UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
JUNE 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. 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 generic term "control rod" refers to the length of neutron absorber material that can be positioned by the operator to change core reactivity.

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

1. Print your name in the blank provided on the cover sheet of the examination.

2. Fill in your individual docket number.

3. Fill in the name of your facility.

4. Fill in your start and stop times at the appropriate times.

5. Two aids are provided for your use during the examination:

   (1) An equations and conversions sheet contained within the examination copy, and

   (2) Steam tables and Mollier Diagram provided by your proctor.

6. Place your answers on the answer sheet provided. Credit will only be given for answers properly marked on this sheet. Follow the instructions for filling out the answer sheet.

7. Scrap paper will be provided for calculations.

8. Cheating on the examination will result in the automatic forfeiture of this examination. Cheating could also result in severe penalties.

9. Restroom trips are limited. Only **one** examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside of the examination room.

10. After you have completed the examination, sign the statement on the cover sheet indicating that the work is your own and you have neither given nor received any assistance in completing the examination. Either pencil or pen may be used.

11. Turn in your examination materials, answer sheet on top, followed by the examination copy and the examination aids, e.g., steam tables, handouts, and scrap paper.

12. After turning in your examination materials, leave the examination area, as defined by the proctor. If after leaving you are found in the examination area while the examination is in progress, your examination may be forfeited.

GENERIC FUNDAMENTALS EXAMINATION
EQUATIONS AND CONVERSIONS HANDOUT SHEET

EQUATIONS

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

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

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

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

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

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

Thermal Efficiency = Net Work Out/Energy In

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

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

CONVERSIONS

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1 Mw = 3.41×10^6 Btu/hr

1 hp = 2.54×10^3 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 = 3.7×10^{10} dps

QUESTION: 1

A completely full water storage tank is being hydrostatically tested to 200 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 6 gpm. The tank is protected by two relief valves that discharge to the atmosphere. The relief valves have the following characteristics:

- Relief valve A opening setpoint is 200 psig with an accumulation of 1.5 percent.
- Relief valve B opening setpoint is 200 psig with an accumulation of 3.0 percent.
- Each valve has linear flow characteristics and a maximum discharge flow rate of 6 gpm.

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

With the PDP running continuously, what will be the discharge flow rates of the relief valves when tank pressure stabilizes?

	Relief Valve A	Relief Valve B
A.	1 gpm	5 gpm
B.	2 gpm	4 gpm
C.	3 gpm	3 gpm
D.	4 gpm	2 gpm

QUESTION: 2

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

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

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

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

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

QUESTION: 3

A nuclear power plant is operating at 100 percent power with constant steam generator water levels. Only main feedwater is entering the steam generators and only main steam is leaving the steam generators. Both the main feedwater mass flow rate and main steam mass flow rate instruments use venturi flow sensing elements.

For the above conditions, the indication that most accurately reflects the mass flow rate through a steam generator will typically be the mass flow rate indication for...

A. main feedwater, because condensation can adversely affect the characteristics of a steam flow venturi.

B. main feedwater, because steam generator pressure changes affect the specific volume of steam more than water.

C. main steam, because the enthalpy of high quality steam flowing through a venturi is constant, unlike the enthalpy of water.

D. main steam, because a given mass flow rate of steam through a venturi develops a larger pressure change than the same mass flow rate of water.

QUESTION: 4

Refer to the drawing of an open water storage tank with a differential pressure (D/P) level detector (see figure below).

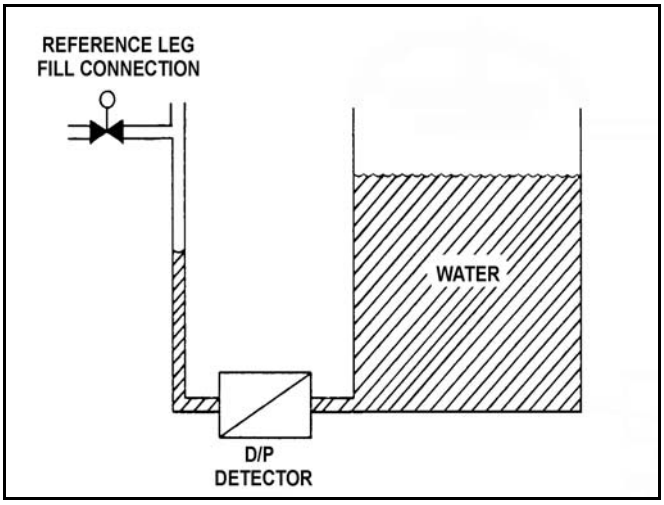
The level instrument has just been calibrated to indicate actual tank water level. Assume that tank water temperature and level remain constant. If the reference leg temperature increases by 20°F, indicated tank water level will...

