UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
JUNE 2013--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. 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.

_____

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 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

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

$g_c = 32.2$ 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

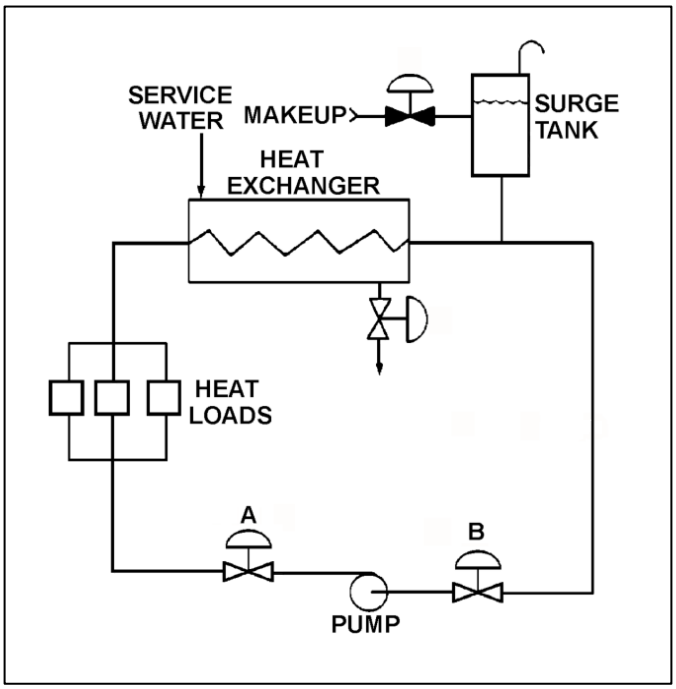
Refer to the drawing of an operating cooling water system (see figure below) in which valves A and B are identical. Valve A is one-half open and valve B is fully open. If valve A is opened fully, the differential pressure (D/P) across valve B will…

A. increase by the same amount as the absolute change in D/P across valve A.

B. increase by an amount less than the absolute change in D/P across valve A.

C. decrease by the same amount as the absolute change in D/P across valve A.

D. decrease by an amount less than the absolute change in D/P across valve A.



QUESTION: 2

Refer to the drawing of four air-operated valves (see figure below). **Note:** The valve actuators may be shown with or without air pressure applied.

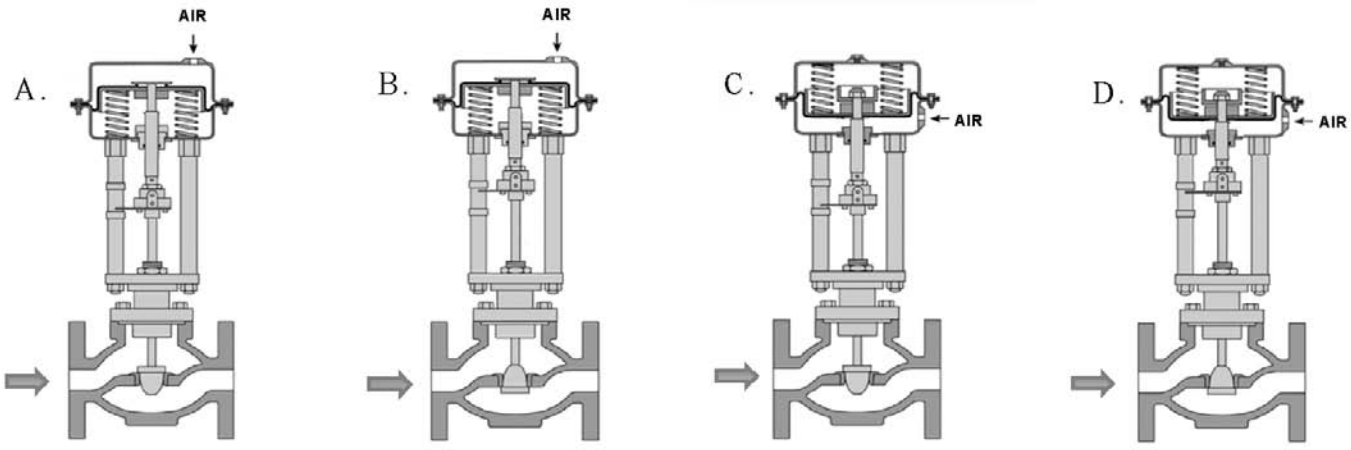
Which valves are currently shown in their failed (i.e., no air pressure applied to the actuator) positions?

