JABchem

Past Papers Higher Chemistry

2005

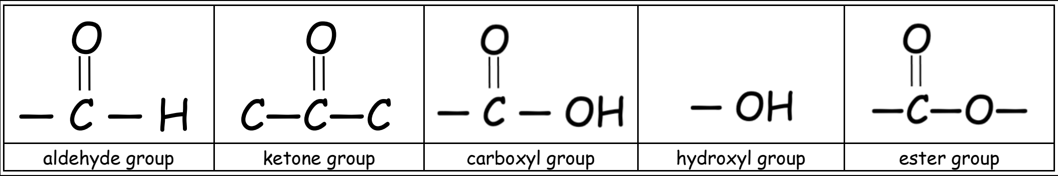
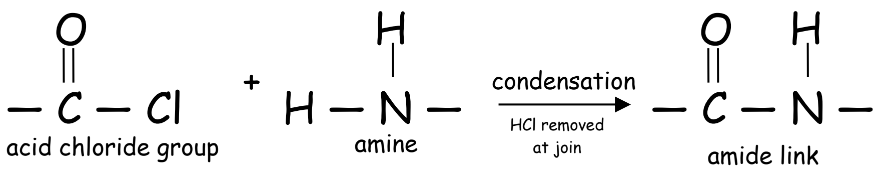
Marking Scheme

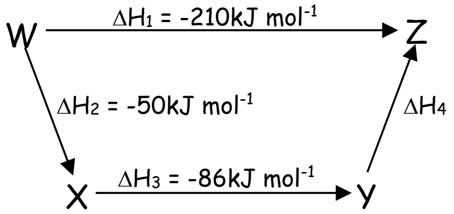
Grade Awarded	Mark Required (/100)	% candidates achieving grade
A	77+	26.0%
B	62+	24.0%
C	48+	24.9%
D	41+	10.0%
No award	<41	15.1%

Section:	Multiple Choice	Extended Answer
Average Mark:	25 /40	36.1 /60

2005 Higher Chemistry Marking Scheme

MC Qu	Answer	% Pupils Correct	Reasoning
1	D	70	☒A Isotopes have the same atomic number but different mass number ☒B Isotopes must have different no. of neutrons to have different mass numbers ☒C Isotopes have equal no. of protons and electrons *not* protons and neutrons ☑D Isotopes have same no. of protons (atomic no) but different no. of neutrons
2	C	74	Swap names of compounds and look up solubility page of data book for a combination which is insoluble: copper (II) sulphate + sodium carbonate → copper(II) carbonate (insoluble) + sodium sulphate (soluble)
3	A	23	Copper metal does not react with dilute hydrochloric acid (no gas produced) copper (II) carbonate + hydrochloric acid → copper chloride + water + carbon dioxide (gas)
4	B	67	**n**o. of mol HCl = **v**olume x **c**oncentration = 0.02 litres x 2 mol l^{-1} = 0.04 mol $Mg + 2HCl \rightarrow MgCl_2 + H_2$ 1mol 2mol 0.02mol 0.04mol
5	C	48	Explosion will occur when small particles of flour burn very quickly. Remove small flour particles by an air extractor fan and explosion will not occur.
6	D	64	Activation Energy: temperature change does not change the value of E_a No. of Successful Collisions: decrease in temp ∴ less collisions with enough energy to overcome activation energy barrier
7	A	71	☑A enthalpy of combustion for ethane ☒B oxidation of ethanol to ethanoic acid ☒C oxidation of ethanal to ethanoic acid ☒D not complete combustion as CO is formed
8	B	28	<u>Bond Breaking Steps</u>: 1x H–H = 1x432kJ = 432kJ; 1x I–I = 1x149kJ = 149kJ; Total = 581kJ <u>Bond Forming Steps</u>: 2x H–I = 2x295kJ = 590kJ; Total = 590kJ ΔH = ΣBond enthalpies for bonds broken - ΣBond enthalpies for bonds formed ΔH = 581 - 590 ΔH = -9 kJ mol^{-1}
9	C	82	☒A Ionisation is removing electrons not adding electrons ☒B 1st Ionisation energy is removing 1 mole of e^- from 1 mole of *neutral* atoms ☑C 1st Ionisation energy is removing 1 mole of e^- from 1 mole of atoms in gas state ☒D 1st Ionisation energy is removing 1 mole of e^- from 1 mole of *neutral* atoms
10	B	88	Page 11 of data booklet list values of electronegativity: Li=1.0, <u>Cs=0.8</u>, F=4.0, I=2.6
11	A	65	☑A Suitably high melting & boiling points and conducts by electrolysis when molten. ☒B Metallic structures do not conduct by electrolysis as metals are unchanged ☒C Molecular covalent substances have low melting and boiling points ☒D Covalent molecules do not conduct electricity
12	B	37	Distillation involves boiling and condensing hydrocarbons and no covalent bonds are broken. Non-polar hydrocarbons are held together by London dispersion forces which break when boiled and reform when condensed.
13	D	58	☒A Ionic bonding in $RaCl_2$ ☒B Noble gases have no covalent bonds (only London dispersion forces between atoms) ☒C High melting point indicates covalent network structure in SiO_2 ☑D Fullerene in a molecular form of covalent bonding.
14	D	48	Metal formed in a liquid state (metal melts at 328°C and electrolysis must be happening at least 501°C to melt metal chloride). Metal is more dense than metal chloride so falls to the bottom of the electrolyte.

