UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
DECEMBER 2010--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

Subcooled water is flowing through a throttled valve in an open system. The initial steady state conditions for the throttled valve were as follows:

- Inlet pressure = 60 psia
- Outlet pressure = 44 psia
- Flow rate = 800 gpm

After four hours, the current steady state conditions for the throttled valve are as follows:

- Inlet pressure = 63 psia
- Outlet pressure = 54 psia
- Flow rate = 600 gpm

Which one of the following could be responsible for the difference between the initial and current conditions for the throttled valve?

A. The throttled valve was opened farther.

B. The throttled valve was closed farther.

C. Another valve, located upstream of the throttled valve, was partially closed.

D. Another valve, located downstream of the throttled valve, was partially closed.

QUESTION: 2

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

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

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

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

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

QUESTION: 3

When comparing gate valves to globe valves, gate valves...

A. are more effective at throttling flow.

B. are more effective as pressure regulating valves.

C. produce a larger pressure decrease when fully open.

D. require more force to open against large differential pressures.

QUESTION: 4

Which one of the following flow measuring elements produces the largest unrecoverable head loss when used in an operating fluid system?

A. Venturi

B. Flow nozzle

C. Pipe elbow

D. Orifice

QUESTION: 5

A bourdon-tube pressure detector was indicating 50 percent of scale when it was suddenly exposed to a high-pressure transient that caused permanent strain to the bourdon tube. The detector remained intact and actual pressure was restored to its original value.

During the pressure transient, the affected pressure indication initially went off-scale high. After the original pressure was restored, the indication was...

A. unpredictable.

B. less than 50 percent of scale.

C. 50 percent of scale.

D. greater than 50 percent of scale.

QUESTION: 6

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

The water storage tank is 40 feet tall. The level detection system is calibrated to provide a level indication of 30 feet when the tank and reference leg levels are equal.

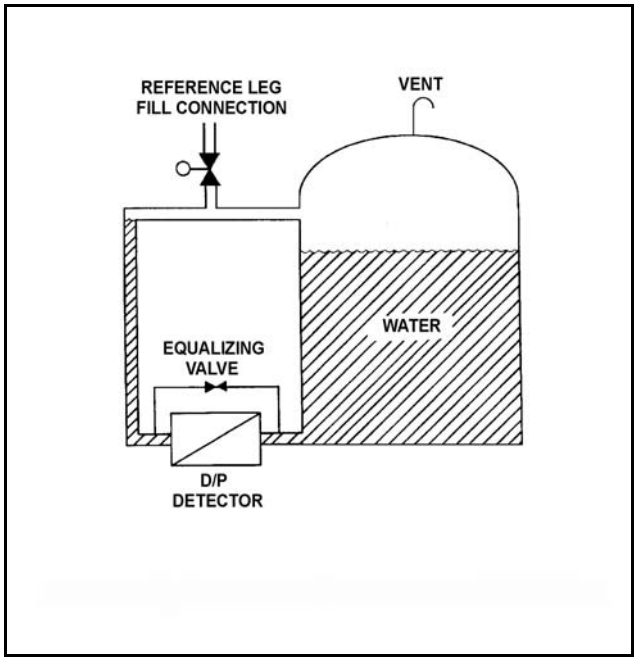
If the tank is completely filled with water, the tank level will indicate...

A. less than 30 feet.

B. 30 feet.

C. greater than 30 feet, but less than 40 feet.

D. 40 feet.



QUESTION: 7

A beta particle and an alpha particle with equal kinetic energies cause ionization in a gas-filled radiation detector. The detector is operating in the ion chamber region of the gas ionization curve. Which one of the following describes the amplitudes of the detector pulses caused by each type of radiation?

A. The beta particle pulse will be larger in amplitude.

B. The alpha particle pulse will be larger in amplitude.

C. The amplitudes of both pulses will be approximately equal for all detector voltages in the ion chamber region.

D. The amplitudes of both pulses will be approximately equal for all detector voltages in the ion chamber region, as well as all detector voltages outside the ion chamber region.

QUESTION: 8

In a proportional controller, the term "offset" refers to the difference between the...

A. control point and setpoint.

B. control point and proportional band.

C. deadband and setpoint.

D. deadband and proportional band.

QUESTION: 9

Refer to the drawing of a lube oil temperature control system (see figure below).

