UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 2012--FORM A

Please Print

Name: _____

Docket No.: _____

Facility: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO APPLICANT

Answer all the test items using the answer sheet provided, ensuring a single answer is marked for each test item. Each test item has equal point value. A score of at least 80 percent is required to pass this portion of the NRC operator licensing written examination. All examination materials will be collected 3 hours after the examination begins. This examination applies to a typical U.S. 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 INSTRUCTIONS FOR THE NRC
GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

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

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

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

2. Fill in your individual docket number.

3. Fill in the name of your facility.

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

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

   (1) An equations and conversions sheet contained within the examination copy, and

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

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

7. Scrap paper will be provided for calculations.

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

9. Restroom trips are limited. Only **one** examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside 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, e.g., steam tables, handouts, and scrap paper.

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

GENERIC FUNDAMENTALS EXAMINATION
EQUATIONS AND CONVERSIONS HANDOUT SHEET

EQUATIONS

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

$A = A_0e^{-\lambda t}$

$P = P_o10^{SUR(t)}$

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

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

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

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

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

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

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

Thermal Efficiency = Net Work Out/Energy In

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

$g_c = 32.2$ 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 kg = 2.21 lbm

1 ft^3_{water} = 7.48 gal

1 gal_{water} = 8.35 lbm

1 Curie = 3.7×10^{10} dps

QUESTION: 1

A main steam system uses a combination of safety and relief valves for overpressure protection. Which one of the following describes a major design consideration for installing both types of valves in the same system?

A. The safety valves are installed to prevent chattering of the relief valves during normal power operation.

B. The safety valves are installed to prevent unnecessary opening of the relief valves during a steam pressure transient.

C. The relief valves are installed to prevent chattering of the safety valves during normal power operation.

D. The relief valves are installed to prevent unnecessary opening of the safety valves during a steam pressure transient.

QUESTION: 2

A typical motor-operated valve has been returned to service following a complete maintenance overhaul of the valve and actuator. The valve was remotely opened and closed to verify operability. The measured valve stroke time in each direction was 15 seconds, which is 25 percent longer than normal.

Which one of the following could have caused the increased stroke time?

A. The valve position limit switches were removed and were <u>not</u> reinstalled.

B. The valve torque limit switches were misadjusted to open at half their normal setpoints.

C. The valve was packed with improved packing material having a lower friction coefficient.

D. The valve stem packing gland was overtightened after the packing material was replaced.

QUESTION: 3

Why are gate valves generally not used to throttle water flow?

A. Rapid changes in flow direction inside the valve cause a large unrecoverable system head loss.

B. Gate valves experience stem leakage unless they are fully open or fully closed.

C. The turbulent flow created by a partially opened gate valve causes excessive seat and disk wear.

D. Flow rate through a gate valve is not proportional to the differential pressure across the valve.

QUESTION: 4

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

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

A. volumetric flow rate; mass flow rate

B. volumetric flow rate; differential pressure

C. differential pressure; mass flow rate

D. differential pressure; volumetric flow rate

QUESTION: 5

Refer to the drawing of a reactor vessel (RV) differential pressure (D/P) level detection system (see figure below).

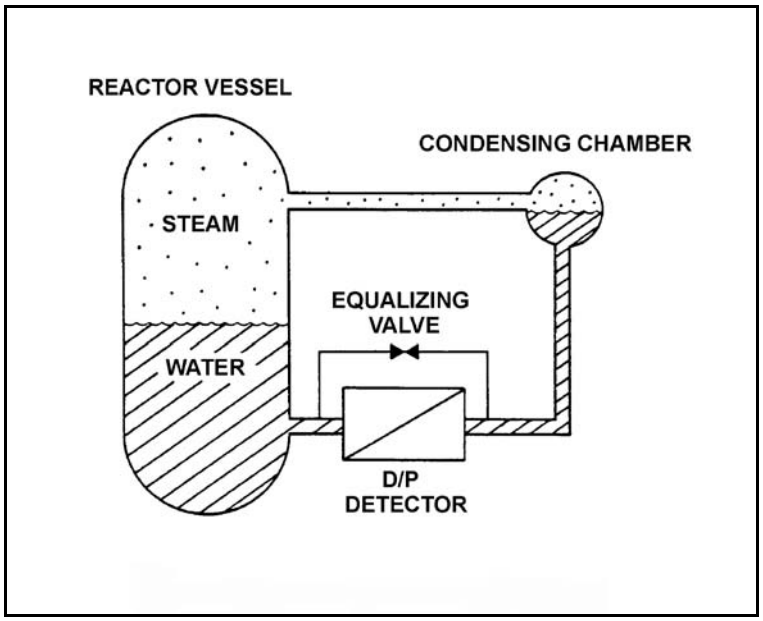
The reactor vessel is supplying steam at normal operating temperature and pressure and the level instrumentation has just been calibrated. Which one of the following events will result in a vessel level indication that is lower than actual level?