A. A and B

B. B and C

C. C and D

D. D and A



QUESTION: 3

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

Three separate bellows-type 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

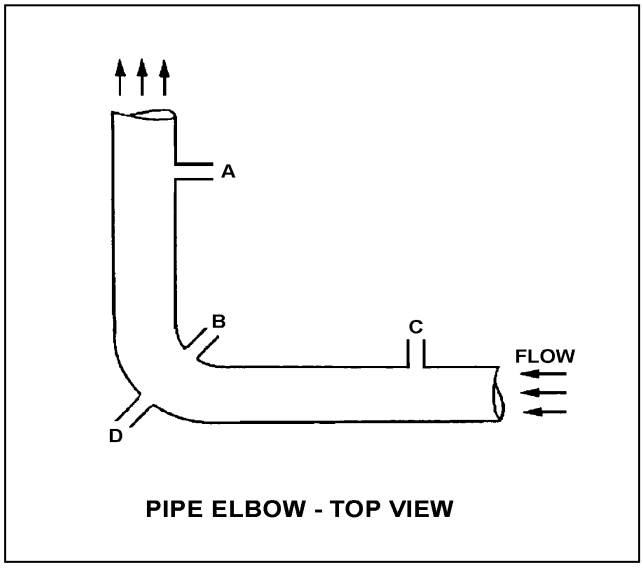
Assuming zero head loss in this section of pipe, how will the detectors be affected if tap B experiences a significant leak? (Assume water system pressure does not change.)

A. All detectors will fail low.

B. All detectors will fail high.

C. Only one detector will fail, and it will fail low.

D. Only one detector will fail, and it will fail high.



QUESTION: 4

Refer to the drawing of a water storage tank with a differential pressure (D/P) level detection system (see figure below). The level detector has just been calibrated.

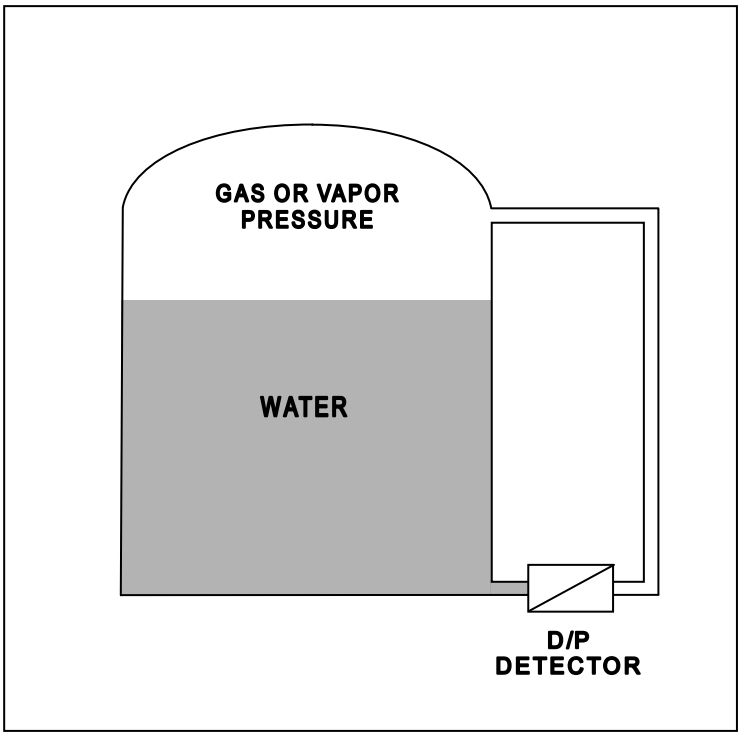
How will the indicated level be affected if condensation partially fills the normally dry reference leg?

A. Indicated level will not be affected.

B. Indicated level will be lower than actual level.

C. Indicated level will be higher than actual level.

D. Indicated level may be higher or lower than actual level depending on the pressure in the upper volume of the tank.



QUESTION: 5

In a comparison between a thermocouple and a resistance temperature detector, the thermocouple generally...

A. measures temperature less accurately.

B. is less affected by ambient temperature changes.

C. has a lower usable temperature range.

D. responds more slowly to a temperature change.

QUESTION: 6

Which one of the following describes the ion collection that occurs in a proportional counter, such as a BF_3 detector?

A. A fraction of the ions created by primary ionizations are collected. No secondary ionizations take place.

B. Virtually all of the ions created by primary ionizations are collected. No secondary ionizations take place.

C. Virtually all of the ions created by primary ionizations along with a fraction of the ions created by secondary ionizations are collected.

D. Virtually all of the ions created by primary and secondary ionizations are collected.

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

The water level in a water storage tank is being controlled by an automatic bistable level controller. If water level increases to 70 percent, the controller bistable turns on to open a tank drain valve. When water level decreases to 60 percent, the controller bistable turns off to close the drain valve.

