JABchem

Past Papers Int 2 Chemistry

2005

Marking Scheme

Grade Awarded	Mark Required (/80)		% candidates achieving grade
A	55+	69%	30.6%
B	46+	57%	21.4%
C	38+	47%	18.5%
D	34+	42%	7.9%
No award	<34	<42%	21.6%

Section:	Multiple Choice	Extended Answer
Average Mark:	17.7 /30	29.0 /50

2005 Int2 Chemistry Marking Scheme

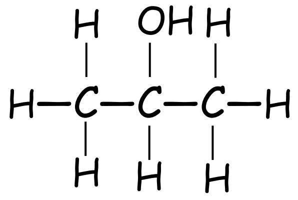
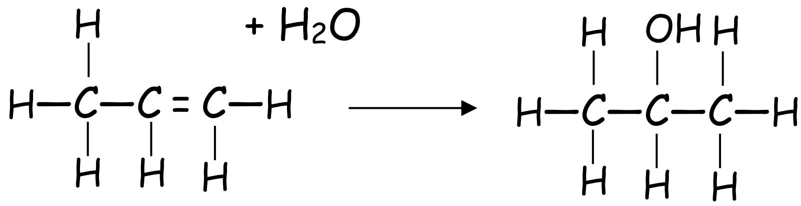
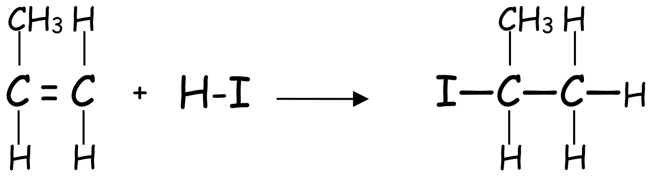
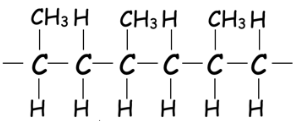
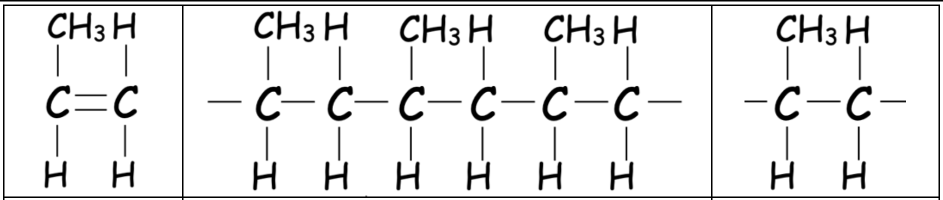
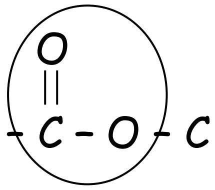
MC Qu	Answer	% Pupils Correct	Reasoning
1	B	38	☒A Graph Q is faster initially but no change to particle size so initial rate is same ☑B 0.5g of magnesium would half the gas volume and powder is faster than ribbon ☒C same mass of magnesium so final volume of gas given off would remain the same ☒D increased mass of magnesium would increase volume of gas given off
2	D	61	☒A magnesium hydroxide contains magnesium, hydrogen and oxygen ☒B magnesium phosphate contains magnesium, phosphate and oxygen ☒C magnesium sulphite contains magnesium, sulphur and oxygen ☑D magnesium nitride contains magnesium and nitrogen
3	A	70	☑A carbon dioxide does not react as it passes over a catalytic converter. ☒B carbon monoxide reacts to become carbon dioxide in a catalytic converter ☒C nitrogen dioxide reacts and reverts back to nitrogen in a catalytic converter ☒D nitrogen monoxide reacts and reverts back to nitrogen in catalytic converter
4	B	89	☒A Halogens (group 7) have 7 electrons in their outer shell ☑B Noble gases have a full outer electron shell ∴2,8,8 is a Noble Gas (Argon) ☒C Alkali metals (group 1) have 1 electron in their outer shell ☒D Transition Metals (block between groups 2+3) do not have a full outer shell
5	D	58	Atoms of the same element must have the same atomic number and same number of protons. Isotopes of the same element have the same number of protons but can have different numbers of neutrons (hence a different mass number)
6	A	38	☑A carbon monoxide (CO) is a diatomic molecule due to 2 atoms in the molecule ☒B carbon tetrachloride (CCl_4) is a pentatomic molecule (5 atoms in the molecule) ☒C nitrogen trihydride (NH_3) is a tetratomic molecule (4 atoms in the molecule) ☒D Sulphur dioxide (SO_2) is a triatomic molecule (3 atoms in the molecule)
7	A	59	☑A Ionic compounds conduct as liquids but not as solids & have high melting points ☒B Metallic substances conduct as both solids and liquids ☒C Covalent networks do not conduct in any state and have high melting points ☒D Covalent molecular do not conduct in any state and have low melting points
8	D	53	1mol $CaSiO_3$ = (1x40) + (1x28) + (3x16) = 40 + 28 + 48 = 118g 1mol CaO = (1x40) + (1x16) = 40 + 16 = 56g 1mol SiO_2 = (1x28) + (2x16) = 28 + 32 = 62g 1 mol of reactants = 118g and 1 mol of products = 56g+62g = 118g
9	A	35	☑A Combustion: burning reaction joining up with oxygen ☒B Condensation: small molecules join together with water removed at join ☒C Dehydration: water is removed from a molecule leaving a C=C double bond ☒D Hydrolysis: larger molecule breaks up with water added at the split
10	C	92	☒A C_5H_{10} molecule cannot be an isomer as it has a different formula to C_5H_{12} ☒B C_5H_{10} molecule cannot be an isomer as it has a different formula to C_5H_{12} ☑C Molecules are isomers as they have same formula but different structures ☒D C_6H_{14} molecule cannot be an isomer as it has a different formula to C_5H_{12}
11	B	66	☒A Molecule shown has C=C double bond so it is unsaturated ☑B Molecule is unsaturated (C=C double bond) and an alcohol (contains –OH group) ☒C Molecule shown has C=C double bond so it is unsaturated ☒D Molecule shown has hydroxyl group so it is an alcohol not a carboxylic acid
12	B	82	☒A But-2-ene has 4 carbons and molecule shown has 5 carbons ☑B Pent-2-ene has 5 carbons with a C=C double bond between carbons 2 and 3 ☒C But-3-ene has 4 carbons and molecule shown has 5 carbons ☒D Pent-3-ene: wrong numbering system as C=C should have lowest number possible

