UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
SEPTEMBER 2021 BWR – FORM A

DO NOT BEGIN THIS EXAMINATION UNTIL DIRECTED TO DO SO.

Please Print:

Name: _____

Docket No.: 55-_____

Facility: _____

Start Time: _____ Stop Time: _____

Instructions to Examinee:

This examination applies to a typical U.S. boiling water reactor (BWR) nuclear power plant. There are 50 multiple-choice test items to answer, each having equal point value. There are multiple forms of this examination, each containing the same test items in a random order. Answer all test items using the provided answer sheet, ensuring a single answer is marked for each test item. A score of at least 80 percent is required to pass this portion of the NRC operator licensing written examination. When you have completed the examination, sign your name under the statement at the bottom of this page. All examination materials will be collected 3 hours after the examination begins.

KNOWLEDGE AREA	NUMBER OF TEST ITEMS	PERCENT OF TOTAL	SCORE
COMPONENTS	22	44	
REACTOR THEORY	14	28	
THERMODYNAMICS	14	28	
TOTALS	50	100	

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

_____

Examinee 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. Scrap paper will be provided for calculations.

7. 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.

8. Do not make assumptions regarding conditions that are not specified in the question unless they occur as a consequence of other conditions that are stated in the question. For example, you should not assume operator actions have been taken. Also, this examination tests knowledge of general fundamentals, therefore do not make assumptions based on specific plant procedures.

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

10. 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 the examination room.

11. 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.

12. 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.

13. 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 SHEET

EQUATIONS

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

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

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

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

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

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

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

$SUR = 26.06/\tau$

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

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

$\ell^* = 1.0 \times 10^{-4}$ sec

$\lambda_{eff} = 0.1\ \text{sec}^{-1}$ (for $\rho > 0$)

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

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

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

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

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

$CR_1(1 - K_{eff_1}) = CR_2(1 - K_{eff_2})$

$1/M = CR_1/CR_x$

$A = \pi r^2$

$F = PA$

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

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

$P = I^2R$

$P = IE$

$P_A = \sqrt{3}IE$

$P_T = \sqrt{3}IEpf$

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

Thermal Efficiency = Net Work Out/Energy In

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

$g = 32.2\ \text{ft/sec}^2$

$g_c = 32.2$ lbm-ft/lbf-sec^2

CONVERSIONS

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

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

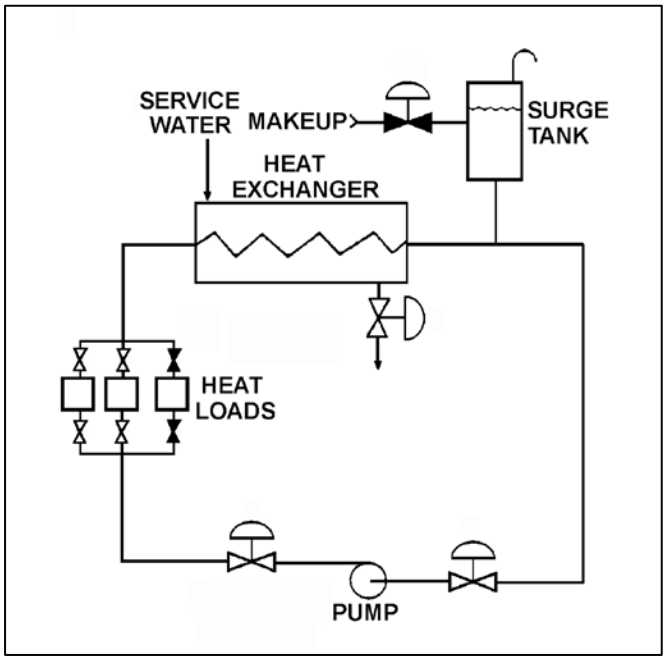
Which one of the following changes to the cooling water system will result in a higher cooling water pump flow rate and a reduced pump discharge head?

A. Increase pump speed by 20 percent.

B. Decrease pump speed by 20 percent.

C. Isolate one of the two in-service heat loads.

D. Place the third system heat load in service.



QUESTION: 2

Which one of the following modes of heat transfer is characterized by steam bubbles moving away from a heated surface and collapsing in the bulk fluid?

A. Bulk boiling

B. Subcooled nucleate boiling

C. Saturated nucleate boiling

D. Saturated natural convection

QUESTION: 3

Refer to the drawing of a section of 6-inch diameter pipe containing subcooled water flowing left to right at 100 gpm (see figure below). The pipe is frictionless, and no heat transfer is occurring. Point A is 10 feet higher in elevation than point B.

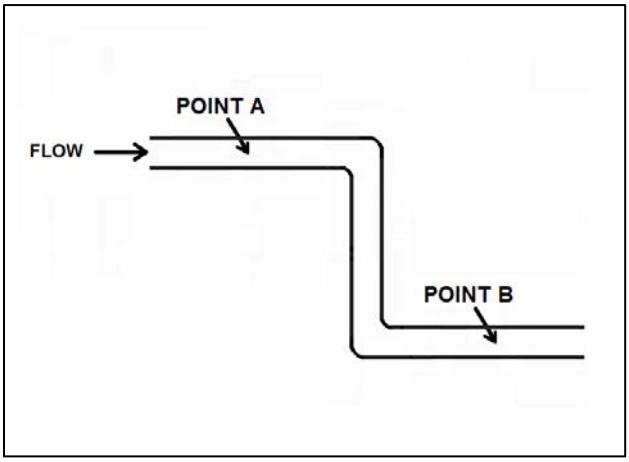
Compared to the enthalpy at point B, the enthalpy at point A is…

A. smaller, because some of the water's potential energy is converted to enthalpy as it flows to point B.

B. greater, because some of the water's enthalpy is converted to kinetic energy as it flows to point B.

C. the same, because the pipe is frictionless and no heat transfer is occurring.

D. the same, because the total energy of the water does not change from point A to point B.



QUESTION: 4

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully open and has a 10-second stroke time. Limit switch LS2 has failed open.