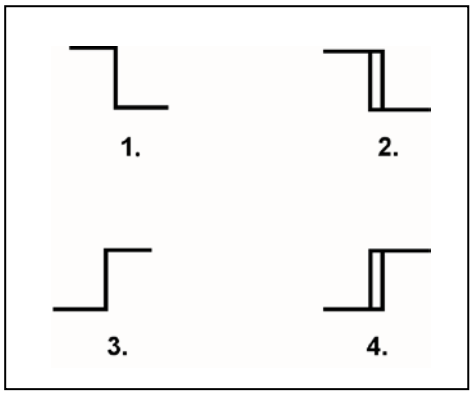
Which one of the following bistable symbols indicates the characteristics of the bistable used in the level controller?

A. 1.

B. 2.

C. 3.

D. 4.



QUESTION: 9

The water level in a tank is being controlled by an automatic level controller using proportional-only control as shown in the figure below. Initially the tank level is stable at 50 percent, but then the flow into the tank increases and stabilizes at a higher flow rate.

As tank level increases, the controller positions the drain valve more open than necessary to stabilize the level. As tank level decreases, the controller positions the drain valve more closed than necessary to stabilize the level. This cycle is repeated continuously, never reaching a stable tank level or drain valve position.

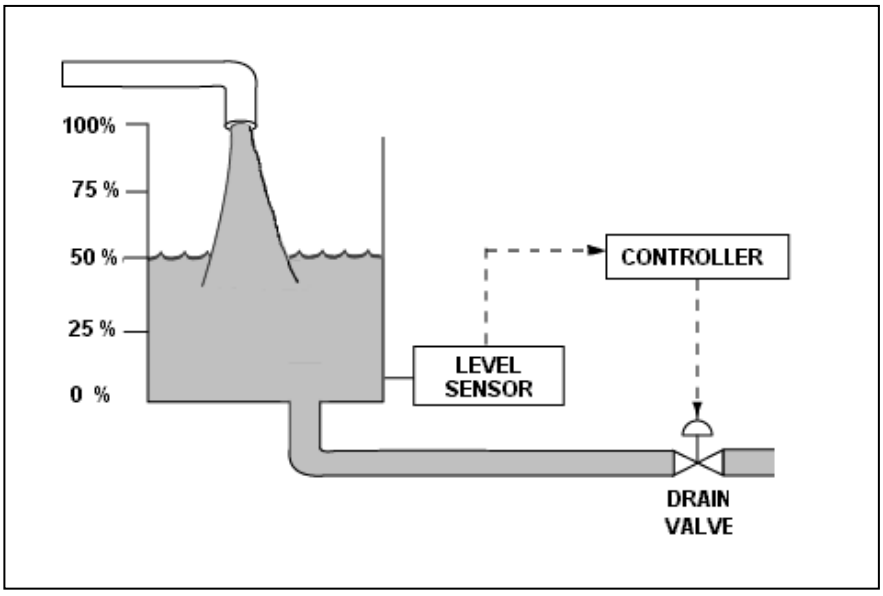
The excessive valve cycling described above can be reduced if the controller's gain is _____ or if the controller's proportional band is _____.

A. increased; widened

B. increased; narrowed

C. decreased; widened

D. decreased; narrowed



QUESTION: 10

The presence of air in a pump casing may result in _____ when the pump is started.

A. vortexing

B. pump runout

C. pump overspeed

D. gas binding

QUESTION: 11

Refer to the pump and system curves (see figure below) for a centrifugal pump operating in a cooling water system.

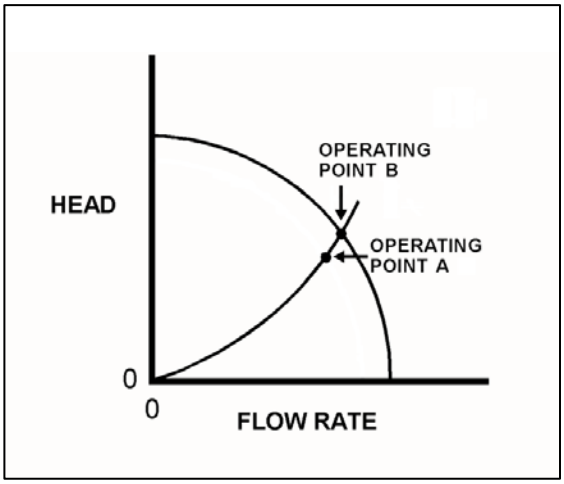
Operating point A existed when data was taken six months ago. Operating point B is the current operating point. Which one of the following could be responsible for the difference between the operating points?

