UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
JUNE 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	°C = (5/9)(°F - 32)	1 ft^3_{water} = 7.48 gal
1 hp = 2.54×10^3 Btu/hr	°F = (9/5)(°C) + 32	1 gal_{water} = 8.35 lbm
1 Btu = 778 ft-lbf	1 kg = 2.21 lbm	1 Curie = 3.7×10^{10} dps

QUESTION: 1

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

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

A. at; safety

B. above; safety

C. at; relief

D. above; relief

QUESTION: 2

Subcooled water is flowing through a throttled valve in an open system. The initial steady state conditions for the throttled valve were as follows:

Inlet pressure = 60 psia
Outlet pressure = 44 psia
Flow rate = 800 gpm

After four hours, the current steady state conditions for the throttled valve are as follows:

Inlet pressure = 63 psia
Outlet pressure = 54 psia
Flow rate = 600 gpm

Which one of the following could be responsible for the difference between the initial and current conditions for the throttled valve?

A. The throttled valve was opened farther.

B. The throttled valve was closed farther.

C. Another valve, located upstream of the throttled valve, was partially closed.

D. Another valve, located downstream of the throttled valve, was partially closed.

QUESTION: 3

A differential pressure flow detector is connected to a calibrated orifice in a cooling water system. Which one of the following will cause indicated volumetric flow rate to be lower than actual volumetric flow rate?

A. System pressure decreases.

B. The orifice erodes over time.

C. Debris becomes lodged in the orifice.

D. A leak develops in the low pressure sensing line.

QUESTION: 4

Refer to the drawing of a pressurizer differential pressure (D/P) level detection system (see figure below).

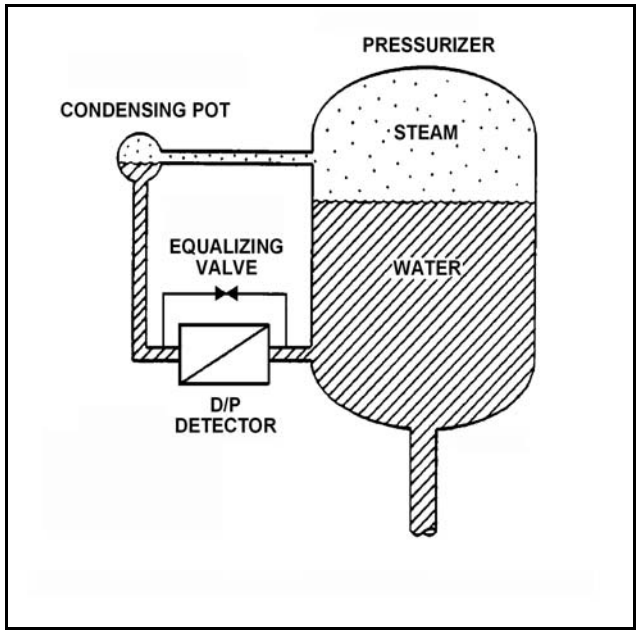
The pressurizer level instrument was calibrated while the plant was at normal operating conditions. With the plant in cold shutdown conditions, the pressurizer level D/P instrument will indicate _____ than actual level because the D/P sensed by the detector at cold shutdown conditions will be _____ than at normal operating conditions for the same level.

A. lower; greater

B. lower; smaller

C. higher; greater

D. higher; smaller



QUESTION: 5

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

The temperature value taken from the conversion tables is 120°F.

What adjustment must be made to the temperature value taken from the conversion tables to calculate the actual temperature at the measuring tip of the thermocouple?

A. Add 48°F.

B. Subtract 48°F.

C. Add 88°F.

D. Subtract 88°F.

QUESTION: 6

Which one of the following personal radiation monitoring devices can be charged with DC voltage to "zero" the device prior to use?