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.

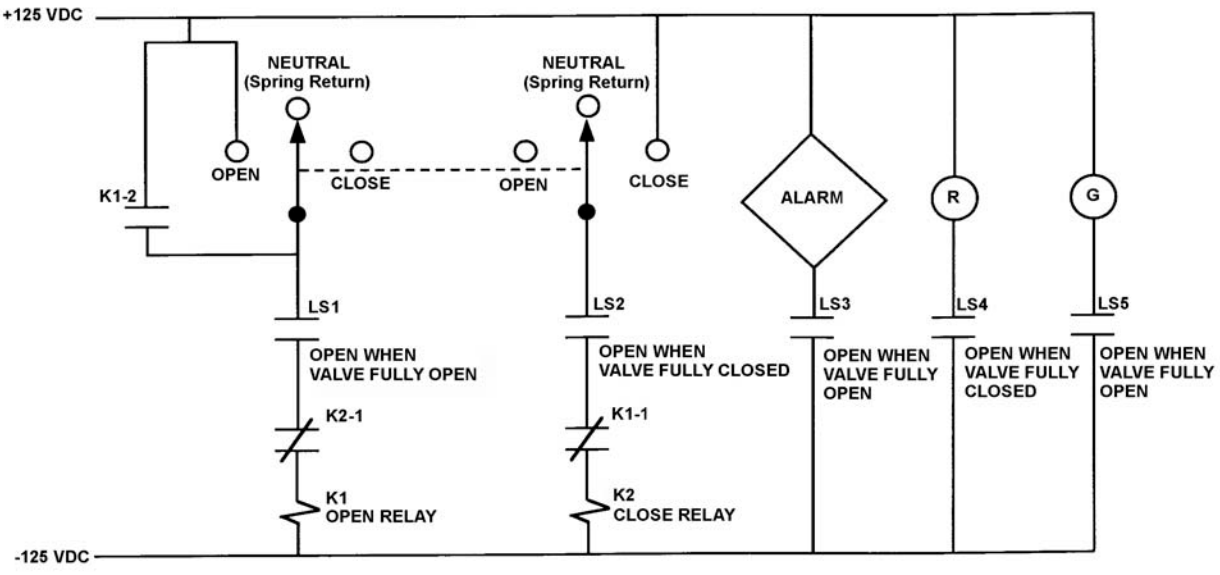
Which one of the following describes the valve response if the control switch is taken to the CLOSE position for 2 seconds and then released?

A. The valve will <u>not</u> move.

B. The valve will close fully.

C. The valve will begin to close and then stop moving.

D. The valve will begin to close and then open fully.



VALVE MOTOR CONTROL CIRCUIT

QUESTION: 5

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

A. Sodium ions are being exchanged, but the chloride ions are unaffected.

B. Chloride ions are being exchanged, but the sodium ions are unaffected.

C. Sodium ions are being exchanged, and chloride ions are being removed by filtration.

D. Chloride ions are being exchanged, and sodium ions are being removed by filtration.

QUESTION: 6

A positive displacement pump is operating in a water system. How can the net positive suction head requirement ($NPSH_R$) for the pump be determined?

A. The value can be calculated with the aid of steam and water property tables if the pump volumetric flow rate is known.

B. The value can be calculated with the aid of steam and water property tables if the pump inlet water pressure and temperature are known.

C. The value can be found on a pump performance curve provided by the pump vendor if the pump volumetric flow rate is known.

D. The value can be found on a pump performance curve provided by the pump vendor if the pump inlet water pressure and temperature are known.

QUESTION: 7

Initially, a nuclear power plant is operating at steady-state 60 percent power in the middle of a fuel cycle when a turbine control system malfunction closes the turbine steam inlet valves an additional 5 percent. Which one of the following describes the initial reactor power change, and the cause for the power change?

A. Decrease, because the rate of neutron absorption in the moderator initially increases.

B. Decrease, because the rate of neutron absorption at U-238 resonance energies initially increases.

C. Increase, because the rate of neutron absorption in the moderator initially decreases.

D. Increase, because the rate of neutron absorption at U-238 resonance energies initially decreases.

QUESTION: 8

Which one of the following is a characteristic of a delayed neutron?

A. It is emitted with an average kinetic energy of 2.0 MeV.

B. It is in thermal equilibrium with the surrounding atoms.

C. It is produced in less than one percent of all fissions.

D. It is released an average of 1.0×10^{-4} seconds after a fission.

QUESTION: 9

Initially, a reactor was operating at steady-state 100 percent power with a top-peaked axial power distribution. Reactor power was reduced, and a control rod pattern exchange was completed to establish a bottom-peaked axial power distribution. Reactor power was returned to 100 percent and is currently at steady-state.

Compared to the initial (top-peaked) critical power for a typical fuel bundle, the current (bottom-peaked) critical power is…

A. higher, because the highest linear heat generation rate is occurring in the region of the fuel bundle with the highest mass flow rate of coolant.

B. higher, because the greatest coolant enthalpy rise is occurring in the region of the fuel bundle that contains subcooled or low-quality coolant.

C. lower, because the highest linear heat generation rate is occurring in the region of the fuel bundle with the highest mass flow rate of coolant.

D. lower, because the greatest coolant enthalpy rise is occurring in the region of the fuel bundle that contains subcooled or low-quality coolant.

QUESTION: 10

Refer to the drawing of four air-operated valves (see figure below). The valve actuators may be shown with or without air pressure applied.