A. The pump discharge valve was more open when the data was collected for operating point A.

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

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

D. The pump was rotating slower when the data was collected for operating point A.



QUESTION: 12

An ideal positive displacement pump is pumping to a system operating at 100 psig. Assume pump speed is constant, zero pump slip, and pump backpressure remains within normal pump operating limits.

If system pressure increases to 200 psig, the pump head will _____; and pump flow rate will _____.

A. increase; remain the same

B. increase; decrease

C. remain the same; remain the same

D. remain the same; decrease

QUESTION: 13

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

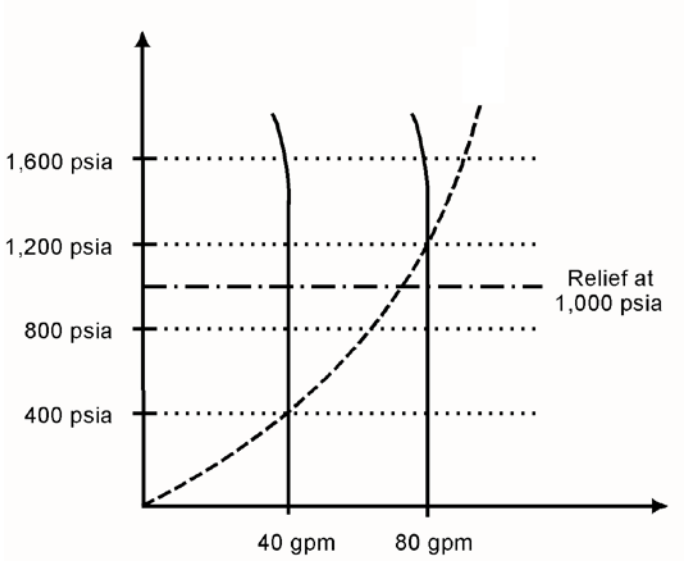
A positive displacement pump is initially supplying water at 40 gpm with a pump discharge pressure of 400 psia. If pump speed is increased until pump flow rate is 80 gpm, what is the new pump discharge pressure?

A. 800 psia

B. 1,000 psia

C. 1,200 psia

D. 1,600 psia



QUESTION: 14

During a reactor coolant pump (RCP) locked rotor event, RCP motor current will...

A. increase due to the increased rotor torque.

B. increase due to the increased counter electromotive force (CEMF) in the stator.

C. decrease due to the decreased pump flow rate.

D. decrease due to the increased CEMF in the rotor.

QUESTION: 15

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

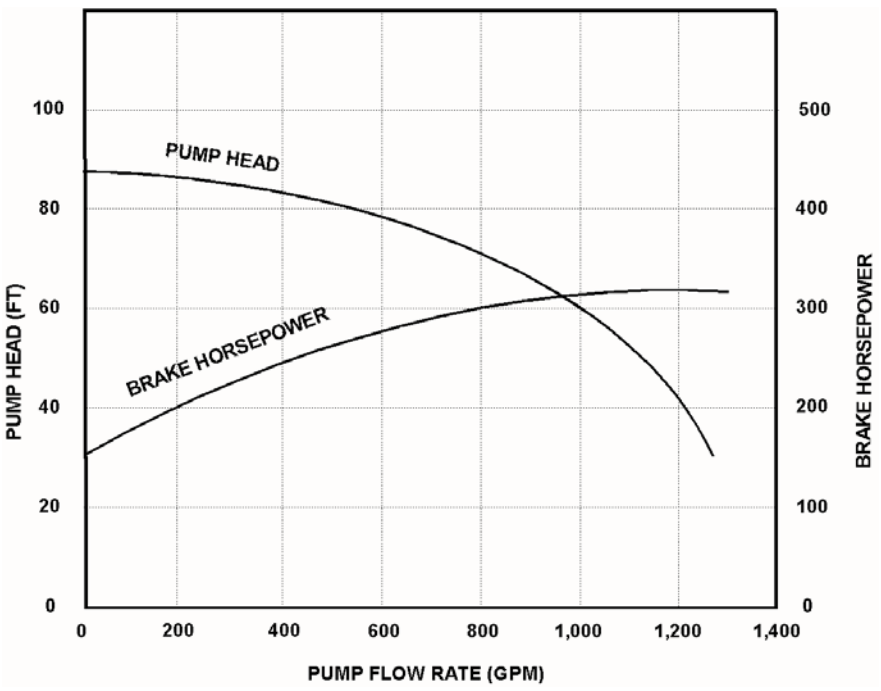
What will be the approximate value of pump motor current if the flow control valve is repositioned such that pump flow rate increases to 800 gpm?

