UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING 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 boiling water reactor (BWR) 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 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.

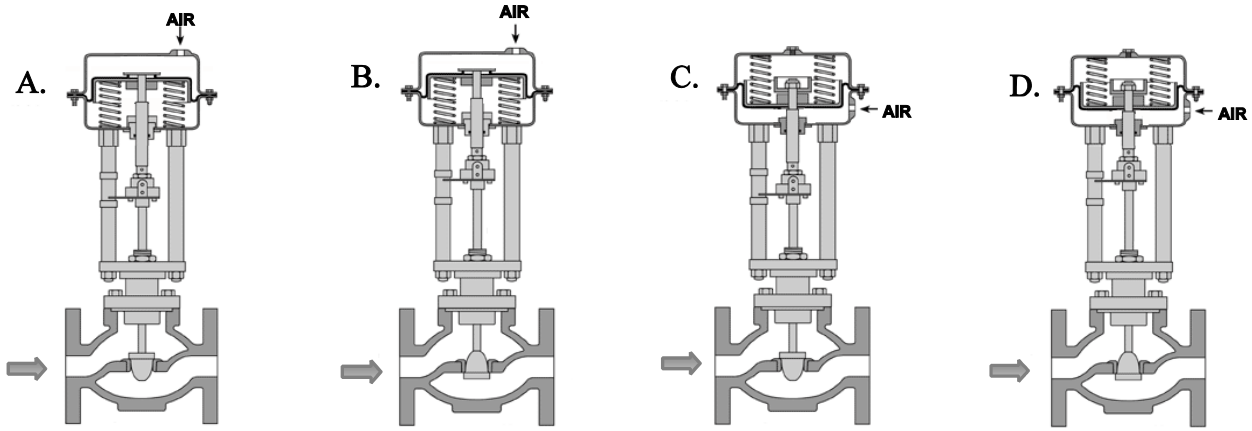
If each actuator is vented, which valve disk will remain closed with the most force?

A. A.

B. B.

C. C.

D. D.



QUESTION: 2

To verify a manual valve in an operating system is closed, the operator should observe valve position indication and operate the valve handwheel in the...

A. open direction at least one full rotation, then close the valve using normal force.

B. open direction until system flow is observed, then close the valve using normal force.

C. close direction using normal force and verify there is no substantial handwheel movement.

D. close direction using normal force, then operate the valve handwheel an additional one-quarter turn in the close direction.

QUESTION: 3

A gate valve is generally a poor choice for throttling fluid flow because...

A. the turbulent flow created by a partially opened gate valve can cause extensive damage to the valve.

B. the tortuous path through a gate valve body can make flow control difficult.

C. excessive stem leakage will result unless the gate valve is fully open or fully closed.

D. the head loss from a throttled gate valve will result in an unacceptable reduction in system flow rate.

QUESTION: 4

Which one of the following will cause indicated liquid flow rate to be higher than actual flow rate when using a differential pressure (D/P) flow detector with a calibrated orifice?

A. System pressure decreases.

B. The detector diaphragm ruptures.

C. Debris becomes lodged in the orifice.

D. The pressure surrounding the D/P detector housing decreases.

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.

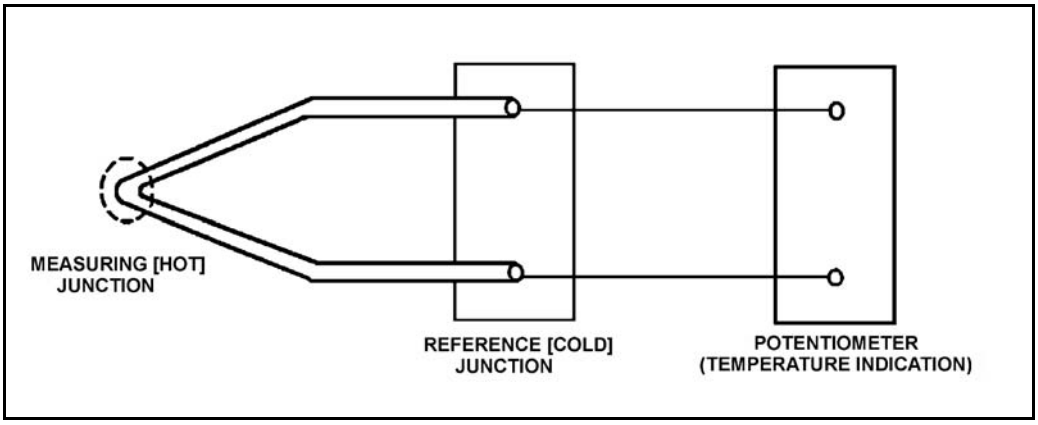
An ambient temperature decrease outside the containment building lowers the temperature of the potentiometer by 10°F while the measuring and reference junction temperatures remain constant. Thermocouple temperature indication at the lower ambient temperature will be...

