JABchem

Past Papers Int 2 Chemistry

2007

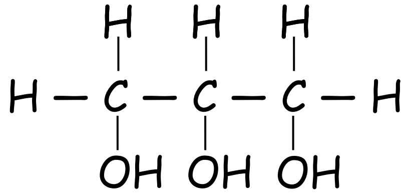
Marking Scheme

Grade Awarded	Mark Required (/80)	%	% candidates achieving grade
A	58+	72%	36.0%
B	49+	61%	22.6%
C	41+	51%	18.5%
D	37+	46%	7.5%
No award	<37	<46%	15.4%

Section:	Multiple Choice	Extended Answer
Average Mark:	20.7 /30	31.1 /50

2007 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>B</td><td>92</td><td>☒A Fluorine is in group 7 and is in a different group from Argon (group 0)
☑B Krypton and argon are both in Group 0 and have similar chemical properties
☒C Potassium is in group 1 and is in a different group from Argon (group 0)
☒D Zinc is a transition metal and is in a different group from Argon (group 0)</td></tr>
<tr><td>2</td><td>D</td><td>74</td><td>☒A A colour change is one sign that a chemical reaction has taken place
☒B A Gas given off is one sign that a chemical reaction has taken place
☒C Temperature rising is one sign that a chemical reaction has taken place
☑D Solid disappearing is dissolving and a physical change not a chemical reaction</td></tr>
<tr><td>3</td><td>A</td><td>79</td><td>The composition of air is:
<table>
<tr><td>Nitrogen</td><td>Oxygen</td><td>Carbon Dioxide</td><td>Nobles Gases</td></tr>
<tr><td>78%</td><td>21%</td><td>0.03%</td><td>1%</td></tr>
</table></td></tr>
<tr><td>4</td><td>D</td><td>65</td><td>☒A Isotopes have different nuclei as they have different numbers of neutrons
☒B Isotopes have different mass numbers due to different numbers of neutrons
☒C Isotopes have different numbers of neutrons
☑D Isotopes have same number of protons but different numbers of neutrons</td></tr>
<tr><td>5</td><td>C</td><td>68</td><td>
<table>
<tr><td>Solute</td><td>Ethanoic acid</td><td>The substance which is dissolved</td></tr>
<tr><td>Solvent</td><td>Water</td><td>The liquid which does the dissolving</td></tr>
<tr><td>Solution</td><td>Vinegar</td><td>The mixture produced when solute dissolves in solvent</td></tr>
</table></td></tr>
<tr><td>6</td><td>A</td><td>79</td><td>☑A Covalent Network substances have covalent bonds in a large network of atoms
☒B Substance is ionic due to presence of positive and negative ions
☒C Substance contains covalent molecules. Not big enough to be covalent network
☒D Substance is metallic with electrons able to jump from atom to atom</td></tr>
<tr><td>7</td><td>B</td><td>78</td><td>
<table>
<tr><th colspan="2">Comparison of Compounds</th><th>Conclusion</th></tr>
<tr><td>potassium chloride</td><td>white</td><td>Potassium ions are colourless</td></tr>
<tr><td>potassium chromate</td><td>yellow</td><td>chromate ions are yellow</td></tr>
<tr><td>copper sulphate</td><td>Blue</td><td>copper ions are blue</td></tr>
<tr><td>copper chromate</td><td>Green</td><td>blue ions + yellow ions make green</td></tr>
</table></td></tr>
<tr><td>8</td><td>B</td><td>71</td><td>
<table>
<tr><th>Property</th><th>Petroleum Gas</th><th>Gasoline</th><th>Kerosene</th><th>Light gas Oil</th><th>Heavy Gas Oil</th><th>Residue</th></tr>
<tr><td>Viscosity</td><td>Low</td><td colspan="4">←→</td><td>High</td></tr>
<tr><td>Evaporation</td><td>Quickly</td><td colspan="4">←→</td><td>Slowly</td></tr>
<tr><td>Flammability</td><td>High</td><td colspan="4">←→</td><td>Low</td></tr>
<tr><td>Boiling Point</td><td>Low</td><td colspan="4">←→</td><td>High</td></tr>
</table></td></tr>
<tr><td>9</td><td>D</td><td>76</td><td>
<table>
<tr><td>C_2H_2</td><td>C_3H_4</td><td>C_4H_6</td></tr>
<tr><td colspan="3">Correct general formula: C_nH_{2n-2}</td></tr>
<tr><td>If n=2
2n-2 = (2x2) -2 = 4-2 = 2</td><td>If n=3
2n-2 = (2x3) -2 = 6-2 = 4</td><td>If n=4
2n-2 = (2x4) -2 = 8-2 = 6</td></tr>
</table></td></tr>
<tr><td>10</td><td>D</td><td>64</td><td>☒A Formula = C_3H_8O ∴ not isomer of $C_4H_{10}O$ as formulae are different
☒B Formula = $C_5H_{12}O$ ∴ not isomer of $C_4H_{10}O$ as formulae are different
☒C Formula = $C_4H_{10}O$ but same structure as –OH group is on second carbon
☑D Formula = $C_4H_{10}O$ ∴ isomers - same formula but different structures</td></tr>
<tr><td>11</td><td>A</td><td>66</td><td>☑A Compound is an ester as it contains the ester group –COOC
☒B Compound is not an ester as C-O-C group does not have carbonyl C=O on one end
☒C Compound is an alcohol
☒D Compound is an carboxylic acid</td></tr>
</table>

