UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
SEPTEMBER 2014 – FORM A

Please Print

Name: _____

Docket No.: _____

Facility: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO APPLICANT

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

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

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

_____
Applicant's Signature

RULES AND INSTRUCTIONS FOR THE
NRC GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

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

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

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

2. Fill in your individual docket number.

3. Fill in the name of your facility.

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

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

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

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

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

7. Scrap paper will be provided for calculations.

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

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

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

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

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

EQUATIONS

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

$DRW \propto \varphi_{tip}^2\ /\ \varphi_{avg}^2$

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

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

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

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

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

$1/M = CR_1/CR_x$

$A = \pi r^2$

$F = PA$

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

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

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

Thermal Efficiency $=$ Net Work Out/Energy In

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

$g = 32.2\ ft/sec^2$

$g_c = 32.2\ lbm\text{-}ft/lbf\text{-}sec^2$

CONVERSIONS

- -

$1\ MW = 3.41 \times 10^6\ Btu/hr$	$°C = (5/9)(°F - 32)$	$1\ ft_{water}^3 = 7.48\ gal$
$1\ hp = 2.54 \times 10^3\ Btu/hr$	$°F = (9/5)(°C) + 32$	$1\ gal_{water} = 8.35\ lbm$
$1\ Btu = 778\ ft\text{-}lbf$	$1\ kg = 2.21\ lbm$	$1\ Curie = 3.7 \times 10^{10}\ dps$

QUESTION: 1

Subcooled water is flowing through a throttled valve in an open system. The <u>initial</u> steady-state conditions for the throttled valve are as follows:

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

After four hours, the <u>current</u> steady-state conditions for the throttled valve are as follows:

Inlet pressure = 62 psia
Outlet pressure = 40 psia
Flow rate = 600 gpm

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

A. The throttled valve was opened more.

B. The throttled valve was closed more.

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: 2

During a local inspection of a manually operated three-inch gate valve, the valve stem is observed to be flush with the top of the handwheel. Two inches of unthreaded valve stem is visible between the handwheel and the packing gland. The handwheel is mounted to the valve body and valve stem such that the handwheel can be rotated in either direction, but <u>cannot</u> change its axial position.

Which one of the following describes the position of the valve?

A. The valve is fully open or nearly fully open.

B. The valve is fully closed or nearly fully closed.

C. The valve may be in any position because it has a rising stem.

D. The valve may be in any position because it has a non-rising stem.

QUESTION: 3

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

Assume the initial temperature of the reference leg and the water in the tank is 100°F, and that reference leg temperature does <u>not</u> change.

If the temperature of the water in the tank increases by 20°F, the D/P sensed by the detector will _____ as long as the water _____ is maintained constant.

A. increase; level

B. decrease; level

C. increase; mass

D. decrease; mass
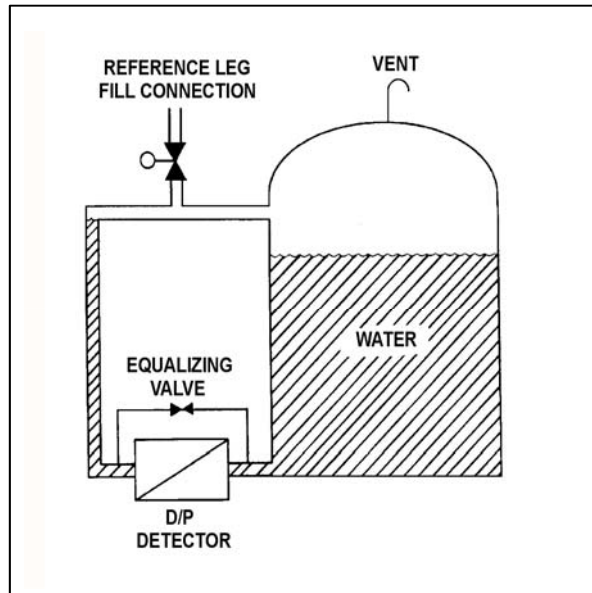
QUESTION: 4

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 maintained at 96°F. Room temperature surrounding the panel is 72°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 64°F.