A. RV saturation pressure increases by 50 psi.

B. Actual RV water level decreases by 6 inches.

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

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



QUESTION: 6

A resistance temperature detector (RTD) and a thermocouple (TC) are commonly used sensors for temperature measurement. If a temperature display fails, which sensor(s), if any, has/have a property that can be measured manually and converted to a temperature value with the aid of conversion tables.

A. TC only.

B. RTD only.

C. Both TC and RTD.

D. Neither TC nor RTD.

QUESTION: 7

A proportional detector with pulse height discrimination circuitry is being used in a constant field of neutron and gamma radiation to provide source range neutron count rate indication. Assume that the pulse height discrimination setpoint does not change.

If the detector's operating voltage is increased but maintained within the true proportional operating region, count rate indication will increase because...

A. a single neutron- or gamma- induced ionizing event will result in multiple pulses inside the detector.

B. the ratio of the number of neutron-induced pulses to gamma-induced pulses inside the detector will increase.

C. the positive space charge effect will increase and promote the collection of both gamma- and neutron-induced pulses.

D. all detector pulses will increase in amplitude and previously uncounted gamma pulses will be added to the total count rate.

QUESTION: 8

Given:

- A direct-acting proportional pneumatic controller will be used to maintain level in a water storage tank by positioning an air-operated flow control valve in the tank's makeup water supply line.
- The controller's input varies directly with tank level.

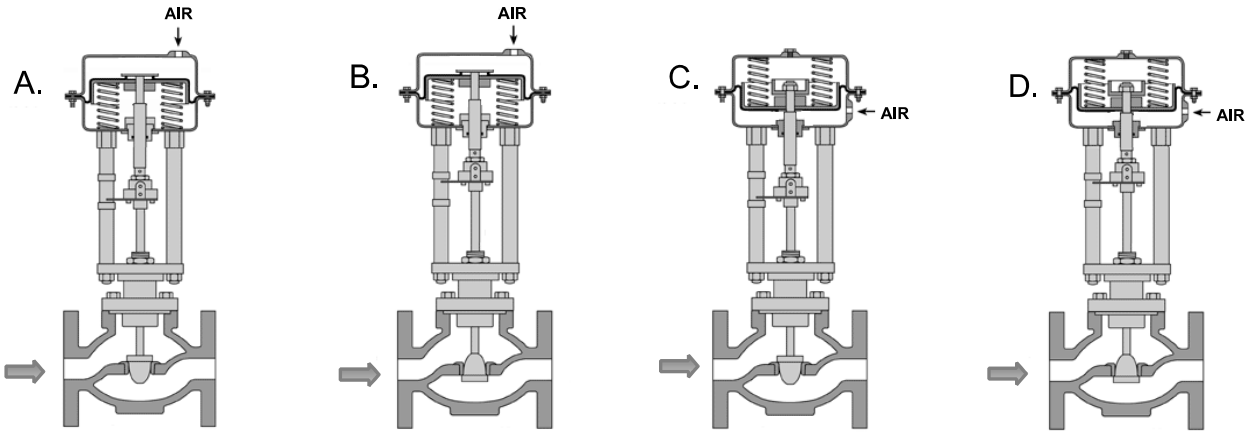
Which of the flow control valves shown below will be compatible with the controller in the above application?

