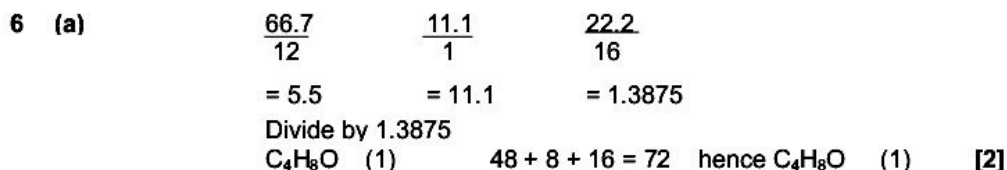
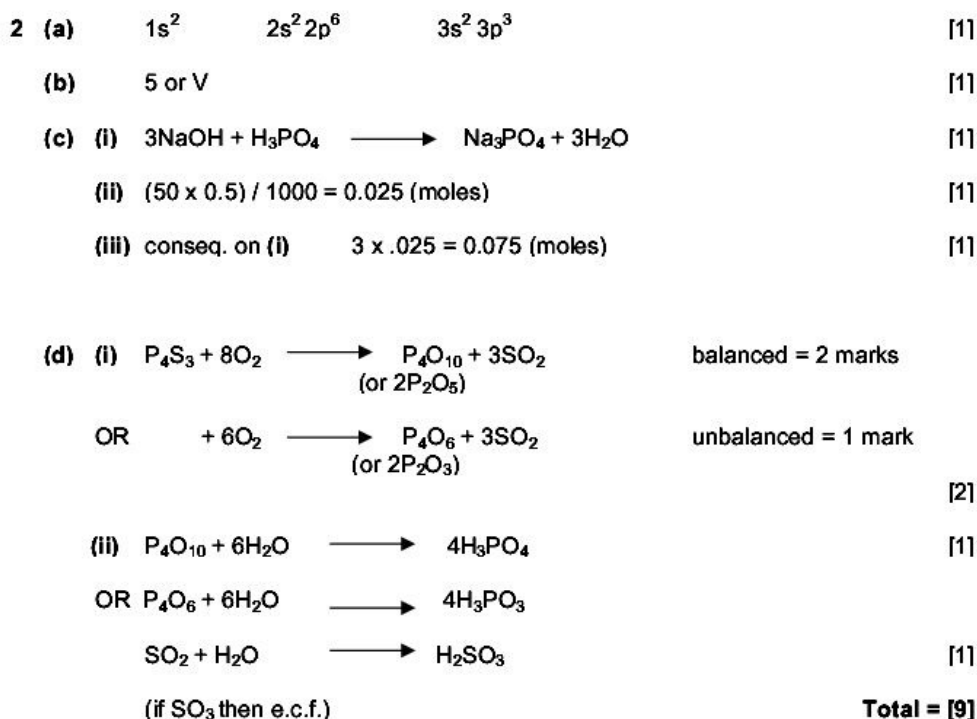


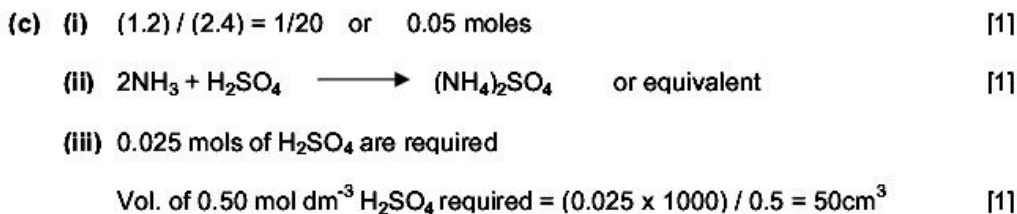
Q1.



Q2.



Q3.



Q4.

- (d) (i) $2\text{H}_2\text{S} + 3\text{O}_2 \rightarrow 2\text{H}_2\text{O} + 2\text{SO}_2$ (1)
 from -2 (1) to +4 (1)
 allow e.c.f. on equation
- (ii) 68.2g H_2S react with $3 \times 24 \text{ dm}^3 \text{ O}_2$ (1)
 8.65g H_2S react with $\frac{3 \times 24 \times 8.65}{68.2} = 9.13 \text{ dm}^3$ (1)
 allow 9.16 dm^3 if $\text{H}_2\text{S} = 68$ is used
 allow e.c.f on (d)(i) [5]

Q5.