B. Subtract 64°F.

C. Add 40°F.

D. Subtract 40°F.

QUESTION: 5

Reed switches are being used in an electrical measuring circuit to monitor the position of a control rod in a reactor. The reed switches are mounted in a column above the reactor vessel such that the control rod drive shaft passes by the reed switches as the control rod is withdrawn.

Which one of the following describes the action that causes the electrical output of the measuring circuit to change as the control rod is withdrawn?

A. An AC coil on the control rod drive shaft induces a voltage into each reed switch as the drive shaft passes by.

B. A metal tab on the control rod drive shaft mechanically closes each reed switch as the drive shaft passes by.

C. The primary and secondary coils of each reed switch attain maximum magnetic coupling as the drive shaft passes by.

D. A permanent magnet on the control rod drive shaft attracts the movable contact arm of each reed switch as the drive shaft passes by.

QUESTION: 6

A Geiger Mueller detector with a "pancake" probe (sometimes called a frisker) is being used to monitor for skin contamination.   During frisking, the probe is more likely to detect contamination if the probe is held _____ than one-half inch from the skin; and is moved _____ than two inches per second.

A. farther; faster

B. farther; slower

C. closer; faster

D. closer; slower

QUESTION: 7

Refer to the drawing of a temperature 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 turns on to actuate an alarm at a temperature of 130°F.   The bistable has a 5°F deadband, or neutral zone.

If the current temperature is 150°F, which one of the following describes the alarm circuit response as temperature slowly decreases to 110°F?

A. The alarm is currently actuated and will <u>not</u> turn off.

B. The alarm will actuate at 130°F and will <u>not</u> turn off.

C. The alarm is currently actuated and will turn off at 125°F.

D. The alarm will actuate at 130°F and will turn off at 125°F.
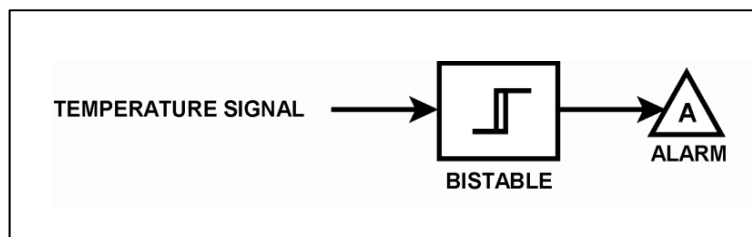
QUESTION: 8

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 by the controller's proportional band being too _____.

A. high; wide

B. high; narrow

C. low; wide

D. low; narrow

QUESTION: 9

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.   If water temperature decreases faster than 1°F/min, the heaters will reach maximum power at a higher water temperature.

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

C. Proportional plus derivative

D. Proportional plus integral plus derivative

QUESTION: 10

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

A. 60 psia

B. 83 psia

C. 108 psia

D. 127 psia

QUESTION: 11

A radial-flow centrifugal cooling water pump is driven by an AC induction motor. The pump can supply cooling water to several heat loads, all of which are in parallel alignment. The following pump conditions initially exist:

    Pump motor current   = 100 amps
    Pump flow rate   = 400 gpm
    Pump suction temperature = 70°F

Four hours later, the motor is drawing 105 amps. Which one of the following could be responsible for the observed increase in motor current?

A. The temperature of the cooling water being pumped decreased to 60°F with <u>no</u> change in pump flow rate.

B. The temperature of the cooling water being pumped increased to 80°F with <u>no</u> change in pump flow rate.

C. Cooling water flow was established to an additional heat load with <u>no</u> change in the temperature of the cooling water being pumped.

D. Cooling water flow was isolated from an out-of-service heat load with <u>no</u> change in the temperature of the cooling water being pumped.

QUESTION: 12

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

A. The motor breaker will trip on instantaneous overcurrent.

B. The motor will <u>not</u> turn and will emit a humming sound.

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

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

QUESTION: 13

Which one of the following conditions will result in the greatest increase in volumetric flow rate from a positive displacement pump operating at 300 rpm and a discharge pressure of 100 psig?