A. be unpredictable.

B. equal the actual level.

C. be less than the actual level.

D. be greater than the actual level.



QUESTION: 5

A fission chamber detector is located in a constant neutron radiation field and is initially operating in the proportional region of the gas-filled detector ionization curve. If the voltage applied to the detector is changed such that the detector operates in the ion chamber region of the curve, the rate of neutron interactions in the detector will _____, and the amplitude of each neutron-induced detector pulse will _____.

A. increase; increase

B. decrease; decrease

C. remain the same; increase

D. remain the same; decrease

QUESTION: 6

During power operation, a reactor coolant sample is taken and analyzed. Which one of the following lists three nuclides that are each indicative of a possible fuel cladding failure if found to be at elevated concentrations in the reactor coolant sample?

A. Oxygen-18, iron-59, and zirconium-95

B. Cobalt-60, iodine-131, and xenon-135

C. Krypton-85, strontium-90, and cesium-136

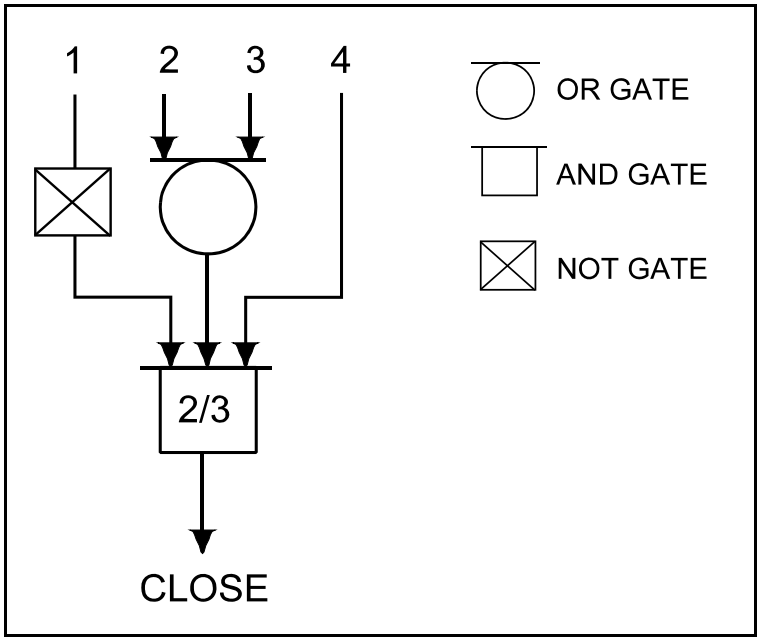
D. Hydrogen-2, hydrogen-3, and nitrogen-16

QUESTION: 7

Refer to the valve controller logic diagram (see figure below).

Which one of the following combinations of inputs will result in the valve receiving a close signal?

	INPUTS			
	1.	2.	3.	4.
A.	On	On	Off	Off
B.	Off	Off	On	Off
C.	On	Off	Off	On
D.	On	On	On	Off



QUESTION: 8

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

The temperature controller is a direct-acting proportional-integral controller with a gain of 1.0. A step increase in lube oil temperature results in an initial controller demand for the temperature control valve (TCV) to open an additional 10 percent. After the lube oil temperature stabilizes, the final TCV position is 60 percent open.