A. 490°F.

B. 500°F.

C. 510°F.

D. unpredictable.



QUESTION: 6

Refer to the simplified drawing of a control rod position detector circuit (see figure below).

A magnet on the control rod extension (or drive) shaft sequentially closes individual reed switches mounted vertically adjacent to the control rod drive housing. A constant +5 dc volts is supplied to the input of the resistor network at resistor R_1.

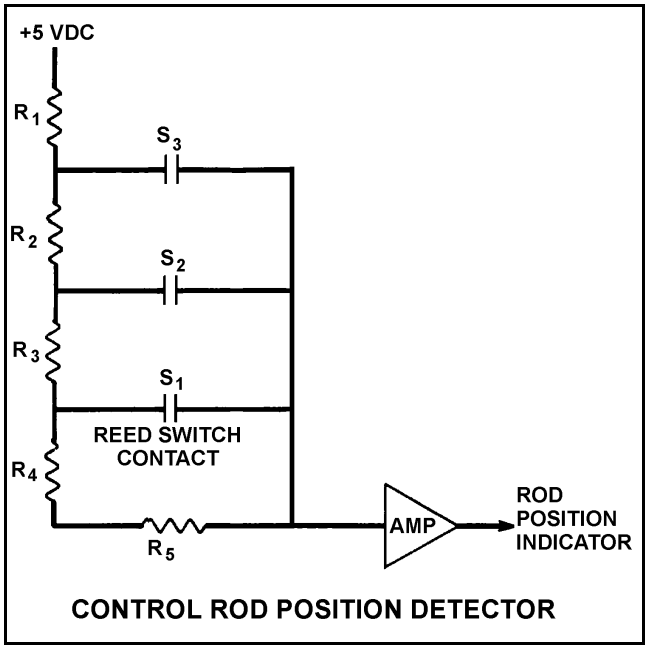
A control rod is initially fully inserted such that all reed switch contacts are open; then the rod is withdrawn until reed switch contact S_1 is closed. Compared to the initial circuit currents, the current through resistor R_5 after the rod withdrawal will be _____, and the output current of the resistor network to the amplifier will be _____.

A. lower, higher

B. lower, lower

C. higher, higher

D. higher, lower



QUESTION: 7

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

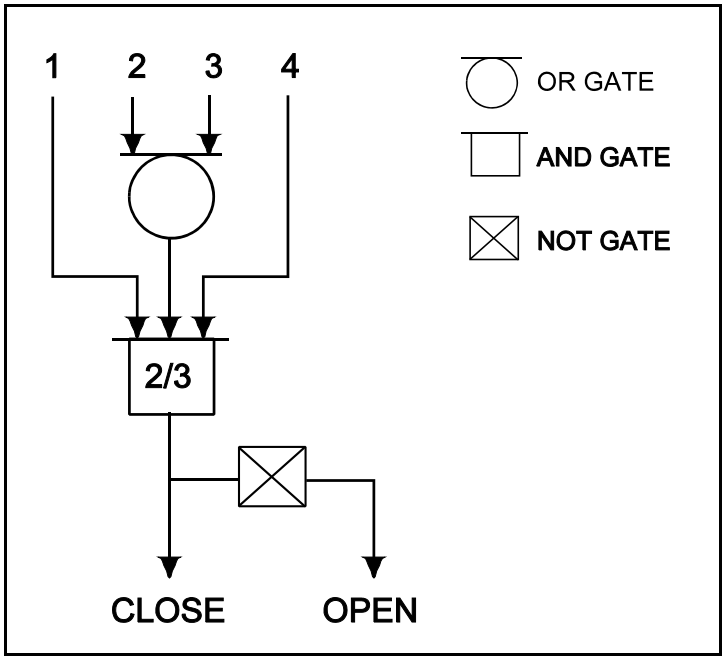
D. Scintillation

QUESTION: 8

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: 9

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: 10

Which one of the following is an effective method for ensuring that a centrifugal pump remains primed and does not become gas bound during operation and after shutdown?