- 1 (a) (i) ammonia/ NH_3 (1)
 (ii) NH_4^+ (1)
 (iii) iron(II) hydroxide/ $\text{Fe}(\text{OH})_2$ (1) [3]
- (b) barium sulphate/ BaSO_4 (1) [1]
- (c) (i) FeSO_4 (1)
 $(\text{NH}_4)_2\text{SO}_4$ (1)
 (ii) $\text{FeSO}_4 = 151.9$ (allow 151.8 to 152) (1)
 $(\text{NH}_4)_2\text{SO}_4 = 132.1$ (allow 132) (1)
 (iii) $x\text{H}_2\text{O} = 392 - (132.1 + 151.9) = 108$ (1)
 $x = \frac{108}{18} = 6$ (1)
 allow e.c.f. on candidate's sulphate in (c)(i)
 e.c.f. answer must be a whole number [6]

[Total: 10]

Q6.

- (c) (i) $\text{CaC}_2 + 2\text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{C}_2\text{H}_2$ (1)
- (ii) $n(\text{C}_2\text{H}_2) = n(\text{CaC}_2) = 100 \times 46.5$ (1)
 mass of $\text{CaC}_2 = 100 \times 46.5 \times 64 =$
 $= 297\,570 \text{ g}$
 $= 297.6 \text{ kg}$ (accept 298 kg)
 correct units necessary (1)
 allow e.c.f. on candidate's answer in (b) [3]

Q7.

(b) $C:H:O = \frac{40}{2} : \frac{6.7}{1} : \frac{53.3}{16}$ [1]
 $= 3.33 : 6.7 : 3.33$ [1]
 $= 1 : 2 : 1$ [2]

Q8.

(d) (i) $n(Ti) = \frac{0.72}{47.9} = 0.015$ (1)
(ii) $n(Cl) = \frac{(2.85 - 0.72)}{35.5} = 0.06$ (1)
(iii) $0.015 : 0.06 = 1:4$
empirical formula of **A** is $TiCl_4$
Allow ecf on answers to (i) and/or (ii). (1)
(iv) $Ti + 2Cl_2 \rightarrow TiCl_4$ (1)
Allow ecf on answers to (iii). [4]

Q9.

4 (a) $C:H:O = \frac{48.7}{12} : \frac{8.1}{1} : \frac{43.2}{16}$ (1)
 $= 4.06 : 8.1 : 2.70$
 $= 1.5 : 3 : 1$
 $= 3 : 6 : 2$
empirical formula is $C_3H_6O_2$ (1) [2]

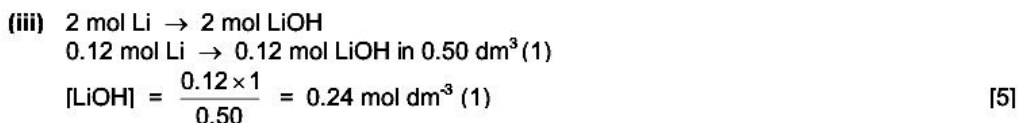
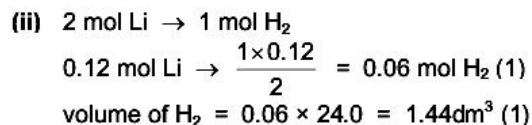
(b) (i) $M_r = \frac{mRT}{pV} = \frac{0.13 \times 8.31 \times 400}{1.00 \times 10^5 \times 58.0 \times 10^{-6}}$ (1)
 $= 74.5$ (1)
(ii) $C_3H_6O_2 = 36 + 6 + 32 = 74$ (1)
 $n(C_3H_6O_2) = 74.5$
hence molecular formula of **E** is $C_3H_6O_2$ (1) [4]

Q10.

(d) (i) $C:H:O = \frac{35.8}{12} : \frac{4.5}{1} : \frac{59.7}{16}$ this mark is for correct use of A_r values (1)
 $C:H:O = 2.98 : 4.5 : 3.73$
 $C:H:O = 1 : 1.5 : 1.25$ this mark is for evidence of correct calculation (1)
gives empirical formula of **W** is $C_4H_6O_5$
(ii) $C_4H_6O_5 = 12 \times 4 + 1 \times 6 + 16 \times 5 = 134$
molecular formula of **W** is $C_4H_6O_5$ (1) [3]

Q11.

