JABchem

Past Papers

Standard Grade

General

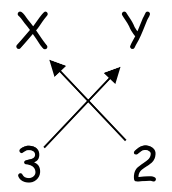
Chemistry

2010

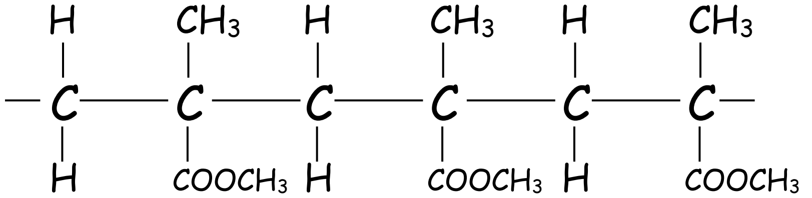
Marking Scheme

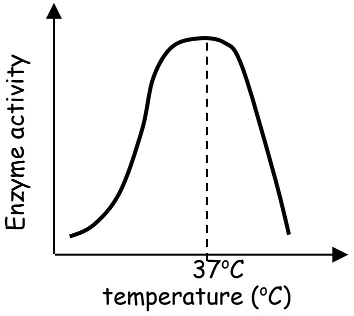
2010 Credit	KU		PS	
	/30	%	/30	%
1	21+	70%	22+	73%
2	16+	53%	13+	43%
See general	<16	<53%	<13	<43%