A. Install an orifice plate in the discharge piping of the pump.

B. Install a pump recirculation line from the pump discharge piping to the pump supply piping.

C. Install the pump below the level of the suction supply.

D. Install a check valve in the discharge piping of the pump.

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...

A. pump discharge pressure.

B. heating of the pumped fluid.

C. the potential for cavitation at the pump suction.

D. the duration of the pump motor starting current.

QUESTION: 12

A centrifugal pump is operating at its maximum design flow rate, delivering water through two parallel valves. Valve "A" is half open, and valve "B" is one quarter open.

Which one of the following will occur if both valves are fully opened?

A. The pump will operate at shutoff head.

B. The pump available net positive suction head will increase.

C. The pump required net positive suction head will decrease.

D. The pump will operate at runout conditions.

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.

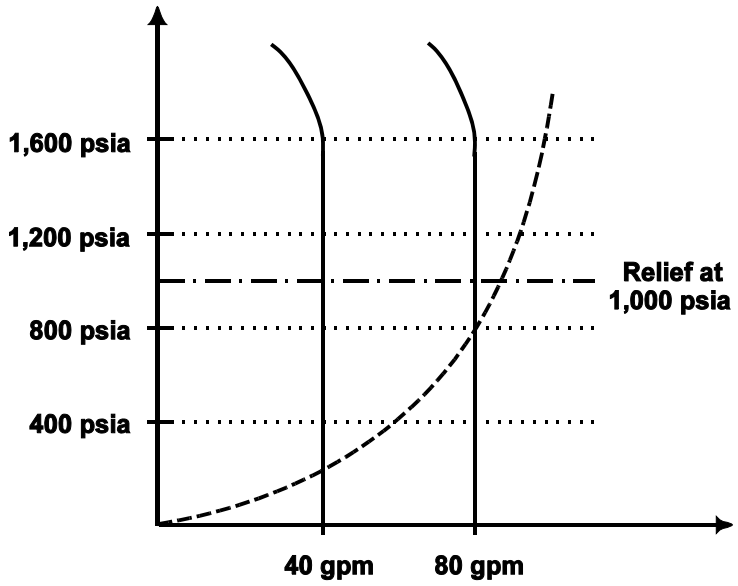
A positive displacement pump is initially supplying water at 40 gpm with a pump discharge pressure of 200 psia. Then, pump speed is increased until pump flow rate is 80 gpm. What is the pump discharge pressure at the new pump flow rate of 80 gpm?

A. 400 psia

B. 800 psia

C. 1,000 psia

D. 1,600 psia



QUESTION: 14

Refer to the pump performance curves for a centrifugal cooling water pump (see figure below). The pump is being driven by a single-speed ac induction motor. Pump flow rate is being controlled by a throttled discharge flow control valve.

The following initial pump conditions exist:

Pump motor current:	50 amps
Pump flow rate:	400 gpm
Pump suction temperature:	70°F

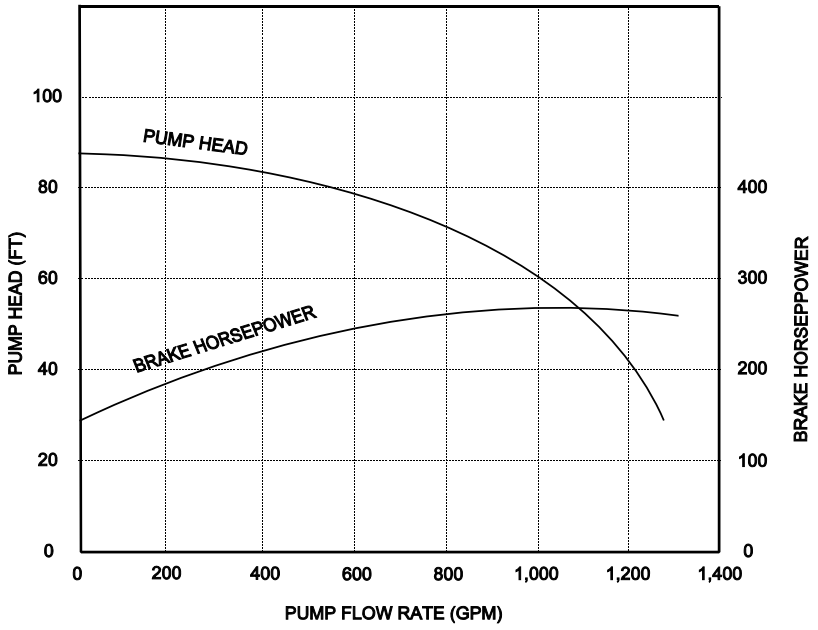
If the flow control valve is repositioned such that pump flow rate is now 800 gpm, what will be the approximate new pump motor current?