A. Increasing pump speed to 700 rpm.

B. Decreasing pump discharge pressure to 30 psig.

C. Starting a second identical positive displacement pump in series with the first.

D. Starting a second identical positive displacement pump in parallel with the first.

QUESTION: 14

A nuclear power plant is operating at steady-state 80 percent power when a reactor coolant pump (RCP) shaft seizes.   Which one of the following indications would <u>not</u> accompany the seized shaft?

A. Reactor coolant system pressure transient.

B. Decreased flow rate in the associated reactor coolant loop.

C. Decreased flow rate in the remaining reactor coolant loop(s).

D. Increased current to the affected RCP with possible breaker trip.

QUESTION: 15

A motor-driven radial-flow centrifugal pump is operating to provide makeup water from a constant head source to a vented storage tank that is 30 feet tall.   The pump is located at the base of the tank and discharges directly into the bottom of the tank.   As the tank water level increases from 20 to 25 feet, the pump discharge pressure will _____; and the pump motor current will _____.

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

QUESTION: 16

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

Which one of the following effects will occur because of the failed tube in the heat exchanger?

A. Level in the surge tank will increase.

B. Flow in the low pressure (LP) system will reverse.

C. Pressure in the low pressure (LP) system will decrease.

D. Low pressure (LP) fluid heat exchanger outlet temperature will decrease.
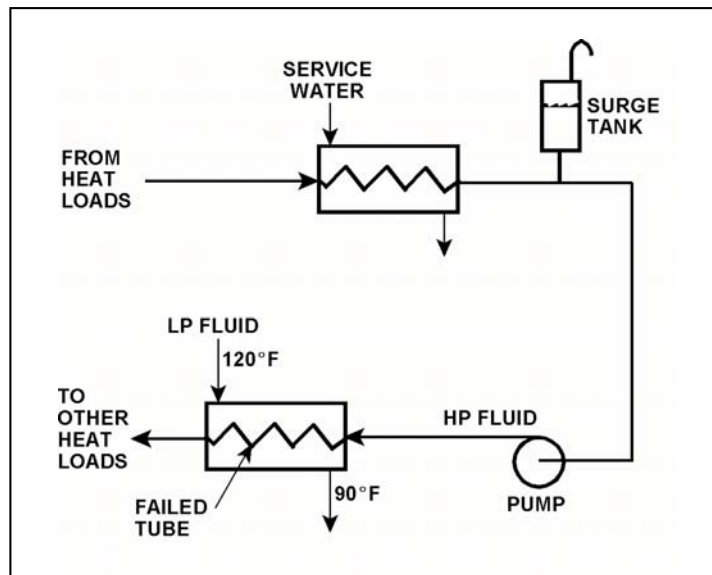
QUESTION: 17

A nuclear power plant is operating at steady-state 100 percent power. Assuming that condenser cooling water inlet temperature and flow rate do <u>not</u> change, if main condenser vacuum <u>decreases</u>, condensate temperature will...

A. increase, because condensate subcooling has decreased.

B. increase, because condenser saturation pressure has increased.

C. decrease, because condensate subcooling has increased.

D. decrease, because condenser saturation pressure has decreased.

QUESTION: 18

Demineralizer 1A was removed from service after it became saturated with chloride ions while processing condensate with 10 times the normal chloride concentration. Replacement demineralizer 1B has restored the condensate chloride concentration to normal. Demineralizer 1A has <u>not</u> been processed in any way since being removed from service.

If demineralizer 1A is returned to service to replace demineralizer 1B, the downstream condensate system chloride concentration will...

A. remain the same, because demineralizer 1A resin has already been conditioned by previous operation.

B. remain the same, because demineralizer 1A resin can no longer remove chloride ions from the condensate.

C. increase, only due to the volume of water contained in demineralizer 1A mixing with the incoming condensate.

D. increase, due to both the volume of water contained in demineralizer 1A mixing with the incoming condensate and the release of chloride ions from the resin.

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. Increased flow rate through the ion exchangers.

