UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
DECEMBER 2015 – FORM A

Please Print

Name: _____

Docket No.: _____

Facility: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO EXAMINEE

Answer all the test items using the answer sheet provided, ensuring a single answer is marked for each test item. Each test item has equal point value. A score of at least 80 percent is required to pass this portion of the NRC operator licensing written examination. All examination materials will be collected 3 hours after the examination begins. This examination applies to a typical U.S. pressurized water reactor (PWR) nuclear power plant.

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

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

_____

Examinee's Signature

RULES AND INSTRUCTIONS FOR THE
NRC GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

NOTE: The term "control rod" refers to the length of neutron absorber material that can be positioned by the operator to change core reactivity.

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

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

2. Fill in your individual docket number.

3. Fill in the name of your facility.

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

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

   (1) An Equations and Conversions Sheet contained within the examination copy, and

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

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

7. Scrap paper will be provided for calculations.

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

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

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

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

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

GENERIC FUNDAMENTALS EXAMINATION
EQUATIONS AND CONVERSIONS SHEET

EQUATIONS

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

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

$1/M = CR_1/CR_x$

$A = \pi r^2$

$F = PA$

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

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

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

Thermal Efficiency = Net Work Out/Energy In

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

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

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

CONVERSIONS

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1 MW $= 3.41 \times 10^6$ Btu/hr

1 hp $= 2.54 \times 10^3$ Btu/hr

1 Btu $= 778$ ft-lbf

$°C = (5/9)(°F - 32)$

$°F = (9/5)(°C) + 32$

1 kg $= 2.21$ lbm

1 ft^3_{water} $= 7.48$ gal

1 gal_{water} $= 8.35$ lbm

1 Curie $= 3.7 \times 10^{10}$ dps

QUESTION: 1

A completely full water tank is being hydrostatically tested to 180 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 180 psig with an accumulation of 5 percent.
- Relief valve B opening setpoint is 200 psig with an accumulation of 5 percent.
- Each relief valve has linear flow rate characteristics and a maximum flow rate of 4 gpm.

The PDP is inadvertently left running when tank pressure reaches 180 psig.

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

A. 190 psig

B. 195 psig

C. 205 psig

D. 210 psig

QUESTION: 2

A typical motor-operated valve (MOV) has just been opened from the main control room, and the breaker for the MOV has been opened. A plant operator has been directed to close the MOV locally for a surveillance test.

If the operator attempts to turn the MOV handwheel in the clockwise direction without first operating the declutch lever, which one of the following will occur?

A. The handwheel will turn, but the valve stem will <u>not</u> move.

B. The handwheel will <u>not</u> turn, and the valve stem will <u>not</u> move.

C. The handwheel will turn, and the valve stem will move toward the closed position because the clutch is automatically engaged when the handwheel is turned.

D. The handwheel will turn, and the valve stem will move toward the closed position because the clutch is automatically engaged when the breaker is opened.

QUESTION: 3

A steam flow measuring instrument uses density compensation and square root extraction to convert the differential pressure across the flow element to flow rate in lbm/hr.

The purpose of density compensation in this flow measuring instrument is to convert _____ to _____.

A. differential pressure; mass flow rate

B. differential pressure; volumetric flow rate

C. volumetric flow rate; mass flow rate

D. volumetric flow rate; differential pressure

QUESTION: 4

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

The water storage tank is 40 feet tall. The level detection system is calibrated to provide a level indication of 30 feet when the tank and reference leg levels are equal.

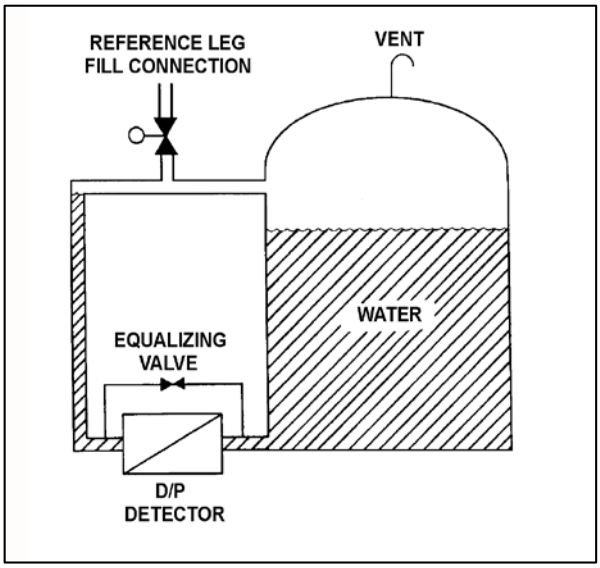
If the tank is completely filled with water, the tank level will indicate...

