

**UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
DECEMBER 2007--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% is required to pass this portion of the NRC operator licensing written examination. All examination papers will be collected 3.0 hours after the examination starts. This examination applies to a typical boiling water reactor (BWR) nuclear power plant.

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

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

Applicant's Signature

**RULES AND GUIDELINES FOR THE NRC
GENERIC FUNDAMENTALS EXAMINATION**

During the administration of this examination the following rules apply:

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

1. Print your name in the blank provided on the cover sheet of the examination.
2. Fill in your individual docket number.
3. Fill in the name of your facility.
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 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 - 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

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

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

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

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

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

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

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

$$\text{SUR} = 26.06/\tau$$

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

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

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

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

$$\text{DRW} \propto \phi_{\text{tip}}^2 / \phi_{\text{avg}}^2$$

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

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

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

$$\text{CR}_{\text{S/D}} = S/(1 - K_{\text{eff}})$$

$$\text{CR}_1(1 - K_{\text{eff}1}) = \text{CR}_2(1 - K_{\text{eff}2})$$

$$1/M = \text{CR}_1/\text{CR}_x$$

$$A = \pi r^2$$

$$F = PA$$

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

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

$$E = IR$$

$$\text{Thermal Efficiency} = \text{Net Work Out/Energy In}$$

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

$$g_c = 32.2 \text{ lbm-ft/lbf-sec}^2$$

CONVERSIONS

$$1 \text{ Mw} = 3.41 \times 10^6 \text{ Btu/hr}$$

$$1 \text{ hp} = 2.54 \times 10^3 \text{ Btu/hr}$$

$$1 \text{ Btu} = 778 \text{ ft-lbf}$$

$$^\circ\text{C} = (5/9)(^\circ\text{F} - 32)$$

$$^\circ\text{F} = (9/5)(^\circ\text{C}) + 32$$

$$1 \text{ Curie} = 3.7 \times 10^{10} \text{ dps}$$

$$1 \text{ kg} = 2.21 \text{ lbm}$$

$$1 \text{ gal}_{\text{water}} = 8.35 \text{ lbm}$$

$$1 \text{ ft}^3_{\text{water}} = 7.48 \text{ gal}$$

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QUESTION: 1

A vertical safety valve has a compressed spring assembly that is applying 1,200 lbf to the top of the valve disk in opposition to system pressure. System pressure is being exerted on the underside of the valve disk that is 3 inches in diameter.

Which one of the following is the approximate system pressure at which the safety valve will open? (Ignore any effects from atmospheric pressure.)

- A. 44 psi
- B. 64 psi
- C. 128 psi
- D. 170 psi

QUESTION: 2

Water storage tanks A and B are identical except that tank A receives overpressure protection from an installed relief valve, whereas tank B has an installed safety valve. The relief valve and safety valve have the same pressure setpoint and design flow rate.

Water is continuously added to each tank at the same rate (50% of the design flow rate of the relief/safety valve). After the tanks are completely full, tank A pressure will _____; and tank B pressure will _____.

- A. stabilize slightly above the pressure setpoint; stabilize slightly above the pressure setpoint
- B. stabilize slightly above the pressure setpoint; fluctuate within a few percent of the pressure setpoint
- C. fluctuate within a few percent of the pressure setpoint; stabilize slightly above the pressure setpoint
- D. fluctuate within a few percent of the pressure setpoint; fluctuate within a few percent of the pressure setpoint

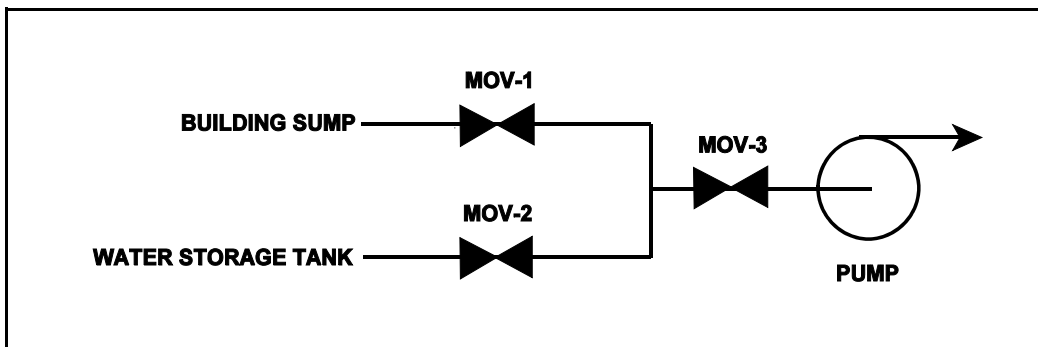
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QUESTION: 3

Refer to the drawing of a water supply pump with two suction sources (see figure below). All motor-operated valves (MOVs) are currently closed.

Which one of the following MOV interlocks will permit the pump to take a suction on either the building sump or the water storage tank, while preventing the two sources from being cross-connected?

- A. Neither MOV-1 nor MOV-2 can be opened unless MOV-3 is fully closed.
- B. None of the MOVs can be opened unless at least one MOV remains fully closed.
- C. None of the MOVs can be opened unless at least two MOVs remain fully closed.
- D. Neither MOV-1 nor MOV-2 can be opened unless the other source MOV is fully closed.