B. Increased radiation levels around the ion exchangers.

C. Decreased ion exchanger outlet conductivity.

D. Decreased pressure drop across the ion exchangers.

QUESTION: 20

Two identical 1,000 MW generators are operating in parallel, supplying the same isolated 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
22.5 KV	22.5 KV
60.2 Hertz	60.2 Hertz
750 MW	750 MW
25 MVAR (out)	50 MVAR (out)

A malfunction causes the voltage regulator setpoint for generator B to slowly and continuously increase.   If no operator action is taken, which one of the following describes the electrical current indications for generator A?

A. Current will decrease continuously until the output breaker for generator A trips on reverse power.

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

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

D. Current will initially decrease, and then increase until the output breaker for generator B trips on overcurrent.
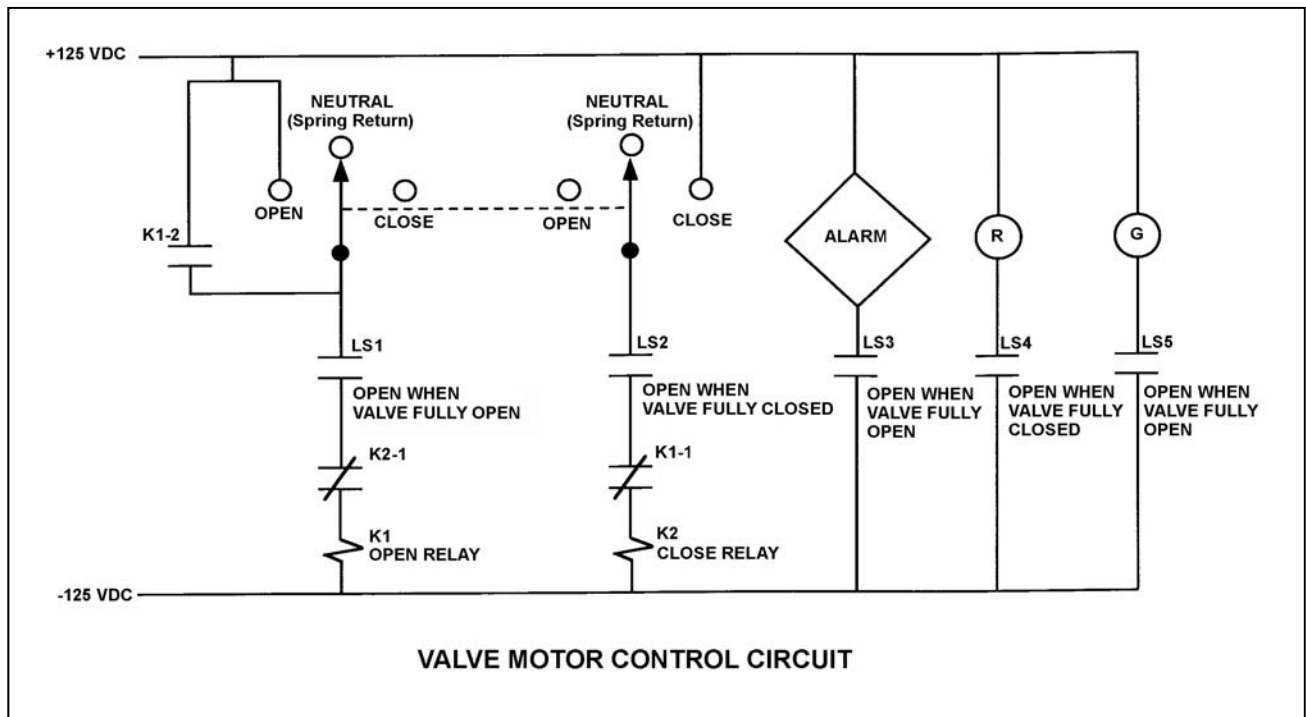
QUESTION: 21

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully open 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.

Which one of the following describes the valve response if the control switch is taken to the CLOSE position for two seconds and then released?