A. A and B

B. B and C

C. C and D

D. D and A



QUESTION: 9

The level in a condensate collection tank is being controlled by an automatic level controller using proportional-only control. Initially the tank level is stable, but then the flow into the tank increases and stabilizes at a higher flow rate.

As tank level increases, the controller positions a drain valve more open than necessary to stabilize the level. As tank level decreases, the controller positions the drain valve more closed than necessary to stabilize the level. This cycle is repeated continuously, never reaching a stable tank level or drain valve position.

The excessive valve positioning described above could be caused by the controller's gain being too _____ or the controller's proportional band being too _____.

A. low; wide

B. low; narrow

C. high; wide

D. high; narrow

QUESTION: 10

A centrifugal pump is initially operating at maximum rated flow rate in an open system. Which one of the following moderate changes will cause the pump to operate in closer proximity to cavitation?

A. Increase pump inlet temperature.

B. Decrease pump speed.

C. Increase pump suction pressure.

D. Decrease pump recirculation flow rate.

QUESTION: 11

Which one of the following describes gas binding of a centrifugal pump?

A. Pump capacity is reduced due to the presence of steam or air in the pump impeller.

B. Pump capacity is reduced due to windage losses between the pump impeller and pump casing.

C. Pump motor current increases due to the compression of gases in the pump volute.

D. Pump motor current increases due to the high head requirements for pumping a fluid saturated with dissolved gases.

QUESTION: 12

Refer to the drawing of a centrifugal pump taking suction from a reservoir.

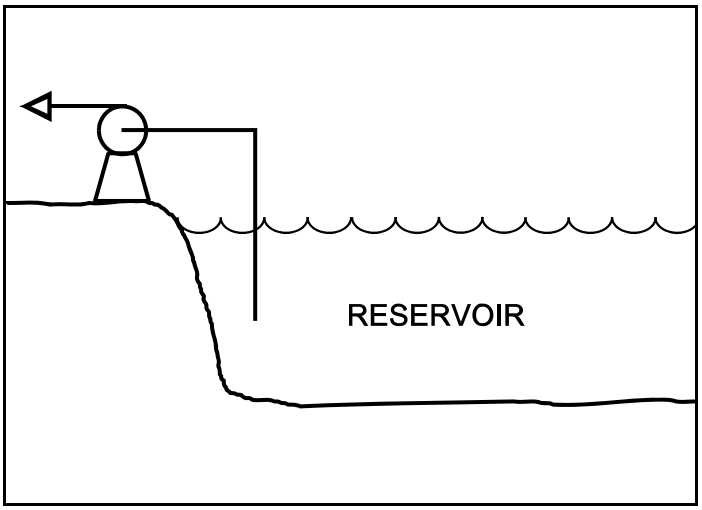
The pump is located on shore, with the eye of the pump 4 feet higher than the reservoir water level. The pump's suction line extends 4 feet below the surface of the reservoir. Which one of the following modifications would increase the pump's available net positive suction head? (Assume the reservoir is at a uniform temperature and ignore any changes in suction line head loss due to friction.)

A. Raise the pump and suction line by 2 feet.

B. Lower the pump and suction line by 2 feet.

C. Lengthen the suction line to take a suction from 2 feet deeper.

D. Shorten the suction line to take a suction from 2 feet shallower.



QUESTION: 13

Which one of the following describes the primary purpose of minimum flow piping for a centrifugal pump?

A. Prevent pump runout during high flow conditions.

B. Prevent vortexing at the pump suction during high flow conditions.

C. Ensure adequate net positive suction head during low flow conditions.

D. Ensure adequate pump cooling during low flow conditions.

QUESTION: 14

A large centrifugal pump is driven by a 200 horsepower 4.16 KV AC motor. The motor breaker control circuit contains the following protection devices: instantaneous overcurrent relay, motor thermal overload relay, control power fuses, and an anti-pumping device.

The pump had been manually started and stopped several times during a 5-minute period when the motor breaker unexpectedly tripped. For this situation, which one of the following is the most likely cause of the breaker trip?

