely coupled.

D. major distortion, because power production along the length of the rod drastically decreases.

QUESTION: 30

Which one of the following describes the production mechanisms of xenon-135 in a reactor that is operating at steady-state 100 percent power?

A. Primarily from fission, secondarily from iodine decay

B. Primarily from fission, secondarily from promethium decay

C. Primarily from iodine decay, secondarily from fission

D. Primarily from promethium decay, secondarily from fission

QUESTION: 31

Nuclear reactors A and B are identical and are operating near the middle of a fuel cycle. Reactor A is operating at steady-state 100 percent power, while reactor B is operating at steady-state 50 percent power. The integral control rod worth is the same for both reactors.

Which one of the following describes which reactor will have the greater K_{eff} <u>at three minutes</u> and <u>at three days</u> following a reactor trip? (Assume that all control rods fully insert and that <u>no</u> subsequent operator actions affecting reactivity are taken.)

	Three <u>Minutes</u>	Three <u>Days</u>
A.	Reactor A	Reactor A
B.	Reactor A	Reactor B
C.	Reactor B	Reactor A
D.	Reactor B	Reactor B

QUESTION: 32

Refer to the graph of critical boron concentration versus core burnup for a reactor during its first fuel cycle (see figure below).

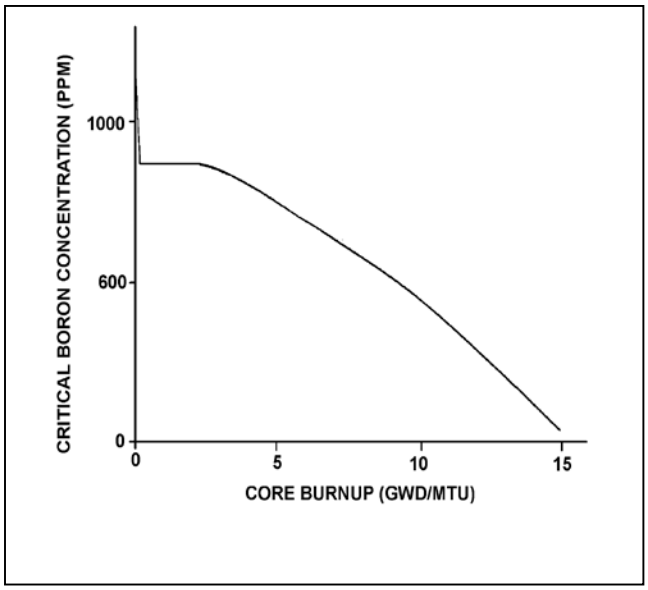
Which one of the following explains why reactor coolant critical boron concentration becomes relatively constant for a period early in the fuel cycle?

A. Fission product poison buildup is being offset by burnable poison burnout and fuel depletion.

B. Fission product poison buildup and fuel depletion are being offset by burnable poison burnout.

C. Fuel depletion is being offset by the buildup of fissionable plutonium and fission product poisons.

D. Fuel depletion and burnable poison burnout and are being offset by the buildup of fission product poisons.



QUESTION: 33

During a reactor startup, positive reactivity addition X caused the stable source range count rate to increase from 15 cps to 30 cps. Later in the startup, after several more positive reactivity additions, positive reactivity addition Y caused the stable source range count rate to increase from 60 cps to 120 cps.

With the reactor still subcritical, which one of the following statements describes how the magnitudes of positive reactivity additions X and Y compare?

A. Positive reactivity addition X was smaller than positive reactivity addition Y.

B. Positive reactivity addition X was greater than positive reactivity addition Y.

C. Positive reactivity additions X and Y were about equal in magnitude.

D. There is <u>not</u> enough information given to compare the positive reactivity additions.

QUESTION: 34

After taking critical data during a reactor startup, the operator establishes a positive 0.54 dpm startup rate to increase reactor power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize power at the POAH? (Assume $\bar{\beta}_{eff} = 0.00579$.)