2010 Standard Grade Chemistry Credit Marking Scheme

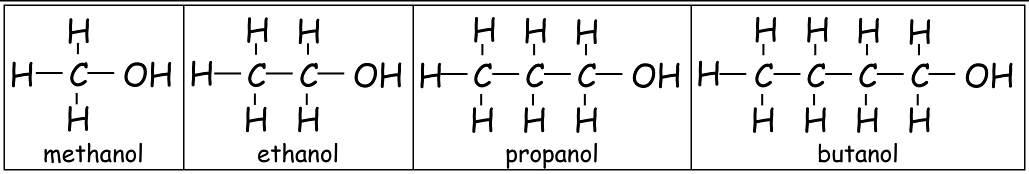
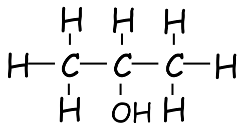
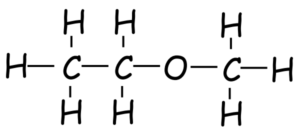
<table>
<tr><th>Question</th><th>Answer</th><th>Chemistry Covered</th></tr>
<tr><td>1a</td><td>E</td><td>
<table>
<tr><td>Property</td><td>Fraction A</td><td>Fraction B</td><td>Fraction C</td><td>Fraction D</td><td>Fraction E</td></tr>
<tr><td>Viscosity</td><td>Low</td><td colspan="3">⟷</td><td>High</td></tr>
<tr><td>Evaporation</td><td>Easily</td><td colspan="3">⟷</td><td>Slowly</td></tr>
<tr><td>Flammability</td><td>High</td><td colspan="3">⟷</td><td>Low</td></tr>
<tr><td>Boiling Point</td><td>Low</td><td colspan="3">⟷</td><td>High</td></tr>
</table>
</td></tr>
<tr><td>1b</td><td>A</td><td>
<table>
<tr><td>Property</td><td>Fraction A</td><td>Fraction B</td><td>Fraction C</td><td>Fraction D</td><td>Fraction E</td></tr>
<tr><td>Name</td><td>Petroleum Gas</td><td>Naphtha</td><td>Kerosene</td><td>Gas Oil</td><td>Residue</td></tr>
<tr><td>Use</td><td>Camping Gas</td><td>Petrol</td><td>Aircraft Fuel</td><td>Diesel</td><td>Tar/Bitumen</td></tr>
</table>
</td></tr>
<tr><td>2a</td><td>E</td><td>
<table>
<tr><td>Element</td><td>Hydrogen</td><td>Nitrogen</td><td>Silicon</td><td>Aluminium</td><td>Magnesium</td><td>Oxygen</td></tr>
<tr><td>Density (g/cm^3)</td><td>0.00009</td><td>0.0013</td><td>2.33</td><td>2.70</td><td>1.74</td><td>0.0014</td></tr>
</table>
</td></tr>
<tr><td>2b</td><td>A+C
Both for 1 mark</td><td>Si can be substituted for C as they are both in group 4</td></tr>
<tr><td>2C</td><td>D+F
Both for 1 mark</td><td>
<table>
<tr><td>Write down Formulae</td><td>Write Down Reverse of Cross Over Rule</td><td>Follow arrows to get formula</td></tr>
<tr><td>X_2Y_3</td><td> </td><td>Valency of X=3
∴ X is Aluminium
Valency of Y=2
∴ Y is Oxygen</td></tr>
</table>
</td></tr>
<tr><td>3a</td><td>A+D
Both for 1 mark</td><td>
No. of neutrons = mass number – atomic number
<table>
<tr><td>Particle</td><td>$^{23}_{11}Na$</td><td>$^{18}_{8}O$</td><td>$^{40}_{19}K^+$</td><td>$^{24}_{12}Mg^{2+}$</td><td>$^{35}_{17}Cl^-$</td><td>$^{16}_{8}O$</td></tr>
<tr><td>No of Neutrons</td><td>23-11
=12</td><td>18-8
=10</td><td>40-19
=21</td><td>24-12
=12</td><td>35-17
=18</td><td>16-8
=8</td></tr>
</table>
</td></tr>
<tr><td>3b</td><td>D</td><td>
<table>
<tr><td>Particle</td><td>$^{23}_{11}Na$</td><td>$^{18}_{8}O$</td><td>$^{40}_{19}K^+$</td><td>$^{24}_{12}Mg^{2+}$</td><td>$^{35}_{17}Cl^-$</td><td>$^{16}_{8}O$</td></tr>
<tr><td>No of electrons</td><td>11</td><td>8</td><td>18</td><td>10</td><td>18</td><td>8</td></tr>
<tr><td>Electron Arrangement</td><td>2,8,1</td><td>2,6</td><td>2,8,8</td><td>2,8</td><td>2,8,8</td><td>2,6</td></tr>
</table>
</td></tr>
<tr><td>4a</td><td>E</td><td rowspan="2">
<table>
<tr><td>Carbohydrate</td><td>fructose</td><td>glucose</td><td>maltose</td><td>sucrose</td><td>starch</td></tr>
<tr><td>Formula</td><td>$C_6H_{12}O_6$</td><td>$C_6H_{12}O_6$</td><td>$C_{12}H_{22}O_{11}$</td><td>$C_{12}H_{22}O_{11}$</td><td>$(C_6H_{10}O_5)_n$</td></tr>
<tr><td>Type</td><td>monosaccharide</td><td>monosaccharide</td><td>disaccharide</td><td>disaccharide</td><td>polysaccharide</td></tr>
</table>
</td></tr>
<tr><td>4b</td><td>A+B
Both for 1 mark</td></tr>
<tr><td>5a</td><td>B</td><td>Galvanising is the coating of iron/steel with zinc. Zinc is higher up the electrochemical series and protects the iron/steel from corrosion by sacrificial protection.</td></tr>
<tr><td>5b</td><td>D</td><td>An intact layer of tin will prevent iron from corroding as the intact tin layer acts a barrier to air and water getting to the iron underneath.
If the tin layer is scratched, the iron corrodes to sacrificially protect the tin.</td></tr>
<tr><td>6a</td><td>B+F
Both for 1 mark</td><td>☒A Propene C_3H_6 will decolourise bromine water quickly
☑B Cyclopropane C_3H_6 fits C_nH_{2n} and decolourises bromine solution quickly
☒C Propane C_3H_8 does not have a general formula of C_nH_{2n}
☒D Butane C_4H_{10} does not have a general formula of C_nH_{2n}
☒E Butene C_4H_8 will decolourise bromine water quickly.
☑F Cyclobutane C_4H_8 fits C_nH_{2n} and decolourises bromine solution quickly</td></tr>
</table>

