

## 2.4 MOLE CONCEPT

### Gram atoms and gram molecules

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| 1. How many gram atoms are present in 100 g of Calcium?                             | 1 |
| 2. What is the mass of 2 gram atoms of potassium?                                   | 1 |
| 3. How many gram molecules of SO <sub>2</sub> are there in 32g of SO <sub>2</sub> ? | 1 |
| 4. Calculate the mass of 0.5 gram molecules of water.                               | 1 |

### Mole Concept

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| 5. The SI unit of the amount of substance is the mole.                                |         |
| a. Define a mole of a substance.                                                      |         |
| b. Differentiate between the terms mole and molecule.                                 |         |
| c. Is the gram atom the same as the mole of atoms?                                    |         |
| d. Relate a mole to Avogadro's number, molar volume and mass of a substance in grams. | 1+1+1+2 |

### Moles and number of particles

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| 6. How many atoms are there in 2.5 moles of Iron?                            | 1 |
| 7. How many moles of atoms are contained in 15g of Zn?                       | 1 |
| 8. How many molecules are there in 5 moles of water?                         | 1 |
| 9. What is the number of moles of $20 \times 10^{20}$ sodium atoms?          | 1 |
| 10. What is the number of moles of $1.2 \times 10^{25}$ molecules of oxygen? | 1 |

### Moles and Mass

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| 11. What is the mass of 2 moles of magnesium metal?                                                                                   | 1 |
| 12. Calculate the mass of a mole of Sulphur dioxide.                                                                                  | 1 |
| 13. Find the mass of 3 moles of methane.                                                                                              | 1 |
| 14. How many moles of CO <sub>2</sub> are there in 44g of carbon dioxide?                                                             | 1 |
| 15. How many grams of H <sub>2</sub> S are contained in 0.800 moles of H <sub>2</sub> S?                                              | 1 |
| 16. Make the following conversions a) 2.62 moles of C to grams of C b) 28.0g of N <sub>2</sub> to moles of N <sub>2</sub> .           | 2 |
| 17. Which one has a higher mass and why? 0.5 mole of CO <sub>2</sub> or 16g of SO <sub>2</sub> . (ans = 0.5 mole of CO <sub>2</sub> ) | 2 |

### Mass and number of particles

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| 18. Convert 4 g of carbon into no of atoms.                                                                                                                     | 2 |
| 19. How heavy is one atom of Hydrogen?                                                                                                                          | 1 |
| 20. What is the mass in grams of a molecule of CO <sub>2</sub> ? (ans= $7.31 \times 10^{-23}$ )                                                                 | 1 |
| 21. Convert 3 atoms of nitrogen into grams. (ans = $6.97 \times 10^{-23}$ )                                                                                     | 1 |
| 22. Calculate the mass of a) 4 atoms of carbon b) 3 molecules of Hydrogen.<br>(ans = $7.97 \times 10^{-23}$ g and $9.96 \times 10^{-24}$ g)                     |   |
| 23. Calculate the mass of a) one molecule of hydrogen b) two atoms of nitrogen c) one molecule of H <sub>2</sub> O <sub>2</sub> in grams.<br>(ans =             | 2 |
| 24. What is the weight (mass) in grams of 0.5 atoms of oxygen?                                                                                                  | 2 |
| 25. Which has higher mass: 2 moles of hydrogen or $6.023 \times 10^{24}$ oxygen molecules?                                                                      |   |
| 26. Which of the following has a larger number of molecules, and how? 7g of nitrogen or 1g of Hydrogen. (ans = 1 g hydrogen has the higher number of molecules) | 2 |
| 27. Which has a higher mass: 2 g of Hydrogen or $6.023 \times 10^{21}$ oxygen molecules? (ans = 2 g of H)                                                       |   |

28. How many moles of CO will be left when  $2 \times 10^{21}$  molecules are removed from 0.28 gm of CO? (ans = 0.0067 moles) 2

## Moles and gaseous volumes

29. What volume does 2 moles of carbon dioxide gas occupy at NTP? 1  
 30. How many moles of oxygen molecules are present in 112ml of  $O_2$  gas at NTP?  
 31. Calculate the mass of 120cc of nitrogen at NTP. How many molecules are present in it? 2

## Particles Inside Particles

32. Calculate the number of atoms of Carbon present in 25g of  $CaCO_3$ . ( $1.501 \times 10^{23}$ ) 2  
 33. Calculate the number of atoms of hydrogen present in 4 g of methane. (ans =  $6.023 \times 10^{23}$ ) 2  
 34. Find the number of H, C and O atoms present in 23 grams of ethanol. 2  
 35. You have been given 7.2 grams of HCl. Calculate  
     i) the number of moles of HCl. (ans = 0.197 moles)  
     ii) the volume occupied by it at NTP in millilitres. (ans = 4418.6 ml)  
     iii) the total number of atoms present in it. (ans =  $2.37 \times 10^{22}$ )  
 36. A jar contains 0.400 moles of  $H_2S$ . Calculate the following:  
     I. How many grams of  $H_2S$ ? (ans = 13.6 g)  
     II. How many moles of H and S? (ans = 0.800 and 0.400 moles)  
     III. How many grams of H and S? (ans = 0.800 g and 12.8 g)  
     IV. How many molecules of  $H_2S$ ? (ans =  $2.409 \times 10^{23}$ )  
     V. How many atoms of H and S? (ans =  $4.818 \times 10^{23}$  and  $2.409 \times 10^{23}$ ) 5  
 37. Calculate the moles of chlorine atoms in 44.8 litres of it at NTP. 2  
 38. How many oxygen atoms are present in 3 litres of  $CO_2$  at STP? 2  
 39. How many moles of Hydrogen are left when  $3 \times 10^{21}$  molecules of it are removed from a vessel containing 40 mg of hydrogen gas? (ans = 0.015 moles)  
 40. The cost of table sugar is Rs. 24 per kg. Calculate its cost per mole. (ans = Rs. 8.208) 1  
 41. The cost per mole of table sugar ( $C_{12}H_{22}O_{11}$ ) is Rs. 20. How much does a packet of sugar containing 2 kg cost? (ans = Rs. 116.8) 2  
 42. What will be the molecular weight of a gas, 112 ml of which at NTP weighs 14g?  
 43. One atom of an element X weighs  $6.64 \times 10^{-23}$ g. Calculate the number of gram atoms in 80kg of it. 2  
 44. One mole of a compound contains 1 mole of C and 1 mole of O. What is the molecular weight of the compound? 2

## Calculations based on chemical equations

45. How many oxygen molecules are required to produce 220mg of  $CO_2$  according to the following reaction?  
 $C + O_2 \rightarrow CO_2$  2  
 46. What mass of nitrogen will be required to produce  $6.022 \times 10^{24}$  ammonia molecules by the following reaction?  
 $N_2 + 3 H_2 \rightarrow 2 NH_3$  2  
 47. How many grams of Sulphur and oxygen are needed to produce  $6.022 \times 10^{24}$  molecules of  $SO_2$  according to the reaction?  $S + O_2 \rightarrow SO_2$  2  
 48. What mass of  $H_2$  gas will react with 22.4 litres of  $O_2$  at STP to produce 36g of water?  
 49. Calculate the amount of lime ( $CaO$ ) that can be prepared by heating 200kg of limestone ( $CaCO_3$ ) that is 95% pure. 2

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