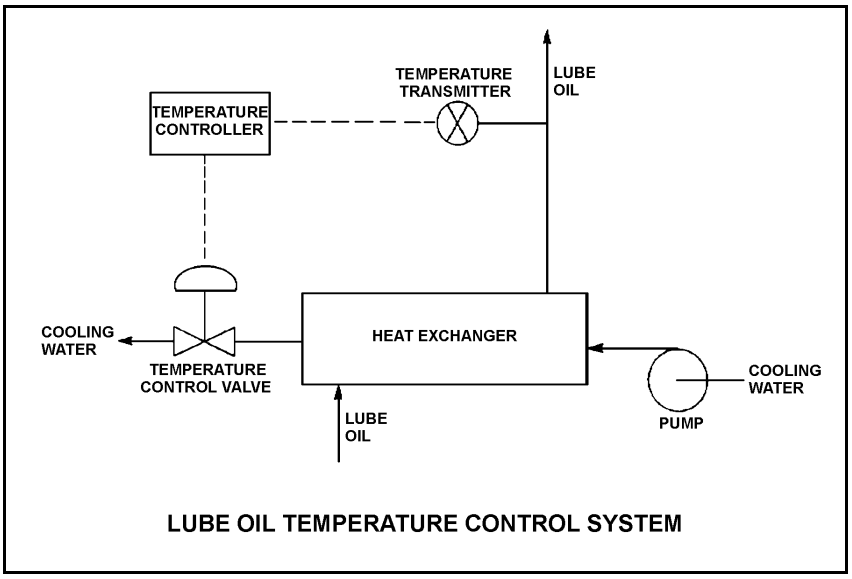
If the controller gain was 2.0 rather than 1.0, the initial controller demand for the above temperature transient would be for the TCV to open an additional _____ percent, and the final TCV position would be _____ percent open.

A. 5; 60

B. 5; less than 60

C. 20; 60

D. 20; more than 60



LUBE OIL TEMPERATURE CONTROL SYSTEM

QUESTION: 9

An air-operated isolation valve requires 3,200 pounds-force (lbf) from its diaphragm actuator and 4 inches of stem travel for proper operation. The area of the actuator diaphragm is 80 square inches.

What is the minimum air pressure (rounded to the nearest psig) required for proper valve operation?

A. 10 psig

B. 25 psig

C. 40 psig

D. 55 psig

QUESTION: 10

An operating centrifugal pump has a net positive suction head (NPSH) requirement of 150 ft-lbf/lbm. Water at 300°F is entering the pump. Which one of the following is the lowest listed pump inlet pressure that will ensure adequate NPSH for the pump?

A. 60 psia

B. 83 psia

C. 108 psia

D. 127 psia

QUESTION: 11

An ac motor-driven centrifugal water pump was just started. During the start, motor current remained peaked for 2 seconds, and then decreased and stabilized at about one-fifth the standard running current. Normally, the starting current peak lasts about 4 seconds.

Which one of the following could have caused the abnormal start indications above?

A. The pump shaft was initially seized and the motor breaker opened.

B. The pump was initially rotating slowly in the reverse direction.

C. The pump was initially air bound, and then primed itself after 2 seconds of operation.

D. The coupling between the motor and pump shafts was left unfastened after maintenance.

QUESTION: 12

A typical single-stage radial-flow centrifugal pump is being returned to service following maintenance on its three-phase ac induction motor. Which one of the following will occur when the pump is started if two of the three motor power leads were inadvertently swapped during restoration?

A. The motor breaker will trip on instantaneous overcurrent.

B. The motor will not turn and will emit a humming sound.

C. The pump will rotate in the normal direction with reduced flow rate.

D. The pump will rotate in the reverse direction with reduced or no flow rate.

QUESTION: 13

A section of reactor coolant piping is being hydrostatically tested to 2,900 psig using a positive displacement pump. The operating characteristics of the positive displacement pump are shown below, identifying ideal, expected, and actual pump performance.

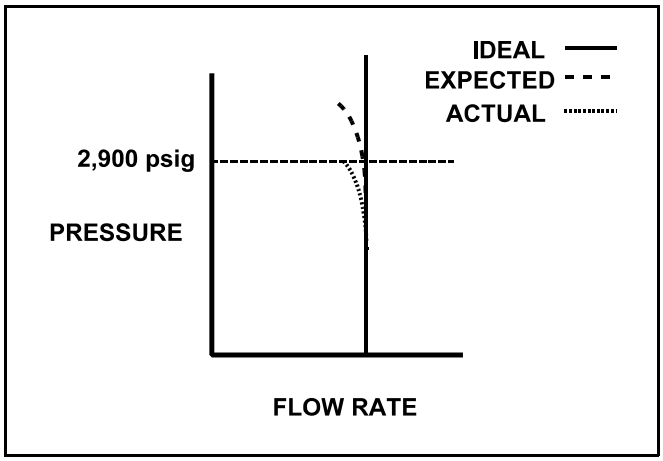
Which one of the following could cause the observed difference between the expected and the actual pump performance?