15	A	64	☑A 1mol F_2 = 38g ∴ no. of mol = $^{mass}/_{gfm}$ = $^{100}/_{38}$ = 2.63mol ☒B 1mol N_2 = 28g ∴ no. of mol = $^{mass}/_{gfm}$ = $^{100}/_{28}$ = 3.57mol ☒C 1mol O_2 = 32g ∴ no. of mol = $^{mass}/_{gfm}$ = $^{100}/_{32}$ = 3.125mol ☒D 1mol H_2 = 2g ∴ no. of mol = $^{mass}/_{gfm}$ = $^{100}/_{2}$ = 50mol
16	C	28	1mol CO = 28g. = 6.02×10^{23}molecules = 23litres $^{11.5}/_{23} \times 6.02 \times 10^{23}$molecules = 11.5litres = 3.01×10^{23}molecules But 2 atoms per molecule ∴ 3.01×10^{23}molecules x 2atoms/molecule = 6.02×10^{23}atoms
17	A	62	$3CuO_{(s)} + 2NH_{3(g)} \rightarrow 3Cu_{(s)} + N_{2(g)} + 3H_2O_{(l)}$ 3mol 2mol 3mol 1mol 3mol - 2vol - 1vol - (NB solids & liquids have negligible volume compared to gases) - 100cm^3 - 50cm^3 -
18	D	74	☒A Dehydration: removal of water and C=C double bond created ☒B Cracking: small more useful molecules are formed, some with C=C bonds. ☒C Hydrogenation: hydrogen is added across C=C double bonds ☑D Reforming: straight-chains turned into branch-chain and ring structures.
19	C	91	Methane is the main constituent of biogas. Anaerobic respiration/fermentation of biological materials results in small carbon gas compounds breaking off as material breaks down.
20	B	63	Hexanal has the formula $C_6H_{12}O$ ☒A 2-methylbutanal: $CH_3CH_2CH(CH_3)CHO$ ∴ $C_5H_{10}O$ ☑B 3-methylpentan-2-one: $CH_3CH_2COCH(CH_3)CH_3$ ∴ $C_6H_{12}O$ ☒C 2,2-dimethylbutan-1-ol: $CH_3C(CH_3)_2CH_2OH$ ∴ $C_5H_{12}O$ ☒D 3-ethylpentanal: $CH_3CH_2CH(C_2H_5)CH_2CHO$ ∴ $C_7H_{14}O$
21	B	71	
22	C	53	☒A 1-chlorohexane, 2-chlorohexane and 3-chlorohexane would be produced. ☒B many products produced: (1or2or3or4or5or6)-chlorohex-1-ene all produced ☑C the carbon the Cl attaches to will always be carbon C_1 of chlorohexane ☒D many isomers produced depending on location of C=C and where Cl attaches
23	A	65	4-methylpentan-2-ol ($C_6H_{13}OH$) → 4-methylpentan-2-one ($C_6H_{12}O$) 2H atoms lost per molecule of $C_6H_{13}OH$ ∴1mol of $C_6H_{13}OH$ loses 2g.
24	D	65	Ozone absorbs harmful ultraviolet rays from the sun CFCs (chlorofluorocarbons breaks down ozone)
25	C	77	Synthesis gas is a mixture of carbon monoxide (CO) and hydrogen (H_2) Synthesis gas is made by steam reforming methane gas or coal.
26	A	68	H-Cl is produced: 
27	C	18	☒A polystyrene is a thermoplastic material ☒B polystyrene is made by addition polymerisation ☑C Both nylon and polystyrene contain C and H so both burn to form CO_2 and H_2O ☒D Polystyrene does not contain N, O or F attached to a H atom