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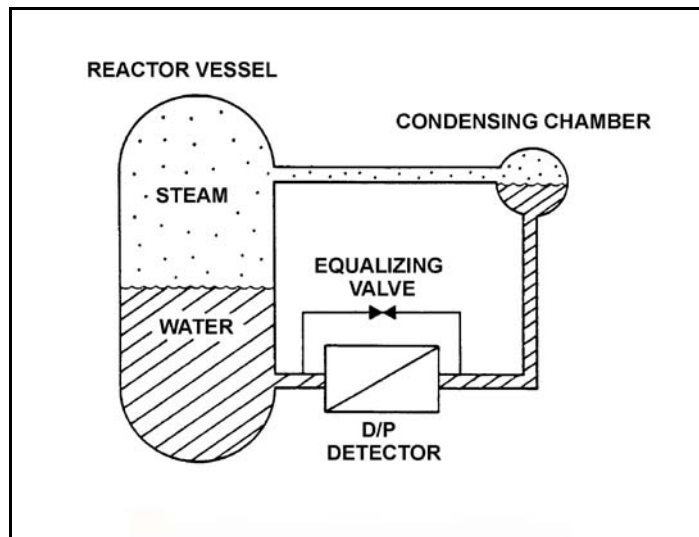
QUESTION: 4

Refer to the drawing of a reactor vessel level detection system (see figure below). The differential pressure (D/P) detector was calibrated while the plant was at normal operating conditions.

With the plant initially at normal operating conditions, a reactor vessel head leak occurred. Reactor vessel pressure decreased by 300 psia, and the ambient air temperature surrounding the reference leg increased by 80°F, where these parameters stabilized.

If the actual reactor vessel water level is 6 feet above the fuel, the reduced reactor vessel pressure will tend to make the indicated reactor vessel level read _____ than actual; and the increased reference leg temperature will tend to make the indicated reactor vessel level read _____ than actual.

- A. higher; higher
- B. higher; lower
- C. lower; higher
- D. lower; lower



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QUESTION: 5

What is the most common type of sensor used to provide remote position indication of a valve that is normally either fully open or fully closed?

- A. Limit switch
- B. Reed switch
- C. Servo transmitter
- D. Linear variable differential transformer

QUESTION: 6

Fission chamber detectors are used to monitor reactor power/neutron level in a shutdown reactor as well as a reactor operating at full power (and all power levels in between). At what power level(s) is it necessary to compensate the output of the fission chamber detectors for gamma interactions with the detectors and why?

- A. At all power levels, because gamma interactions produce larger detector pulses than neutron interactions.
- B. At all power levels, because gamma interactions produce smaller detector pulses than neutron interactions.
- C. Only when shutdown or at low power levels, because gamma flux is not proportional to reactor power at low power levels.
- D. Only when operating at high power levels, because gamma flux is not proportional to reactor power at high power levels.

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QUESTION: 7

Which one of the following describes a characteristic of a self-reading pocket dosimeter (SRPD)?

- A. The output of an SRPD is a dose rate in mR/hr.
- B. SRPDs are primarily sensitive to beta radiation.
- C. SRPD readings must be considered inaccurate when they are dropped.
- D. SRPDs hold their charge indefinitely when removed from a radiation field.

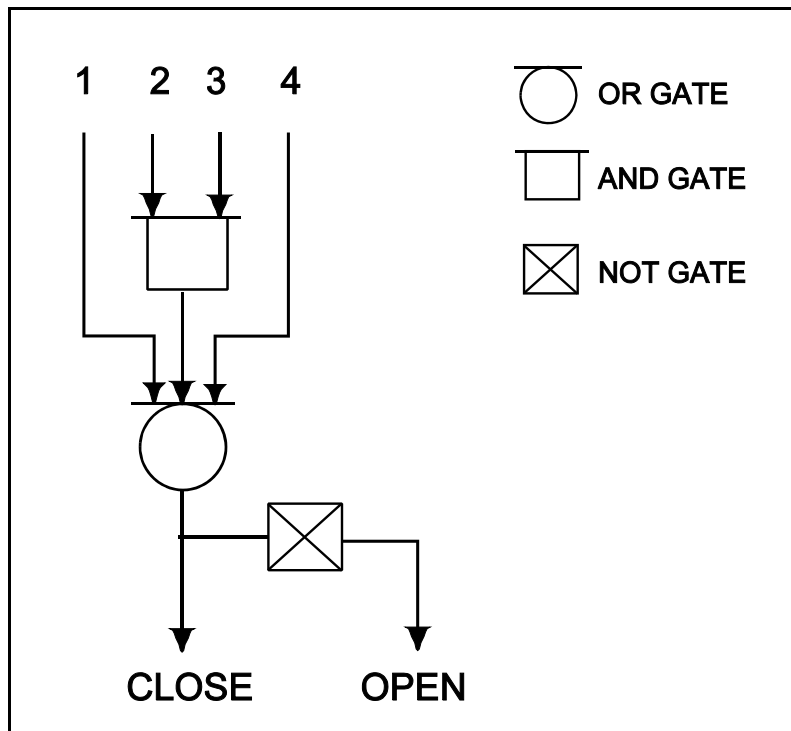
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QUESTION: 8

Refer to the valve controller logic diagram (see figure below).