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 2,900 psig.



QUESTION: 14

Which one of the following will result from prolonged operation of an ac motor with excessively high stator temperatures?

A. Decreased electrical current demand due to reduced counter electromotive force.

B. Decreased electrical resistance to ground due to breakdown of winding insulation.

C. Increased electrical current demand due to reduced counter electromotive force.

D. Increased electrical resistance to ground due to breakdown of winding insulation.

QUESTION: 15

A main generator is connected to an infinite power grid. Which one of the following pairs of main generator output parameters places the generator in the closest proximity to slipping a pole.

A. 400 MW; 200 MVAR (out)

B. 400 MW; 600 MVAR (out)

C. 800 MW; 200 MVAR (in)

D. 800 MW; 600 MVAR (in)

QUESTION: 16

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

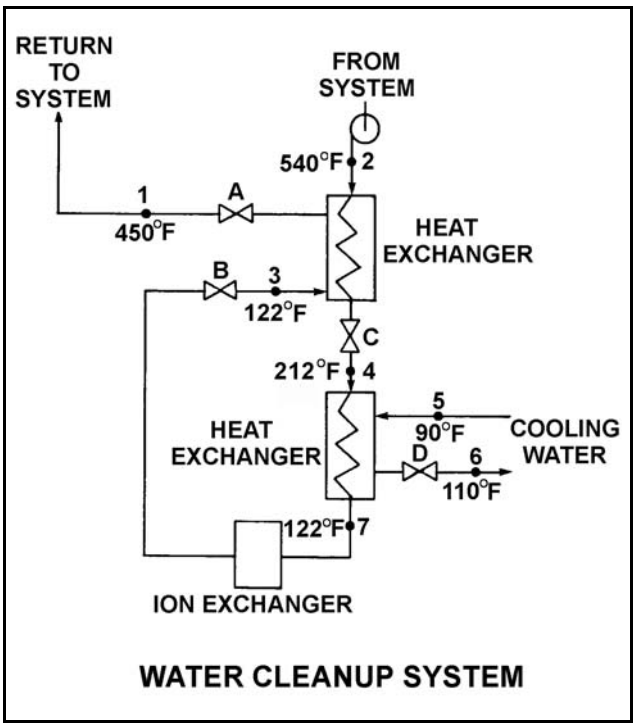
All valves are identical and are initially 50 percent open. To lower the temperature at point 4, the operator can adjust valve _____ in the _____ direction.

A. A; open

B. B; shut

C. C; open

D. D; shut



WATER CLEANUP SYSTEM

QUESTION: 17

Refer to the drawing of two system curves for a typical main condenser cooling water system (see figure below).

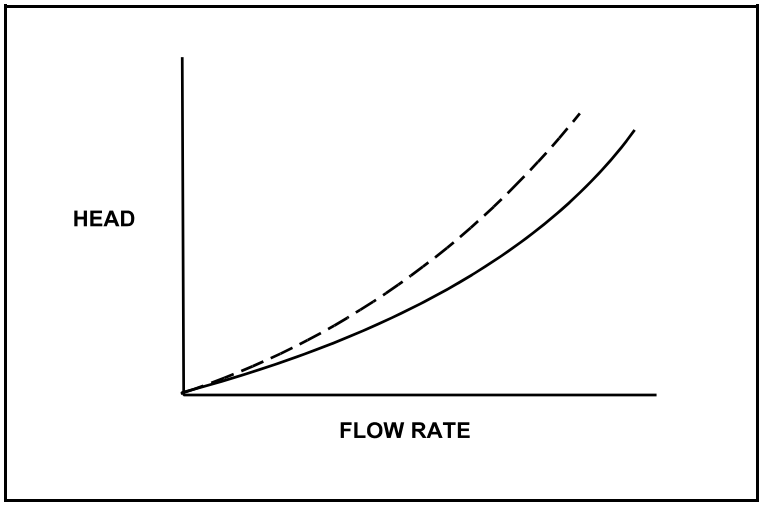
Which one of the following will result in the system curve shifting from the solid curve toward the dashed curve?