<table>
<tr><td>28</td><td>A</td><td>92</td><td>The shape of a globular protein e.g. an enzyme is critical to the function of the enzyme.
Acid and high temperature can denature the enzyme and stop it from working.</td></tr>
<tr><td>29</td><td>A</td><td>67</td><td>Only enzyme-controlled reactions exhibit this shape of curve. The fermentation of glucose by an enzyme called zymase (found in yeast) exhibits this shape of curve as the temperature is varied.</td></tr>
<tr><td>30</td><td>D</td><td>81</td><td>☒A Land rentals are fixed as long land leases are usually arranged.
☒B The cost of plant construction is a set up cost not a variable cost
☒C Labour cost may rise every year but in a predictable way.
☑D Raw material cost will vary as the markets rise and fall</td></tr>
<tr><td>31</td><td>B</td><td>65</td><td>Medicines are usually made by the batch process.
Chemicals made in huge quantities are made by a continuous process.</td></tr>
<tr><td>32</td><td>A</td><td>63</td><td>$\Delta H_1 = \Delta H_2 + \Delta H_3 + \Delta H_4$
$\Delta H_4 = \Delta H_1 - \Delta H_2 - \Delta H_3$
$\Delta H_4 = -210 - (-50) - (-86)$
$\Delta H_4 = -74\text{kJ mol}^{-1}$
But ΔH for Z to Y = $+74\text{kJ mol}^{-1}$

</td></tr>
<tr><td>33</td><td>C</td><td>92</td><td>☒A Reactions at (dynamic) equilibrium rarely have ΔH= zero
☒B Reactions at equilibrium rarely have equal concentrations of reactants & products
☑C Rate of forward reaction = rate of reverse reaction at equilibrium
☒D The activation energy for both reactions would only be equal if ΔH= zero</td></tr>
<tr><td>34</td><td>D</td><td>53</td><td>☒A hydrogen gas is neither a reactant nor a product and does not react with either
☒B $HCl_{(g)}$ releases H^+ ions in solution. H^+ is a product as equilibrium shifts to left.
☒C $NaCl_{(s)}$ dissolves to release Cl^- ions. Cl^- is a product as equilibrium shifts to left.
☑D NaOH reacts with product H^+ ∴ removing a product moves equilibrium to right</td></tr>
<tr><td>35</td><td>D</td><td>61</td><td><table><tr><td>pH = 4</td><td>pH = 6</td><td>pH 4 → 6 ∴ $[H^+]$ decreases $10^{-4} \rightarrow 10^{-6}$</td></tr><tr><td>$[H^+] = 10^{-4}$</td><td>$[H^+] = 10^{-6}$</td><td>Concentration decreases by factor of 100</td></tr></table></td></tr>
<tr><td>36</td><td>C</td><td>67</td><td>$[OH^-] = 0.1\text{ mol l}^{-1} = 10^{-1}$
<table><tr><td>pH</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td></tr><tr><td>$[H^+]$</td><td>10^0</td><td>10^{-1}</td><td>10^{-2}</td><td>10^{-3}</td><td>10^{-4}</td><td>10^{-5}</td><td>10^{-6}</td><td>10^{-7}</td><td>10^{-8}</td><td>10^{-9}</td><td>10^{-10}</td><td>10^{-11}</td><td>10^{-12}</td><td>10^{-13}</td><td>10^{-14}</td></tr><tr><td>$[OH^-]$</td><td>10^{-14}</td><td>10^{-13}</td><td>10^{-12}</td><td>10^{-11}</td><td>10^{-10}</td><td>10^{-9}</td><td>10^{-8}</td><td>10^{-7}</td><td>10^{-6}</td><td>10^{-5}</td><td>10^{-4}</td><td>10^{-3}</td><td>10^{-2}</td><td>10^{-1}</td><td>10^0</td></tr></table></td></tr>
<tr><td>37</td><td>B</td><td>53</td><td>☒A copper(II) ethanoate made from weak acid ethanoic acid ∴pH>7 (alkaline)
☑B potassium carbonate made from weak acid carbonic acid ∴pH>7 (alkaline)
but only carbonates will react with acid to from a gas
☒C ammonium chloride is made from a weak alkali ammonium hydroxide ∴pH<7 (acidic)
☒D lead (II) carbonate is insoluble in water</td></tr>
<tr><td>38</td><td>A</td><td>59</td><td>☑A $Zn \rightarrow Zn^{2+} + 2e^-$ (oxidation) and $2H^+ + 2e^- \rightarrow H_2$ (reduction)
☒B neutralisation reaction: no transfer of electrons in $H^+ + OH^- \rightarrow H_2O$
☒C neutralisation reaction: no transfer of electrons in $2H^+ + O^{2-} \rightarrow H_2O$
☒D neutralisation reaction: no transfer of electrons in $2H^+ + CO_3^{2-} \rightarrow H_2O + CO_2$</td></tr>
<tr><td>39</td><td>B</td><td>70</td><td>Neutron capture involves changing the number of neutrons so there is no change of atomic number (number of protons).
Answer B is the only answer with the same atomic number as ^{32}P.</td></tr>
<tr><td>40</td><td>B</td><td>57</td><td>α-emission → loss of mass of 4 ∴ mass no.=200 is starting isotope.
25% of starting isotope (200) remains so 2 half-lives have passed
2 half-lives = 8 days ∴ 1 half-life = 4 days</td></tr>
</table>