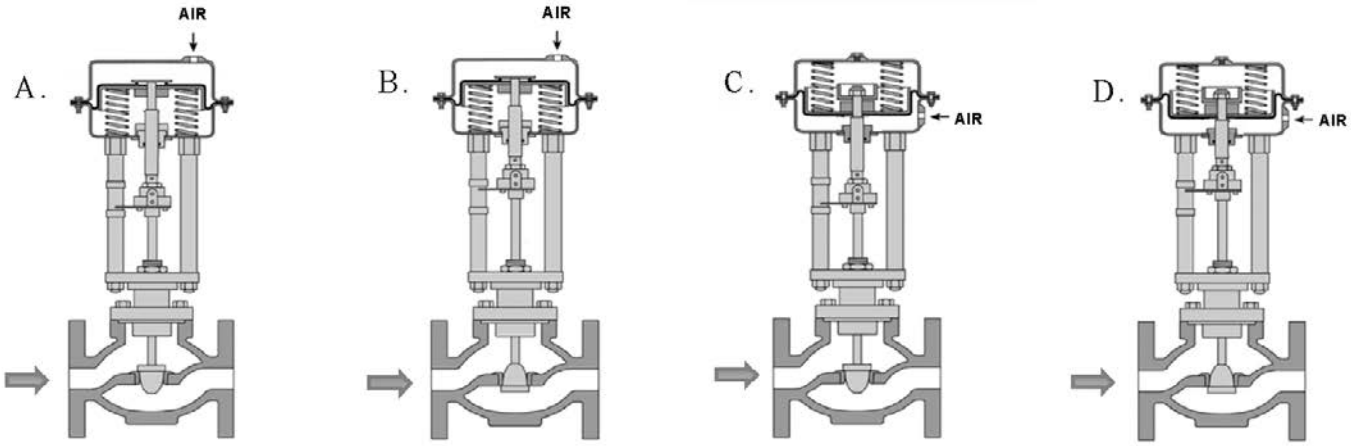
Which valves are currently shown in their failed (i.e., no air pressure applied to the actuator) positions?

A. A and B

B. B and C

C. C and D

D. D and A



QUESTION: 11

An AC motor-driven centrifugal pump was just started. During the start, motor current remained peaked for 6 seconds before decreasing to standard running current. Normally, the starting current peak lasts about 4 seconds.

Which one of the following could have caused the extended starting current peak?

A. The pump shaft was seized and did not turn.

B. The pump was initially rotating slowly in the reverse direction.

C. The pump discharge check valve was stuck closed and did not open.

D. The pump was initially air bound, and then primed itself after 6 seconds of operation.

QUESTION: 12

Refer to the drawing of an operating service water heat exchanger (see figure below).

Given:

Service water inlet temperature = 140°F
Service water outlet temperature = 90°F
Cooling water inlet temperature = 70°F
Cooling water outlet temperature = 95°F
Specific heat for both fluids = 1.0 Btu-°F/lbm

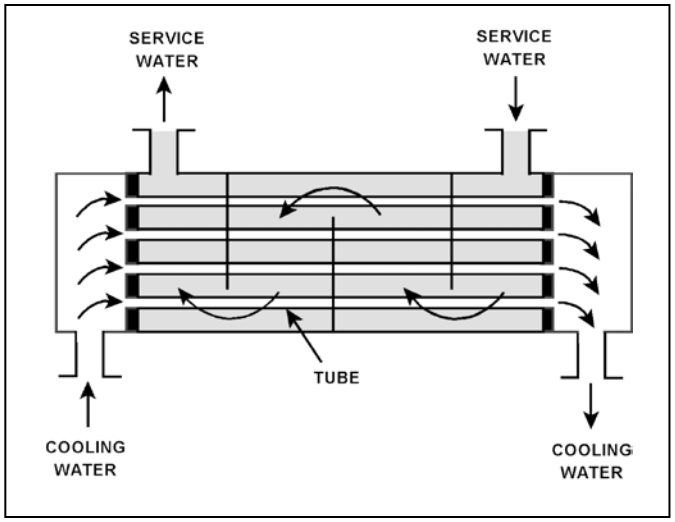
Which one of the following conclusions can be drawn from the given information?

A. The cooling water mass flow rate is twice the service water mass flow rate.

B. The service water mass flow rate is twice the cooling water mass flow rate.

C. The cooling water heat transfer rate is twice the service water heat transfer rate.

D. The service water heat transfer rate is twice the cooling water heat transfer rate.



QUESTION: 13

A reactor was initially operating at steady-state 100 percent power near the middle of a fuel cycle when it was shut down and then cooled down to 200°F over a three-day period.

Given the following absolute values of reactivities added during the shutdown and cooldown, assign a (+) or (–) as appropriate and choose the current value of core reactivity.

Control rods	=	( ) 12.50 %ΔK/K
Voids	=	( ) 3.50 %ΔK/K
Xenon	=	( ) 2.50 %ΔK/K
Fuel temperature	=	( ) 2.00 %ΔK/K
Moderator temperature	=	( ) 0.50 %ΔK/K

A. -3.0 %ΔK/K

B. -4.0 %ΔK/K

C. -8.0 %ΔK/K

D. -9.0 %ΔK/K

QUESTION: 14

A main steam flow rate differential pressure detector was properly calibrated to produce a main steam flow rate indication of 500,000 lbm/hr with the following initial input conditions:

Detector high pressure input = 1,000 psia
Detector low pressure input = 950 psia

The current detector input conditions are as follows:

Detector high pressure input = 985 psia
Detector low pressure input = 935 psia

Assume that the detector and associated circuitry do not have steam density compensation. Also, assume that the main steam quality and volumetric flow rate do not change.

The current main steam flow rate indication is _____ 500,000 lbm/hr; and the current main steam flow rate is _____ 500,000 lbm/hr.