A. The main condenser tubes are cleaned.

B. The main condenser tubes become increasingly fouled.

C. Cooling water system flow rate is increased by 25 percent by starting an additional cooling water pump.

D. Cooling water system flow rate is decreased by 25 percent by stopping one of the operating cooling water pumps.



QUESTION: 18

What percentage of ionic impurities is being removed from the water passing through an ion exchanger if the ion exchanger has a decontamination factor of 1.0?

A. 0 percent

B. 1 percent

C. 99 percent

D. 100 percent

QUESTION: 19

A demineralizer that has been exposed to _____ should be bypassed because the resin beads may release unwanted ions.

A. high flow

B. low flow

C. high temperature

D. low temperature

QUESTION: 20

To completely deenergize an electrical component and its associated control and indication circuits, the component breaker should be...

A. open with the control switch in Pull-To-Lock.

B. open with the control switch tagged in the open position.

C. racked out and tagged in the racked-out position.

D. racked out with control power fuses removed.

QUESTION: 21

Given the following indications for an open 4,160 VAC breaker:

All phase overcurrent trip flags are reset.
The control power fuses indicate blown.
The line-side voltmeter indicates 4,160 VAC.
The load-side voltmeter indicates 0 volts.

Assuming no operator actions were taken since the breaker opened, which one of the following could have caused the breaker to open?

A. A ground fault caused an automatic breaker trip.

B. A loss of control power caused an automatic breaker trip.

C. An operator tripped the breaker manually at the breaker cabinet.

D. An operator tripped the breaker manually from a remote location.

QUESTION: 22

A main generator is about to be connected to an infinite power grid with the following conditions:

Generator frequency	= 59.8 Hz
Grid frequency	= 59.5 Hz
Generator voltage	= 114.8 KV
Grid voltage	= 115.1 KV

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

A. acquire real load and reactive load.

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

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

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

QUESTION: 23

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

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

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

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

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

QUESTION: 24

A 1.5 MeV neutron is about to interact with a U-238 nucleus in an operating nuclear reactor core. Which one of the following describes the most likely interaction and the effect on core K_{eff}?

A. The neutron will be scattered, thereby leaving K_{eff} unchanged.

B. The neutron will be absorbed and the nucleus will fission, thereby decreasing K_{eff}.

C. The neutron will be absorbed and the nucleus will fission, thereby increasing K_{eff}.

D. The neutron will be absorbed and the nucleus will decay to Pu-239, thereby increasing K_{eff}.

QUESTION: 25

For an operating nuclear reactor, the "effective" core delayed neutron fraction may differ from the core delayed neutron fraction because, compared to prompt neutrons, delayed neutrons...

A. are less likely to leak out of the reactor core, and they are less likely to cause fast fission.

B. are less likely to cause fast fission, and they require more time to complete a neutron generation.

C. require more time to complete a neutron generation, and they spend less time in the resonance absorption energy region.

D. spend less time in the resonance absorption energy region, and they are less likely to leak out of the reactor core.

QUESTION: 26

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

A. Fuel temperature decreases from 1500°F to 1200°F.

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

C. Reactor coolant boron concentration increases by 20 ppm.

D. The controlling bank of control rods is inserted 5 percent into the core.

QUESTION: 27

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

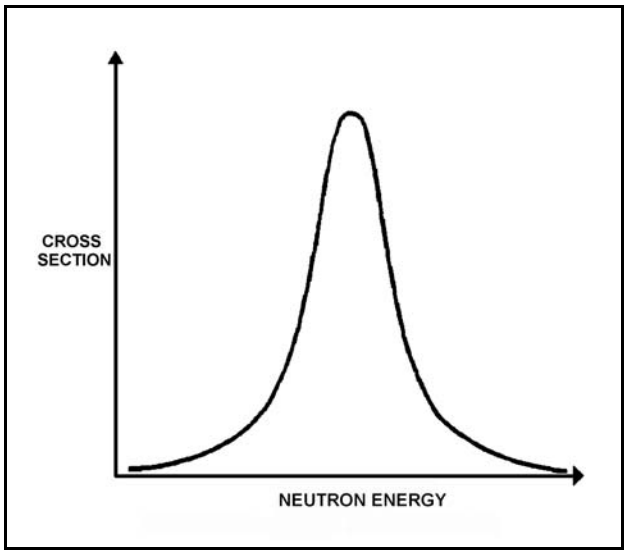
During a subsequent reactor power decrease to 70 percent, the curve will become _____; and the percentage of the core neutron population lost to resonance capture by U-238 will _____.