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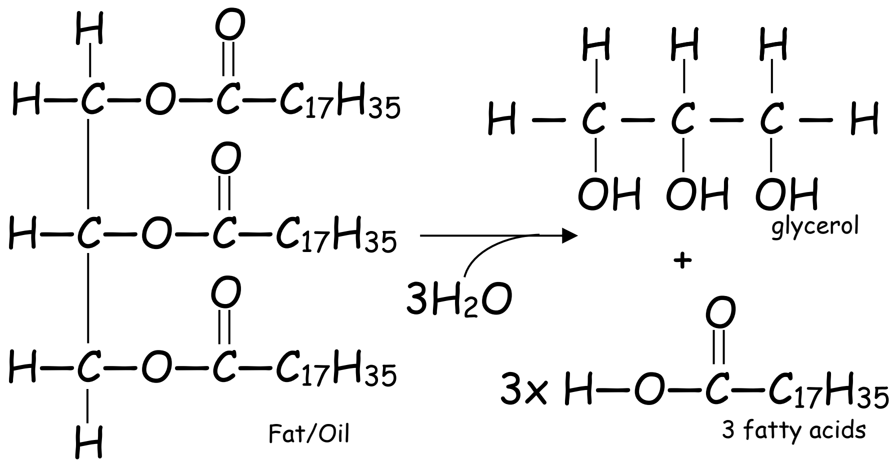
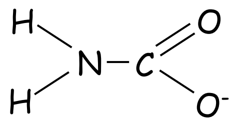
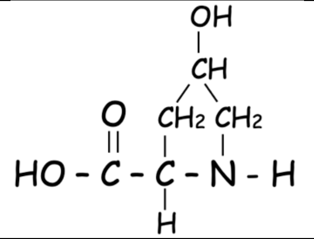
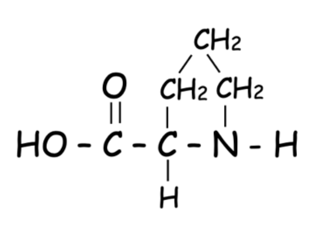
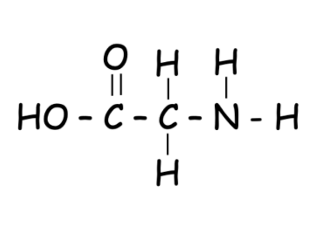
<table>
<tr><th>Long Qu</th><th>Answer</th><th>Reasoning</th></tr>
<tr><td>1a</td><td>glycerol</td><td>
</td></tr>
<tr><td>1b</td><td>more C=C bonds in carbon chains of oils</td><td>C=C bonds in unsaturated fatty acid chains of oils mean the molecules cannot get close enough to one another to be a solid. In fats, fatty acid chains being straight so the molecules fit closely together making fats solid.</td></tr>
<tr><td>2a</td><td>catalyst</td><td>Catalysts lower the activation energy (A is E_a for forward reaction and B is E_a for reverse reaction) but does not alter the enthalpy change (C).</td></tr>
<tr><td>2b</td><td>activated complex</td><td>Activated complete is the intermediary formed when reactants are starting to break up and reform as the products.</td></tr>
<tr><td>3a(i)</td><td>primary alcohol</td><td><table>
<tr><td rowspan="3">Oxidation of alcohols</td><td>Primary alcohol → aldehyde → carboxylic acid</td></tr>
<tr><td>Secondary alcohol → ketone –X→ [No oxidation]</td></tr>
<tr><td>Tertiary alcohol –X→ [No oxidation]</td></tr>
</table></td></tr>
<tr><td>3a(ii)</td><td>orange → green</td><td><table>
<tr><th>Oxidising agent</th><th>Start Colour</th><th>End Colour</th></tr>
<tr><td>Acidified Dichromate</td><td>Orange</td><td>Green</td></tr>
<tr><td>Benedict's/Fehling's</td><td>Blue</td><td>Brick Red (orange)</td></tr>
<tr><td>Hot copper (II) oxide</td><td>Black</td><td>Brown</td></tr>
<tr><td>Tollen's Reagent</td><td>(Colourless)</td><td>Silver mirror produced</td></tr>
</table></td></tr>
<tr><td>3b(i)</td><td>water bath</td><td>Naked flames must not be used as the reactants/vapours are flammable</td></tr>
<tr><td>3b(ii)</td><td>60.6%</td><td>ethanol + ethanoic acid → ethyl ethanoate + water
1 mol … 1mol
46g … 88g
5.0g … 88g x $^5/_{46}$ = 9.57g (Theoretical)
$\%Yield = \frac{Actual}{Theoretical} \times 100 = \frac{5.8}{9.57} \times 100 = 60.6\%$</td></tr>
<tr><td>4a(i)</td><td>shifts to left</td><td>If temperature is increased ∴ endothermic reaction is favoured
Reverse reaction is endothermic ∴ equilibrium shifts to left (i.e. more reactants)</td></tr>
<tr><td>4a(ii)</td><td>Low pressure favours the pressure-increasing forward reaction</td><td>Low pressure favours the pressure-increasing reaction
∴ Reactants have no gas particles but products have $H_2O(g)$
∴ Forward reaction increases pressure so is forward reaction favoured
∴ equilibrium moves to right.</td></tr>
<tr><td>4b</td><td></td><td>Ammonium ion is NH_4^+ (p21 data booklet). Carbamate ion must have -1 charge.
COO^- is an carboxyl group with the H atom dissociated to an H^+ ion.
$-NH_2$ on other side of molecule is an amine group.</td></tr>
<tr><td>5a</td><td>2.5</td><td>$Rate = \frac{\Delta quantity}{\Delta time} = \frac{90 - 65}{20 - 10} = \frac{25}{10} = 2.5\ cm^3\ s^{-1}$</td></tr>
<tr><td>5b</td><td>Graph showing:</td><td>Curve labelled B: Steeper line initially + same final volume
Curve labelled C: Not as steep at start + ~50cm^3 gas produced
NB: sulphuric acid (H_2SO_4) contains twice as many H^+ ions as hydrochloric acid (HCl)</td></tr>
</table>

