UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 2012--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 8 gpm. The tank is protected by a relief valve and a safety valve that discharge to the atmosphere. The valves have the following characteristics:

- The relief valve opening setpoint is 200 psig with an accumulation of 5 percent.
- The safety valve opening setpoint is 240 psig with a blowdown of 5 percent.
- Both valves have a maximum discharge flow rate of 6 gpm.

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

With the PDP still running, the relief valve will be _____ open; and the safety valve will be discharging an average flow rate of _____.

A. partially; 6 gpm

B. partially; 2 gpm

C. fully; 6 gpm

D. fully; 2 gpm

QUESTION: 2

Which one of the following statements describes the throttling characteristics of a typical globe valve?

A. The first third of valve disk travel in the open direction will result in approximately one-third of full flow rate.

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

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

D. The first two-thirds of valve disk travel in the open direction will produce approximately the same increase in flow rate as the last third of valve disk travel.

QUESTION: 3

A resistance temperature detector (RTD) and a thermocouple (TC) are commonly used sensors for temperature measurement. If a temperature display fails, which sensor(s), if any, has/have a property that can be measured manually and converted to a temperature value with the aid of conversion tables.

A. TC only.

B. RTD only.

C. Both TC and RTD.

D. Neither TC nor RTD.

QUESTION: 4

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

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

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

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

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

QUESTION: 5

Which one of the following types of radiation is the major contributor to the dose indication on a self-reading pocket dosimeter (SRPD)? (also called SRD, PIC, and direct reading dosimeter)

A. Alpha

B. Beta

C. Gamma

D. Neutron

QUESTION: 6

During reactor power operation, a reactor coolant sample is taken and analyzed. Which one of the following lists three radionuclides that are all indicative of a fuel cladding failure if detected in elevated concentrations in the reactor coolant sample?

A. Lithium-6, cobalt-60, and argon-41.

B. Iodine-131, cesium-138, and strontium-89.

C. Nitrogen-16, xenon-135, and manganese-56.

D. Hydrogen-2 (deuterium), hydrogen-3 (tritium), and oxygen-18.

QUESTION: 7

A diesel generator is supplying an isolated electrical bus with the governor operating in the isochronous mode. If a large electrical load is started on the bus, generator frequency will...

A. initially decrease, then increase and stabilize below the initial value.

B. initially decrease, then increase and stabilize at the initial value.

C. initially decrease, then increase and stabilize above the initial value.

D. remain constant during and after the load start.

QUESTION: 8

The level in a condensate collection tank is being controlled by an automatic level controller using proportional-only control. Initially the tank level is stable, but then the flow into the tank increases and stabilizes at a higher flow rate.

As tank level increases, the controller positions a 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 positioning described above could be caused by the controller's gain being too _____ or the controller's proportional band being too _____.

A. low; wide

B. low; narrow

C. high; wide

D. high; narrow

QUESTION: 9

Given:

- A direct-acting proportional pneumatic controller will be used to maintain level in a water storage tank by positioning an air-operated flow control valve in the tank's makeup water supply line.
- The controller's input varies directly with tank level.

