UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
SEPTEMBER 2007--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% is required to pass this portion of the NRC operator licensing written examination. All examination papers will be collected 3.0 hours after the examination starts. This examination applies to a typical 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 GUIDELINES 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.

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 time.

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 - steam table booklets, handouts, and scrap paper used during the examination.

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

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

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

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

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

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

$E = IR$

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

QUESTION: 1

Refer to the drawing of a typical safety valve (see figure below).

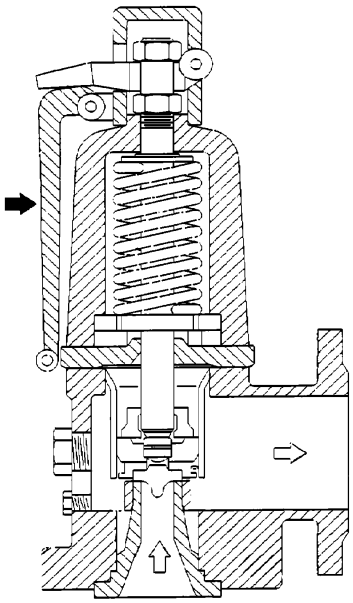
The component indicated by the solid arrow is used when necessary to manually...

A. rachet open the safety valve.

B. pop open the safety valve.

C. gag shut the safety valve.

D. determine the position of the safety valve.



SAFETY VALVE

QUESTION: 2

Refer to the drawing of four air-operated valves (see figure below). **Note:** The valve actuators may be shown with or without air pressure applied.

Given:

- The direction of system flow is from left to right when the valves are open.
- The internal components for each valve are identical except for the orientation of the valve disk and seat.
- The valve actuators exert the same force on the attached valve stem for a given applied air pressure.

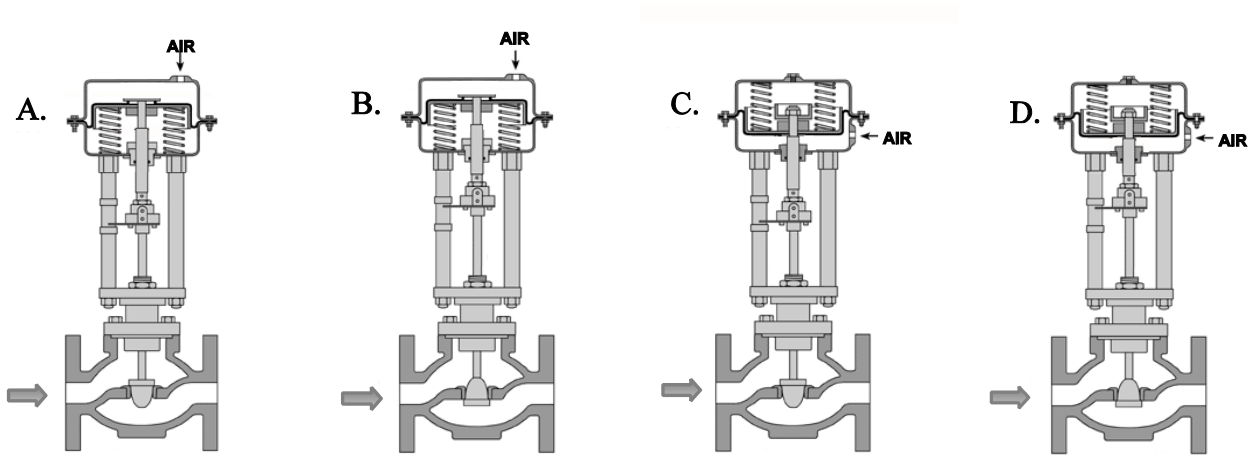
If each actuator is vented, which valve disk will remain closed with the most force?