5c	Diagram showing:	a) Closed vessel for reaction (no gaps allowing gas to escape) b) Suitable gas collection system, e.g. gas syringe or collection over water
6a(i)	Displacement	Displacement Reactions: Higher up metals will displace metals from their ions.
6a(ii)	$U^{4+} + 4e^- \rightarrow U$	Oxidation Reaction: $Mg \rightarrow Mg^{2+} + 2e^-$ Reduction Reaction: $U^{4+} + 4e^- \rightarrow U$
6a(iii)	Magnesium would react with oxygen in air	Magnesium will not react with Argon gas but would react with any oxygen in air and so not react with U^{4+} ions in redox/displacement reaction.
6b(i)	Covalent	UF_6 is not ionic as it is a gas at room temperature. All ionic compounds are solids at room temperature.
6b(ii)	Same half-life	The half-life does not change regardless of the compound/state the isotope of Uranium is in.
7a	To reduce heat loss from cup	Any heat loss from cup will reduce the temperature change and affect the value calculated for enthalpy of solution
7b	-54.4 kJ mol^{-1}	gfm KOH = (1x39) + (1x16) + (1x1) = 39 + 16 + 1 = 56g no. of mol = $\frac{\text{mass}}{\text{gfm}} = \frac{3.6}{56} = 0.0643$mol 0.0643mol KOH ⇔ 3.5kJ 1mol KOH ⇔ $3.5\text{kJ} \times {}^{1}/_{0.0643}$ = 54.4 kJ mol^{-1} Exothermic reaction = -54.4 kJ mol^{-1}
8a	$CuO + 2HNO_3$ ↓ $Cu(NO_3)_2 + H_2O$	$CuO + 2HNO_3 \rightarrow Cu(NO_3)_2 + H_2O$
8b(i)	Acid: H_2S; Base: H_2O	Acid H_3O^+ loses H^+ to become H_2O (base) Base HS^- gains H^+ to become H_2S (acid)
8b(ii)	Acid	In reverse reaction: $H_2O \rightarrow OH^-$ ∴from table this is acting as an acid as H_2O is losing H^+ ion.
9a	Hydrogen bonding	-O-H, -N-H and H-F bonds exhibit hydrogen bonding between molecules
9b	-188	❶x-1: $\frac{1}{2}O_2 + H_2O \rightarrow H_2O_2$ ΔH=+98kJ ❷: $H_2 + \frac{1}{2}O_2 \rightarrow H_2O$ ΔH=$\underline{-286}$kJ Add ❶'+❷: $H_2 + O_2 \rightarrow H_2O_2$ ΔH=$\underline{-188}$kJ mol^{-1}
9c(i)	Volume of KI Solution or total volume of mixture	The total volume of the KI solution is always $25cm^3$.
9c(ii)	To show the effect of varying concentration of KI on reaction rate	The total volume of KI + H_2O is always $25cm^3$.
9c(iii)	50	rate = $\frac{1}{\text{time}}$ ∴time = $\frac{1}{\text{rate}} = \frac{1}{0.02} = 50$ s
10a	Soluble in water	Poly(ethenol) contains –OH groups which form hydrogen bonds with water.
10b(i)	Addition	Addition polymerisation: C=C double bonds join up to form a long C-C chain
10b(ii)	Methanol	Ester produced is methylethanoate. Ethanoate-part comes from the plastic so methyl-part must come from the alcohol.

