UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
MARCH 2011--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 completely full water tank is being hydrostatically tested to 180 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 6 gpm. The tank is protected by two relief valves that discharge to the atmosphere. The relief valves have the following characteristics:

- Relief valve A opening setpoint is 180 psig with an accumulation of 5 percent.
- Relief valve B opening setpoint is 200 psig with an accumulation of 5 percent.
- Each relief valve has linear flow rate characteristics and a maximum flow rate of 4 gpm.

The PDP is inadvertently left running when tank pressure reaches 180 psig.

With the PDP still running, at what pressure will the tank stabilize?

A. 190 psig

B. 195 psig

C. 205 psig

D. 210 psig

QUESTION: 2

Which one of the following statements describes the flow rate characteristics of a typical gate valve in an operating water system?

A. The first 25 percent of valve disk travel in the open direction will produce a smaller change in flow rate than the last 25 percent of valve disk travel.

B. The first 25 percent of valve disk travel in the open direction will produce a greater change in flow rate than the last 25 percent of valve disk travel.

C. The first 25 percent of valve disk travel in the open direction will produce approximately the same change in flow rate as the last 25 percent of valve disk travel.

D. A gate valve that has been opened to 25 percent of valve disk travel will result in approximately 25 percent of full flow rate.

QUESTION: 3

In a comparison of butterfly valves with ball valves, _____ valves are generally more leak tight in high pressure applications; and _____ valves generally exhibit the lower system pressure drop when fully open.

A. ball; ball

B. ball; butterfly

C. butterfly; ball

D. butterfly; butterfly

QUESTION: 4

The flow rate of a fluid passing through a venturi can be determined by measuring the...

A. differential pressure of the fluid as it passes through the venturi.

B. change in the velocity of the fluid as it passes through the venturi.

C. linear displacement of a metering plug installed in the throat of the venturi.

D. rotation of a paddle wheel type device installed in the throat of the venturi.

QUESTION: 5

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

Assume that the initial temperature of the reference leg and the water in the tank is 100°F, and that reference leg temperature does not change.

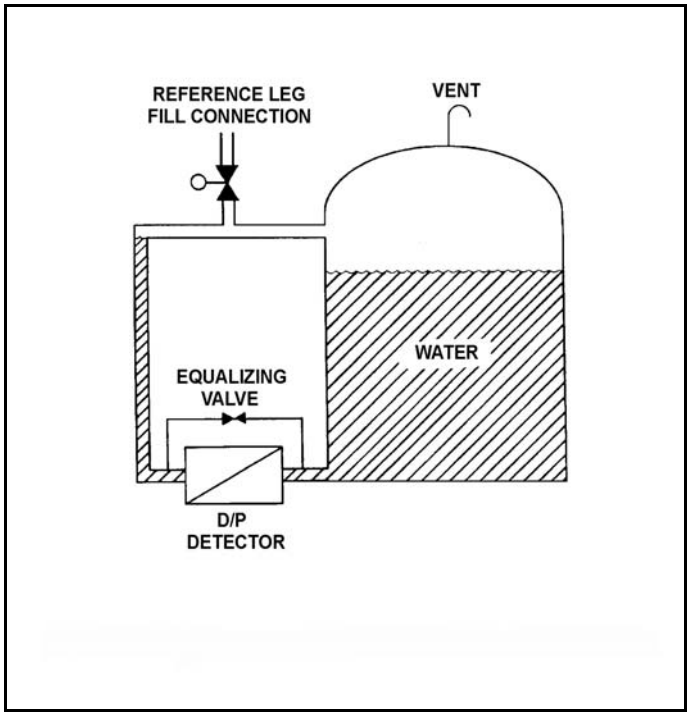
If the temperature of the water in the tank increases by 20°F, the D/P sensed by the detector will _____ if the_____ of the water in the tank is constant.

A. decrease; level

B. decrease; mass

C. remain the same; level

D. remain the same; mass



QUESTION: 6

A centrifugal pump is taking suction from the bottom of a vented cylindrical storage tank that contains 100,000 gallons of water at 60°F. A pressure gauge at the inlet to the pump indicates 40 psig. Over the next several days storage tank temperature increases to 90°F with no change in tank water level and no change in head loss in the pump suction line.

Which one of the following is the current pressure at the inlet to the pump?