A. A.

B. B.

C. C.

D. D.



QUESTION: 3

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

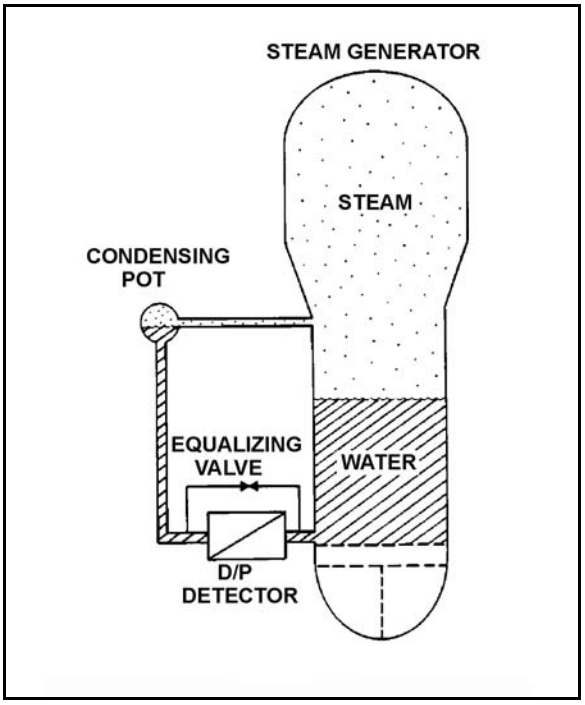
The S/G is supplying steam at normal operating temperature and pressure and currently has accurate level indication. Which one of the following events will result in a S/G level indication that is less than actual level?

A. Actual S/G water level decreases by 6 inches.

B. The external pressure surrounding the D/P detector decreases by 2 psi.

C. The temperature surrounding the reference leg increases by 20°F.

D. S/G pressure increases by 50 psi with no change in actual water level.



QUESTION: 4

Cooling water system pressure is being monitored by a simple diaphragm pressure detector with its low pressure side vented to the containment. If a main steamline rupture raises containment pressure by 20 psi, cooling water system pressure indication will: (Disregard any temperature effect on the detector.)

A. increase by 20 psi.

B. decrease by 20 psi.

C. increase by the square root of 20 psi.

D. decrease by the square root of 20 psi.

QUESTION: 5

Refer to the drawing of a simple thermocouple circuit (see figure below).

The measuring and reference junctions are located inside the reactor containment building while the potentiometer is located in a remote location outside the containment building. Thermocouple temperature indication is initially 500°F.

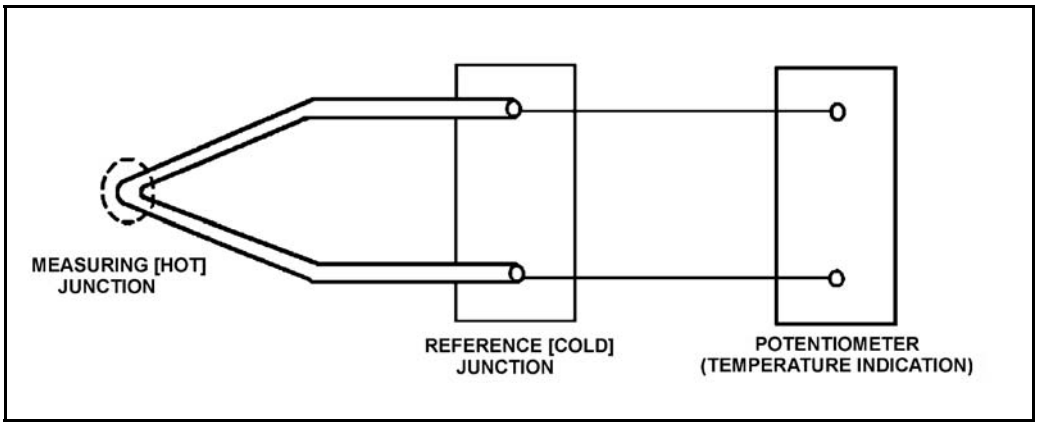
An ambient temperature decrease outside the containment building lowers the temperature of the potentiometer by 10°F while the measuring and reference junction temperatures remain constant. Thermocouple temperature indication at the lower ambient temperature will be...

A. 490°F.

B. 500°F.

C. 510°F.

D. unpredictable.



QUESTION: 6

Which one of the following types of radiation detectors is generally not used for measuring a high-intensity beta and gamma radiation field because of a relatively long detector recovery time, or dead time, following each ionization event.

A. Geiger-Mueller

B. Ion chamber

C. Proportional

D. Scintillation

QUESTION: 7

A flow controller has proportional, integral, and derivative control features. Which one of the following lists the effect on the control features when the controller is switched from the automatic mode to the manual mode?

A. Only the derivative feature will be lost.

B. Only the integral and derivative features will be lost.

C. All proportional, integral, and derivative features will be lost.

D. All control features will continue to influence the controller output.

QUESTION: 8

A direct-acting proportional controller is being used to control the temperature of lube oil exiting a heat exchanger. The controller's proportional band is 70°F to 120°F.

