Answer all the questions below then check your answers

1 Calculate the relative formula mass and the % composition of each element present in each of the following compounds.

Compound	molecular Formula	M_r	% of each element present
ethane	C_2H_4		
magnesium chloride	$MgCl_2$		
sodium fluoride	NaF		
potassium sulphate	K_2SO_4		
sucrose	$C_{12}H_{22}O_{11}$		
calcium nitrate	$Ca(NO_3)_2$		

2 In an experiment 16g g of iron oxide was reduced to give 11.2 g of iron. Calculate the formula of this oxide of iron.

3 Fred reacted 5.62g of cadmium metal with iodine. He produced 11.93 g of cadmium iodide. Calculate the formula of cadmium iodide.

4 Calculate the percentage mass of:

a sodium in sodium chloride ($NaCl$)

b lithium in lithium oxide (Li_2O)

c lead in lead (III) chloride ($PbCl_3$)

d calcium in calcium hydroxide. note hydroxide is $Ca(OH)_2$

Additional questions:

1. Calculate the percentage composition by mass of oxygen in water (H_2O).

2. What is the percentage composition by mass of sodium in sodium chloride ($NaCl$)?

3. Calculate the percentage composition by mass of carbon in calcium carbonate ($CaCO_3$).

Practice Questions (with answers hidden, try them yourself!)

4. What is the percentage composition by mass of nitrogen in ammonium nitrate (NH_4NO_3)? *Answer: 35%*

5. Find the percentage composition by mass of hydrogen in methane (CH_4). *Answer: 25%*

6. A compound has the formula X_2O_3. If the percentage composition by mass of X is 70%, what is the element X? (Hint: Use the periodic table) *Answer: Iron (Fe)*

Answers

1 Calculate the relative formula mass and the % composition of each element present in each of the following compounds.

Compound	molecular Formula	M_r	% by mass of each element present
ethane	C_2H_4	28	% carbon = 24/28 x 100%=86% % hydrogen = 4/28 x 100%= 14%
magnesium chloride	$MgCl_2$	95	% magnesium = 24/95 x 100%=25% % chlorine = 71/95 x 100%=75%
sodium fluoride	NaF	42	% sodium = 23/42 x 100%=55% % fluorine = 19/42 x 100%=45%
potassium sulphate	K_2SO_4	174	% potassium = 78/174 x 100%=45% % sulfur = 32/174 x 100%=18% % oxygen= 64/174 x 100%=37%

sucrose	$C_{12}H_{22}O_{11}$	318	% carbon = 120/318 x 100%=38% % hydrogen = 22/318 x 100%=7% % oxygen= 176/318 x 100%=55%
calcium nitrate	$Ca(NO_3)_2$	164	% calcium = 40/164 x 100%=24% % nitrogen = 28/164 x 100%=17% % oxygen= 96/164 x 100%=58%

2 In an experiment 16g of iron oxide was reduced to give 11.2 g of iron. Calculate the formula of this oxide of iron.

A_r of iron is 56. A_r of oxygen is 16.

Number of moles iron present = 11.2/56= 0.2 moles

Mass of oxygen is 16g-11.2g of iron = 4.8g of oxygen.

Number of moles of oxygen present = 4.8/16 = 0.3 moles

Ratio of iron to oxygen is 0.2 : 0.3 or simply 2:3, so formula is Fe_2O_3

3 Fred reacted 5.62g of cadmium metal with iodine. He produced 11.93 g of cadmium iodide. Calculate the formula of cadmium iodide.

A_r of cadmium is 112. A_r of iodine is 127.

Number of moles of cadmium = 5.62g/112 = 0.05 moles

Mass of iodine in compound is 11.93-5.62g = 6.31g

Number of moles of iodine = 6.31/127=0.05

Mole ratio of cadmium to iodine is 0.05: 0.05 or simply 1:1

So formula is CdI

4 Calculate the percentage mass of:

Use the periodic table to find the A_r of each element to calculate the M_r for the compounds.

a sodium in sodium chloride (NaCl)

M_r of sodium chloride is 58.5

% sodium = 23/58.5 x 100%=39%

% fluorine = 19/42 x 100%=61%

b lithium in lithium oxide (Li_2O)

M_r of lithium oxide is 30

% lithium = 14/30 x 100%=46%

% oxygen = 16/30 x 100%=53%

c lead in lead (III) chloride ($PbCl_3$)

M_r of lead chloride is 313.5

% lead = 207/313.5 x 100%=66%

% fluorine = 19/42 x 100%=34%

d calcium in calcium hydroxide. note hydroxide is $Ca(OH)_2$

M_r of calcium hydroxide is 74

% calcium = 40/74 x 100%=54%

% oxygen = 32/74 x 100%=43%

% hydrogen = 2/74 x 100%=3%

Additional questions- answers:

1. Calculate the percentage composition by mass of oxygen in water (H_2O).

1. Formula mass of H_2O: (2 x 1) + 16 = 18
2. Mass of oxygen in H_2O: 16
3. Percentage of oxygen: (16/18) x 100% = 88.9%

2. What is the percentage composition by mass of sodium in sodium chloride ($NaCl$)?

1. Formula mass of $NaCl$: $23 + 35.5 = 58.5$
2. Mass of sodium in $NaCl$: 23
3. Percentage of sodium: $(23/58.5) \times 100\% = 39.3\%$

3. Calculate the percentage composition by mass of carbon in calcium carbonate ($CaCO_3$).

1. Formula mass of $CaCO_3$: $40 + 12 + (3 \times 16) = 100$
2. Mass of carbon in $CaCO_3$: 12
3. Percentage of carbon: $(12/100) \times 100\% = 12\%$

Practice Questions (with answers hidden, try them yourself!)

4. What is the percentage composition by mass of nitrogen in ammonium nitrate (NH_4NO_3)? *Answer: 35%*

5. Find the percentage composition by mass of hydrogen in methane (CH_4). *Answer: 25%*

6. A compound has the formula X_2O_3. If the percentage composition by mass of X is 70%, what is the element X? (Hint: Use the periodic table) Answer: *Iron (Fe)*