UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED 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 pressurized water reactor (PWR) nuclear power plant.

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

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

_____
Applicant's Signature

RULES AND GUIDELINES FOR THE NRC
GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

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

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

2. Fill in 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).

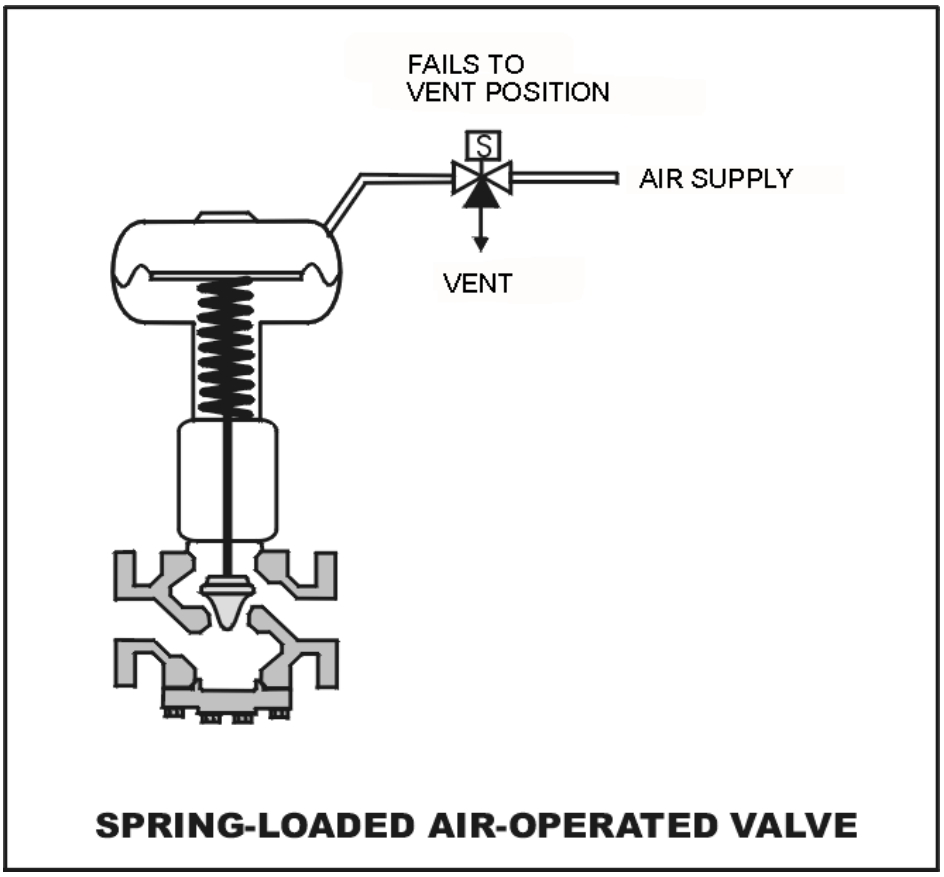
The figure currently depicts normal air supply pressure and an energized solenoid. What will be the valve position following a loss of electrical power to the solenoid?

A. As is

B. More open

C. More closed

D. Varies with system flow



SPRING-LOADED AIR-OPERATED VALVE

QUESTION: 2

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.

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

C. Adjusting the packing overtorqued the valve in the closed direction.

D. The operator overtightened the packing, causing the stem to bind.

QUESTION: 3

Refer to the drawing in which subcooled water is flowing through a convergent-divergent venturi (see figure below). The pipe diameters at P1 and P2 are equal.

