UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 2005--FORM A

Please Print

Name: _____

Facility: _____

Docket No.: _____

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 the name of your facility.

3. Fill in your individual docket number.

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 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.

11. Turn in your examination materials, answer sheet on top, followed by the examination booklet, then 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

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

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

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

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

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

$E = IR$

Eff. = Net Work Out/Energy In

$\upsilon(P_2 - P_1) + \dfrac{(\vec{v}_2^{\,2} - \vec{v}_1^{\,2})}{2g_c} + \dfrac{g(z_2 - z_1)}{g_c} = 0$

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

CONVERSIONS

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1 Mw = 3.41×10^6 Btu/hr

1 hp = 2.54×10^3 Btu/hr

1 Btu = 778 ft-lbf

°C = (5/9)(°F - 32)

°F = (9/5)(°C) + 32

1 Curie = 3.7×10^{10} dps

1 kg = 2.21 lbm

1 gal_{water} = 8.35 lbm

1 ft^3_{water} = 7.48 gal

QUESTION: 1

Refer to the drawing of a spring-loaded air-operated valve shown in a throttled position (see figure below).

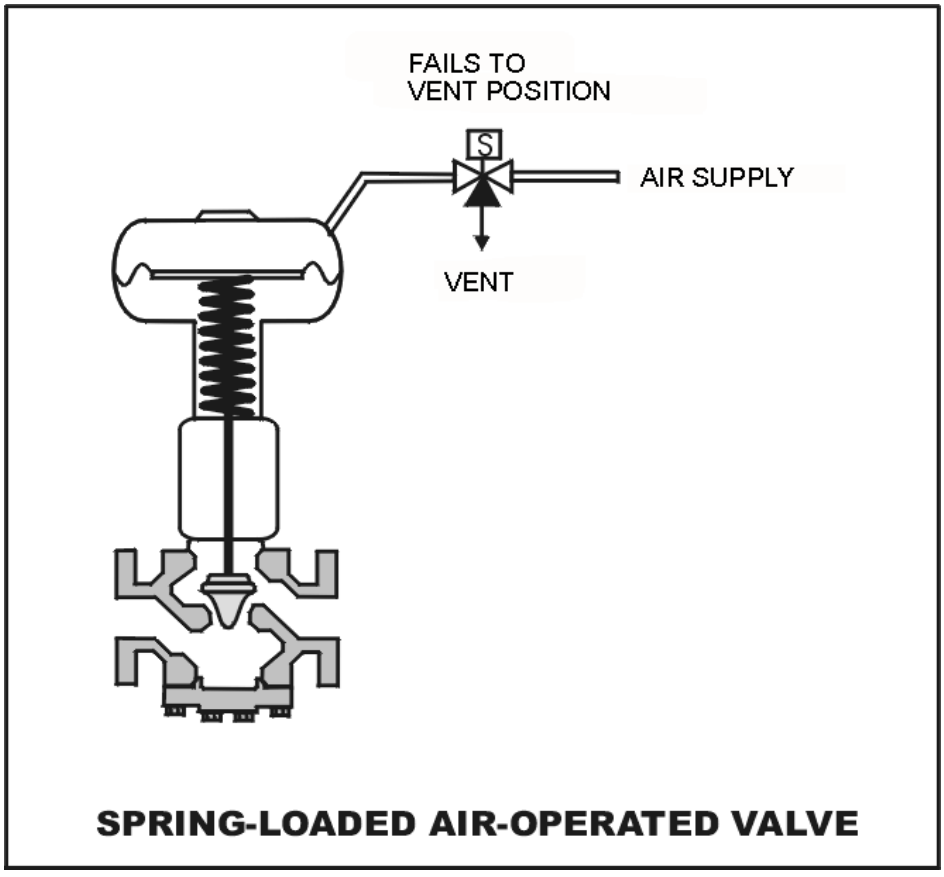
The figure currently depicts normal air supply pressure and an energized solenoid. What will be the valve position following a loss of electrical power to the solenoid?

A. As is

B. More open

C. More closed

D. Varies with system flow



SPRING-LOADED AIR-OPERATED VALVE

QUESTION: 2

Which one of the following is a generally accepted method for locally verifying that a manual valve is fully closed in a depressurized static piping system?

A. Check a downstream flow gauge to be indicating zero flow.

B. Compare an upstream and downstream pressure gauge to ensure zero differential pressure.

C. Attempt to turn the valve handwheel in the close direction and verify no movement.

D. Attempt to turn the valve handwheel in the open direction and verify movement.

QUESTION: 3

After an adjustment of the packing gland on a valve that had a minor packing leak, the operator attempts to operate the valve but finds that the valve is stuck. What is the most probable cause?