(c) (i) $n(\text{Li}) = \frac{0.83}{6.9} = 0.12 \text{ (1)}$



Q12.

(c) (i) mass of $\text{C}_{14}\text{H}_{30}$ burnt

$$\frac{8195 \times 10.8}{1000} = 88.506 = 88.5 \text{ t} \quad (1)$$

(ii) mass of CO_2 produced

$$M_r \text{ of } \text{C}_{14}\text{H}_{30} = (14 \times 12 + 30 \times 1) = 198 \quad (1)$$

$$2 \times 198 \text{ t of } \text{C}_{14}\text{H}_{30} \rightarrow 28 \times 44 \text{ t of } \text{CO}_2$$

$$88.5 \text{ t of } \text{C}_{14}\text{H}_{30} \rightarrow \frac{28 \times 44 \times 88.5}{2 \times 198} \quad (1)$$

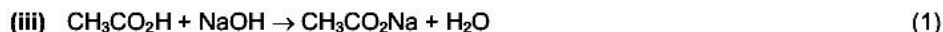
$$= 275.3 \text{ t of } \text{CO}_2 \quad (1)$$

allow 275.4 t if candidate has used 88.506
allow ecf on wrong value for M_r of $\text{C}_{14}\text{H}_{30}$ [4]

Q13.

(b) (i) $n(\text{NaOH}) = \frac{22.5 \times 2.00}{1000} = 0.045 \quad (1)$

(ii) $n(\text{NaOH}) = n(\text{HCl}) = 0.005 \quad (1)$



(iv) $n(\text{NaOH}) = 0.045 - 0.005 = 0.04$
allow ecf on (i) and/or (ii) (1) [4]

Q14.

- 1 Throughout this question, deduct **one mark only** for sig. fig. error.
- (a) (i) the volume of solution A present in one 'typical ant' is
 $7.5 \times 10^{-6} \times 1000 = 7.5 \times 10^{-3} \text{ cm}^3$ (1)
- (ii) the volume of pure methanoic acid in one 'typical ant' is
 $7.5 \times 10^{-3} \times \frac{50}{100} = 3.75 \times 10^{-3}$ gives $3.8 \times 10^{-3} \text{ cm}^3$
- allow ecf on (i) (1)
- (iii) no. of ants = $\frac{1000}{3.8 \times 10^{-3}} = 263157.8947$ gives 2.6×10^5
 use of 3.75×10^{-3} gives $266666.6667 = 2.7 \times 10^5$ (1) [3]
- (b) (i) the volume of solution A, in one ant bite is
 $\frac{80}{100} \times 7.5 \times 10^{-3} = 6.0 \times 10^{-3} \text{ cm}^3$
- allow ecf on (a)(i) (1)
- the volume of pure methanoic acid in one bite is
 $\frac{50}{100} \times 6.0 \times 10^{-3} = 3.0 \times 10^{-3} \text{ cm}^3$
- allow ecf on first part of (b)(i) (1)
- (ii) the mass of methanoic acid in one bite is
 $3.0 \times 10^{-3} \times 1.2 = 3.6 \times 10^{-3} \text{ g}$
- allow ecf on (b)(i) (1) [3]
- (c) (i) $\text{HCO}_2\text{H} + \text{NaHCO}_3 \rightarrow \text{HCO}_2\text{Na} + \text{H}_2\text{O} + \text{CO}_2$ (1)
- (ii) $46 \text{ g HCO}_2\text{H} = 84 \text{ g NaHCO}_3$ (1)
- $5.4 \times 10^{-3} \text{ g HCO}_2\text{H} = \frac{84 \times 5.4 \times 10^{-3}}{46} \text{ g NaHCO}_3$
 $= 9.860869565 \times 10^{-3}$
 $= 9.9 \times 10^{-3} \text{ g NaHCO}_3$ (1) [3]
- [Total: 9]**

Q15.