Which one of the following will be the controller output percentage when the measured lube oil temperature is 83°F?

A. 13%

B. 26%

C. 37%

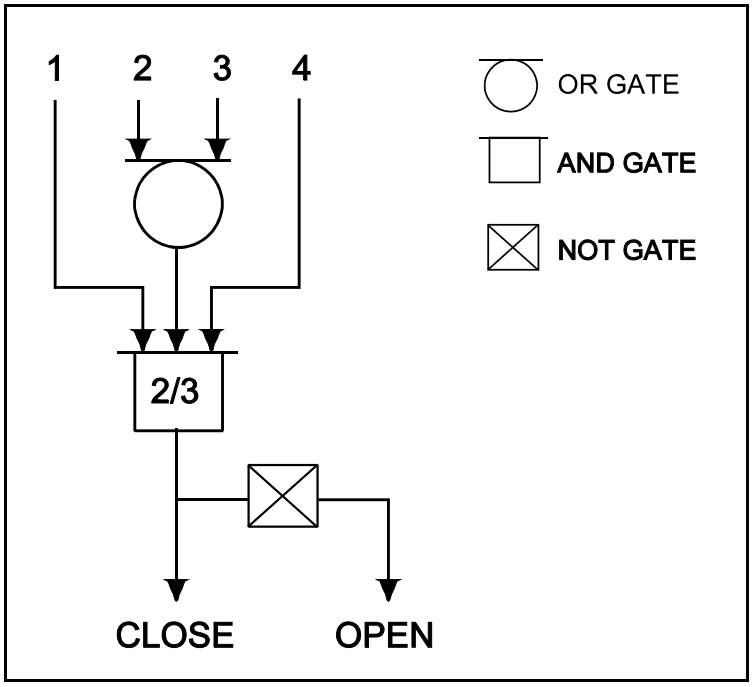
D. 74%

QUESTION: 9

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

Which one of the following combinations of inputs will result in the valve receiving an open signal?

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



QUESTION: 10

A cooling water pump is operating with the following pump suction parameters:

Suction Temperature: 124°F
Suction Pressure: 11.7 psia

What is the approximate available net positive suction head (NPSH) for the pump? (Neglect the contribution of the suction fluid velocity to NPSH.)

A. 23 feet

B. 27 feet

C. 31 feet

D. 35 feet

QUESTION: 11

Some large centrifugal pumps are interlocked so that the pump will not start unless its discharge valve is at least 90% fully 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 typical single-stage radial-flow centrifugal pump is being returned to service following maintenance on its ac motor. Which one of the following will occur when the pump is started if two of the three motor power leads were inadvertently swapped during restoration?

A. The motor breaker will trip on instantaneous overcurrent.

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

C. The motor will rotate in the reverse direction with reduced or no flow rate.

D. The motor will rotate in the normal direction with reduced flow rate.

QUESTION: 13

Use the following drawing of system and pump operating curves for an operating positive displacement pump with relief valve protection to answer the following question.

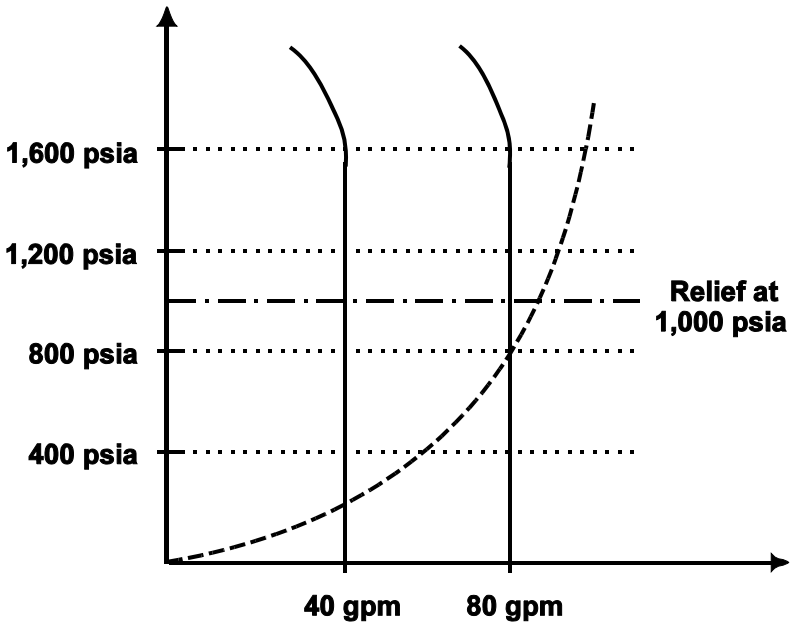
A positive displacement pump is initially supplying water at 40 gpm with a pump discharge pressure of 200 psia. Then, pump speed is increased until pump flow rate is 80 gpm. What is the pump discharge pressure at the new pump flow rate of 80 gpm?