<table>
<tr><td>12</td><td>B</td><td>82</td><td>☒A pH of compound must be pH=7 as –OH groups are neutral not acidic
☑B pH=7 due to –OH group and C=C double bond will decolourise Bromine solution
☒C pH of compound must be pH=7 as –OH groups are neutral not acidic
☒D Compound has C=C double bond which will decolourise Bromine solution quickly</td></tr>
<tr><td>13</td><td>C</td><td>54</td><td>☒A poly(ethenol) is a synthetic polymer and is soluble in water
☒B poly(ethenol) is a synthetic polymer
☑C poly(ethenol) is a synthetic polymer and is soluble in water
☒D poly(ethenol) is soluble in water</td></tr>
<tr><td>14</td><td>B</td><td>100</td><td>☒A Cannot be a repeating unit as the molecule contains a C=C double bond
☑B Although this is the answer – the question had a mistake ∴ mark awarded to all
☒C Cannot be a repeating unit as the molecule contains a C=C double bond
☒D Side group has 2 carbons but in polymer side groups only have 1 carbon</td></tr>
<tr><td>15</td><td>D</td><td>71</td><td>☒A Fructose turns warm Benedict's solution blue → brick red
☒B Glucose turns warm Benedict's solution blue → brick red
☒C Maltose turns warm Benedict's solution blue → brick red
☑D Sucrose does not turn give a colour change with warm Benedict's solution.</td></tr>
<tr><td>16</td><td>C</td><td>66</td><td>Glycerol has the structure:
(It is also known as propane-1,2,3-triol)
</td></tr>
<tr><td>17</td><td>B</td><td>52</td><td>Oils hare liquids because the shape of C=C double bond stops oil molecules getting too close together and being a solid. Hydrogen is added across the C=C double bond to straighten the carbons chains and the oil becomes a solid.</td></tr>
<tr><td>18</td><td>B</td><td>76</td><td>☒A carbon dioxide (non-metal oxide) dissolves in water to make an acidic solution
☑B Copper oxide is insoluble in water (p8 of data booklet) ∴ pH unchanged
☒C Sodium oxide (metal oxide) dissolves in water to make an alkaline solution
☒D Sulphur Dioxide (non-metal oxide) dissolves in water to make an acidic solution</td></tr>
<tr><td>19</td><td>D</td><td>77</td><td>☒A Rate of reaction decreases as concentration of H^+ decreases
☒B Concentration of H^+ ions decreases with dilution
☒C Electrical conductivity decreases with dilution as ion concentration decreases
☑D pH is below 7 and increases up to 7 as water is added</td></tr>
<tr><td>20</td><td>A</td><td>85</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>21</td><td>B</td><td>69</td><td><table><tr><th>Volume</th><th>Concentration</th><th>No of Moles</th><th>Mass of Solid</th></tr><tr><td>$100cm^3$</td><td>1 mol l^{-1}</td><td>0.1mol</td><td>14.2g</td></tr><tr><td>$50cm^3$</td><td>2 mol l^{-1}</td><td>0.1mol</td><td>14.2g</td></tr></table></td></tr>
<tr><td>22</td><td>C</td><td>54</td><td>☒A copper + hydrochloric acid → no reaction as copper not reactive enough
☒B copper oxide + hydrochloric acid → copper chloride + water
☑C copper carbonate + hydrochloric acid→ copper chloride + water + carbon dioxide
☒D copper hydroxide + hydrochloric acid→ copper chloride + water</td></tr>
<tr><td>23</td><td>C</td><td>71</td><td>☒A Can be used as a fertiliser: soluble compound containing nitrogen
☒B Can be used as a fertiliser: soluble compound containing potassium + nitrogen
☑C Cannot be a fertiliser as it does not contain nitrogen, potassium or phosphorus
☒D Can be used as a fertiliser: soluble compound containing potassium</td></tr>
<tr><td>24</td><td>D</td><td>62</td><td>☒A Ammonium nitrate and potassium chloride are both soluble
☒B Zinc sulphate and magnesium nitrate are both soluble
☒C Calcium chloride and nickel nitrate are both soluble
☑D Silver iodide is insoluble (sodium nitrate is soluble)</td></tr>
</table>