A. 31.2 psig

B. 34.6 psig

C. 37.4 psig

D. 39.8 psig

QUESTION: 7

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: 8

Given:

- A reverse-acting proportional controller will be used to maintain level in a water storage tank by positioning an air-operated makeup water flow control valve.
- The controller input varies directly with water level.

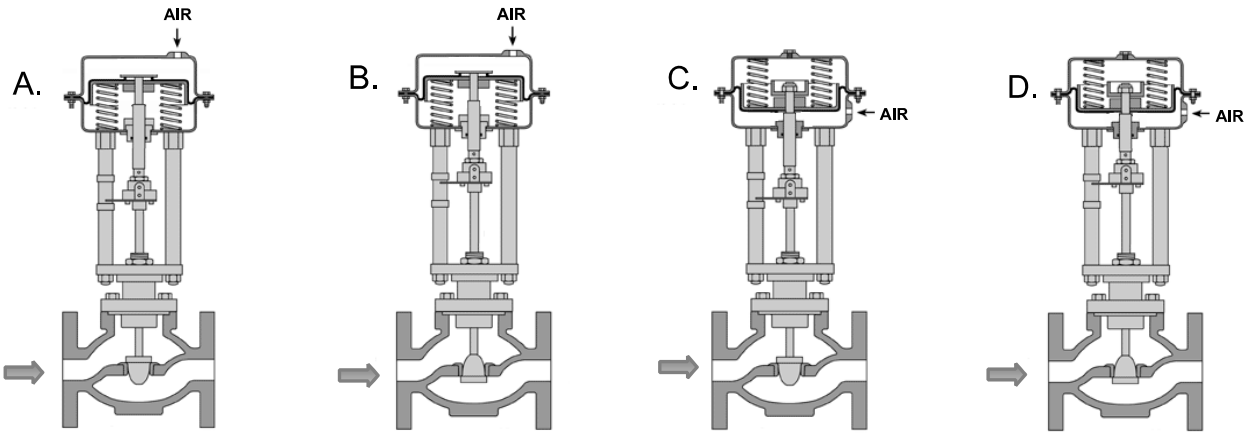
Which of the following flow control valves will be compatible with the controller in this application?

A. A and B

B. B and C

C. C and D

D. D and A



QUESTION: 9

Refer to the drawing of four bistable symbols (see figure below).

A temperature controller uses a bistable that turns on to actuate a warning light when the controlled temperature reaches a low setpoint. The bistable turns off to extinguish the warning light when the temperature increases to 5°F above the low setpoint.

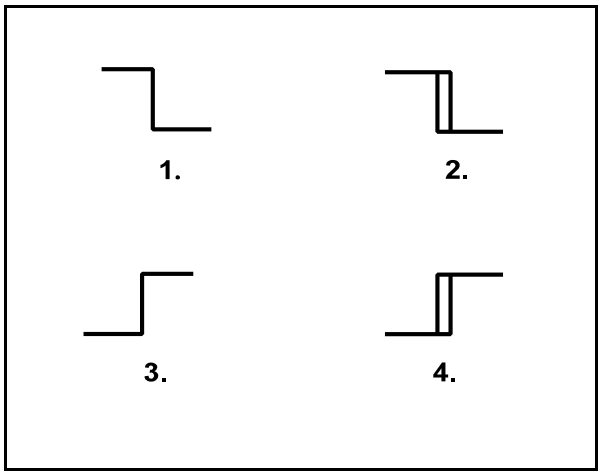
Which one of the following bistable symbols indicates the characteristics of the bistable?

A. 1.

B. 2.

C. 3.

D. 4.



QUESTION: 10

A motor-driven centrifugal pump with no recirculation flow path must be stopped when discharge pressure reaches the pump shutoff head to prevent...

A. overheating of the pump.

B. overheating of the motor.

C. bursting of the pump casing.

D. water hammer in downstream lines.

QUESTION: 11

Refer to the drawing of an elevated centrifugal pump taking suction from the bottom of an open storage tank containing water at 66°F (see figure below). Assume standard atmospheric pressure.

The pump requires 4.0 ft-lbf/lbm of net positive suction head (NPSH). Assume that pump suction head loss is negligible.

