JABchem

Past Papers Int 2 Chemistry

2010

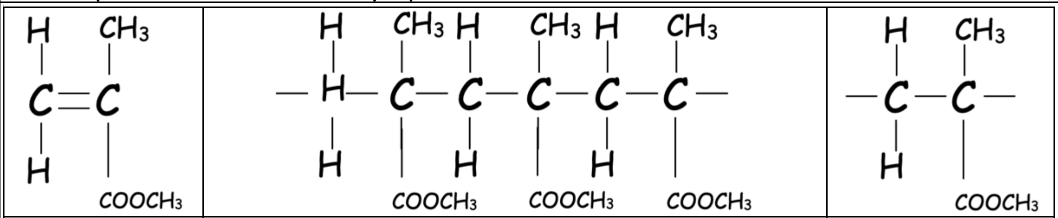
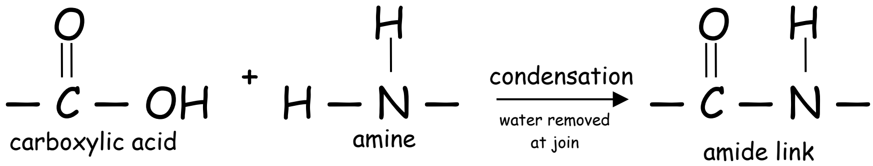
Marking Scheme

Grade Awarded	Mark Required (/80)	%	% candidates achieving grade
A	58+	72%+	41.0%
B	49+	61%+	21.2%
C	41+	51%+	17.7%
D	37+	46%+	6.4%
No award	<37	<46%	13.8%

Section:	Multiple Choice	Extended Answer
Average Mark:	20.9 /30	32.3 /50

2010 Int2 Chemistry Marking Scheme

<table>
<tr><th>MC Qu</th><th>Answer</th><th>% Pupils Correct</th><th>Reasoning</th></tr>
<tr><td>1</td><td>A</td><td>89</td><td>☑A Ice Melting is a physical change as no new chemical has been formed
☒B Iron rusting produces a new chemical: $4Fe + 3O_2 \rightarrow 2Fe_2O_3$
☒C Methane burns to form carbon dioxide and water: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
☒D Acid neutralises to form water: $H^+ + OH^- \rightarrow H_2O$</td></tr>
<tr><td>2</td><td>D</td><td>75</td><td>$\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{5-0}{20-0} = \frac{5}{20} = 0.25\text{cm}^3\ \text{s}^{-1}$</td></tr>
<tr><td>3</td><td>C</td><td>57</td><td>☒A C-H: electronegativity difference = 2.5-2.2 = 0.3 ∴ least polar bond
☒B N-H: electronegativity difference = 3.0-2.2 = 0.8
☑C O-H: electronegativity difference = 3.5-2.2 = 1.3 ∴ most polar bond
☒D C-O: electronegativity difference = 4.5-2.5 = 1.0</td></tr>
<tr><td>4</td><td>D</td><td>70</td><td>☒A Non-polar covalent bonding: Pairs of electrons shared equally between atoms
☒B Polar covalent bonding: Pairs of electrons shared unequally between atoms
☒C Ionic Bonding: attraction of oppositely charged ions for each other
☑D Metallic Bonding: attraction of positively charged ions for delocalised electrons</td></tr>
<tr><td>5</td><td>C</td><td>73</td><td>☒A Carbon (diamond) is a covalent network with large tetrahedral structure
☒B Helium is a Noble gas and comes in single atoms (monatomic)
☑C Nitrogen has a C≡C triple bond within the N_2 molecule
☒D Sulphur has an S_8 ring structure</td></tr>
<tr><td>6</td><td>D</td><td>63</td><td><table><tr><td>Ion</td><td>F^-</td><td>Cl^-</td><td>Br^-</td></tr><tr><td>Size</td><td>Smallest</td><td>Medium</td><td>Largest</td></tr><tr><td>Speed of Ion</td><td>Fastest</td><td>Medium</td><td>Slowest</td></tr></table></td></tr>
<tr><td>7</td><td>B</td><td>79</td><td><table><tr><td>Write down Valency below each ion's symbol
Mg SO_3^{2-}
2 2</td><td>Put in Cross-over Arrows
Mg SO_3^{2-}
2 2</td><td>Follow arrows and cancel down to get formula
$MgSO_3$</td></tr></table></td></tr>
<tr><td>8</td><td>B</td><td>89</td><td>❶ Write down reactants and product formulae $Al_{(s)} + Br_{2(l)} \rightarrow AlBr_{3(s)}$
❷ 1 aluminium on each side ∴ no action $Al_{(s)} + Br_{2(l)} \rightarrow AlBr_{3(s)}$
❸ 2xBr before arrow and 3xBr after arrow ∴ make both sides up to 6xBr $Al_{(s)} + 3Br_{2(l)} \rightarrow 2AlBr_{3(s)}$
❹ 1xAl before arrow and 2xAl after arrow ∴ make both sides up to 2xAl $2Al_{(s)} + 3Br_{2(l)} \rightarrow 2AlBr_{3(s)}$</td></tr>
<tr><td>9</td><td>C</td><td>86</td><td>☒A mass = (1x12) + (2x16) = 12+32 = 44amu
☒B mass = (1x14) + (2x18) = 14+36 = 50amu
☑C mass = (1x12) + (1x16) + (1x18) = 12+16+18 = 46amu
☒D mass = (1x14) + (1x16) + (1x18) = 14+16+18 = 48amu</td></tr>
<tr><td>10</td><td>A</td><td>70</td><td>☑A $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$
☒B $C_2H_6 + 3\frac{1}{2}O_2 \rightarrow 2CO_2 + 3H_2O$
☒C $C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$
☒D $C_4H_{10} + 6\frac{1}{2}O_2 \rightarrow 4CO_2 + 5H_2O$</td></tr>
<tr><td>11</td><td>A</td><td>83</td><td>☑A large molecules are more viscous (thicker) than small molecules
☒B small molecules are more flammable than large molecules
☒C small molecules evaporate more readily than large molecules
☒D small molecules have lower boiling point range than large molecules</td></tr>
</table>