A. 400 psia

B. 800 psia

C. 1,000 psia

D. 1,600 psia



QUESTION: 14

A main generator that is connected to an infinite power grid has the following indications:

500 Mw
300 MVAR (out)
2,800 amps

If main generator excitation is reduced slightly, amps will _____ and Mw will _____.

A. increase; decrease

B. increase; remain the same

C. decrease; decrease

D. decrease; remain the same

QUESTION: 15

Which one of the following causes starting current to be greater than running current for a typical ac induction motor?

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

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

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

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

QUESTION: 16

A main turbine-generator was operating at 80% load with the following initial steady-state lube oil and cooling water temperatures for the main turbine lube oil heat exchanger:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Six months later, the current steady-state heat exchanger temperatures are:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 120°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 120°F

Assume that the total heat exchanger heat transfer coefficient and the lube oil mass flow rate do not change, and that the specific heat values for the cooling water and lube oil do not change. Also, assume that the main turbine lube oil system is a closed system.

The differences between the initial and current steady-state heat exchanger temperatures could be caused by the current main turbine generator load being _____ with the current heat exchanger cooling water mass flow rate being _____.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

QUESTION: 17

A nuclear power plant is operating at 100% power when air inleakage results in the buildup of noncondensible gases in the main condenser. Which one of the following will decrease as a result of this air inleakage?

A. Condensate temperature

B. Pressure in the main condenser

C. Suction pressure at the condensate pumps

D. Condenser cooling water outlet temperature

QUESTION: 18

Which one of the following is an indication of resin exhaustion in a demineralizer:

A. An increase in suspended solids in the effluent

B. A decrease in the flow rate through the demineralizer

C. An increase in the conductivity of the effluent

D. An increase in the differential pressure across the demineralizer

QUESTION: 19

A nuclear power plant has been operating normally at 100% power for one month and with the same reactor coolant boron concentration for the last 24 hours.

Which one of the following changes associated with the in-service reactor coolant demineralizer will cause a reduction in reactor coolant boron concentration in the demineralizer effluent?

A. Increase the temperature of the reactor coolant being processed from 95°F to 105°F.

B. Decrease the temperature of the reactor coolant being processed from 105°F to 95°F.

C. Increase the flow rate of reactor coolant being processed from 75 gpm to 100 gpm.

D. Decrease the flow rate of reactor coolant being processed from 75 gpm to 50 gpm.

QUESTION: 20

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

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

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

A. A ground fault caused an automatic breaker trip.

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

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

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

QUESTION: 21

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

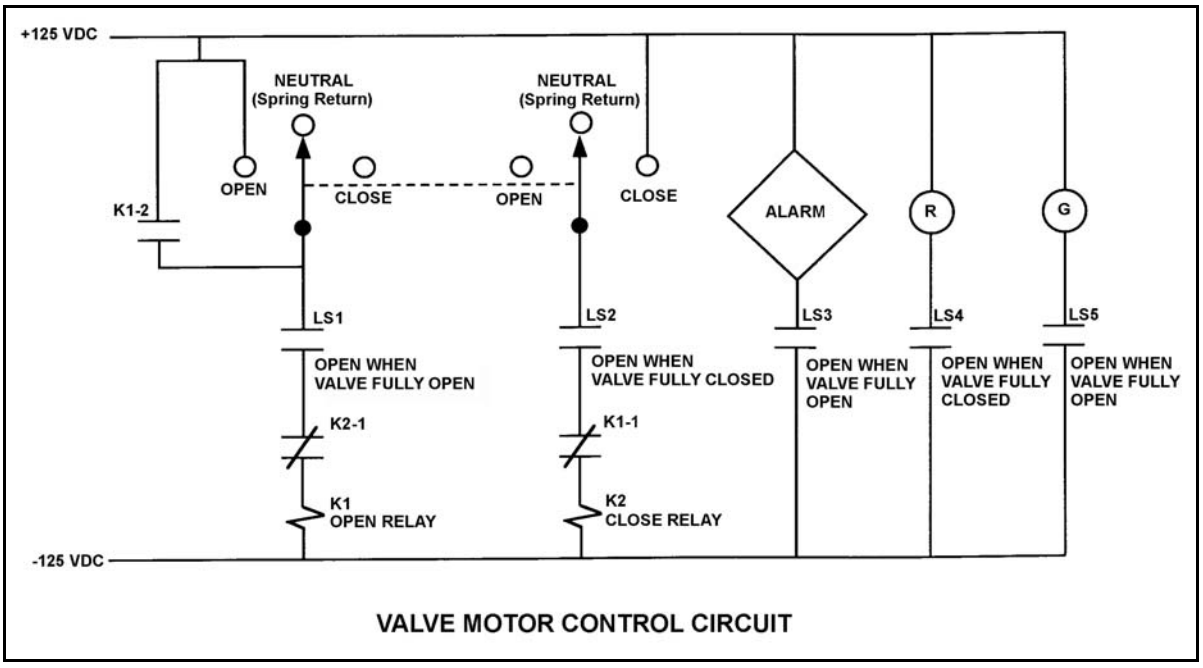
The operator takes the control switch to "Open" momentarily and the valve begins to open. Five seconds later, the operator takes the switch to "Close" momentarily and then releases the switch. Which one of the following describes the valve response after the switch is released?