Which one of the following combinations of inputs will result in the valve receiving an open signal?

	INPUTS			
	1.	2.	3.	4.
A.	On	Off	On	On
B.	Off	On	Off	Off
C.	On	Off	Off	On
D.	Off	On	On	Off



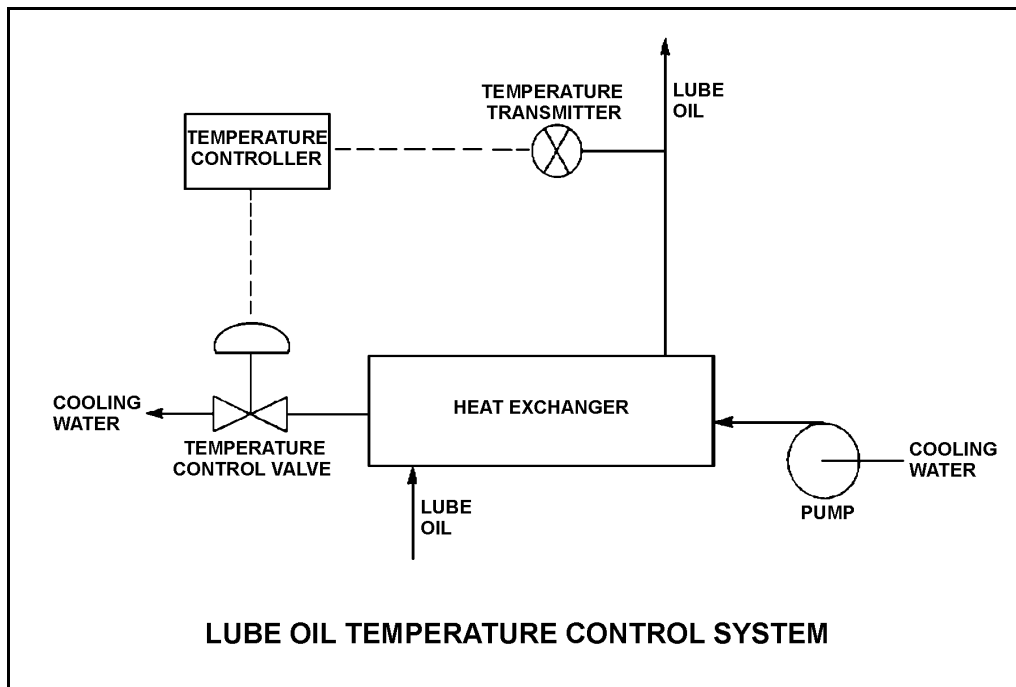
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QUESTION: 9

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

The temperature controller is a direct-acting proportional controller with a gain of 1.0. Which one of the following describes the effect of changing the gain to 2.0?

- A. Half the temperature deviation from setpoint will produce a given controller output.
- B. Twice the temperature deviation from setpoint will produce a given controller output.
- C. The temperature control valve will move half as far for a given change in controller output.
- D. The temperature control valve will move twice as far for a given change in controller output.



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QUESTION: 10

Many large centrifugal pumps are interlocked so that the pump will not start unless its discharge valve is at least 90% closed. This interlock is provided to minimize the...

- A. duration of the pump motor starting current.
- B. required net positive suction head.
- C. loading on the pump thrust bearing.
- D. pump discharge pressure.

QUESTION: 11

A single-speed centrifugal pump is needed to supply river water to a storage facility. The pump must be capable of providing a very high flow rate at a low discharge pressure. Which one of the following types of centrifugal pumps is best suited for this application?

- A. Single-stage, axial flow
- B. Single-stage, radial flow
- C. Multiple-stage, axial flow
- D. Multiple-stage, radial flow

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QUESTION: 12

A motor-driven centrifugal pump is operating in a closed-loop cooling water system and is unable to achieve its rated volumetric flow rate due to cavitation. Which one of the following will enable the pump to achieve a higher volumetric flow rate before cavitation occurs?

- A. Operate the system at a higher pressure.
- B. Operate the system at a higher temperature.
- C. Remove the existing pump motor and install a motor with a higher horsepower rating.
- D. Remove the existing pump and install a same-capacity pump with a higher minimum required net positive suction head rating.

QUESTION: 13

Which one of the following conditions will result in the greatest increase in volumetric flow rate in a water system with one positive displacement pump operating at 400 rpm and a discharge pressure of 100 psig?

- A. Increasing pump speed to 700 rpm
- B. Decreasing pump discharge pressure to 40 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

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QUESTION: 14

A 120 Vdc battery is rated at 800 amp-hours for a continuous 50 kW load. Approximately how long will the fully charged battery be able to supply a continuous 50 kW load before the battery rating is exceeded?

- A. 115 minutes
- B. 90 minutes
- C. 75 minutes
- D. 60 minutes

QUESTION: 15

A main generator is connected to an infinite power grid. Which one of the following pairs of main generator output parameters places the generator in the closest proximity to slipping a pole.