A. The valve will <u>not</u> move.

B. The valve will close fully.

C. The valve will begin to close and then stop moving.

D. The valve will begin to close and then open fully.

VALVE MOTOR CONTROL CIRCUIT

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. A ground fault caused an automatic breaker trip.

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

C. An operator opened the breaker locally.

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

QUESTION: 23

In a comparison between a delayed neutron and a prompt neutron produced from the same fission event, the delayed neutron is more likely to... (Assume that each neutron remains in the core unless otherwise stated.)

A. leak out of the core.

B. be absorbed in a B-10 nucleus.

C. cause fission of a U-238 nucleus.

D. travel to an adjacent fuel assembly.

QUESTION: 24

Reactors A and B are identical except that reactor A is operating near the beginning of a fuel cycle (BOC) and reactor B is operating near the end of a fuel cycle (EOC). Both reactors are operating at 100 percent power with all control rods fully withdrawn.

If the total reactivity worth of the control rods is the same for both reactors, which reactor will have the smaller K_{eff} five minutes after a reactor trip, and why?

A. Reactor A, because the power coefficient is less negative near the BOC.

B. Reactor A, because the concentration of U-235 in the fuel rods is higher near the BOC.

C. Reactor B, because the power coefficient is more negative near the EOC.

D. Reactor B, because the concentration of U-235 in the fuel rods is lower near the EOC.

QUESTION: 25

During a reactor startup, reactor power increases from 1.0×10^{-8} percent to 2.0×10^{-8} percent in two minutes. What was the average reactor period during the power increase?

A. 173 seconds

B. 235 seconds

C. 300 seconds

D. 399 seconds

QUESTION: 26

Differential boron worth (ΔK/K/ppm) will become _____ negative as moderator temperature increases because, at higher moderator temperatures, a 1 ppm increase in reactor coolant boron concentration will add _____ boron atoms to the core.

A. less; more

B. less; fewer

C. more; more

D. more; fewer

QUESTION: 27

A reactor startup is in progress with the reactor at normal operating temperature and pressure. With reactor power stable at the point of adding heat, a control rod malfunction causes an inadvertent rod withdrawal that results in adding 0.3% ΔK/K reactivity.

Given:

- All control rod motion has been stopped.
- No automatic system or operator actions occur to inhibit the power increase.
- Power coefficient equals -0.04% ΔK/K/percent.
- The effective delayed neutron fraction equals 0.006.

What is the approximate power level increase required to offset the reactivity added by the inadvertent control rod withdrawal?   (Ignore any reactivity effects from changes in fission product poisons.)

A. 3.0 percent

B. 5.0 percent

C. 6.7 percent

D. 7.5 percent

QUESTION: 28

A reactor is operating at 60 percent power near the end of a fuel cycle with the controlling group of control rods inserted 5 percent into the core. Which one of the following will cause group differential rod worth to become <u>less</u> negative? (Consider only the direct effect of the indicated change.)

A. Burnable poison rods become increasingly depleted.

B. Core Xe-135 concentration decreases toward an equilibrium value.

C. Reactor coolant temperature is allowed to decrease from 575°F to 570°F.

D. The group of control rods is inserted an additional 0.5 percent.

QUESTION: 29

A reactor is operating at steady-state 75 percent power with all control rods fully withdrawn. Assuming the reactor does <u>not</u> trip, which one of the following compares the effects of dropping (full insertion) a center control rod to the effects of partially inserting (50 percent) the same control rod?

A. A dropped rod causes a greater change in shutdown margin.

B. A dropped rod causes a smaller change in shutdown margin.

C. A dropped rod causes a greater change in radial power distribution.

D. A dropped rod causes a greater change in axial power distribution.

QUESTION: 30

With Xe-135 initially at equilibrium, which one of the following power changes produces the greatest change in equilibrium Xe-135 negative reactivity?

A. 0 percent to 10 percent

B. 30 percent to 40 percent

C. 60 percent to 70 percent

D. 90 percent to 100 percent

QUESTION: 31

A reactor was operating at 100 percent power for 2 months when a reactor trip occurred.   Four hours later, the reactor is critical and stable at 10 percent power.