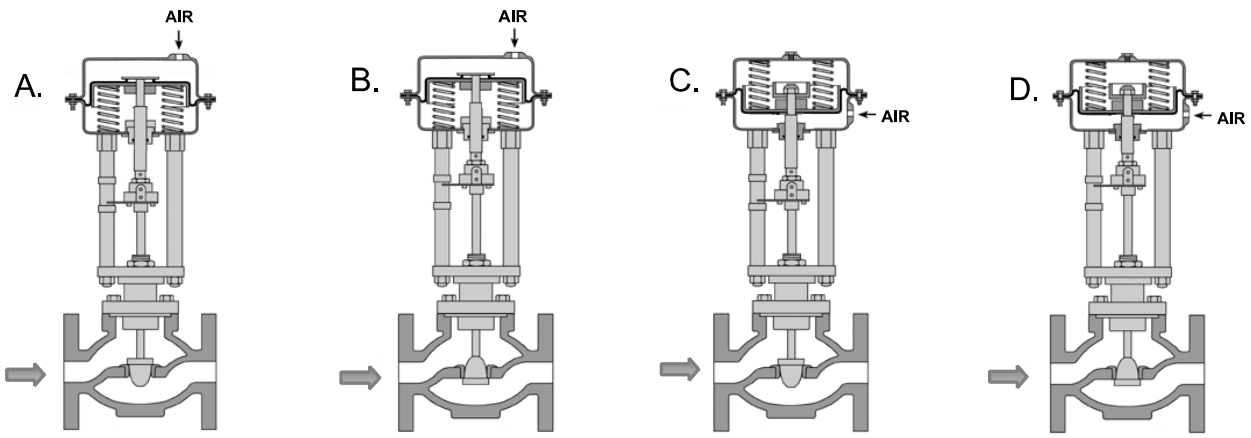
Which of the flow control valves shown below will be compatible with the controller in the above application?

A. A and B

B. B and C

C. C and D

D. D and A



QUESTION: 10

Refer to the drawing of a centrifugal pump taking suction from a reservoir.

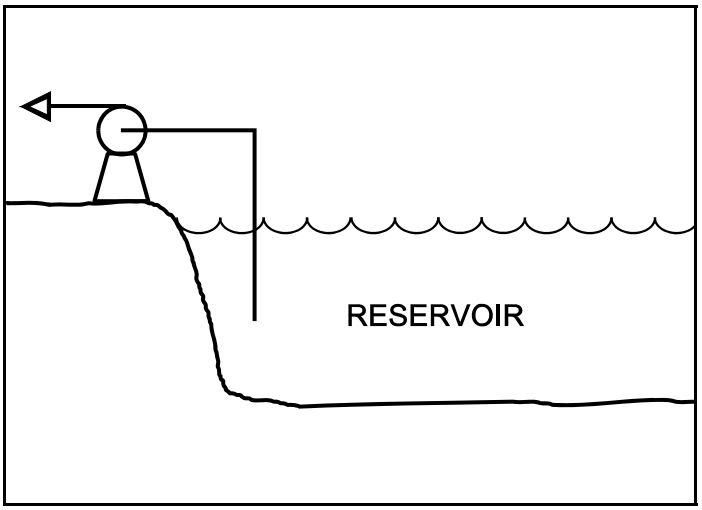
The pump is located on shore, with the eye of the pump 4 feet higher than the reservoir water level. The pump's suction line extends 4 feet below the surface of the reservoir. Which one of the following modifications would increase the pump's available net positive suction head? (Assume the reservoir is at a uniform temperature and ignore any changes in suction line head loss due to friction.)

A. Raise the pump and suction line by 2 feet.

B. Lower the pump and suction line by 2 feet.

C. Lengthen the suction line to take a suction from 2 feet deeper.

D. Shorten the suction line to take a suction from 2 feet shallower.



QUESTION: 11

Which one of the following is an indication of pump runout?

A. Low pump flow rate.

B. High pump vibration.

C. Low pump motor current.

D. High pump discharge pressure.

QUESTION: 12

Refer to the drawing of four sets of centrifugal pump and system operating curves (see figure below). Each set of curves shows a combination of two pump/system operating conditions.