<table>
<tr><td>12</td><td>D</td><td>82</td><td>☒A CH_4 fits into the general formula of C_nH_{2n+2} ∴ CH_4 is an alkane
☒B C_2H_6 fits into the general formula of C_nH_{2n+2} ∴ C_2H_6 is an alkane
☒C C_4H_{10} fits into the general formula of C_nH_{2n+2} ∴ C_4H_{10} is an alkane
☑D C_6H_{12} fits into the general formula of C_nH_{2n} ∴ C_6H_{12} is an alkene or cycloalkane</td></tr>
<tr><td>13</td><td>B</td><td>37</td><td>☒A Condensation: Small molecules join together with water removed at join
☑B Dehydration: Water molecule removed and C=C double bond formed in its place
☒C Hydration: Water molecule added across a C=C double bond
☒D Hydrolysis: Large molecule splits into smaller ones with water added at the break</td></tr>
<tr><td>14</td><td>D</td><td>59</td><td>☒A Kevlar is a very strong polymer used in bullet-proof vests
☒B Perspex is a transparent polymer used as a replacement for glass
☒C Poly(ethene) is a widely used polymer
☑D Poly(ethenol) is a soluble polymer</td></tr>
<tr><td>15</td><td>B</td><td>87</td><td>
Monomer | Polymer | Repeating Unit</td></tr>
<tr><td>16</td><td>C</td><td>72</td><td>
</td></tr>
<tr><td>17</td><td>A</td><td>47</td><td>In a reversible reaction at equilibrium:
Rate of forward reaction = Rate of reverse reaction
Concentration of reactants and products are constant but not equal</td></tr>
<tr><td>18</td><td>A</td><td>74</td><td>☑A Ammonia dissolves in water to form ammonium hydroxide ∴ alkaline pH>7
☒B Carbon dioxide dissolves in water to form carbonic acid ∴ acidic pH<7
☒C Sulphur Dioxide dissolves in water to form sulphurous acid ∴ acidic pH<7
☒D Sodium chloride dissolves in water to form a neutral solution ∴ pH=7</td></tr>
<tr><td>19</td><td>B</td><td>79</td><td>☒A acidic solutions have a small number of OH^- ions in them
☑B acidic solutions have concentration of H^+ ions > concentration of OH^- ions
☒C alkaline solutions have concentration of OH^- ions > concentration of H^+ ions
☒D neutral solutions have concentration of H^+ ions = concentration of OH^- ions</td></tr>
<tr><td>20</td><td>C</td><td>63</td><td>no. of mol $(NH_4)_2SO_4$ = volume x concentration = 0.5litres x 1mol l^{-1} = 0.5mol
gfm $(NH_4)_2SO_4$ = (2x14)+(8x1)+(1x32)+(4x16) = 28+8+32+64 = 132g
mass = no. of mol x gfm = 0.5 x 132 = 66g</td></tr>
<tr><td>21</td><td>C</td><td>64</td><td><table><tr><th>Acid</th><th>pH</th><th>Conductivity</th><th>Rate of Reaction with Magnesium</th></tr><tr><td>Hydrochloric acid</td><td>lower</td><td>higher</td><td>faster</td></tr><tr><td>Ethanoic Acid</td><td>higher</td><td>lower</td><td>slower</td></tr></table></td></tr>
<tr><td>22</td><td>D</td><td>58</td><td><table><tr><th colspan="3">Base: Compound which neutralises an acid to form water</th></tr><tr><td>metal hydroxides
(alkalis)</td><td>metal oxides</td><td>metal carbonates</td></tr></table></td></tr>
<tr><td>23</td><td>A</td><td>88</td><td>☑A during neutralisation: pH of acid increases up to pH=7
☒B during neutralisation: pH of acid increases up to pH=7
☒C during neutralisation: pH of an alkali decreases down to pH=7
☒D during neutralisation: pH of an alkali decreases down to pH=7</td></tr>
<tr><td>24</td><td>A</td><td>60</td><td>☑A copper is not reactive enough to react with dilute hydrochloric acid
☒B zinc + hydrochloric acid → zinc chloride + hydrogen
☒C copper carbonate + hydrochloric acid → copper chloride + water + carbon dioxide
☒D zinc carbonate + hydrochloric acid → zinc chloride + water + carbon dioxide</td></tr>
</table>