Which one of the following operator actions is required to maintain reactor coolant temperature stable over the next 18 hours?

A. Add positive reactivity during the entire period.

B. Add negative reactivity during the entire period.

C. Add positive reactivity at first, and then negative reactivity.

D. Add negative reactivity at first, and then positive reactivity.

QUESTION: 32

Refer to the graph of critical boron concentration versus burnup for a reactor following a refueling outage (See figure below.).

Which one of the following is primarily responsible for the shape of the curve from the middle of core life to the end of core life?

A. Fuel depletion

B. Fission product buildup

C. Burnable poison burnout

D. Conversion of U-238 to Pu-239
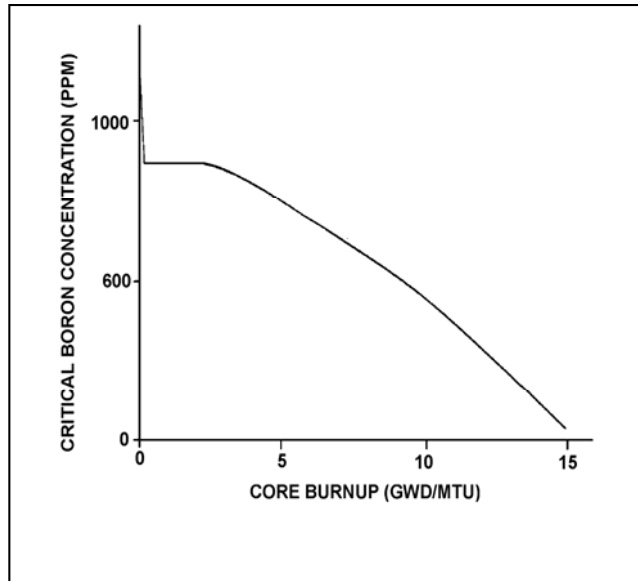
QUESTION: 33

A nuclear power plant is being cooled down from 500°F to 190°F. Just prior to commencing the cooldown, the source range count rate was stable at 32 cps. After two hours, with reactor coolant temperature at 350°F, the source range count rate is stable at 64 cps.

Assume the moderator temperature coefficient remains constant throughout the cooldown and reactor power remains below the point of adding heat.

Without additional operator action, what will the status of the reactor be when reactor coolant temperature reaches 190°F?

A. Subcritical, with source range count rate below 150 cps.

B. Subcritical, with source range count rate above 150 cps.

C. Exactly critical.

D. Supercritical.

QUESTION: 34

As a reactor approaches criticality during a reactor startup, it takes longer to reach an equilibrium neutron level after each control rod withdrawal due to the increased...

A. length of time required to complete a neutron generation.

B. number of neutron generations required to reach a stable neutron level.

C. length of time from neutron birth to absorption.

D. fraction of delayed neutrons being produced.

QUESTION: 35

Refer to the graph of neutron flux versus time (see figure below) for a nuclear power plant that experienced a reactor trip from extended full power operation at time = 0 seconds. The neutron flux axis has a logarithmic scale while the time axis has a linear scale.

In which section of the curve does the production rate of source neutrons primarily determine the slope of the curve?

A. A

B. B

C. C

D. D
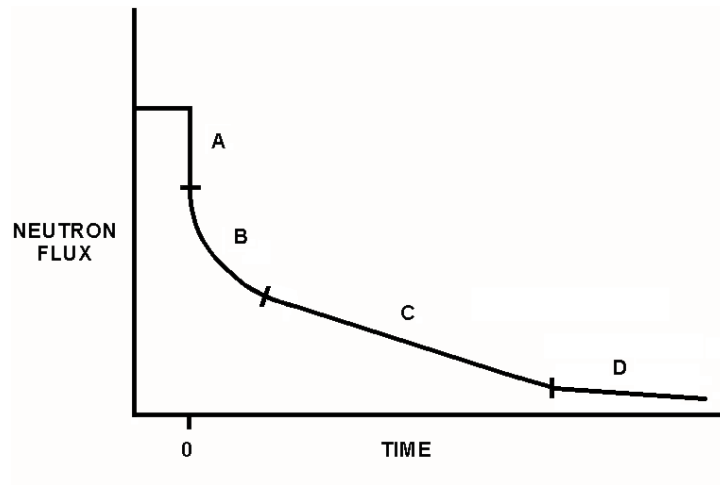
QUESTION: 36

A nuclear power plant has been operating for one hour at 50 percent power following six months of operation at steady-state 100 percent power. What percentage of rated thermal power is currently being generated by fission product decay?

