Section A

1. D	**2. C**	**3. B**	**4.A**	**5. D**
6. A	7. C	8. C	9. A	10. A
11. C	**12. C**	**13. A**	**14. B**	**15. B**
16.A	17. C	18. C	19. A	20. D
21. B	**22. C**	**23. A**	**24. D**	**25. D**
26. A	27. B	28. B	29. D	30. B
31. a)E b)D+E	32. a)D b)C	33. C+D	34. C+E	35. B+F

Section B

1. a) Electro negativity

   b) Ionisation energy increases

   c) Negative electron has to be removed from shell closer to positive nuclear attraction

2. a) 5800 years

   b) $^{14}_{6}C \longrightarrow {}^{14}_{7}N + {}^{0}_{-1}e$

   c) Fossil fuels were formed millions of years ago so carbon-14 would have decayed to the point where it would be undetectable.

3. a) (i) Heterogeneous

   (ii) Fewer carbon to carbon double bonds so more saturated

   b) (i) Glycerol or propan-1,2,3-triol

   (ii) Soaps

4. a) (i) $FeS + 2HCl \rightarrow H_2S + FeCl_2$

(ii) $Fe + HCl \rightarrow FeCl_2 + H_2$ ie Hydrogen gas would also be produced

b) Target Equation: $H_2(g) + S(s) \rightarrow H_2S(g)$

1. $H_2S + 1.5O_2 \rightarrow SO_2 + H_2O$ $\Delta H = -563kJ\ mol^{-1}$

2. $H_2 + 0.5O_2 \rightarrow H_2O$ $\Delta H = -286kJ\ mol^{-1}$

3. $S + O_2 \rightarrow SO_2$ $\Delta H = -297kJ\ mol^{-1}$

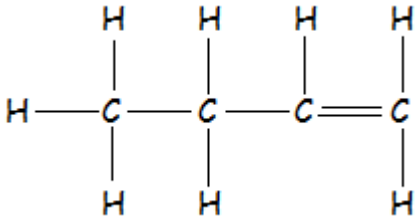
Reverse 1 $SO_2 + H_2O \rightarrow H_2S + 1.5O_2$ $\Delta H = +563kJ\ mol^{-1}$

Copy 2 x 1 $H_2 + 0.5O_2 \rightarrow H_2O$ $\Delta H = -286kJ\ mol^{-1}$

Copy 3 x 1 $S + O_2 \rightarrow SO_2$ $\Delta H = -297kJ\ mol^{-1}$

$H_2(g) + S(s) \rightarrow H_2S(g)$ $\Delta H = -20kJ\ mol^{-1}$

5. a) (i) But-1-ene



(ii) Addition OR Catalytic hydration

(iii) Orange → Green

(iv) Butanoic Acid

b) (i) Two separate layers or immiscible layers or smell

(ii) Solvents or flavourings or perfumes etc

6. a) Increases surface area to ensure maximum heat distribution to water

b) Complete combustion of ethanol

c) EXOTHERMIC REACTION!!!!!!

E_H = $cm\Delta T$

= 4.18 x 0.4 x 17.4 kJ for 0.98g ethanol (C_2H_5OH gfm = 46g)

= 29.093 kJ for 0.98g ethanol

⇨ 0.98g → 29.093kJ
⇨ 46g → x
⇨ 0.98x = 46 x 29.093

⇨ $x = \frac{46 \times 29.093}{0.98}$

= 1365.6

⇨ 0.98g → 29.093kJ

$\Delta H = -1365.5\ kJmol^{-1}$

7. a) Van der Waals forces

b) In Hydrogen Fluoride hydrogen atoms are covalently bonded to one of the three most electronegative elements, fluorine, this allows hydrogen bonds to occur between molecules of hydrogen fluoride. Hydrogen bonds are stronger than the van der Waals forces found between elemental hydrogen or fluorine so it is possible for 2 or 3 molecules of hydrogen fluoride to remain 'joined together' by hydrogen bonds.

8. a) (i) Precipitation (look at the state symbols of the products)

(ii) $AgNO_3$ + HCl → AgCl + HNO_3

1 mol 1 mol

169.9g 0.02 l

0.01 moll-1

$n = \frac{0.2}{169.9}$ $n = c \times v$

$= 0.0012mol$ $= 0.01 \times 0.02$

$= 0.0002mol$

Since 1 mol $AgNO_3$ reacts with 1 mol HCl

0.0012 mol $AgNO_3$ needs 0.0012 mol HCl which is not available

so $AgNO_3$ is in excess.

b) (i) A strong acid is one which fully dissociates into ions when added to water.