<table>
<tr><td>6b</td><td>B</td><td><table><tr><td>Homologous Series</td><td>Alkane</td><td>Alkene</td><td>Cycloalkane</td></tr><tr><td>1st Member</td><td>Methane CH_4</td><td>Ethene C_2H_4</td><td>Cyclopropane C_3H_6</td></tr></table></td></tr>
<tr><td>6c</td><td>E+F
Both for 1 mark</td><td>☒A Propene C_3H_6 has a different formula so is not an isomer of C_4H_8
☒B Cyclopropane C_3H_6 has a different formula so not an isomer of C_4H_8
☒C Propane C_3H_8 has a different formula so is not an isomer of C_4H_8
☒D Butane C_4H_{10} has a different formula so is not an isomer of C_4H_8
☑E Butene C_4H_8 has the same formula but a different structure
☑F Cyclobutane C_4H_8 has the same formula but a different structure</td></tr>
<tr><td>7a</td><td>D</td><td>Nitrogen + Hydrogen $\xrightarrow{\text{iron}}$ Ammonia</td></tr>
<tr><td>7b</td><td>C</td><td>ammonia + oxygen $\xrightarrow{\text{platinum}}$ nitrogen dioxide + water</td></tr>
<tr><td>8</td><td>B,E
1 mark each</td><td>☒A alkaline solutions have a pH greater than 7
☑B alkaline solutions contain ions and conduct electricity
☒C alkaline solutions contain more OH^- ions than pure water
☒D alkaline solutions neutralise acids like hydrochloric acid
☑E Dilution decreases the concentration of OH^- ions in an alkali</td></tr>
<tr><td>9</td><td>A,F
1 mark each</td><td>☑A copper carbonate + sulphuric acid → copper sulphate + water + carbon dioxide
☒B lead nitrate + potassium iodide → lead iodide solid + potassium nitrate
☒C potassium hydroxide + nitric acid → potassium nitrate + water
☒D copper is not reactive enough to react with water
☒E silver is not reactive enough to react with hydrochloric acid
☑F ammonium nitrate + sodium hydroxide → ammonia + water + sodium nitrate</td></tr>
</table>

Question	Answer	Chemistry Covered
10a	Man-made or not found in nature	Synthetic materials are not found naturally on Earth and are made by the chemical industry.
10b(i)	Diagram showing:	
10b(ii)	Addition	In addition polymerisation, C=C double bonds open up to form a polymer with a long chain of C-C single bonds
10c	Carbon monoxide	Carbon monoxide is a toxic gas formed when carbon compounds burn in a limited supply of air.
11a(i)	Fermentation or anaerobic respiration	glucose $\xrightarrow[\text{(no air)}]{\text{yeast}}$ ethanol + carbon dioxide
11a(ii)	Carbon dioxide	
11b	Balloon doesn't inflate or no gas produced or Enzymes destroyed at 80°C	

		Enzymes do not work at high temperatures and are denatured at these temperatures. Enzymes work best at their optimum temperature (usually ~37°C)	