A. 1 percent to 2 percent

B. 3 percent to 5 percent

C. 6 percent to 8 percent

D. 9 percent to 11 percent

QUESTION: 37

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

The tanks are identical with equal water levels and 20 psia gas pressure above the water.   The tanks are surrounded by standard atmospheric pressure.   The temperature of the water in the tanks and reference legs is 70°F.

If each detector experiences a ruptured diaphragm, which detector(s) will produce a lower level indication?   (Assume that actual tank and reference leg water levels do not change.)

A. No. 1 only

B. No. 2 only

C. No. 1, 2, and 3

D. No. 2, 3, and 4
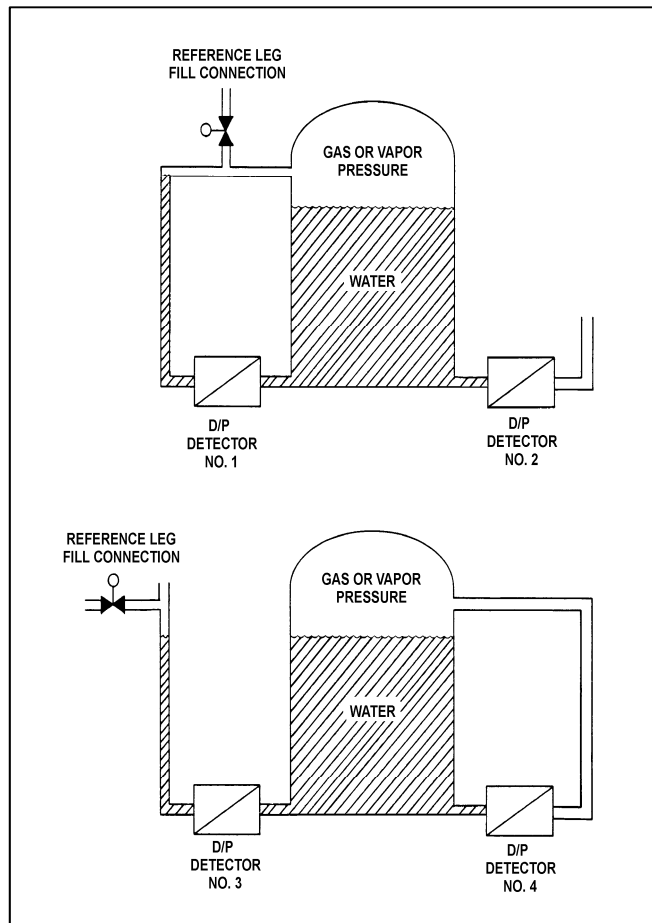
QUESTION: 38

Given the following:

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

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

A. 10 lbm

B. 20 lbm

C. 30 lbm

D. 40 lbm

QUESTION: 39

Saturated steam at 900 psia enters an ideal high pressure (HP) turbine and exhausts at 240 psia.   How much heat, if any, must be added to the HP turbine exhaust to produce saturated steam at 240 psia?

A. 0 Btu/lbm

B. 11 Btu/lbm

C. 111 Btu/lbm

D. 155 Btu/lbm

QUESTION: 40

A pressurizer safety valve is leaking by, allowing 100 percent quality steam from the pressurizer to enter the discharge pipe, which remains at a constant pressure of 30 psig. Initial safety valve discharge pipe temperature is elevated but stable. Assume <u>no</u> heat loss from the safety valve discharge pipe.

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

As pressurizer pressure decreases from 2,000 psig to 1,800 psig, the safety valve discharge pipe temperature will...