A. equal to; greater than

B. less than; greater than

C. equal to; less than

D. greater than; less than

QUESTION: 15

A nuclear power plant is operating at steady-state 100 percent power when a reactor scram occurs. As a result of the scram, the core neutron flux initially will decrease on a period that is much _____ than -80 seconds; and the period will become approximately -80 seconds about _____ minutes after the scram.

A. longer; 3

B. longer; 30

C. shorter; 3

D. shorter; 30

QUESTION: 16

Check valves are normally used to prevent...

A. overpressurization of nonoperating system piping and components.

B. backflow through nonoperating components or flowpaths.

C. pump runout by providing a constant backpressure.

D. pump cavitation by keeping nonoperating systems filled.

QUESTION: 17

Refer to the drawing of operating curves for a centrifugal pump in a closed water system (see figure below).

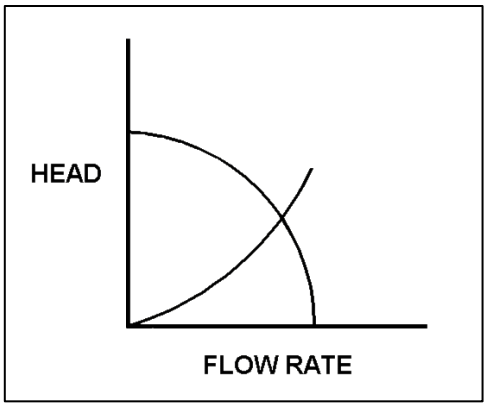
Which one of the following describes the value of head where the two curves cross?

A. The maximum amount of head that the pump can provide.

B. The amount of pump head that is required to avoid cavitation.

C. The amount of pump head that is converted to kinetic energy in the pump.

D. The amount of pump head that is converted to heat and other losses as the water circulates through the system.



QUESTION: 18

Initially, a reactor is operating at 100 percent power with equilibrium xenon-135 concentration. Then a reactor scram occurs. During the first hour following the reactor scram, the change in xenon-135 concentration is primarily being caused by the...

A. decreased removal rate of xenon-135.

B. decreased production rate of xenon-135.

C. increased removal rate of xenon-135.

D. increased production rate of xenon-135.

QUESTION: 19

An open vessel contains 2.0 lbm of water at 200°F and standard atmospheric pressure. Which one of the following will be caused by the addition of 16.0 Btu to the water?

A. The water temperature will increase, and all of the water will boil off.

B. The water temperature will increase, and none of the water will boil off.

C. The water temperature will increase to 212°F, and some of the water will boil off.

D. The water temperature will increase to 216°F and some of the water will boil off.

QUESTION: 20

A reactor was operating at steady-state 50 percent power near the beginning of a fuel cycle when a centrally-located shallow control rod dropped out of the core. The reactor stabilized without a scram, and no operator actions were taken.

If the dropped control rod had been a deep control rod, it would have produced a _____ change in the _____. (Again, assume the reactor stabilizes without a scram, and no operator actions are taken.)

A. smaller; shutdown margin.

B. greater; shutdown margin.

C. smaller; radial power distribution.

D. greater; radial power distribution.

QUESTION: 21

Refer to the drawing of two lengths of 6-inch diameter pipe, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing

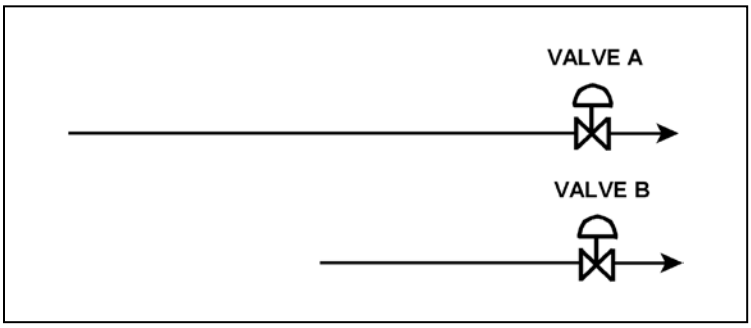
Water at 65°F is flowing at 1,000 gpm through each pipe. If isolation valves A and B instantly close, the pressure spike experienced by valve A will be _____ the pressure spike experienced by valve B; and the pressure spike will dissipate faster in the _____ length of pipe.

A. equal to; shorter

B. equal to; longer

C. less than; shorter

D. less than; longer



QUESTION: 22

A temperature controller uses a bistable that turns on to energize a set of heaters when the controlled temperature decreases to 40°F. The bistable turns off to deenergize the heaters when the controlled temperature increases to 45°F.

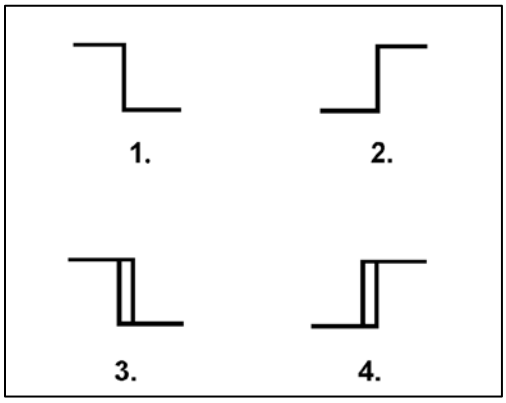
Which one of the following bistable symbols indicates the characteristics of the bistable described above?

A. 1.

B. 2.

C. 3.

D. 4.



QUESTION: 23

Refer to the drawing of a simple chromel-alumel thermocouple circuit (see figure below). Initially, the temperature instrument indicates 350°F.

A steam leak inside the reactor building (RB) increases the temperature of the thermocouple connection head, reference junction panel, and extension wires inside the RB from 120°F to 160°F. The temperature at the location measured by the thermocouple remains the same.