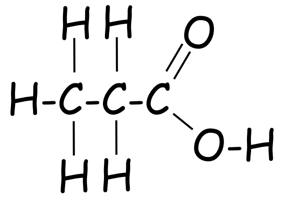
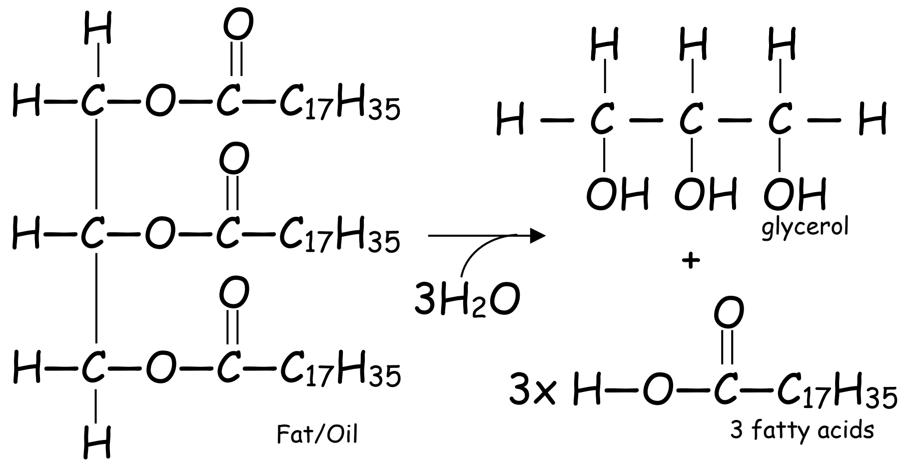
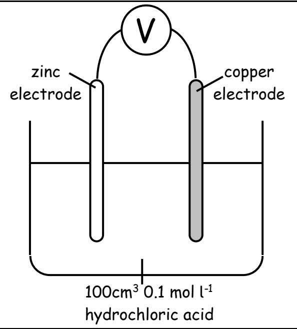
<table>
<tr><td>13</td><td>D</td><td>52</td><td>☒A Molecule is an alcohol as it has a hydroxyl –OH group
☒B Molecule is an aldehyde as it has an aldehyde –CHO group (Higher Chemistry)
☒C Molecule is an carboxylic acid as it has a carboxyl –COOH group
☑D Molecule contains the ester group (-C-O-CO-)</td></tr>
<tr><td>14</td><td>B</td><td>76</td><td>☒A Molecule shown has formula C_6H_{14} and compound Y has formula C_6H_{12}
☑B Compound Y is cyclohexane as it has formula C_6H_{12} and does not decolourise Br_2
☒C Compound Y has no C=C double bond as it does not decolourise Bromine solution
☒D Compound Y has no C=C double bond as it does not decolourise Bromine solution</td></tr>
<tr><td>15</td><td>C</td><td>70</td><td>☒A Coal is a non-renewable fossil fuel
☒B Petrol is made from crude oil. Crude oil is a non-renewable fossil fuel
☑C Ethanol is a renewable energy source as it is made from sugar
☒D Natural gas is a non-renewable fossil fuel</td></tr>
<tr><td>16</td><td>B</td><td>53</td><td>Fermentation: glucose ⟶ ethanol + carbon dioxide
☒A Hydrogen: burns with a pop
☑B Carbon Dioxide: turns lime water milky
☒C Oxygen: relights a glowing splint
☒D Alkenes: rapidly decolourises bromine solution</td></tr>
<tr><td>17</td><td>D</td><td>66</td><td>☒A $C_6H_{14}O$ is not a carbohydrate as hydrogen and oxygen are not in ratio 2:1
☒B $C_6H_{12}O_2$ is not a carbohydrate as hydrogen and oxygen are not in ratio 2:1
☒C $C_6H_{10}O_4$ is not a carbohydrate as hydrogen and oxygen are not in ratio 2:1
☑D $C_6H_{12}O_6$ is a carbohydrate with hydrogen and oxygen in the ration of 2:1</td></tr>
<tr><td>18</td><td>C</td><td>76</td><td>Proteins are polymers made from amino acid monomer units.
Hydrolysis of proteins breaks the protein back to its amino acid building blocks.</td></tr>
<tr><td>19</td><td>D</td><td>69</td><td><table><tr><td>Action on Acid</td><td>Effect on pH</td><td>Effect on H^+ concentration</td></tr><tr><td>Dilution</td><td>Increase to 7</td><td>Decreases</td></tr></table></td></tr>
<tr><td>20</td><td>B</td><td>47</td><td>☒A Ammonia solution is a weak alkali so has pH less than a strong alkali
☑B Sodium hydroxide is a strong alkali so has the highest pH
☒C Ethanoic acid is a weak acid with pH below 7
☒D Hydrochloric acid is a strong acid with pH below 7</td></tr>
<tr><td>21</td><td>C</td><td>50</td><td>$\text{concentration} = \frac{\text{no. of mol}}{\text{volume}} = \frac{0.2\text{ mol}}{0.1\text{ litres}} = 2\text{ mol l}^{-1}$</td></tr>
<tr><td>22</td><td>D</td><td>28</td><td>no. of mol H_2SO_4 = volume x concentration = 0.02litres x 1mol l^{-1} = 0.02mol
$2KOH + H_2SO_4 \longrightarrow K_2SO_4 + 2H_2O$
2mol 1mol
0.04mol 0.02mol</td></tr>
<tr><td>23</td><td>D</td><td>47</td><td>☒A addition: molecule adds across a C=C double bond
☒B displacement: higher up metal displaces a lower down metal from its ion
☒C neutralisation: H^+ ions (acid) react with bases to form water
☑D precipitation: insoluble solid is formed when two solutions are mixed</td></tr>
<tr><td>24</td><td>A</td><td>83</td><td>$Ba^{2+} + 2NO_3^- + 2Na^+ + SO_4^{2-} \longrightarrow Ba^{2+}SO_4^{2-} + 2Na^+ + 2NO_3^-$
Cancel out any spectator ions which appear on both sides
$Ba^{2+} + \cancel{2NO_3^-} + \cancel{2Na^+} + SO_4^{2-} \longrightarrow Ba^{2+}SO_4^{2-} + \cancel{2Na^+} + \cancel{2NO_3^-}$
Re-write equation omitting spectator ions
$Ba^{2+} + \quad + SO_4^{2-} \longrightarrow Ba^{2+}SO_4^{2-}$</td></tr>
<tr><td>25</td><td>C</td><td>38</td><td>☒A no reaction: copper is below magnesium in electrochemical series
☒B no reaction: copper is below sodium in electrochemical series
☑C displacement reaction: copper is higher than silver in electrochemical series
☒D no reaction: copper cannot displace itself</td></tr>
</table>