A. less than 30 feet.

B. 30 feet.

C. greater than 30 feet, but less than 40 feet.

D. 40 feet.



QUESTION: 5

Which one of the following is a characteristic of a resistance temperature detector but not a thermocouple?

A. Sensing element is made from a single metal or alloy.

B. Requires a reference junction for accurate temperature measurement.

C. Extension leads made from relatively expensive metals or alloys are required for accurate temperature measurement.

D. Temperature measurement relies on a sensor material property that varies directly with the change in the measured temperature.

QUESTION: 6

A fission chamber detector is initially operating in the proportional region to measure neutron flux in the source range. If the voltage applied to the detector is changed such that the detector is operating in the ion chamber region, the detector will produce _____ pulses; and will experience a _____ positive space charge effect.

A. larger; larger

B. larger; smaller

C. smaller; larger

D. smaller; smaller

QUESTION: 7

Refer to the drawing of a pressure alarm circuit (see figure below). The orientation of the bistable symbol indicates the characteristics of the bistable, as is normal for a control circuit diagram.

The bistable will turn on at a system pressure of 100 psig. The bistable has a 5 psig deadband, or neutral zone.

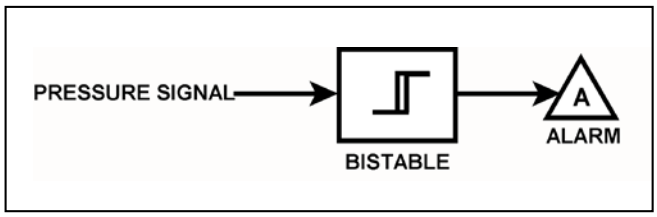
If system pressure is currently 98 psig, which one of the following describes the status of the alarm?

A. The alarm is <u>not</u> actuated.

B. The alarm is actuated and will turn off at 95 psig.

C. The alarm is actuated and will turn off at 105 psig.

D. Additional information is needed to determine the status of the alarm.



QUESTION: 8

An outside water storage tank is equipped with submerged heaters. The heaters energize at minimum power when water temperature decreases to 48°F. If water temperature continues to decrease, heater power will increase directly with the temperature deviation from 48°F until maximum power is reached at 40°F. On cold days, the tank water temperature is usually maintained at about 44°F with the heaters energized at half power.

Which one of the following types of control is used in the heater control circuit to produce these characteristics?

A. Proportional only

B. Proportional plus integral only

C. Proportional plus derivative only

D. Proportional plus integral plus derivative

QUESTION: 9

What precaution must be observed before transferring a valve controller from the automatic mode to the manual mode of control?

A. Ensure that a substantial steady-state deviation is established between the automatic and manual valve controller outputs.

B. Ensure that the automatic and manual valve controller outputs are matched.

C. Ensure that the automatic valve controller output is increasing before transferring to the manual mode of control.

D. Ensure that the automatic valve controller output is decreasing before transferring to the manual mode of control.

QUESTION: 10

Refer to the drawing of a centrifugal pump with a water storage tank for its suction source. The storage tank is open to the atmosphere and contains 20 feet of water at 90°F. The pump is currently stopped.

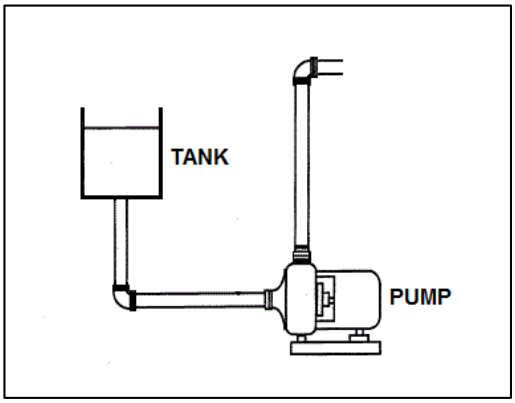
If the temperature of the water in the storage tank and pump suction piping decreases to 70°F, with the accompanying water contraction, the suction head for the pump will _____; and the available net positive suction head for the pump will _____.

A. decrease; increase

B. decrease; remain the same

C. remain the same; increase

D. remain the same; remain the same



QUESTION: 11

A flow-limiting venturi in the discharge piping of a centrifugal pump decreases the potential for the pump to experience...