A. Instantaneous overcurrent.

B. Motor thermal overload.

C. Blown control power fuse.

D. Anti-pumping device actuation.

QUESTION: 15

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

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

A malfunction causes the voltage regulator setpoint for generator A to slowly increase continuously toward a maximum of 25 KV. If no operator action is taken, generator B output current will...

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

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

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

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

QUESTION: 16

The rate of heat transfer between two liquids in a heat exchanger will decrease if the... (Assume single-phase conditions and constant specific heat capacities.)

A. inlet temperature of both liquids is decreased by 20°F.

B. inlet temperature of both liquids is increased by 20°F.

C. flow rate of the colder liquid is decreased by 10 percent.

D. flow rate of the hotter liquid is increased by 10 percent.

QUESTION: 17

A nuclear power plant is shut down with core decay heat being removed by the residual heat removal (RHR) system. Assume that only the RHR heat exchangers are removing heat from the reactor vessel (RV), and that the RHR system provides complete thermal mixing in the RV.

Given the following information:

Reactor core rated thermal power:	2,950 MW
Core decay heat rate:	0.5% rated thermal power
RHR system heat removal rate:	5.7×10^7 Btu/hr
RHR and reactor coolant c_p:	1.05 Btu/lbm-°F
Combined RV and RHR inventory:	450,000 lbm

Which one of the following actions will establish a reactor cooldown rate between 20°F/hour and 30°F/hour?

A. Increase RHR heat exchanger flow rate to increase the cooldown rate by 10°F/hour.

B. Increase RHR heat exchanger flow rate to increase the cooldown rate by 20°F/hour.

C. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 10°F/hour.

D. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 20°F/hour.

QUESTION: 18

A nuclear reactor is shut down at 400 psia when all forced core coolant flow is lost. Which one of the following will enhance natural circulation inside the reactor vessel (RV)?

A. Decrease RV pressure to 300 psia.

B. Increase RV pressure to 500 psia.

C. Decrease RV water level to just above the top of the core.

D. Increase RV water level to just above the steam separators.

QUESTION: 19

The demineralization factor of a demineralizer can be expressed as...

A. Inlet Conductivity minus Outlet Conductivity.

B. Outlet Conductivity minus Inlet Conductivity.

C. Inlet Conductivity divided by Outlet Conductivity.

D. Outlet Conductivity divided by Inlet Conductivity.

QUESTION: 20

If water containing positively-charged ionic impurities passes through a mixed-bed ion exchanger, the positively-charged ionic impurities will be removed by the _____ exchange resin, with the corresponding release of _____ ions into the water.

A. anion; negative

B. anion; positive

C. cation; negative

D. cation; positive

QUESTION: 21

Refer to the drawing of a valve motor control circuit 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.