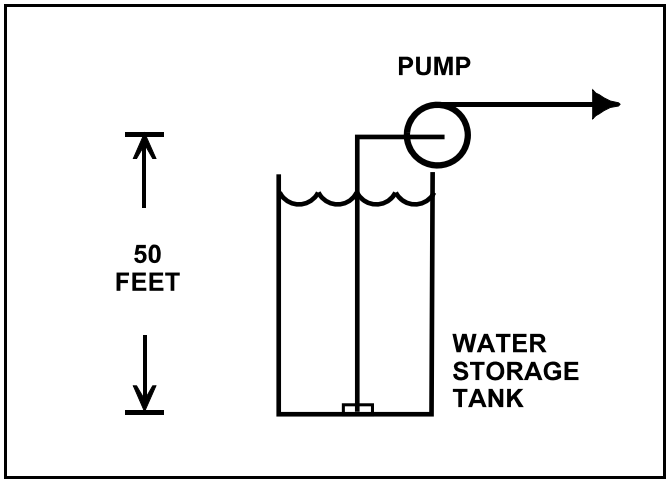
If tank water level is allowed to decrease continuously, at what approximate water level will the pump begin to cavitate?

A. 34 feet

B. 29 feet

C. 21 feet

D. 16 feet



QUESTION: 12

A centrifugal pump is located adjacent to the bottom of an open water storage tank. The pump is taking suction from a river and discharging to the bottom of the tank. Initially the tank was empty and the pump was operating at point B on the drawing below.

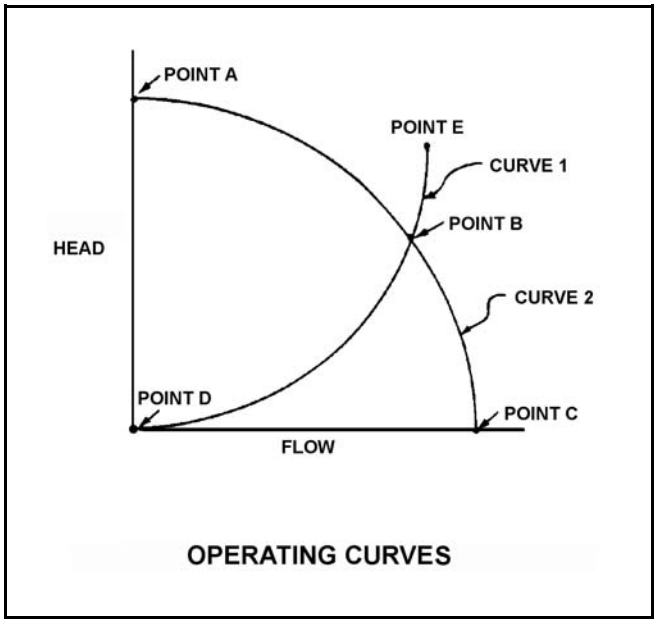
When tank water level reaches 30 feet, the new pump operating point will be located on curve _____, closer to point _____. (Assume that no other changes occur in the system.)

A. 1; D

B. 2; A

C. 1; E

D. 2; C



QUESTION: 13

Which one of the following conditions will result in the greatest increase in volumetric flow rate from a positive displacement pump operating at 300 rpm and a discharge pressure of 100 psig?

A. Increasing pump speed to 700 rpm.

B. Decreasing pump discharge pressure to 30 psig.

C. Starting a second identical positive displacement pump in series with the first.

D. Starting a second identical positive displacement pump in parallel with the first.

QUESTION: 14

A motor-driven centrifugal pump exhibits indications of pump failure while being started in an idle cooling water system. Assuming the pump motor breaker does <u>not</u> trip, which one of the following pairs of indications would be observed if the pump failure is a locked impeller shaft?

A. Lower than normal running current with zero system flow rate.

B. Lower than normal running current with a fraction of normal system flow rate.

C. Excessive duration of peak starting current with zero system flow rate.

D. Excessive duration of peak starting current with a fraction of normal system flow rate.

QUESTION: 15

An ac generator is supplying an isolated electrical system with a power factor of 1.0. 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 the generator power factor remains constant at 1.0.)

A. cube

B. square

C. amount

D. square root

QUESTION: 16

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 of 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:	5.3×10^7 Btu/hr
Reactor coolant c_p:	1.05 Btu/lbm-°F
Combined RV and RHR inventory:	425,000 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: 17

Assuming that condenser cooling water inlet temperature and flow rate do not change, if condenser vacuum improves, condensate temperature will...