A. runout

B. reverse flow

C. shutoff head

D. water hammer

QUESTION: 12

A reactor is shutdown with decay heat being removed by the residual heat removal (RHR) system. The operating RHR pump is taking suction from the bottom of a reactor coolant system (RCS) hot leg and discharging to a cold leg. The RCS has been drained to a mid-loop water level in the hot legs. Which one of the following makes vortexing at the RHR suction piping hot leg connection more likely?

A. RCS pressure is decreased from 100 psia to 50 psia.

B. RCS pressure is increased from 100 psia to 150 psia.

C. RHR pump flow rate is increased from 1,000 gpm to 1,250 gpm.

D. Water level in the hot leg is increased from 16 inches to 20 inches.

QUESTION: 13

An ideal (no slip) reciprocating positive displacement pump is operating in an open system to provide makeup water to a coolant system that is being maintained at 800 psig. The discharge valve of the pump is full open.

If the pump discharge valve is subsequently throttled to 80 percent open, pump flow rate will _____; and pump head will _____.

A. decrease; increase

B. decrease; remain constant

C. remain constant; increase

D. remain constant; remain constant

QUESTION: 14

An axial flow ventilation fan is being driven by an AC motor. The fan is operating at 90 percent of rated flow with its discharge damper partially closed. How will the fan motor current change if its discharge damper is fully opened?

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

If the discharge valve of a large motor-driven centrifugal pump is kept closed during a normal pump start, the current indication for the AC induction motor will rise to...

A. approximately the full-load current value, and then decrease to the no-load current value.

B. approximately the full-load current value, and then stabilize at the full-load current value.

C. several times the full-load current value, and then decrease to the no-load current value.

D. several times the full-load current value, and then decrease to the full-load value.

QUESTION: 16

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

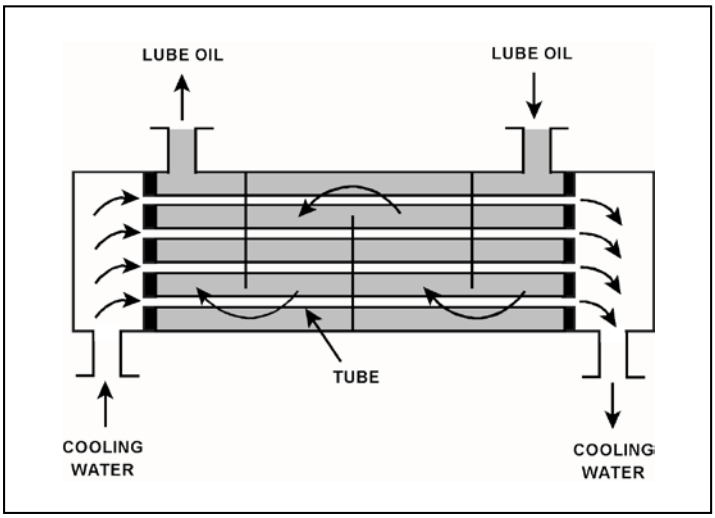
Increasing the oil flow rate through the heat exchanger will cause the oil outlet temperature to _____ and the cooling water outlet temperature to _____.

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase



QUESTION: 17

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

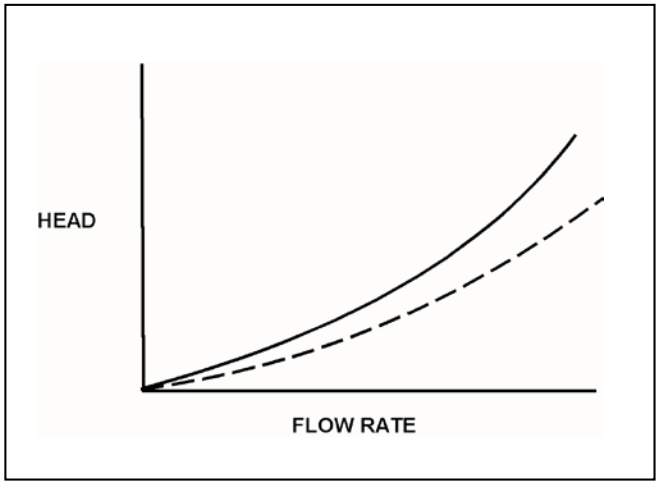
Which one of the following will cause the system curve to shift from the solid curve toward the dashed curve?