A. The disk separated from the valve stem as a result of overtightening the packing gland.

B. The operator placed the valve in the wrong position for adjusting the packing gland.

C. The valve was overtorqued in the closed direction during the packing gland adjustment.

D. The maintenance technician overtightened the packing gland, causing the stem to bind.

QUESTION: 4

A main steam flow rate measuring instrument uses a steam pressure input to produce main steam mass flow rate indication. Assuming volumetric steam flow rate does not change, a steam pressure decrease will cause indicated steam mass flow rate to...

A. decrease because the density of the steam has decreased.

B. increase because the specific volume of the steam has increased.

C. remain the same because steam pressure does not affect the mass flow rate of steam.

D. remain the same because the steam pressure input compensates for changes in steam pressure.

QUESTION: 5

Reed switches are being used in an electrical measuring circuit to monitor the position of a control rod in a nuclear 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

Gamma radiation contributes to the output of a fission chamber mainly by interacting with the...

A. detector gas.

B. detector leads.

C. center electrode.

D. U-235 coating on the detector walls.

QUESTION: 7

Scintillation detectors convert radiation energy into light by a process known as...

A. gas amplification.

B. space charge effect.

C. luminescence.

D. photoionization.

QUESTION: 8

An emergency diesel generator (D/G) is operating as the only power source connected to an emergency bus. The governor of the D/G is directly sensing D/G _____ and will directly adjust D/G _____ flow to maintain a relatively constant D/G frequency.

A. speed; air

B. speed; fuel

C. load; air

D. load; fuel

QUESTION: 9

The water level in a water collection tank is being controlled by an automatic level controller that positions a tank drain valve. Tank water level is initially at the controller set point. Flow rate into the tank increases, slowly at first, and then faster until a stable flow rate is attained.

When tank level increases, the controller begins to open the tank drain valve farther. The level controller output signal increases both as the tank level increases and as the rate of tank level change quickens. After a few minutes, a new, steady-state tank level above the original level is established, with the drain flow rate equal to the supply flow rate.

The controller in this system uses _____ control.

A. proportional only

B. proportional plus derivative

C. proportional plus integral

D. proportional plus integral plus derivative

QUESTION: 10

Refer to the drawing showing two operating points for the same centrifugal pump (see figure below).

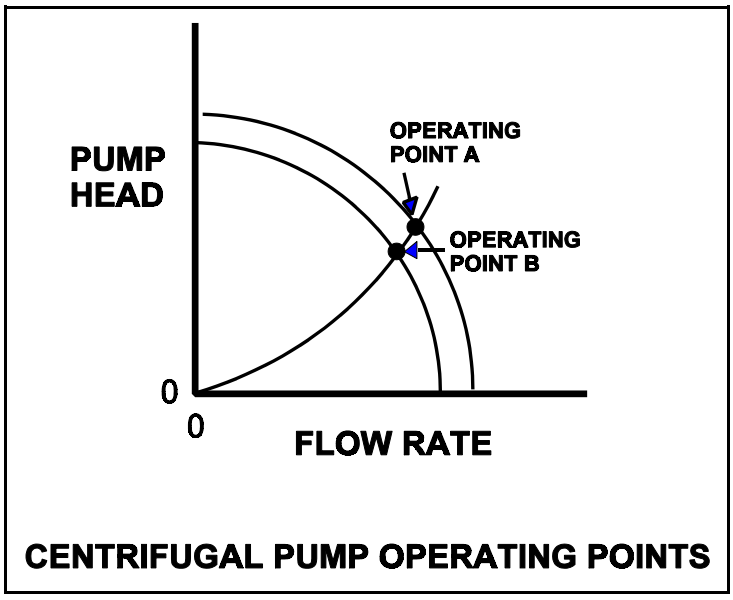
Operating point A was generated from pump performance data taken six months ago. Operating point B was generated from current pump performance data. Which one of the following would cause the observed difference between operating points A and B?

A. The pump discharge valve was more open when data was collected for operating point A.

B. The pump discharge valve was more closed when data was collected for operating point A.

C. The pump internal components have worn since data was collected for operating point A.

D. The system piping head loss has increased since data was collected for operating point A.



CENTRIFUGAL PUMP OPERATING POINTS

QUESTION: 11

A centrifugal cooling water pump is being driven by an ac induction motor. The pump is supplying several heat loads in parallel alignment. The following initial pump conditions exist:

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

Four hours later, the motor is drawing 94 amps. Which one of the following could be responsible for the observed decrease in motor amps?