A. Less than 100 amps

B. 200 amps

C. 400 amps

D. More than 500 amps



QUESTION: 15

The frequency of start/stop cycles for an electrical motor is limited to prevent...

A. overheating the motor windings.

B. excessive shaft torsional stresses.

C. overheating the motor supply bus.

D. excessive cycling of the motor breaker.

QUESTION: 16

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

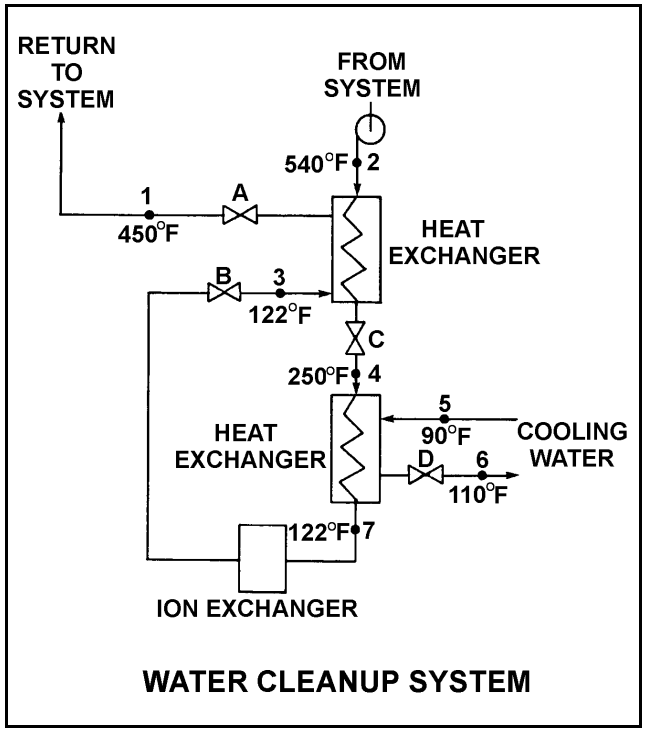
If cooling water flow rate is 1.0 x 10^6 lbm/hr, what is the approximate water flow rate in the cleanup system?

A. 1.6 x 10^5 lbm/hr

B. 3.2 x 10^5 lbm/hr

C. 1.6 x 10^6 lbm/hr

D. 3.2 x 10^6 lbm/hr



QUESTION: 17

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: 18

A pressure gauge on a condenser reads 27 inches of mercury (Hg) vacuum. What is the absolute pressure corresponding to this vacuum? (Assume that standard atmospheric pressure equals 15 psia.)

A. 1.0 psia

B. 1.5 psia

C. 13.5 psia

D. 14.0 psia

QUESTION: 19

The ion exchange efficiency of a condensate demineralizer is determined by performing a calculation using the...

A. change in conductivity at the outlet of the demineralizer over a period of time.

B. change in pH at the outlet of the demineralizer over a period of time.

C. demineralizer inlet and outlet conductivity.

D. demineralizer inlet and outlet pH.

QUESTION: 20

Which one of the following refers to the condition in which large portions of a demineralizer resin bed are bypassed, thereby allowing waterborne impurities to reach the outlet?

A. Channeling

B. Leaching

C. Exhaustion

D. Mineralization

QUESTION: 21

Refer to the drawing of a motor controller circuit for a three-phase ac motor (see figure below).

Note: Relay contacts are shown open/closed according to the standard convention for control circuit drawings.