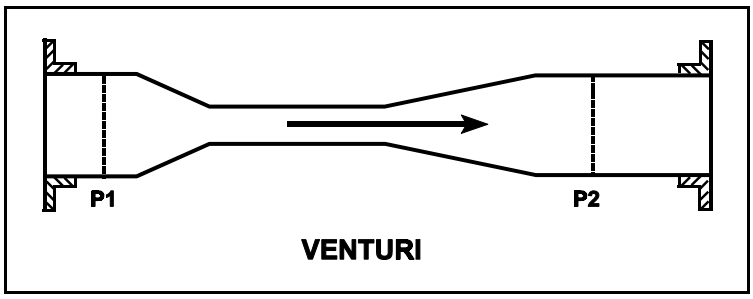
Compared to the conditions at the inlet of the venturi (P1), the pressure at the outlet of the venturi (P2) has _____ and the mass flow rate of the water at the outlet of the venturi has _____. (Assume "real" conditions.)

A. remained the same; remained the same

B. remained the same; decreased slightly

C. decreased slightly; remained the same

D. decreased slightly; decreased slightly



QUESTION: 4

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

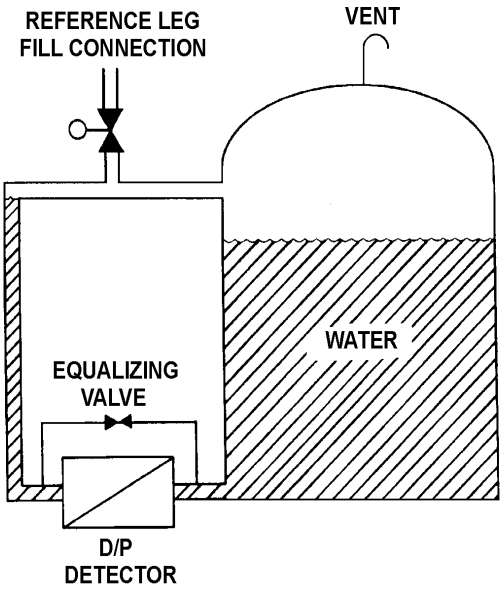
The D/P sensed by the detector varies in the _____ direction as the temperature of the water in the tank if the _____ of the tank water is constant. (Assume reference leg and tank water temperatures are initially the same.)

A. same; level

B. inverse; level

C. same; mass

D. inverse; mass



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

QUESTION: 5

During a nuclear reactor refueling outage, the fuel assemblies were reconfigured to reduce the radial power peak at the center of the core while maintaining the same rated thermal power. Excore power range detectors were calibrated at 50% of rated power just prior to the outage.

How will actual reactor power compare to indicated reactor power when the nuclear power plant is stabilized at 50% power following the outage?

A. Actual reactor power will be higher than indicated reactor power due to increased core neutron leakage.

B. Actual reactor power will be higher than indicated reactor power due to decreased core neutron leakage.

C. Actual reactor power will be lower than indicated reactor power due to decreased core neutron leakage.

D. Actual reactor power will be lower than indicated reactor power due to increased core neutron leakage.

QUESTION: 6

During reactor power operation, a reactor coolant sample is taken and analyzed. Which one of the following lists three radionuclides that are all indicative of a fuel cladding failure if detected in elevated concentrations in the reactor coolant sample?

A. Lithium-6, cobalt-60, and argon-41

B. Iodine-131, cesium-138, and strontium-89

C. Nitrogen-16, xenon-135, and manganese-56

D. Hydrogen-2 (deuterium), hydrogen-3 (tritium), and oxygen-18

QUESTION: 7

The difference between the setpoint in an automatic controller and the steady-state value of the controlled parameter is called...

A. offset.

B. gain.

C. deadband.

D. feedback.

QUESTION: 8

Refer to the drawing of a pressure bistable in an alarm circuit (see figure below).

The orientation of the bistable symbol indicates the characteristics of the bistable, as is normal for a control circuit diagram. The bistable turns on to actuate an alarm at a system pressure of 100 psig. The bistable has a 5 psig dead band, or neutral zone.