A. shorter and broader; increase

B. shorter and broader; decrease

C. taller and more narrow; increase

D. taller and more narrow; decrease



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

Differential rod worth will become most negative if reactor coolant system (RCS) temperature is _____ and RCS boron concentration is _____.

A. increased; decreased

B. decreased; decreased

C. increased; increased

D. decreased; increased

QUESTION: 30

A nuclear power plant has been operating at 100 percent power for several months. Which one of the following describes the relative contributions of beta decay and neutron capture to Xe-135 removal from the reactor core?

A. Primary - neutron capture; secondary - beta decay.

B. Primary - beta decay; secondary - neutron capture.

C. Beta decay and neutron capture contribute equally.

D. Not enough information is given to make a comparison.

QUESTION: 31

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

Which reactor core has the greater <u>concentration</u> of Xe-135?

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

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

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

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

QUESTION: 32

Instead of using a higher concentration of soluble boric acid, burnable poisons are installed in a new nuclear reactor core to...

A. prevent boron precipitation during normal operation.

B. establish a more negative moderator temperature coefficient.

C. allow control rods to be withdrawn farther upon initial criticality.

D. maintain reactor coolant pH above a minimum acceptable value.

QUESTION: 33

A nuclear power plant was operating at steady-state 100 percent power near the end of a fuel cycle when a reactor trip occurred. Four hours after the trip, with reactor coolant temperature at normal no-load temperature, which one of the following will cause the fission rate in the reactor core to increase?

A. The operator fully withdraws the shutdown control rods.

B. Reactor coolant temperature is allowed to increase by 3°F.

C. Reactor coolant boron concentration is increased by 10 ppm.

D. An additional two hours is allowed to pass with no other changes in plant parameters.

QUESTION: 34

When a nuclear reactor is exactly critical, reactivity is...

A. 0.0 ΔK/K.

B. 1.0 ΔK/K.

C. infinity.

D. undefined.

QUESTION: 35

A nuclear reactor is critical near the end of a fuel cycle with power level stable at 1.0×10^{-10} percent. Which one of the following is the smallest listed amount of positive reactivity that is capable of increasing reactor power level to the point of adding heat?

A. 0.001 %ΔK/K

B. 0.003 %ΔK/K

C. 0.005 %ΔK/K

D. 0.007 %ΔK/K

QUESTION: 36

A nuclear reactor startup is in progress near the end of a fuel cycle. Reactor power is 5×10^{-3} percent and increasing slowly with a stable 0.3 dpm startup rate. Assuming no operator action, no reactor trip, and no steam release, what will reactor power be after 10 minutes?

A. Below the point of adding heat (POAH).

B. At the POAH.

C. Above the POAH but less than 50 percent.

D. Greater than 50 percent.

QUESTION: 37

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

The tanks are identical and they are presently at 2 psig overpressure, 60°F, and the same constant water level. They are located within a sealed containment structure that is being maintained at atmospheric pressure. All level detectors have been calibrated and are producing the same level indication.