A. 15 amps

B. 40 amps

C. 160 amps

D. Greater than 200 amps



QUESTION: 16

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: 17

During normal nuclear power plant operation, why does air entry into the main condenser reduce the thermodynamic efficiency of the steam cycle?

A. The rate of steam flow through the main turbine increases.

B. The condensate subcooling in the main condenser decreases.

C. The enthalpy of the low pressure turbine exhaust increases.

D. The air mixes with the steam and enters the condensate.

QUESTION: 18

A condensate demineralizer differential pressure (D/P) gauge indicates 4.0 psid at 50% flow rate. Over the next two days plant power changes have caused condensate flow rate to vary between 25% and 100%.

Which one of the following combinations of condensate flow rate and demineralizer D/P, observed during the power changes, indicates an increase in the accumulation of insoluble corrosion products in the demineralizer?

	Condensate Flow Rate	Demineralizer D/P (psid)
A.	100%	15.0
B.	75%	9.0
C.	60%	5.0
D.	25%	2.0

QUESTION: 19

A mixed-bed ion exchanger is being used to process reactor coolant. The ion exchanger has been in service for 6 months at 100 percent power. A temperature controller malfunction causes the ion exchanger influent temperature to exceed the resin's maximum temperature limit before being manually restored to normal. Ion exchanger water chemistry analyses are being performed to check for resin decomposition.

Which one of the following water chemistry test results does not indicate that significant resin decomposition has occurred?

A. A significant decrease in the ion exchanger's decontaminator factor.

B. A significant increase in the ion exchanger's effluent conductivity.

C. A significant increase in the ion exchanger's effluent radioactivity.

D. A significant increase in the ion exchanger's effluent dissolved gases.

QUESTION: 20

Which one of the following results from a loss of control power to a breaker supplying a large motor?

A. The motor ammeter indication will be zero regardless of actual breaker position.

B. The breaker will trip open due to the actuation of its protective trip device.

C. The breaker position will remotely indicate closed regardless of actual position.

D. The breaker charging motor will <u>not</u> recharge the closing spring after the breaker closes.

QUESTION: 21

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

A. Open the breaker first, then the disconnect.

B. Open the disconnect first, then the breaker.

C. Open the device that is closest to the motor first.

D. Open the device that is closest to the power source first.

QUESTION: 22

A main generator is about to be connected to an infinite power grid. The main generator has the following initial conditions:

Generator frequency	= 59.9 Hz	Generator voltage	= 115.1 KV
Grid frequency	= 60.1 Hz	Grid voltage	= 114.8 KV

When the generator output breaker is closed, the generator will...

A. acquire real load and reactive load.

B. acquire real load, but become a reactive load to the grid.

C. become a real load and a reactive load to the grid.

D. become a real load to the grid, but acquire reactive load.

QUESTION: 23

Which one of the following is the process that produces the majority of delayed neutrons in an operating reactor?

A. A thermal neutron is absorbed by a fuel nucleus. After a period of time, the nucleus fissions and releases a delayed neutron.

B. A thermal neutron is absorbed by a fuel nucleus. The fuel nucleus fissions. During the decay process of the fission products, a delayed neutron is emitted.

C. A fast neutron is absorbed by a fuel nucleus. After a period of time, the nucleus fissions and releases a delayed neutron.

D. A fast neutron is absorbed by a fuel nucleus. The fuel nucleus fissions. During the decay process of the fission products, a delayed neutron is emitted.

QUESTION: 24

A reactor near the end of a fuel cycle has been shut down from 100 percent power and cooled down to 140°F over three days. During the cooldown, reactor coolant boron concentration was increased by 100 ppm.

Given the following absolute values of reactivities added during the shutdown and cooldown, assign a (+) or (–) as appropriate and choose the current value of core reactivity.

Xenon	=	( ) 2.5% ΔK/K
Moderator temperature	=	( ) 0.5% ΔK/K
Power defect	=	( ) 1.5% K/K
Control rods	=	( ) 7.0% ΔK/K
Boron	=	( ) 1.0% ΔK/K

A. -8.5% ΔK/K

B. -6.5% ΔK/K

C. -3.5% ΔK/K

D. -1.5% ΔK/K

QUESTION: 25

A nuclear power plant has just completed a refueling outage and a reactor startup is in progress. Reactor engineers have determined that during the upcoming fuel cycle, $\bar{\beta}_{eff}$ will range from a minimum of 0.0052 to a maximum of 0.0064.

After the reactor becomes critical, control rods are withdrawn further to increase reactivity by an additional 0.1% ΔK/K. Assuming no other reactivity changes occur, what will the approximate stable startup rate be for this reactor until the point of adding heat is reached?