A. increase because condensate subcooling has decreased.

B. increase because condenser saturation pressure has increased.

C. decrease because condensate subcooling has increased.

D. decrease because condenser saturation pressure has decreased.

QUESTION: 18

A nuclear power plant is operating normally at 50 percent power. Which one of the following will result from a cooling water tube rupture in the main condenser?

A. Increased condenser vacuum.

B. Increased conductivity of the condensate.

C. Decreased condensate pump available net positive suction head.

D. Decreased condensate pump flow rate.

QUESTION: 19

During a nuclear power plant cooldown, the reactor experiences a large crud burst. After 10 minutes, with stable reactor coolant chemistry parameters, the operators begin to record parameters for the in-service reactor coolant purification ion exchanger. The ion exchanger was recently filled with fresh resin.

Assuming no additional operator actions, what trend will the recorded parameters show during the next few hours?

A. Increasing ion exchanger inlet water conductivity.

B. Increasing ion exchanger outlet water conductivity.

C. Increasing flow rate through the ion exchanger.

D. Increasing radiation levels around the ion exchanger.

QUESTION: 20

A demineralizer that continuously receives flowing water with a high concentration of suspended solids will first develop an increase in the...

A. conductivity at the demineralizer outlet.

B. decontamination factor of the demineralizer.

C. differential pressure across the demineralizer.

D. pH at the demineralizer outlet.

QUESTION: 21

While remotely investigating the condition of a normally-open 480 VAC motor control center (MCC) feeder breaker, an operator observes the following indications:

Green breaker position indicating light is out.
Red breaker position indicating light is lit.
MCC voltmeter indicates 480 VAC.
MCC ammeter indicates zero amperes.

Based on these indications, the operator should report that the feeder breaker is _____ and racked _____.

A. open; in

B. closed; in

C. open; to the test position

D. closed; to the test position

QUESTION: 22

The main generator output breaker is about to be closed to connect the main generator to the power grid via the main transformer. The main transformer voltage and frequency are as follows:

Voltage: 20,000 volts
Frequency: 60.0 Hz

Which combination of main generator voltage and frequency will ensure that the main generator will immediately supply real (MW) and reactive (MVAR) electrical power to the power grid when the main generator output breaker is closed?

A. 19,950 volts; 59.9 Hz

B. 19,950 volts; 60.1 Hz

C. 20,050 volts; 59.9 Hz

D. 20,050 volts; 60.1 Hz

QUESTION: 23

Delayed neutrons are neutrons that...

A. have reached thermal equilibrium with the surrounding medium.

B. are expelled within 10^{-14} seconds of the fission event.

C. are expelled with the lowest average kinetic energy of all fission neutrons.

D. are responsible for the majority of U-235 fissions.

QUESTION: 24

Which one of the following conditions describes a nuclear reactor that is exactly critical?

A. $K_{eff} = 0$; $\Delta K/K = 0$

B. $K_{eff} = 0$; $\Delta K/K = 1$

C. $K_{eff} = 1$; $\Delta K/K = 0$

D. $K_{eff} = 1$; $\Delta K/K = 1$

QUESTION: 25

Reactor power is increased at a constant rate from 50 kW to 370 kW in 2 minutes. What is the approximate doubling time?

A. 42 seconds

B. 60 seconds

C. 86 seconds

D. 120 seconds

QUESTION: 26

During a reactor vessel cooldown, positive reactivity is added to the core if the moderator temperature coefficient is negative. This is partially due to...

A. a decrease in the thermal utilization factor.

B. an increase in the thermal utilization factor.

C. a decrease in the resonance escape probability.

D. an increase in the resonance escape probability.

QUESTION: 27

As fuel temperature increases, the effective resonance absorption peaks exhibited by U-238 will _____ in height and will _____ in width.

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

QUESTION: 28

A control rod, initially at position 06, is withdrawn three notches. After withdrawal, the control rod is classified as a _____ rod; and the blade tip for this control rod is positioned 36 inches from the _____ position.

A. shallow; fully inserted

B. shallow; fully withdrawn

C. deep; fully inserted

D. deep; fully withdrawn

QUESTION: 29

Which one of the following parameters typically has the greatest influence on the shape of a differential rod worth curve?

