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Math of Chemistry Review

34 What is the gram-formula mass of $Ca_3(PO_4)_2$?

(1) 248 g/mol (3) 279 g/mol
(2) 263 g/mol (4) 310. g/mol

17 What is the total number of different elements present in NH_4NO_3?

(1) 7 (3) 3
(2) 9 (4) 4

Base your answers to questions 77 through 79 on the information below.

Some dry chemicals can be used to put out forest fires. One of these chemicals is $NaHCO_3$. When $NaHCO_3(s)$ is heated, one of the products is $CO_2(g)$, as shown in the balanced equation below.

$$2NaHCO_3(s) + \text{heat} \rightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

77 In the space *in your answer booklet*, show a correct numerical setup for calculating the percent composition by mass of carbon in the product Na_2CO_3. [1]

78 Identify the type of chemical reaction represented by this equation. [1]

79 Determine the total number of moles of $CO_2(g)$ produced when 7.0 moles of $NaHCO_3(s)$ is completely reacted. [1]

10 Given the balanced equation representing a reaction:

$$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$$

What is the mole ratio of $CO(g)$ to $CO_2(g)$ in this reaction?

(1) 1:1 (3) 2:1
(2) 1:2 (4) 3:2

12 Which polyatomic ion contains the greatest number of oxygen atoms?

(1) acetate (3) hydroxide
(2) carbonate (4) peroxide

51 What is the oxidation number of nitrogen in $NO(g)$? [1] **51** _____

35 A compound has a molar mass of 90. grams per mole and the empirical formula CH_2O. What is the molecular formula of this compound?

(1) CH_2O (3) $C_3H_6O_3$
(2) $C_2H_4O_2$ (4) $C_4H_8O_4$

9 What is the name of the polyatomic ion in the compound Na_2O_2?

(1) hydroxide (3) oxide
(2) oxalate (4) peroxide

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9 What is the name of the polyatomic ion in the compound Na_2O_2?

(1) hydroxide (3) oxide
(2) oxalate (4) peroxide

36 Which formula represents lead(II) chromate?

(1) $PbCrO_4$ (3) Pb_2CrO_4
(2) $Pb(CrO_4)_2$ (4) $Pb_2(CrO_4)_3$

36 Given the balanced equation representing a reaction:

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$$

What is the *minimum* number of moles of O_2 that are needed to completely react with 16 moles of NH_3?

(1) 16 mol (3) 64 mol
(2) 20. mol (4) 80. mol

18 Bronze contains 90 to 95 percent copper and 5 to 10 percent tin. Because these percentages can vary, bronze is classified as

(1) a compound (3) a mixture
(2) an element (4) a substance

38 Which pair consists of a molecular formula and its corresponding empirical formula?

(1) C_2H_2 and CH_3CH_3 (3) P_4O_{10} and P_2O_5
(2) C_6H_6 and C_2H_2 (4) SO_2 and SO_3

10 Given the balanced equation representing the reaction between propane and oxygen:

$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$

According to this equation, which ratio of oxygen to propane is correct?

(1) $\frac{5 \text{ grams } O_2}{1 \text{ gram } C_3H_8}$ (3) $\frac{10 \text{ grams } O_2}{11 \text{ grams } C_3H_8}$

(2) $\frac{5 \text{ moles } O_2}{1 \text{ mole } C_3H_8}$ (4) $\frac{10 \text{ moles } O_2}{11 \text{ moles } C_3H_8}$

17 Which substance can be decomposed by chemical means?

(1) tungsten (3) krypton
(2) antimony (4) methane

55 Determine the percent composition by mass of oxygen in the compound $C_6H_{12}O_6$. [1]

55 _____ %

54 A hydrated compound contains water molecules within its crystal structure. The percent composition by mass of water in the hydrated compound $CaSO_4 \cdot 2H_2O$ has an accepted value of 20.9%. A student did an experiment and determined that the percent composition by mass of water in $CaSO_4 \cdot 2H_2O$ was 21.4%.

In the space *in your answer booklet*, calculate the percent error of the student's experimental result. Your response must include *both* a correct numerical setup and the calculated result. [2]

54

_____ %

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6 A compound is made up of iron and oxygen, only. The ratio of iron ions to oxide ions is 2:3 in this compound. The IUPAC name for this compound is

(1) triiron dioxide
(2) iron(II) oxide
(3) iron(III) oxide
(4) iron trioxide

37 The percent composition by mass of magnesium in $MgBr_2$ (gram-formula mass = 184 grams/mole) is equal to

(1) $\frac{24}{184} \times 100$
(2) $\frac{160.}{184} \times 100$
(3) $\frac{184}{24} \times 100$
(4) $\frac{184}{160.} \times 100$

51 In the space *in your answer booklet*, draw a Lewis electron-dot diagram for a sulfur atom in the ground state. [1]

51

6 What is the IUPAC name for the compound FeS?

(1) iron(II) sulfate
(2) iron(III) sulfate
(3) iron(II) sulfide
(4) iron(III) sulfide

35 In which compound is the percent composition by mass of chlorine equal to 42%?

(1) HClO (gram-formula mass = 52 g/mol)
(2) $HClO_2$ (gram-formula mass = 68 g/mol)
(3) $HClO_3$ (gram-formula mass = 84 g/mol)
(4) $HClO_4$ (gram-formula mass = 100. g/mol)

33 A substance has an empirical formula of CH_2 and a molar mass of 56 grams per mole. The molecular formula for this compound is

(1) CH_2
(2) C_4H_6
(3) C_4H_8
(4) C_8H_4

36 Given the balanced equation:

$$2C + 3H_2 \rightarrow C_2H_6$$

What is the total number of moles of C that must completely react to produce 2.0 moles of C_2H_6?