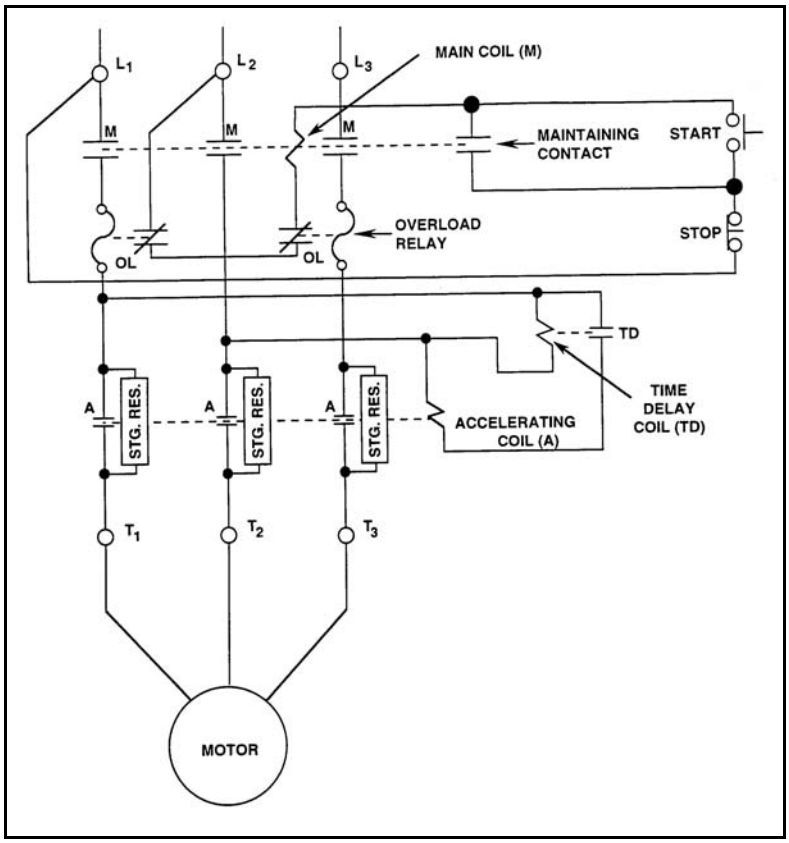
The motor receives overload protection from _____ overload (OL) relays, and _____ OL relay(s) must actuate to deenergize the motor.

A. two; one

B. two; two

C. three; one

D. three; two



QUESTION: 22

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

A. Using two hands for balance and to prevent dropping tools onto energized equipment.

B. Standing on insulating rubber material to increase the electrical resistance of the body to ground.

C. Having a person stand by to deenergize the equipment in the event of an emergency.

D. Covering exposed energized circuits with insulating material to prevent inadvertent contact.

QUESTION: 23

The ideal neutron moderator has a _____ microscopic scattering cross section for thermal neutrons and a _____ density.

A. small; low

B. small; high

C. large; low

D. large; high

QUESTION: 24

With K_{eff} equal to 0.983, how much positive reactivity must be added to make the reactor exactly critical? (Round answer to nearest 0.01% ΔK/K.)

A. 1.70% ΔK/K

B. 1.73% ΔK/K

C. 3.40% ΔK/K

D. 3.43% ΔK/K

QUESTION: 25

A subcritical nuclear reactor has an initial K_{eff} of 0.8 with a stable source range count rate of 100 cps. If positive reactivity is added until K_{eff} equals 0.95, at what value will the source range count rate stabilize?

A. 150 cps

B. 200 cps

C. 300 cps

D. 400 cps

QUESTION: 26

A nuclear reactor is shut down with the reactor vessel head removed. The core is covered by 23 feet of refueling water at a temperature of 100°F.

Which one of the following will increase core K_{eff} if the reactor is at the end of core life, but will decrease core K_{eff} if the reactor is at the middle of core life?

A. A fresh neutron source is installed in the core.

B. Refueling water temperature is increased to 105°F.

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

D. Movable incore source range instrumentation is repositioned to increase source range count rate.

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.

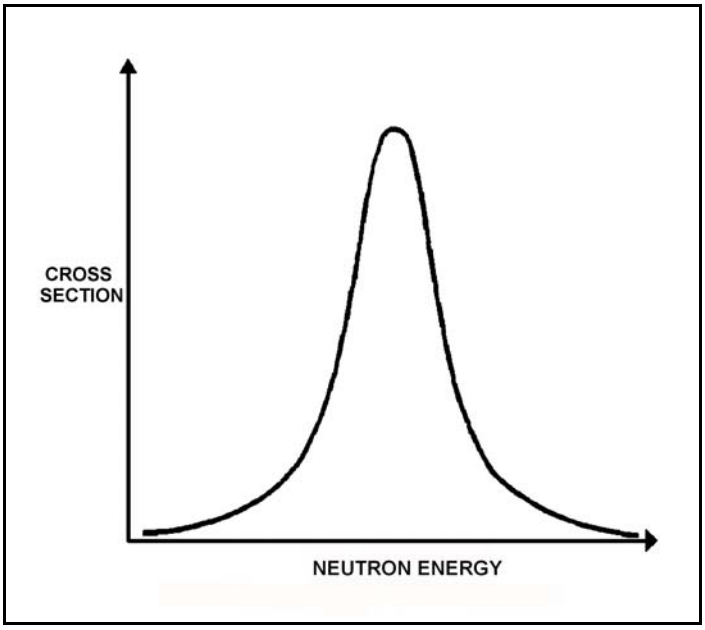
During a subsequent reactor power decrease to 70%, the curve will become _____; and the percentage of the core neutron population lost to resonance capture by U-238 will _____.