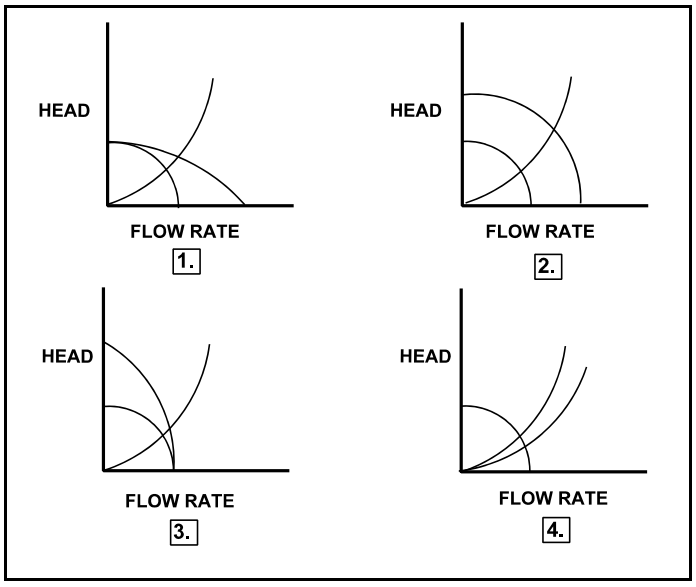
Two identical constant-speed centrifugal pumps are operating in parallel in an open system when one pump trips. Which set of operating curves depicts the "before" and "after" conditions described above?

A. 1.

B. 2.

C. 3.

D. 4.



QUESTION: 13

A positive displacement pump should be started with its suction valve _____ and its discharge valve _____.

A. open; open

B. open; closed

C. closed; open

D. closed; closed

QUESTION: 14

Which one of the following is a characteristic of a typical AC induction motor that causes starting current to be greater than running current?

A. The rotor field induces an opposing voltage in the stator that is proportional to rotor speed.

B. After the motor starts, resistors are added to the electrical circuit to limit the running current.

C. A large amount of starting current is required to initially establish the rotating magnetic field.

D. The rotor does not develop maximum induced current flow until it has achieved synchronous speed.

QUESTION: 15

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

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

A. Instantaneous overcurrent.

B. Motor thermal overload.

C. Blown control power fuse.

D. Anti-pumping device actuation.

QUESTION: 16

A nuclear power plant is shut down with core decay heat being removed by the residual heat removal (RHR) system. Assume that only the RHR heat exchangers are removing heat from the reactor coolant system (RCS) and that the RHR system provides complete thermal mixing of the RCS.

Given the following information:

Reactor core rated thermal power:	2,950 MW
Core decay heat rate:	0.5% rated thermal power
RHR system heat removal rate:	5.7×10^7 Btu/hr
RHR and reactor coolant c_p:	1.05 Btu/lbm-°F
Combined RCS and RHR inventory:	450,000 lbm

Which one of the following actions will establish a reactor cooldown rate between 20°F/hour and 30°F/hour?

A. Increase RHR heat exchanger flow rate to increase the cooldown rate by 10°F/hour.

B. Increase RHR heat exchanger flow rate to increase the cooldown rate by 20°F/hour.

C. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 10°F/hour.

D. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 20°F/hour.

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 main condenser 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 condensate demineralizer differential pressure (D/P) gauge indicates 4.0 psid at 50 percent flow rate. Which one of the following combinations of condensate flow and demineralizer D/P observed at various power levels over the next few days indicates an increase in the accumulation of insoluble corrosion products in the demineralizer?

	Condensate Flow Rate	Demineralizer D/P (psid)
A.	25%	0.9
B.	60%	6.3
C.	75%	8.7
D.	100%	15.6

QUESTION: 19

The ion exchange efficiency of a condensate demineralizer can be calculated using the values for demineralizer inlet and outlet...

A. conductivity.

B. pH.

C. N-16 radioactivity.

D. pressure.

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

Two identical 1,000 MW AC electrical generators are operating in parallel, supplying all the loads on a common electrical bus. The generator output breakers provide identical protection for the generators. Generator A and B output indications are as follows:

Generator A	Generator B
28 KV	28 KV
60 Hertz	60 Hertz
150 MW	100 MW
25 MVAR (out)	50 MVAR (out)

A malfunction causes the voltage regulator set point for generator B to slowly and continuously decrease. If no operator action is taken, the electrical current indication for generator B will...