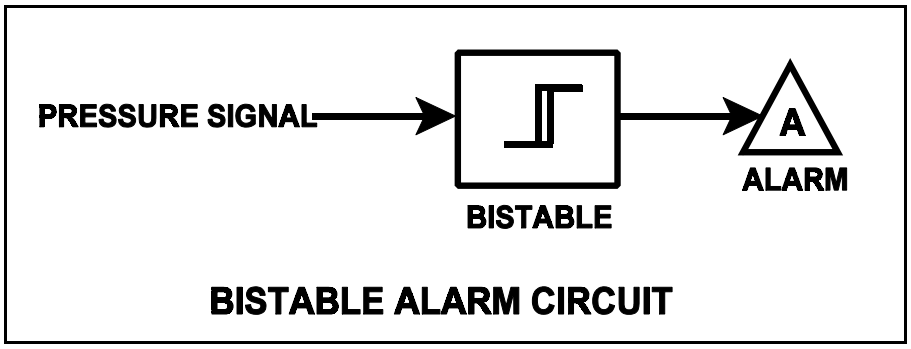
If current system pressure is 90 psig, which one of the following describes the alarm response as system pressure is slowly increased to 110 psig?

A. The alarm is currently actuated and will turn off at 95 psig.

B. The alarm will actuate at 100 psig and will not turn off.

C. The alarm is currently actuated and will turn off at 105 psig.

D. The alarm will actuate at 100 psig and will turn off at 105 psig.



QUESTION: 9

Given the following diesel generator design ratings:

Overspeed trip setpoint:	2,000 rpm
Operating speed, no load:	1,800 rpm
Operating speed, full load:	1,720 rpm

Which one of the following is the speed droop for the diesel generator?

A. 3.6%

B. 3.8%

C. 4.4%

D. 4.6%

QUESTION: 10

Refer to the drawing of a pump with a recirculation line (see figure below).

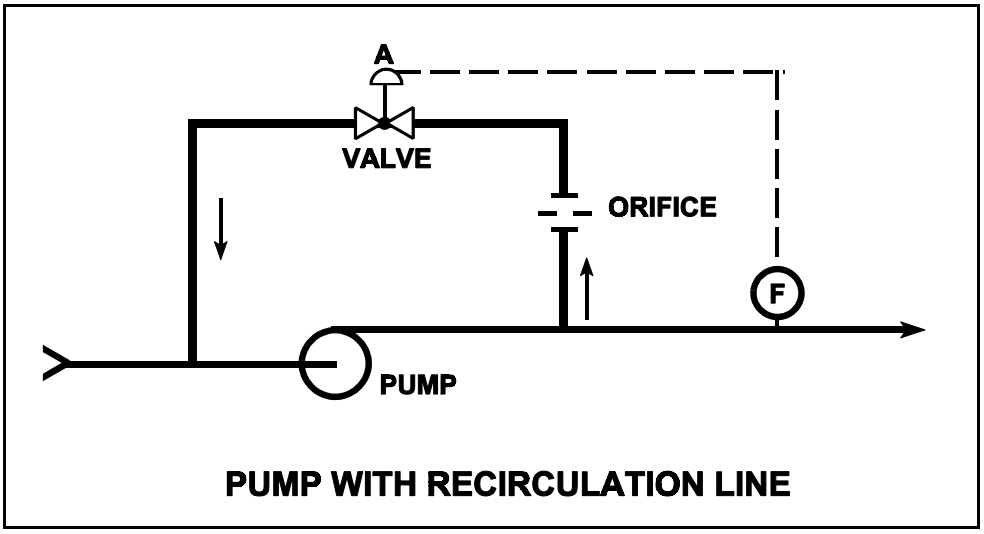
Valve "A" will close when pump...

A. flow rate increases above a setpoint.

B. flow rate decreases below a setpoint.

C. discharge pressure increases above a setpoint.

D. discharge pressure decreases below a setpoint.



PUMP WITH RECIRCULATION LINE

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

Refer to the drawing of a cooling water system and the associated centrifugal pump operating curve (see figure below). Pumps A and B are identical single-speed centrifugal pumps and initially only pump A is operating.