A. The temperature of the water being pumped has decreased to 60°F with no change in pump flow rate.

B. The temperature of the water being pumped has increased to 80°F with no change in pump flow rate.

C. An additional heat load was added in parallel alignment with no change in the temperature of the water being pumped.

D. One of the existing heat loads was removed from service with no change in the temperature of the water being pumped.

QUESTION: 12

A centrifugal firewater pump is operating to pressurize a fire main. The pump takes suction from a vented water storage tank. A fire hose connected to the fire main is being used to suppress an elevated fire.

Given:

- The pump impeller eye is located 30 feet below the tank water level.
- The pump has a shutoff head of 120 feet.
- The required net positive suction head (NPSH) for the pump is 15 feet.
- The tank water temperature is 60°F.

At which one of the following elevations above the pump impeller eye will the fire hose spray nozzle first be unable to provide flow? (Disregard all sources of system frictional head loss.)

A. 106 feet

B. 121 feet

C. 136 feet

D. 151 feet

QUESTION: 13

A section of reactor coolant piping is being hydrostatically tested to 1,400 psig using a positive displacement pump. The operating characteristics of the positive displacement pump are shown below, identifying ideal, expected, and actual pump performance.

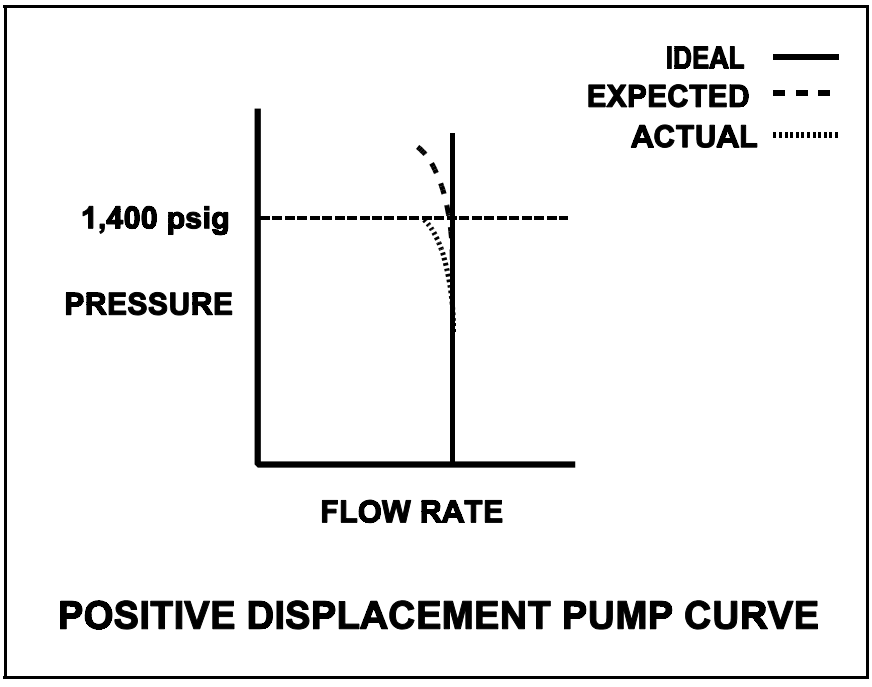
Which one of the following could cause the observed difference between the expected and the actual pump performance?

A. Pump internal leakage is greater than expected.

B. Reactor coolant piping boundary valve leakage is greater than expected.

C. Available NPSH has decreased more than expected, but remains slightly above required NPSH.

D. A relief valve on the pump discharge piping has opened prior to its setpoint of 1,400 psig.



QUESTION: 14

An ac generator is supplying an isolated electrical system with a 1.0 power factor. If generator voltage is held constant while real load (kW) increases, the current supplied by the generator will increase in direct proportion to the _____ of the change in real load. (Assume power factor remains constant at 1.0.)

A. square root

B. amount

C. square

D. cosine

QUESTION: 15

A main generator is operating and connected to an infinite power grid with the following initial generator parameters:

Terminal Voltage:	22 KV
Frequency:	60 Hertz
Load--Real:	575 MW
Load--Reactive:	100 MVAR (out)
Power Factor:	0.985

Which one of the following contains a combination of manual adjustments to the main generator voltage regulator and speed control setpoints such that each adjustment will result in main generator operation at a power factor closer to 1.0. (Assume that generator power factor remains less than 1.0.)