- 2 (a) $(\text{NH}_4)_2\text{SO}_4 + 2\text{NaOH} \rightarrow 2\text{NH}_3 + \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ (1)
 correct products (1) [2]
 correctly balanced equation
- (b) (i) $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$ (1)
- (ii) $n(\text{HCl}) = \frac{31.2}{1000} \times 1.00 = 0.0312 = 0.03$ (1)
- (iii) $n(\text{NaOH}) = \frac{50.0}{1000} \times 2.00 = 0.10$ (1)
- (iv) $n(\text{NaOH}) \text{ used up} = 0.10 - 0.0312 = 0.0688 = 0.07$ (1)
- (v) $n[(\text{NH}_4)_2\text{SO}_4] = \frac{0.0688}{2} = 0.0344 = 0.03$ (1)
- (vi) mass of $(\text{NH}_4)_2\text{SO}_4 = 0.0344 \times 132 = 4.5408 = 4.54$ (1)
- (vii) percentage purity = $\frac{4.5408 \times 100}{5.00} = 90.816 = 90.8$ (1) [7]
- [Total: 9]**

Q16.

- (e) $\text{C} : \text{H} : \text{O} = \frac{37.5}{12} : \frac{4.17}{1} : \frac{58.3}{16}$
- = 3.13 : 4.17 : 3.64 (1)
- = 1 : 1.33 : 1.16 (1)
- = 6 : 8 : 7
- empirical formula is $\text{C}_6\text{H}_8\text{O}_7$ (1) [3]
- [Total: 19]**

Q17.

- 2 (a) (i) $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$ (1)
- (ii) $n(\text{HCl}) = \frac{35.8}{1000} \times 0.100 = 3.58 \times 10^{-3}$ (1)
- (iii) $n(\text{Na}_2\text{CO}_3) = \frac{35.8}{2} \times 10^{-3} = 1.79 \times 10^{-3} \text{ mol in } 25.0 \text{ cm}^3$ (1)
- (iv) $n(\text{Na}_2\text{CO}_3) = 1.79 \times 10^{-3} \times 10 = 1.79 \times 10^{-2} \text{ mol in } 250 \text{ cm}^3$ (1)
- (v) mass of $\text{Na}_2\text{CO}_3 = 1.79 \times 10^{-2} \times 106 = 1.90\text{g}$ (1)
 M_r of $\text{Na}_2\text{CO}_3 = 106$ (1)
 mass of $\text{Na}_2\text{CO}_3 = 1.90 \text{ g}$ (1) [6]

(b) $n(\text{H}_2\text{O})$ in 5.13 g of washing soda = $\frac{5.13 - 1.90}{18} = 1.79 \times 10^{-1}$ mol (1)

$n(\text{Na}_2\text{CO}_3)$ in 5.13 g of washing soda = 1.79×10^{-2} mol
 $n(\text{H}_2\text{O}) : n(\text{Na}_2\text{CO}_3) = 10 : 1$ (1)

or

1.90 g Na_2CO_3 are combined with 3.23 g H_2O

106 g Na_2CO_3 are combined with $\frac{3.23 \times 106}{1.90} = 180.2$ g H_2O (1)

this is 10 mol of H_2O (1)

or

1.79×10^{-2} mol $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O} \equiv 5.13$ g of washing soda

1 mol $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O} \equiv \frac{5.13}{1.79 \times 10^{-2}} = 286.6$ g (1)

$\text{Na}_2\text{CO}_3 = 106$ and $\text{H}_2\text{O} = 18$ hence $x = 10$ (1) [2]

[Total: 8]

Q18.



allow ionic equations in each case

(ii) $n(\text{NaOH}) = n(\text{HCl}) = \frac{39.2 \times 2.00}{1000} = 0.0784$ (1)

(iii) $n(\text{NaOH}) = n(\text{HCl}) = \frac{29.5 \times 2.00}{1000} = 0.059$ (1)

(iv) $n(\text{NaOH}) = 0.0784 - 0.059 = 0.0194$ (1)

(v) $n[(\text{NH}_4)_2\text{SO}_4] = \frac{0.0194}{2} = 9.7 \times 10^{-3}$ (1)

(vi) mass of $(\text{NH}_4)_2\text{SO}_4 = 9.7 \times 10^{-3} \times 132.1 = 1.2814$ g (1)

(vii) % of $(\text{NH}_4)_2\text{SO}_4 = \frac{1.2814 \times 100}{2.96} = 43.30405405 = 43.3$ (1)

give one mark for the correct expression (1)

give one mark for answer given as 43.3 – i.e. to 3 sig. fig. (1)

allow ecf where appropriate

[9]

- (b) fertiliser in the river causes
 excessive growth of aquatic plants/algae or algal bloom (1)
 when plants and algae die O₂ is used up or fish or aquatic life die (1) [2]
- (c) manufacture of HNO₃ or explosives or nylon or
 as a cleaning agent or as a refrigerant (1) [1]
 not detergent (1) [1]
- [Total:12]**

Q19.