A. initially decrease, and then increase until the output breaker for generator A trips on overcurrent.

B. initially decrease, and then increase until the output breaker for generator B trips on overcurrent.

C. decrease continuously until the output breaker for generator A trips on overcurrent.

D. decrease continuously until the output breaker for generator B trips on reverse power.

QUESTION: 22

Refer to the drawing of a valve motor control circuit for a valve that is currently fully closed and has a 10-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.

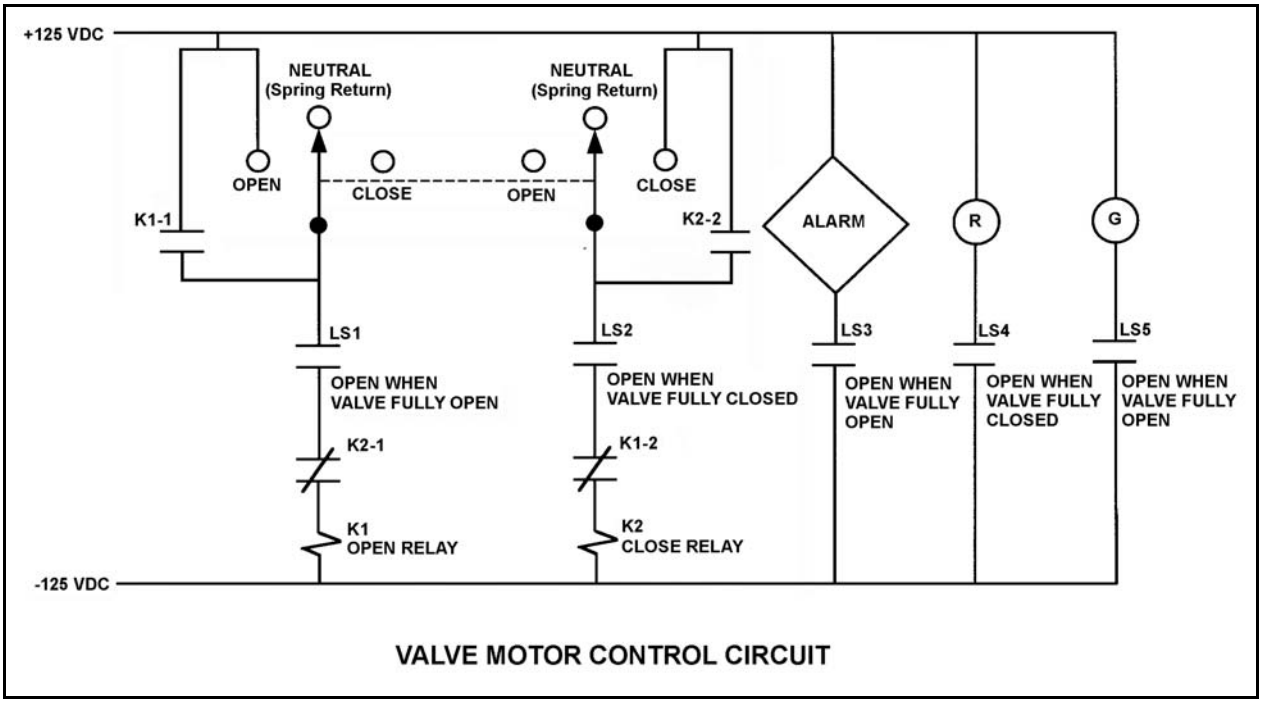
The operator takes the control switch to OPEN momentarily and the valve begins to open. Five seconds later, the operator takes the switch to CLOSE momentarily and then releases the switch. Which one of the following describes the valve response after the switch is released?