A. +0.10 %ΔK/K

B. +0.12 %ΔK/K

C. -0.10 %ΔK/K

D. -0.12 %ΔK/K

QUESTION: 35

A nuclear power plant is operating at 100 percent power near the end of a fuel cycle when the main turbine trips. If the reactor does not immediately trip, which one of the following will act first to change reactor power?

A. Positive reactivity addition from the Doppler coefficient will cause reactor power to initially increase.

B. Positive reactivity addition from the moderator temperature coefficient will cause reactor power to initially increase.

C. Negative reactivity addition from the Doppler coefficient will cause reactor power to initially decrease.

D. Negative reactivity addition from the moderator temperature coefficient will cause reactor power to initially decrease.

QUESTION: 36

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

A. Boron may precipitate out of the reactor coolant during a cooldown.

B. An RCS temperature decrease may result in a negative reactivity addition.

C. Power changes requiring dilution of RCS boron may take longer.

D. The differential boron worth ($\Delta K/K/ppm$) may become positive.

QUESTION: 37

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

A. 13 feet

B. 17 feet

C. 21 feet

D. 25 feet

QUESTION: 38

A nuclear power plant is shut down with the pressurizer in a saturated condition as follows:

Pressurizer liquid temperature = 588°F
Pressurizer vapor temperature = 588°F
Pressurizer pressure = 1,410 psia

Pressurizer heaters are energized to raise pressurizer pressure to 1,450 psia. When pressurizer pressure stabilizes at 1,450 psia, liquid temperature will be _____ and vapor temperature will be _____.

A. the same; the same

B. the same; higher

C. higher; the same

D. higher; higher

QUESTION: 39

Three days ago, a nuclear power plant experienced a sustained loss of all AC electrical power. Currently, there is turbulent boiling occurring throughout the entire spent fuel pool. Spent fuel assembly temperatures are elevated but stable. Assume the spent fuel pool contains pure water in thermal equilibrium, and boiling is the only means of heat removal from the spent fuel pool.

Given the following current conditions:

Total Spent fuel decay heat rate = 1.4 MW
Spent fuel building pressure = 15.0 psia

What is the approximate rate of water loss occurring from the spent fuel pool?

A. 4,149 lbm/hr

B. 4,924 lbm/hr

C. 18,829 lbm/hr

D. 26,361 lbm/hr

QUESTION: 40

Main condenser pressure is 1.0 psia. During the cooling process in the condenser, the temperature of the low pressure turbine exhaust decreases to 100°F, at which time it is a...

A. saturated liquid.

B. saturated vapor.

C. subcooled liquid.

D. superheated vapor.

QUESTION: 41

In a nuclear power plant main turbine, if the moisture content of the inlet steam increases from 0.25 percent to 0.5 percent at the same pressure, the main turbine work output will…

A. increase due to the greater initial enthalpy of the inlet steam.

B. increase due to the increased momentum transfer from water droplets impacting the turbine blading.

C. decrease due to the lower initial temperature of the inlet steam.

D. decrease due to the increased braking action from water droplets impacting the turbine blading.

QUESTION: 42

Pump cavitation occurs when vapor bubbles are formed at the eye of a pump impeller...

A. because the localized flow velocity exceeds sonic velocity for the existing fluid temperature.

B. because the localized pressure exceeds the vapor pressure for the existing fluid temperature.

C. and enter a high pressure region of the pump where they collapse causing damaging pressure pulsations.

D. and are discharged from the pump where they expand into larger bubbles causing damaging pressure pulsations.

QUESTION: 43

The following are current parameter values for an operating PWR nuclear power plant:

Steam generator (SG) pressure = 1,000 psia
Main feed pump (MFP) discharge pressure = 1,220 psia

If SG pressure does not change, what MFP discharge pressure will increase main feedwater mass flow rate by 10 percent? (Assume MFP inlet temperature remains the same. Also, assume all valves/components that contribute to head loss downstream of the MFP remain in their current configuration.)

A. 1,242 psia

B. 1,266 psia

C. 1,293 psia

D. 1,342 psia

QUESTION: 44

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

B. The reactor coolant pump heat input value used in the heat balance was 10 percent lower than actual reactor coolant pump heat input.