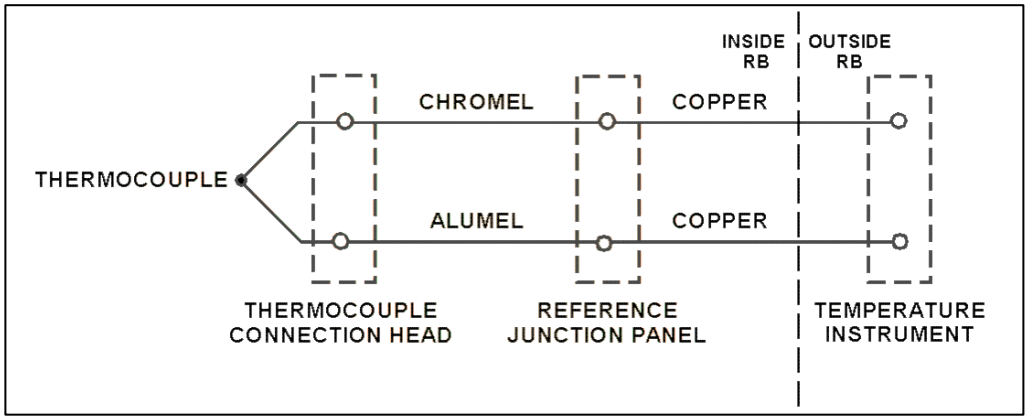
What is the resulting temperature indication?

A. 310°F

B. 350°F

C. 390°F

D. 430°F



QUESTION: 24

Refer to the drawing that shows a graph of fission rate versus time (see figure below). Both axes have linear scales.

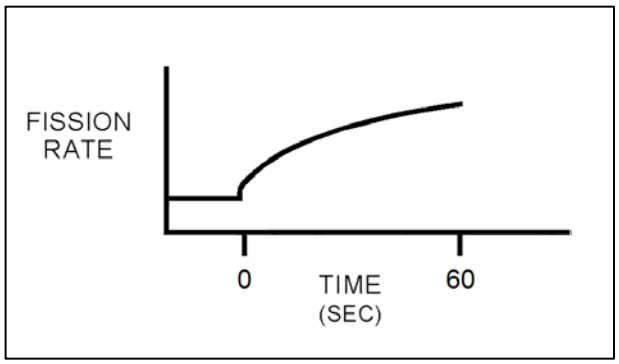
Which one of the following events, initiated at 0 seconds, could cause the reactor response shown on the graph?

A. A step addition of positive reactivity to a reactor that is initially subcritical in the source range, and remains subcritical for the duration of the 60-second interval shown.

B. A step addition of positive reactivity to a reactor that is initially critical in the source range, and remains below the point of adding heat for the duration of the 60-second interval shown.

C. A continuous addition of positive reactivity at a constant rate to a reactor that is initially subcritical in the source range, and remains subcritical for the duration of the 60-second interval shown.

D. A continuous addition of positive reactivity at a constant rate to a reactor that is initially critical in the source range, and remains below the point of adding heat for the duration of the 60-second interval shown.



QUESTION: 25

A diesel generator (DG) is supplying an isolated electrical bus with the DG governor operating in the speed droop mode. Assuming the DG does not trip, if a large electrical bus load trips, bus frequency will initially...

A. increase, and then decrease and stabilize below the initial value.

B. increase, and then decrease and stabilize above the initial value.

C. decrease, and then increase and stabilize below the initial value.

D. decrease, and then increase and stabilize above the initial value.

QUESTION: 26

If a control rod is being moved from position 16 to 22, it is being...

A. inserted 18 inches.

B. withdrawn 18 inches.

C. inserted 36 inches.

D. withdrawn 36 inches.

QUESTION: 27

Initially, a reactor was operating at steady-state 100 percent power when a loss of offsite power caused a reactor scram and a loss of forced reactor coolant flow. Several minutes later, the occurrence of natural circulation flow will be indicated by a differential _____ across the core plate and coolant flow through the _____ pumps.

A. temperature; recirculation

B. temperature; jet

C. pressure; recirculation

D. pressure; jet

QUESTION: 28

Refer to the drawing of a curve showing the neutron absorption cross-section for U-238 at a resonance energy (see figure below). The reactor associated with the curve is operating at 80 percent power.

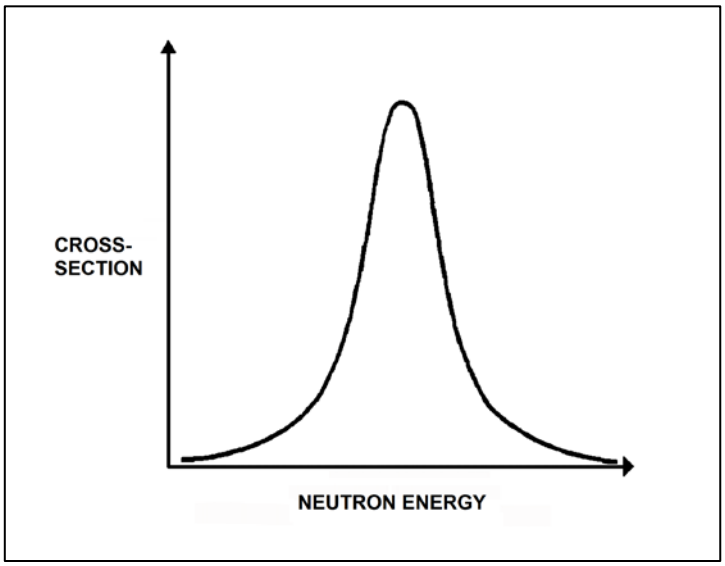
If reactor power is increased to 90 percent over the next few hours, the curve will become _____; and the percentage of the core neutron population lost to resonance capture by U-238 will _____.