<table>
<tr><td>12a</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>Test</td><td>burns with a pop</td><td>relights a glowing splint</td><td>turns lime water milky</td></tr></table></td></tr>
<tr><td>12b</td><td>Line graph showing:</td><td><table><tr><td>½ mark – both labels with units</td><td>½ mark – both scales</td></tr><tr><td>½ mark – points plotted correctly</td><td>½ mark – points joined up appropriately</td></tr></table></td></tr>
<tr><td>12c</td><td>42-44cm³</td><td>Problem Solving: Answer should be taken from graph</td></tr>
<tr><td>12d</td><td>53cm³</td><td>Reaction with dilute sulphuric acid was finished at 60seconds
At a higher concentration of sulphuric acid will finish before 60seconds but will still produce same final volume of gas (53cm³)</td></tr>
<tr><td>12e</td><td>0.4g</td><td>1 mol Mg = 24.5g
$\textbf{no}\text{. of mol} = \frac{\textbf{mass}}{\textbf{gfm}} = \frac{4.9g}{24.5g\ mol^{-1}} = 0.2mol$
$Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$
1mol 1mol
0.2mol 0.2mol
1mol H_2 = 2x1 = 2g
mass = no. of mol x gfm = 0.2mol x 2g mol⁻¹ = 0.4g</td></tr>
<tr><td>13a</td><td>Electrodes have same charge at all times</td><td>Direct current (d.c.) must be used as this give constant positive and negative electrodes as the direction of electron flow is always the same.
Alternating current (a.c.)has reversing current direction so the charge on each electrode would keep changing.</td></tr>
<tr><td>13b</td><td>Green</td><td>Ni^{2+} nickel ions are positive because metals always form positive ions.
Ni^{2+} ions will travel to the negative electrode (electrode A)</td></tr>
<tr><td>13c</td><td>$Ni^{2+}CrO_4^{2-}$</td><td><table><tr><td>Write down Valency below each element's symbol</td><td>Put in Cross-over Arrows</td><td>Follow arrows and cancel down to get formula</td></tr><tr><td>Ni^{2+} CrO_4^{2-}
2 2</td><td>Ni^{2+} CrO_4^{2-}
2 2</td><td>$Ni^{2+}CrO_4^{2-}$</td></tr></table></td></tr>
<tr><td>14a</td><td>Covalent</td><td>Titanium (IV) chloride contains a metal and a non-metal in the compound
• Metals and non-metals usually join to form ionic bonding
• Ionic bonding results in a high melting and boiling points
Titanium (IV) chloride contains covalent bonding as it is a liquid at room temperature so must have a boiling point below 20°C</td></tr>
<tr><td>14b(i)</td><td>$TiCl_4 + 4Na$
↓
$Ti + 4NaCl$</td><td>$TiCl_4 + 4Na \longrightarrow Ti + 4NaCl$</td></tr>
<tr><td>14b(ii)</td><td>Sodium is more reactive than titanium</td><td>Redox Equation: $Ti^{4+} + 4Na \longrightarrow Ti + 4Na^+$
Higher up metal displaces a lower down metal from its ion</td></tr>
<tr><td>15a</td><td>Higher the distance from surface the higher the concentration</td><td>Problem Solving: Interpretation of table of results</td></tr>
<tr><td>15b</td><td>80.5</td><td><table>
<tr><td>Distance</td><td colspan="2">0</td><td colspan="2">10</td><td colspan="2">20</td><td colspan="2">30</td><td colspan="2">40</td><td colspan="2">50</td><td colspan="2">60</td></tr>
<tr><td>Concentration</td><td colspan="2">11.5</td><td colspan="2">23.0</td><td colspan="2">34.5</td><td colspan="2">46.0</td><td colspan="2">57.5</td><td colspan="2">-</td><td colspan="2">-</td></tr>
<tr><td>difference</td><td>▨</td><td colspan="2">11.5</td><td colspan="2">11.5</td><td colspan="2">11.5</td><td colspan="2">11.5</td><td colspan="2">(11.5)</td><td colspan="2">(11.5)</td><td>▨</td></tr>
<tr><td>Estimate</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">69</td><td colspan="2">80.5</td></tr>
</table></td></tr>
<tr><td>15c</td><td>Protons
Electrons</td><td>A covalent bond is a shared pair of electrons between two atoms. The electrostatic attraction between the negative electrons and the positive nuclei holds the covalent bond together</td></tr>
<tr><td>16a(i)</td><td>2+</td><td>Sulphur is a group 6 non-metal element and forms S^{2-} ions
For PbS to be balanced in charge, lead ion must have charge Pb^{2+}</td></tr>
</table>