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

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

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

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



VALVE MOTOR CONTROL CIRCUIT

QUESTION: 22

Two identical 1,000 MW electrical generators are being connected to the same electrical bus. Generator A is currently supplying the bus. Generator A and B output indications are as follows:

Generator A	Generator B
4,160 Volts	4,140 Volts
60.2 Hertz	60.8 Hertz
25 MW	0 MW
10 MVAR (out)	0 MVAR

When the output breaker for generator B is closed, which generator is more likely to trip on reverse power?

A. Generator A due to the higher initial voltage

B. Generator A due to the lower initial frequency

C. Generator B due to the lower initial voltage

D. Generator B due to the higher initial frequency

QUESTION: 23

In a comparison between a delayed neutron and a prompt neutron born from the same fission event, the prompt neutron is more likely to...

A. leak out of the core while slowing down.

B. be captured by a U-238 nucleus at a resonance energy.

C. be captured by a Xe-135 nucleus.

D. cause thermal fission of a U-235 nucleus.

QUESTION: 24

A nuclear reactor is shutdown with the reactor vessel head removed for refueling. The core is covered by 23 feet of refueling water at 105°F with a boron concentration of 2,000 ppm.

Which one of the following will decrease core K_{eff}?

A. Refueling water temperature decreases by 5°F.

B. A depleted neutron source is removed from the core.

C. A spent fuel assembly is replaced with a new fuel assembly.

D. Refueling water boron concentration decreases by 5 ppm.

QUESTION: 25

Refer to the unlabeled nuclear reactor response curve shown below for a reactor that was initially subcritical in the source range. A small amount of positive reactivity was added at time = 0 sec.

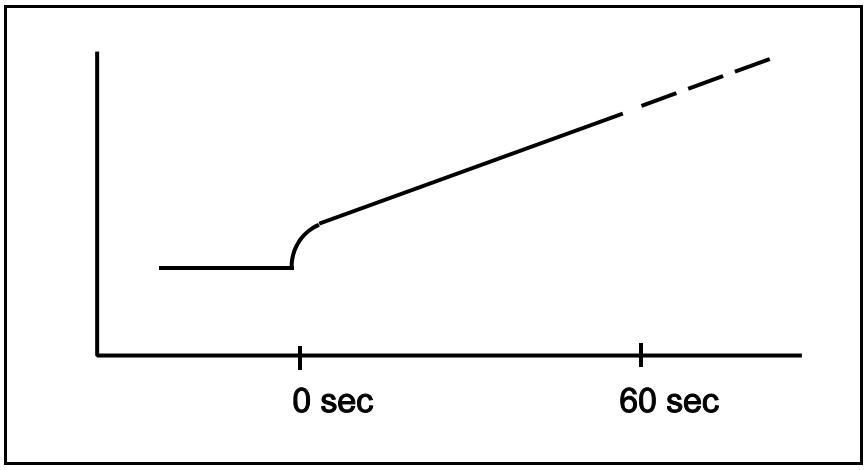
The response curve shows _____ versus time for a reactor that is currently (at time = 60 sec) _____.