A. Film badge

B. Alarming dosimeter

C. Thermoluminescent dosimeter

D. Self-reading pocket dosimeter

QUESTION: 7

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

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

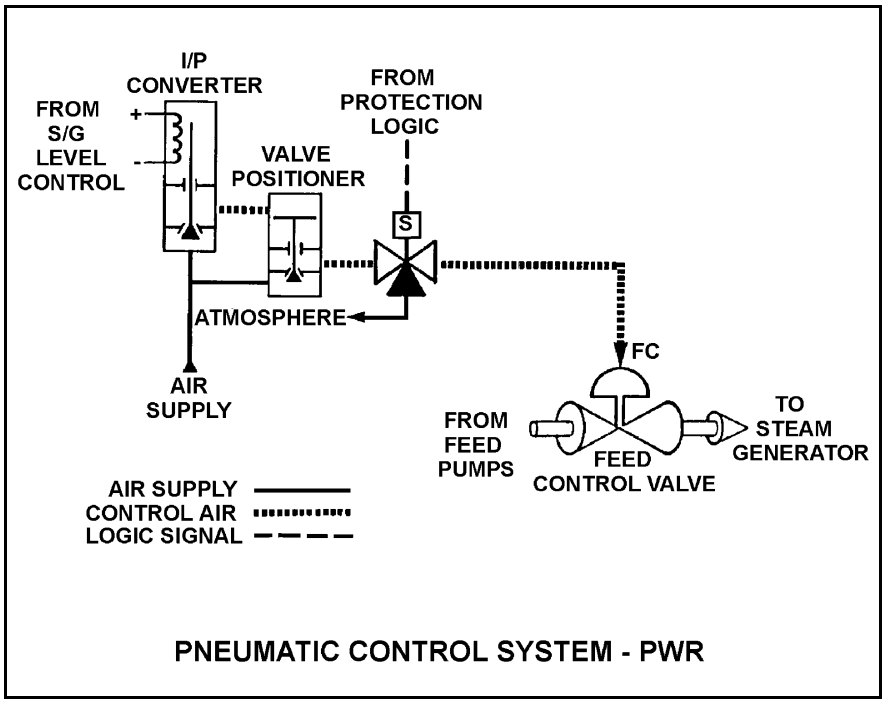
If the level control signal fails high, SG water level will _____ because the control air pressure to the valve positioner will _____.

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease



PNEUMATIC CONTROL SYSTEM - PWR

QUESTION: 8

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

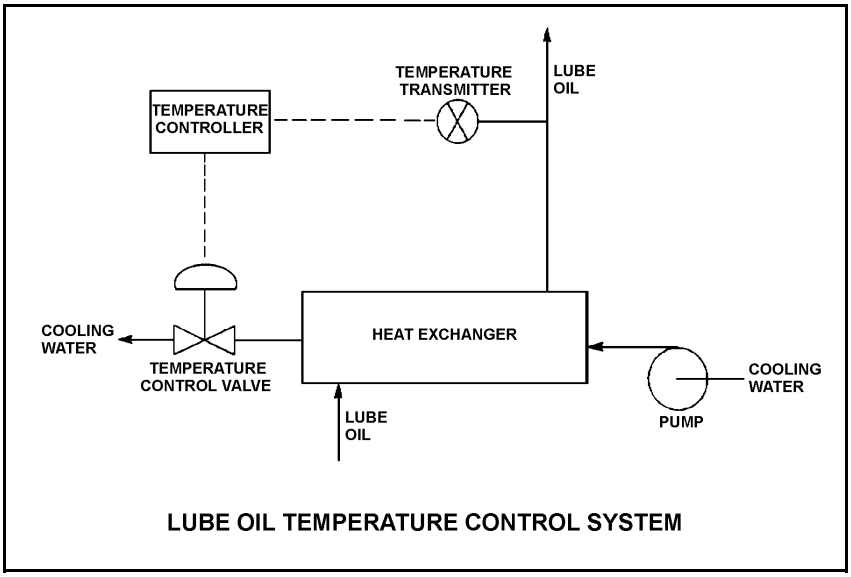
The temperature controller is a direct-acting proportional controller with a gain of 1.0. Which one of the following describes the effect of changing the gain to 2.0?

A. Half the temperature deviation from setpoint will produce a given controller output.

B. Twice the temperature deviation from setpoint will produce a given controller output.

C. The temperature control valve will move half as far for a given change in controller output.

D. The temperature control valve will move twice as far for a given change in controller output.



LUBE OIL TEMPERATURE CONTROL SYSTEM

QUESTION: 9

The level in a tank is controlled by an automatic level controller. Level is initially at the setpoint when a drain valve opens. When level decreases to 5 percent below setpoint the level controller opens a makeup supply valve. After a few minutes level is 5 percent above setpoint and the makeup valve closes. With the drain valve still open, level continues to oscillate 5 percent above and below the setpoint.