(1) 1.0 mol
(2) 2.0 mol
(3) 3.0 mol
(4) 4.0 mol

9 What is the total number of pairs of electrons shared in a molecule of N_2?

(1) one pair
(2) two pairs
(3) three pairs
(4) four pairs

38 Given the balanced equation:

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(\ell) + CO_2(g)$$

What is the total number of moles of CO_2 formed when 20. moles of HCl is completely consumed?

(1) 5.0 mol
(2) 10. mol
(3) 20. mol
(4) 40. mol

7 Given the balanced equation representing a reaction:

$$F_2(g) + H_2(g) \rightarrow 2HF(g)$$

What is the mole ratio of $H_2(g)$ to HF(g) in this reaction?

(1) 1:1
(2) 1:2
(3) 2:1
(4) 2:3

8 What is the chemical formula for sodium sulfate?

(1) Na_2SO_3
(2) Na_2SO_4
(3) $NaSO_3$
(4) $NaSO_4$

10 Which chemical equation is correctly balanced?

(1) $H_2(g) + O_2(g) \rightarrow H_2O(g)$
(2) $N_2(g) + H_2(g) \rightarrow NH_3(g)$
(3) $2NaCl(s) \rightarrow Na(s) + Cl_2(g)$
(4) $2KCl(s) \rightarrow 2K(s) + Cl_2(g)$

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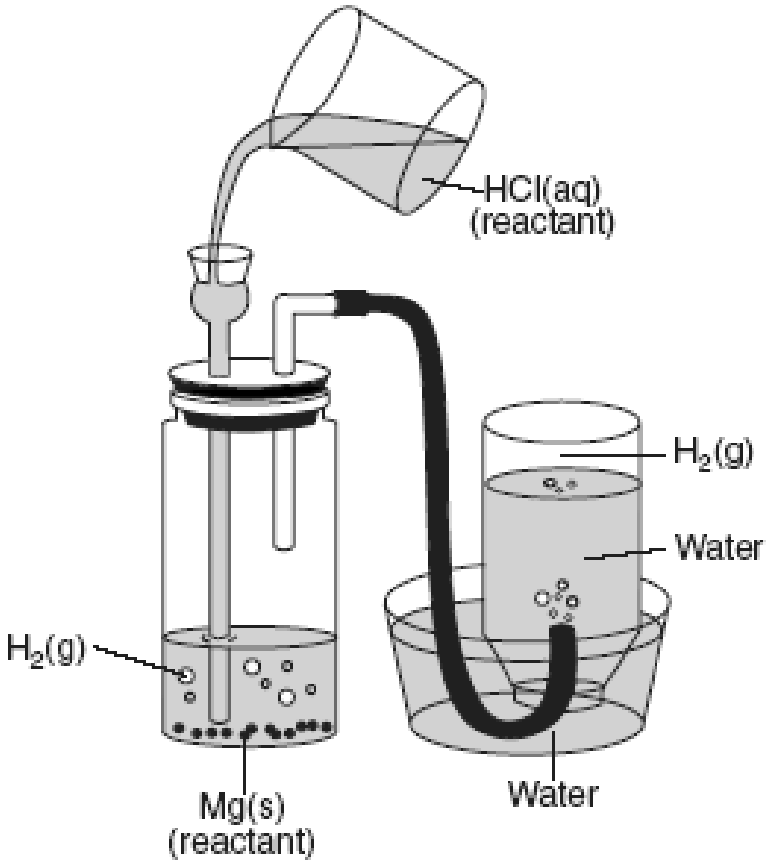
Base your answers to questions 82 through 85 on the information below.

A student places a 2.50-gram sample of magnesium metal in a bottle and fits the bottle with a 2-hole stopper as shown in the diagram. Hydrochloric acid is added to the bottle, causing a reaction. As the reaction proceeds, hydrogen gas travels through the tubing to an inverted bottle filled with water, displacing some of the water in the bottle.



82 Balance the equation *in your answer booklet* for the reaction of magnesium and hydrochloric acid, using the smallest whole-number coefficients. [1]

83 Identify the type of chemical reaction that occurs when magnesium reacts with hydrochloric acid. [1]

84 In the space *in your answer booklet*, show a correct numerical setup for calculating the number of moles of magnesium used in the experiment. [1]

85 Based on Reference Table *J*, explain why Ag(s) will *not* react with HCl(aq) to generate $H_2(g)$. [1]

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82 _____ $Mg(s)$ + _____ $HCl(aq) \rightarrow$ _____ $MgCl_2(aq)$ + _____ $H_2(g)$

83 _____

84

85 _____

33 What is the percent composition by mass of nitrogen in NH_4NO_3 (gram-formula mass = 80.0 grams/mole)?

(1) 17.5%
(2) 35.0%
(3) 52.5%
(4) 60.0%

31 The percentage by mass of Br in the compound $AlBr_3$ is closest to

(1) 10.%
(2) 25%
(3) 75%
(4) 90.%

9 The correct chemical formula for iron(II) sulfide is

(1) FeS
(2) Fe_2S_3
(3) $FeSO_4$
(4) $Fe_2(SO_4)_3$

48 Given the incomplete equation:

$$4Fe + 3O_2 \rightarrow 2X$$

Which compound is represented by *X*?

(1) FeO
(2) Fe_2O_3
(3) Fe_3O_2
(4) Fe_3O_4