A. startup rate; exactly critical

B. startup rate; supercritical

C. reactor fission rate; exactly critical

D. reactor fission rate; supercritical



QUESTION: 26

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

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

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

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

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

QUESTION: 27

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

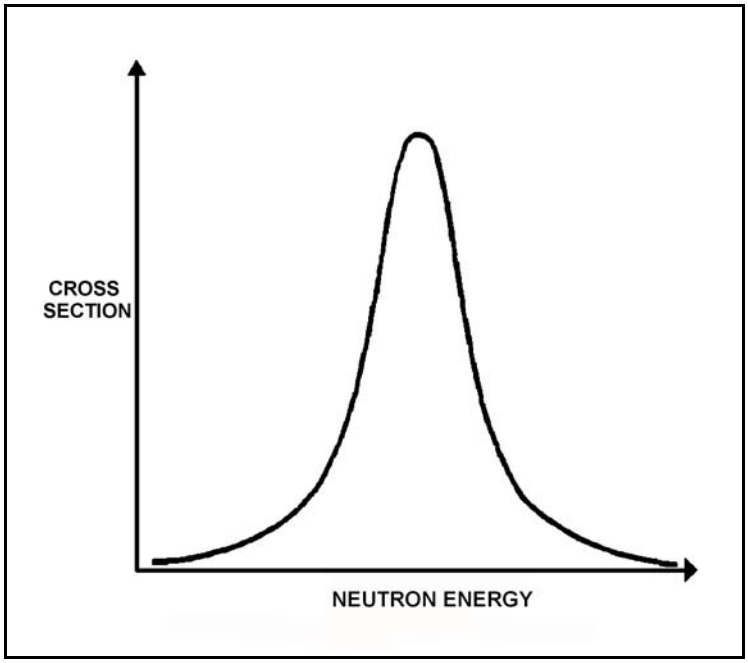
During a subsequent reactor power decrease to 70%, the curve will become _____; and the percentage of the core neutron population lost to resonance capture by U-238 will _____.

A. taller and more narrow; decrease

B. taller and more narrow; increase

C. shorter and broader; decrease

D. shorter and broader; increase



QUESTION: 28

A nuclear reactor is operating near the end of a fuel cycle at steady state 50% power level when the operator withdraws a group of control rods for 5 seconds. (Assume that main turbine load remains constant and the reactor does not scram/trip.)

Actual reactor power will stabilize _____ the initial power level and reactor coolant temperature will stabilize _____ the initial temperature.

A. at; at

B. at; above

C. above; at

D. above; above

QUESTION: 29

Consider a nuclear reactor core with four quadrants: A, B, C, and D. The reactor is operating at steady state 90% power when a fully withdrawn control rod in quadrant C drops to the bottom of the core. Assume that no operator actions are taken and reactor power stabilizes at 88%.

How are the maximum upper and lower core power tilt values (sometimes called quadrant power tilt ratio or azimuthal power tilt) affected by the dropped rod?

A. Upper core value decreases while lower core value increases.

B. Upper core value increases while lower core value decreases.

C. Both upper and lower core values decrease.

D. Both upper and lower core values increase

QUESTION: 30

A nuclear reactor has been operating at full power for one month following a refueling outage with core axial neutron flux distribution peaked in the bottom half of the core. An inadvertent reactor trip occurs. The reactor is restarted, with criticality occurring 6 hours after the trip. Reactor power is increased to 60% over the next 4 hours and stabilized.

How will core axial neutron flux distribution be affected during the 1-hour period immediately following the return to 60% power?

The core axial neutron flux peak will be located _____ in the core than the pre-trip peak location, and the flux peak will be moving _____.

A. higher; downward

B. higher; upward

C. lower; downward

D. lower; upward

QUESTION: 31

A nuclear reactor has been operating at steady-state 50% power for 12 hours following a one-hour power reduction from steady-state 100% power. 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: 32

During continuous full-power nuclear reactor operation in the middle of a fuel cycle, the reactor coolant boron concentration must be decreased periodically to compensate for fuel depletion. What other core age-related factor requires a periodic decrease in reactor coolant boron concentration?

A. Decreasing control rod worth

B. Buildup of fission product poisons

C. Burnout of burnable poisons

D. Decreasing fuel temperature

QUESTION: 33

To predict critical control rod position prior to commencing a nuclear reactor startup, the operator must consider the amount of reactivity added by post-shutdown changes in...