The controller in this system uses primarily _____ control.

A. integral

B. bistable

C. derivative

D. proportional

QUESTION: 10

An AC motor-driven centrifugal pump was initially circulating water at 150°F in a cooling water system. Over several hours, the circulating water temperature decreased to 100°F. Assuming system flow rate (gpm) remained constant, pump motor current _____ because _____ increased.

A. increased; water density

B. increased; motor efficiency

C. decreased; water density

D. decreased; motor efficiency

QUESTION: 11

Some large centrifugal pumps are interlocked so that the pump will not start unless its discharge valve is at least 90 percent closed. This interlock is provided to minimize the...

A. pump discharge pressure.

B. heating of the pumped fluid.

C. cavitation at the pump suction.

D. duration of the pump motor starting current.

QUESTION: 12

A centrifugal pump is used to provide makeup water to a storage tank that is 30 feet high. The pump is located at the base of the tank. The pump can be aligned to fill the tank via a top connection or a bottom connection using piping of equal lengths and diameters. The tank is currently half full.

With the pump in operation, the pump will have the highest discharge pressure if the pump is aligned to fill the tank via the _____ connection; and the tank will become full in the least amount of time if the pump is aligned to fill the tank via the _____ connection.

A. top; top

B. top; bottom

C. bottom; top

D. bottom; bottom

QUESTION: 13

A pump is needed to supply fuel oil from a day tank to a diesel engine fuel injection system. The pump must maintain a nearly constant flow rate with a minimum of discharge pressure fluctuations as system pressure varies between 200 psig and 1,900 psig.

Which one of the following types of pumps would typically be used in this application?

A. Axial flow centrifugal

B. Radial flow centrifugal

C. Rotary positive displacement

D. Reciprocating positive displacement

QUESTION: 14

An axial flow ventilation fan is being driven by an AC motor. How will the fan motor current be affected if the volumetric flow rate through the fan is decreased by partially closing a discharge damper?

A. The motor current will increase in accordance with the centrifugal pump laws.

B. The motor current will increase, but not in accordance with the centrifugal pump laws.

C. The motor current will decrease in accordance with the centrifugal pump laws.

D. The motor current will decrease, but not in accordance with the centrifugal pump laws.

QUESTION: 15

What is the primary reason for limiting the number of starts for an electric motor in a given period of time?

A. Prevent overheating of the windings due to high starting currents.

B. Prevent overheating of the windings due to shorting within the stator.

C. Prevent rotor damage due to excessive cyclic stresses on the shaft.

D. Prevent rotor damage due to excessive axial displacement of the shaft.

QUESTION: 16

Which one of the following will reduce the rate of heat transfer between two liquids in a heat exchanger? (Assume single-phase conditions and a constant specific heat for both liquids.)

A. The inlet temperatures of both liquids are decreased by 20°F.

B. The inlet temperatures of both liquids are increased by 20°F.

C. The inlet temperature of the hotter liquid is increased by 20°F.

D. The inlet temperature of the colder liquid is increased by 20°F.

QUESTION: 17

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following initial parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$) = 75°F
Cooling water outlet temperature ($T_{cw\text{-}out}$) = 95°F
Oil inlet temperature ($T_{oil\text{-}in}$) = 150°F
Oil outlet temperature ($T_{oil\text{-}out}$) = 110°F

Air leakage into the heat exchanger causes some of the heat exchanger tubes to become uncovered. As a result, $T_{cw\text{-}out}$ decreases to 89°F. Assume the inlet temperatures, mass flow rates, and specific heats of both fluids remain the same.

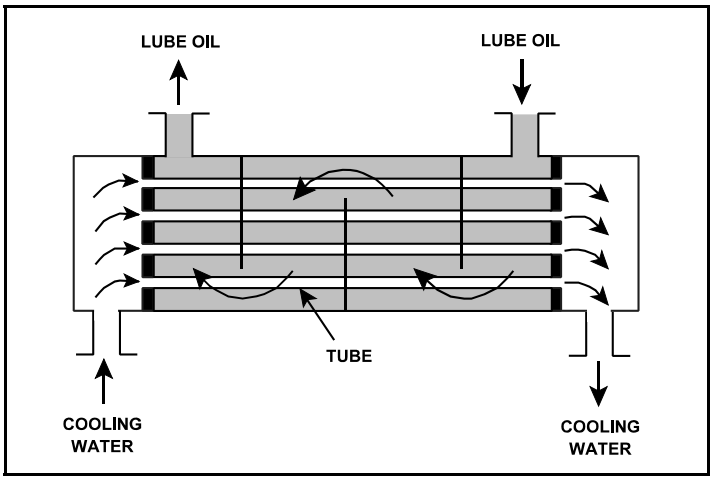
Which one of the following will be the new approximate temperature of the lube oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