<table>
<tr><td>26</td><td>A</td><td>53</td><td>☑A electrons travel from higher metal (zinc) to lower metal (tin) through the wires
☒B electrons travel from higher metal (zinc) to lower metal (tin)
☒C ions travel through he electrolyte, electrons travel through the wires
☒D ions travel through he electrolyte, electrons travel through the wires</td></tr>
<tr><td>27</td><td>C</td><td>78</td><td><table>
<tr><th>Type</th><th>pH</th><th>Ions in Solution</th></tr>
<tr><td>Acid</td><td>pH$<$7</td><td>Concentration of H^+ $>$ Concentration of OH^-</td></tr>
<tr><td>Neutral</td><td>pH=7</td><td>Concentration of H^+ = Concentration of OH^-</td></tr>
<tr><td>Alkali</td><td>pH$>$7</td><td>Concentration of OH^- $>$ Concentration of H^+</td></tr>
</table></td></tr>
<tr><td>28</td><td>B</td><td>41</td><td>☒A Electrons before arrow is gain of electrons ∴ reduction reaction
☑B Fe^{2+} ions are losing electrons ∴ Fe^{2+} ions are being oxidised
☒C Fe atoms are losing electrons ∴ Fe atoms are being oxidised
☒D Electrons before arrow is gain of electrons ∴ reduction reaction</td></tr>
<tr><td>29</td><td>A</td><td>40</td><td>Ferroxyl indicator turns blue in the presence of Fe^{2+} ions
Ferroxyl indicator turns pink in the presence of OH^- ions</td></tr>
<tr><td>30</td><td>C</td><td>60</td><td>☒A Plastic coating acts as barrier to rusting (except in scratch)
☒B Zinc layer sacrificially protects iron from rusting (galvanising)
☑C Iron rusts to sacrificially protect the tin layer
☒D Paint acts as barrier to rusting (except in scratch)</td></tr>
</table>

