Fundamentals of Engineering Exam - General Chemistry Review

1. All of the following are oxidation-reduction reactions EXCEPT:

A) $CaCO_3 \rightarrow CaO + CO_2$

B) $CO_2 + C \rightarrow 2\ CO$

C) $Fe + S \rightarrow FeS$

D) $2\ SO_2 + O_2 \rightarrow 2\ SO_3$

2. To determine the chemical formula of a compound, one needs to know all of the following EXCEPT the:

A) atomic weights of the elements in the compound

B) density of the compound

C) molecular weight of the compound

D) elements that compose the compound

3. The element tin has eight different stable isotopes. The atomic nuclei of all eight isotopes have the same:

A) binding energy

B) number of neutrons

C) mass

D) number of protons

4. The photoelectric effect refers to a process in which:

A) a quantum of energy is converted into a photon

B) electrons release light from a metal target

C) an electron is converted into two photons

D) light releases electrons from a target metal

5. When the pressure of a constant mass of an ideal gas is doubled and the absolute temperature is halved, the volume is:

A) quartered

B) halved

C) quadrupled

D) doubled

6. The volume (L) of 1 mol of H_2O at 546 K and 1.00 atm pressure is most nearly:

A) 11.2

B) 14.9

C) 22.4

D) 44.8

7. Consider the equation:

$$As_2O_3 + 3\,C \rightarrow 3\,CO + 2\,As$$

Atomic weights may be taken as 75 for arsenic, 16 for oxygen, and 12 for carbon. According to the equation above, the reaction of one standard gram-mole of As_2O_3 with carbon will result in the formation of:

A) 1 gram-mole of As
B) 28 grams of CO
C) 150 grams of As
D) a greater amount by weight of CO than As

8. If 60 mL of NaOH solution neutralizes 40 mL of 0.50 M H_2SO_4, the concentration of NaOH solution is most nearly:

A) 0.80 M
B) 0.67 M
C) 0.45 M
D) 0.33 M

9. The atomic weights of sodium, oxygen, and hydrogen are 23, 16, and 1, respectively. To neutralize 4 grams of NaOH dissolved in 1 L of water requires 1 L of:

A) 0.001 normal HCl solution
B) 0.01 normal HCl solution
C) 0.1 normal HCl solution
D) 1.0 normal HCl solution

10. Consider the following equation

$$K = \frac{[C]^2[D]^2}{[A]^4[B]}$$

The equation above is the formulation of the chemical equilibrium constant equation for which of the following reactions?

A) $C_2 + D_2 \rightarrow A_4 + B$
B) $4\,A + B \rightarrow 2\,C + 2\,D$
C) $4\,C + 2\,D \rightarrow 2\,A + B$
D) $A_4 + B \rightarrow C_2 + D_2$

11. Pure water is boiling in an open pan at atmospheric pressure. Salt at a temperature equal to that of the boiling water is added. Immediately after the salt dissolves, which of the following will most likely occur?

A) The boiling ceases.
B) The temperature of the solution drops by 10°C.
C) The water ionizes.
D) The entire mass becomes solid.

12. The statement that equal volumes of all gases under the same conditions of temperature and pressure contain very nearly the same number of molecules is known as
A) Avogadro's law
B) Boyle's law
C) Dalton's law
D) Gay-Lussac's law

13. Ethane burns according to the equation

$$2\ C_2H_6 + 7\ O_2 \rightarrow 4\ CO_2 + 6\ H_2O$$

What volume of CO_2, measured at standard temperature and pressure, is formed for each gram-mole of C_2H_6 burned?
A) 22.4 liters
B) 44.8 liters
C) 88.0 liters
D) 89.6 liters

14. The valence (oxidation state) of manganese in potassium permanganate, $KMnO_4$, is
A) +3
B) +4
C) +5
D) +7

15. In electrolysis, the anions migrate to the anode. Which of the following ions migrate to the other electrode?
A) Acidic ions
B) Basic ions
C) Neutral ions
D) Cations

16. Which of the following elements would **NOT** be expected to form a positive ion?
A) Lithium (Li)
B) Sulfur (S)
C) Magnesium (Mg)
D) Tantalum (Ta)