**UNIT 5 REVIEW**

**The Mole, Percent Composition, Empirical & Molecular Formula**

1. a) Water is 11.2 % Hydrogen. What mass of hydrogen is required to produce 11.2 g of Water?

b) What mass of oxygen is required to produce 8.6 g of water?

2. Hydrogen chloride is 2.76 % Hydrogen. How much hydrogen will combine with 5.0 g of chlorine? What will the mass of the Hydrogen chloride formed be?

3. Iron forms two oxides, one with 69.9 % Iron and the other with 77.7 % Iron. How much oxygen will react with 1.00 g of Iron in each case? Explain how this shows the law of multiple proportions.

4. Two volumes of diphosphorous tetroxide will combine with one volume of oxygen gas to form two volumes of another oxide of phosphorous (measured at the same temperature and pressure).

a) What volume of product phosphorous oxide could be made from 5.6 L of oxygen, given enough diphosphorous tetroxide?

b) If 2.5 L of P2O4 is mixed with 1.15 L of oxygen, which is the limiting reagent?

c) How much product can be made with the volumes given in b)?

5. From the information in question #4, propose a formula for the new oxide of phosphorous.

6. The following data and results were generated in an experiment

|  |  |  |  |
| --- | --- | --- | --- |
|  | gas A | gas B | gas C |
| mass of gas container (g) | 25.363 | 24.150 |  |
| mass of container + gas (g) |  | 25.510 | 30.911 |
| mass of gas (g) | 0.085 |  | 5.580 |
| relative mass of gas |  | 48.0 |  |

Fill in the blanks in the chart. Show your work.

7. Consider the following data collected in an experiment;

mass of empty gas container 71.36 g

mass of container + oxygen gas 72.52 g

mass of container + unknown gas 77.16 g

a calculate the mass of each gas {1 mark each}

b. what is the molar mass of the unknown gas? {3 marks}

8. What mass will 4.79 moles of carbon be?

9. How many moles will be found in 16.7 g of Zinc?

10. What are the empirical formulas of the following compounds?

a) compound 1: 25.8% oxygen by mass, the rest is sodium.

b) compound 2: 28.2% potassium, 25.6% chlorine and 46.2% oxygen.

11. What mass of Ca(OH)2 can be made from 5.00 grams of Ca?

12. What is the percent composition of all of the elements of potassium carbonate?

13. Cobalt(II)chloride exists as a hydrate with 6 waters (CoCl2 6H2O). How many grams of the hydrate could be made from 10.0 grams of the anhydrous salt?

14. What is the mass of 2.61 moles of sodium oxide?

15. A compound has the empirical formula of CHO. Name 3 molecular formulas that have CHO as their empirical formula.

16. List the molar masses of the molecules you suggested in question 1.

17. A compound is 42.9% C, 7.1% H and 50.0%N. It has a molar mass of 140 g/mole. What is its molecular formula?

18. 3.36 g of C, 0.708 g of H and 2.24 g of O combine to form 0.0702 moles of compound. What are its empirical and molecular formulas?

19. 10.0 grams of a compound containing C, H and N is burned in oxygen. 16.28 grams of CO2 and 3.34 grams of water are produced. When a sample of the compound is compared to the same volume of Neon gas at the same temperature and pressure, it is found to be 6.75 times heavier. What is the molecular formula of the compound?

20. A compound containing C, S and O was burned. 12.36 grams of the sample produced 7.15 grams of CO2. The compound contained 5.20 grams of Sulphur. The same 12.36 gram sample was found to contain 0.0813 moles. What is the molecular formula of the compound?

**Answers:**

1 a) 1.25 g b) 7.6 g

2 0.14 g hydrogen 5.14 g hydrogen chloride

3 Compound 1 (69.9%) combines with 0.43 g of oxygen

Compound 2 (77.7%) combines with 0.28 g of oxygen

Oxygen mass in Compound 2: Compound 1 = 2:3. Since it is a small, whole number ratio, it fits with the law of multiple proportions.

4 a) 11.2 L b) oxygen is limiting c) 2.3 L of product

5 2P2O4 + O2 🡪 2P2Ox . In order to balance, the x must be 5 (diphosphorous pentoxide)

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|  |  |  |  |
| --- | --- | --- | --- |
|  | gas A | gas B | gas C |
| mass of gas container (g) | 25.363 | 24.150 | 25.331 |
| mass of container + gas (g) | 25.448 | 25.510 | 30.911 |
| mass of gas (g) | 0.085 | 1.360 | 5.580 |
| relative mass of gas | 3.0 | 48.0 | 196.9 |

7 a) oxygen 1.016 g unknown gas 5.80 g

b) 183 g/mole

8 57.48 g

9 0.255 moles

10. a)Na2O b) KClO4

11. 9.25 g Ca(OH)2

12. K=56.5%, C=8.69%, O=34.8%

13. 18.31 g hydrate

14. 161.8 g Na2O

15. C2H2O2, C3H3O3, etc.

16. masses: 58 g/mol, 87 g/mol, etc.

17. C5H10N5

18. C4H10O2 (molecular)

19. C5H5N5

20. C2S2O4