The temperature controller is a direct-acting proportional-integral controller with a gain of 1.0. All system temperatures are initially stable.

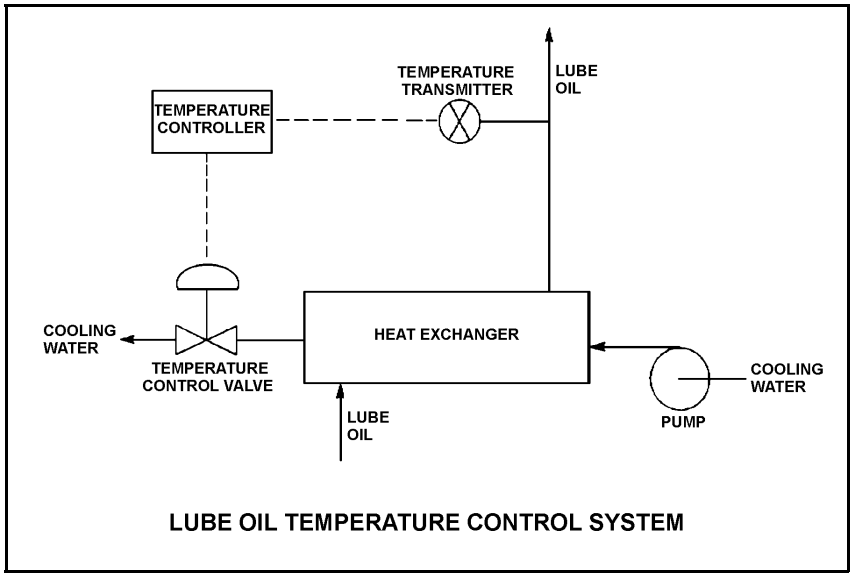
An increase in lube oil temperature causes the controller to open the temperature control valve (TCV) farther. What would be the effect on the TCV response if the controller gain was 2.0 rather than 1.0?

A. The final TCV position would be half as far from its initial position.

B. The final TCV position would be twice as far from its initial position.

C. The final TCV position would be the same, but the TCV initially would travel a greater distance in response to the lube oil temperature change.

D. The final TCV position would be the same, but the TCV initially would travel a shorter distance in response to the lube oil temperature change.



LUBE OIL TEMPERATURE CONTROL SYSTEM

QUESTION: 10

If a centrifugal pump is started with the discharge valve fully open, versus throttled, the possibility of pump runout will _____ and the possibility of pump cavitation will _____.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 11

A motor-driven centrifugal cooling water pump is operating in an open system with its discharge valve fully open. If the discharge valve is repositioned to 50 percent open, the pump's available net positive suction head (NPSH) will _____ and the pump's required NPSH will _____.

A. remain the same; decrease

B. remain the same; remain the same

C. increase; decrease

D. increase; remain the same

QUESTION: 12

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

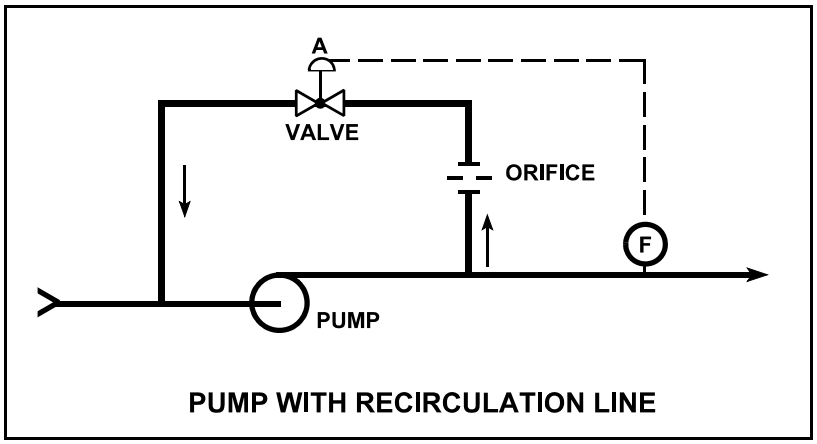
The flow path through valve A is designed to...