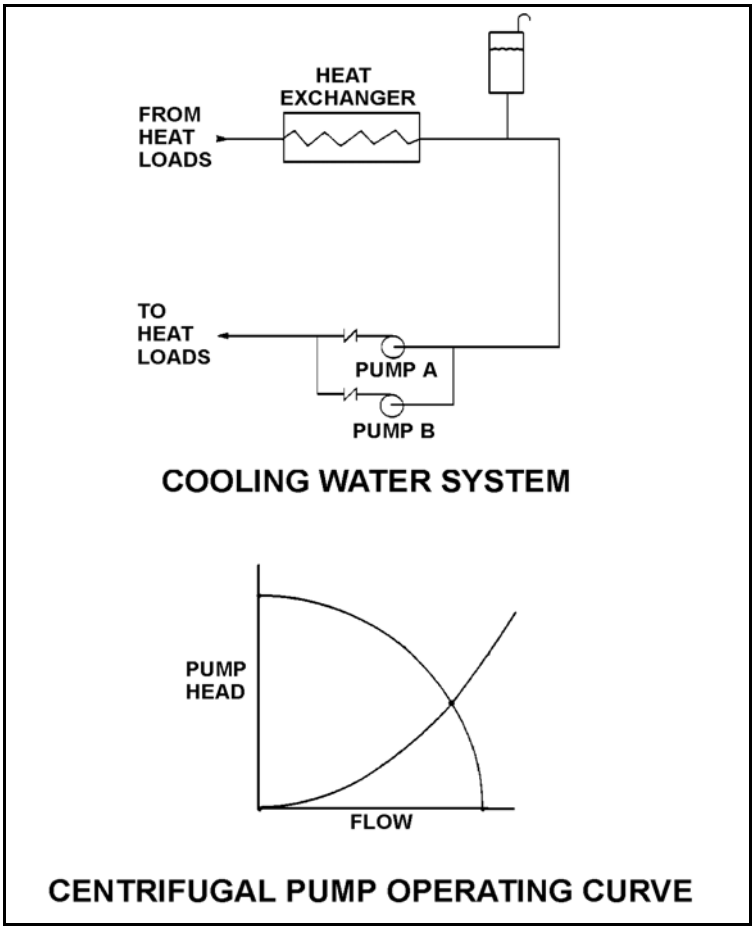
Pump B is then started. After the system stabilizes, system flow rate will be...

A. the same as the initial flow rate.

B. less than twice the initial flow rate.

C. twice the initial flow rate.

D. more than twice the initial flow rate.



QUESTION: 13

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: 14

A nuclear power plant is operating normally at 80% power when a reactor coolant pump (RCP) shaft seizes. Which one of the following indications would not accompany the seized shaft?

A. Reactor coolant system pressure transient.

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

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

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

QUESTION: 15

A 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 (in)
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 an increase in main generator amps? (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

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: 17

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: 18

High differential pressure in a demineralizer could be caused by all of the following except...

A. resin exhaustion.

B. resin overheating.

C. crud buildup.

D. high flow rate.

QUESTION: 19

Which one of the following indicates that a demineralizer receiving 75 gpm of reactor coolant is boron-saturated?

A. The decontamination factor of the demineralizer is less than 1.0.

B. The decontamination factor of the demineralizer is greater than 1.0.

C. Following a reactor coolant temperature increase, demineralizer effluent boron concentration exceeds influent boron concentration.

D. Following a reactor coolant temperature increase, demineralizer influent boron concentration exceeds effluent boron concentration.

QUESTION: 20

Given the following indications for an open 4160 Vac breaker:

All phase overcurrent trip flags are reset.
The control power fuses indicate blown.
The line-side voltmeter indicates 4160 Vac.
The load-side voltmeter indicates 0 volts.

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

A. A ground fault caused an automatic breaker trip.

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

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

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

QUESTION: 21

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

Which one of the following types of neutrons has an average neutron generation lifetime of 12.5 seconds?