A. The valve will stop opening and remain partially open.

B. The valve will stop opening and then go fully closed.

C. The valve will open fully and remain fully open.

D. The valve will open fully and then go fully closed.



VALVE MOTOR CONTROL CIRCUIT

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 nuclear reactor is shutdown with the reactor vessel head removed for refueling. The core is covered by 23 feet of refueling water at 120°F with a boron concentration of 2,000 ppm. Source range instrumentation indicates 100 cps.

How will source range indication be affected if refueling water temperature decreases to 100°F?

A. Indication will increase because the effect of increased core K_{eff} more than offsets the effect of decreased neutron leakage from the core.

B. Indication will increase because of the cooperative effects of increased neutron leakage from the core and increased core K_{eff}.

C. Indication will decrease because the effect of decreased neutron leakage from the core more than offsets the effect of increased core K_{eff}.

D. Indication will decrease because of the cooperative effects of decreased core K_{eff} and decreased neutron leakage from the core.

QUESTION: 25

Given the following data for a nuclear reactor:

The core average delayed neutron fraction is 0.0068.
The core effective delayed neutron fraction is 0.0065.

The above data indicates that the reactor core is operating near the _____ of a fuel cycle and that a typical delayed neutron is _____ likely than a typical prompt neutron to cause another fission in the core.

A. beginning; less

B. beginning; more

C. end; less

D. end; more

QUESTION: 26

Which one of the following describes the net reactivity effect of a moderator temperature decrease in an overmoderated reactor core?

A. Positive reactivity will be added because fewer neutrons will be captured by the moderator.

B. Positive reactivity will be added because fewer neutrons will be absorbed at resonance energies while slowing down.

C. Negative reactivity will be added because more neutrons will be captured by the moderator.

D. Negative reactivity will be added because more neutrons will be absorbed at resonance energies while slowing down.

QUESTION: 27

A reactivity coefficient measures a/an _____ change in reactivity while a reactivity defect measures a _____ change in reactivity due to a change in the measured parameter.

A. integrated; total

B. integrated; differential

C. unit; total

D. unit; differential

QUESTION: 28

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

A. DRW is the IRW at a specific rod position.

B. DRW is the square root of the IRW at a specific rod position.

C. DRW is the slope of the IRW curve at a specific rod position.

D. DRW is the area under the IRW curve at a specific rod position.

QUESTION: 29

Consider a nuclear 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

Select the combination below that completes the following statement.

The amount of negative reactivity associated with peak core xenon-135 is smallest after a reactor trip from equilibrium _____ reactor power at the _____ of a fuel cycle.

A. 20 percent; beginning

B. 20 percent; end

C. 100 percent; beginning

D. 100 percent; end

QUESTION: 31

A nuclear power plant was initially operating at 100 percent power with equilibrium core xenon-135. Then, power was decreased to 75 percent over a 1-hour period. The operator is currently adjusting control rod position as necessary to maintain average reactor coolant temperature constant.

What will the rod position and directional trend be 30 hours after power reaches 75 percent?

A. Above the initial 75 percent power position and inserting slowly.

B. Above the initial 75 percent power position and withdrawing slowly.

C. Below the initial 75 percent power position and inserting slowly.

D. Below the initial 75 percent power position and withdrawing slowly.

QUESTION: 32

Just prior to a refueling outage, a nuclear power plant was operating at 100 percent power with a reactor coolant boron concentration of 50 ppm. After the refueling outage, the 100 percent power boron concentration is approximately 1,000 ppm.

Which one of the following is the primary reason for the large increase in 100 percent power reactor coolant boron concentration?

A. The reactivity from power defect at beginning of core life (BOL) is much greater than at end of core life (EOL).

B. The differential boron worth at BOL is much less than at EOL.
[The inverse boron worth at BOL is much greater than at EOL.]

