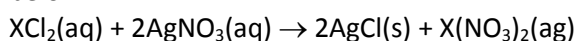


## DETERMINATION OF UNKNOWN SUBSTANCES

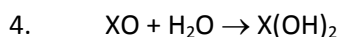
1. A 1.46 g of HCl acid was used to dissolve 1.6 g of oxide of a divalent ( $2+$  charged) metal. What is the formula of this oxide?

2. A 0.4 moles of the compound  $X_2O_3$  weighs 79.2 grams and there are 108 neutrons in a molecule of  $X_2O_3$ . If one oxygen atom contains 8 protons and 8 neutrons, find the proton number of X in  $X_2O_3$ ?

3. A 11.1 grams of compound  $XCl_2$  is reacted with a sufficient amount of  $AgNO_3$  and, then 28.70 grams of  $AgCl$  is precipitated. The reaction equation is given below



What is the molar mass of X? (Ag:108, Cl:35.5)



If 3.6 grams of  $H_2O$  is consumed, 14.8 g of  $X(OH)_2$  is produced according to given equation.

Find the atomic mass of X? (O: 16, H: 1)

5. By the reaction of 5.4 grams of Al with element X,  $Al_2X_3$  is formed and all formed product reacts with Mg to produce  $MgX$  completely. And all formed  $MgX$  reacts with Na and produce 23.4 grams of  $Na_2X$ . Find atomic mass of X?

(Al: 27, Mg: 24, Na: 23)

6. If complete combustion of 0.2 moles of a hydrocarbon needs 1.2 moles of  $O_2$  and produce 0.8 moles of  $CO_2$ , how many moles of atoms are there in 1 mole of this hydrocarbon?

7. When 10 grams of a hydrocarbon compound, which consists of carbon, hydrogen and oxygen, is burnt, 19.1 grams of  $CO_2$  and 11.7 grams of  $H_2O$  are produced. What is the empirical formula of the hydrocarbon compound? (C:12, H:1, O:16)

8. A compound contains 19.3% Na, 26.9% S and 53.8% O by mass

**A.** What is the empirical formula of compound?

**B.** What is the molecular formula of compound if molecular mass of the compound is 238 g/mol?

(Na: 23, S: 32, O: 16)

9. If a compound contains 21.6% sodium, 33.3% chlorine and 45.1% oxygen by mass, what is the empirical formula of the compound?

10. When 1.367 grams sample of an organic compound containing carbon, hydrogen and oxygen elements, is burnt, 3.002 grams of  $CO_2$  and 1.640 grams of  $H_2O$  are produced. Find the empirical formula of the compound? (C: 12, H: 1, O: 16)

11. If 4 moles of  $H_3PO_4$  are produced from 1 mole of white solid phosphorous in a series of reactions, what are the empirical and molecular formula of the white phosphorous?

12. When 1 gram of hydrocarbon is burnt 3.3 grams  $CO_2$  and 0.9 grams  $H_2O$  are obtained. What is the empirical formula of this hydrocarbon?

(C: 12, H: 1, O: 16)

13. When a 2.3 g compound containing carbon, hydrogen, and oxygen is burned, 4.4 g of carbon dioxide and 2.7 g of water are produced. Find the empirical formula of the compound.

14. The combustion of 0.25 mole of compound containing carbon, hydrogen, and oxygen requires 1.25 mole of oxygen and produces 1 mole of carbon dioxide and 1 mole of water. What is the formula of the compound?

15. A metal oxide contains 47.06 % oxygen. Find the oxide.

16. When a 10 g sample of divalent metal is reacted with nitric acid, 5.6 L of hydrogen gas forms at STP. Find the metal.

17. A 60 g of C-H-O compound contains 4 g of hydrogen and 32 g of oxygen. What is its empirical formula?

18. When 2.2 g of a compound containing carbon hydrogen and oxygen is burned 4.4 g of carbon dioxide and 1.8 g of water are produced. What is the empirical formula of the compound?

19. A 0.02 mole of  $Na_2CO_3 \cdot xH_2O$  solid is heated and its mass decreases by 3.6 g. What is the value of x in the formula?