- A. 800 MW; 200 MVAR (in)
- B. 800 MW; 600 MVAR (in)
- C. 400 MW; 200 MVAR (out)
- D. 400 MW; 600 MVAR (out)

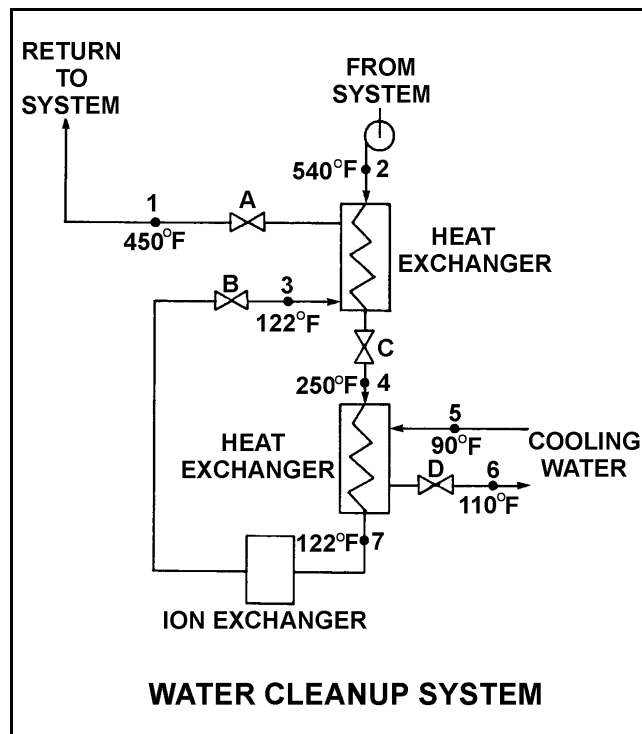
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QUESTION: 16

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

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

- A. A; shut
- B. B; shut
- C. C; open
- D. D; open



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QUESTION: 17

Which one of the following effects will occur as a result of multiple tube failures (leaks) in the main condenser with the plant at 50% power? (Assume condenser vacuum does not change.)

- A. Condensate depression will decrease.
- B. Condensate conductivity will increase.
- C. Condensate oxygen concentration will decrease.
- D. Condenser inlet cooling water flow rate will decrease.

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QUESTION: 18

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

The heat exchanger was operating with the following initial parameters:

Cooling water inlet temperature (T_{cw-in}) = 71 °F
Cooling water outlet temperature (T_{cw-out}) = 91 °F
Oil inlet temperature (T_{oil-in}) = 175 °F
Oil outlet temperature ($T_{oil-out}$) = 125 °F

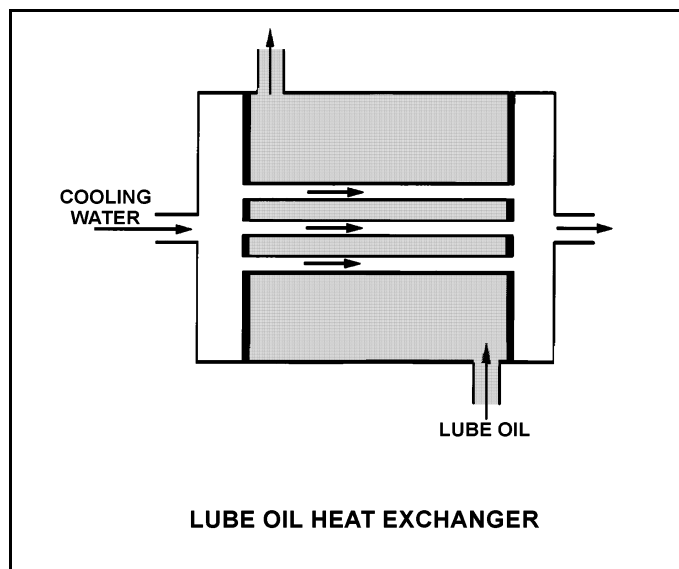
The heat exchanger was vented, resulting in the following current parameters:

Cooling water inlet temperature (T_{cw-in}) = 71 °F
Cooling water outlet temperature (T_{cw-out}) = 95 °F
Oil inlet temperature (T_{oil-in}) = 175 °F
Oil outlet temperature ($T_{oil-out}$) = ?

Assume that the mass flow rates and specific heats of both fluids were unchanged.

Which one of the following is the current lube oil outlet temperature ($T_{oil-out}$)?

- A. 115 °F
- B. 120 °F
- C. 130 °F
- D. 135 °F



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QUESTION: 19

Water is passing through an ion exchanger that contains only anion exchange resin. Currently, every available ion exchange site in the resin has exchanged its original anion and is occupied by a chloride (Cl⁻) anion. Assuming that water temperature does not change, what will be the effect on the ion exchanger if a new anion impurity is introduced into the water entering the ion exchanger?

- A. The new anions will bypass the occupied ion exchange sites under all circumstances.
- B. The new anions will take the place of the Cl⁻ anions on the ion exchange sites under all circumstances.
- C. The new anions will take the place of the Cl⁻ anions on the ion exchange sites only if the new anions have a greater negative charge than the Cl⁻ anions.
- D. The new anions will take the place of the Cl⁻ anions on the ion exchange sites only if the new anions have a greater affinity for the anion exchange resin.

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.