25	A	52	Sodium ions and chloride ions are both spectator ions as neither end up in the precipitate (new substance formed). As neither sodium ions and chloride ions are chemically changed, they are spectator ions.
26	B	50	☒A No displacement reaction – magnesium cannot displace magnesium ions ☑B Magnesium metal will displace zinc ions as Mg is higher in electrochemical series ☒C No displacement reaction – magnesium cannot displace higher up potassium ions ☒D No displacement reaction – magnesium cannot displace higher up sodium ions
27	C	90	The highest voltage is achieved by having the biggest difference between metals on the electrochemical series. Magnesium Aluminium Zinc Iron Nickel Tin Lead Copper
28	B	47	☒A $2I^- \rightarrow I_2 + 2e^-$ is the oxidation reaction not a reduction reaction ☑B $2I^- \rightarrow I_2 + 2e^-$ is the oxidation reaction at the positive electrode ☒C Positive ions move to the negative electrode ☒D Positive ions move to the negative electrode
29	A	53	☑A Calcium is a solid at 800°C and is less dense so floats on top ☒B Calcium has not melted at 800°C so calcium is still a solid ☒C Calcium is less dense than molten calcium chloride so calcium floats on top ☒D Calcium has not melted at 800°C so calcium is still a solid
30	D	46	☒A Ferroxyl indicator turns blue in the presence of Fe^{2+} ions ☒B Fe^{3+} ions have no effect on ferroxyl indicator ☒C H^+ ions have no effect on ferroxyl indicator ☑D Ferroxyl indicator turns pink in the presence of OH^- ions