A. Prompt

B. Delayed

C. Fast

D. Thermal

QUESTION: 24

With a nuclear power plant operating at 75% power and rod control in Manual, the operator dilutes reactor coolant system (RCS) boron concentration by 5 ppm to adjust RCS temperature. Assuming reactor power does not change, shutdown margin will...

A. increase and stabilize at a higher value.

B. increase, then decrease to the original value as coolant temperature changes.

C. decrease and stabilize at a lower value.

D. decrease, then increase to the original value as coolant temperature changes.

QUESTION: 25

Nuclear reactors A and B are identical except that the reactor cores are at different times in core life. The reactor A effective delayed neutron fraction is 0.007, and the reactor B effective delayed neutron fraction is 0.005. Both reactors are currently subcritical and stable with neutron flux level in the source range.

Given:

Reactor A $K_{eff} = 0.999$
Reactor B $K_{eff} = 0.998$

If positive 0.003 $\Delta K/K$ is suddenly added to each reactor, how will the resulting stable reactor startup rates (SUR) compare? (Consider only the reactor response while power is below the point of adding heat.)

A. Reactor A stable SUR will be higher because it will have the higher positive reactivity in the core.

B. Reactor B stable SUR will be higher because it has the smaller effective delayed neutron fraction.

C. Reactors A and B will have the same stable SUR because both reactors will remain subcritical.

D. Reactors A and B will have the same stable SUR because both reactors received the same amount of positive reactivity.

QUESTION: 26

Refer to the drawing of microscopic cross section for absorption versus neutron energy for a resonance peak in U-238 (see figure below).

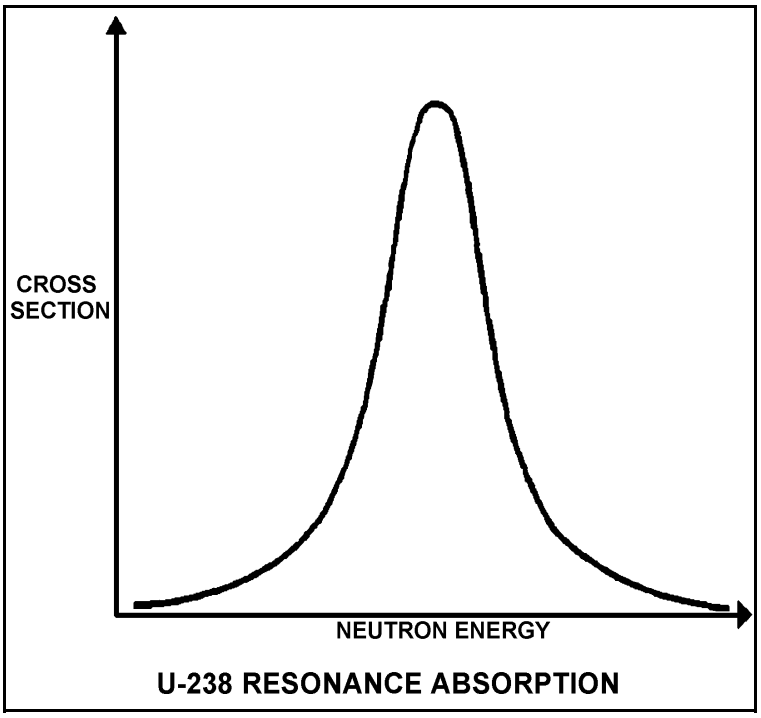
If fuel temperature increases, the area under the curve will _____ and negative reactivity will be added to the core because _____.

A. increase; neutrons of a wider range of energies will be absorbed by U-238

B. increase; more neutrons will be absorbed by U-238 at the resonance neutron energy

C. remain the same; neutrons of a wider range of energies will be absorbed by U-238

D. remain the same; more neutrons will be absorbed by U-238 at the resonance neutron energy



QUESTION: 27

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: 28

A nuclear reactor is operating at steady state 50% power near the end of core life when the operator inserts a group of control rods for 5 seconds. Assume turbine load remains constant and the reactor does <u>not</u> scram/trip.