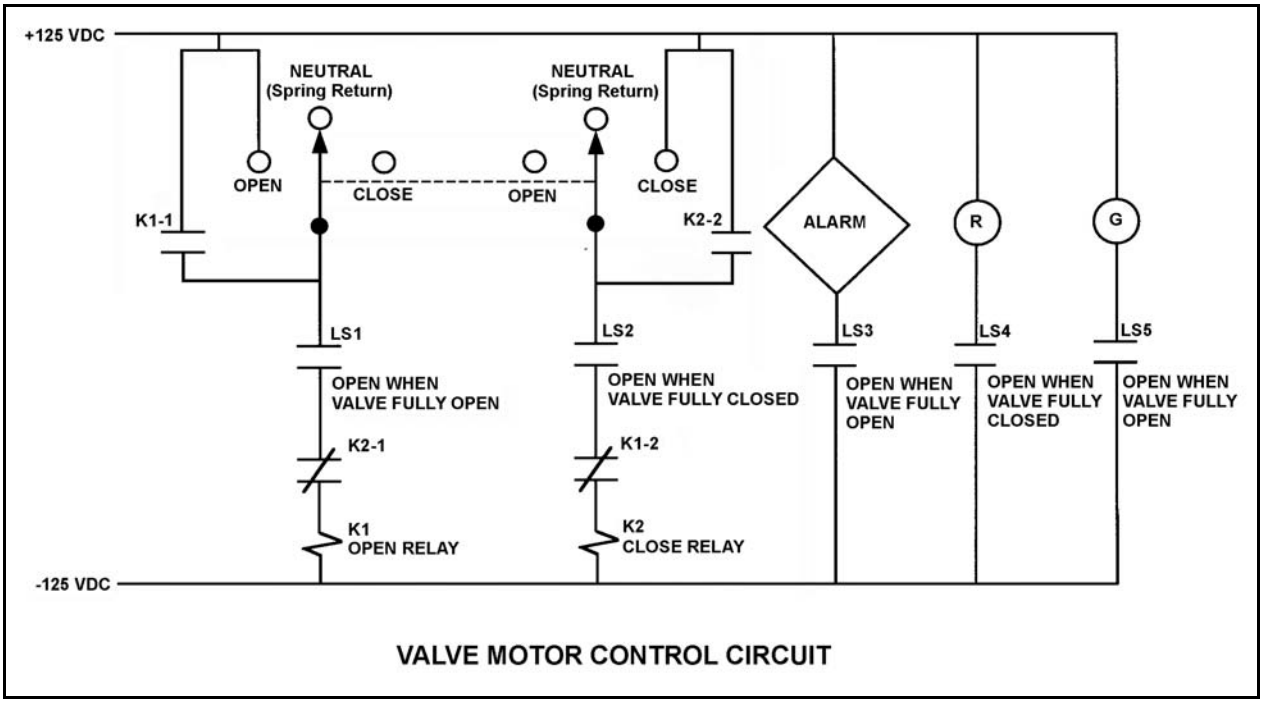
The operator takes the control switch to OPEN momentarily and the valve begins to open. Five seconds later, the operator takes the switch to CLOSE momentarily and then releases the switch. Which one of the following describes the valve response after the switch is released?

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

A main generator is about to be connected to an infinite power grid with the following conditions:

Generator frequency:	59.5 Hz
Grid frequency:	59.8 Hz
Generator voltage:	115.1 KV
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 to the grid but acquire reactive load.

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

QUESTION: 23

Which one of the following is the process that produces the majority of delayed neutrons in an operating reactor?

A. A thermal neutron is absorbed by a fuel nucleus. After a period of time the nucleus fissions and releases a delayed neutron.

B. A thermal neutron is absorbed by a fuel nucleus. The fuel nucleus fissions. During the decay process of the fission products a delayed neutron is emitted.

C. A fast neutron is absorbed by a fuel nucleus. After a period of time the nucleus fissions and releases a delayed neutron.

D. A fast neutron is absorbed by a fuel nucleus. The fuel nucleus fissions. During the decay process of the fission products a delayed neutron is emitted.

QUESTION: 24

A nuclear reactor scrammed from 100 percent steady state power due to an instrument malfunction 16 hours ago. All systems operated normally.

Given the following absolute values of reactivities added since the scram, assign a (+) or (-) as appropriate and choose the current value of core reactivity.

Xenon	= ( ) 1.5% ΔK/K
Fuel temperature	= ( ) 2.5% ΔK/K
Control rods	= ( ) 14.0% ΔK/K
Voids	= ( ) 3.5% ΔK/K

A. -6.5% ΔK/K

B. -9.5% ΔK/K

C. -11.5% ΔK/K

D. -13.5% ΔK/K

QUESTION: 25

Given the following stable initial conditions for a nuclear reactor:

Power level:	1.0×10^{-8} percent
K_{eff} :	0.999
Core $\overline{\beta}_{eff}$:	0.006

What will the stable reactor period be following an addition of positive 0.2 %ΔK/K reactivity to the reactor? (Assume the stable reactor period occurs before the reactor reaches the point of adding heat.)

A. 20 seconds

B. 50 seconds

C. 80 seconds

D. 110 seconds

QUESTION: 26

Under which one of the following conditions is a nuclear reactor core most likely to have a positive moderator temperature coefficient?

A. Low coolant temperature at the beginning of a fuel cycle.

B. Low coolant temperature at the end of a fuel cycle.

C. High coolant temperature at the beginning of a fuel cycle.

D. High coolant temperature at the end of a fuel cycle.

QUESTION: 27

Which one of the following describes how and why the void coefficient of reactivity changes as void fraction increases during a control rod withdrawal at 80 percent power?