2005 Int2 Chemistry Marking Scheme

<table>
<tr><th>Long Qu</th><th>Answer</th><th>Reasoning</th></tr>
<tr><td>1a</td><td>non-metal | reactive</td><td>The halogens (group 7) are a family reactive non-metal elements.</td></tr>
<tr><td>1b</td><td>9 | F | 19 | -1</td><td>Atomic number = no. of protons = 9
Atomic Number = 9 ∴ Element is Fluorine
Mass number = no. of protons + no of neutrons = 9+10 = 19
Charge = no. of protons – no. of electrons = 9-10 = -1</td></tr>
<tr><td>2a(i)</td><td>Na_2CO_3</td><td><table>
<tr><th>Write down Formulae of ions</th><th>Write down Valency below each ion</th><th>Put in Cross-over Arrows</th><th>Follow arrows to get formula</th></tr>
<tr><td>Na CO_3^{2-}</td><td>Na CO_3
1 2</td><td>Na CO_3
1 2</td><td>Na_2CO_3</td></tr>
</table></td></tr>
<tr><td>2a(ii)</td><td>Sodium chloride</td><td>ACID + Metal Carbonate ⟶ SALT + WATER + Carbon Dioxide
hydrochloric acid + sodium carbonate ⟶ sodium chloride + water + carbon dioxide</td></tr>
<tr><td>2b</td><td>Reaction would be slower</td><td>Ethanoic acid is a weak acid and would react slower with sodium carbonate than a strong acid like hydrochloric acid</td></tr>
<tr><td>3a(i)</td><td>Burns with a pop</td><td><table>
<tr><th>Gas</th><th>Hydrogen</th><th>Oxygen</th><th>Carbon Dioxide</th></tr>
<tr><td>Gas Test</td><td>Burns with a pop</td><td>Relights glowing splint</td><td>Turns lime water milky</td></tr>
</table></td></tr>
<tr><td>3a(ii)</td><td>exothermic</td><td>Exothermic: reactions which release (heat) energy
Endothermic: reactions which absorb heat energy from the surroundings</td></tr>
<tr><td>3b(i)</td><td>Line graph showing:</td><td>½mark: labelling axes ½mark: correct scales ½mark: plotting points ½mark: drawing line</td></tr>
<tr><td>3b(ii)</td><td>85±1cm³</td><td>Or answer taken from graph as drawn</td></tr>
<tr><td>3c</td><td>1.8±0.05</td><td>$\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{72-0}{40-0} = \frac{72}{40} = 1.8\ cm^3\ s^{-1}$</td></tr>
<tr><td>3d</td><td>Greater number of collisions so faster reaction</td><td>Collision Theory can explain changes to reaction rate:<table>
<tr><th>Change</th><th>Effect</th><th>Collision Theory</th></tr>
<tr><td>Increase Concentration
Increase Temperature
Decrease Particle Size</td><td>Reaction Rate increases</td><td>Increases the number of successful collisions giving increased reaction rate.</td></tr>
</table></td></tr>
<tr><td>4a</td><td>Chlorine Gas – Positive
Copper Metal - Negative</td><td><table>
<tr><th>Electrode</th><th>Product</th><th>Equation</th></tr>
<tr><td>Positive</td><td>Chlorine gas</td><td>$2Cl^- \rightarrow Cl_2 + 2e^-$</td></tr>
<tr><td>Negative</td><td>Copper metal</td><td>$Cu^{2+} + 2e^- \rightarrow Cu$</td></tr>
</table></td></tr>
<tr><td>4b</td><td>Waft gas towards nose carefully</td><td>It is advisable to use your hand to waft a small amount of the gas you are smelling for the first time . Do not breathe in large amount of gas until you are sure there is no danger.</td></tr>
<tr><td>4c(i)</td><td>Copper ions gain electrons</td><td>$Cu^{2+} + 2e^- \rightarrow Cu$</td></tr>
<tr><td>4c(ii)</td><td>0.02</td><td>$\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{1.27}{63.5} = 0.02\ \text{mol}$</td></tr>
</table>