A. Core radial neutron flux distribution

B. Core axial neutron flux distribution

C. Core xenon distribution

D. Burnable poison distribution

QUESTION: 30

A nuclear reactor has been operating at 100 percent power for two weeks when power is decreased to 10 percent 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: 31

A nuclear reactor had been operating at 50 percent power for two weeks when power was increased to 100 percent over a 3-hour period. To maintain reactor power stable during the next 24 hours, which one of the following incremental control rod manipulations will be required?

A. Insert rods slowly during the entire period.

B. Insert rods slowly at first, then withdraw rods slowly.

C. Withdraw rods slowly during the entire period.

D. Withdraw rods slowly at first, then insert rods slowly.

QUESTION: 32

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

A. control rod; larger

B. burnable poison; larger

C. control rod; smaller

D. burnable poison; smaller

QUESTION: 33

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

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

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

A. negative; above

B. negative; below

C. positive; above

D. positive; below

QUESTION: 34

Nuclear reactors A and B are identical except that reactor A has an effective delayed neutron fraction of 0.007 and reactor B has an effective delayed neutron fraction of 0.006. Both reactors are initially critical at 1.0×10^{-8} percent of rated thermal power when +0.1 %ΔK/K is simultaneously added to both reactors.

Five minutes following the reactivity additions, reactor ____ will be at the higher power level; and reactor ____ will have the shorter period.

A. A; A

B. A; B

C. B; A

D. B; B

QUESTION: 35

After recording critical data during a cold reactor startup with main steam isolation valves open, the operator withdraws the control rods to continue the startup. Which one of the following pairs of parameters will provide the first indications of reaching the point of adding heat?

A. Reactor pressure and reactor water level

B. Reactor power and reactor period

C. Reactor pressure and turbine load

D. Reactor water level and core flow rate

QUESTION: 36

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 caused a rod withdrawal that increased reactivity by 0.14 %ΔK/K.

Given:

- All control rod motion has stopped.
- No automatic system or operator actions occur to inhibit the power increase.
- Power coefficient equals -0.028 %ΔK/K per % power.
- Core effective delayed neutron fraction equals 0.006.

Assuming the reactor does not scram, what is the approximate reactor power level increase required to offset the reactivity added by the control rod withdrawal? (Ignore any reactivity effects from changes in fission product poisons.)

A. 2.0 percent

B. 5.0 percent

C. 20 percent

D. 50 percent

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

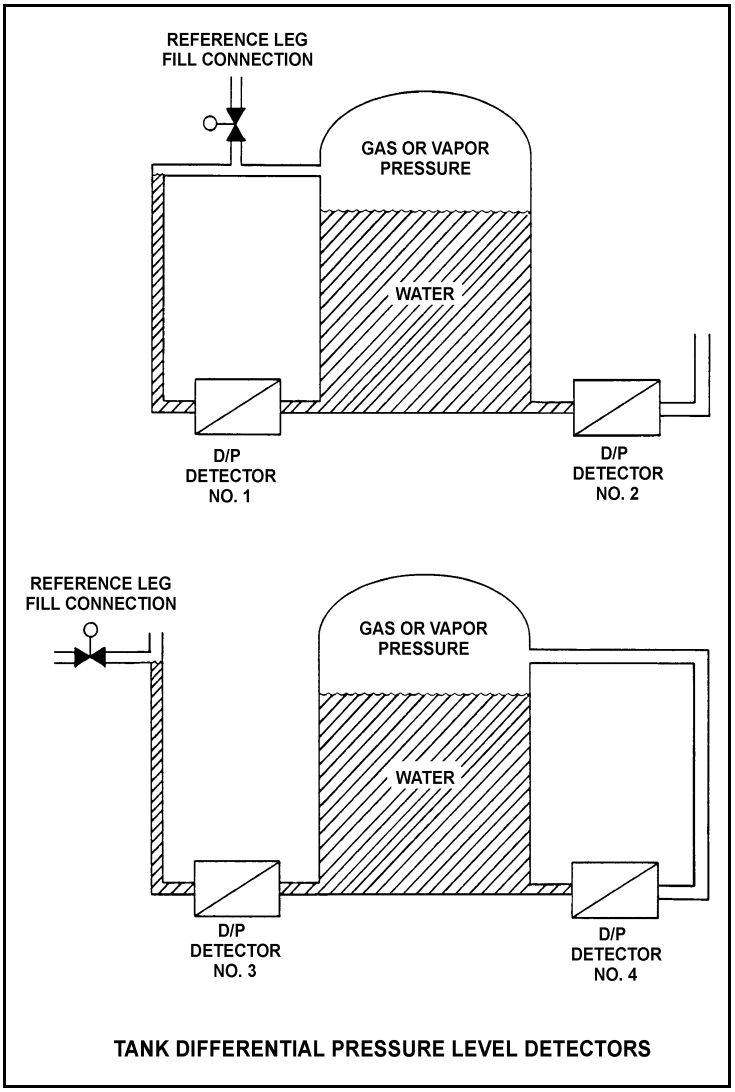
If each detector experiences a ruptured diaphragm, which detector(s) will cause indicated tank level to increase? (Assume actual tank water level remains constant.)