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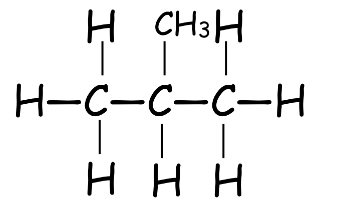
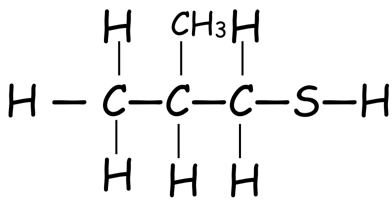
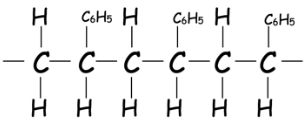
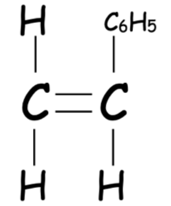
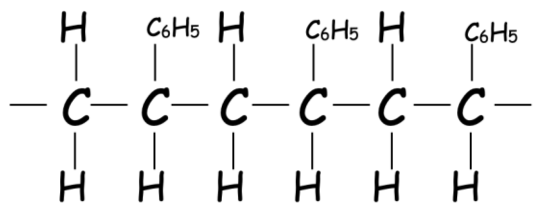
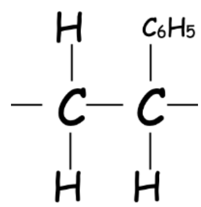
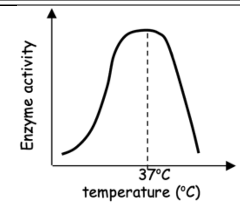
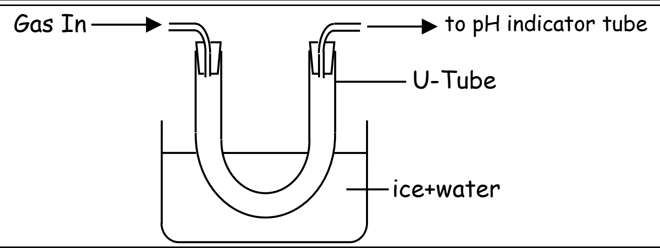
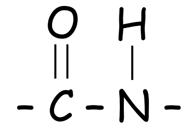
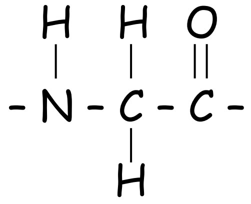
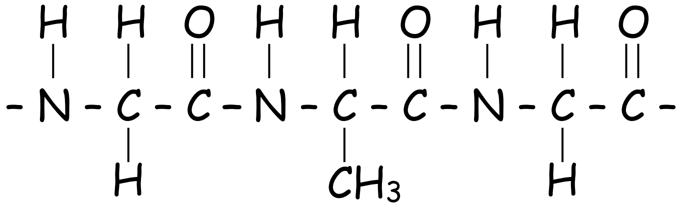
<table>
<tr><th>Long Qu</th><th>Answer</th><th>Reasoning</th></tr>
<tr><td>1a</td><td><table><tr><td></td><td>1</td><td></td></tr><tr><td></td><td></td><td>0</td></tr><tr><td></td><td></td><td></td></tr><tr><td>electron</td><td></td><td>-1</td></tr></table></td><td><table><tr><th>Particle</th><th>Location</th><th>Charge</th><th>Mass</th></tr><tr><td>Proton</td><td>in nucleus</td><td>+1</td><td>1 amu</td></tr><tr><td>Neutron</td><td>in nucleus</td><td>0</td><td>1 amu</td></tr><tr><td>Electron</td><td>outside nucleus</td><td>–1</td><td>approx zero</td></tr></table></td></tr>
<tr><td>1b(i)</td><td>2</td><td>Atomic number = no. of protons = 2</td></tr>
<tr><td>1b(ii)</td><td>X</td><td>No. of protons = 2 and no. of electrons = 0
∴ Alpha particles are positively charge
∴ Alpha particles are bend towards negative plate (X)</td></tr>
<tr><td>2a</td><td>1.45</td><td>$\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{29 - 0}{20 - 0} = \frac{29}{20} = 1.45\ cm^3\ s^{-1}$</td></tr>
<tr><td>2b(i)</td><td>Reactant and catalyst are in same state</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>2b(ii)</td><td>Amber</td><td>Catalysts speed up chemical reactions but are not used up in the reaction and are chemically unchanged. Amber coloured catalyst would remain the same during the course of the reaction.</td></tr>
<tr><td>3a</td><td>Electrons able to move from atom to atom</td><td>Electrons are free to move from atom to atom because they are delocalised and not fixed to any bond or atom. All metals conduct electricity.</td></tr>
<tr><td>3b(i)</td><td>Neutralisation</td><td>ACID + METAL OXIDE ⟶ SALT + WATER
hydrochloric acid + tin (IV) oxide ⟶ tin (IV) chloride + water</td></tr>
<tr><td>3b(ii)</td><td>Covalent</td><td>Tin chloride contains a metal and non-metal in the compound and would be expected to have ionic bonding. However, compounds with ionic bonding are solids at room temperature and have high melting points.
• To be a liquid at room temperature means that tin chloride must have covalent bonding and be molecular.</td></tr>
<tr><td>4a(i)</td><td>(aq)</td><td>Magnesium chloride is soluble in water (p8 of data booklet)
The symbol of dissolved in water is (aq) which means aqueous</td></tr>
<tr><td>4a(ii)</td><td>Burns with a pop</td><td><table><tr><td>Gas</td><td>Hydrogen</td><td>Oxygen</td><td>Carbon Dioxide</td></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>4b</td><td>0.4</td><td>gfm Mg = 24.3g
$\text{no. of mol} = \frac{\textbf{mass}}{\textbf{gfm}} = \frac{4.9}{24.5} = 0.2\ \text{mol}$
$Mg + 2HCl \longrightarrow MgCl_2 + H_2$
Mg: 1mol, 0.2mol; $MgCl_2$: 1mol, 0.2mol
gfm H_2 = 2g
mass = no. of mol x gfm = 0.2 x 2 = 0.4g</td></tr>
<tr><td>5a</td><td>H H
| |
H—C—C–S–H
| |
H H</td><td>In the bond to the–SH thiol group, the S atom has a valency of 2 so it makes 2 bonds (1 to the C atom and 1 to the H atom)
However –H-S is incorrect due to the valency of H being 1 and cannot make 2 bonds</td></tr>
</table>

