Chemistry Handout 5C & 6A - Gas Laws & Kinetics

Name: _____

1) Which graph *best* shows the relationship between the pressure of a gas and its average kinetic energy at constant volume?

A)

B)

C)

D)

2) The temperature of a 2.0-liter sample of helium gas at STP is increased to $27°C$ and the pressure is decreased to 80. kPa. What is the new volume of the helium sample?

A) 4.0 L
B) 2.8 L
C) 2.0 L
D) 1.4 L

3) At the same temperature and pressure, which sample contains the same number of moles of particles as 1 liter of $O_2(g)$?

A) $1 L H_2O(\ell)$
B) $2 L N_2(g)$
C) $0.5 L SO_2(g)$
D) $1 L Ne(g)$

4) The diagram below shows a piston confining a gas in a cylinder.

The gas volume in the cylinder is 6.2 milliliters and its pressure is 1.4 atmospheres. The piston is then pushed in until the gas volume is 3.1 milliliters while the temperature remains constant. Calculate the pressure, in atmospheres, after the change in volume. [*Show all work*.]

5) According to the kinetic theory of gases, which assumption is correct?

A) Gas particles strongly attract each other.
B) Energy may be transferred between colliding particles.
C) The volume of gas particles prevents random motion.
D) Gas particles travel in curved paths.

6) An assumption of the kinetic theory of gases is that the particles of a gas have

A) strong attraction for each other and an insignificant volume
B) strong attraction for each other and a significant volume
C) little attraction for each other and a significant volume
D) little attraction for each other and an insignificant volume

7) One reason that a real gas deviates from an ideal gas is that the molecules of the real gas have

A) a negligible volume
B) forces of attraction for each other
C) no net loss of energy on collision
D) a straight-line motion

8) Under what conditions does a real gas behave *most* like an ideal gas?

A) at low temperatures and high pressures
B) at high temperatures and low pressures
C) at low temperatures and low pressures
D) at high temperatures and high pressures

9) As the pressure on a sample of a gas increases at constant temperature, the volume of the gas
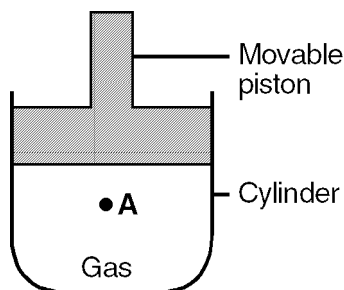
A) decreases
B) remains the same
C) increases

10) The diagram represents a gas confined in a cylinder fitted with a movable piston.

As the piston moves toward point A at constant temperature, which relationship involving pressure (P) and volume (V) is correct?
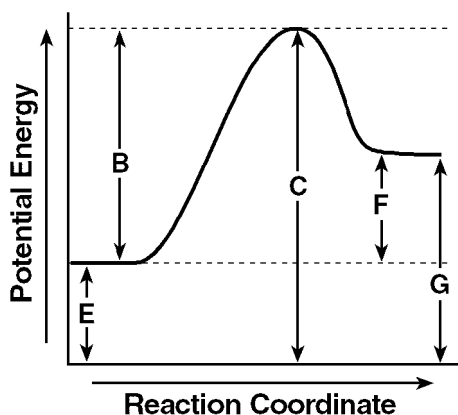
A) $P + V = k$

C) $\dfrac{P}{V} = k$

B) $P \times V = k$

D) $P - V = k$

11) At constant temperature, the pressure on 8.0 liters of a gas is increased from 1 atmosphere to 4 atmospheres. What will be the new volume of the gas?

A) 4.0 L
C) 2.0 L

B) 32 L
D) 1.0 L

12) The volume of a given mass of an ideal gas at constant pressure is

A) directly proportional to the Celsius temperature
B) inversely proportional to the Celsius temperature
C) directly proportional to the Kelvin temperature
D) inversely proportional to the Kelvin temperature

13) At constant pressure, which graph shows the correct relationship between the volume of a gas (V) and its absolute temperature (T)?

A)

C)

B)

D)

14) A gas occupies a volume of 30 milliliters at 273 K. If the temperature is increased to 364 K while the pressure remains constant, what will be the volume of the gas?