20. By the reaction of 11.2 grams of  $XOH$  and 4.4 grams of  $YO_2$ , 13.8 grams of  $X_2YO_3$  and some amount of  $H_2O$  are produced. Find the molar mass of X and Y? (H: 1, O: 16)

21. The mass of oxygen in 15g nitrogen dioxide is 8 g

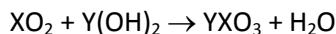
What is the empirical formula of the compound?  
(N: 14, O: 16)

22. What is the empirical formula of the nitrogen oxide, if 7.6 g of nitrogen oxide sample contains 4.8 grams of oxygen. (N: 14, O: 16)

23. A 0.25 moles of  $O_2$  is used to burn 0.1 mole compound of  $C_2H_x(OH)_2$ . According to this information, what is the value of x in the compound of  $C_2H_x(OH)_2$ ?

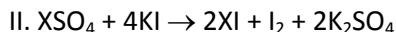
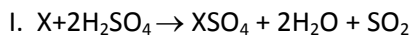
24. Given:  $X(OH)_3 + 3HY \rightarrow XY_3 + 3H_2O$   
9.5 grams of  $X(OH)_3$  and 19.2 grams of  $HY$  combine completely and produce 2.7grams of  $H_2O$ . Find the atomic weights of X and Y.

25. Given the reaction:



3.2 g  $XO_2$  reacts completely with 3.7 g  $Y(OH)_2$  to produce 6 g  $YXO_3$ . Calculate the atomic weights of the elements X and Y.

26. Given the reactions:



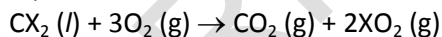
When 19.2 g X is used in the above sequence of reactions, 104.4 g of  $K_2SO_4$  is produced. What is the atomic weight of X? ( $K_2SO_4$ : 174)

27. When 13.7g of  $M_3O_4$  was heated, it decomposed into 13.38 g  $MO$  and some  $O_2$  gas. What is the atomic weight of M?

28. Calculate the atomic weight of the element represented by X in each of the following.

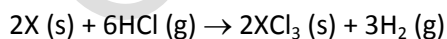
**A.** 10.8 g Al combines with 32g  $X_2O_3$  according to the equation  $2Al(s) + X_2O_3(s) \rightarrow Al_2O_3 + 2X(s)$

**B.** 2.24L  $XO_2$  at STP is produced from 3.8 g of  $CX_2$  in the equation:



**C.** 26 g of  $XCl_2$  is produced from 37g of  $XBr_2$  in the equation  $XBr_2(s) + Cl_2(g) \rightarrow XCl_2(g) + Br_2(l)$

**D.** 27 g of  $XCl_3$  is produced from 11.2 L  $HCl$  at STP in the reaction :

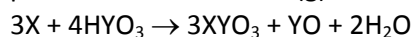


29. Calculate the atomic weights of X and Y elements in each of the following.

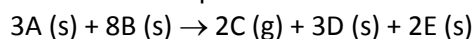
**A.** 10 g of  $X_3Y_2$  combines with 10.8 g of  $H_2O$  to produce 17.4 g of  $X(OH)_2$  and some  $YH_3$ .

**B.** 11.2L of  $XO_2(g)$  at STP reacts with 52 g of  $YO(s)$  to give 74 g of  $XYO_3$  and some water.

**C.** 16.2 g of X (s) combines with 12.6 g of  $HYO_3$  to produce 1120 mL of  $YO(g)$  at STP.



30. Given the equation:



If the complete reaction of 48 g of A with 126 g of B produces 11.2 L of C (g) at STP, what are the molecular weights of A and B?

31. When 13.35 g of  $MYO_3$  is heated, until no more gas is produced, 11.15 g of  $MO(s)$  and 1.12 L of  $YO_2$  gas at STP are produced. Calculate the atomic weights of M and Y elements.

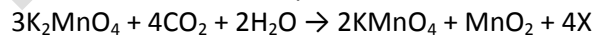
32. The sulfur dioxide gas obtained from the combustion of 6.4 g of sulfur is used in the following reaction.



If 24.8 g of  $M_2O$  is produced in the reaction, find the atomic weight of M.

33. When 4 g of  $XBr_2$  react with sufficient amount of  $AgNO_3$ , 7.54 g of  $AgBr$  are formed. What is the atomic weight of X?

34. Given the balanced equation



Calculate the mass of X produced by the reaction of 6 mol of each reactant.