A. 1.0 dpm

B. 0.6 dpm

C. 0.5 dpm

D. 0.3 dpm

QUESTION: 26

A reactor is shutdown near the end of a fuel cycle with the shutdown cooling system in service. The initial reactor coolant system (RCS) temperature is 100°F. In this condition, the reactor is overmoderated.

Then, a heatup and pressurization is performed using decay heat to bring the RCS to normal operating temperature and pressure. Assume the reactor remains subcritical.

During the RCS heatup, K_{eff} will…

A. increase continuously.

B. decrease continuously.

C. initially increase, and then decrease.

D. initially decrease, and then increase.

QUESTION: 27

Which one of the following is responsible for the largest positive reactivity addition following a reactor trip from 100 percent power at the beginning of a fuel cycle? (Assume reactor coolant system parameters stabilize at their normal post-trip values.)

A. Void coefficient

B. Pressure coefficient

C. Fuel temperature coefficient

D. Moderator temperature coefficient

QUESTION: 28

Which one of the following parameters typically has the greatest influence on the shape of a differential rod worth curve?

A. Core xenon distribution

B. Burnable poison distribution

C. Core axial neutron flux distribution

D. Core radial neutron flux distribution

QUESTION: 29

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

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

A. Upper core value decreases while lower core value increases.

B. Upper core value increases while lower core value decreases.

C. Both upper and lower core values decrease.

D. Both upper and lower core values increase.

QUESTION: 30

A reactor was initially operating at 80 percent power near the beginning of a fuel cycle with equilibrium xenon-135. Then, reactor power was increased to 100 percent over a 2 hour period.

The following information is provided:

	Prior to Power Change	After Power Change
Reactor power:	80 percent	100 percent
Reactor coolant boron concentration:	780 ppm	760 ppm
Control rod position:	Fully Withdrawn	Fully Withdrawn

What is the effect on power distribution in the core during the first 4 hours following the power increase?

A. Power production in the top of the core increases relative to the bottom of the core.

B. Power production in the top of the core decreases relative to the bottom of the core.

C. There is no relative change in power distribution in the core.

D. It is impossible to determine without additional information.

QUESTION: 31

A reactor has been shut down for 7 days to perform maintenance. A reactor startup is performed, and power level is increased to 50 percent over a 5 hour period.

When power reaches 50 percent, the magnitude of xenon-135 negative reactivity will be...

A. increasing toward a peak value.

B. increasing toward an equilibrium value.

C. decreasing toward an equilibrium value.

D. decreasing toward an upturn.

QUESTION: 32

Why are burnable poisons installed in a new reactor core instead of simply using a higher reactor coolant boron concentration for reactivity control?

A. To prevent boron precipitation during normal operation.

B. To establish a more negative moderator temperature coefficient.

C. To minimize the distortion of the neutron flux distribution caused by soluble boron.

D. To allow the loading of excessive reactivity in the form of higher fuel enrichment.

QUESTION: 33

During a reactor startup, the first reactivity addition caused the stable source range count rate to increase from 20 cps to 40 cps. The second reactivity addition caused the stable count rate to increase from 40 cps to 80 cps. K_{eff} was 0.92 prior to the first reactivity addition.

Which one of the following statements describes the magnitude of the reactivity additions?

A. The first reactivity addition was approximately twice as large as the second.

B. The second reactivity addition was approximately twice as large as the first.

C. The first and second reactivity additions were approximately the same.

D. There is not enough data given to determine the relationship between reactivity values.

QUESTION: 34

An estimated critical rod position (ECP) has been calculated for criticality to occur 15 hours after a reactor trip from long-term 100 percent power operation. Which one of the following conditions would cause the actual critical rod position to be higher than the ECP?

A. A 90 percent value for reactor power was used for power defect determination in the ECP calculation.

B. Reactor criticality is achieved approximately 2 hours earlier than anticipated.

C. Steam generator pressures are decreased by 100 psi just prior to criticality.

D. Current boron concentration is 10 ppm lower than the value used in the ECP calculation.

QUESTION: 35

Which one of the following indicates that a reactor has achieved criticality during a normal reactor startup?

A. Constant positive startup rate during rod withdrawal.

B. Increasing positive startup rate during rod withdrawal.

C. Constant positive startup rate with no rod motion.

D. Increasing positive startup rate with no rod motion.

QUESTION: 36

A refueling outage has just been completed, during which the entire core was offloaded and replaced with new fuel. A reactor startup has been performed and power is being increased to 100 percent.

