1. What is the **mass percent** of sulfur in $Al_2(SO_4)_3$?

   A. 9.372 %
   C. 28.12 %
   B. 21.38 %
   D. 42.73 %

2. How many **grams** of phosphorus are in 35.70 g of P_2O_5?

   A. 6.359 g
   C. 15.58 g
   B. 23.37 g
   D. 31.16 g

3. A compound contains only C, H, and O. If 52.14% is carbon and 34.73% is oxygen by mass, what is the **empirical formula** of the compound?

   A. CHO
   C. CH_4O_3
   B. CH_3O
   D. C_2H_6O

4. What is the **molecular formula** for a compound with a molar mass of 186.24 g/mol and the empirical formula C_6H_7N?

   A. C_6H_7N
   C. $C_9H_{10.5}N_{1.5}$
   B. $C_{12}H_{14}N_2$
   D. $C_{18}H_{21}N_3$

5. For the reaction below, which statement is **incorrect**?

$$2\ Mg(s) + O_2(g) \rightarrow 2\ MgO(s)$$

   A. 2 atoms of Mg plus 1 molecule of O_2 yields 2 formula units of MgO.
   B. 2 moles of Mg plus 1 mole of O_2 yields 2 moles of MgO.
   C. 48.6 grams of Mg plus 32.0 grams of O_2 yields 80.6 grams of MgO.
   D. 2 grams of Mg plus 1 gram of O_2 yields 2 grams of MgO.

6. After balancing the following reaction equation using the smallest integral coefficients, what is the **sum** of the molar coefficients of the **products?**

$$\_\_\ (NH_4)_2Cr_2O_7(s) \rightarrow \_\_\ Cr_2O_3(s) + \_\_\ N_2(g) + \_\_\ H_2O(g)$$

A. 4
B. 6
C. 5
D. 7

7. Consider the following balanced reaction equation. How many **moles of O_2** are required to produce 2.33 moles of water, if excess C_3H_7SH is present?

$$C_3H_7SH(l) + 6\ O_2(g) \rightarrow 3\ CO_2(g) + SO_2(g) + 4\ H_2O\ (g)$$

A. 1.55 moles O_2
B. 4.14 moles O_2
C. 3.50 moles O_2
D. 6.21 moles O_2

8. Consider the following balanced reaction equation. How many **grams of sulfur** are formed when 22.3 g of dihydrogen sulfide are allowed to react with an excess of sulfur dioxide?

$$2\ H_2S(g) + SO_2(g) \rightarrow 3\ S(s) + 2\ H_2O(l)$$

A. 12.9 g S
B. 31.5 g S
C. 22.3 g S
D. 64.1 g S

9. According to the balanced reaction equation below, what is the **limiting reactant** if 50.0 g of N_2O_4 and 45.0 g of N_2H_4 react? (molar masses: N_2O_4 = 92.02 g/mol, N_2H_4 = 32.05 g/mol, N_2 = 28.01 g/mol, H_2O = 18.02 g/mol)

$$N_2O_4(l) + 2\ N_2H_4(l) \rightarrow 3\ N_2(g) + 4\ H_2O(g)$$

A. N_2O_4
B. N_2H_4
C. N_2
D. H_2O

10. Isoamyl acetate ($C_7H_{14}O_2$) is one of the products of the following balanced reaction equation. What is the **percent yield** when 5.2 grams of isoamyl acetate is recovered from a reaction of 5.0 g of $C_5H_{12}O$ with 5.0 g of $HC_2H_3O_2$? (molar masses: $C_5H_{12}O$ = 88.15 g/mol, $HC_2H_3O_2$ = 60.05 g/mol, $C_7H_{14}O_2$ = 130.19 g/mol)

$$C_5H_{12}O(l) + HC_2H_3O_2(l) \rightarrow C_7H_{14}O_2(l) + H_2O(l)$$

A. 50 %
B. 88 %
C. 47%
D. 70 %

11. How many milliliters of a 0.184 M $NaNO_3$ solution contain 0.113 moles of $NaNO_3$?

A. 163 mL
B. 326 mL
C. 543 mL
D. 614 mL

12. What volume of 4.26 M sodium hydroxide solution is diluted to prepare 85.0 mL of 0.327 M sodium hydroxide solution?

A. 2.75 mL
B. 6.52 mL
C. 5.20 mL
D. 9.11 mL

13. Which of the following is a **<u>weak electrolyte</u>** in aqueous solution?

A. lithium hydroxide
B. acetic acid
C. hydrobromic acid
D. calcium chloride

14. Which compound is the **<u>least soluble</u>** in water?

A. CaI_2
B. Na_2SO_4
C. $Mg(OH)_2$
D. NH_4OH

15. Give the **<u>net ionic equation</u>** for the reaction that occurs when aqueous solutions of K_2S and $Fe(NO_3)_2$ are mixed.

A. $K^+(aq) + NO_3^-(aq) \rightarrow KNO_3(s)$
B. $Fe^{2+}(aq) + S^{2-}(aq) + 2\ K^+(aq) + 2\ NO_3^-(aq) \rightarrow FeS(s) + 2\ K^+(aq) + 2\ NO_3^-(aq)$
C. $Fe^{2+}(aq) + S^{2-}(aq) + 2\ K^+(aq) + 2\ NO_3^-(aq) \rightarrow Fe^{2+}(aq) + S^{2-}(aq) + 2\ KNO_3(s)$
D. $Fe^{2+}(aq) + S^{2-}(aq) \rightarrow FeS(s)$

16. What is a common method used to determine the concentrations of acids and bases?

A. titration
B. filtration
C. distillation
D. combustion

17. What is the molarity of a NaOH solution if 28.2 mL of a 0.355 M H_2SO_4 solution is required to neutralize a 25.0 mL sample of the NaOH solution?