A. prevent pump runout by creating a recirculation flow path.

B. provide an adequate pump cooling flow rate during shutoff head conditions.

C. direct a small amount of water to the pump suction to raise available net positive suction head.

D. prevent the discharge piping from exceeding design pressure during no-flow conditions.



PUMP WITH RECIRCULATION LINE

QUESTION: 13

Refer to the drawing of a steam condenser, hotwell, and condensate pump (see figure below).

Given the following:

- The eye of the pump impeller is located 6.0 feet below the bottom of the hotwell.
- The pump requires 10.0 ft-lbf/lbm of net positive suction head (NPSH).
- Condenser pressure is 1.2 psia.
- Hotwell water temperature is 90°F.
- Pump suction head losses are zero.

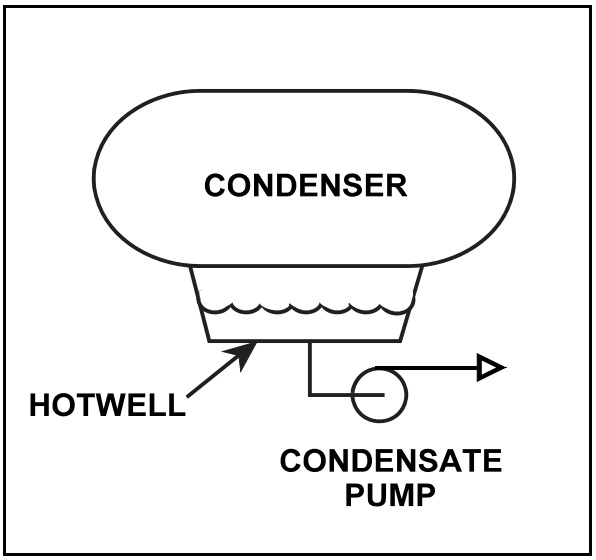
What is the minimum hotwell water level necessary to provide the required NPSH?

A. 1.2 feet

B. 2.8 feet

C. 4.0 feet

D. 5.2 feet



QUESTION: 14

When a motor-driven centrifugal pump was started, the motor ammeter reading immediately increased to, and stabilized at, many times the normal operating value. Which one of the following describes a possible cause for the ammeter response?

A. The pump was started with a fully closed discharge valve.

B. The pump was started with a fully open discharge valve.

C. The pump shaft seized upon start and did not rotate.

D. The pump shaft separated from the motor shaft upon start.

QUESTION: 15

A 4,000 KW diesel generator (DG) and a 1,000 MW turbine generator (TG) at a nuclear power plant are connected to a power grid.

The following stable generator conditions initially exist:

Diesel Generator	Turbine Generator
700 KW	800 MW
200 KVAR (out)	100 MVAR (out)

Then, a malfunction occurs, causing the voltage regulator for the TG to slowly and continuously decrease the TG field excitation current. If no operator action is taken, the DG output current will _____ until a breaker trip separates the generators.

A. increase continuously

B. decrease continuously

C. initially increase, and then decrease

D. initially decrease, and then increase

QUESTION: 16

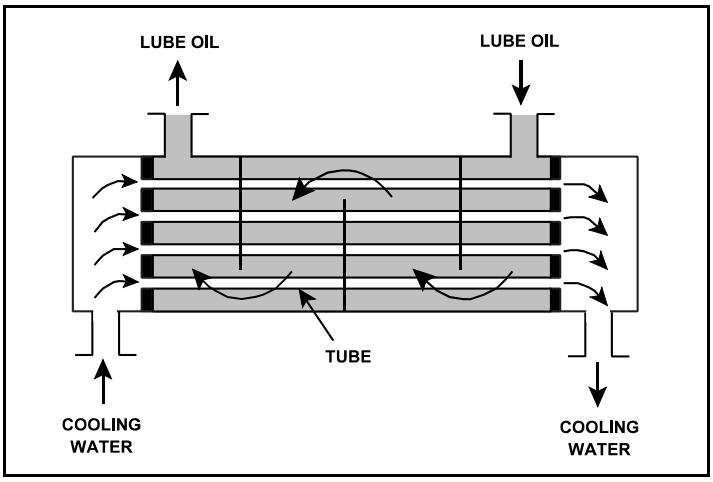
Refer to the drawing of a lube oil heat exchanger (see figure below).