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 has been shut down for three weeks with all control rods fully inserted. If a center control rod is fully and continuously withdrawn from the core, neutron population will: (Assume the reactor remains subcritical.)

A. increase and stabilize above the original level.

B. increase, then decrease and stabilize at the original level.

C. increase, then decrease and stabilize above the original level.

D. remain the same during and after the withdrawal.

QUESTION: 29

If the void fraction surrounding several centrally located fuel bundles increases, the worth of the associated control rod(s) will...

A. decrease, because the average neutron energy in the fuel bundles decreases, resulting in fewer neutrons traveling from within the fuel bundles to the affected control rod(s).

B. decrease, because more neutrons are resonantly absorbed in the fuel while they are being thermalized, resulting in fewer thermal neutrons available to be absorbed by the affected control rod(s).

C. increase, because the diffusion length of the thermal neutrons increases, resulting in more thermal neutrons traveling from within the fuel bundles to the affected control rod(s).

D. increase, because neutrons will experience a longer slowing down length, resulting in a smaller fraction of thermal neutrons being absorbed by the fuel and more thermal neutrons available to be absorbed by the affected control rod(s).

QUESTION: 30

A nuclear power plant has been operating at 100% power for several months. Which one of the following describes the relative contributions of beta decay and neutron capture to Xe-135 removal from the reactor core?

A. Primary - neutron capture; secondary - beta decay.

B. Primary - beta decay; secondary - neutron capture.

C. Beta decay and neutron capture contribute equally.

D. Not enough information is given to make a comparison.

QUESTION: 31

A nuclear reactor has been operating at 100% power for two months when a reactor scram occurs. Four hours later, the reactor is critical and stable at 10% power.

Which one of the following operator actions is required to maintain reactor power at 10% 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, then negative reactivity

D. Add negative reactivity, then positive reactivity

QUESTION: 32

Gadolinium (Gd-155 and -157) is used instead of boron (B-10) as the _____ material; when compared to gadolinium, boron has a much _____ cross section for absorbing thermal neutrons.

A. control rod; larger

B. burnable poison; larger

C. control rod; smaller

D. burnable poison; smaller

QUESTION: 33

A nuclear reactor startup is in progress for a reactor that is in the middle of a fuel cycle. The reactor is at normal operating temperature and pressure. The main steam isolation valves are open and the main turbine bypass (also called steam dump) valves are closed. The reactor is near criticality.

Reactor period is stable at infinity when, suddenly, a turbine bypass valve fails open and remains stuck open, dumping steam to the main condenser. The operator immediately ensures no control motion is occurring and takes no further action. Assume that the reactor vessel water level remains stable, the reactor does not scram, and no other protective actions occur.

As a result of the valve failure, reactor period will initially become _____; and reactor power will stabilize _____ the point of adding heat.

A. positive; below

B. positive; above

C. negative; below

D. negative; above

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 is critical just below the point of adding heat when an inadvertent reactor scram occurs. All control rods fully insert except for one rod, which remains fully withdrawn. Five minutes after the reactor scram, with reactor period stable at approximately negative (-) 80 seconds, the remaining withdrawn control rod suddenly and rapidly fully inserts.

Which one of the following describes the reactor response to the insertion of the last control rod?

A. The negative period will remain stable at approximately -80 seconds.

B. The negative period will immediately become shorter, and then lengthen and stabilize at approximately -80 seconds.

C. The negative period will immediately become shorter, and then lengthen and stabilize at a value more negative than -80 seconds.

D. The negative period will immediately become shorter, and then lengthen and stabilize at a value less negative than -80 seconds.

