**Select the best answer to the following questions. Place your answers on the provided bubble sheet.**

1. It is possible to separate copper (II) ions from lead (II) ions by precipitation with the addition of aqueous
   A. Sodium sulfide
   B. Sodium carbonate
   C. Sodium hydroxide
   D. Sodium chloride
   E. Sodium nitrate

2. For the following unbalanced equation, what will be the coefficient in front of the hydrogen peroxide when the equation is balanced with the lowest se3t of whole numbers.

$$Cr(OH)_4^{-1} + H_2O_2 + OH^{-1} \rightarrow CrO_4^{-2} + H_2O$$

   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

3. In order to convert zinc metal to zinc ions, all of the following can be used EXCEPT

   A. MnO_4^{-1}
   B. CrO_4^{-2}
   C. NO_3^{-1}
   D. OH^{-1}
   E. H_2O_2

4. A sample of an organic compound contains 55.8% C, 7.00% H, and 37.2% oxygen by weight and has an approximate molecular weight of 175 g/mole. What is the molecular formula of the compound?

   A. C_2H_3O
   B. $C_6H_8O_6$
   C. $C_7H_{10}O_5$
   D. $C_9H_{16}O_3$
   E. $C_8H_{12}O_4$

5. Calcium carbonate reacts with acid to produce carbon dioxide, water, and the corresponding calcium salt. What volume of 0.0300 M hydrochloric acid is needed to react completely with 1.24 g of calcium carbonate?

   A. 0.124 liters
   B. 0.248 liters
   C. 0.413 liters
   D. 0.672 liters
   E. 0.827 liters

6. Calcium carbide reacts with water to produce acetylene (ethyne) as shown:

$$CaC_2 + 2 H_2O \rightarrow Ca(OH)_2 + C_2H_2$$
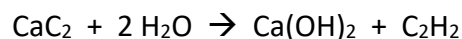
If 1.28 grams of calcium carbide reacts with 0.310 grams of water, how many grams of acetylene could be produced?

   A. 0.224 g
   B. 0.260 g
   C. 0.448 g
   D. 0.520 g
   E. 0.723 g

7. In a typical equilibrium experiment, 0.124 moles of hydrogen gas were mixed with 0.102 moles of oxygen has in a 1.00-liter flask and allowed to reach equilibrium. At that point, the concentration of hydrogen was found to be 0.0820 M. What is the equilibrium constant, K_c, for the formation of water vapor? $2 H_2 (g) + O_2 (g) \rightarrow 2 H_2O (g)$

   A. 1.12
   B. 3.24
   C. 8.17
   D. 23.8
   E. 47.6

8. For the following reaction: $Cu(NH_3)_4^{+2} (aq) \rightarrow Cu^{+2} (aq) + 4 NH_3 (aq)$ $\Delta H > 0$
   All of the following will shift equilibrium to the products EXCEPT

   A. Increasing $[Cu(NH_3)_4^{+2}]$
   B. Adding some dilute nitric acid
   C. Heating the reaction
   D. Adding some sulfide ion solution
   E. Adding a catalyst

9. "Water gas," a mixture of carbon monoxide and hydrogen gases, is formed by reacting steam with pure carbon.

$$C\ (s)\ +\ H_2O\ (g)\ \longleftrightarrow\ CO\ (g)\ +\ H_2\ (g)$$
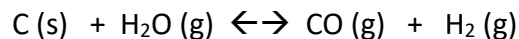
If 6.00 grams of carbon are placed in a one-liter flask with 0.36 grams of steam and allowed to reach equilibrium, the mass of the steam is found to be 0.900 grams. What is the equilibrium constant, K_c, for this reaction?

    A. 0.045
    B. 0.090
    C. 0.810
    D. 1.72
    E. 3.0

10. Use the reaction shown here to select the best answer: $CaCO_3\ (s)\ \longleftrightarrow\ CaO\ (s)\ +\ CO_2\ (g)$ $\Delta H > 0$

The reaction is in a cylinder sealed by a moveable piston and has come to equilibrium. What will happen if the volume is decreased by pushing in on the piston? Temperature is held constant.

A. The amount of all 3 substances will remain constant.
B. The pressure will increase, although some oxygen will be consumed.
C. The pressure will decrease.
D. Some $CaCO_3$ will decompose.
E. The pressure will remain constant, but not the amounts of the 3 substances.

11. ,Equilibrium is reached in chemical reactions when:
A. The rates of the forward and reverse reactions become equal.
B. The concentrations of reactants and products become equal.
C. The temperature shows a sharp rise.
D. All chemical reactions stop.
E. The forward reaction stops.

12. The value of the equilibrium constant, K, is dependent on:
I.   the temperature of the system
II.   the nature of the reactants and products
III.   the concentration of the reactants
IV. the concentration of the products

A. I, II
B. II, III
C. III, IV
D. It is dependent on three of the above choices.

13. If, at a given temperature, the equilibrium constant for the reaction $H_2(g) + Cl_2(g) \rightleftharpoons 2HCl(g)$ is K_p, then the equilibrium constant for the reaction $HCl(g) \rightarrow \frac{1}{2}H_2(g) + \frac{1}{2}Cl_2(g)$ can be represented as:

A. $\dfrac{1}{K_p{}^2}$

B. $K_p{}^2$

C. $\dfrac{1}{\sqrt{K_p}}$

D. $\sqrt{K_p}$

E. none of these

14. If $K = 0.121$ for $A_2 + 2B \rightleftharpoons 2AB$, then for $4AB \rightleftharpoons 2A_2 + 4B$, K would equal:

A. 0.242

B. 0.121

C. –0.121

D. 4.13

E. 68.3

15. Consider the following reaction: $CS_2(g) + 4H_2(g) \rightleftharpoons CH_4(g) + 2H_2S(g)$. The equilibrium constant K is about 0.27 at 900.°C. What is K_p at this temperature?

A. 2.5×10^3

B. 2.8×10^{-3}

C. 2.9×10^{-5}

D. 2.6×10^1

E. 1.1×10^{-3}