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

A. U-235 and U-238

B. U-238 and Pu-239

C. U-235 and Pu-239

D. U-235 and Pu-241

QUESTION: 37

Refer to the drawing of a water-filled manometer (see figure below).

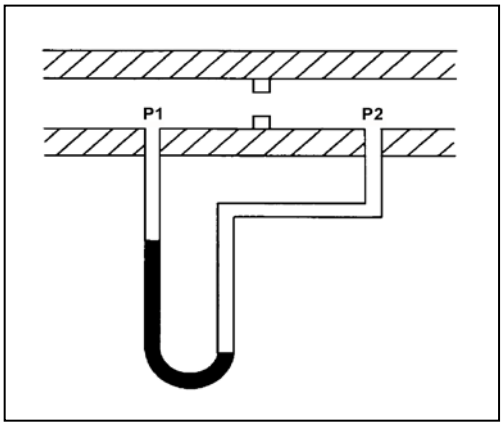
The manometer is installed across an orifice in a ventilation duct to determine the direction of airflow. With the manometer conditions as shown, the pressure at P1 is _____ than P2; and the direction of airflow is _____.

A. less; right to left

B. less; left to right

C. greater; right to left

D. greater; left to right



QUESTION: 38

Consider a pressurizer containing a saturated steam-water mixture at 636°F with a quality of 15 percent. If an outsurge removes 10 percent of the liquid volume from the pressurizer, the temperature of the remaining mixture will _____, and the quality of the remaining mixture will _____. (Assume the mixture remains saturated.)

A. decrease; decrease

B. decrease; increase

C. remain the same; decrease

D. remain the same; increase

QUESTION: 39

A main condenser is operating at 1.0 psia. If 20,000 ft^3 of saturated steam is condensed to saturated water in the condenser, what will be the approximate volume of the saturated water?

A. 1 ft^3

B. 10 ft^3

C. 100 ft^3

D. 1,000 ft^3

QUESTION: 40

A pressurizer safety valve is leaking by, allowing the 100 percent quality saturated steam from the pressurizer to enter the discharge pipe, which remains at a constant pressure of 40 psia. Initial safety valve discharge pipe temperature is elevated but stable. Assume no heat loss occurs from the safety valve discharge pipe.

Upon discovery of the leak, the reactor is shut down, and a plant cooldown and depressurization are commenced. Throughout the cooldown and depressurization, 100 percent quality saturated steam continues to leak through the pressurizer safety valve.

As pressurizer pressure decreases from 1,000 psia to 700 psia, the safety valve discharge pipe temperature will...

A. decrease, because the entropy of the safety valve discharge will decrease during the pressurizer pressure decrease in this range.

B. decrease, because the enthalpy of the safety valve discharge will decrease during the pressurizer pressure decrease in this range.

C. increase, because the safety valve discharge will become more superheated during the pressurizer pressure decrease in this range.

D. remain the same, because the safety valve discharge will remain a saturated steam-water mixture at 40 psia during the pressurizer pressure decrease in this range.

QUESTION: 41

To achieve maximum overall nuclear power plant thermal efficiency, feedwater should enter the steam generator (SG)_____ and the pressure difference between the SG and the condenser should be as _____ as possible.

A. close to saturation; great

B. close to saturation; small

C. as subcooled as practical; great

D. as subcooled as practical; small

QUESTION: 42

Refer to the drawing of two lengths of 16-inch diameter pipe, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing.

Water is flowing at 10,000 gpm through each pipe when both isolation valves instantly close. Consider two cases:

Case 1: The water temperature upstream of both valves is 65°F.
Case 2: The water temperature is 65°F upstream of valve A, and 85°F upstream of valve B.

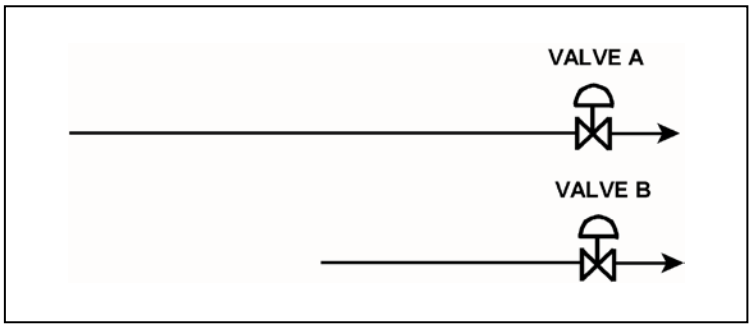
For which case(s), if any, will valve A experience a pressure spike that is greater than the pressure spike at valve B?