QUESTION: 36

A nuclear reactor has been shutdown for several weeks when a loss of all ac power results in a loss of forced decay heat removal flow.

Given the following information, what will be the average reactor coolant heatup rate during the 20 minutes immediately after decay heat removal flow is lost? Assume that only ambient losses are removing heat from the reactor coolant system (RCS).

Reactor rated thermal power:	2,800 MWt
Decay heat rate:	0.2% rated thermal power
RCS ambient heat loss rate:	2.4 MWt
RCS c_p:	1.1 Btu/lbm-°F
Reactor vessel coolant inventory:	325,000 lbm

A. Less than 25°F/hour

B. 26 to 50°F/hour

C. 51 to 75°F/hour

D. More than 76°F/hour

QUESTION: 37

Refer to the drawing of four tank differential pressure (D/P) level detectors (see figure below). The tanks are identical and are being maintained at 17 psia and the same constant water level. They are surrounded by atmospheric pressure.

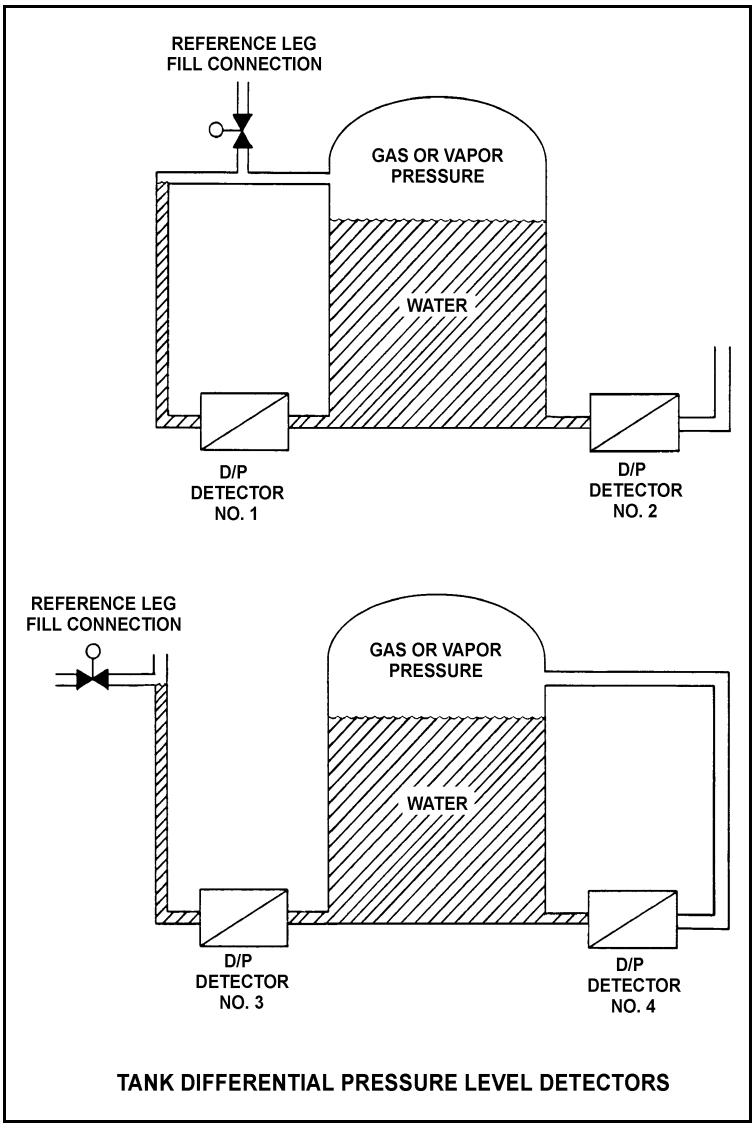
Which one of the level detectors is sensing the greatest D/P?

A. No. 1

B. No. 2

C. No. 3

D. No. 4



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

QUESTION: 38

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: 39

Condensate depression (subcooling) will increase if the _____ increases.

A. main turbine load

B. condenser cooling water temperature

C. condenser cooling water flow rate

D. air leakage rate into the condenser

QUESTION: 40

A nuclear power plant was initially operating normally at 90% of rated power when heating steam (extracted from the main turbine) was automatically isolated to several feedwater heaters. Reactor power was returned to 90% and the plant is currently stable.

Compared to the initial main generator MW load, the current main generator MW load is...