The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 120°F
Cooling water inlet temperature: 60°F

Assuming that cooling water flow rate is greater than lube oil flow rate, which one of the following sets of heat exchanger outlet temperatures is possible? (Neglect any difference between fluid specific heats.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	90°F	100°F
B.	90°F	85°F
C.	95°F	100°F
D.	95°F	85°F



QUESTION: 17

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

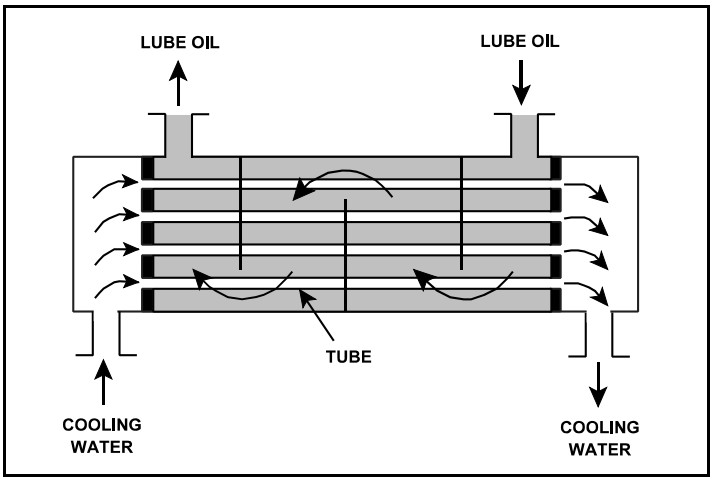
If mineral deposits accumulate on the inside of the cooling water tubes, cooling water outlet temperature will _____ and lube oil outlet temperature will _____. (Assume that the lube oil and cooling water inlet temperatures and flow rates do not change.)

A. increase; decrease

B. increase; increase

C. decrease; decrease

D. decrease; increase



QUESTION: 18

A nuclear power plant was initially operating at steady-state 50 percent power with 50 gpm of main condenser cooling water inleakage through a cooling water tube rupture. Power was then increased, and is currently stable at 60 percent.

Assume that the size of the cooling water tube rupture does not change, and that the main condenser cooling water inlet pressure and inlet temperature do not change.

When compared to the flow rate of main condenser cooling water inleakage at 50 percent power, the flow rate of main condenser cooling water inleakage at 60 percent power is _____ because the main condenser pressure at 60 percent power is _____.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

QUESTION: 19

A condensate demineralizer differential pressure (D/P) gauge indicates 6.0 psid at 50% flow rate. Which one of the following combinations of condensate flow rate and demineralizer D/P observed at various power levels over the next few days indicates an increase in the accumulation of insoluble corrosion products in the demineralizer?

	Condensate Flow Rate	Demineralizer D/P (psid)
A.	100%	23.5
B.	75%	16.5
C.	60%	8.5
D.	25%	1.5

QUESTION: 20

Water containing dissolved sodium (Na^+) and chloride (Cl^-) ionic impurities is passing through an ion exchanger that contains only anion exchange resin. How are the ionic impurities being affected as the water flows through the ion exchanger?

A. The sodium ions are being exchanged, but the chloride ions are unaffected.

B. The chloride ions are being exchanged, but the sodium ions are unaffected.

C. The sodium ions are being exchanged, and the chloride ions are being removed by filtration.

D. The chloride ions are being exchanged, and the sodium ions are being removed by filtration.

QUESTION: 21

Given the following indications for an open 4,160 VAC breaker:

- The local OPEN/CLOSED mechanical flag indicates open.
- A breaker overcurrent trip flag is actuated on one phase.
- The line-side voltmeter indicates 4,160 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. An operator opened the breaker locally.

B. A ground fault caused an automatic breaker trip.

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

D. An operator opened the breaker from a remote location.

QUESTION: 22

A thermal overload device for a large motor protects the motor from...

A. instantaneous overcurrent by opening contacts in the motor windings.

B. instantaneous overcurrent by opening the motor breaker or motor line contacts.

C. sustained overcurrent by opening contacts in the motor windings.

D. sustained overcurrent by opening the motor breaker or motor line contacts.

QUESTION: 23

Which one of the following accounts for the majority of energy transfer from a fission neutron while slowing down in a moderator?

