Name:_____ Chem Lab Test

1) Collision theory states that which of the following must be true for a reaction to occur? (2)

I. Colliding particles must have sufficient kinetic energy.
II. Colliding particles must hit each other from the correct direction and with the correct orientation.
III. The total energy of the colliding particles must not exceed the activation energy.

(a) I Only (b) II Only (c) I and II Only (d) I and III Only (e) I, II, and III

2) Consider the generic reaction $aA+bB \longrightarrow cC$ with an activation energy of 10.0 kJ/mol. The following experiment was done at 298K to determine the rate law. Different initial concentrations of reactants were used and the initial rate was recorded. All concentrations are measured in mol/L.

[A]	[B]	Initial rate (M/s)
2.0	3.0	13.5
4.0	3.0	27.0
4.0	6.0	108.0

(a) Write the rate law for this reaction using k as the rate constant. (2)

(b) If [A] is doubled and [B] is tripled, how will the rate of reaction change? (2)

(c) Find k at 25◦ C (298K). (2)

(d) Find k at 64◦ C (Assume frequency factor is constant with temperature for (d) and (e)). (2)

(e) At what temperature does k = 0.88? (Note: units excluded for testing purposes) (1)

3) Write the balanced chemical equations for the following processes. Include state symbols.
(a) A strip of magnesium is burned. (2)

(b) Solutions of silver nitrate and sodium chloride are mixed. (2)

(c) Hydrogen chloride gas is bubbled through water. (2)

(d) Powdered sodium bicarbonate is added to aqueous acetic acid. (2)

(e) Butane is burned in air. (2)

4) A sample of helium has a volume of 3 liters when the pressure is 500 torr. What volume does the gas occupy at 300 torr? (1)_____

5) At constant pressure, a sample of gas occupies 420 mL at 210 K. What volume does the gas occupy at 250 K? (1)_____

6) At what **Kelvin** temperature will a sample of gas occupy 12 liters if the same sample occupies 8 liters at 27 °C? (1)_____

7) One mole of an ideal gas is held at standard conditions. At what **Kelvin** temperature would the pressure be doubled? (1)_____

8) Which of the following statements is not true of ideal gases? (1)

1. The volume occupied by gas particles is only significant at very low pressures.
2. Gas molecules occupy an insignificant volume compared to the volume of the container that holds them.
3. The particles of a gas move in random straight line paths until a collision occurs.
4. The collisions that occur between gas particles are considered elastic.
5. At a given temperature, all gas molecules within a sample possess the same average kinetic energy.

9) For the elementary reaction $2\ A \rightleftarrows B + C$, the forward rate constant for the formation of B is 265 L/mol·min and the rate constant for the reverse reaction is 392 L/mol·min. The activation energy for the forward reaction is 39.7 kJ/mol and that of the reverse reaction is 25.4 kJ/mol.
a) Calculate the rate of the forward reaction if [A] = 2.0 M (2 pt)

b) What is the change in enthalpy of this reaction? (2 pt)

c) What will the effect of raising the temperature be on each of the rate constants and the equilibrium constant? Give your answer as "increases", "decreases" or "stays the same" for the three options. (3 pts)

forward reaction rate constant _____

reverse reaction rate constant _____

equilibrium constant _____

Answers

1) c (2)

2) a) rate = k[A][B]^2 (2 point)

b) The rate will increase by 18 times. (2 point)

c) k =rate/[A][B]^2= 0.750L^2 mol^−2 s^−1 (2 points: 1 for number + 1 for units)

d) Use the combined Arrhenius equation: ln(k1/k2)= EA/R (1/T2 −1/T1). Make sure to match up the units for EA and R. k = 1.20L^2 mol^−2 s^−1 (2 points: 1 for number + 1 for units)

e) Use above formula again. 310 K (1 point)

3) (2 points each)

a) $2Mg(s) + O2(g) \longrightarrow 2MgO(s)$

b) $AgNO3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO3(aq)$

c) $HCl(g) + H2O(l) \longrightarrow H3O+(aq) + Cl–(aq)$

d) $NaHCO3(s) + CH3COOH(aq) \longrightarrow NaC2H3O2(aq) + H2O(l) + CO2(g)$

e) $2C4H10(g) + 13O2(g) \longrightarrow 8CO2(g) + 10H2O(g)$

4) 5 liters (1 point)

5) 500mL (1 point)

6) 450K (1 point)

7) 136.5K (1 point)

8) 1 (1 point)

9) a) 1060 mol / L / min (2 points)

b) +14.3 kJ/mol (2 points)

c) forward rate constant increases, reverse rate constant increases, equilibrium constant increases (1 point each)