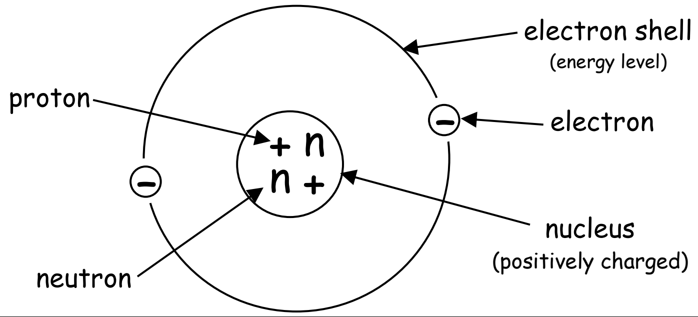
<table>
<tr><td>25</td><td>C</td><td>77</td><td>☒A barium sulphate is insoluble and can be prepared by a precipitation reaction
☒B lead (II) sulphate is insoluble and can be prepared by a precipitation reaction
☑C calcium chloride is soluble and will not form a precipitate
☒D silver chloride is insoluble and can be prepared by a precipitation reaction</td></tr>
<tr><td>26</td><td>A</td><td>84</td><td>$Pb^{2+} + 2NO_3^- + 2Na^+ + 2I^- \longrightarrow Pb^{2+}(I^-)_2 + 2Na^+ + 2NO_3^-$
Cancel out any spectator ions which appear on both sides
$Pb^{2+} + \cancel{2NO_3^-} + \cancel{2Na^+} + 2I^- \longrightarrow Pb^{2+}(I^-)_2 + \cancel{2Na^+} + \cancel{2NO_3^-}$
Re-write equation omitting spectator ions
$Pb^{2+} + 2I^- \longrightarrow Pb^{2+}(I^-)_2$</td></tr>
<tr><td>27</td><td>B</td><td>91</td><td>☒A iron is below zinc in the electrochemical series ∴ iron will not displace zinc
☑B magnesium is above zinc in the electrochemical series ∴ magnesium displaces zinc
☒C silver is below zinc in the electrochemical series ∴ silver will not displace zinc
☒D tin is below zinc in the electrochemical series ∴ tin will not displace zinc</td></tr>
<tr><td>28</td><td>A</td><td>35</td><td>❶ $Mg \longrightarrow Mg^{2+} + 2e^-$
❷ $Ag^+ + e^- \longrightarrow Ag$