A) 60 mL
C) 20 mL

B) 40 mL
D) 30 mL

15) A sample of oxygen gas has a volume of 150. milliliters at 300 K. If the pressure of the sample is held constant and the temperature is raised to 600 K, the new volume of the sample will be

A) 600 mL
C) 150. mL

B) 300. mL
D) 75.0 mL

16) A sample of gas is at STP. As the pressure decreases and the temperature increases, the volume of the gas

A) remains the same
B) decreases
C) increases

17) A sample of gas A was stored in a container at a temperature of 50°C and a pressure of 0.50 atmosphere. Compared to a sample of gas B at STP, gas A had a

A) higher temperature and a lower pressure
B) lower temperature and a higher pressure
C) higher temperature and a higher pressure
D) lower temperature and a lower pressure

18) A gas has a volume of 1,400 milliliters at a temperature of 20.0 K and a pressure of 101.3 kPa. What will be the volume when the temperature is changed to 40.0 K and the pressure is changed to 50.65 kPa?

A) 350 mL
C) 750 mL

B) 5,600 mL
D) 1,400 mL

19) A 20.-milliliter sample of a gas is at 546 K and has a pressure of 6.0 atmospheres. If the temperature is changed to 273 K and the pressure to 2.0 atmospheres, the new volume of the gas will be

A) 120 mL
C) 3.3 mL

B) 13 mL
D) 30. mL

20) At the same temperature and pressure, which gas will diffuse through air at the *fastest* rate?

A) CO_2
C) CH_4

B) He
D) CO

21) Under the same conditions of temperature and pressure, which noble gas diffuses *most* rapidly?

A) Ne
C) Kr

B) Xe
D) Ar

22) A 1.0 liter flask contains 5.0 moles of a gas at 27.0°C. What is the pressure of the gas? [$R = .082 \ L \cdot atm/mol \cdot k$]

A) 101.3 atm
C) 123 atm

B) 300 atm
D) 0.41 atm

23) What is the total pressure exerted by a mixture containing two gases if the partial pressure of one gas is 70 kPa and the partial pressure of the other gas is 30 kPa?
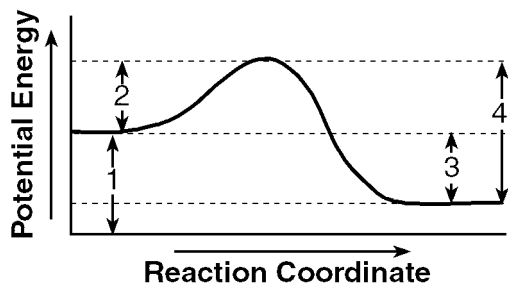
A) 70 kPa
C) 30 kPa

B) 40 kPa
D) 100 kPa

24) A gas volume that contains an equal number of hydrogen and oxygen molecules has a pressure of 0.6 atmosphere. The partial pressure due to the oxygen molecules is

A) 0.6 atm C) 0.3 atm
B) 0.2 atm D) 0.1 atm

25) In a chemical reaction, the difference between the potential energy of the products and the potential energy of the reactants is the

A) activation energy C) free energy
B) heat of reaction D) heat of fusion

26) For a chemical reaction, ΔH is equal to

A) $\dfrac{H_{products}}{H_{reactants}}$

B) $H_{products} - H_{reactants}$

C) $H_{products} \times H_{reactants}$

D) $H_{products} + H_{reactants}$

27) In a chemical reaction, the products have a lower potential energy than the reactants. This reaction must have a negative

A) ΔX C) ΔS
B) ΔH D) ΔG

28) Which of the following statements describes characteristics of an endothermic reaction?

A) The sign of ΔH is negative, and the products have more potential energy than the reactants.
B) The sign of ΔH is positive, and the products have more potential energy than the reactants.
C) The sign of ΔH is negative, and the products have less potential energy than the reactants.
D) The sign of ΔH is positive, and the products have less potential energy than the reactants.