A. shorter and broader; increase

B. shorter and broader; decrease

C. taller and more narrow; increase

D. taller and more narrow; decrease



QUESTION: 29

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

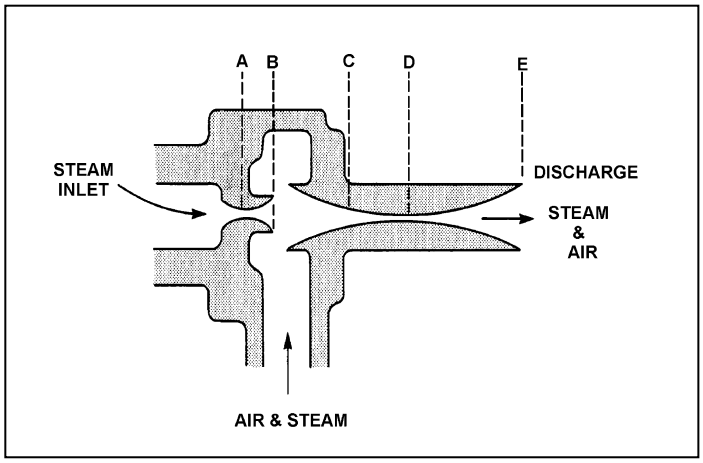
Steam flowing from C to D undergoes a pressure _____ and a velocity _____.

A. decrease; decrease

B. decrease; increase

C. increase; increase

D. increase; decrease



QUESTION: 30

A large AC motor has a maximum ambient temperature rating of 40°C. Which one of the following will occur if the motor is continuously operated at rated load with an ambient temperature of 50°C?

A. Accelerated embrittlement of the motor windings, leading to an open circuit within the motor windings.

B. Accelerated embrittlement of the motor windings, leading to a short circuit within the motor windings.

C. Accelerated breakdown of the motor winding insulation, leading to an open circuit within the motor windings.

D. Accelerated breakdown of the motor winding insulation, leading to a short circuit within the motor windings.

QUESTION: 31

A centrifugal pump is operating at its maximum design flow rate, delivering water through two parallel valves. Valve A is half open, and valve B is one quarter open.

Which one of the following will occur if both valves are fully opened?

A. The pump will operate at shutoff head.

B. The pump available net positive suction head will increase.

C. The pump required net positive suction head will decrease.

D. The pump will operate at runout conditions.

QUESTION: 32

Which one of the following approximates the fission product decay heat produced in a reactor at one second and one hour following a reactor scram from long-term operation at 100 percent power?

	One Second	One Hour
A.	7 percent	1 percent
B.	7 percent	0.1 percent
C.	3 percent	1 percent
D.	3 percent	0.1 percent

QUESTION: 33

Two reactors are identical except that reactor A is near the end of core life and reactor B is near the beginning of core life. Both reactors are operating at 100 percent power when a reactor scram occurs at the same time on each reactor. The scrams insert equal amounts of negative reactivity, and no operator actions are taken.

For the conditions above, a power level of 1.0×10^{-5} percent will be reached first by reactor _____ because it has the _____ effective delayed neutron fraction.

A. A; larger

B. B; larger

C. A; smaller

D. B; smaller

QUESTION: 34

A Geiger-Mueller detector with a pancake probe is being used to monitor workers leaving a radiologically controlled area for contamination. The probe is sensitive to alpha, beta, and gamma radiation. The background count rate is 20 cpm. As one worker's shoe is scanned, the count rate increases to 1,000 cpm.

Given the following separate actions:

- When a sheet of paper is placed between the probe and the shoe, the count rate decreases to 600 cpm.
- When a sheet of aluminum foil is placed between the probe and the shoe, the count rate decreases to 200 cpm.

Which one of the following describes the type(s) of radiation being emitted by the contamination?

A. Beta only

B. Alpha and beta only

C. Beta and gamma only

D. Alpha, beta, and gamma

QUESTION: 35

During a rapid increase in core flow rate in a reactor operating at 100 percent power, the most limiting thermal limit is the...

A. total peaking factor.

B. critical power ratio.

C. average planar linear heat generation rate.

D. linear heat generation rate.

QUESTION: 36

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

Generator frequency	=	59.5 Hz
Grid frequency:	=	59.8 Hz
Generator voltage:	=	115.1 KV
Grid voltage:	=	114.8 KV

When the generator output breaker is closed, the generator will...

A. acquire real load and reactive load.

B. acquire real load, but become a reactive load to the grid.

C. become a real load to the grid, but acquire reactive load.

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

QUESTION: 37

Operating lube oil heat exchangers X and Y are identical in size and construction (see figure below for general design), except that heat exchanger X has twice the number of tubes as heat exchanger Y.

Given:

- All tubes have equal diameters.
- The lube oil mass flow rates are the same in both heat exchangers.
- The cooling water mass flow rates are the same in both heat exchangers.
- $h_{f\text{-}oil}$ is the lube oil film heat transfer coefficient.
- $h_{f\text{-}water}$ is the cooling water film heat transfer coefficient.

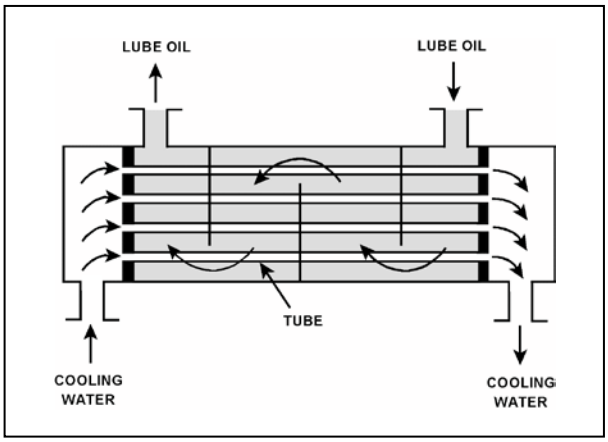
Considering only the effect of film thickness on $h_{f\text{-}oil}$ and $h_{f\text{-}water}$, the greater $h_{f\text{-}oil}$ occurs in heat exchanger _____; and the greater $h_{f\text{-}water}$ occurs in heat exchanger _____.