11a	21.4	2807kJ of energy is released from 1 mol of $C_6H_{12}O_6$ 418 kJ ↔ 1 mol x $^{418}/_{2807}$ = 0.15mol $C_6H_{12}O_6$ $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$ 1mol 6mol 0.15mol 6mol x $^{0.15}/_1$ = 0.89mol **V**olume = **n**o. of mol x **M**olar **V**olume = 0.89mol x 24litres mol^{-1} = 21.4litres
11b(i)	Reaction produces oxygen needed for body	Water moisture in exhaled air reacts to produce oxygen for next breath.
11b(ii)	CO_2 reacts with KOH and removes CO_2	Lime water is $Ca(OH)_2$ and reacts with CO_2 to go milky. A similar reaction happens with other hydroxide solutions. ($CO_2 + 2KOH \rightarrow K_2CO_3 + H_2O$)
12	Acid: HCl / CH_3COOH Type: Strong / weak pH: 1 / 4-5 Conductivity: high / low	Hydrochloric acid is a strong acid as all molecules of HCl gas dissociate when it dissolves in water. $HCl_{(g)} \rightarrow H^+_{(aq)} + Cl^-_{(aq)}$ 0.1mol l^{-1} hydrochloric acid has a pH=1 due to full ionisation of HCl. The conductivity of strong acids like hydrochloric acid is high due to the large number of ions present in the acid. Ethanoic acid is a weak acid as not all the molecules of CH_3COOH dissociate in water and an equilibrium is formed: $CH_3COOH \rightleftharpoons CH_3COO^- + H^+$ 0.1mol l^{-1} CH_3COOH has a pH around 4-5 due to partial dissociation of H^+ Conductivity of CH_3COOH is low due to less ions present.
13a(i)	$2CH_3OH + 3O_2$ ↓ $2CO_2 + 4H_2O$	❶ $CH_3OH + H_2O \rightarrow CO_2 + 6H^+ + 6e^-$ ❷ $3O_2 + 12H^+ + 12e^- \rightarrow 6H_2O$ ❶x2 $2CH_3OH + 2H_2O \rightarrow 2CO_2 + 12H^+ + 12e^-$ ❷ $3O_2 + 12H^+ + 12e^-$ $6H_2O$ cancel down $2CH_3OH + \cancel{2H_2O} \rightarrow 2CO_2 + \cancel{12H^+} + \cancel{12e^-}$ $3O_2 + \cancel{12H^+} + \cancel{12e^-} \rightarrow \cancel{6}\ 4H_2O$ ❶'+❷ $2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$
13a(ii)	Methanol fuel cell produces the greenhouse gas CO_2	The hydrogen fuel cell produces no CO_2 making it better for the environment as it does not contribute to Global Warming (the greenhouse effect/climate change). The methanol fuel cell produces CO_2.
13b	0.112litres (or 112cm^3)	Q=It = 0.50A x (30x60)seconds = 900C $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$ 2mol 2mol 1mol 2mol 2x96500C 24litres 193000C 24litres 900C 24litres x $^{900}/_{193000}$ = 0.112litres
14a	sodium chloride type	MgO radius ratio = $\frac{\text{radius of positive ion}}{\text{radius of negative ion}} = \frac{65}{136}$ = 0.48 Radius ratio of 0.48 is similar to that of NaCl.
14b	Smaller the ion, the larger the lattice breaking enthalpy	Smaller the ion, the larger the lattice breaking enthalpy as $Li^+ < Na^+ < K^+$ and $F^- < Cl^- < Br^-$. Li^+F^- has the 2 smallest ions in table and has the highest lattice breaking enthalpy and K^+Br^- has the largest ions in the table and the lowest lattice breaking enthalpy.