A. 116°F

B. 122°F

C. 130°F

D. 138°F



QUESTION: 18

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

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

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

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

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

QUESTION: 19

Prior to a scheduled nuclear power plant shutdown, the reactor coolant system was chemically shocked to induce a crud burst. What effect will the crud burst have on the in-service reactor coolant letdown ion exchangers?

A. Decreased ion exchanger outlet conductivity.

B. Decreased pressure drop across the ion exchangers.

C. Increased flow rate through the ion exchangers.

D. Increased radiation levels around the ion exchangers.

QUESTION: 20

Which one of the following is an unsafe practice if performed when working on or near energized electrical equipment?

A. Cover exposed energized circuits with insulating material to prevent inadvertent contact.

B. Have a person standing by to deenergize the equipment in the event of an emergency.

C. Use two hands for balance and to prevent dropping tools onto energized equipment.

D. Stand on insulating rubber material to prevent yourself from being grounded.

QUESTION: 21

A main generator is about to be connected to an infinite power grid. Closing the generator output breaker with the generator voltage slightly lower than grid voltage and with generator frequency slightly higher than grid frequency will initially result in: (Assume no generator breaker protective trip occurs.)

A. the generator supplying reactive power to the grid.

B. the generator attaining a leading power factor.

C. the generator acting as a real load to the grid.

D. motoring of the generator.

QUESTION: 22

While remotely investigating the condition of a normally-open 480 VAC motor control center (MCC) feeder breaker, an operator observes the following indications:

Green breaker position indicating light is out.
Red breaker position indicating light is lit.
MCC voltmeter indicates 480 VAC.
MCC ammeter indicates zero amperes.

Based on these indications, the operator should report that the feeder breaker is _____ and racked _____.

A. open; in

B. closed; in

C. open; to an unknown position

D. closed; to an unknown position

QUESTION: 23

Delayed neutrons are neutrons that...

A. have reached thermal equilibrium with the surrounding medium.

B. are expelled within 10^{-14} seconds of the fission event.

C. are produced from the radioactive decay of certain fission fragments.

D. are responsible for the majority of U-235 fissions.

QUESTION: 24

A nuclear power plant was initially operating at equilibrium 100 percent power just prior to a refueling outage. The plant was shut down, refueled, restarted, and is currently operating at equilibrium 100 percent power. Assume the 100 percent power fission rate did not change.

Which one of the following describes the current plant status as compared to the conditions just prior to the refueling?

A. The available shutdown margin is greater.

B. The reactor coolant boron concentration is smaller.

C. The equilibrium core Xe-135 concentration is smaller.

D. The difference between the reactor coolant hot leg and cold leg temperatures is greater.

QUESTION: 25

Given the following stable initial conditions for a nuclear reactor:

Power level: 1.0×10^{-8} percent
K_{eff} : 0.999
Core $\overline{\beta}_{eff}$: 0.006

What will the stable startup rate be following an addition of positive 0.2 %ΔK/K reactivity to the reactor? (Assume the stable startup rate occurs before the reactor reaches the point of adding heat.)

A. 0.24 dpm

B. 0.33 dpm

C. 0.52 dpm

D. 1.30 dpm

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

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

A. 3% power to 10% power

B. 10% power to 25% power

C. 25% power to 65% power

D. 65% power to 100% power

QUESTION: 28

A nuclear reactor is initially critical below the point of adding heat with a constant reactor coolant temperature. If control rods are manually inserted for 5 seconds, reactor power will decrease...

A. to a lower power level determined by subcritical multiplication.

B. temporarily, then return to the original power level due to subcritical multiplication.

C. temporarily, then return to the original power level due to a decrease in moderator temperature.

D. until inherent positive reactivity feedback causes the reactor to become critical at a lower power level.

QUESTION: 29

After a control rod is fully inserted (from the fully withdrawn position), the effect on the axial flux shape is minimal. This is because...