	VOLTAGE SETPOINT	SPEED SETPOINT
A.	Increase	Increase
B.	Increase	Decrease
C.	Decrease	Increase
D.	Decrease	Decrease

QUESTION: 16

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

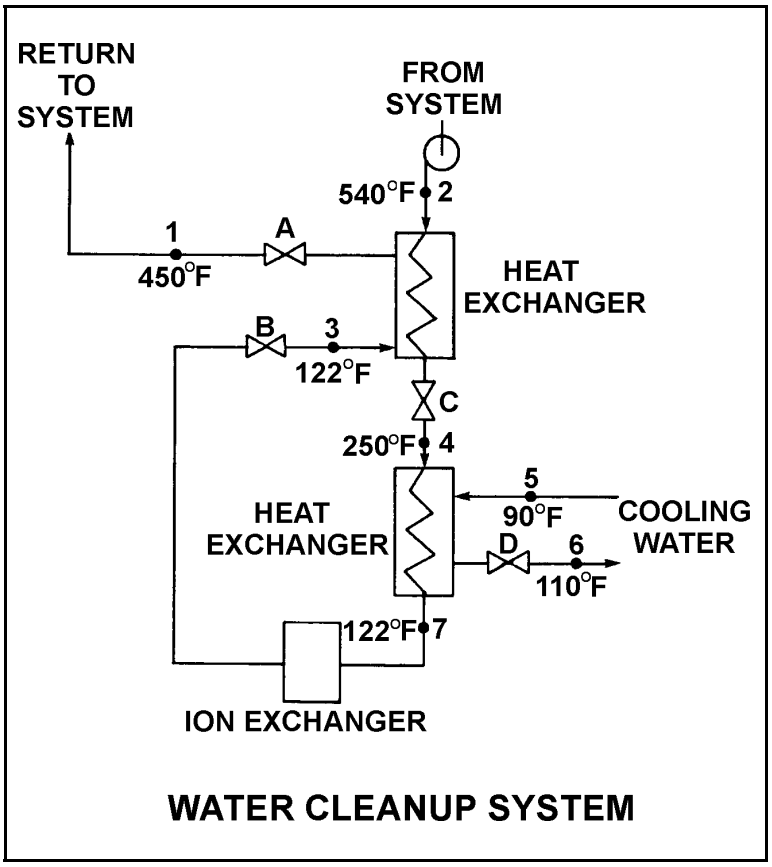
All valves are identical and are initially 50% open. To raise the temperature at point 4, the operator can adjust valve _____ in the _____ direction.

A. A; shut

B. B; shut

C. C; open

D. D; open



QUESTION: 17

Steam has been admitted to a main condenser for 25 minutes with no cooling water. Initiating full cooling water flow rate at this time will...

A. reduce the stress on the condenser shell by rapidly cooling the shell.

B. reduce the stress on the condenser tubes by rapidly cooling the tubes.

C. induce large thermal stresses on the condenser shell.

D. induce large thermal stresses on the junctions between the condenser tubes and the tubesheet.

QUESTION: 18

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

$T_{oil\ in} = 177°F$
$T_{oil\ out} = 111°F$
$T_{water\ in} = 85°F$
$T_{water\ out} = 115°F$

Assume that the total heat exchanger heat transfer coefficient and the cooling water flow rate did not change, and that the specific heat values for the cooling water and lube oil did not change.

Which one of the following could be responsible for the differences between the initial and current steady-state heat exchanger temperatures?

A. The current main turbine lube oil flow rate is greater than the initial flow rate.

B. The current main turbine lube oil flow rate is less than the initial flow rate.

C. The current main turbine-generator load is higher than the initial load.

D. The current main turbine-generator load is lower than the initial load.

QUESTION: 19

Which one of the following conditions will lead to channeling in an operating demineralizer?

A. Suspended solids and insoluble particles forming a mat on the surface of the resin bed.

B. A sudden 10°F decrease in the temperature of the influent to the demineralizer .

C. Exhaustion of the resin bed due to high conductivity of the demineralizer influent.

D. Operation of the demineralizer with influent flow rate at 10% below design flow rate.

QUESTION: 20

The purpose of a mixed-bed demineralizer is to...

A. raise the conductivity of water with little effect on pH.

B. reduce the conductivity of water with little effect on pH.

C. increase the pH of water by reducing the number of positively charged ions in it.

D. decrease the pH of water by increasing the number of negatively charged ions in it.

QUESTION: 21

A main generator is about to be connected to an infinite power grid. The main generator has the following initial conditions:

Generator frequency:	59.9 Hz	Generator voltage:	115.1 kV
Grid frequency:	60.1 Hz	Grid voltage:	114.8 kV

When the generator output breaker is closed, the generator will...