<table>
<tr><td>16a(ii)</td><td>86.6%</td><td>1 mol PbS = (1x207) + (1x32) = 207 + 32 = 239g
$\%Pb = \frac{\text{mass of Pb}}{\text{mass of PbS}} = \frac{207}{239} \times 100 = 86.6\%$</td></tr>
<tr><td>16b(i)</td><td>Iron</td><td>Iron is made from iron ore in a blast furnace: $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$</td></tr>
<tr><td>16b(ii)</td><td><table><tr><td>Mercury</td></tr><tr><td>Aluminium</td></tr><tr><td>Copper</td></tr></table></td><td><table>
<tr><th>Method</th><th>Metals Made This Way</th><th>Reason</th></tr>
<tr><td>Electrolysis</td><td><table><tr><td>Potassium</td><td>Sodium</td><td>Lithium</td></tr><tr><td>Calcium</td><td>Magnesium</td><td>Aluminium</td></tr></table></td><td>most reactive metals</td></tr>
<tr><td>Heat With Carbon</td><td><table><tr><td>Zinc</td><td>Iron</td><td rowspan="2">Copper</td></tr><tr><td>Tin</td><td>Lead</td></tr></table></td><td>medium reactive metals</td></tr>
<tr><td>Heat Alone</td><td><table><tr><td>Mercury</td><td>Silver</td></tr><tr><td>Gold</td><td>Platinum</td></tr></table></td><td>least reactive metals</td></tr>
</table></td></tr>
<tr><td>17a</td><td>NO_3^-
circled on both sides</td><td>$Fe_{(s)} + 2Ag^+_{(aq)} + 2NO_3^-{}_{(aq)} \longrightarrow Fe^{2+}_{(aq)} + 2Ag_{(s)} + 2NO_3^-{}_{(aq)}$
Cancel out any spectator ions which appear on both sides
$Fe_{(s)} + 2Ag^+_{(aq)} + \cancel{2NO_3^-{}_{(aq)}} \longrightarrow Fe^{2+}_{(aq)} + 2Ag_{(s)} + \cancel{2NO_3^-{}_{(aq)}}$
Re-write equation omitting spectator ions
$Fe_{(s)} + 2Ag^+_{(aq)} \longrightarrow Fe^{2+}_{(aq)} + 2Ag_{(s)}$</td></tr>
<tr><td>17b</td><td>Ferroxyl indicator turns blue with Fe^{2+}</td><td>Ferroxyl Indicator turns blue in presence of Fe^{2+} ions
turns pink in presence of OH^- ions</td></tr>
<tr><td>17c</td><td>$Ag^+ + e^- \longrightarrow Ag$</td><td>$Fe(s) + 2Ag^+(aq) \rightarrow Fe^{2+}(aq) + 2Ag(s)$ redox
Separate out equations and balance charge with e^-
$Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$ oxidation
$2e^- + 2Ag^+(aq) \rightarrow 2Ag(s)$ reduction</td></tr>
<tr><td>17d</td><td>iron silver
silver nitrate</td><td>As Iron is higher up electrochemical series than silver (p7 data booklet)
Iron electrode must be on left as electrons flow from left to right
Silver electrode must be on right as electrons flow from left to right
Silver nitrate solution is used with silver electrode
1st line of question states silver nitrate is used</td></tr>
<tr><td>18a</td><td>ethoxypropane</td><td>Carbon fragment to left of Oxygen atom = 2 carbons ∴ethoxy-
Carbon fragment to right of Oxygen atom = 3 carbons ∴-propane</td></tr>
<tr><td>18b</td><td>36°C</td><td>Gfm: $CH_3CH_2OCH_2CH_3$ = (4x12) + (10x1) + (1x16) = 48 + 10 + 16 = 74g
Alkane with the similar gfm with have similar boiling point:<table>
<tr><td>Alkane</td><td>Methane</td><td>Ethane</td><td>Propane</td><td>Butane</td><td>Pentane</td><td>Hexane</td><td>Heptane</td><td>Octane</td></tr>
<tr><td>Formula</td><td>CH_4</td><td>C_2H_6</td><td>C_3H_8</td><td>C_4H_{10}</td><td>C_5H_{12}</td><td>C_6H_{14}</td><td>C_7H_{16}</td><td>C_8H_{18}</td></tr>
<tr><td>gfm</td><td>16g</td><td>30g</td><td>44g</td><td>58g</td><td>72g</td><td>86g</td><td>100g</td><td>114g</td></tr>
<tr><td>Boiling Pt</td><td>-164°C</td><td>-89°C</td><td>-42°C</td><td>-1°C</td><td>36°C</td><td>69°C</td><td>98°C</td><td>126°C</td></tr>
</table></td></tr>
<tr><td>19a</td><td>$25.0cm^3$</td><td>The rough titre is never used to calculate the average volume</td></tr>
<tr><td>19b</td><td>0.25mol/l</td><td>no. of mol = volume x concentration = $0.025_{\text{litres}} \times 0.1\ mol\ l^{-1}$ = 0.0025mol
$HCl + NaOH \longrightarrow H_2O + NaCl$
1mol 1mol
0.0025mol 0.0025mol
$\text{concentration} = \frac{\text{no. of mol}}{\text{volume}} = \frac{0.0025mol}{0.01 \text{litres}} = 0.25\ mol\ l^{-1}$</td></tr>
<tr><td>20a(i)</td><td>Propanol</td><td>
methanol ethanol propanol butanol</td></tr>
<tr><td>20a(ii)</td><td>One from:</td><td>
or
</td></tr>
<tr><td>20b</td><td>carbon dioxide & water</td><td>Alkanols burn to in a plentiful supply of air to form carbon dioxide and water:
$2C_3H_7OH + 9O_2 \longrightarrow 6CO_2 + 8H_2O$</td></tr>
</table>