A. Collisions with the nuclei in the moderator.

B. Collisions with the electrons in the moderator.

C. Interactions with the electric fields of the nuclei in the moderator.

D. Interactions with the electric fields of the electrons in the moderator.

QUESTION: 24

When determining the shutdown margin for an operating nuclear reactor, how many control rods are assumed to remain fully withdrawn?

A. A single control rod of the highest reactivity worth.

B. A symmetrical pair of control rods of the highest reactivity worth.

C. A single control rod of average reactivity worth.

D. A symmetrical pair of control rods of average reactivity worth.

QUESTION: 25

A subcritical nuclear reactor has an initial source/startup range count rate of 150 cps with a shutdown reactivity of -2.0% ΔK/K. Approximately how much positive reactivity must be added to establish a stable count rate of 600 cps?

A. 0.5% ΔK/K

B. 1.0% ΔK/K

C. 1.5% ΔK/K

D. 2.0% ΔK/K

QUESTION: 26

Which one of the following describes the net reactivity effect of a moderator temperature increase in an overmoderated nuclear reactor core?

A. Negative reactivity will be added because more neutron leakage will occur.

B. Negative reactivity will be added because more neutrons will be captured by the moderator.

C. Positive reactivity will be added because less neutron leakage will occur.

D. Positive reactivity will be added because fewer neutrons will be captured by the moderator.

QUESTION: 27

If the average temperature of a fuel pellet increases by 50°F, the microscopic cross-section for absorption of neutrons at a resonance energy of U-238 will _____; and the microscopic cross-sections for absorption of neutrons at energies that are slightly higher or lower than a U-238 resonance energy will _____.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 28

As moderator temperature increases, the differential rod worth will become...

A. more negative due to longer neutron migration length.

B. less negative due to reduced moderation of neutrons.

C. more negative due to decreased resonance absorption of neutrons.

D. less negative due to decreased moderator absorption of neutrons.

QUESTION: 29

During nuclear reactor power operations, the axial neutron flux shape is affected most by withdrawal of _____ control rods and the radial neutron flux shape is affected most by withdrawal of _____ control rods.

A. shallow; shallow

B. deep; shallow

C. shallow; deep

D. deep; deep

QUESTION: 30

Following a two-week shutdown, a nuclear reactor is taken critical and ramped to full power in 6 hours. How long will it take to achieve an equilibrium xenon condition after the reactor reaches full power?

A. 70 to 80 hours

B. 40 to 50 hours

C. 8 to 10 hours

D. 1 to 2 hours

QUESTION: 31

A reactor scram recently occurred from steady state 100 percent power and a reactor startup is currently in progress. Which one of the following sets of initial startup conditions will require the most control rod withdrawal to achieve criticality? (BOC = beginning of fuel cycle; EOC = end of fuel cycle.)

	Core Age	Time Since Reactor Scram
A.	BOC	12 hours
B.	BOC	40 hours
C.	EOC	12 hours
D.	EOC	40 hours

QUESTION: 32

Burnable poisons are placed in a nuclear reactor core to...

A. increase the amount of fuel that can be loaded into the core.

B. accommodate control rod depletion that occurs over core life.

C. compensate for the buildup of xenon-135 that occurs over core life.

D. ensure that the reactor will always operate in an undermoderated condition.

QUESTION: 33

A nuclear reactor is currently operating in the source range with a stable period of 90 seconds. The core effective delayed neutron fraction ($\overline{\beta}_{eff}$) is 0.006. How much additional positive reactivity must be added to establish a stable period of 60 seconds?

A. 0.026 %ΔK/K

B. 0.033 %ΔK/K

C. 0.067 %ΔK/K

D. 0.086 %ΔK/K

QUESTION: 34

A nuclear reactor is currently at 10^{-3} percent power with a positive 60 second reactor period. An amount of negative reactivity is added to the core that places the reactor on a negative 40 second reactor period.

If the same amount of positive reactivity is added to the core approximately 5 minutes later, reactor power will...