<table>
<tr><td>5b</td><td>2-methylpropane-1-thiol</td><td><table><tr><td></td><td></td></tr><tr><td>2-methylpropane
Methylpropane is also acceptable as answer</td><td>2-methylpropane-1-thiol
-SH group could be placed on C_1 or C_2 so must be give a number in the name</td></tr></table></td></tr>
<tr><td>5c</td><td>sulphur dioxide</td><td>Compounds containing sulphur release sulphur dioxide when burned
thiol + oxygen ⟶ carbon dioxide + water + sulphur dioxide
e.g. $CH_3SH + 3O_2 \longrightarrow CO_2 + 2H_2O + SO_2$</td></tr>
<tr><td>6a</td><td><table><tr><td></td><td>unsaturated</td></tr><tr><td>bromine decolourises</td><td></td></tr><tr><td>no change</td><td></td></tr><tr><td></td><td>unsaturated</td></tr></table></td><td><table><tr><td>A</td><td>C_6H_{14}</td><td>No change</td><td>saturated</td><td>C_6H_{14} is hexane: no C=C double bonds</td></tr><tr><td>B</td><td>C_6H_{12}</td><td>Bromine decolourises</td><td>unsaturated</td><td>C_6H_{12} is hexene: C=C double bond decolourises bromine</td></tr><tr><td>C</td><td>C_6H_{12}</td><td>No change</td><td>saturated</td><td>C_6H_{12} is cyclohexane: no C=C double bonds</td></tr><tr><td>D</td><td>C_6H_{10}</td><td>Bromine decolourises</td><td>unsaturated</td><td>C_6H_{10} is cyclohexene: C=C double bond decolourises Br_2</td></tr></table></td></tr>
<tr><td>6b</td><td>Safety gloves or wash spills with soldium thiosulphate</td><td>Int2 PPA 2.2 Question. (sodium thiosulphate will react with spilled Bromine)</td></tr>
<tr><td>6c</td><td>Hexene</td><td>C_6H_{12} could be hexene or cyclohexane. However, as compound B decolourises bromine solution it must have a C=C double and therefore cannot be cyclohexane and must be hexene.</td></tr>
<tr><td>7a</td><td>C=C double bond</td><td>Styrene forms poly(styrene) by addition polymerisation. Addition reactions require a C=C double bond for a reaction to occur.</td></tr>
<tr><td>7b</td><td></td><td><table><tr><td></td><td></td><td></td></tr><tr><td>Monomer</td><td>Polymer</td><td>Repeating Unit</td></tr></table></td></tr>
<tr><td>7c</td><td>Poly(phenylethene)</td><td>Styrene is also known as phenylethene
∴ poly(styrene) is also known as poly(phenylethene)</td></tr>
<tr><td>8a</td><td>$C_6H_{12}O_6$
↓
$2C_2H_5OH + 2CO_2$</td><td>$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$</td></tr>
<tr><td>8b(i)</td><td>Line graph showing:</td><td>½mark: labelling axes ½mark: correct scales ½mark: plotting points ½mark: drawing line</td></tr>
<tr><td>8b(ii)</td><td>Enzyme denatured or no longer works</td><td><table><tr><td>Enzymes work best at body temperature (37°C). Temperatures above 37°C change the shape of the enzyme and stops it from working.</td><td></td></tr></table></td></tr>
<tr><td>9a</td><td>Diagram showing:</td><td></td></tr>
<tr><td>9b</td><td>CO_2 dissolves to make an acid</td><td><table><tr><td>Type of Oxide</td><td>Dissolved in water</td><td colspan="3">Examples</td></tr><tr><td>metal oxide</td><td>alkaline solution</td><td>sodium oxide</td><td>potassium oxide</td><td>calcium oxide</td></tr><tr><td>non-metal oxide</td><td>acidic solution</td><td>carbon dioxide</td><td>sulphur dioxide</td><td>nitrogen dioxide</td></tr></table></td></tr>
</table>