A. reactor coolant boron concentration, neutron flux level, and burnable poisons.

B. control rod positions, core xenon-135 concentration, and reactor coolant temperature.

C. neutron flux level, reactor coolant boron concentration, and control rod positions.

D. reactor coolant temperature, burnable poisons, and core xenon-135 concentration.

QUESTION: 34

Given:

- Nuclear reactors A and B are identical except that reactor A has an effective delayed neutron fraction of 0.0068 and reactor B has an effective delayed neutron fraction of 0.0052.
- Reactor A has a stable period of 45 seconds and reactor B has a stable period of 42 seconds.
- Both reactors are initially operating at 1.0×10^{-8} percent power.

The reactor that is supercritical by the greater amount of positive reactivity is reactor _____; and the first reactor to reach 1.0×10^{-1} percent power will be reactor _____.

A A; A

B. A; B

C. B; A

D. B; B

QUESTION: 35

A nuclear reactor startup is in progress. Control rod withdrawal was stopped several minutes ago to assess criticality. Which one of the following is a combination of indications in which <u>each</u> listed indication supports a declaration that the reactor has reached criticality?

A. Startup rate is stable at 0.0 dpm; source range count rate is stable.

B. Startup rate is stable at 0.2 dpm; source range count rate is stable.

C. Startup rate is stable at 0.0 dpm; source range count rate is slowly increasing.

D. Startup rate is stable at 0.2 dpm; source range count rate is slowly increasing.

QUESTION: 36

A nuclear reactor is exactly critical below the point of adding heat when a single control rod fully inserts into the core. Assuming no operator or automatic action, reactor power will slowly decrease to...

A. zero.

B. an equilibrium value equal to the source neutron strength.

C. an equilibrium value greater than the source neutron strength.

D. a slightly lower value, then slowly return to the initial value.

QUESTION: 37

Which one of the following is the approximate condenser vacuum when condenser pressure is 16 inches Hg absolute?

A. 4 inches Hg vacuum

B. 8 inches Hg vacuum

C. 12 inches Hg vacuum

D. 14 inches Hg vacuum

QUESTION: 38

A nuclear reactor is shut down with reactor coolant system (RCS) pressure at 1,500 psia and core decay heat is being removed via the steam generators (S/Gs). What pressure must be maintained in the S/Gs to obtain a 110°F subcooling margin in the RCS loop cold legs? (Assume a negligible temperature difference across the S/G tubes.)

A. 580 psia

B. 600 psia

C. 620 psia

D. 640 psia

QUESTION: 39

Consider a 100 lbm quantity of a steam-water mixture at standard atmospheric pressure. The mixture has a quality of 70 percent. Assume that pressure remains constant and there is no heat loss from the mixture.

Which one of the following is the approximate heat addition needed to increase the quality of the mixture to 100 percent?

A. 5,400 Btu

B. 12,600 Btu

C. 29,100 Btu

D. 67,900 Btu

QUESTION: 40

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

Pressure: 900 psia
Quality: 99%

The main turbine steam chest pressure is 300 psia. Which one of the following is the quality of the steam in the steam chest?

A. 100%

B. 98%

C. 88%

D. 87%

QUESTION: 41

A nuclear power plant is operating at 90% of rated power. Main condenser pressure is 1.7 psia and hotwell condensate temperature is 120°F.

If main condenser cooling water flow rate is reduced by 5%, overall steam cycle efficiency will...

A. increase because condensate depression will decrease.

B. decrease because condensate depression will increase.

C. increase because the work output of the main turbine will increase.

D. decrease because the work output of the main turbine will decrease.

QUESTION: 42

A heat exchanger has the following initial cooling water inlet temperature and differential pressure (ΔP) parameters:

Inlet Temperature = 70°F
Heat Exchanger ΔP = 10 psi

Six hours later, the current heat exchanger cooling water parameters are:

Inlet Temperature = 85°F
Heat Exchanger ΔP = 10 psi

In comparison to the initial cooling water mass flow rate, the current mass flow rate is...

A. lower because the density of the cooling water has decreased.

B. higher because the velocity of the cooling water has increased.

C. the same because the changes in cooling water velocity and density offset.

D. the same because the heat exchanger cooling water ΔP is the same.

QUESTION: 43

A length of pipe in a cooling water system uses a reducer fitting to decrease the pipe diameter from 6 inches to 4 inches. The flow rate in the 6-inch diameter section of pipe is 200 gpm. What is the flow rate in the 4-inch diameter section of pipe?