A. increase and stabilize at the point of adding heat.

B. increase and stabilize at 10^{-3} percent power.

C. continue to decrease on a negative 40 second period until the equilibrium source neutron level is reached.

D. continue to decrease with an unknown period until the equilibrium source neutron level is reached.

QUESTION: 35

A boiling water reactor is undergoing a startup with the reactor coolant initially saturated at 508°F. The main steam isolation valves are closed and reactor criticality has been achieved. The reactor currently has a stable positive 100-second reactor period with reactor power well below the point of adding heat (POAH).

Which one of the following will occur first when reactor power reaches the POAH?

A. Reactor period will shorten.

B. Reactor pressure will increase.

C. Reactor coolant temperature will decrease.

D. Intermediate range power level will decrease.

QUESTION: 36

Which one of the following is the purpose of a rod sequence exchange?

A. Ensures proper rod coupling

B. Prevents rod shadowing

C. Promotes even fuel burnout

D. Minimizes water hole peaking

QUESTION: 37

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

The tanks are identical and 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.

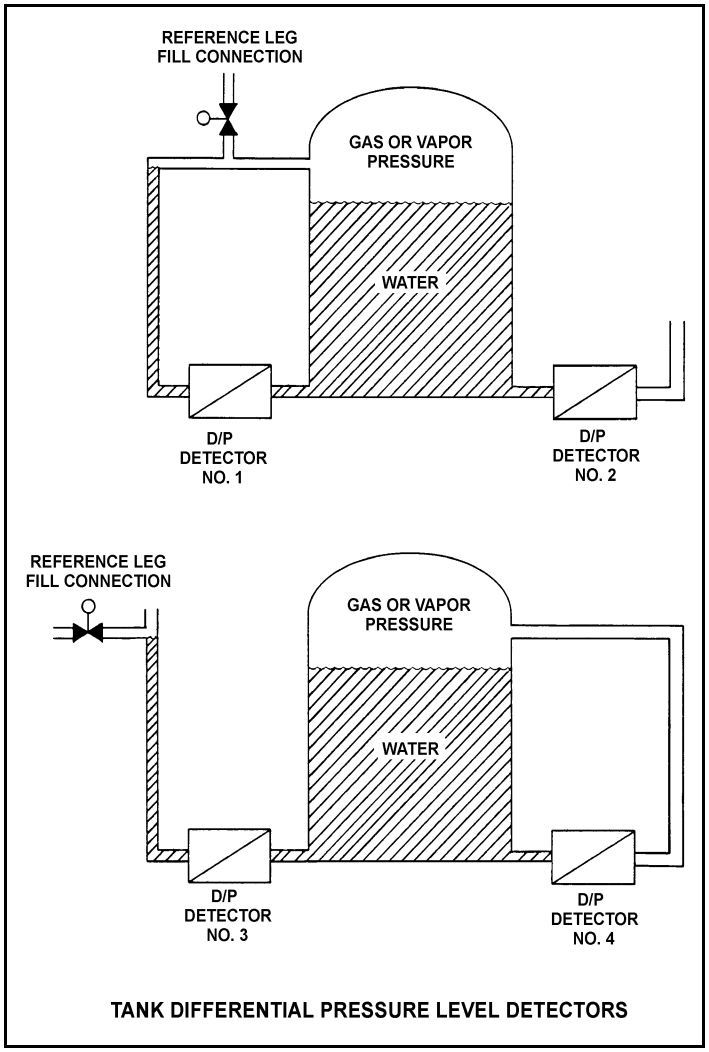
If a ventilation malfunction causes the containment structure pressure to decrease to 13 psia, which level detectors will produce the highest indication?

A. 1 and 2

B. 3 and 4

C. 1 and 4

D. 2 and 3



QUESTION: 38

Saturated steam (100 percent quality) at 240 psia enters an ideal low pressure turbine and exhausts to a steam condenser at 1.0 psia. Compared to the entry conditions, the volumetric flow rate of the steam leaving the LP turbine will be about _____ times larger.

A. 103

B. 132

C. 178

D. 240

QUESTION: 39

A nuclear power plant is operating at 90 percent of rated power. Main condenser pressure is 1.69 psia and hotwell condensate temperature is 120°F.

Which one of the following describes the effect of a 5 percent decrease in cooling water flow rate through the main condenser on overall steam cycle thermal efficiency?