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

A. at; at

B. at; below

C. below; at

D. below; below

QUESTION: 29

After a control rod is fully inserted (from the fully withdrawn position), the effect on the axial flux shape is minimal. This is because...

A. the differential rod worth is constant along the length of the control rod.

B. the fully inserted control rod is an axially uniform poison.

C. a control rod only has reactivity worth if it is moving.

D. a variable poison distribution exists throughout the length of the control rod.

QUESTION: 30

A fission product poison can be differentiated from all other fission products because a fission product poison...

A. has a higher microscopic cross section for thermal neutron capture.

B. has a longer half-life.

C. is produced in a greater percentage of thermal fissions.

D. is formed as a gas and is contained in the fuel pellets.

QUESTION: 31

A nuclear reactor has been operating at 100% power for two weeks when power is decreased to 10% in 1 hour. Immediately following the power decrease, core xenon-135 concentration will _____ for a period of _____.

A. decrease; 4 to 6 hours

B. increase; 4 to 6 hours

C. decrease; 8 to 11 hours

D. increase; 8 to 11 hours

QUESTION: 32

Which one of the following describes whether reactor power can be increased from 50% to 100% in a controlled manner faster near the beginning of core life (BOL) or near the end of core life (EOL)? (Assume all control rods are fully withdrawn just prior to beginning the power increase.)

A. Faster near EOL due to faster changes in boron concentration

B. Faster near EOL due to greater control rod worth

C. Faster near BOL due to faster changes in boron concentration

D. Faster near BOL due to greater control rod worth

QUESTION: 33

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

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

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

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

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

QUESTION: 34

Which one of the following indicates that a nuclear reactor has achieved criticality during a normal reactor startup?

A. Constant positive startup rate during rod withdrawal

B. Increasing positive startup rate during rod withdrawal

C. Constant positive startup rate with no rod motion

D. Increasing positive startup rate with no rod motion

QUESTION: 35

Refer to the drawing that shows two graphs (see figure below). The axes on each graph have linear scales.

A nuclear reactor is initially critical in the source range. At time = 0 sec, a constant rate addition of positive reactivity commences. Assume reactor power remains below the point of adding heat for the entire time interval shown.

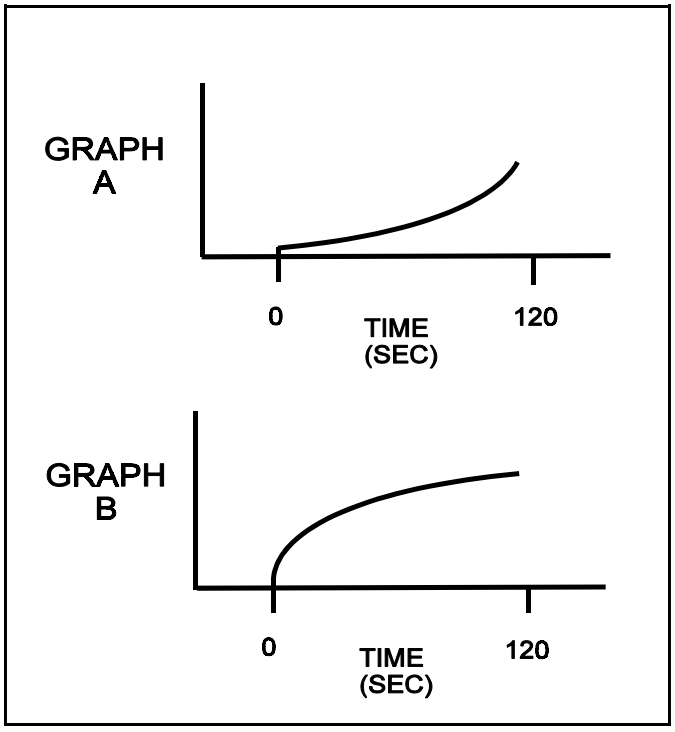
The general response of startup rate to this event is shown on graph _____; and the general response of reactor power to this event is shown on graph _____. (Note: Either graph may be chosen once, twice, or not at all.)

