Paper 3

Questions are applicable for both core and extended candidates

1 (e) (iii) Methylbutanoic acid has the molecular formula $C_5H_{10}O_2$.

Complete Table 2.2 to calculate the relative molecular mass of $C_5H_{10}O_2$.

Table 2.2

atom	number of atoms	relative atomic mass	
carbon	5	12	$5 \times 12 = 60$
hydrogen		1	
oxygen		16	

relative molecular mass = ... [2]

2 Sulfur is an element in Group VI of the Periodic Table.

(b) Sulfur has a relative atomic mass of 32.

Complete these sentences about the relative atomic mass of sulfur using terms from the list.

^{12}C electrons ^{1}H isotopes neutrons ^{16}O protons ^{32}S

The relative atomic mass of sulfur is the average mass of the sulfur ..... .

This average mass is compared to 1/12th of the mass of an atom of ..... .

[2]

3 This question is about metals and compounds of metals.

(e) A compound of nickel has the molecular formula NiP_4F_{12}.

Complete Table 4.3 to calculate the relative molecular mass of NiP_4F_{12}.

Table 4.3

atom	number of atoms	relative atomic mass	
fluorine	12	19	$12 \times 19 = 228$
nickel		59	
phosphorus		31	

relative molecular mass = ... [2]

4 (d) Ethanoic acid reacts with ethanol.
The organic product has the molecular formula $C_4H_8O_2$.

Complete Table 7.1 to calculate the relative molecular mass of $C_4H_8O_2$.

Table 7.1

atom	number of atoms	relative atomic mass	
carbon	4	12	$4 \times 12 = 48$
hydrogen		1	
oxygen		16	

relative molecular mass = ... [2]

5 **(a)** Fig. 7.1 shows the displayed formula of compound **S**.

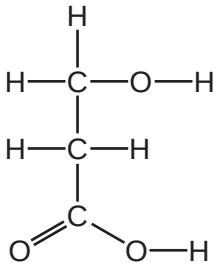

Fig. 7.1

(i) On Fig. 7.1, draw a circle around the carboxylic acid functional group. [1]

(ii) Deduce the molecular formula of compound **S**.

..... [1]

(b) Compound **S** can be converted to acrylic acid.
The molecular formula of acrylic acid is $C_3H_4O_2$.

(i) Complete Table 7.1 to calculate the relative molecular mass of acrylic acid.

Table 7.1

atom	number of atoms	relative atomic mass	
carbon	3	12	$3 \times 12 = 36$
hydrogen		1	
oxygen		16	

relative molecular mass = ... [2]

6 (c) Sulfuric acid is a compound.

(iv) The formula of sulfuric acid is H_2SO_4.

Complete Table 4.1 to calculate the relative molecular mass of sulfuric acid.

Table 4.1

atom	number of atoms	relative atomic mass	
hydrogen	2	1	$2 \times 1 = 2$
sulfur			
oxygen			

relative molecular mass = ... [2]

7 This question is about chlorine and compounds of chlorine.

(e) A compound of chlorine has the formula $C_3H_6Cl_2$.

Complete the table to calculate the relative molecular mass of $C_3H_6Cl_2$.

atom	number of atoms	relative atomic mass	
carbon	3	12	$3 \times 12 = 36$
hydrogen		1	
chlorine		35.5	

relative molecular mass = ... [2]

8 This question is about zinc and compounds of zinc.

(e) A compound of zinc has the formula ZnC_4H_{10}.

Complete the table to calculate the relative molecular mass of ZnC_4H_{10}.

atom	number of atoms	relative atomic mass	
zinc	1	65	$1 \times 65 = 65$
carbon		12	
hydrogen		1	

relative molecular mass = ... [2]

9 This question is about metals.

(d) A compound of nickel has the formula NiC_4O_4.

Complete the table to calculate the relative molecular mass of NiC_4O_4.

atom	number of atoms	relative atomic mass	
nickel	1	59	$1 \times 59 = 59$
carbon		12	
oxygen		16	

relative molecular mass = ... [2]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

10 Iron ore contains iron(III) oxide, Fe_2O_3. A blast furnace is used to extract iron from Fe_2O_3.

Equations for some of the reactions in the blast furnace are shown.

equation 1 $C + O_2 \rightarrow CO_2$

equation 2 $CaCO_3 \rightarrow CaO + CO_2$

equation 3 $CaO + SiO_2 \rightarrow CaSiO_3$

(b) Iron(III) oxide, Fe_2O_3, in iron ore is converted to iron when it reacts with carbon monoxide, CO, in the blast furnace.

(i) Calculate the percentage by mass of iron in iron(III) oxide, Fe_2O_3.

percentage = ...% [2]