29) As a chemical bond forms between two hydrogen atoms, the potential energy of the atoms

A) remains the same
B) increases
C) decreases

30) Activation energy is required to initiate

A) neither exothermic nor endothermic reactions
B) endothermic reactions, only
C) exothermic reactions, only
D) both exothermic and endothermic reactions

31) A catalyst changes the rate of a chemical reaction by lowering the

A) potential energy of the reactants
B) activation energy of the reaction
C) heat of the reaction
D) potential energy of the products

32) The reaction $A(g) + B(g) \longrightarrow C(g) + D(g) + 30$ kJ has a forward activation energy of 20 kJ. What is the activation energy for the reverse reaction?

A) 10 kJ C) 50 kJ
B) 30 kJ D) 20 kJ

33) In the reversible reaction, the difference between the activation energy of the forward reaction and the activation energy of the reverse reaction is equal to the

A) heat of reaction
B) potential energy of the products
C) activation complex
D) potential energy of reactants

34) Given the following potential energy diagram and the reaction $A + B + 20$ kJ $\longrightarrow C$.

If the activation energy for the forward reaction is 60 kilojoules, then the activation energy for the reverse reaction is

A) 60 kJ C) 20 kJ
B) 40 kJ D) 30 kJ

35) The graph below is a potential energy diagram of a compound which is formed from its elements.

What interval represents the heat of reaction?

A) *A* B) *B* C) *C* D) *D*

36) The diagram below represents a potential energy diagram of a chemical reaction.

Interval B represents the

A) potential energy of the products
B) activated complex
C) activation energy
D) potential energy of the reactants

37)

The activation energy for the reverse reaction is represented by
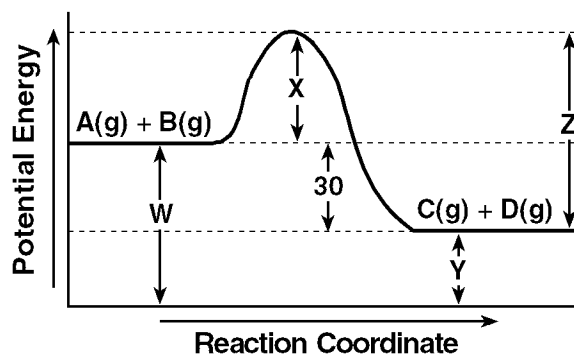
A) 1   B) 2   C) 3   D) 4

38) The potential energy diagram below represents the reaction $R + S + \text{energy} \longrightarrow T$.
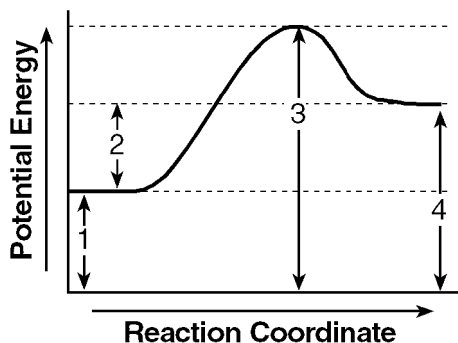
What numbered interval represents the potential energy of the product T?

A) 1   B) 2   C) 3   D) 4

39)

The potential energy of the activated complex is equal to the sum of

A) $X + W + Z$ C) $X + Y + W$
B) $X + W$ D) $X + Y$

40) The graph below represents the potential energy changes that occur in a chemical reaction.
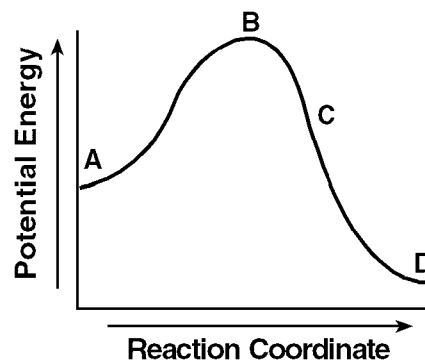
What letter represents the activated complex?

A) A B) B C) C D) D

41) Which potential energy diagram represents the reaction
$A + B \longrightarrow C + $ energy?