(ii) Concentration $= 0.0010\ moll^{-1}$

$= 1 \times 10^{-3}$

pH = the negative of the power of the hydrogen ion concentration (-3)

= 3

9. a) (i) Average rate = $\frac{\text{change of mass } g}{\text{time for change min}}$

= $\frac{60 - 59.68 \ g}{20 \text{ min}}$

= $\frac{0.32 \ g}{20 \text{ min}}$

= $0.016 \ gmin^{-1}$

(ii) The optimum pH for enzyme efficiency is pH 10

b) The number of bubbles of oxygen could be counted per unit time

10. a) Contact Process - oxygen

Haber Process - nitrogen

b) Both processes are exothermic in the forward direction therefore low temperatures promote high yield of products so high temperatures promote the reverse reaction reducing the yield.

c) In the Haber Process high pressures are needed to convert 4 volumes of reactants into only 2 volumes whereas, in the Contact Process, only 3 volumes of reactants are converted into 2 volumes so high pressure is not as necessary.

d)

N_2	+	$3H_2$	→	$2NH_3$
1 mol		3 mol	→	2 mol
28g		6g	→	34g
28kg		6kg	→	34kg
excess		200kg	→	x

⇨ $6x = 34 \times 200kg$

⇨ $x = \frac{34 \times 200kg}{6}$

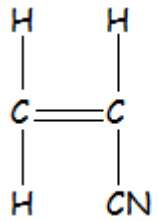
⇨ $x = 1133.33kg$ ie expected yield

$$\text{\% age yield} = \frac{\text{actual yield}}{\text{expected yield}}$$

$$= \frac{650 \times 100\%}{1133.33}$$

$$= \underline{57.35\%}$$

11. a) (i)



(ii) Addition

b) $2CH_2CHCN + 2H_2O + 2e^- \rightarrow (CH_2CH_2CN)_2 + 2OH^-$

12. a) The maximum temperature which can be obtained by a water bath is 100°C, the boiling point of water. Oil has higher boiling point so can reach the required temperature.

b)(i) $2NaHCO_3 \longrightarrow Na_2CO_3 + CO_2 + H_2O$

2 mol : 1 mol

168 g → 23 L

1.68 g → x.

$168x = 23 \times 1.68$

$x = \frac{23 \times 1.68}{168}$

$= 0.23 L$

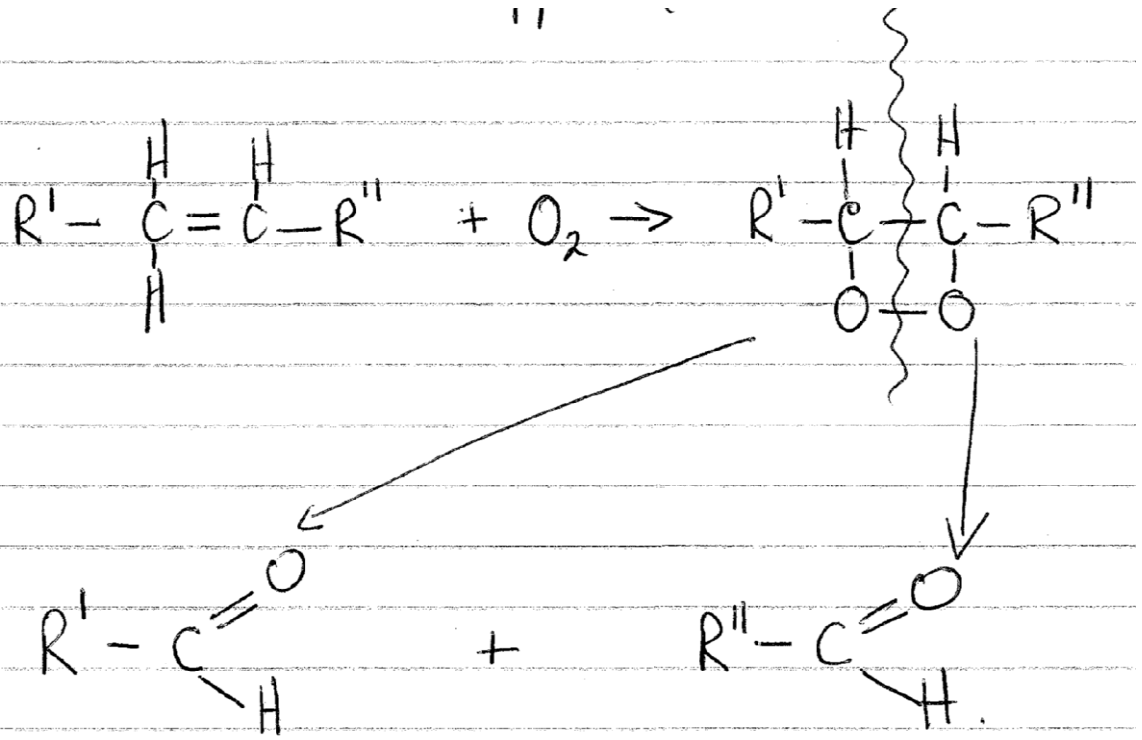
$= 230 cm^3$

(ii) Some would dissolve in water. (acid rain!!)