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 saturated vapor exists at 800 psia. If 500 Btu/lbm is removed from this saturated vapor at a constant pressure, the vapor...

A. temperature will decrease.

B. density will decrease.

C. specific volume will decrease.

D. enthalpy will increase.

QUESTION: 39

A nuclear power plant is operating at 100 percent power when the only in-service steam jet air ejector is inadvertently isolated from the main condenser. The operator verifies that condenser cooling water system parameters have not changed. If no operator action is taken over the next 60 minutes, condenser pressure will...

A. slowly decrease.

B. slowly increase and stabilize at a slightly higher pressure.

C. slowly and continuously increase towards atmospheric pressure.

D. remain the same.

QUESTION: 40

A nuclear power plant is operating at 80 percent power with 10°F of condensate subcooling. Which one of the following initially will increase the steam cycle thermal efficiency? (Assume main condenser vacuum does not change unless stated otherwise.)

A. Isolating heating steam to a feedwater heater.

B. Decreasing main condenser cooling water flow rate.

C. Decreasing main condenser cooling water temperature.

D. Decreasing main condenser vacuum (increasing pressure).

QUESTION: 41

Refer to the drawing of two lengths of 16-inch diameter pipe, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing.

Water is flowing at 10,000 gpm through each pipe when both isolation valves instantly close.

Consider two cases:

Case 1: The water temperature upstream of both valves is 65°F.
Case 2: The water temperature is 85°F upstream of valve A, and 65°F upstream of valve B.

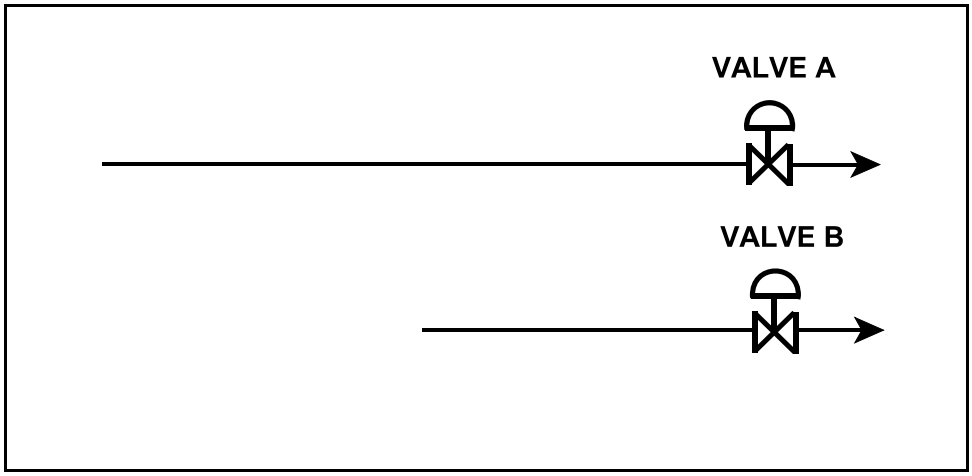
For which case(s), if any, will valve A experience a pressure spike that is greater than the pressure spike at valve B?

A. Case 1 only

B. Case 2 only

C. Both cases

D. Neither case



QUESTION: 42

A centrifugal pump is operating at a constant speed in an open system with the following initial parameters:

Suction pressure:	10 psig
Discharge pressure:	25 psig
Pump flow rate:	500 gpm

If the pump discharge flow control valve is throttled such that the pump discharge pressure increases to 40 psig, the change in pump flow rate is...