A. A; A

B. A; B

C. B; A

D. B; B



QUESTION: 36

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

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

Which one of the following is arranged from the highest pressure to the lowest pressure?

A. 8 psia, 2 psig, 20 inches Hg absolute

B. 8 psia, 20 inches Hg absolute, 2 psig

C. 2 psig, 8 psia, 20 inches Hg absolute

D. 2 psig, 20 inches Hg absolute, 8 psia

QUESTION: 38

Consider a saturated water/steam mixture at 500°F with a quality of 90%. If the pressure of the mixture is decreased with no heat gain or loss, the temperature of the mixture will _____ and the quality of the mixture will _____. (Assume the mixture remains saturated.)

A. decrease; decrease

B. decrease; increase

C. remain the same; decrease

D. remain the same; increase

QUESTION: 39

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: 40

A nuclear power plant is operating at 80% of rated power with 5°F of condensate depression in the main condenser. If the condensate depression decreases to 2°F, steam cycle efficiency will _____ and the probability of condensate pump cavitation will _____.

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

QUESTION: 41

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

A. operating temperature of the turbine blading has increased.

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

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

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

QUESTION: 42

Cavitation is the formation of vapor bubbles in the _____ of a pump and the subsequent collapse of these bubbles in the pump _____.

A. impeller; casing

B. impeller; discharge piping

C. volute; casing

D. volute; discharge piping

QUESTION: 43

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: 44

Which one of the following describes a heat transfer process in which convection is the most significant heat transfer mechanism?

A. From the reactor fuel to the core barrel during core uncovery

B. Through the tube walls in a steam generator during normal operation at 100% power

C. From the reactor fuel to the steam generators following a loss of all RCPs

D. From the fuel pellet centerline to the fuel clad during normal operation at 100% power

QUESTION: 45

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 45% in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will decrease the steady-state departure from nucleate boiling ratio?

A. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction decreases reactor coolant system pressure by 20 psig with no rod motion.

C. The operator increases reactor coolant boron concentration by 5 ppm with no control rod motion.

D. Core Xe-135 builds up in proportion to the axial and radial power distribution with automatic rod control.

QUESTION: 46

Refer to the drawing of a pool-boiling curve (see figure below).

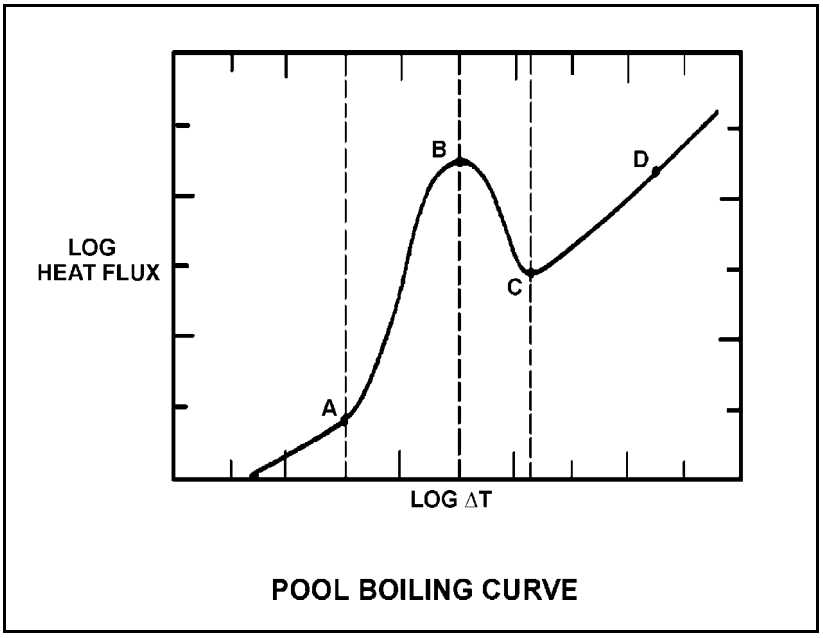
Which one of the points shown marks the lowest ΔT at which stable film boiling can exist?