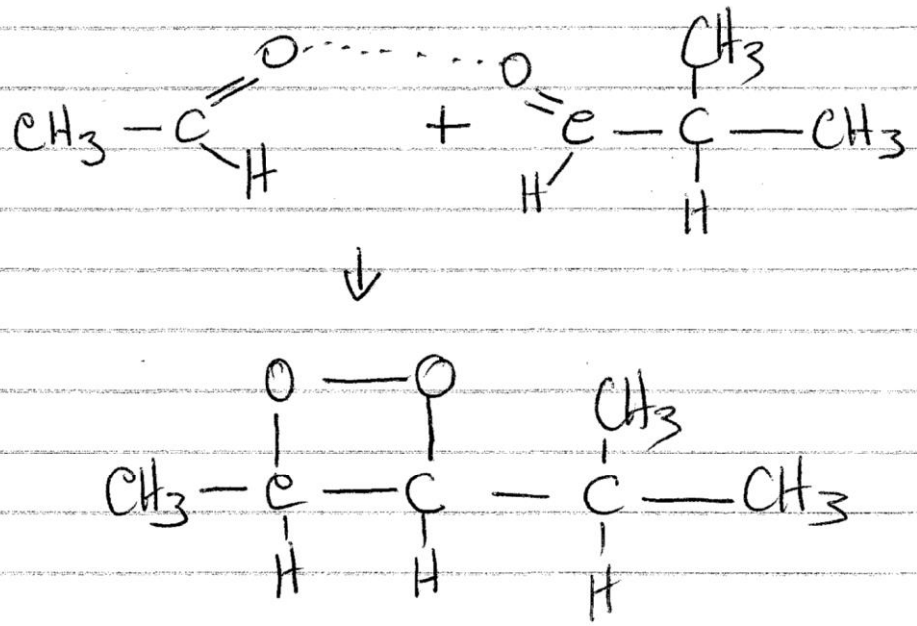
13. a) Alkanals OR aldehydes

b)

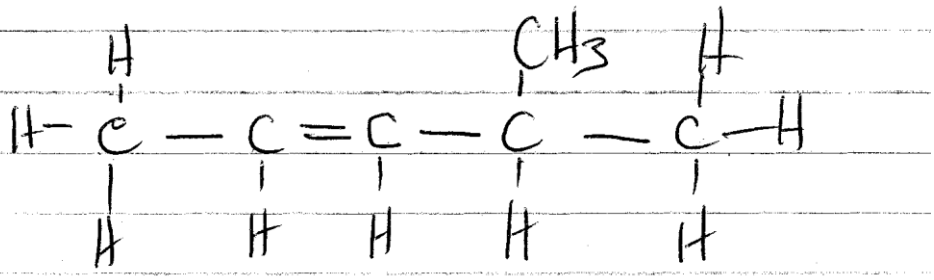
Look at example given first to figure out what has happened.



Work backwards now to get original alkene.



Put double bond back in and DRAW FULL STRUCTURE TO HELP WITH NAMING!



4-methylpent-2-ene.

14. a) $2I^- \rightarrow I_2 + 2e^-$

1 mol $\quad 2 \times 9.65 \times 10^4\ C$

$Q = I \times t$

$= 0.01A \times 97s$

$= 0.97\ C$

$2 \times 9.65 \times 10^4\ C \rightarrow 1\ mol\ I_2$

$0.97\ C \rightarrow x\ mol$

$$x = \frac{0.97\ C}{2 \times 9.65 \times 10^4\ C}$$

$$= \frac{0.97 \times 10^{-4}}{2 \times 9.65\ mol}$$

$$= \underline{5.00 \times 10^{-6}}\ mol$$

b) (i) Starch

(ii) $I_2 \rightarrow 2S_2O_3^{2-}$

1 mol $\quad$ 2 mol

1.2×10^{-5} mol $\rightarrow 2.4 \times 10^{-5}$ mol in 3 cm^3

$$c = \frac{n}{v}$$

$$= \frac{2.4 \times 10^{-5}}{3.0 \times 10^{-3}}$$

$$= \frac{2.4 \times 10^{-5}}{3.0} \times 10^3$$

$$= \underline{8.0 \times 10^{-3}}\ mol^{-1}$$

(ii) Stir it

15. a) $2H_2 \rightarrow 4H^+ + 4e^-$

$O_2 + 4H^+ + 4e^- \rightarrow + 2H_2O$

$2H_2 + O_2 \rightarrow + 2H_2O$

(ii) Left to right H2 → O2

b) Safe product etc