10a		The peptide link is the same as an amide link • Peptide link is found in proteins • Amide link is found in polyamide polymers like nylon
10b		
10c	Condensation	Condensation polymerisation is the process where monomers e.g. *amino acids* join together to make polymers e.g. *protein* with a small molecule e.g. *water* is removed during the joining process.
11a	Iron sacrificially protects copper	As iron is higher up reactivity series than copper and electrons from the iron flow to the copper to protect the copper from corroding.
11b	Seawater contains ions/electrolyte	Ions are required to complete the circuit and seawater contains many more ions than pure water.
11c	Fe_2O_3	Write down Valency below each element's symbol: Fe O / 3 2 Put in Cross-over Arrows: Fe O / 3 ✕ 2 Follow arrows to get formula: Fe_2O_3
12a	Electrode A or positive electrode	Hydrogen is produced by: $2H^- \rightarrow H_2 + 2e^-$ ∴ Negative hydride H^- ions will travel to the positive electrode.
12b	$2Na^+ + 2H^- \rightarrow 2Na + H_2$	2x❶ $2Na^+ + 2e^- \rightarrow 2Na^+$ ❷ $2H^- \rightarrow H_2 + 2e^-$ add ❶' + ❷ $2Na^+ + 2H^- \rightarrow 2Na + H_2$
12c	Higher Higher	Solution | Strong/Weak | pH | Conductivity 0.1 mol l^{-1} sodium hydroxide solution | strong alkali | higher | higher 0.1 mol l^{-1} ammonia solution | weak alkali | lower | lower
13a(i)	2 or 2,0	Lithium atoms have an electron arrangement of 2,1 (p1 data booklet) Lithium ions attain a full outer shell by losing 1 electron Li → $Li^+ + e^-$ 2,1 → 2
13a(ii)	Lithium atoms are too reactive	Lithium is a group 1 Alkali Metal and will react with oxygen or water rapidly
13b	The higher metal is in electrochemical series the higher the voltage	The voltage from a cell is directly linked to the position of the two metals in the electrochemical series. The bigger the difference the higher the voltage.
14a	chlorine carbon dioxide distillation magnesium chloride	Problem solving: Written passage → flow chart
14b(i)	3.6g	45% of 8g = $\frac{45}{100}$ x 8g = 3.6g
14b(ii)	0.075mol	no of mol = $\frac{\text{mass}}{\text{gfm}}$ = $\frac{3.6}{48}$ = 0.075 mol

<table>
<tr><td>15a</td><td>sulphuric acid</td><td><table><tr><td>Name of Acid</td><td>hydrochloric acid</td><td>sulphuric acid</td><td>nitric acid</td></tr><tr><td>2nd Name of Salt</td><td>chloride</td><td>sulphate</td><td>nitrate</td></tr></table></td></tr>
<tr><td>15b(i)</td><td>to remove unreacted magnesium</td><td>magnesium + sulphuric acid → magnesium sulphate + hydrogen
When all the sulphuric acid has reacted with the magnesium, there will be unreacted solid magnesium metal left over in the beaker as magnesium is insoluble in water. Unreacted magnesium is removed by filtration.</td></tr>
<tr><td>15b(ii)</td><td>Evaporation or boil off water</td><td>Once the unreacted magnesium metal is removed by filtration, the magnesium sulphate filtrate can then be evaporated to leave solid magnesium sulphate.</td></tr>
<tr><td>15c</td><td>Reactants have more energy then products</td><td>In exothermic reactions, reactants have more chemical energy than products. During the reaction, the energy left over from the reactants turning into the products is transferred into heat energy and increases the temperature of the surroundings.</td></tr>
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