A. directly proportional to the square of the change in pump differential pressure.

B. directly proportional to the square root of the change in pump differential pressure.

C. inversely proportional to the square root of the change in pump differential pressure.

D. impossible to determine from the provided information.

QUESTION: 43

The power range nuclear instruments have been adjusted to 100 percent based on a heat balance calculation. Which one of the following will result in indicated reactor power being higher 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 was omitted from the heat balance calculation.

C. The feedwater flow rate used in the heat balance calculation was 10 percent lower than actual feedwater flow rate.

D. The ambient heat loss term was omitted from the heat balance calculation.

QUESTION: 44

Select the statement that describes transition (partial film) boiling.

A. A small increase in ΔT (at the heat transfer and coolant interface) causes increased steam blanketing and a reduction in heat flux.

B. The temperature of the heat transfer surface is so high that thermal radiative heat transfer becomes significant and heat flux increases.

C. As the ΔT increases, the increasing number of bubbles causes increased agitation and turbulence of the boundary layer consequently increasing heat flux.

D. As the ΔT increases a few vapor bubbles are formed that may collapse when they enter into the bulk of the fluid.

QUESTION: 45

A nuclear reactor is operating at steady-state 70 percent power when recirculation flow rate is increased by 5 percent.

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

A. It physically moves upward, because each pound mass of coolant must travel farther through a fuel bundle before vaporizing.

B. It physically moves upward, because each pound mass of coolant enters the core with a larger subcooled margin.

C. It physically moves downward, because each pound mass of coolant will vaporize sooner as it travels through a fuel bundle.

D. It physically moves downward, because each pound mass of coolant enters the core with a smaller subcooled margin.

QUESTION: 46

Given:

- Nuclear reactors A and B are identical except that reactor A has no core orifices while reactor B is equipped with orifices.
- Both reactors always operate with identical recirculation system flow rates.
- Both reactors are currently operating at 80 percent of full power with the thermal neutron flux radially peaked in the center of both cores.

Compared to reactor A, the critical power ratio (CPR) in the central fuel bundles of reactor B is _____; and the average power in the peripheral fuel bundles of reactor B is _____.

A. smaller; smaller

B. smaller; larger

C. larger; smaller

D. larger; larger

QUESTION: 47

Linear heat generation rate is the...

A. ratio of the average power per fuel rod divided by the associated fuel bundle power.

B. ratio of the power produced in a given fuel bundle divided by total core thermal power.

C. sum of the power produced by all fuel rods in a given fuel bundle at a specific planar cross section.

D. sum of the power per unit area for each unit area of the fuel cladding for a unit length of a fuel rod.

QUESTION: 48

Which one of the following describes the fuel-to-coolant thermal conductivity at the end of core life (EOL) as compared to the beginning of core life (BOL)?

A. Smaller at EOL due to fuel pellet densification.

B. Smaller at EOL due to contamination of fill gas with fission product gases.

C. Larger at EOL due to reduction in gap between fuel pellets and clad.

D. Larger at EOL due to greater temperature difference between fuel pellets and coolant.

QUESTION: 49

A nuclear power plant is operating at 90 percent power at the end of core life when a signal error causes the turbine control system to open the turbine control valves an additional 5 percent. Assuming the reactor does <u>not</u> scram, the critical power ratio will initially...

A. increase, because reactor power initially increases.

B. decrease, because reactor power initially decreases.

C. increase, because the reactor coolant latent heat of vaporization initially increases.

D. decrease, because the reactor coolant latent heat of vaporization initially decreases.

QUESTION: 50

A nuclear reactor is shut down for refueling following 18 months of operation at an average power level of 85 percent. During the shutdown, a reactor vessel metal specimen was removed from the reactor vessel for testing. The testing determined that the nil-ductility transition (NDT) temperature of the specimen increased from 42°F to 44°F since the previous refueling shutdown.

Which one of the following conclusions is warranted?

A. The test results are credible and the reactor vessel is more susceptible to brittle fracture now than after the previous refueling shutdown.

B. The test results are credible and the reactor vessel is less susceptible to brittle fracture now than after the previous refueling shutdown.

C. The test results are questionable because the vessel NDT temperature would not increase during the described 18 month period of operation.

D. The test results are questionable because the vessel NDT temperature would increase by at least 10°F during the described 18 month period of operation.

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

MARCH 2011 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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