A. Efficiency will increase because condensate depression will decrease.

B. Efficiency will increase because the work output of the main turbine will increase.

C. Efficiency will decrease because condensate depression will increase.

D. Efficiency will decrease because the work output of the main turbine will decrease.

QUESTION: 40

A nuclear power plant is operating steady-state at 85 percent power when the extraction steam to a high-pressure feedwater heater is isolated. Which one of the following describes the initial effect on main turbine-generator output (MWe)? (Assume no operator action and no reactor protection actuation.)

A. MWe increases because plant efficiency increases.

B. MWe decreases because plant efficiency decreases.

C. MWe increases because the total steam flow rate through the turbine increases.

D. MWe decreases because the total steam flow rate through the turbine decreases.

QUESTION: 41

An ideal positive displacement pump is pumping to a system operating at 100 psig. Assume pump speed is constant, zero pump slip, and pump backpressure remains within normal pump operating limits.

If system pressure increases to 200 psig, the pump head will _____; and pump flow rate will _____.

A. increase; remain the same

B. increase; decrease

C. remain the same; remain the same

D. remain the same; decrease

QUESTION: 42

A 55 gpm leak to atmosphere has developed from a cooling water system that is operating at 100 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 50 psig?

A. 27.5 gpm

B. 31.8 gpm

C. 38.9 gpm

D. 43.4 gpm

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. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

QUESTION: 44

Which one of the following conditions must occur to sustain natural convection in a fluid system?

A. Subcooling of the fluid.

B. A phase change in the fluid.

C. An enthalpy change in the fluid.

D. Radiative heat transfer to the fluid.

QUESTION: 45

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

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

A. decreased; increased

B. decreased; decreased

C. increased; increased

D. increased; decreased

QUESTION: 46

Refer to the drawing of a section of pipe with subcooled water flowing through it (see figure below).

Given:

Pressure at P_1 is 30 psig.
Pressure at P_2 is 32 psig.
Pressure change due to change in velocity is 2 psig.
Pressure change due to change in elevation is 2 psig.

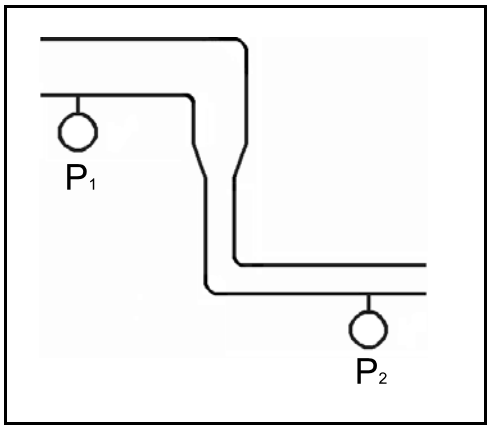
The pressure decrease due to friction head loss between P_1 and P_2 is _____; and the direction of flow is from _____.

A. 2 psig; left to right

B. 2 psig; right to left

C. 6 psig; left to right

D. 6 psig; right to left



QUESTION: 47

Which one of the following is responsible for the clad failure caused by operating the nuclear reactor above the limit for linear heat generation rate?

A. Fission product gas expansion causes clad internal design pressure to be exceeded.

B. Corrosion buildup on the fuel clad surface reduces heat transfer and promotes transition boiling.

C. The zircaloy-steam reaction causes accelerated oxidation of the clad at high temperatures.

D. The difference between thermal expansion rates of the fuel pellets and the clad causes severe clad stress.

QUESTION: 48

Which one of the following adverse conditions is avoided primarily by maintaining the minimum critical power ratio within specified values (limits)?

A. Excessive plastic strain on cladding

B. Excessive cladding creep

C. Excessive decay heat in the fuel

D. Excessive cladding temperatures

QUESTION: 49

Studies of nuclear fuel rod damage revealed that two essential criteria for pellet-clad interaction fuel damage are cladding stress and a chemical embrittling fission product interaction between two chemical agents and the zircaloy cladding.

What are the two chemical agents?

A. Iodine and cadmium

B. Cadmium and bromine

C. Bromine and ruthenium

D. Ruthenium and iodine

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 12 years. Reactor B has achieved an average lifetime power capacity of 60 percent while operating for 15 years.

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

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

B. Reactor B because it has produced more 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 *****

DECEMBER 2010 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY

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