<table>
<tr><td>5a</td><td>$C_2H_4 + 3O_2$
↓
$2CO_2 + 2H_2O$</td><td>$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$</td></tr>
<tr><td>5b</td><td>heterogeneous</td><td><table><tr><th>Type of Catalyst</th><th>Definition</th></tr><tr><td>Homogeneous</td><td>Catalyst in same state as reactants</td></tr><tr><td>Heterogeneous</td><td>Catalyst in different state from reactants</td></tr></table></td></tr>
<tr><td>6a(i)</td><td></td><td>propan-2-ol
3 carbons
functional group on carbon no. 2
-OH hydroxyl group</td></tr>
<tr><td>6a(ii)</td><td>hydration</td><td></td></tr>
<tr><td>6b</td><td>HI
hydrogen iodide</td><td></td></tr>
<tr><td>6c</td><td></td><td></td></tr>
<tr><td>7a</td><td>to neutralise excess acid</td><td>Sodium hydrogencarbonate is used to neutralise the dilute hydrochloric acid used in test tube B to hydrolyses starch into glucose.</td></tr>
<tr><td>7b</td><td><table><tr><td>A</td><td>No change</td></tr><tr><td>B</td><td>Turns brick red</td></tr></table></td><td>In test tube A: starch does not react with Benedict's solution
In test tube B: acid hydrolyses starch into glucose. Once acid is neutralised, glucose turn blue Benedict's solution brick red.</td></tr>
<tr><td>8a(i)</td><td>ethyl pentanoate</td><td>ethanol + pentanoic acid ⟶ ethyl pentanoate + water
NB: alcohol name come first in ester name</td></tr>
<tr><td>8a(ii)</td><td>water is removed as molecules join</td><td>Condensations reactions have small molecules joining up to make a larger molecule with a small molecule like water removed at the join.</td></tr>
<tr><td>8b(i)</td><td>man-made</td><td>Synthetic materials are man-made materials manufactured by the chemical industry and are not natural materials</td></tr>
<tr><td>8b(ii)</td><td></td><td>Ester links have the C – O – C bond combination with 1 carbon has a C=O double bond</td></tr>
<tr><td>9a</td><td>Takes place at lower temp
or catalyst can be reused</td><td>Catalysts speed up chemical reactions but are not used up during the reaction. All the catalyst can be recovered. Catalysts can often be used to lower the temperature a reaction takes place at.</td></tr>
<tr><td>9b</td><td>Distillation</td><td>Distillation is used to separate chemicals with different boiling points</td></tr>
</table>