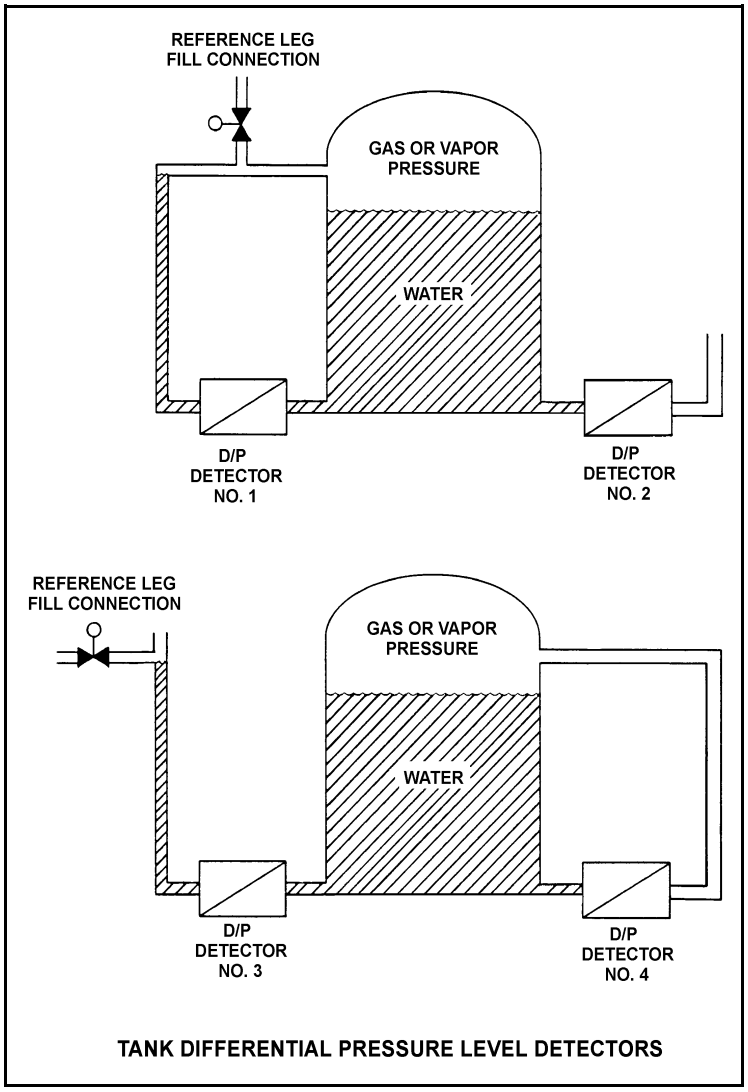
If a ventilation malfunction causes containment structure pressure to decrease to 12 psia, which level detectors will produce the lowest level indication?

A. 1 and 3

B. 2 and 4

C. 1 and 4

D. 2 and 3



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

QUESTION: 38

Given the following:

- A saturated steam-water mixture with an inlet quality of 40 percent is flowing through a moisture separator.
- The moisture separator is 100 percent efficient for removing water.

How much water will be removed by the moisture separator from 50 lbm of the steam-water mixture?

A. 10 lbm

B. 20 lbm

C. 30 lbm

D. 40 lbm

QUESTION: 39

An open vessel contains 5.0 lbm of water at constant standard atmospheric pressure. The water has been heated to the saturation temperature. If an additional 1,600 Btu is added to the water, the water temperature will _____, and _____ than 50 percent of the water will vaporize.

A. increase significantly; less

B. increase significantly; more

C. remain approximately constant; less

D. remain approximately constant; more

QUESTION: 40

Which one of the following is essentially a constant enthalpy process?

A. Steam flowing through an ideal convergent nozzle.

B. Condensation of turbine exhaust in a main condenser.

C. Expansion of main steam through the stages of an ideal turbine.

D. Throttling of main steam through main turbine steam inlet valves.

QUESTION: 41

A nuclear power plant was initially operating at steady-state 90 percent reactor power when heating steam (supplied from main turbine extraction steam) to the feedwater heaters was isolated. With heating steam still isolated, reactor power was returned to 90 percent and the plant was stabilized.

Compared to the initial main generator MW output, the current main generator MW output is...

A. lower, because the steam cycle is less efficient.

B. higher, because the steam cycle is less efficient.

C. lower, because more steam heat energy is available to the main turbine.

D. higher, because more steam heat energy is available to the main turbine.

QUESTION: 42

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

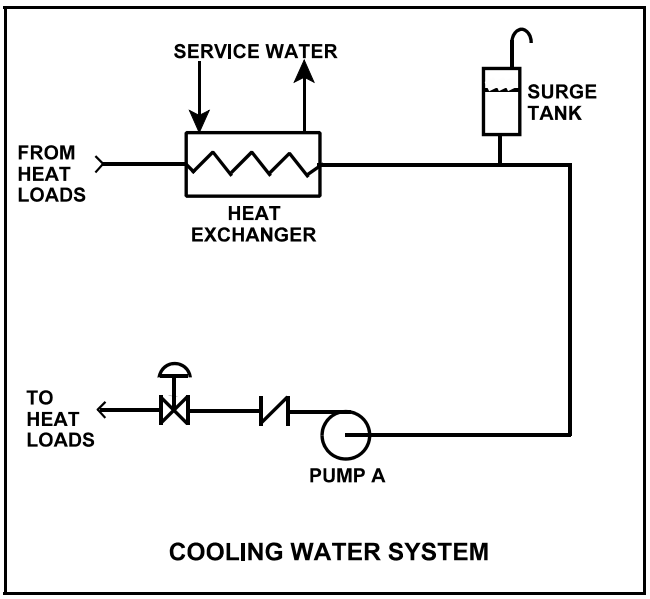
Centrifugal pump A is circulating water at 100°F. Which one of the following will cause the centrifugal pump to operate closer to a condition in which gas/vapor binding can occur?