C. The excess reactivity in the core at BOL is much greater than at EOL.

D. The integral control rod worth at BOL is much less than at EOL.

QUESTION: 33

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

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

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

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

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

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

QUESTION: 34

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

Control Rod Units Withdrawn	Source Range Count Rate (cps)
0	180
10	210
15	250
20	300
25	360
30	420

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

A. 35 to 45 units withdrawn

B. 46 to 55 units withdrawn

C. 56 to 65 units withdrawn

D. 66 to 75 units withdrawn

QUESTION: 35

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

A. infinity.

B. undefined.

C. 0.0 ΔK/K.

D. 1.0 ΔK/K.

QUESTION: 36

Which one of the following is the reason for inserting control rods in a predetermined sequence during a normal reactor shutdown?

A. To prevent uneven fuel burnup.

B. To prevent an excessive reactor coolant system cooldown rate.

C. To prevent abnormally high local power peaks.

D. To prevent divergent xenon oscillations.

QUESTION: 37

Refer to the drawing of two water storage tanks with four differential pressure level detectors (see figure below).

The tanks are identical and are currently at 2 psig overpressure, the same constant water level, and a temperature of 60°F. They are surrounded by atmospheric pressure. All level detectors have been calibrated and are producing the same level indication.

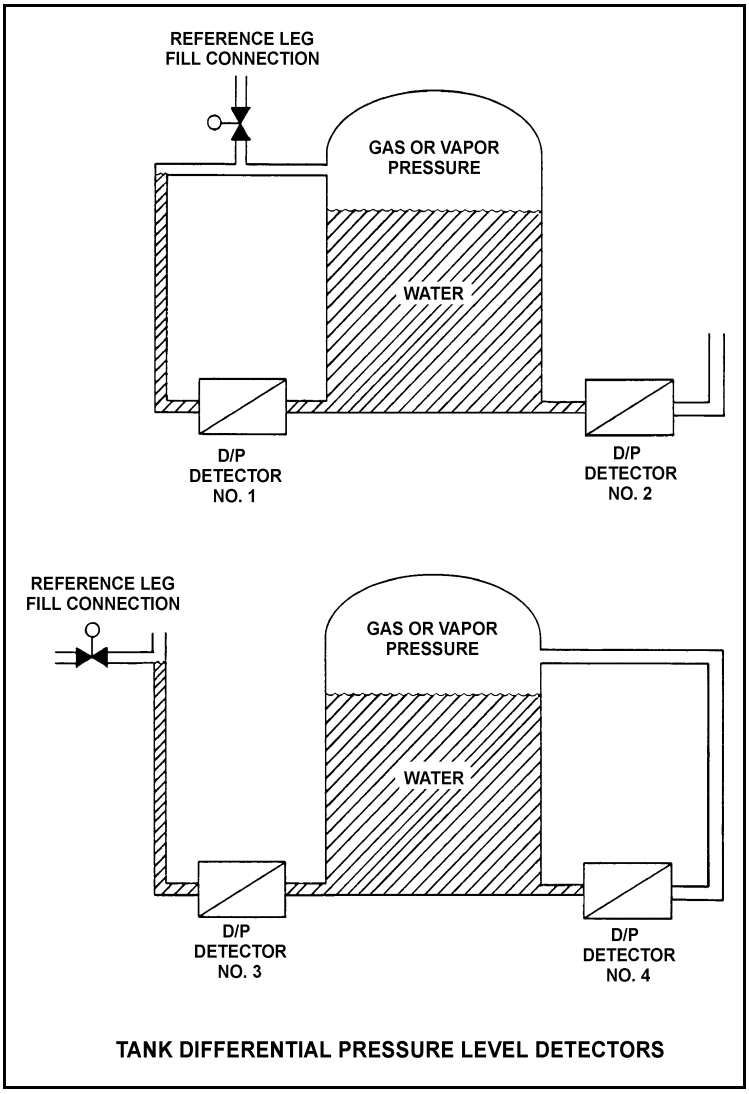
If a leak in the top of each tank causes a complete loss of overpressure, which level detector(s) will produce the lowest level indication?