A. The main condenser tubes are cleaned.

B. The main condenser tubes become increasingly fouled.

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

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



QUESTION: 18

Two indications of channeling through an operating demineralizer are a _____-than-normal demineralizer differential pressure and a _____-than-normal decontamination factor for ionic impurities.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

QUESTION: 19

A nuclear power plant is operating at 70 percent steady-state power level when the temperature of the reactor coolant letdown passing through a boron-saturated mixed-bed ion exchanger is decreased by 20°F.

As a result, the boron concentration in the effluent of the ion exchanger will _____ because the ability of the ion exchanger to remove boron atoms has _____.

A. increase; decreased

B. increase; increased

C. decrease; decreased

D. decrease; increased

QUESTION: 20

Two identical 1,000 MW generators are operating in parallel supplying the same isolated electrical bus. The generator output breakers also provide identical protection for the generators. Generator A and B output indications are as follows:

Generator A	Generator B
22 KV	22 KV
60.2 Hertz	60.2 Hertz
200 MW	200 MW
25 MVAR (out)	50 MVAR (out)

A malfunction causes the voltage regulator setpoint for generator A to slowly and continuously increase. If no operator action is taken, generator B output current will...

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

B. increase continuously until the output breaker for generator B trips on overcurrent.

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

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

QUESTION: 21

Typical high-voltage disconnect switches are designed to...

A. interrupt circuits under load.

B. automatically trip open to protect breakers.

C. protect circuits during overcurrent conditions.

D. isolate equipment electrically during no-load conditions.

QUESTION: 22

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

The local OPEN/CLOSED mechanical flag indicates OPEN.
A breaker overcurrent trip flag is actuated on one phase.
The line-side voltmeter indicates 4,160 VAC.
The load-side voltmeter indicates 0 VAC.

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

A. An operator opened the breaker locally.

B. A ground fault caused an automatic breaker trip.

C. An operator opened the breaker from a remote location.

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

QUESTION: 23

Which one of the following is the process that produces the majority of delayed neutrons in an operating nuclear plant 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 thermal neutron is about to interact with a U-238 nucleus in an operating reactor. Which one of the following describes the most likely interaction and its effect on 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

Which one of the following is the primary reason that delayed neutrons are more effective than prompt neutrons at controlling the rate of reactor power changes?

A. Delayed neutrons have a longer mean generation time than prompt neutrons.

B. Delayed neutrons produce a larger amount of core fissions than prompt neutrons.

C. Delayed neutrons make up a larger fraction of fission neutrons than prompt neutrons.

D. Delayed neutrons are born with a lower average kinetic energy than prompt neutrons.

QUESTION: 26

Which one of the following describes how the magnitude of the fuel temperature coefficient of reactivity is affected as the core ages?

A. It remains essentially constant over core life.

B. It becomes more negative, due to the buildup of Pu-240.

C. It becomes less negative, due to the decrease in RCS boron concentration.

D. It becomes more negative initially due to buildup of fissions product poisons, then less negative due to fuel depletion.

QUESTION: 27

The amount of pure water required to decrease the reactor coolant boron concentration by 20 ppm at 100 ppm is approximately _____ the amount of pure water required to decrease the reactor coolant boron concentration by 20 ppm at 1,000 ppm.

A. one-tenth

B. the same as

C. 10 times

D. 100 times

QUESTION: 28

Which one of the following is a reason for neutron flux shaping in a reactor core?

A. To minimize local power peaking by more evenly distributing the core thermal neutron flux.

B. To reduce thermal neutron leakage by decreasing the neutron flux at the periphery of the reactor core.

C. To reduce the size and number of control rods needed to shut down the reactor during a reactor trip.

D. To increase differential control rod worth by peaking the thermal neutron flux at the top of the reactor core.

QUESTION: 29

A reactor is operating at steady-state 75 percent power in the middle of a fuel cycle. Which one of the following actions will cause the greatest shift in reactor power distribution toward the top of the core? (Assume control rods remain fully withdrawn.)

A. Decrease reactor power by 25 percent.

B. Decrease reactor coolant boron concentration by 10 ppm.

C. Decrease average reactor coolant temperature by 5°F.

D. Decrease reactor coolant system operating pressure by 15 psia.

QUESTION: 30

What is the major contributor to the production of Xe-135 in a reactor that has been operating at full power for two weeks?