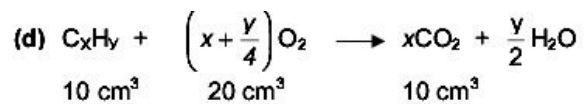
- 2 (a) (i) $n(\text{H}_2\text{SO}_4) = \frac{25.0 \times 1.00}{1000} = 0.025 \text{ mol}$ (1)
- (ii) $n(\text{NaOH}) = \frac{16.2 \times 2.00}{1000} = 0.0324 \text{ mol}$ (1)
- (iii) $n(\text{H}_2\text{SO}_4) \text{ reacting with NaOH} = \frac{0.0324}{2} = 0.0162 \text{ mol}$ (1)
- (iv) $n(\text{H}_2\text{SO}_4) \text{ reacting with NH}_3 = 0.025 - 0.0162 = 0.0088 \text{ mol}$ (1)
- (v) $n(\text{NH}_3) \text{ reacting with H}_2\text{SO}_4 = 2 \times 0.0088 = 0.0176 \text{ mol}$ (1)
- (vi) $n(\text{NaNO}_3) \text{ reacting} = n(\text{NH}_3) \text{ produced} = 0.0176 \text{ mol}$ (1)
- (vii) mass of NaNO₃ that reacted = 0.0176 x 85 = 1.496 g (1)
- (viii) $\% \text{ of NaNO}_3 = \frac{1.496 \times 100}{1.64} = 91.2195122 = 91.2$ (1)
 give one mark for the correct expression (1)
 give one mark for answer given as 91.2 – i.e to 3 sig. fig. (1)
 allow ecf where appropriate (1)
- [9]
- (b) NaNO₃ +5 and NH₃ -3 both required (1) [1]
- [Total: 10]**

Q20.

- 1 (a) (i) substance that speeds up a chemical reaction (1)
 by lowering E_a
 or by providing an alternative reaction pathway
 or without being used up in the process (1)
- (ii) $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ (1) [3]
- (b) (i) alkanes or paraffins (1)
- (ii) $2\text{H}_2\text{O}_2 : \text{O}_2$ and $\text{C}_{15}\text{H}_{32} : 23\text{O}_2$ (1)
 whence $\text{C}_{15}\text{H}_{32} : 46\text{H}_2\text{O}_2$ (1)
 allow e.c.f. on (a)(ii) [3]
- (c) (i) $\text{C}_{15}\text{H}_{32} = 212$ (1)
 $n(\text{C}_{15}\text{H}_{32}) = \frac{212 \times 10^6}{212} = 1 \times 10^6 \text{ mol}$
 allow e.c.f. on wrong M_r of $\text{C}_{15}\text{H}_{32}$ (1)
- (ii) $n(\text{H}_2\text{O}_2)$ required = $46 \times 10^6 \text{ mol}$ (1)
 mass of $\text{H}_2\text{O}_2 = 34 \times 46 \times 10^6 \text{ g} = 1564 \text{ tonnes}$
 final answer must be in tonnes (1)
 allow e.c.f. on (b)(ii) and (c)(i) [4]
- (d) they would dissolve (1) [1]
- [Total: 11]**

Q21.

- 1 (a) the actual number of atoms of each element present (1)
 in one molecule of a compound (1) [2]
- (b) $\text{C}_x\text{H}_y + \left(x + \frac{y}{4}\right)\text{O}_2 \rightarrow x\text{CO}_2 + \frac{y}{2}\text{H}_2\text{O}$
- $x\text{CO}_2$ (1)
- $\frac{y}{2}\text{H}_2\text{O}$ (1) [2]
- (c) (i) oxygen/ O_2 (1)
- (ii) carbon dioxide/ CO_2 (1)
- (iii) 10 cm^3 (1)
- (iv) 20 cm^3 (1) [4]



1 mol of C_xH_y gives 1 mol of CO_2

whence $x = 1$ (1)

1 mol of C_xH_y reacts with 2 mol of O_2

$$\text{whence } \left(x + \frac{y}{4}\right) = 2$$

$$\text{and } y = 4 \text{ (1)}$$

molecular formula is CH_4 (1)

[3]

[Total: 11]

Q22.