A. No. 1 only

B. No. 2 only

C. No. 1 and 4

D. No. 2 and 3



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

QUESTION: 38

An open vessel contains one pound-mass of water at 206°F and standard atmospheric pressure. Which one of the following will be caused by the addition of 3.0 Btu to the water?

A. The water temperature will rise by approximately 3°F.

B. Approximately 3 percent of the water mass will vaporize.

C. The water density will decrease by approximately 3 percent.

D. The water will become superheated by approximately 3°F.

QUESTION: 39

Which one of the following will increase the subcooling of the condensate in the condenser hotwell?

A. Isolate circulating water to one shell of the main condenser.

B. Increase circulating water inlet temperature.

C. Decrease circulating water flow rate.

D. Decrease main turbine steam flow rate.

QUESTION: 40

A nuclear power plant is operating with the following main steam parameters at a main turbine steam inlet valve:

Pressure: 1,050 psia
Quality: 100 percent

The main turbine steam chest pressure is 400 psia. Which one of the following describes the steam in the steam chest?

A. Saturated, 96 percent quality

B. Saturated, 98 percent quality

C. Saturated, 100 percent quality

D. Superheated

QUESTION: 41

Consider the steam cycle thermal efficiency of a nuclear power plant operating at rated power.

If the pressure at which saturated steam is produced in the steam generators is increased, thermal efficiency will _____; and if the temperature of the feedwater entering the steam generators is increased, thermal efficiency will _____.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 42

Which one of the following contains indications of pump cavitation?

A. Abnormally low discharge pressure and flow rate.

B. Abnormally high discharge pressure and flow rate.

C. Abnormally low discharge pressure and abnormally high flow rate.

D. Abnormally high discharge pressure and abnormally low flow rate.

QUESTION: 43

The following are current parameter values for an operating 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

A nuclear reactor is producing 200 MW of core thermal power. Reactor coolant pumps are adding 10 MW of additional thermal power into the coolant system based on heat balance calculations. The core is rated at 1,330 MW thermal power.

Which one of the following is the core thermal power in percent?

A. 14.0 percent

B. 14.3 percent

C. 15.0 percent

D. 15.8 percent

QUESTION: 45

As heat is transferred to water adjacent to a heating surface, many factors influence steam bubble formation. Which one of the following characteristics will enhance steam bubble formation?

A. Chemicals dissolved in the water.

B. The absence of ionizing radiation exposure to the water.

C. A highly polished heat transfer surface with minimal scratches or cavities.

D. The presence of gases dissolved in the water.

QUESTION: 46

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

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

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

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

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

QUESTION: 47

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 decrease 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 increases reactor coolant system pressure by 20 psig.

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

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

QUESTION: 48

Adequate core bypass flow is needed to...

A. cool the excore nuclear instrument detectors.

B. provide reactor coolant pump minimum flow requirements.

C. prevent stratification of reactor coolant inside the reactor vessel lower head.

D. equalize the temperatures between the reactor vessel and the reactor vessel upper head.

QUESTION: 49

A nuclear reactor is operating at steady state conditions in the power range with the following average temperatures in a core plane:

$T_{coolant} = 550°F$
$T_{fuel\ centerline} = 1{,}680°F$

Assume that the fuel rod heat transfer coefficients and reactor coolant temperatures are equal throughout the core plane. If the maximum total peaking factor in the core plane is 2.1, what is the maximum fuel centerline temperature in the core plane?

A. 2,923°F

B. 3,528°F

C. 4,078°F

D. 4,683°F

QUESTION: 50

The thermal stress experienced by the reactor vessel during a reactor coolant system cooldown is...

A. tensile across the entire vessel wall.

B. tensile at the inner wall, compressive at the outer wall of the vessel.

C. compressive across the entire vessel wall.

D. compressive at the inner wall, tensile at the outer wall of the vessel.

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

MARCH 2012 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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