A. acquire real load and reactive load.

B. acquire real load, but become a reactive load to the grid.

C. become a real load and a reactive load to the grid.

D. become a real load to the grid, but acquire reactive load.

QUESTION: 22

During a routine inspection of a main generator output breaker, a technician discovers severely damaged main contact surfaces. Which one of the following is the most likely cause of the damaged contact surfaces?

A. The main generator breaker automatically tripped open after it was closed with the generator and power grid voltages 60 degrees out of phase.

B. The main generator breaker automatically tripped open due to a faulty trip relay actuation while the main generator was operating unloaded.

C. The main generator breaker automatically tripped open on a loss of offsite power while the main generator was operating at its maximum rated load.

D. The main generator breaker automatically tripped open after it was closed with the generator and power grid voltages in phase but with generator frequency 0.2 Hz lower than power grid frequency.

QUESTION: 23

During a brief time interval in a typical commercial nuclear reactor operating at the beginning of a fuel cycle, 1.0×10^3 delayed neutrons were emitted.

Approximately how many prompt neutrons were emitted during this same time interval?

A. 1.5×10^5

B. 6.5×10^6

C. 1.5×10^7

D. 6.5×10^8

QUESTION: 24

A nuclear reactor is initially operating at steady-state 60% power near the end of core life when a fully withdrawn control rod suddenly inserts completely into the core. No operator action is taken and the plant control systems stabilize the reactor at a power level in the power range.

Compared to the initial shutdown margin (SDM), the new steady-state SDM is _____; compared to the initial 60% power core K_{eff}, the new steady-state core K_{eff} is _____.

A. the same; smaller

B. the same; the same

C. less negative; smaller

D. less negative; the same

QUESTION: 25

A nuclear 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 0.2 %ΔK/K reactivity.

Given:

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

What is the approximate reactor power level increase required to offset the reactivity added by the inadvertent rod withdrawal?

A. 3.3%

B. 5.0%

C. 6.7%

D. 7.5%

QUESTION: 26

The moderator temperature coefficient of reactivity is _____ negative at end of core life because, over core life, the utilization of thermal neutrons _____.

A. more; decreases

B. less; decreases

C. more; increases

D. less; increases

QUESTION: 27

Refer to the drawing of microscopic cross section for absorption versus neutron energy for a resonance peak in U-238 in a nuclear reactor operating at 80% power (see figure below).

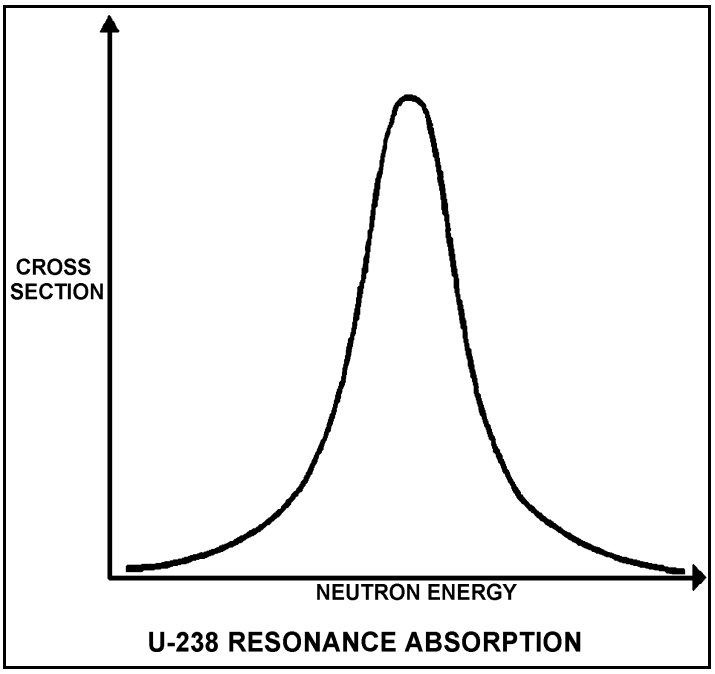
If reactor power is decreased to 60%, the height of the curve will _____ and the area under the curve will _____.

A. increase; increase

B. increase; remain the same

C. decrease; decrease

D. decrease; remain the same



QUESTION: 28

A control rod is positioned in a nuclear reactor with the following neutron flux parameters:

Core average thermal neutron flux = 1.0×10^{12} n/cm^2-sec
Control rod tip thermal neutron flux = 5.0×10^{12} n/cm^2-sec

If the control rod is slightly inserted such that the control rod tip is located in a thermal neutron flux of 1.0×10^{13} n/cm^2-sec, then the differential control rod worth will increase by a factor of _____. (Assume the average flux is constant.)