A. Becomes less negative due to the increased absorption of neutrons by U-238.

B. Becomes less negative due to a greater fraction of neutrons lost to leakage from the core.

C. Becomes more negative due to the reduction in the fast fission contribution to the neutron population.

D. Becomes more negative due to a greater fractional loss of moderator for a 1 percent void increase at higher void fractions.

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

Which one of the following conditions will cause the associated individual control rod worth(s) to become more negative? (Consider only the direct effect of the indicated changes.)

A. During a small power change, fuel temperature increases.

B. During a small power change, the percentage of voids increases.

C. With the reactor shut down, reactor coolant temperature increases from 100°F to 200°F.

D. During a control pattern adjust, the local thermal neutron flux surrounding a control rod decreases while the core average thermal neutron flux remains the same.

QUESTION: 30

Which one of the following explains why core Xe-135 oscillations are a concern in a nuclear reactor?

A. They can adversely affect core power distribution and they can require operation below full rated power.

B. They can adversely affect core power distribution and they can prevent reactor criticality during a reactor startup.

C. They can cause excessively short reactor periods during power operation and they can require operation below full rated power.

D. They can cause excessively short reactor periods during power operation and they can prevent reactor criticality during a reactor startup.

QUESTION: 31

A nuclear reactor has been operating at 100 percent power for two weeks when power is reduced to 50 percent. During the next 2 hours, what must the operator do to compensate for the change in core Xe-135?

A. The operator must add positive reactivity because Xe-135 is decaying.

B. The operator must add negative reactivity because Xe-135 is decaying.

C. The operator must add positive reactivity because Xe-135 is building in.

D. The operator must add negative reactivity because Xe-135 is building in.

QUESTION: 32

Refer to the curve of K_{eff} versus core age for an operating nuclear reactor (see figure below).

The reactor has been operating at 100 percent power for several weeks and is currently operating between points 2 and 3 on the curve.

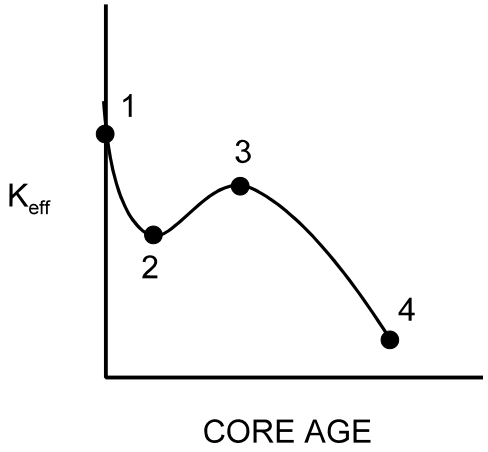
Assuming reactor recirculation flow rate remains the same, what general control rod operation will be necessary to maintain the reactor operating at 100 percent power until point 3 is reached?

A. Withdrawal for the entire period.

B. Withdrawal at first, then insertion.

C. Insertion for the entire period.

D. Insertion at first, then withdrawal.



QUESTION: 33

A refueling outage has just been completed and a reactor startup is being commenced. Which one of the following lists the method(s) used to add positive reactivity during the approach to criticality?

A. Control rods only.

B. Recirculation flow only.

C. Control rods and recirculation flow.

D. Recirculation flow and steaming rate.

QUESTION: 34

Which one of the following will add the most positive reactivity during a power decrease from 100 percent to 65 percent over a 1 hour period? (Assume the power change is performed only by changing core recirculation flow rate.)

A. Fuel temperature change.

B. Moderator temperature change.

C. Fission product poison change.

D. Core void fraction change.

QUESTION: 35

A nuclear power plant is initially operating at 100 percent power with 100 percent core flow rate. Reactor power is reduced to 90 percent by inserting control rods. (Recirculating pump speed remains constant.)

What is the effect of the power reduction on core flow rate?