❶ $Mg \longrightarrow Mg^{2+} + 2e^-$
❷x2 $2Ag^+ + 2e^- \longrightarrow 2Ag$

Add ❶+❷ $Mg + 2Ag^+ + 2e^- \longrightarrow Mg^{2+} + 2e^- + 2Ag$

Cancel e^- $Mg + 2Ag^+ + \cancel{2e^-} \longrightarrow Mg^{2+} + \cancel{2e^-} + 2Ag$
$Mg + 2Ag^+ \longrightarrow Mg^{2+} + 2Ag$</td></tr>
<tr><td>29</td><td>D</td><td>59</td><td><table>
<tr><th>Method</th><th>Electrolysis</th><th>Heat With Carbon</th><th>Heat Alone</th></tr>
<tr><td>Metals Made This Way</td><td>Potassium, Sodium
Lithium, Calcium
Magnesium, Aluminium</td><td>Zinc, Iron
Tin, Lead
Copper</td><td>Mercury, Silver
Gold, Platinum</td></tr>
<tr><td>Reason</td><td>most reactive metals</td><td>medium reactive metals</td><td>least reactive metals</td></tr>
</table></td></tr>
<tr><td>30</td><td>C</td><td>44</td><td>☒A Glucose $C_6H_{12}O_6$ is covalent and does not act as a electrolyte
☒B Magnesium would protect the nail from rusting by sacrificial protection
☑C Potassium nitrate is ionic and will act as an electrolyte to complete the circuit
☒D Attaching nail to negative terminal will protect the nail by cathodic protection</td></tr>
</table>

2010 Int2 Chemistry Marking Scheme

<table>
<tr><th>Long Qu</th><th>Answer</th><th>Reasoning</th></tr>
<tr><td>1a</td><td>Nucleus</td><td>


</td></tr>
<tr><td>1b(i)</td><td>8</td><td>

Mass number = no. of protons + no. of neutrons
= 3 + 5
= 8

</td></tr>
<tr><td>1b(ii)</td><td>number of protons equals number of electrons</td><td>Atoms are electrically neutral because the number of positive protons equals the number of negative electrons.</td></tr>
<tr><td>1b(iii)</td><td>Alkali Metals</td><td>

Group	1	7	0	between 2 & 3
Name	Alkali Metals	Halogens	Noble Gases	Transitional metals

</td></tr>
<tr><td>2a</td><td>Endothermic</td><td>

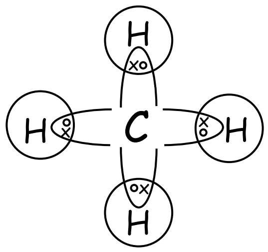
Exothermic	Reaction which gives off energy/heat to the surroundings
Endothermic	Reaction which takes in energy/heat from the surroundings

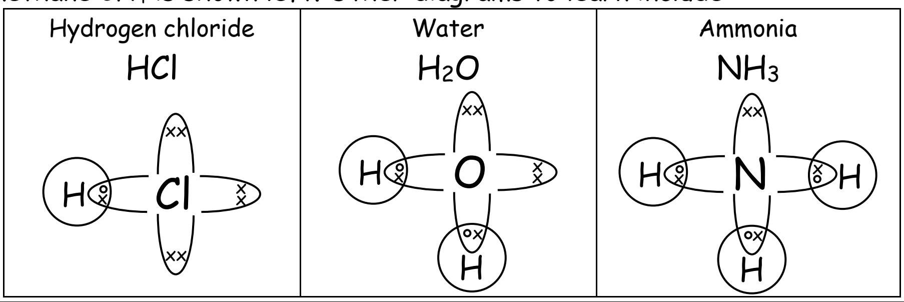
</td></tr>
<tr><td>2b</td><td>(s) (l) (aq)</td><td>$NH_4NO_{3(s)} + H_2O_{(l)} \longrightarrow NH_4NO_{3(aq)}$</td></tr>
<tr><td>2c</td><td>Solvent</td><td>

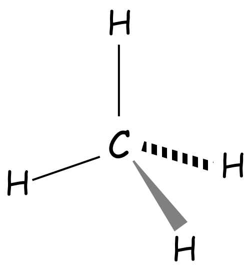
Solute	Substance which is dissolved
Solvent	Liquid which does the dissolving
Solution	Mixture of solute dissolved in the solvent