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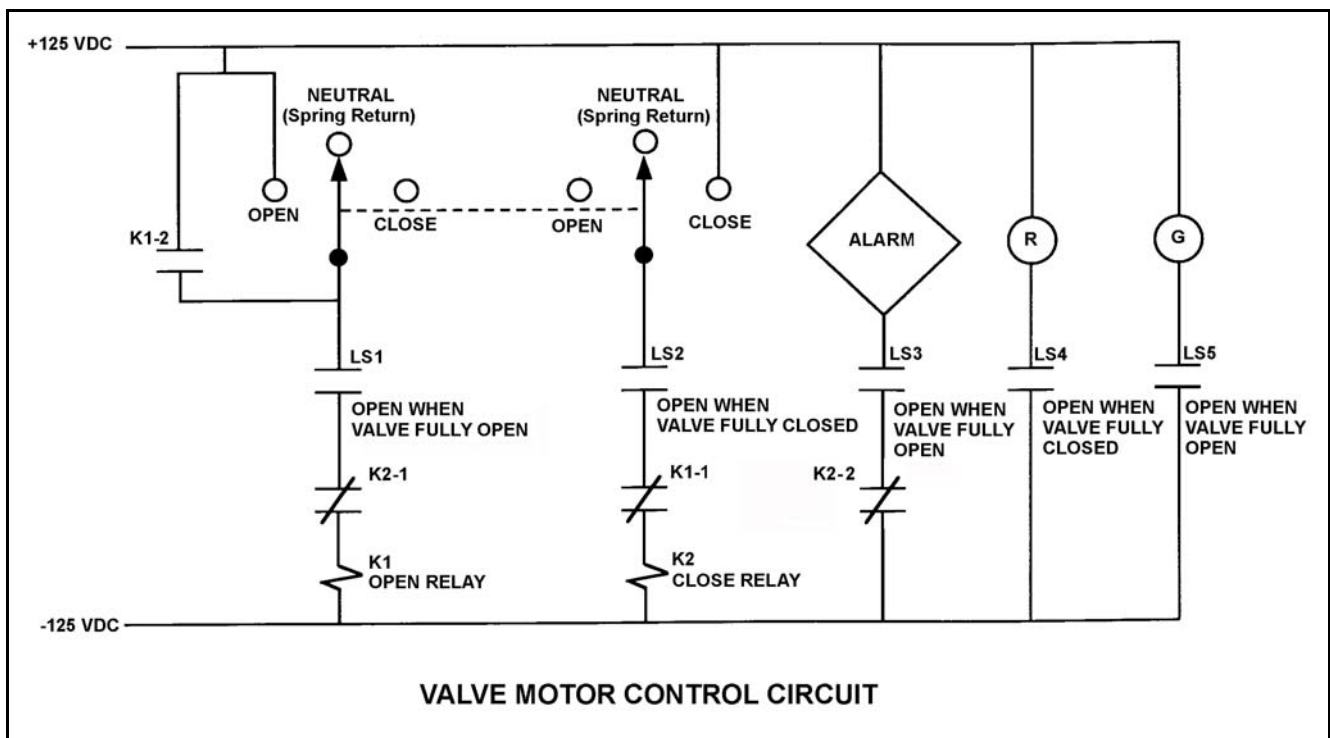
QUESTION: 21

Refer to the drawing of a valve control circuit (see figure below).

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

Which one of the following conditions will actuate the alarm?

- A. The valve is partially closed with the control switch in the CLOSE position.
- B. The valve is fully open with the control switch in the CLOSE position.
- C. The valve is partially closed with the control switch in the OPEN position.
- D. The valve is fully open with the control switch in the OPEN position.



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QUESTION: 22

A main generator is being prepared for paralleling with an infinite power grid. Which one of the following indicates that the generator and grid voltages are in phase?

- A. The voltage of the generator is equal to the voltage of the grid.
- B. The frequency of the generator is equal to the frequency of the grid.
- C. The synchroscope pointer is turning slowly in the clockwise direction.
- D. The synchroscope pointer is passing through the 12 o'clock position.

QUESTION: 23

A fast neutron will lose the greatest amount of energy during a scattering reaction in the moderator if it interacts with...

- A. an oxygen nucleus.
- B. a hydrogen nucleus.
- C. a deuterium nucleus.
- D. an electron surrounding a nucleus.

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QUESTION: 24

When determining the shutdown margin for an operating nuclear reactor, how many control rod assemblies 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

The following data is given for the fuel in an operating nuclear reactor core:

<u>Nuclide</u>	<u>Delayed Neutron Fraction</u>	<u>Fraction of Total Fuel Composition</u>	<u>Fraction of Total Fission Rate</u>
U-235	0.0065	0.023	0.63
U-238	0.0148	0.965	0.07
Pu-239	0.0021	0.012	0.30

What is the core delayed neutron fraction for this reactor?

- A. 0.0052
- B. 0.0058
- C. 0.0072
- D. 0.0078

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QUESTION: 26

A nuclear reactor is shut down with the reactor vessel head removed for refueling. The core is covered by 23 feet of refueling water with a temperature of 100°F.

Which one of the following could increase or decrease K_{eff} depending on core burnup?

- A. A spent fuel assembly is removed from the core.
- B. Refueling water temperature is decreased to 95°F.
- C. A fresh neutron source is installed in the core.
- D. Movable incore source range instrumentation is repositioned to increase source range count rate.