A. 0.315 M NaOH
C. 0.629 M NaOH
B. 0.801 M NaOH
D. 0.427 M NaOH

18. Which of the following is/are redox reaction(s)?

I. $4\ Li(s) + O_2(g) \rightarrow 2\ Li_2O(s)$

II. $C_3H_8(l) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(l)$

III. $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$

IV. $Pb(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow PbSO_4(s) + 2\ NaNO_3(aq)$

A. I
C. I and II
B. III and IV
D. IV

19. What is the **<u>oxidation number</u>** of the chromium atom in K_2CrO_4?

A. +4
C. +6
B. +5
D. +7

20. An ideal gas occupies 3.8 liters at a pressure of 0.71 atm. If the volume of the gas is **tripled**, what is the pressure? Assume that the temperature and the amount of the gas are held constant.

A. 1.1 atm
B. 0.24 atm
C. 2.4 atm
D. 0.63 atm

21. An ideal gas

A. exerts no pressure on the walls of its container.
B. is hypothetical, but is a good approximation for many real gases.
C. has a constant density with increasing pressure.
D. becomes a liquid at low pressures

22. How many **molecules** of CO_2 are contained in a 10.0 L tank at 7.53 atm and 485 K?

A. 1.14×10^{24} molecules
B. 5.52×10^{24} molecules
C. 3.65×10^{24} molecules
D. 2.39×10^{24} molecules

23. Which of the following gases occupies the **largest** volume at STP?

A. 22 g Cl_2
B. 22 g CO_2
C. 22 g O_2
D. 22 g SO_2

24. What is the **density** of argon gas at STP?

A. 7.81 g/L
B. 2.77 g/L
C. 1.78 g/L
D. 39.9 g/L

25. A 0.133-gram sample of an ideal gas occupies 164 mL at 747 torr and 298 K. What is the molar mass of the gas?

A. 4.00 g/mol
B. 39.9 g/mol
C. 83.8 g/mol
D. 20.2 g/mol

26. A gaseous mixture contains oxygen, nitrogen, neon, and helium. If the partial pressures of the gases are $P_{N_2} = 0.5$ atm, $P_{O_2} = 0.6$ atm, $P_{Ne} = 0.1$ atm and $P_{He} = 0.2$ atm, what is the **total pressure** of the mixture?

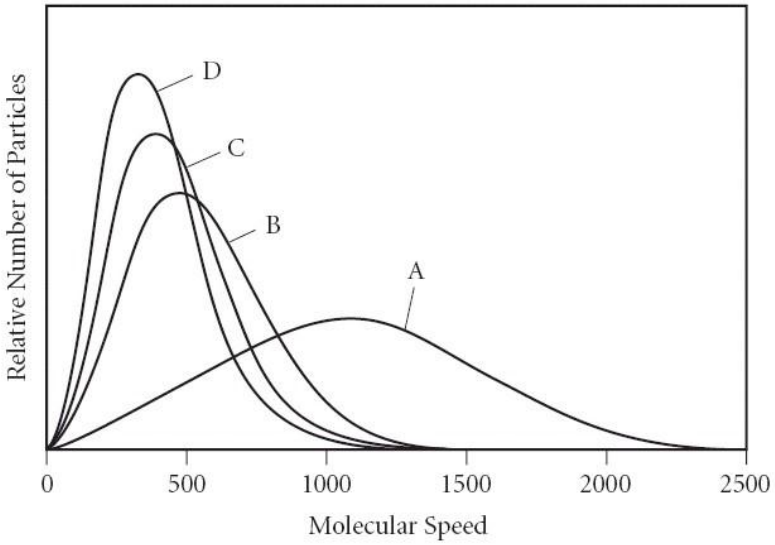
A. 1.4 atm
B. 3.5 atm
C. 2.0 atm
D. 4.7 atm

27. How many **moles** of XeF_6 are formed when 12.9 L of F_2 at 298 K and 2.60 atm reacts with excess Xe according to the following equation?

$$Xe(g) + 3\ F_2(g) \rightarrow XeF_6(g)$$

A. 4.11 moles XeF_6
B. 0.296 moles XeF_6
C. 0.457 moles XeF_6
D. 2.15 moles XeF_6

28. Which of the gases in the plot below has the **smallest** molar mass? All measurements were performed at the same temperature.



A. A
B. B
C. C
D. D

29. Which of the following equations is used to correct for **non-ideal** behavior of gases?

A. $P_1V_1 = P_2V_2$
B. $PV = nRT$
C. $[P + a(n/V)^2][V - nb] = nRT$
D. $d = m/V$

30. When the reaction

$$2\ CO(NH_2)_2(g) + 4\ NO(g) + O_2(g) \rightarrow 4\ N_2(g) + 2\ CO_2(g) + 4\ H_2O(g)$$

occurs in a sealed container at constant temperature, the pressure

A. increases.
B. decreases.
C. remains unchanged.
D. behaves unpredictably.

Answer Key:

1. C
2. C
3. D
4. B
5. D
6. B
7. C
8. B
9. A
10. D
11. D
12. B
13. B
14. C
15. D
16. A
17. B
18. C
19. C
20. B
21. B
22. A
23. C
24. C
25. D
26. A
27. C
28. A
29. C
30. A