A. lower, because the steam cycle is less efficient.

B. lower, because less steam is being extracted from the main turbine.

C. higher, because the steam cycle is less efficient.

D. higher, because less steam is being extracted from the main turbine.

QUESTION: 41

Refer to the drawing of two lengths of 6-inch diameter pipe, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing

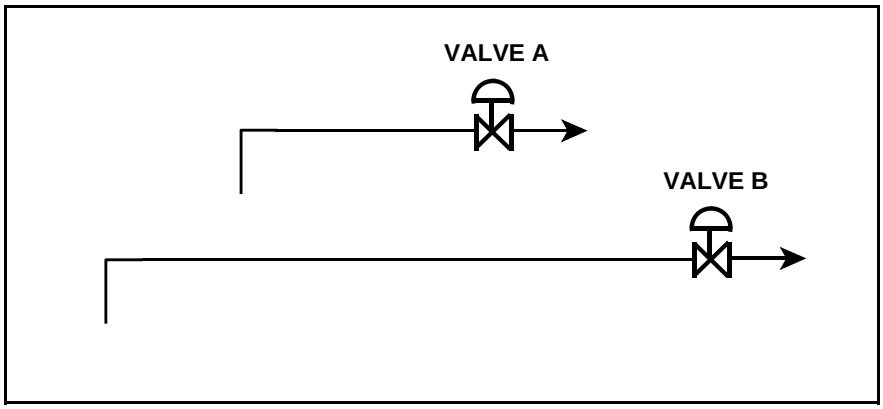
Water at 65°F is flowing at 1,000 gpm through each pipe. If the isolation valves suddenly and simultaneously close, valve A and its associated piping will experience a maximum pressure that is _____ the maximum pressure experienced by valve B and its associated piping. The pressure spike will dissipate quicker in the _____ length of pipe.

A. equal to; shorter

B. equal to; longer

C. less than; shorter

D. less than; longer



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

Which one of the following is the most accurate indication of mass flow rate through a nuclear reactor for calculating core thermal power during reactor power operation?

A. Core flow rate

B. Steam flow rate

C. The sum of feed water and control rod drive flow rates

D. The sum of both recirculation loop flow rates

QUESTION: 44

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

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

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

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

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

QUESTION: 45

The magnitude of the local fuel pin heat flux that is necessary to cause the onset of transition boiling is...

A. largest at the top of the core and smallest at the bottom of the core.

B. largest at the bottom of the core and smallest at the top of the core.

C. largest at the core midplane and smallest at the top and bottom of the core.

D. largest at the top and bottom of the core and smallest at the core midplane.

QUESTION: 46

Core inlet subcooling is defined as the difference between the temperature of the fluid _____ and the saturation temperature of the fluid in the core inlet plenum.

A. in the core inlet plenum

B. at the feedwater pump discharge

C. in the downcomer area

D. in the lower fuel channel area

QUESTION: 47

In a nuclear reactor operating at full power, the fuel bundle with the greatest radial peaking factor always has the...

A. greatest power.

B. greatest critical power ratio.

C. smallest axial peaking factor.

D. smallest linear heat generation rate.

QUESTION: 48

Which one of the following is indicated when the maximum average power ratio (MAPRAT) is greater than 1.0?

A. The linear heat generation rate (LHGR) limit has not been exceeded.

B. The average planar linear heat generation rate (APLHGR) limit has not been exceeded.

C. The LHGR limit has been exceeded.

D. The APLHGR limit has been exceeded.

QUESTION: 49

Given the following initial core parameters for a segment of a fuel rod:

Power density = 2 kW/ft
$T_{coolant}$ = 540°F
$T_{fuel\ centerline}$ = 1,200°F

Reactor power is increased such that the following core parameters now exist for the fuel rod segment:

Power density = 3 kW/ft
$T_{coolant}$ = 540°F
$T_{fuel\ centerline}$ = ?

Assuming void fraction surrounding the fuel rod segment does not change, what will be the new stable $T_{fuel\ centerline}$?

A. 1,380°F

B. 1,530°F

C. 1,670°F

D. 1,820°F

QUESTION: 50

Brittle fracture of a low-carbon steel is more likely to occur when the temperature of the steel is _____ the nil ductility temperature, and will normally occur when the applied stress is _____ the steel's yield strength (or yield stress).

A. greater than; greater than

B. greater than; less than

C. less than; greater than

D. less than; less than

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

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

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