A. A

B. B

C. C

D. D



QUESTION: 47

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

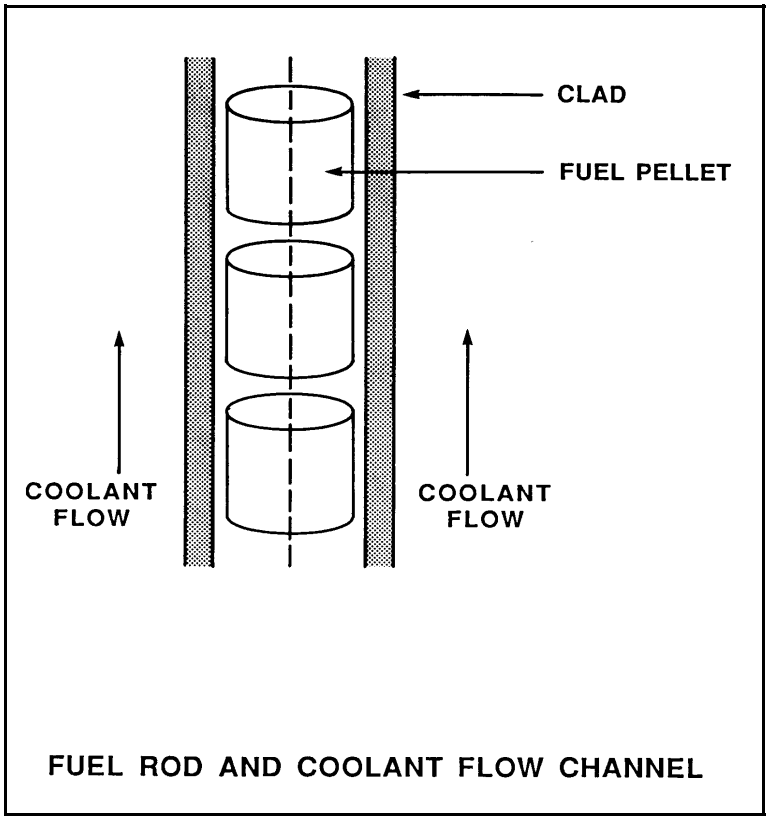
At 100% reactor power, the greatest temperature difference in a fuel channel radial temperature profile will occur across the: (Assume the temperature profile begins at the fuel centerline.)

A. fuel pellet centerline to pellet surface.

B. fuel-to-clad gap.

C. zircaloy cladding.

D. flow channel boundary (laminar) layer.



FUEL ROD AND COOLANT FLOW CHANNEL

QUESTION: 48

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

A. 7.92×10^6 lbm/hour

B. 8.40×10^6 lbm/hour

C. 1.26×10^8 lbm/hour

D. 1.32×10^8 lbm/hour

QUESTION: 49

A nuclear reactor is operating at steady state 80% reactor power with core power distribution peaked both radially and axially in the center of the core. Reactor coolant boron concentration changes are used to maintain a constant T_{ave} and control rod position does not change.

Neglecting any change in reactor poisons, during the next three months the maximum radial peaking factor will _____ and the maximum axial peaking factor will _____.

A. increase; decrease

B. increase; increase

C. decrease; decrease

D. decrease; increase

QUESTION: 50

The thermal stress experienced by the reactor vessel during a reactor coolant system cooldown is...

A. tensile across the entire vessel wall.

B. tensile at the inner wall, compressive at the outer wall of the vessel.

C. compressive across the entire vessel wall.

D. compressive at the inner wall, tensile at the outer wall of the vessel.

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

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

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