A. Radioactive decay of I-135.

B. Radioactive decay of Cs-135.

C. Direct production from fission of U-235.

D. Direct production from fission of U-238.

QUESTION: 31

A reactor trip occurred one hour ago following several months of operation at 100 percent power. Reactor coolant temperature is being maintained at 550°F and the source range count rate is currently 400 cps. If no additional operator action is taken, how will the source range count rate respond during the next 24 hours? (Assume a constant source neutron flux.)

A. The count rate will remain about the same.

B. The count rate will decrease for the entire period.

C. The count rate will initially decrease and then increase.

D. The count rate will initially increase and then decrease.

QUESTION: 32

Which one of the following is not a function performed by burnable poisons in an operating reactor?

A. Provide neutron flux shaping.

B. Provide more uniform power density.

C. Offset the effects of control rod burnout.

D. Allow higher enrichment of new fuel assemblies.

QUESTION: 33

The following data was obtained under stable conditions during a reactor startup:

Control Rod Position (units withdrawn)	Source Range Count Rate (cps)
10	360
15	400
20	450
25	514
30	600
35	720
40	900

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

A. 50 units withdrawn

B. 60 units withdrawn

C. 70 units withdrawn

D. 80 units withdrawn

QUESTION: 34

A reactor was operating for several months at 100 percent power when a reactor trip occurred. Which one of the following is primarily responsible for the startup rate value 2 minutes after the trip?

A. The K_{eff} in the core.

B. The rate of source neutron production in the core.

C. The effective delayed neutron fraction in the core.

D. The decay rates of the delayed neutron precursors in the core.

QUESTION: 35

A reactor is initially critical in the source range during a reactor startup when the control rods are inserted a small amount. Reactor startup rate stabilizes at -0.15 dpm. Assuming startup rate remains constant, how long will it take for source range count rate to decrease by one-half?

A. 0.3 minutes

B. 2.0 minutes

C. 3.3 minutes

D. 5.0 minutes

QUESTION: 36

After one month of operation at 100 percent power, the fraction of rated thermal power being produced from the decay of fission products in an operating reactor is...

A. greater than 10 percent.

B. greater than 5 percent, but less than 10 percent.

C. greater than 1 percent, but less than 5 percent.

D. less than 1 percent.

QUESTION: 37

Which one of the following is arranged from the highest pressure to the lowest pressure?

A. 8 psia, 20 inches Hg absolute, 2 psig

B. 8 psia, 2 psig, 20 inches Hg absolute

C. 2 psig, 8 psia, 20 inches Hg absolute

D. 2 psig, 20 inches Hg absolute, 8 psia

QUESTION: 38

Two identical pressurizers are connected to the same location on two identical reactor coolant systems operating at 1,000 psia. Pressurizer A volume contains 50 percent subcooled water (at 300°F) and 50 percent nitrogen. Pressurizer B volume contains 50 percent saturated water and 50 percent saturated steam.

Which pressurizer will maintain the higher pressure during a sudden 10 percent liquid outsurge from each pressurizer, and why?

A. Pressurizer A due to the subcooled water removing a relatively small amount of energy during the outsurge.

B. Pressurizer A due to the expansion characteristics of nitrogen being better than the expansion characteristics of saturated steam.

C. Pressurizer B due to vaporizing of saturated water as pressure begins to decrease.

D. Pressurizer B due to the expansion characteristics of saturated steam being better than the expansion characteristics of nitrogen.

QUESTION: 39

Consider 1.0 lbm of dry saturated steam at 200 psia. If pressure does <u>not</u> change, which one of the following will be caused by the addition of 6.0 Btu to the steam?

A. The steam will remain saturated at the same temperature.

B. The steam will become superheated at the same temperature.

C. The steam will remain saturated at a higher temperature.

D. The steam will become superheated at a higher temperature.

QUESTION: 40

A pressurizer safety valve is leaking by, allowing the dry saturated steam in the pressurizer to flow to the pressurizer relief tank (PRT). The reactor has been shut down, and a plant cooldown and depressurization are in progress. PRT pressure is being maintained constant at 35 psia.

Which one of the following describes how the safety valve tailpipe temperature will be affected as pressurizer pressure slowly decreases from 1,500 psia to 500 psia? (Assume there is no ambient heat loss from the tailpipe.)

A. Increases, because the entropy of the pressurizer steam will be increasing.

B. Increases, because the enthalpy of the pressurizer steam will be increasing.

C. Decreases, because the mass flow rate of the leaking steam will be decreasing.

D. Decreases, because the temperature of the pressurizer steam will be decreasing.

QUESTION: 41

A nuclear power plant is operating at 85 percent power when the extraction steam to a high pressure feedwater heater is isolated. After the transient, the operator returns reactor power to 85 percent and stabilizes the plant. Compared to the conditions just prior to the transient, the current main generator output (MW) is...