QUESTION: 27

Which one of the following is an effect of fuel pellet expansion during the normal operation of a nuclear power plant?

- A. Decreased fuel rod clad strain.
- B. Decreased decay heat generation rate.
- C. Decreased neutron resonance absorption rate.
- D. Decreased core effective delayed neutron fraction.

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QUESTION: 28

Neutron flux shaping within a nuclear reactor core is designed to...

- A. prevent the effects of rod shadowing during control rod motion.
- B. generate more power in the top portion of the core early in core life.
- C. ensure that local core thermal power limits are not exceeded.
- D. minimize the reverse power effect during control rod motion.

QUESTION: 29

A control rod located at notch position _____ in the core would be considered a _____ control rod.

- A. 36; deep
- B. 36; intermediate
- C. 12; intermediate
- D. 12; deep

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QUESTION: 30

A nuclear reactor was operating at 100% power for one week when power was decreased to 50%. Which one of the following describes the equilibrium core xenon-135 concentration at 50% power?

- A. The same as the 100% value.
- B. More than one-half the 100% value.
- C. Less than one-half the 100% value.
- D. One-half the 100% value.

QUESTION: 31

A nuclear power plant is being returned to operation following a refueling outage. Fuel preconditioning requires reactor power to be increased from 10% to full power gradually over a one week period.

During this slow power increase, most of the positive reactivity added by the operator is required to overcome the negative reactivity from...

- A. fuel burnup.
- B. xenon buildup.
- C. fuel temperature increase.
- D. moderator temperature increase.

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QUESTION: 32

Which one of the following is not a function performed by burnable poisons in an operating nuclear reactor?

- A. Provide neutron flux shaping.
- B. Provide more uniform power density.
- C. Offset the effects of control rod burnout.
- D. Allow higher fuel enrichment of initial core load.

QUESTION: 33

A nuclear reactor startup is in progress. Control rod withdrawal was stopped several minutes ago to assess criticality. Which one of the following is a combination of indications in which each listed indication supports a declaration that the reactor has reached criticality?

- A. Period is stable at 200 seconds; source range count rate is stable.
- B. Period is stable at infinity; source range count rate is stable.
- C. Period is stable at 200 seconds; source range count rate is slowly increasing.
- D. Period is stable at infinity; source range count rate is slowly increasing.

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QUESTION: 34

A nuclear reactor is undergoing a startup with reactor pressure and temperature initially stable at 731.4 psia and 508°F. 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: 35

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

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

- A. intrinsic source neutrons
- B. fission gammas from previous power operation
- C. fission neutrons from subcritical multiplication
- D. delayed fission neutrons from previous power operation

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QUESTION: 36

A nuclear power plant is initially operating at 100% power when a control rod fully inserts into the core. Assuming no operator action, reactor power will initially decrease and then...

- A. return to the original power level with the void boundary lower in the core.
- B. stabilize at a lower power level with the void boundary lower in the core.
- C. return to the original power level with the void boundary higher in the core.
- D. stabilize at a lower power level with the void boundary higher in the core.

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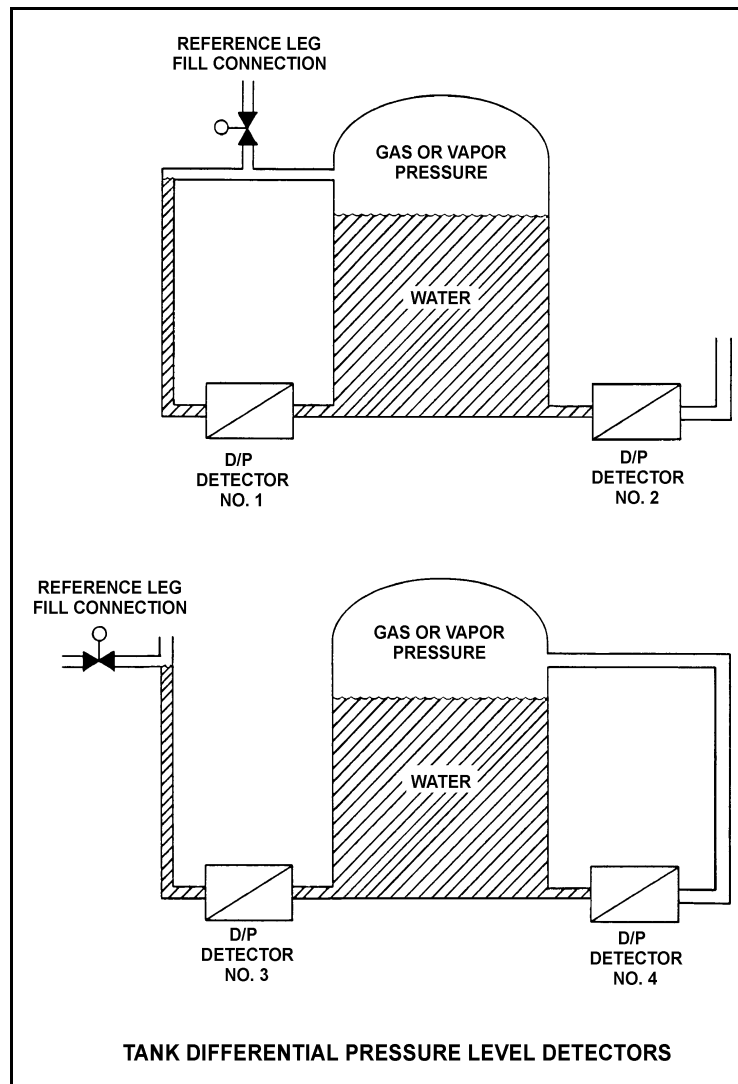
QUESTION: 37

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

The tanks are identical and are currently at 2 psig overpressure, the same constant water level, and a temperature of 60°F. They are surrounded by atmospheric pressure. All level detectors have been calibrated and are producing the same level indication.