<table>
<tr><td>9c</td><td>Methane</td><td>2 possible cracking equations:
<table>
<tr><td>$C_3H_8 \rightarrow C_3H_6 + H_2$</td><td>$C_3H_8 \rightarrow C_2H_4 + CH_4$</td></tr>
<tr><td>propane propene hydrogen</td><td>propane ethene methane</td></tr>
</table></td></tr>
<tr><td>10a</td><td></td><td>Propanoic acid has 3 carbons and the –COOH functional group must be on carbon number 1</td></tr>
<tr><td>10b</td><td>Pentanoic acid</td><td>
<table>
<tr><th colspan="2">Alkanoic acid</th><th colspan="2">Alkane</th></tr>
<tr><td>ethanoic acid</td><td>CH_3COOH</td><td>methane</td><td>CH_4</td></tr>
<tr><td>propanoic acid</td><td>C_2H_5COOH</td><td>ethane</td><td>C_2H_6</td></tr>
<tr><td>butanoic acid</td><td>C_3H_7COOH</td><td>propane</td><td>C_3H_8</td></tr>
<tr><td>pentanoic acid</td><td>C_4H_9COOH</td><td>butane</td><td>C_4H_{10}</td></tr>
</table></td></tr>
<tr><td>11a</td><td>3</td><td>
</td></tr>
<tr><td>11b</td><td>glycerol</td><td>Glycerol is also known as propane-1,2,3-triol
Glycerol has 3 carbons, each carbon has an –OH hydroxyl group</td></tr>
<tr><td>11c</td><td>red/orange</td><td>3 Fatty acids and glycerol are created by the hydrolysis of fat or oil.
Fatty acids are weak acids: gives a pH below 7 with universal indicator.</td></tr>
<tr><td>12a</td><td>
</td><td>In a fair test, only the solution type is changed from sodium chloride to hydrochloric acid.
The volume of solution, concentration of solution, temperature, size of electrodes and metals in electrodes are kept the same.</td></tr>
<tr><td>12b</td><td>Electrodes removed, cleaned, dried and replaced</td><td>In the experiment, it is importance that there is no contamination between experiments and the electrodes are dry so water does not dilute solution.</td></tr>
<tr><td>12c</td><td><table><tr><td>Zn→Ni</td><td>0.5V</td></tr></table></td><td>Electrons always flow from the metal higher in the electrochemical series to the metal lower in the series.
Voltage must be below 1.0V (Cu/Zn) but must be higher than 0.3V (Fe/Zn)</td></tr>
<tr><td>13a</td><td>Electrons not shared equally</td><td>Polar covalent bonding is caused by unequal sharing of electrons within a covalent bond. Pair of electrons are closer to one end of bond making that end of bond slightly negative and the other end slightly positive.</td></tr>
<tr><td>13b(i)</td><td>Ammonia dissolves to form alkaline OH^- ions</td><td>Ammonia dissolves in water to form the weak alkali ammonium hydroxide.
Only a few molecules dissociate into ions.</td></tr>
</table>

13b(ii)	Reaction is reversible	Some reactions are reversible where the forward reaction and reverse reactions both take place. Equilibrium is formed when the rate of the forward reaction equals the rate of the reverse reaction.
13c	3.18g	**gfm** NH_4Cl = (1x14) + (4x1) + (1x35.5) = 14 + 4 + 35.5 = 53.5g **no**. of mol = $\frac{\textbf{mass}}{\textbf{gfm}} = \frac{10}{53.5}$ = 0.187 mol $NH_4Cl + NaOH \longrightarrow NaCl + H_2O + NH_3$ 1mol ... 1mol 0.187mol ... 0.187mol **gfm** NH_3 = (1x14) + (3x1) = 14 + 3 = 17g **mass** = **no**. of mol x **gfm** = 0.187 x 17 = 3.18g
14a	magnesium hydroxide is insoluble calcium chloride is soluble	Insoluble solids can be separated from solutions by filtration.
14b	Neutralisation	ACID + METAL HYDROXIDE (alkali) $\longrightarrow$ SALT + WATER hydrochloric acid + magnesium hydroxide $\longrightarrow$ magnesium chloride + water
14c	$Mg^{2+} + 2e^- \longrightarrow Mg$	Molten magnesium chloride contains magnesium ions. Magnesium ions pick up electrons from negative electrode to become magnesium atoms.