A. Core flow rate will increase due to a decrease in recirculation ratio.

B. Core flow rate will increase due to a decrease in two-phase flow resistance.

C. Core flow rate will decrease due to an increase in recirculation ratio.

D. Core flow rate will decrease due to an increase in two-phase flow resistance.

QUESTION: 36

A nuclear power plant that has been operating at rated power for two months experiences a reactor scram. Five minutes after the scram, with all control rods still fully inserted, a count rate of 5,000 cps is indicated on the source range nuclear instruments with a reactor period of negative 80 seconds.

The majority of the source range detector output is currently being caused by the interaction of _____ with the detector.

A. intrinsic source neutrons

B. fission gammas from previous power operation

C. fission neutrons from subcritical multiplication

D. delayed fission neutrons from previous power operation

QUESTION: 37

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

The tanks are identical and they are presently at 2 psig overpressure, 60°F, and the same constant water level. They are located within a sealed containment structure that is being maintained at atmospheric pressure. All level detectors have been calibrated and are producing the same level indication.

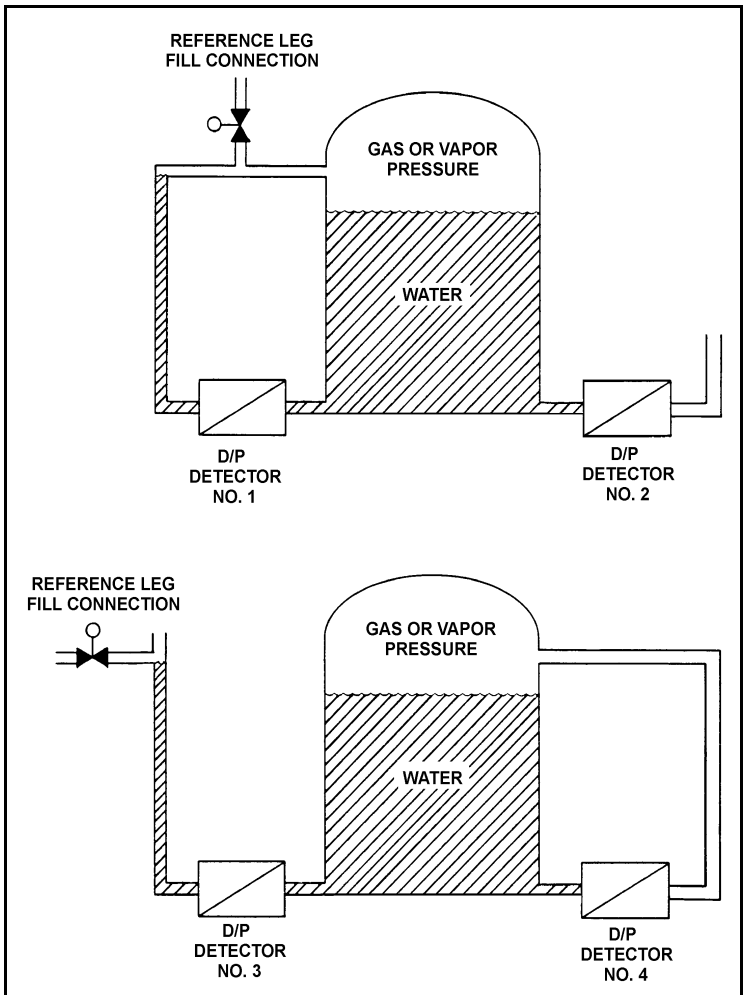
If a ventilation malfunction causes containment structure pressure to decrease to 12 psia, which level detectors will produce the lowest level indication?

A. 1 and 3

B. 2 and 4

C. 1 and 4

D. 2 and 3



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: 1,050 psia
Quality: 100 percent

The main turbine steam chest pressure is 400 psia. Which one of the following describes the steam in the steam chest?

A. Saturated, 96 percent quality

B. Saturated, 98 percent quality

C. Saturated, 100 percent quality

D. Superheated

QUESTION: 39

Refer to the drawing of a steam-jet air ejector (see figure below) in normal operation with supersonic steam velocities.