A. Surge tank level is raised by 5 percent.

B. Service water flow rate is decreased by 5 percent.

C. The pump discharge valve is used to decrease cooling water system flow rate by 5 percent.

D. Makeup water containing a high concentration of total dissolved solids is added to the cooling water system.



QUESTION: 43

Two identical centrifugal pumps (CPs) and two identical positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1,200 psig.

Given the following information:

Centrifugal Pumps

Shutoff head:	1,500 psig
Maximum design pressure:	2,000 psig

Positive Displacement Pumps

Maximum design pressure:	2,000 psig

Which one of the following pump configurations will supply the highest makeup flow rate to the system if system pressure is at 500 psig?

A. Two CPs in series

B. Two CPs in parallel

C. Two PDPs in parallel

D. One CP and one PDP in series (CP supplying PDP)

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 feed water temperature used in the heat balance calculation was 20°F lower than actual feed water temperature.

B. The reactor coolant pump heat input term was omitted from the heat balance calculation.

C. The ambient heat loss value used in the heat balance calculation was only one-half the actual ambient heat loss.

D. The feed water flow rates used in the heat balance calculation were 10 percent higher than actual flow rates.

QUESTION: 45

Initially, subcooled water is flowing into a fuel assembly, with subcooled water exiting the fuel assembly several degrees hotter than when it entered, and no boiling is occurring in the fuel assembly. Assume that fuel assembly thermal power and water flow rate remain the same.

System pressure is decreased, causing some of the water in contact with the fuel rods to boil during transit through the fuel assembly. If the water exiting the fuel assembly remains subcooled, the average fuel temperature in the fuel assembly will be _____, and the temperature of the water exiting the fuel assembly will be _____.

A. higher; the same

B. higher; higher

C. lower; the same

D. lower; higher

QUESTION: 46

Film boiling heat transfer is...

A. the most efficient method of boiling heat transfer.

B. heat transfer through an oxide film on the cladding.

C. heat transfer being accomplished with no enthalpy change.

D. heat transfer through a vapor blanket that covers the fuel cladding.

QUESTION: 47

If a nuclear reactor is operating with the departure from nucleate boiling ratio (DNBR) at its limit, which one of the following is indicated?

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

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

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

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

QUESTION: 48

A nuclear power plant is operating at 100 percent power when a loss of offsite power occurs, resulting in a reactor trip and a loss of forced reactor coolant circulation. After 30 minutes, reactor coolant system (RCS) hot leg temperature is greater than cold leg temperature and steam generator (SG) levels are stable.

Which one of the following combinations of parameter trends, occurring 30 minutes after the trip, indicates that natural circulation is occurring? (CET = core exit thermocouple)

	RCS Hot Leg Temperature	RCS Cold Leg Temperature	SG Pressures	RCS CET Subcooling
A.	Decreasing	Stable	Stable	Increasing
B.	Increasing	Decreasing	Increasing	Decreasing
C.	Decreasing	Decreasing	Decreasing	Decreasing
D.	Increasing	Increasing	Decreasing	Increasing

QUESTION: 49

Consider a new fuel rod operating at a constant power level for several weeks. During this period, fuel densification in the fuel rod causes the heat transfer rate from the fuel pellets to the cladding to _____; which causes the average fuel temperature in the fuel rod to _____.

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

QUESTION: 50

The reference temperature for nil-ductility transition (RT_{NDT}) is the temperature above which...

A. a large compressive stress can result in brittle fracture.

B. a metal exhibits more ductile tendencies.

C. the probability of brittle fracture increases.

D. no appreciable deformation occurs prior to failure.

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

JUNE 2010 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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