A. 2

B. 4

C. 10

D. 100

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

Which one of the following correctly describes the production mechanisms of Xe-135 in a nuclear reactor that is operating at steady-state 100% power?

A. Primarily from fission, secondarily from iodine decay

B. Primarily from fission, secondarily from promethium decay

C. Primarily from iodine decay, secondarily from fission

D. Primarily from promethium decay, secondarily from fission

QUESTION: 31

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

A. Negative only

B. Negative, then positive

C. Positive only

D. Positive, then negative

QUESTION: 32

Refer to the drawing of K_{eff} versus core age for a nuclear reactor core following a refueling outage (see figure below).

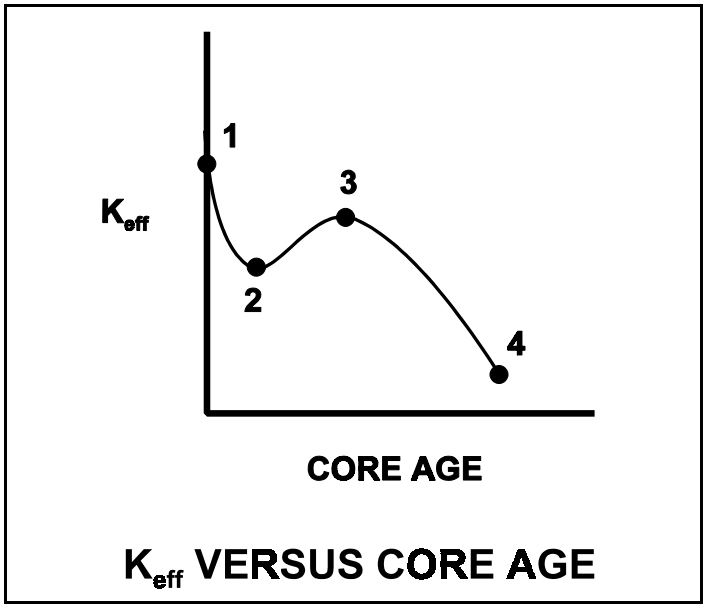
Which one of the following is responsible for the majority of the decrease in K_{eff} from point 1 to point 2?

A. Depletion of fuel

B. Burnout of burnable poisons

C. Initial heat-up of the reactor

D. Buildup of fission product poisons



QUESTION: 33

A nuclear power plant was operating at steady-state 100% power near the end of a fuel cycle when a reactor scram occurred. Reactor pressure is being maintained at 600 psig in anticipation of commencing a reactor startup.

Four hours after the scram, with reactor pressure still at 600 psig, which one of the following will cause the fission rate in the reactor core to increase?

A. Reactor vessel pressure is allowed to increase by 20 psig.

B. Reactor coolant temperature is allowed to increase by 3°F.

C. The operator fully withdraws the first group of control rods.

D. An additional two hours is allowed to pass with no other changes in plant parameters.

QUESTION: 34

A nuclear power plant is operating normally at 50% of rated power when a steam break occurs that releases 5% of rated steam flow. Reactor power will initially...

A. increase due to positive reactivity addition from the void coefficient only.

B. increase due to positive reactivity addition from the void and moderator temperature coefficients.

C. decrease due to negative reactivity addition from the void coefficient only.

D. decrease due to negative reactivity addition from the void and moderator temperature coefficients.

QUESTION: 35

Nuclear reactors A and B are identical and have operated at 100% power for six months when a reactor scram occurs simultaneously on both reactors. All reactor A control rods fully insert. One reactor B control rod sticks fully withdrawn.

After ten minutes, when compared to reactor B, the core fission rate in reactor A will be _____, and the reactor period in reactor A will be _____.

A. the same; shorter

B. the same; the same

C. lower; shorter

D. lower; the same

QUESTION: 36

A nuclear power plant has been operating at rated power for six months when a reactor scram occurs. Which one of the following describes the source(s) of core heat generation 30 minutes after the reactor scram?

A. Fission product decay is the only significant source of core heat generation.

B. Delayed neutron-induced fission is the only significant source of core heat generation.

C. Fission product decay and delayed neutron-induced fission are both significant sources and produce approximately equal rates of core heat generation.

D. Fission product decay and delayed neutron-induced fission are both insignificant sources and generate core heat at rates that are less than the rate of ambient heat loss from the core.

QUESTION: 37

Refer to the drawing of four tank differential pressure level detectors (see figure below).

The tanks are identical and are being maintained at 30 psia and a water level of 20 feet. They are surrounded by standard atmospheric pressure. The water in the tank and reference leg is at 70°F.