A. X; X

B. X; Y

C. Y; X

D. Y; Y



QUESTION: 38

Decreasing the temperature of the lube oil leaving a lube oil heat exchanger is normally accomplished by...

A. increasing the cooling water flow rate.

B. increasing the lube oil flow rate.

C. decreasing the cooling water flow rate.

D. decreasing the lube oil flow rate.

QUESTION: 39

Reactor pressure-temperature limit curves are derived by using a value for the reactor vessel nil-ductility transition temperature (NDTT) that is _____ than the actual NDTT; and the actual NDTT is verified periodically by _____.

A. higher; removing and testing irradiated specimens of reactor vessel material

B. higher; in-service inspection and analysis of the reactor vessel wall

C. lower; removing and testing irradiated specimens of reactor vessel material

D. lower; in-service inspection and analysis of the reactor vessel wall

QUESTION: 40

Initially, a reactor is operating at 50 percent power with equilibrium xenon-135. Then power level is increased to 75 percent over a one-hour period, and no subsequent operator actions are taken.

Considering only the reactivity effects of xenon-135 changes, which one of the following describes reactor power 6 hours after the power change?

A. Greater than 75 percent, and decreasing slowly.

B. Greater than 75 percent, and increasing slowly.

C. Lower than 75 percent, and decreasing slowly.

D. Lower than 75 percent, and increasing slowly.

QUESTION: 41

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

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

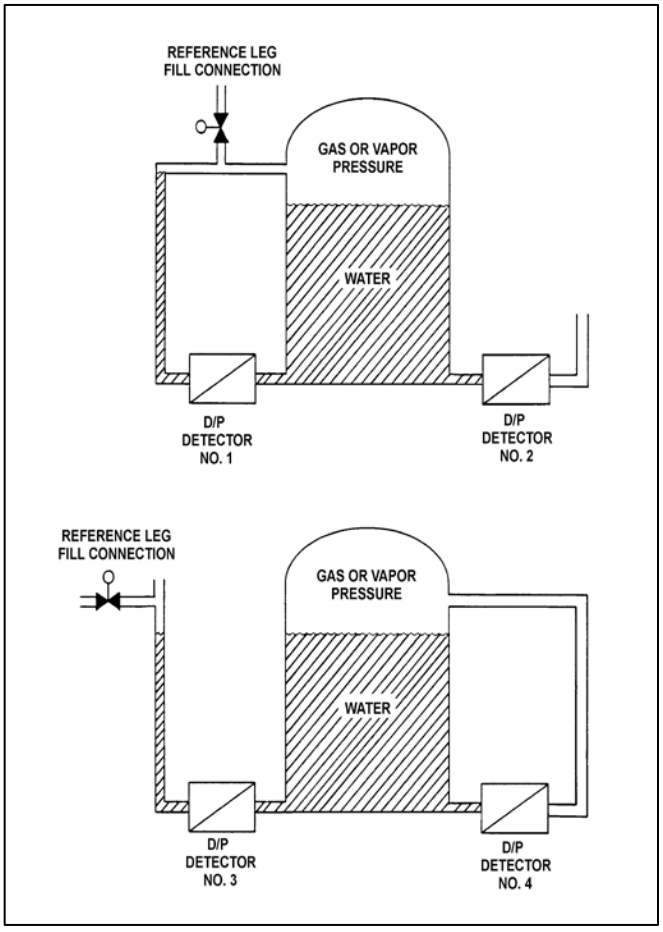
If a leak in the top of each tank causes a complete loss of overpressure in both tanks, which detector(s) will produce the highest level indication(s)?

A. No. 1 only

B. No. 2 only

C. No. 1 and 4

D. No. 2 and 3



QUESTION: 42

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

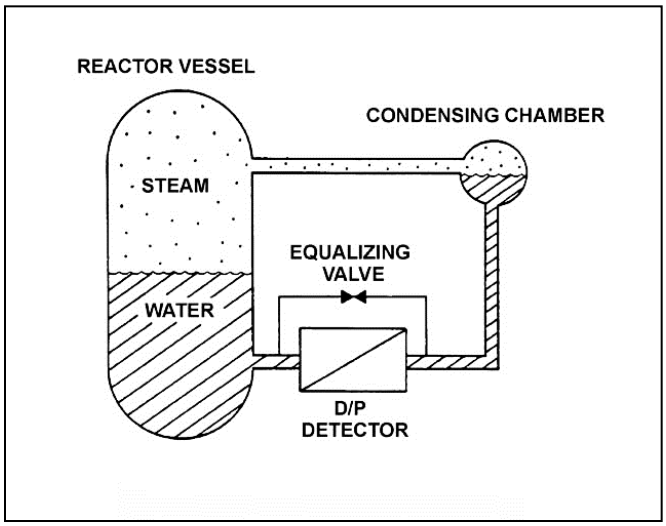
Which one of the following events will result in a reactor vessel level indication that is greater than actual level?

A. The RV pressure increases by 50 psia.

B. The variable leg breaks and completely drains.

C. A portion of the reference leg water flashes to steam.

D. The temperature surrounding the RV and reference leg decreases by 30°F.



QUESTION: 43

Why are burnable poisons installed in a reactor?

A. To compensate for control rod burnout during a fuel cycle.

B. To flatten the radial thermal neutron flux distribution near the end of a fuel cycle.

C. To ensure a negative moderator temperature coefficient exists early in a fuel cycle.

D. To shield some of the reactor fuel from thermal neutron flux until later in a fuel cycle.

QUESTION: 44

Refer to the drawing of an operating cooling water system (see figure below) that is transferring heat between low pressure (LP) and high pressure (HP) water systems.