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

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

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

D. remain the same, because the safety valve discharge will remain a saturated steam-water mixture at 30 psig.

QUESTION: 41

If the moisture content of the steam supplied to a turbine decreases, the steam cycle thermal efficiency will increase because the...

A. enthalpy of the steam being supplied to the turbine has increased.

B. mass flow rate of the steam through the turbine has increased.

C. reheat capacity of the turbine extraction steam has increased.

D. the operating temperature of the turbine blades has increased.

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 repositioned 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.
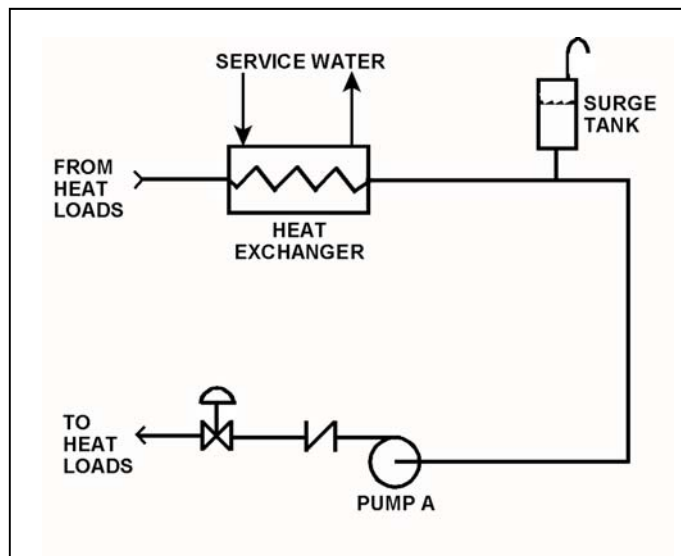
QUESTION: 43

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

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

B. Increasing the flow rate in the system by positioning a flow control valve more open.

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

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

QUESTION: 44

A reactor is producing 200 MW of core thermal power. Reactor coolant pumps are adding 10 MW of additional thermal power into the reactor 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

How does critical heat flux (CHF) vary with core height during normal full power operation?

A. CHF increases from the bottom to the top of the core.

B. CHF decreases from the bottom to the top of the core.

C. CHF increases from the bottom to the core midplane, then decreases from the midplane to the top of the core.

D. CHF decreases from the bottom to the core midplane, then increases from the midplane to the top of the core.

QUESTION: 46

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

A. Forced convection

B. Natural convection

C. Conduction

D. Radiation

QUESTION: 47

A reactor is producing 3,400 MW of thermal output with a reactor vessel differential temperature (ΔT) of 60°F and a reactor vessel mass flow rate of 1.4 x 10^8 lbm/hr.   If core ΔT is 63.6°F, what is core bypass mass flow rate?   (Assume bypass flow ΔT equals 0°F.)

A. 7.92 x 10^6 lbm/hr

B. 8.40 x 10^6 lbm/hr

C. 1.26 x 10^8 lbm/hr

D. 1.32 x 10^8 lbm/hr

QUESTION: 48

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: 49

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

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

QUESTION: 50

A reactor is shut down for refueling following 18 months of operation at an average power level of 85 percent. During the shutdown, a reactor vessel metal specimen was removed from the reactor vessel for testing. The testing determined that the nil-ductility transition (NDT) temperature of the specimen decreased from 44°F to 42°F since the previous refueling shutdown.

Which one of the following conclusions is warranted?

A. The test results are credible and the reactor vessel is <u>more</u> likely to experience brittle fracture now than after the previous refueling shutdown.

B. The test results are credible and the reactor vessel is <u>less</u> likely to experience brittle fracture now than after the previous refueling shutdown.

C. The test results are questionable because the specimen NDT temperature would <u>not</u> decrease during the described 18-month period of operation.

D. The test results are questionable because the specimen NDT temperature would decrease by <u>more</u> than 2°F during the described 18-month period of operation.

*** FINAL ANSWER KEY ***

SEPTEMBER 2014 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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