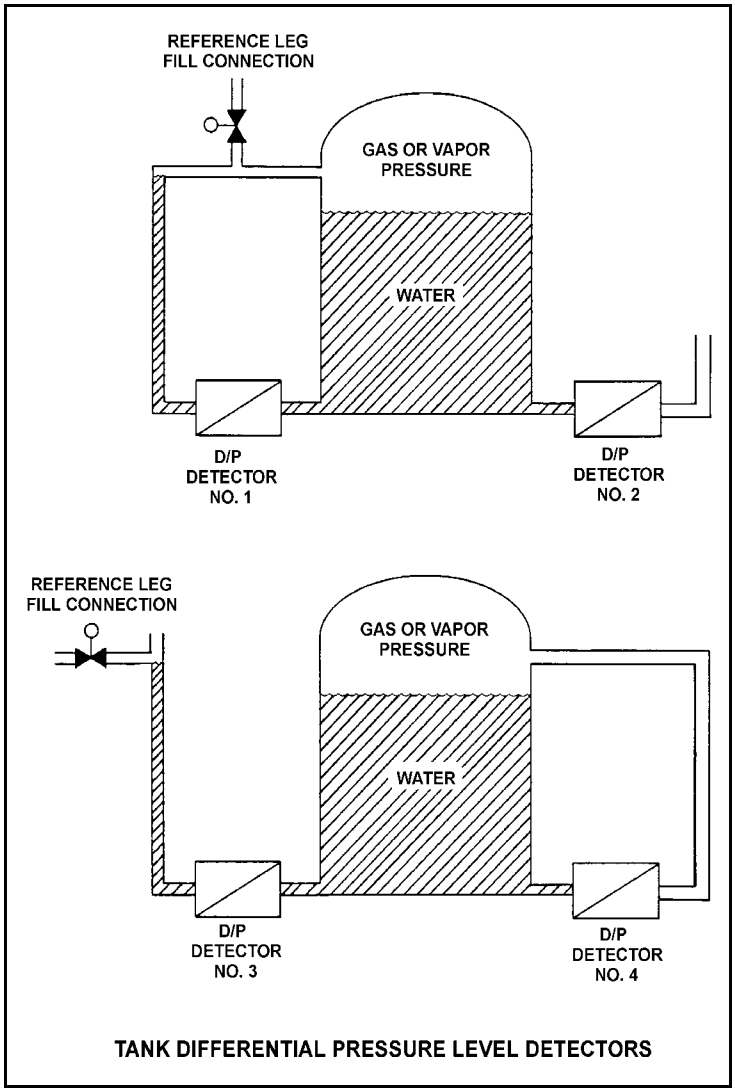
If each detector experiences a ruptured diaphragm, which detector(s) will cause indicated tank level to increase? (Assume actual tank water level remains constant.)

A. No. 1 only

B. No. 2 only

C. No. 1 and 3

D. No. 2 and 4



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

QUESTION: 38

A nuclear power plant is operating at full rated power. The main turbine has one high pressure (HP) unit and one low pressure (LP) unit.

Main steam enters the HP unit of the main turbine with the following parameters:

Pressure: 1,000 psia
Quality: 100%

The exhaust steam exits the HP unit at 200 psia, then goes through a moisture separator/reheater, and enters the LP units with the following parameters:

Pressure: 200 psia
Temperature: 500°F

The main condenser pressure is 1.0 psia. Assume that each unit of the main turbine is 100% efficient.

The higher enthalpy steam is being supplied to the _____ unit of the main turbine; and the greater moisture content is found in the exhaust of the _____ unit.

A. LP; LP

B. LP; HP

C. HP; LP

D. HP; HP

QUESTION: 39

A nuclear power plant is operating at 100% power. Which one of the following describes how and why main condenser pressure changes when condenser cooling water flow rate increases significantly?

A. Decreases because main condenser saturation (shell) temperature decreases

B. Decreases because main condenser condensate subcooling increases

C. Increases because main condenser saturation (shell) temperature decreases

D. Increases because main condenser condensate subcooling increases

QUESTION: 40

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

A. higher because increased steam flow causes the turbine generator to pick up load.

B. lower because decreased steam flow causes the turbine generator to reject load.

C. higher because plant efficiency has increased.

D. lower because plant efficiency has decreased.

QUESTION: 41

Complete the following statement.

Pump cavitation occurs when vapor bubbles are formed at the eye of a pump impeller...