15a(i)	Fibrous	Fibrous proteins provide shape and support to the living tissues of the body and include all structural types of protein. Globular proteins have special shapes which are used in proteins like enzymes.
15a(ii)	Any one from:	  
15b(i)	Starch turns blue/black in the presence of iodine	The iodine titrated from the burette will react with any vitamin C present in the orange juice. When all the vitamin C has reacted with the iodine it will then be available to react with the starch and turn blue/black.
15b(ii)	Repeating results improves accuracy	The likelihood of a rogue result is reduced by repeating the experiment and averaging the results.
15b(iii)	0.188g	**n**o. of mol I_2 = **v**olume x **c**oncentration = 0.0214litres x 0.0050mol l^{-1} = 1.07×10^{-4}mol $C_6H_8O_6$ + I_2 → $C_6H_6O_6$ + $2H^+$ + $2I^-$ 1mol 1mol 1.07×10^{-4}mol 1.07×10^{-4}mol ∴ 1.07×10^{-4}mol Vitamin C ($C_6H_8O_6$) in 50cm^3 orange juice ∴ 1.07×10^{-3}mol Vitamin C ($C_6H_8O_6$) in 500cm^3 orange juice **gfm** Vitamin C ($C_6H_8O_6$) = (6x12) + (8x1) + (6x16) = 72+8+96 = 176g **m**ass = **n**o. of mol x **gfm** = 1.07×10^{-3}mol x 176g mol^{-1} = 0.188g
16a	dehydration	$CH_3CH_2OH \rightarrow CH_2{=}CH_2 + H_2O$ is a dehydration reaction
16b(i)	Structure of monochloroethene	Only one chlorine atom is present in the final product. As only hydrogen atoms are added in a hydrogenation step the one chlorine atom must have been added during the addition step where H-Cl is added across the triple bond: $CH{\equiv}CH + HCl \rightarrow CH_2{=}CHCl$ (followed by $CH_2{=}CHCl + H_2 \rightarrow CH_3CH_2Cl$)
16b(ii)	Structure of cyclohexanone	Cyclohexanol is a secondary alcohol as it has 2 carbons attached to the carbon with the –OH group. Secondary alcohols oxidise to ketones