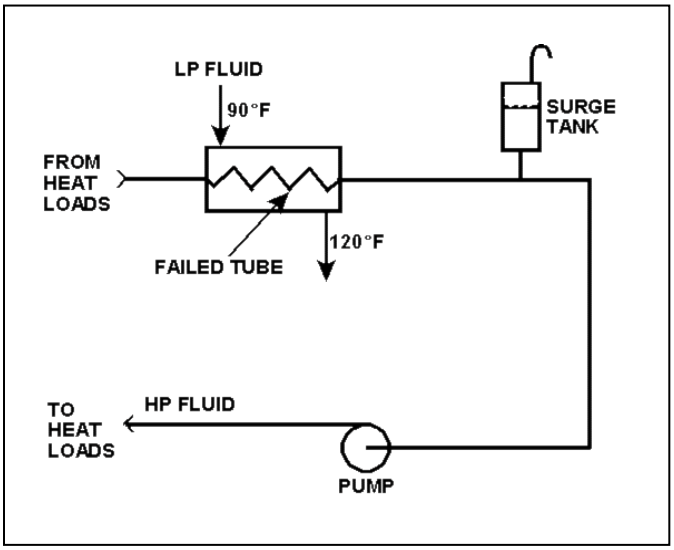
Which one of the following effects initially will occur as a result of a tube failure in the heat exchanger?

A. Level in the surge tank will increase.

B. HP fluid pump flow rate will decrease.

C. HP fluid heat exchanger differential temperature will increase.

D. LP fluid heat exchanger outlet temperature will increase.



QUESTION: 45

An AC motor-driven radial-flow centrifugal pump is being used to fill a vented 30-foot water storage tank. The pump is located at the base of the tank, and discharges through a penetration at the bottom of the tank. Assume the pump is operating with constant inlet water pressure and inlet water temperature.

As the tank water level increases from 10 to 20 feet, the pump motor current will…

A. decrease, because the pump head will decrease.

B. increase, because the pump head will increase.

C. decrease, because the pump flow rate will decrease.

D. increase, because the pump flow rate will increase.

QUESTION: 46

In a reactor operating at full power, the fuel bundle with the lowest power always has the smallest...

A. critical power ratio.

B. radial peaking factor.

C. axial peaking factor.

D. critical heat flux.

QUESTION: 47

Initially, a nuclear power plant was operating at steady-state 85 percent reactor power when the extraction steam to a high pressure feedwater heater became isolated. With the feedwater heater still isolated, the operators stabilized the plant at 85 percent reactor power. Compared to the initial main generator megawatt output, the current main generator megawatt output is…

A. lower, because the steam cycle thermal efficiency is lower.

B. lower, because the steam mass flow rate through the main turbine is lower.

C. higher, because the steam cycle thermal efficiency is higher.

D. higher, because the steam mass flow rate through the main turbine is higher.

QUESTION: 48

A condensate demineralizer differential pressure (D/P) gauge indicates 4.0 psid at 50 percent flow rate. Over the next two days plant power changes have caused condensate flow rate to vary between 25 and 100 percent.

Which one of the following combinations of condensate flow rate and demineralizer D/P, observed during the power changes, indicates an increase in the accumulation of insoluble corrosion products in the demineralizer?

	Condensate Flow Rate (%)	Demineralizer D/P (psid)
A.	100%	15.0
B.	75%	9.0
C.	60%	5.0
D.	25%	2.0

QUESTION: 49

A reactor is shut down near the end of a fuel cycle with the shutdown cooling system in service. The initial reactor vessel water temperature is 100°F. In this condition, the reactor is overmoderated.

Then, a heatup and pressurization is performed to bring the reactor to normal operating temperature and pressure. The reactor remains subcritical.

During the heatup, K_{eff} will…

A. increase continuously.

B. decrease continuously.

C. initially increase, and then decrease.

D. initially decrease, and then increase.

QUESTION: 50

A completely full water storage tank is being hydrostatically tested to 200 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 10 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 200 psig with an accumulation of 2.0 percent.
- Relief valve B opening setpoint is 200 psig with an accumulation of 3.0 percent.
- Each valve has linear flow rate characteristics and a maximum discharge flow rate of 8 gpm.

The PDP is inadvertently left running when tank pressure reaches 200 psig.

With the PDP running continuously, what will the discharge flow rates of the relief valves be when tank pressure stabilizes?

	Relief Valve A	Relief Valve B
A.	2 gpm	8 gpm
B.	4 gpm	6 gpm
C.	6 gpm	4 gpm
D.	8 gpm	2 gpm

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

NRC GENERIC FUNDAMENTALS EXAMINATION
SEPTEMBER 2021 – BWR

FORM A				FORM B			
NO.	ANS.	NO.	ANS.	NO.	ANS.	NO.	ANS.
1	D	26	B	1	C	26	B
2	B	27	D	2	C	27	D
3	A	28	A	3	A	28	C
4	A	29	D	4	B	29	D
5	A	30	D	5	A	30	C
6	C	31	D	6	C	31	B
7	D	32	A	7	C	32	A
8	C	33	C	8	B	33	D
9	B	34	D	9	A	34	B
10	B	35	B	10	A	35	D
11	B	36	C	11	B	36	A
12	A	37	B	12	B	37	A
13	B	38	A	13	A	38	B
14	C	39	A	14	A	39	D
15	C	40	A	15	A	40	D
16	B	41	C	16	B	41	C
17	D	42	C	17	B	42	A
18	A	43	D	18	C	43	D
19	B	44	D	19	A	44	C
20	D	45	C	20	A	45	A
21	A	46	B	21	D	46	D
22	C	47	A	22	D	47	D
23	A	48	D	23	C	48	D
24	A	49	C	24	B	49	C
25	B	50	C	25	C	50	B