A. Case 1 only

B. Case 2 only

C. Both cases

D. Neither case



QUESTION: 43

A nuclear power plant is recovering from a loss of offsite power that caused all reactor coolant pumps (RCPs) to stop. Pressurizer level indication is off-scale high.

Which one of the following is most likely to occur if the steam generator (SG) temperatures are 50°F higher than their associated reactor coolant system (RCS) loop temperatures when an RCP is restarted?

A. Localized water hammer in the RCS.

B. Pressurized thermal shock to the SGs.

C. A large pressure spike throughout the RCS.

D. Inadvertent lifting of a SG atmospheric relief valve.

QUESTION: 44

A nuclear power plant is operating with the following parameters:

Reactor power	=	100 percent
Core ΔT	=	60°F
Reactor coolant system flow rate	=	100 percent
Average coolant temperature	=	587°F

A station blackout occurs and natural circulation is established with the following stable parameters:

Decay heat	=	1 percent
Core ΔT	=	30°F
Average coolant temperature	=	572°F

What is the core mass flow rate in percent?

A. 2.0 percent

B. 2.5 percent

C. 3.0 percent

D. 4.0 percent

QUESTION: 45

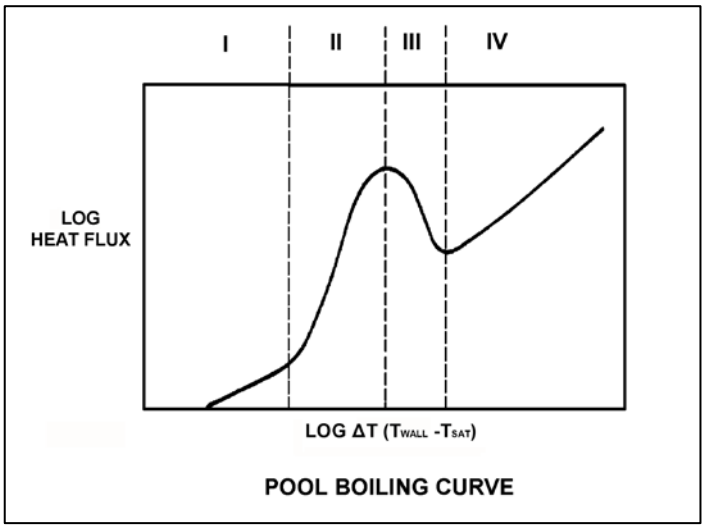
Refer to the drawing of a pool boiling curve (see figure below). Identify the region of the curve where the most efficient form of heat transfer exists.

A. Region I

B. Region II

C. Region III

D. Region IV



QUESTION: 46

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

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

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

A. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction decreases reactor coolant system pressure by 20 psig.

C. The operator decreases reactor coolant boron concentration by 5 ppm with no rod motion.

D. Core xenon-135 depletes in proportion to the axial and radial power distribution with no rod motion.

QUESTION: 47

During a loss of coolant accident, some fuel rods may experience stable film boiling. Which one of the following types of heat transfer from the fuel cladding will increase significantly when stable film boiling begins?

A. Forced convection

B. Natural convection

C. Conduction

D. Radiation

QUESTION: 48

A nuclear power plant was operating at a constant power level for the last two weeks when a loss of offsite power occurred, which caused a reactor trip and a loss of forced reactor coolant flow. Natural circulation reactor coolant flow developed and stabilized 30 minutes after the trip.

Which one of the following combinations of initial reactor power and post-trip steam generator pressure will result in the lowest stable natural circulation flow rate 30 minutes after the trip?

	Initial Reactor Power	Post-trip Steam Generator Pressure
A.	25 percent	1,100 psia
B.	100 percent	1,100 psia
C.	25 percent	1,000 psia
D.	100 percent	1,000 psia

QUESTION: 49

Thermal limits are established to protect the reactor, and thereby protect the public during nuclear power plant operations, which include...

A. normal operations only.

B. normal and abnormal operations only.

C. normal, abnormal, and postulated accident operations only.

D. normal, abnormal, postulated and unpostulated accident operations.

QUESTION: 50

Two identical reactors are currently shut down for refueling. Reactor A has achieved an average lifetime power capacity of 60 percent while operating for 15 years. Reactor B has achieved an average lifetime power capacity of 60 percent while operating for 12 years.

Which reactor, if any, will have the lower reactor vessel nil-ductility transition temperature, and why?

A. Reactor A, because it has produced more total fissions.

B. Reactor B, because it has produced less total fissions.

C. Both reactors will have approximately the same nil-ductility transition temperature because they have equal average lifetime power capacities.

D. Both reactors will have approximately the same nil-ductility transition temperature because the fission rate in a shutdown reactor is not significant.

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

JUNE 2013 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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