A. the differential rod worth is constant along the length of the control rod.

B. the fully inserted control rod is an axially uniform poison.

C. a control rod only has reactivity worth if it is moving.

D. a variable poison distribution exists throughout the length of the control rod.

QUESTION: 30

A nuclear reactor has been operating at a constant power level for 15 hours following a rapid power reduction from 100 percent to 50 percent. Which one of the following describes the current core xenon-135 concentration?

A. Increasing toward a peak.

B. Decreasing toward an upturn.

C. Increasing toward equilibrium.

D. Decreasing toward equilibrium.

QUESTION: 31

Following a seven day shutdown, a reactor startup is performed and the nuclear power plant is taken to 100 percent power over a 16 hour period. After reaching 100 percent power, what type of reactivity will the operator need to add to compensate for core xenon-135 changes over the next 24 hours?

A. Negative only

B. Negative, then positive

C. Positive only

D. Positive, then negative

QUESTION: 32

Which one of the following correctly compares the rates at which reactor power can be safely increased from 80 percent to 100 percent at the beginning of a fuel cycle (BOC) and at the end of a fuel cycle (EOC)?

A. Slower at EOC due to a lower maximum rate of reactor coolant boron dilution.

B. Slower at EOC due to a less negative control rod worth.

C. Slower at BOC due to a lower maximum rate of reactor coolant boron dilution.

D. Slower at BOC due to a less negative control rod worth.

QUESTION: 33

During a reactor startup, the first reactivity addition caused the source range count rate to increase from 20 to 40 cps. The second reactivity addition caused the count rate to increase from 40 to 160 cps.

Which one of the following statements accurately compares the two reactivity additions?

A. The first reactivity addition was larger.

B. The second reactivity addition was larger.

C. The first and second reactivity additions were equal.

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

QUESTION: 34

A reactor trip has occurred from 100 percent reactor power and equilibrium xenon-135 conditions near the end of a fuel cycle. An estimated critical rod position (ECP) has been calculated using the following assumptions:

- Criticality occurs 24 hours after the trip.
- Reactor coolant temperature is 550°F.
- Reactor coolant boron concentration is 400 ppm.

Which one of the following will result in criticality occurring at a control rod position that is higher than the calculated ECP?

A. Decreasing reactor coolant system boron concentration to 350 ppm.

B. A malfunction resulting in control rod speed being 20 percent higher than normal speed.

C. Moving the time of criticality to 30 hours after the trip.

D. Misadjusting the steam dump (turbine bypass) controller such that reactor coolant temperature is being maintained at 553°F.

QUESTION: 35

During a reactor startup from a xenon-free condition, and after recording critical data, the operator establishes a positive 0.4 dpm startup rate to continue increasing power. Within 10 minutes, and prior to reaching the point of adding heat, reactor power stops increasing and begins to slowly decrease.

Which one of the following changes could have caused this behavior?

A. Inadvertent boration of the RCS.

B. Xenon buildup in the core.

C. Gradual cooling of the RCS.

D. Fission-induced heating of the fuel.

QUESTION: 36

A nuclear power plant is operating at 60 percent power in the middle of a fuel cycle with manual rod control when a turbine control system malfunction closes the turbine steam inlet valves an additional 5 percent. Which one of the following is mostly responsible for the initial reactor power decrease?

A. The rate of neutron absorption by core Xe-135 initially increases.

B. The rate of neutron absorption by the moderator initially increases.

C. The rate of neutron absorption by the fuel at resonance energies initially increases.

D. The rate of neutron absorption by the boron in the reactor coolant initially increases.

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 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.