C. The feedwater flow rate used in the heat balance calculation was 10 percent higher than actual feedwater flow rate.

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

QUESTION: 45

A reactor is operating at steady-state 100 percent power near the end of a fuel cycle with all control rods fully withdrawn. At what axial location in a typical fuel assembly will the maximum departure from nucleate boiling ratio occur?

A. At the top of the fuel assembly.

B. At the bottom of the fuel assembly.

C. Between the bottom and midplane of the fuel assembly.

D. Between the midplane and the top of the fuel assembly.

QUESTION: 46

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

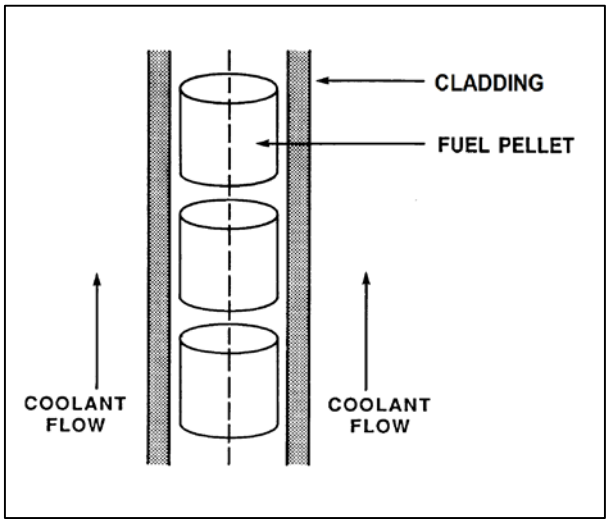
With a nuclear power plant operating at steady-state 100 percent reactor power at the beginning of a fuel cycle, which one of the following has the greater temperature difference?

A. Fuel pellet centerline-to-pellet surface

B. Fuel pellet surface-to-cladding gap

C. Zircaloy cladding

D. Coolant laminar layer



QUESTION: 47

During a plant cooldown and depressurization with forced circulation, reactor coolant system (RCS) loop flow indications and reactor coolant pump (RCP) motor current indications become erratic. These abnormal indications are most likely caused by...

A. RCP cavitation.

B. RCP runout.

C. RCS loop water hammer.

D. RCS hot leg saturation.

QUESTION: 48

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

Given:

- Pressure at P_1 is 24 psig.
- Pressure at P_2 is 16 psig.
- Pressure change due to change in velocity is 2 psig.
- Pressure change due to change in elevation is 10 psig.

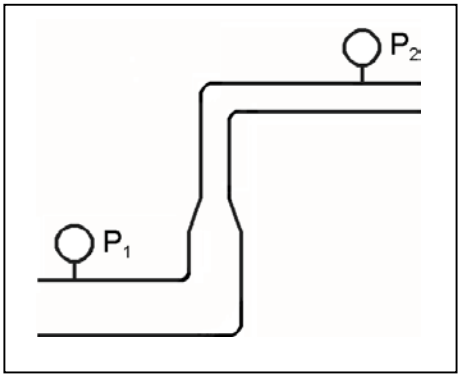
The pressure decrease due to friction head loss between P_1 and P_2 is _____; and the direction of flow is from _____.

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: 49

The 2,200°F maximum fuel cladding temperature limit is imposed because...

A. 2,200°F is approximately 500°F below the fuel cladding melting temperature.

B. the rate of the zircaloy-steam reaction increases significantly at temperatures above 2,200°F.

C. any cladding temperature higher than 2,200°F correlates to a fuel centerline temperature above the fuel melting point.

D. the thermal conductivity of zircaloy decreases rapidly at temperatures above 2,200°F.

QUESTION: 50

A nuclear power plant is shut down with the reactor coolant system at 1,200 psia and 350°F. Which one of the following would be most likely to cause a pressurized thermal shock to the reactor vessel?

A. A rapid heatup followed by a rapid pressurization.

B. A rapid cooldown followed by a rapid pressurization.

C. A rapid depressurization followed by a rapid heatup.

D. A rapid depressurization followed by a rapid cooldown.

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

MARCH 2016 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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