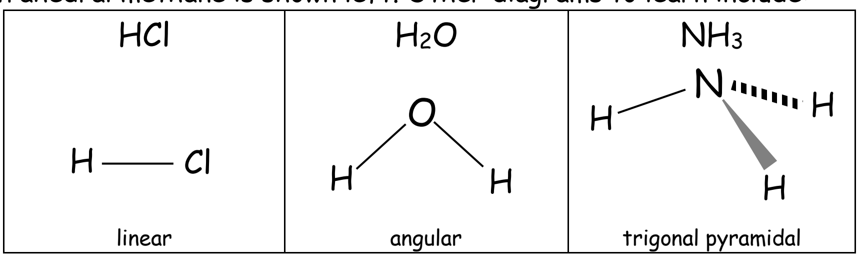
</td></tr>
<tr><td>2d</td><td>8</td><td>$\text{temperature change} = \frac{\text{energy change}}{\text{mass of water} \times 4.2} = \frac{6.72}{0.2 \times 4.2} = 8°C$</td></tr>
<tr><td>3a</td><td>covalent network</td><td>

Covalent	Carbon is a non-metal which forms covalent bonds
Network	Diamond is a covalent network due to its very high melting point

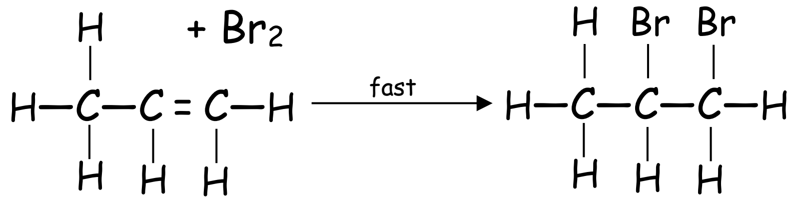
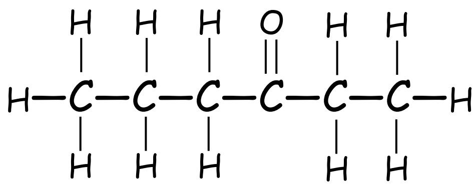
</td></tr>
<tr><td>3b(i)</td><td>


</td><td>
Methane CH_4 is shown left. Other diagrams to learn include:


</td></tr>
<tr><td>3b(ii)</td><td>


</td><td>
Tetrahedral methane is shown left. Other diagrams to learn include:


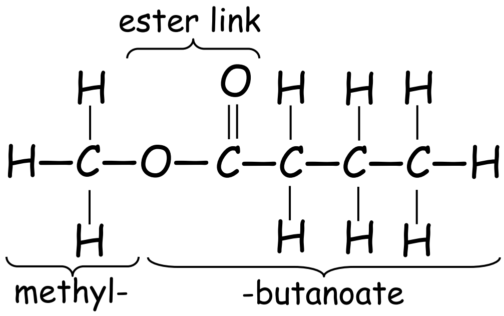
</td></tr>
<tr><td>4a(i)</td><td>25</td><td>Problem Solving: Reading information from a graph</td></tr>
<tr><td>4a(ii)</td><td>1.5</td><td>$25\% \text{ of } 6g = \frac{25}{100} \times 6 = 1.5g$</td></tr>
</table>