A. because the localized flow velocity exceeds sonic velocity for the existing fluid temperature.

B. because the localized pressure exceeds the vapor pressure for the existing fluid temperature.

C. and enter a high pressure region of the pump where they collapse causing damaging pressure pulsations.

D. and are discharged from the pump where they expand into larger bubbles causing damaging pressure pulsations.

QUESTION: 42

Two identical single-speed centrifugal pumps (CPs) and two identical single-speed positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1,200 psig.

Given the following information:

Centrifugal Pumps

Discharge pressure at shutoff head:	1,500 psig
Maximum design pressure:	2,000 psig
Flow rate with no backpressure:	180 gpm

Positive Displacement Pumps

Maximum design pressure:	2,000 psig

Which one of the following pump configurations will supply the lowest initial flow rate of makeup water to a cooling water system that is drained and depressurized?

A. Two CPs in series

B. Two CPs in parallel

C. Two PDPs in parallel

D. One CP and one PDP in series (CP supplying PDP)

QUESTION: 43

The power range nuclear instruments have been adjusted to 100% based on a calculated heat balance. Which one of the following will result in indicated reactor power being lower than actual reactor power?

A. The feedwater temperature used in the heat balance calculation was 20°F higher than actual feedwater temperature.

B. The reactor recirculation pump heat input term used in the heat balance was 10% lower than actual.

C. The steam and feedwater flow rates used in the heat balance calculation were 10% higher than actual flow rates.

D. The operator miscalculated the enthalpy of the steam exiting the reactor vessel to be 10 Btu/lbm higher than actual.

QUESTION: 44

A nuclear power plant is operating at steady state 80% power. Reactor recirculation flow rate is then decreased from 100% to 80%.

Which one of the following statements describes the initial response of the boiling boundary within the reactor core?

A. It physically moves up the fuel rods, because more Btus per pound mass of water are now being transferred.

B. It physically moves up the fuel rods, because fewer Btus per pound mass of water are now being transferred.

C. It physically moves down the fuel rods, because more Btus per pound mass of water are now being transferred.

D. It physically moves down the fuel rods, because fewer Btus per pound mass of water are now being transferred.

QUESTION: 45

Reactor coolant flow that bypasses the core is necessary to...

A. act as a neutron reflector to minimize fast neutron leakage.

B. provide cooling to prevent excessive boiling in the bypass region.

C. ensure that recirculation pump flow rate is adequate to prevent pump overheating.

D. provide a source of water to the incore thermocouples to ensure they measure a representative coolant temperature.

QUESTION: 46

After operating at high power for several weeks, a nuclear reactor was shut down yesterday and cooled down for steam line leak repairs. Shutdown cooling water pumps are being used to maintain reactor temperature and pressure. The pumps will be stopped in 30 minutes to commence a 4-hour test.

What action, if any, should be taken to enhance natural circulation cooling during the test, and why?

A. No action necessary; the increase of density in the downcomer and the reduction of density in the core region will easily support circulation.

B. No action necessary; the density of the mixture in the core region increases, thereby allowing liquid in the downcomer to enter the core.

C. Raise vessel pressure to allow vessel relief valves to lift and create a heat sink for decay heat while control rod drive flow maintains inventory.

D. Raise vessel water level above the bottom of the steam separators to provide a liquid flow path from the inside to the outside of the core shroud.

QUESTION: 47

A nuclear reactor is operating at 40% of rated thermal power with power distribution peaked both radially and axially in the center of the core. Reactor power is then increased to 70% over the next two hours using only reactor recirculation flow rate adjustments for reactivity control.

Neglecting any effect from reactor poisons, when power is stabilized at 70%, the location of the maximum core radial peaking factor will _____ of the core and the location of the maximum core axial peaking factor will _____ of the core.

A. move away from the center; move toward the bottom

B. move away from the center; move toward the top

C. remain near the center; move toward the bottom

D. remain near the center; move toward the top

QUESTION: 48

The ratio of the highest pin heat flux in a node to the average pin heat flux in the same node is called the _____ peaking factor.

A. local

B. radial

C. axial

D. total

QUESTION: 49

Which one of the following expressions describes the critical power ratio?

A. Critical power/actual bundle power

B. Actual bundle power/critical power

C. Average bundle power/critical power

D. Critical power/average bundle power

QUESTION: 50

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

Which reactor, if any, will have the lowest reactor vessel nil ductility transition temperature?

A. Reactor A due to the lower average lifetime power capacity.

B. Reactor B due to the higher average lifetime power capacity.

C. Both reactors will have approximately the same nil ductility transition temperature because each core has produced approximately the same number of fissions.

D. Both reactors will have approximately the same nil ductility transition temperature because fast neutron irradiation in a shut down core is not significant.

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

MARCH 2005 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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