A. 133 gpm

B. 200 gpm

C. 300 gpm

D. 450 gpm

QUESTION: 44

The power range nuclear instruments have been adjusted to 100% based on a calculated heat balance. Which one of the following would cause indicated reactor power to be greater than actual reactor power?

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

B. The feedwater flow rate used in the heat balance calculation was lower than actual feedwater flow rate.

C. The steam pressure used in the heat balance calculation was 50 psi higher than actual steam pressure.

D. The enthalpy of the feed water was miscalculated to be 10 Btu/lbm higher than actual feed water enthalpy.

QUESTION: 45

During a loss of coolant accident, the reactor fuel 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: 46

A nuclear reactor is operating at 100% steady-state power near the end of a fuel cycle with all control rods fully withdrawn. At what axial location in a typical fuel assembly will the maximum departure from nucleate boiling ratio occur?

A. At the top of the fuel assembly

B. At the bottom of the fuel assembly

C. Between the bottom and midplane of the fuel assembly

D. Between the midplane and the top of the fuel assembly

QUESTION: 47

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of a fuel cycle (see figure below).

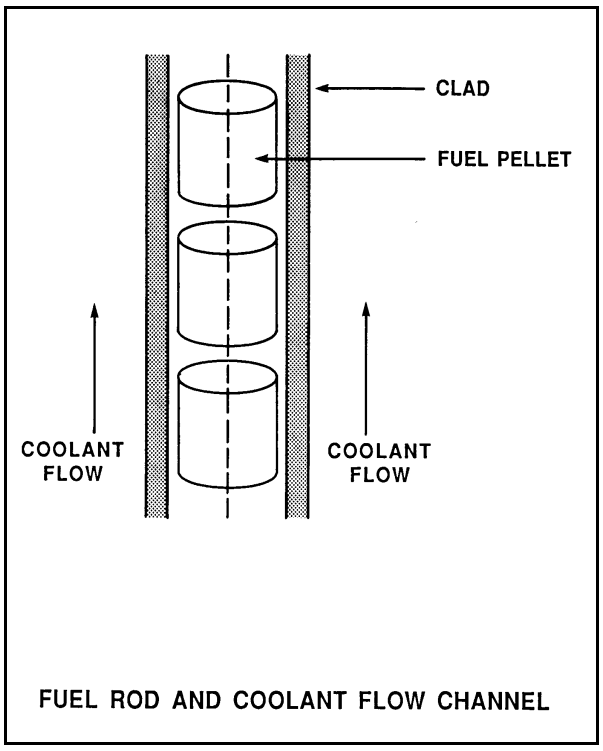
At 100% reactor power, the greatest temperature difference in a fuel channel radial temperature profile will occur across the: (Assume the temperature profile begins at the fuel centerline.)

A. fuel pellet centerline to pellet surface.

B. fuel pellet surface-to-clad gap.

C. zircaloy cladding.

D. flow channel boundary (laminar) layer.



FUEL ROD AND COOLANT FLOW CHANNEL

QUESTION: 48

A nuclear reactor is producing 3,400 MW of thermal output with a vessel ΔT of 60°F and a vessel mass flow rate of 1.0 x 10^8 lbm/hr. If core ΔT is 63.6°F, what is core bypass flow rate? (Assume bypass flow ΔT equals 0°F.)

A. 5.66 x 10^6 lbm/hr

B. 8.40 x 10^6 lbm/hr

C. 3.60 x 10^7 lbm/hr

D. 9.43 x 10^7 lbm/hr

QUESTION: 49

A nuclear reactor is operating at 80% power near the beginning of a fuel cycle. All control rods are fully withdrawn and in manual control. The moderator temperature coefficient is negative. 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%.

B. One control rod fully inserts into the core.

C. Turbine load/reactor power is reduced by 20%.

D. Reactor coolant system boron concentration is reduced by 50 ppm.

QUESTION: 50

Which one of the following comparisons increases the probability of brittle fracture for a reactor pressure vessel wall?

A. Using materials fabricated from stainless steel rather than carbon steel.

B. A compressive stress rather than a tensile stress.

C. A high reactor coolant temperature rather than a low reactor coolant temperature.

D. Performing a 100°F/hr cooldown rather than a 100°F/hr heatup.

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

SEPTEMBER 2007 NRC GENERIC FUNDAMENTALS EXAMINATION
PRESSURIZED WATER REACTOR - ANSWER KEY

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