If a leak in the top of each tank causes a complete loss of overpressure, which level detector(s) will produce the lowest level indication?

- A. No. 1 only
- B. No. 2 only
- C. No. 1 and 4
- D. No. 2 and 3



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QUESTION: 38

An ideal auxiliary steam turbine exhausts to the atmosphere. The steam turbine is supplied with saturated steam at 900 psia. Which one of the following is the maximum specific work (Btu/lbm) that can be extracted from the steam by the steam turbine?

- A. 283 Btu/lbm
- B. 670 Btu/lbm
- C. 913 Btu/lbm
- D. 1,196 Btu/lbm

QUESTION: 39

Which one of the following explains why condensation of the steam entering a main condenser creates a vacuum?

- A. The entropy of the steam increases.
- B. The entropy of the steam decreases.
- C. The specific volume of the steam increases.
- D. The specific volume of the steam decreases.

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QUESTION: 40

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

- 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

The major concern with starting a main feedwater pump with downstream fluid in a saturated condition is...

- A. cavitation.
- B. water hammer.
- C. thermal shock.
- D. positive reactivity addition.

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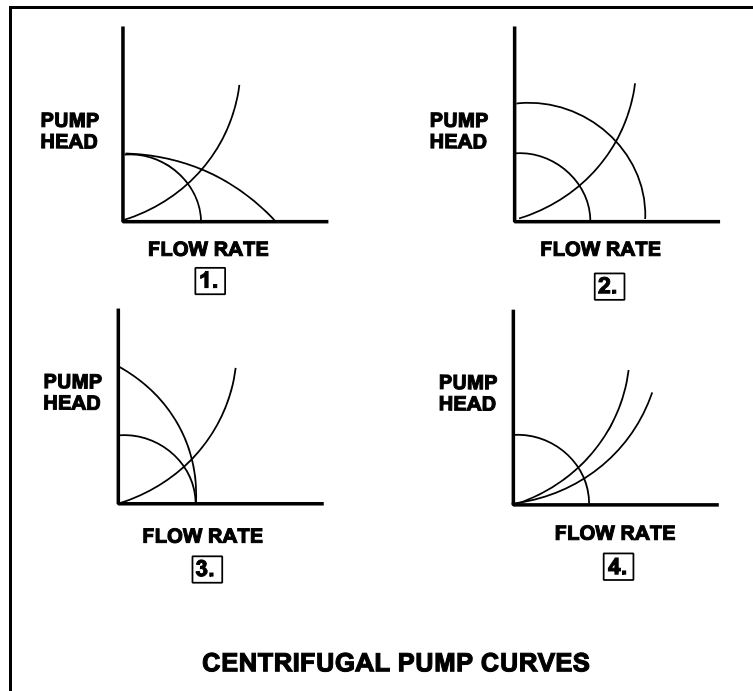
QUESTION: 42

Refer to the drawing of four centrifugal pump operating curves (see figure below).

A centrifugal pump is initially operating in a closed water system and discharging through a heat exchanger. A second heat exchanger, in parallel with the first, is then placed in service.

Which set of curves illustrates the initial and final operating conditions?

- A. 1.
- B. 2.
- C. 3.
- D. 4.



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QUESTION: 43

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

- A. The feedwater temperature used in the heat balance calculation was 20°F higher than actual feedwater temperature.
- B. The reactor recirculation pump heat input term was omitted from the heat balance calculation.
- C. The feed water flow rate used in the heat balance calculation was 10% higher than actual flow rate.
- D. The steam pressure used in the heat balance calculation was 50 psi lower than actual steam pressure.

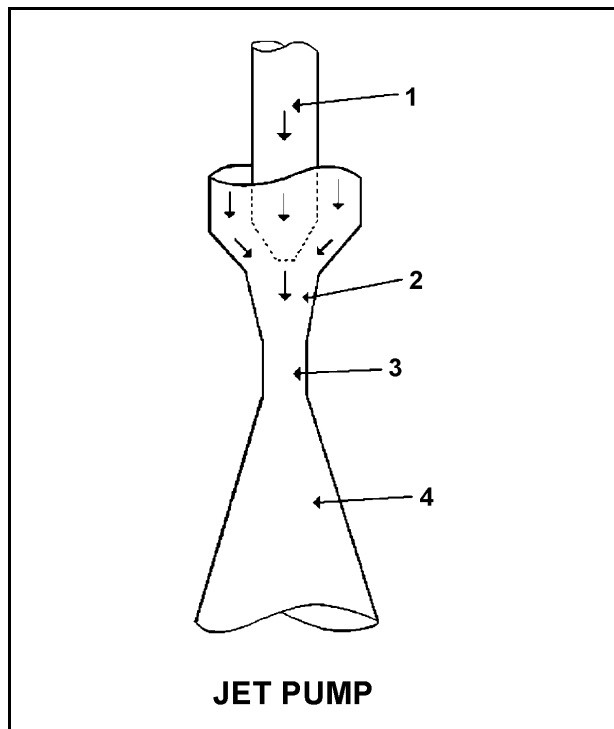
USNRC GENERIC FUNDAMENTALS EXAMINATION
DECEMBER 2007 BWR--FORM A

QUESTION: 44

Refer to the drawing of a core recirculation jet pump (see figure below).