A)

B)

C)

D)
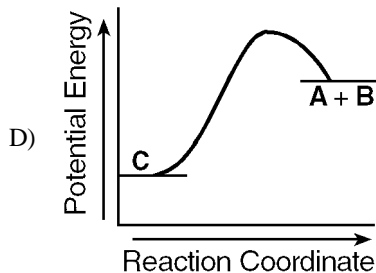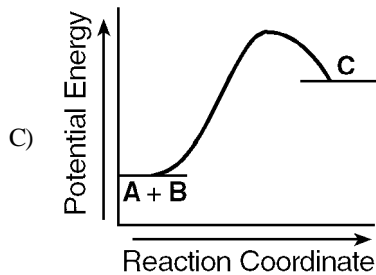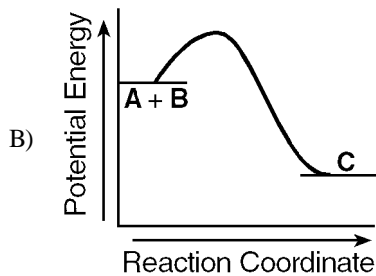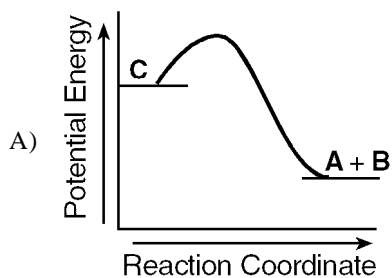
42) According to the potential energy diagram shown below for the reaction $A + B \longrightarrow C + D$, the activation energy is *highest* for the
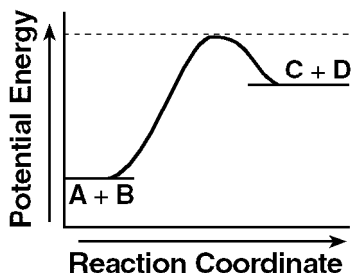
A) reverse reaction, which is exothermic
B) reverse reaction, which is endothermic
C) forward reaction, which is exothermic
D) forward reaction, which is endothermic

43) As the number of effective collisions between the reactant particles in a chemical reaction decreases, the rate of the reaction
A) remains the same
B) increases
C) decreases

44) In order for a chemical reaction to occur, there must *always* be
A) a bond that breaks in a reactant particle
B) an effective collision between reacting particles
C) reacting particles with a high kinetic energy
D) reacting particles with a high charge

45) Two reactant particles collide with proper orientation. The collision will be effective if the particles have
A) sufficient potential energy
B) sufficient kinetic energy
C) high ionization energy
D) high activation energy

46) If the concentration of one of the reactants in a chemical reaction is increased, the rate of the reaction usually
A) increases
B) remains the same
C) decreases

47) Given the reaction:

$$Zn(s) + 2HCl(aq) \longrightarrow Zn^{2+}(aq) + 2Cl^-(aq) + H_2(g)$$
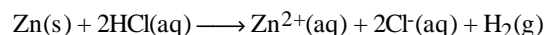
If the concentration of the HCl(aq) is increased, the frequency of reacting collisions will
A) increase, producing an increase in the reaction rate
B) increase, producing a decrease in the reaction rate
C) decrease, producing a decrease in the reaction rate
D) decrease, producing an increase in the reaction rate

48) Raising the temperature speeds up the rate of a chemical reaction by increasing
A) neither the effectiveness nor the frequency of the collisions
B) the frequency of the collisions, only
C) both the effectiveness and the frequency of the collisions
D) the effectiveness of the collisions, only

49) Which of the following statements explains why the speed of some chemical reactions is increased when the surface area of the reactant is increased?
A) This change alters the electrical conductivity of the reactant particles.
B) This change exposes more reactant particles to a possible collision.
C) This change increases the concentration of the reactant.
D) This change increases the density of the reactant particles.

50) As the surface area of the Zn(s) used in the reaction, $Zn(s) + 2HCl(aq) \longrightarrow ZnCl_2(aq) + H_2(g)$, is increased, the rate of the reaction will

A) increase
B) remain the same
C) decrease

51) The addition of a catalyst to a reaction will cause a change in the

A) heat of reaction
B) activation energy
C) potential energy of the products
D) potential energy of the reactants

52) A catalyst can increase the rate of a reaction by

A) decreasing the activation energy
B) increasing the potential energy of the products
C) increasing the activation energy
D) decreasing the potential energy of the products