Understanding Moles

1. Calculate the number of moles present in each of the following cases:	2. Calculate the mass of substance present in the following cases:	3. Calculate the relative molecular mass of the following substances and suggest a possible identity of each substance:
a) 2.3 g of Na	a) 0.05 moles of Cl_2	a) 0.015 moles, 0.42 g
b) 2.5 g of O_2	b) 0.125 moles of KBr	b) 0.0125 moles, 0.50 g
c) 240 kg of CO_2	c) 0.075 moles of $Ca(OH)_2$	c) 0.55 moles, 88 g
d) 12.5 g of $Al(OH)_3$	d) 250 moles of Fe_2O_3	d) 2.25 moles, 63 g
e) 5.2 g of PbO_2	e) 0.02 moles of $Al_2(SO_4)_3$	e) 0.00125 moles, 0.312 g

4. Calculate the number of particles in the following substances:
a) 0.025 moles b) 2.5 g of CO_2 c) 5.0 g of Pb d) 100 g of N_2

5. Calculate the mass of the following substances:
a) 2.5×10^{23} molecules of N_2
b) 1.5×10^{24} molecules of CO_2
c) 2×10^{20} atoms of Mg

Reacting Masses

6. Calculate the mass of H_2O required to react completely with 5.0 g of $SiCl_4$:
$SiCl_4 + 2H_2O \rightarrow SiO_2 + 4HCl$

7. Calculate the mass of phosphorus required to make 200 g of phosphine, PH_3, by the reaction:
$P_4(s) + 3NaOH(aq) + 3H_2O(l) \rightarrow 3NaH_2PO_2(aq) + PH_3(g)$

8. Lead (IV) oxide reacts with concentrated hydrochloric acid as follows:
$PbO_2(s) + 4HCl(aq) \rightarrow PbCl_2(s) + Cl_2(g) + 2H_2O(l)$
What mass of lead chloride would be obtained from 37.2g of PbO_2, and what mass of chlorine gas would be produced?

9. When copper (II) nitrate is heated, it decomposes according to the following equation:
$2Cu(NO_3)_2(s) \rightarrow 2CuO(s) + 4NO_2(g) + O_2(g)$.
When 20.0g of copper (II) nitrate is heated, what mass of copper (II) oxide would be produced? What mass of NO_2 would be produced?

10. A blast furnace can produce about 700 tonnes of iron a day. How much iron (III) oxide will be consumed? Assuming coke is pure carbon, how much coke would be needed to produce the necessary carbon monoxide?
$Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(l) + 3CO_2(g)$
$2C(s) + O_2(g) \rightarrow 2CO(g)$

Ssolutions

Using molarities and concentrations

1. Calculate the number of moles of H_2SO_4 in 50 cm^3 of a 0.50 $moldm^{-3}$ solution.
2. Calculate the number of moles of $FeSO_4$ in 25 cm^3 of a 0.2 $moldm^{-3}$ solution.
3. Calculate the mass of $KMnO_4$ in 25 cm^3 of a 0.02 $moldm^{-3}$ solution.
4. Calculate the mass of $Pb(NO_3)_2$ in 30 cm^3 of a 0.1 $moldm^{-3}$ solution.
5. What is the molarity of 1.06g of H_2SO_4 in 250 cm^3 of solution?
6. What is the molarity of 15.0 g of $CuSO_4.5H_2O$ in 250 cm^3 of solution?
7. What volume of a 0.833 $moldm^{-3}$ solution of H_2O_2 will be required to make 250 cm^3 of a 0.100 $moldm^{-3}$ solution?
8. What volume of a 0.50 $moldm^{-3}$ solution of HCl will be required to make 100 cm^3 of a 0.050M solution?
9. How many moles of NaCl are there in 25 cm^3 of a 50 gdm^{-3} solution?

Formulae, equations and ionic equations

A: Deduce the formulae of the following compounds:

1.	Sodium chloride	2.	Aluminium chloride
3.	Ammonium sulphate	4.	Magnesium nitrate
5.	Magnesium oxide	6.	Copper (II) hydroxide
7.	Aluminium oxide	8.	Sodium carbonate
9.	Copper (I) oxide	10.	Copper (II) oxide
11.	Aluminium sulphate	12.	Lead (II) sulphide
13.	Lead (IV) oxide	14.	Calcium nitride

B: Write out the full stoichiometric and ionic equations for the following reactions:

1. When aqueous magnesium chloride is added to aqueous silver nitrate, a white precipitate is formed.

2. When aqueous sodium hydroxide is added to aqueous aluminium sulphate, a white precipitate is formed.

3. When aqueous barium chloride is treated with dilute sodium sulphate, a white precipitate is formed.

4. Dilute sulphuric acid is neutralised by sodium hydroxide solution.

5. A pale blue precipitate is formed on slow addition of potassium hydroxide solution to copper (II) sulphate solution.

6. A white precipitate is formed when dilute hydrochloric acid is added to a solution of lead (II) nitrate.

7. When dilute calcium chloride is mixed with sulphuric acid, a white precipitate is formed.

8. Calcium carbonate dissolves in dilute hydrochloric acid with the evolution of a colourless gas.

9. When dilute sulphuric acid is added to sodium carbonate solution, a gas is given off.

10. When aqueous calcium chloride is mixed with aqueous sodium carbonate, a white precipitate is formed.

11. Ammonia gas dissolves in dilute nitric acid.