- 1 (a) (i) mass of C = $\frac{12 \times 0.352}{44} = 0.096\text{g}$ (1)
 $n(\text{C}) = \frac{0.096}{12} = 0.008$ (1)
- (ii) mass of H = $\frac{2 \times 0.144}{18} = 0.016\text{g}$ (1)
 $n(\text{H}) = \frac{0.016}{1} = 0.016$ (1)
- (iii) mass of oxygen = $0.240 - (0.096 + 0.016) = 0.128\text{g}$ (1)
 $n(\text{O}) = \frac{0.128}{16} = 0.008$ (1)
- allow ecf at any stage (6)
- (b) C : H : O = 0.008 : 0.016 : 0.008 = 1:2:1
allow C : H : O = $\frac{0.096}{12} : \frac{0.016}{1} : \frac{0.128}{16} = 1:2:1$
gives CH₂O (1) [1]
- (c) (i) $M_r = \frac{mRT}{pV} = \frac{0.148 \times 8.31 \times 333}{1.01 \times 10^5 \times 67.7 \times 10^{-6}}$ (1)
= 59.89
allow 59.9 or 60 (1)
- (ii) C₂H₄O₂ (1) [3]

Q23.

- 2 (a) (i) mass of C = $\frac{12 \times 1.32}{44} = 0.36\text{g}$ (1)
 $n(\text{C}) = \frac{0.36}{12} = 0.03$ (1)
- (ii) mass of H = $\frac{2 \times 0.54}{18} = 0.06\text{g}$ (1)
 $n(\text{H}) = \frac{0.06}{1} = 0.06$ (1)
- (iii) yes **because** 0.03 mol of C are combined with 0.06 mol of H or
C : H ratio is 1 : 2 or
empirical formula is CH₂ (1) [5]

$$(b) (i) \text{ C : H : O} = \frac{64.86}{12} : \frac{13.50}{1} : \frac{21.64}{16} \quad (1)$$

$$= 5.41 : 13.50 : 1.35$$

$$= 4 : 10 : 1$$

$$\text{gives } C_4H_{10}O \quad (1)$$

Q24.

1 (a) $ZnCO_3$ $Zn(OH)_2$ ZnO
not Zn or other compounds of Zn (any 2) [2]

(b) (i) to ensure all of the water of crystallisation had been driven off or
to be at constant mass (1)

(ii) mass of $ZnSO_4 = 76.34 - 74.25 = 2.09 \text{ g}$ (1)

$$M_r \text{ } ZnSO_4 = 65.4 + 32.1 + (4 \times 16.0) = 161.5$$

allow use of $Zn = 65$ and/or $S = 32$ to give values between 161 and 161.5 (1)

$$n(ZnSO_4) = \frac{2.09}{161.5} = 0.01294 = 1.29 \times 10^{-2}$$

$$ZnSO_4 = 161 \text{ gives } 1.30 \times 10^{-2} \quad (1)$$

(iii) mass of H_2O driven off = $77.97 - 76.34 = 1.63 \text{ g}$ (1)

$$n(H_2O) = \frac{1.63}{18} = 0.0905 = 9.1 \times 10^{-2} \quad (1)$$

(iv) 1.29×10^{-2} mol ZnSO_4 are combined with 9.1×10^{-2} mol H_2O

$$1 \text{ mol } \text{ZnSO}_4 \text{ is combined with } \frac{9.1 \times 10^{-2}}{1.29 \times 10^{-2}}$$

$$= 7.054 = 7 \text{ mol } \text{H}_2\text{O}$$

answer must be expressed as a whole number

allow ecf on candidate's answers to (b)(ii) and (b)(iii)

(1) [7]

(c) (i) $n(\text{Zn}) = n(\text{CH}_3\text{CO}_2)_2\text{Zn} \cdot 2\text{H}_2\text{O}$

(1)

$$n(\text{Zn}) = \frac{0.015}{65.4} = 2.29 \times 10^{-4}$$

$$= 2.29 \times 10^{-4}$$

(1)

$$\text{mass of crystals} = 2.29 \times 10^{-4} \times 219.4 = 0.0502655 \text{ g}$$

$$= 0.05 \text{ g} = 50 \text{ mg}$$

(1)

(ii) concentration of $(\text{CH}_3\text{CO}_2)_2\text{Zn} \cdot 2\text{H}_2\text{O} = \frac{2.29 \times 10^{-4}}{0.005} = 0.0458$

$$= 4.58 \times 10^{-2} \text{ mol dm}^{-3}$$

(1)

allow correct answers if Zn = 65 is used

[4]

[Total: 13]

Q25.