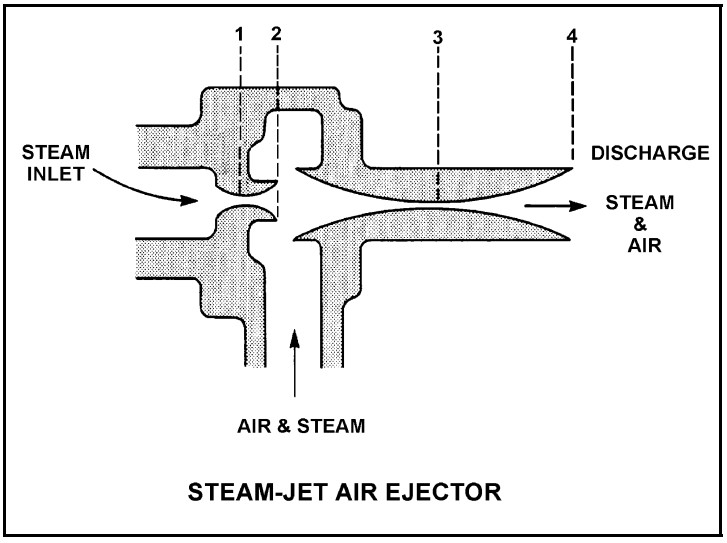
At which one of the following locations is the lowest pressure experienced?

A. 1

B. 2

C. 3

D. 4



QUESTION: 40

The location in a main turbine that experiences the greatest amount of blade erosion is in the _____ stage of the _____ pressure turbine.

A. first; high

B. first; low

C. last; high

D. last; low

QUESTION: 41

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 makeup water pump configurations will supply the highest initial flow rate 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: 42

The following are current parameter values for an operating nuclear power plant:

Reactor vessel (RV) pressure:	1,000 psia
Main feed pump (MFP) discharge pressure:	1,220 psia

If RV pressure does not change, what MFP discharge pressure will increase main feedwater mass flow rate by 10 percent? (Assume MFP inlet temperature remains the same. Also, assume all valves/components that contribute to head loss downstream of the MFP remain in their current configuration.)

A. 1,242 psia

B. 1,266 psia

C. 1,293 psia

D. 1,342 psia

QUESTION: 43

The buildup of fission product gases in a fuel rod causes the thermal conductivity of the fuel pellets to _____ and the thermal conductivity of the fill gas to _____.

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

QUESTION: 44

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

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: 45

Nuclear reactors A and B are identical. Reactor A is operating at 75 percent power and reactor B is operating at 50 percent power with neutron flux radially and axially peaked in the center of each core. Recirculation mass flow rate through each core is the same.

Compared to the center fuel bundle in reactor A, the center fuel bundle in reactor B has the _____ coolant flow rate and the _____ critical power.

A. lower; lower

B. lower; higher

C. higher; lower

D. higher; higher

QUESTION: 46

A nuclear reactor was initially operating at 100 percent power with 100 percent core flow rate. Then, reactor power was decreased and stabilized at 75 percent using only control rods for reactivity control. Core flow rate was maintained at 100 percent.

During the power decrease, core bypass flow rate _____ because core pressure drop _____.

A. increased; decreased

B. increased; increased

C. decreased; decreased

D. decreased; increased

QUESTION: 47

If the linear heat generation rate (LHGR) limiting condition for operation is exceeded, the most probable type of fuel cladding failure is...

A. cracking due to high stress.

B. gross failure due to a lack of cooling.

C. embrittlement due to excessive oxidation.

D. distortion due to inadequate cooling.

QUESTION: 48

During normal power operation a reactor pressure increase causes critical power to _____ because the latent heat of vaporization for the reactor coolant _____.

A. increase; decreases

B. increase; increases

C. decrease; decreases

D. decrease; increases

QUESTION: 49

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

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

QUESTION: 50

Two identical nuclear reactors are currently shut down for refueling. Reactor A has achieved an average lifetime power capacity of 60 percent while operating for 15 years. Reactor B has achieved an average lifetime power capacity of 60 percent while operating for 12 years.

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

A. Reactor A because it has produced more total fissions.

B. Reactor B because it has produced less total fissions.

C. Both reactors will have approximately the same nil ductility transition temperature because they have equal average lifetime power capacities.

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

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

MARCH 2012 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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