During normal operation, the lowest pressure will exist at point _____; and the highest velocity will occur at point _____.

- A. 3; 3
- B. 3; 4
- C. 4; 3
- D. 4; 4



**USNRC GENERIC FUNDAMENTALS EXAMINATION
DECEMBER 2007 BWR--FORM A**

QUESTION: 45

Refer to the drawing of a section of pipe that contains flowing water (see figure below).

Given:

Pressure at P_1 is 24 psig.

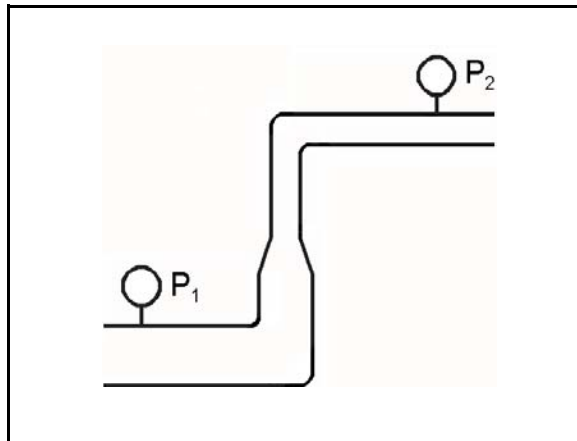
Pressure at P_2 is 16 psig.

Pressure change due to change in velocity is 2 psig.

Pressure change due to change in elevation is 10 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. 4 psig; left to right
- D. 4 psig; right to left



**USNRC GENERIC FUNDAMENTALS EXAMINATION
DECEMBER 2007 BWR--FORM A**

QUESTION: 46

A nuclear reactor was shutdown from long-term 100% power operation 10 days ago. Five minutes ago, a station blackout occurred that caused the complete loss of forced coolant circulation through the core. The following conditions currently exist:

- Reactor pressure vessel (RPV) pressure indicates 0 psig.
- Main steam isolation valves are closed.
- Reactor head vents are open with no steam issuing.
- Average reactor coolant temperature is 150°F.
- Differential temperature between the upper and lower RPV heads is 20°F and increasing.

Over the next hour or so, with no operator action, which one of the following will occur as natural circulation becomes established in the RPV?

- A. RPV pressure will slowly increase and stabilize at about 10 psig, and the differential temperature between the upper and lower RPV heads will stabilize at a value greater than 0°F.
- B. RPV pressure will slowly increase and stabilize at about 10 psig, and the differential temperature between the upper and lower RPV heads will stabilize at 0°F.
- C. RPV pressure will remain near 0 psig, and the differential temperature between the upper and lower RPV heads will stabilize at a value greater than 0°F.
- D. RPV pressure will remain near 0 psig, and the differential temperature between the upper and lower RPV heads will stabilize at 0°F.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
DECEMBER 2007 BWR--FORM A**

QUESTION: 47

A BWR core consists of 30,000 fuel rods; each fuel rod has an active length of 12 feet. The core is producing 1,350 MW of thermal power. If the total peaking factor for a node is 1.6, what is the maximum local linear power density being produced in the node?

- A. 4.0 kW/ft
- B. 6.0 kW/ft
- C. 8.0 kW/ft
- D. 10.0 kW/ft

QUESTION: 48

If a nuclear reactor is operating with the minimum critical power ratio (MCPR) at its transient limit (or safety limit), which one of the following is indicated?

- A. None of the fuel rods are experiencing critical heat flux.
- B. A small fraction of the fuel rods may be experiencing critical heat flux.
- C. All radioactive fission products are being contained within the reactor fuel.
- D. All radioactive fission products are being contained within either the reactor fuel or the reactor vessel.

**USNRC GENERIC FUNDAMENTALS EXAMINATION
DECEMBER 2007 BWR--FORM A**

QUESTION: 49

For what operational condition does the flow biasing correction factor (K_f) adjust the minimum critical power ratio?

- A. Operation at less than rated steam flow.
- B. Operation at greater than rated steam flow.
- C. Operation at less than rated core flow.
- D. Operation at greater than rated core flow.

QUESTION: 50

The probability of reactor vessel brittle fracture is decreased by minimizing...

- A. oxygen content in the reactor coolant.
- B. operation at high temperatures.
- C. the time taken to cool down the reactor coolant system.
- D. the amount of copper manufactured into the reactor vessel.

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

**DECEMBER 2007 NRC GENERIC FUNDAMENTALS EXAMINATION
BOILING WATER REACTOR - ANSWER KEY**

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