A. higher, because increased steam flow to the main turbine caused the main generator to pick up load.

B. lower, because decreased steam flow to the main turbine caused the main generator to reject load.

C. higher, because the steam cycle thermal efficiency has increased.

D. lower, because the steam cycle thermal efficiency has decreased.

QUESTION: 42

Which one of the following describes the relationship between the main steam mass flow rate leaving a steam generator and the main feedwater mass flow rate entering the same steam generator at steady-state power operation? (Assume no other addition/removal of steam generator inventory.)

A. The mass flow rates will be the same only if downcomer level is constant.

B. The mass flow rates will be the same only if the reactor is operating near rated power.

C. The main steam mass flow rate is smaller than the main feedwater mass flow rate by the amount of moisture removed by the steam generator moisture separators.

D. The main steam mass flow rate is greater than the main feedwater mass flow rate by the amount of moisture removed by the steam generator moisture separators.

QUESTION: 43

A vented water storage tank contains 30 feet of water at 70°F. A cracked weld at the bottom of the tank causes an initial leak rate of 12 gpm. If makeup water flow rate is 8 gpm, at what water level will the tank stabilize?

A. 24.5 feet

B. 20.0 feet

C. 13.3 feet

D. 0.0 feet

QUESTION: 44

During steady state power operation, core thermal power can be most accurately determined by multiplying the total mass flow rate of the...

A. reactor coolant by the change in temperature across the core.

B. reactor coolant by the change in enthalpy in the steam generators.

C. feedwater by the change in enthalpy in the steam generators.

D. feedwater by the change in temperature across the core.

QUESTION: 45

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

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

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

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

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

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

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

QUESTION: 46

Assume that a 30°F subcooling margin is maintained in the reactor coolant system (RCS) hot legs during each of the following shutdown reactor cooldown operations. Which one of the following will maintain the greatest subcooling margin in the reactor vessel head?

A. Performing a 25°F/hr RCS cooldown with natural circulation using one steam generator.

B. Performing a 25°F/hr RCS cooldown with all reactor coolant pumps running.

C. Performing a 100°F/hr RCS cooldown with natural circulation using all steam generators.

D. Performing a 100°F/hr RCS cooldown with one reactor coolant pump running.

QUESTION: 47

A nuclear power plant was operating at steady-state 100 percent power when a loss of offsite power occurred, resulting in a reactor trip and a loss of forced reactor coolant circulation. Thirty minutes later, 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, observed 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: 48

Which one of the following describes the method of core heat removal during reflux core cooling following a loss of coolant accident?

A. Convection with forced coolant flow.

B. Convection with natural circulation coolant flow.

C. Conduction with stagnant coolant flow.

D. Radiation with total core voiding.

QUESTION: 49

A reactor is operating at 3,400 MW thermal power. The core linear power density limit is 12.2 kW/ft.

Given:

- The reactor core contains 198 fuel assemblies.
- Each fuel assembly contains 262 fuel rods, each with an active length of 12 feet.
- The highest total peaking factors measured in the core are as follows:

  Location A: 2.5
  Location B: 2.4
  Location C: 2.3
  Location D: 2.2

Which one of the following describes the operating conditions in the core relative to the linear power density limit?

A. All locations in the core are operating below the linear power density limit.

B. Location A has exceeded the linear power density limit while locations B, C, and D are operating below the limit.

C. Locations A and B have exceeded the linear power density limit while locations C and D are operating below the limit.

D. Locations A, B, and C have exceeded the linear power density limit while location D is operating below the limit.

QUESTION: 50

Two identical reactors are currently shut down for refueling. Reactor A has an average lifetime capacity factor of 60 percent and has been operating for 15 years. Reactor B has an average lifetime capacity factor of 75 percent and has been operating for 12 years.

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

A. Reactor A, due to the lower average lifetime capacity factor.

B. Reactor B, due to the higher average lifetime capacity factor.

C. Both reactors will have approximately the same nil-ductility transition temperature because fast neutron irradiation in a shutdown reactor is not significant.

D. Both reactors will have approximately the same nil-ductility transition temperature because each reactor has produced approximately the same number of fissions.

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

DECEMBER 2015 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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