<table>
<tr><td>4b</td><td>1.24</td><td>gfm Ag = 108g
no of mol = $\frac{\text{mass}}{\text{gfm}} = \frac{1.08}{108}$ = 0.01 mol
$4Ag + 2H_2S + O_2 \longrightarrow 2Ag_2S + 2H_2O$
4mol → 2mol
2mol → 1mol
0.01mol → 0.005mol
gfm Ag_2S = (2x108)+(1x32) = 216+32 = 248
mass = no. of mol x gfm = 0.005 x 248 = 1.24g</td></tr>
<tr><td>5a</td><td>Heat catalyst then heat paraffin</td><td>The catalyst must be at a high temperature before it will work efficiently. The Bunsen burner initially heats only the catalyst and when it is hot the Bunsen burner is then moved under the paraffin with the heating shared between the paraffin and the catalyst to keep both warm.</td></tr>
<tr><td>5b</td><td>To prevent suck-back</td><td>When the test tube is heated, the air inside expands and bubbles leave the delivery tube. When heating is stopped, the air inside contracts back to its original size but gas cannot re-enter the delivery tube so liquid is sucked up instead. Cold liquid can cause hot glass to crack.</td></tr>
<tr><td>5c(i)</td><td>aluminium oxide</td><td>Aluminium oxide is the catalyst in a cracking reaction.
Silicate can also be used as the catalyst in this reaction.</td></tr>
<tr><td>5c(ii)</td><td>Lowers temperature cracking takes place</td><td>Catalyst are used to speed up reactions and are not used up in the reaction. Catalyst can be used to lower the temperature a reaction takes place at, often for safety reasons.</td></tr>
<tr><td>5d</td><td>Addition</td><td>
</td></tr>
<tr><td>6a</td><td>Diagram showing:</td><td></td></tr>
<tr><td>6b</td><td>heptan-4-one</td><td><table><tr><td>heptan-</td><td>7 carbons in chain</td></tr><tr><td>-one</td><td>C=O functional group</td></tr><tr><td>-4-</td><td>Functional group on 4th carbon</td></tr></table></td></tr>
<tr><td>6c</td><td>149-153</td><td><table><tr><td>Ketone</td><td>C_3H_6O</td><td>C_4H_8O</td><td>$C_5H_{10}O$</td><td>$C_6H_{12}O$</td><td>$C_7H_{14}O$</td></tr><tr><td>Boiling Point (°C)</td><td>56°C</td><td>80°C</td><td>102°C</td><td>127°C</td><td>-</td></tr><tr><td>Difference</td><td colspan="5">24°C · 22°C · 25°C · Average = 24°C</td></tr><tr><td>Estimate</td><td>-</td><td>-</td><td>-</td><td>-</td><td>151°C</td></tr></table></td></tr>
<tr><td>7a(i)</td><td>Fermentation</td><td>glucose $\xrightarrow[\text{(no air)}]{\text{enzymes}}$ alcohol + carbon dioxide
$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$</td></tr>
<tr><td>7a(ii)</td><td>Enzymes</td><td>Enzymes are biological catalysts which catalyse the chemical reactions in living organisms at body temperature</td></tr>
<tr><td>7b</td><td>Enzymes denature at higher temperatures</td><td>Enzymes will change shape permanently and denature when temperatures are too high. Once denatured, enzymes no longer catalyse reactions.</td></tr>
</table>

7c — Distillation

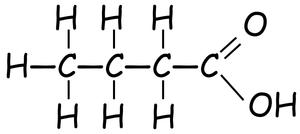
Distillation separates chemicals with different boiling points. Ethanol boils at 78°C and water boils at 100°C. If the temperature is set between 78°C and 100°C, the ethanol will boil but the water will remain in the container.

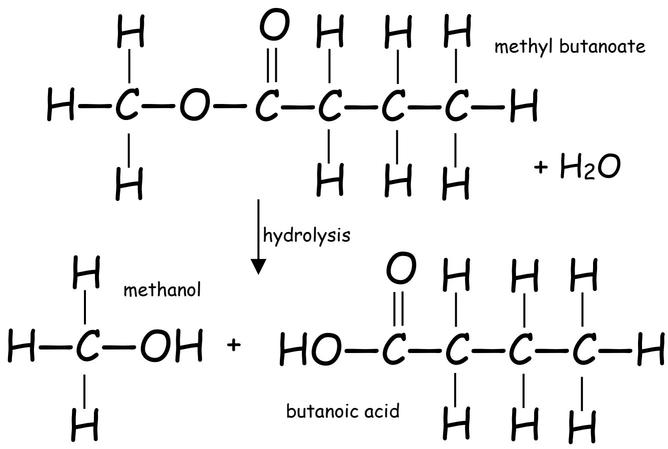
8a — Esters



8b(i) — hydrolysis

8b(ii) —





9a — Photosynthesis

carbon dioxide + water $\xrightarrow[\text{light}]{\text{chlorophyll}}$ glucose + oxygen

$$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$$

9b — Starch: Iodine turns blue/black or Glucose: Benedict's Blue → Red

Carbohydrate	Glucose	Fructose	Maltose	Sucrose	Starch
Formula	$C_6H_{12}O_6$	$C_6H_{12}O_6$	$C_{12}H_{22}O_{11}$	$C_{12}H_{22}O_{11}$	$(C_6H_{10}O_5)_n$
Reaction with Benedict's Solution	blue ↓ brick red	blue ↓ brick red	blue ↓ brick red	no change	no change
Reaction with Iodine Solution	no change	no change	no change	no change	turns blue/black