1 In this question, numerical answers should be given to three significant figures.

(a) (i) $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$

(1)

(ii) $M_r \text{ C}_6\text{H}_{12}\text{O}_6 = 180$

(1)

$$180 \text{ g } \text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 6 \text{ mol } \text{CO}_2$$

$$1200 \text{ g } \text{C}_6\text{H}_{12}\text{O}_6 \rightarrow \frac{6 \times 200}{180} \text{ mol } \text{CO}_2$$

$$= 40.0 \text{ mol to 3 sf}$$

allow ecf on wrong equation and/or wrong M_r

(1)

(iii) 6.82×10^9 people will produce $6.82 \times 10^9 \times 40.0$ mol CO_2

$$= 2.728 \times 10^{11} \text{ mol } \text{CO}_2$$

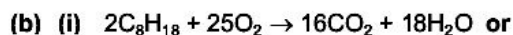
(1)

$$2.728 \times 10^{11} \text{ mol } \text{CO}_2 = 2.728 \times 10^{11} \times 44 = 1.20032 \times 10^{13} \text{ g}$$

$$= 1.20 \times 10^7 \text{ tonnes } \text{CO}_2 \text{ to 3 sf}$$

(1) [5]

allow ecf on answer from (ii)



(ii) $M_r C_8H_{18} = (8 \times 12) + (18 \times 1) = 114$ (1)

mass of 4.00 dm^3 of octane = $4000 \times 0.70 = 2800 \text{ g}$ (1)

$n(C_8H_{18}) = \frac{2800}{114} = 24.56140351 \text{ mol in } 4.00 \text{ dm}^3$

= $24.6 \text{ mol to } 3 \text{ sf}$ (1)

(iii) $2 \text{ mol } C_8H_{18}$ produce $16 \times 44 \text{ g } CO_2$

$24.6 \text{ mol } C_8H_{18}$ produce $\frac{16 \times 44 \times 24.6}{2} \text{ g } CO_2$

= $8659.2 \text{ g } CO_2$

= $8660 \text{ g } CO_2$ to 3 sf (1) [5]

(c) 6.82×10^9 people produce 1.20×10^7 tonnes CO_2 per day

$8660 \text{ g } CO_2$ produced when car travels 100 km

when travelling 1 km , car produces $\frac{8660}{100} = 8.66 \times 10^{-1} \text{ g}$

= $8.66 \times 10^{-5} \text{ tonnes}$ (1)

to produce 1.20×10^7 tonnes CO_2 car must travel

$\frac{1.20 \times 10^7}{8.66 \times 10^{-5}}$

= $1.385681293 \times 10^{11} = 1.39 \times 10^{11} \text{ km to } 3 \text{ sf}$ (1) [2]

(d) possible pollutants and the damage they cause

CO	NO _x		SO ₂	H ₂ O	C	unburned C ₈ H ₁₈
	NO	NO ₂				
toxic	toxic	toxic	toxic			
	global warming	respiratory problems	respiratory problems	global warming	respiratory problems	respiratory problems
	photochemical smog	acid rain	acid rain			

compound
damage

(1)
(1) [2]

[Total: 14]

Q26.

- 4 (a) (i) $\text{H}_2\text{X} + 2\text{NaOH} \rightarrow \text{Na}_2\text{X} + 2\text{H}_2\text{O}$ (1)
- (ii) $n(\text{OH}^-) = \frac{21.6 \times 0.100}{1000} = 2.16 \times 10^{-3} \text{ mol}$ (1)
- (iii) $n(\text{R}) = n(\text{H}_2\text{X}) = \frac{2.16 \times 10^{-3}}{2}$
 $= 1.08 \times 10^{-3} \text{ mol in } 25.0 \text{ cm}^3$ (1)
- (iv) $n(\text{R}) = 1.08 \times 10^{-3} \times \frac{250}{25.0} = 0.0108 \text{ mol in } 250 \text{ cm}^3$ (1)
- (v) 0.0108 mol of R = 1.25 g of R
1 mol of R = $\frac{1.25 \times 1}{0.0108} = 115.7 = 116 \text{ g}$ (1) [5]
- (b) (i) M_r of S = 116
 M_r of T = 134
 M_r of U = 150 **all three needed** (1)
- (ii) S (1) [2]

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