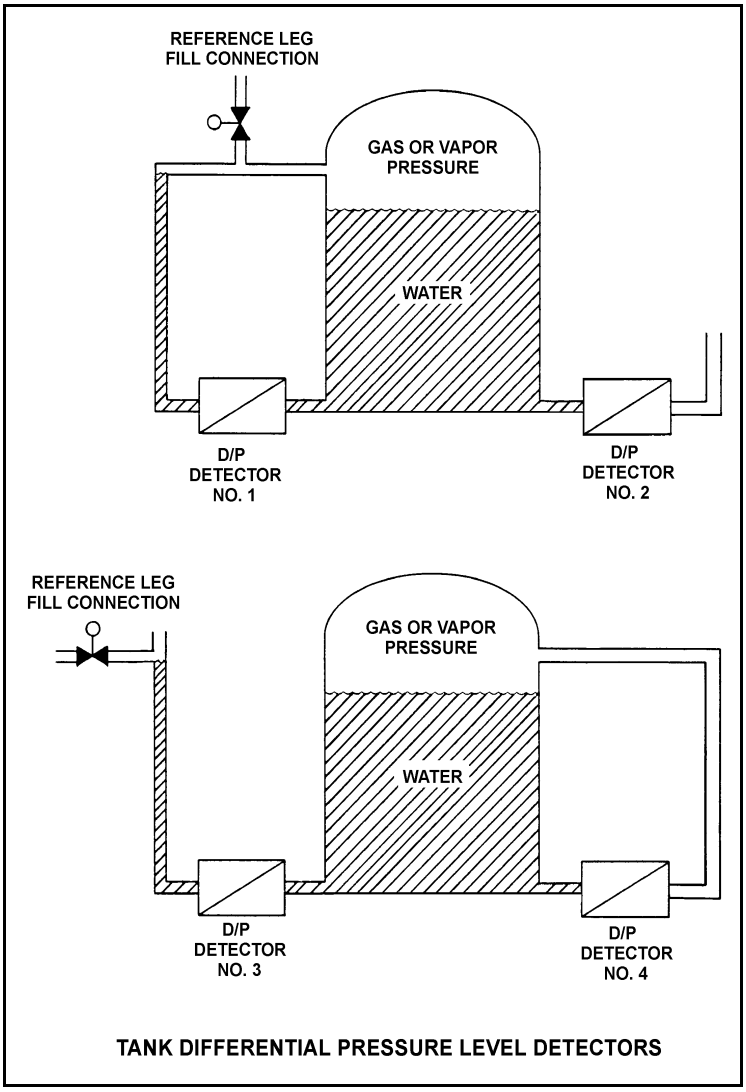
If a ventilation malfunction causes containment structure pressure to decrease to 12 psia, which level detectors will produce the lowest level indications?

A. 1 and 3

B. 2 and 4

C. 1 and 4

D. 2 and 3



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

QUESTION: 38

A reactor trip occurred 10 minutes ago due to a loss of coolant accident. Emergency coolant injection is in progress and pressurizer level is increasing. Current pressurizer conditions are as follows:

Pressurizer liquid temperature	= 568°F
Pressurizer vapor temperature	= 596°F
Pressurizer pressure	= 1,410 psia
Pressurizer level	= 60 percent

Given these conditions, the pressurizer liquid is _____ and the pressurizer vapor is _____.

A. saturated; saturated

B. saturated; superheated

C. subcooled; saturated

D. subcooled; superheated

QUESTION: 39

An open vessel contains 1.0 lbm of water at 120°F and standard atmospheric pressure. Which one of the following will be caused by the addition of 540 Btu to the water?

A. The water temperature will increase to approximately 212°F; and less than 50 percent of the water will vaporize.

B. The water temperature will increase to approximately 212°F; and more than 50 percent of the water will vaporize.

C. The water temperature will increase to significantly higher than 212°F; and less than 50 percent of the water will vaporize.

D. The water temperature will increase to significantly higher than 212°F; and more than 50 percent of the water will vaporize.

QUESTION: 40

A nuclear power plant is operating at 80 percent power with 5°F of condensate depression in the main condenser. If the condensate depression decreases to 2°F, the steam cycle thermal efficiency will _____ and the condensate pumps will operate _____ cavitation.

A. increase; closer to

B. increase; farther from

C. decrease; closer to

D. decrease; farther from

QUESTION: 41

A nuclear power plant has a thermal power rating of 3,200 MW. When the plant operates at 100 percent power the main generator produces 1,200 MW at a 0.95 power factor. Plant modifications are planned that will upgrade the feedwater heaters and moisture separator/reheaters without changing the plant's thermal power rating. If the plant modifications improve plant thermal efficiency by 2 percent, what will be the resulting main generator electrical output at 100 percent power with the same power factor?