9c — -OH group circled

The hydroxyl functional group has the formula –O–H

9d — 2,8

Particle	Magnesium atom	Mg^{2+} ion
Electron Arrangement	2,8,2	2,8

10a — pH value between 0-6

Acidic	Neutral	Alkaline
pH<7	pH=7	pH>7

10b(i) — As temperature increases the solubility decreases

Problem Solving: Interpreting a line graph and making a conclusion

10b(ii) — 1.9

Problem Solving: extend line and estimation of value at 10°C

11a — Acid rain

Acid rain is formed from sulphur dioxide or nitrogen dioxide gas dissolving in rain water.

- sulphur dioxide is formed from burning sulphur in coal
- nitrogen dioxide is formed by sparks in air

11b(i) — calcium, carbon and oxygen

Ending	Meaning	Example
-ide	2 elements in compound	Copper sulphide = copper + sulphur
-ate	2 elements in compound + oxygen	Copper sulphate = copper + sulphur + oxygen
-ite	2 elements in compound + oxygen	Sodium sulphite = sodium + sulphur + oxygen

11b(ii) — water

Calcium oxide + Water ⟶ Calcium hydroxide

$$CaO + H_2O \longrightarrow Ca(OH)_2$$

<table>
<tr><td>12a</td><td>Stops oxygen or water getting to iron</td><td>Corrosion requires both oxygen and water to be present to take place. If either water or oxygen is removed corrosion will not take place.</td></tr>
<tr><td>12b(i)</td><td>Galvanising</td><td>Galvanising is the coating of iron in zinc. Zinc is higher up the electrochemical series than iron and will protect it by sacrificial protection where zinc gives electrons to the iron.</td></tr>
<tr><td>12b(ii)</td><td>One from:</td><td><table><tr><td>Zinc gives electrons to the iron</td><td>Zinc is more reactive</td><td>Zinc gives sacrificial protection</td><td>Zinc is higher up electrochemical series</td></tr></table></td></tr>
<tr><td>13a</td><td>pH probe show neutral or pH=7</td><td>The acid must be fully neutralised by alkali before salt can be collected.
The pH probe can be used to indicated the neutralisation point</td></tr>
<tr><td>13b</td><td>0.08mol l^{-1}</td><td>no. of mol acid = volume x concentration = 0.020 x 0.1 = 0.002mol
$2NaOH + H_2SO_4 \longrightarrow NaSO_4 + 2H_2O$
2mol 1mol
0.004mol 0.002mol
concentration = $\frac{\textbf{n}\text{o. of mol}}{\textbf{v}\text{olume}} = \frac{0.004 \text{ mol}}{0.05 \text{ litres}}$ = 0.08 mol l^{-1}</td></tr>
<tr><td>14a(i)</td><td>Copper electrode
Iron electrode
100cm^3 0.1 mol l^{-1} hydrochloric acid</td><td>In a fair test, only one variable will change in the experiment:<table><tr><td>Variable Changing (in question)</td><td>Variable staying the same</td></tr><tr><td>Solution Type
Sodium chloride → hydrochloric acid</td><td>Metals used as electrode
Concentration of solution</td></tr><tr><td></td><td>Volume of solution</td></tr><tr><td></td><td>Temperature</td></tr><tr><td></td><td>Distance electrode kept apart</td></tr><tr><td></td><td>Mass of electrodes</td></tr></table></td></tr>
<tr><td>14a(ii)</td><td>Repeat Experiment and calculate average</td><td>Repeating an experiment and averaging the results improves the accuracy and reliability of an experiment.</td></tr>
<tr><td>14b(i)</td><td>←
From right to left</td><td><table><tr><td>Electrons are generated on iron electrode (right):</td><td>$Fe \rightarrow Fe^{2+} + 2e^-$</td></tr><tr><td>Electrons are accepted by iodine at carbon electrode (left):</td><td>$I_2 + 2e^- \rightarrow 2I^-$</td></tr></table></td></tr>
<tr><td>14b(ii)</td><td>Good conductor of electricity</td><td>Carbon (graphite) is the only non-metal which conducts electricity</td></tr>
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