A. 1,204 MW

B. 1,224 MW

C. 1,244 MW

D. 1,264 MW

QUESTION: 42

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

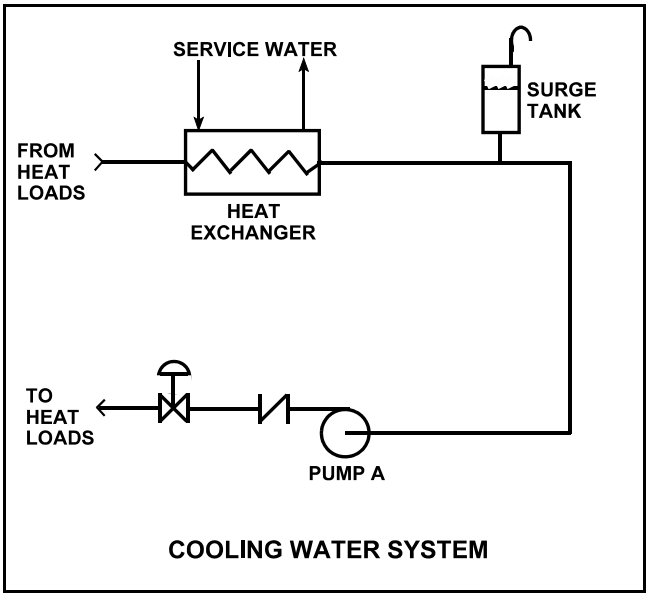
Centrifugal pump A is circulating water at 100°F. Which one of the following will cause the centrifugal pump to operate closer to a condition in which gas/vapor binding can occur?

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

Which one of the following will decrease the head loss occurring in an operating cooling water system?

A. Starting a second pump in parallel with the operating pump.

B. Shifting two heat exchangers from parallel to series operation.

C. Replacing a 10 foot section of 10-inch diameter pipe with a 20 foot section of 10-inch diameter pipe.

D. Replacing a 20 foot section of 10-inch diameter pipe with a 20 foot section of 12-inch diameter pipe.

QUESTION: 44

A secondary heat balance calculation is being performed at 90 percent reactor power to calibrate reactor power instrumentation. Which one of the following will result in a calculated reactor power that is less than actual reactor power?

A. Steam generator pressure is indicating 20 psi above actual steam generator pressure.

B. Steam generator water level is indicating 3 percent below actual steam generator water level.

C. Feedwater flow rate is indicating 3 percent above actual feedwater flow rate.

D. Feedwater temperature is indicating 20°F below actual feedwater temperature.

QUESTION: 45

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

A. Increases continuously

B. Increases, then decreases

C. Decreases continuously

D. Decreases, then increases

QUESTION: 46

A small increase in differential temperature at the fuel clad-to-coolant interface causes increased steam blanketing and a reduction in heat flux. This describes which type of boiling?

A. Subcooled boiling

B. Nucleate boiling

C. Partial film boiling

D. Total film boiling

QUESTION: 47

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

A. RCP cavitation.

B. RCP runout.

C. RCS loop water hammer.

D. RCS hot leg saturation.

QUESTION: 48

Which one of the following conditions must occur to sustain natural circulation in a fluid system?

A. Subcooling of the fluid

B. A phase change in the fluid

C. A density change in the fluid

D. Radiative heat transfer to the fluid

QUESTION: 49

A nuclear power plant is operating at 80 percent power near the middle of a fuel cycle. All control rods are fully withdrawn and in manual control. Core axial power distribution is peaked below the core midplane.

Which one of the following will significantly decrease the core maximum axial peaking (or hot channel) factor? (Assume no subsequent operator action is taken and that main turbine load and core xenon distribution do not change unless stated.)

A. One bank of control rods is inserted 10 percent.

B. Turbine load/reactor power is reduced by 10 percent.

C. Reactor coolant system boron concentration is reduced by 10 ppm.

D. A control rod located at the edge of the core fully inserts into the core.

QUESTION: 50

Which one of the following would be most likely to cause pressurized thermal shock of a reactor vessel?

A. Starting a reactor coolant pump in an idle loop with the associated steam generator temperature less than RCS loop temperature.

B. Starting a reactor coolant pump in an idle loop with the associated steam generator temperature greater than RCS loop temperature.

C. Continuous emergency coolant injection to the RCS during and after a complete and unisolable rupture of a steam generator steam outlet nozzle.

D. Continuous emergency coolant injection to the RCS during and after a complete and unisolable rupture of a reactor vessel coolant outlet nozzle.

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

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

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