JABchem

Past Papers Nat 5 Chemistry

2022

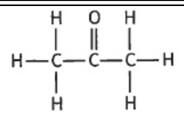
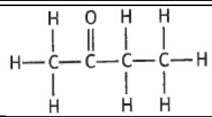
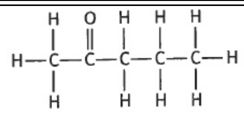
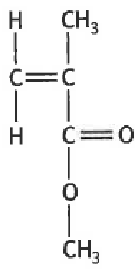
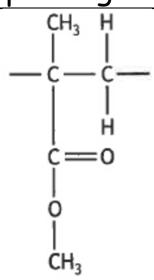
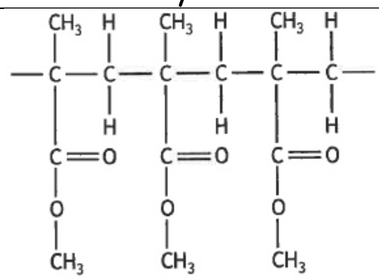
Marking Scheme

Grade Awarded	Mark Required (/100)	Mark Required %	% candidates achieving grade
A	70+	70%	42.5%
B	58+	58%	20.6%
C	46+	46%	16.7%
D	34+	34%	11.9%
No award	<34	<34%	8.3%

Section:	Multiple Choice	Extended Answer	Assignment
Average Mark:	17.2 /25	45.8 /75	No Assignment in 2022

2022 National 5 Chemistry Marking Scheme

MC Qu	Answer	% Pupils Correct	Reasoning
1	C	91	☒A Hydrogen H has an atomic number of 1. Hydrogen is a non-metal. ☒B Arsenic As has an atomic number of 33. Arsenic is a non-metal. ☑C Rhodium Rh has an atomic number of 45. Rhodium is a metal. ☒D Radon Rn has an atomic number of 86. Radon is a non-metal.
2	B	83	☒A Protons are positive and neutrons are neutral ∴ overall this would be positive. ☑B Atoms are neutron because no. of protons equals no of electrons ☒C number of protons plus neutrons is greater than number of electrons ☒D number of electrons plus protons is greater than number of neutrons
3	A	46	☑A weak forces of attraction are found between molecules not inside molecules ☒B strong forces of attraction are found inside molecules not between molecules ☒C weak forces of attraction are found between molecules not inside molecules ☒D strong forces of attraction are found inside molecules not between molecules
4	C	52	☒A Adding more solvent would dilute the solution and decrease the concentration ☒B Adding more solute would increase the concentration of the solute dissolved ☑C Adding solute increases concentration. Adding solvent decreases concentration ☒D Adding more solvent would dilute the solution and decrease the concentration
5	B	91	☒A The shape is similar to the shape of CH_4 and is called tetrahedral ☑B The shape is similar to the shape of H_2O and is called angular ☒C The shape is similar to the shape of HCl and is called linear ☒D The shape is similar to the shape of NH_3 and is called trigonal pyramidal
6	A	91	☑A Electronegativity of O=3.4 & Electronegativity of H=2.2 ∴ Electronegativity Difference = 1.2 ☒B Electronegativity of N=3.0 & Electronegativity of H=2.2 ∴ Electronegativity Difference = 0.8 ☒C Electronegativity of C=2.6 & Electronegativity of H=2.2 ∴ Electronegativity Difference = 0.4 ☒D Electronegativity of C=2.6 & Electronegativity of O=3.4 ∴ Electronegativity Difference = 0.8
7	A	54	☑A Copper forms at negative electrode and chlorine gas forms at positive electrode ☒B Copper forms at negative electrode as positive Cu^{2+} ions move to negative electrode ☒C Chlorine gas forms at positive electrode as negative Cl^- ions move to positive electrode ☒D Chlorine gas forms at positive electrode as negative Cl^- ions move to positive electrode
8	D	35	☒A Calcium oxide cannot be formed by the neutralisation of an acid ☒B Hydrogen nitrate cannot be formed by the neutralisation of an acid ☒C Sodium hydroxide cannot be formed by the neutralisation of an acid. ☑D Potassium ethanoate is a salt formed by the neutralisation of ethanoic acid by a base like sodium hydroxide
9	D	54	☒A pH=3 is acidic and ammonia dissolves in water to form an alkali with pH>7 ☒B pH=5 is acidic and ammonia dissolves in water to form an alkali with pH>7 ☒C pH=7 is acidic and ammonia dissolves in water to form an alkali with pH>7 ☑D pH=9 is alkaline and ammonia dissolves in water to form an alkali with pH>7
10	C	48	☒A Methane CH_4 burns to form CO_2 and H_2O. The CO_2 would turn limewater milky. ☒B Carbon Monoxide CO burns to form CO_2. The CO_2 would turn limewater milky. ☑C Hydrogen H_2 burn to form H_2O only. H_2O would condense as a colourless liquid. ☒D Ethane C_2H_6 burns to form CO_2 and H_2O. The CO_2 would turn limewater milky.
11	C	73	☒A C_4H_{10} molecule is butane and has a boiling point of -1°C ☒B C_4H_8 molecule is but-1-ene and has a boiling point of -6°C ☑C C_3H_7COOH molecule is butanoic acid and has a boiling point of 164°C ☒D C_4H_9OH molecule is butan-2-ol and has a boiling point of 100°C
12	D	52	☒A molecule has no C=C double bond and would not decolourise bromine solution ☒B molecule has no C=C double bond and would not decolourise bromine solution ☒C molecule has no COOH Carboxyl group and would not produce an acidic pH ☑D Carboxyl -COOH group has acid pH & C=C double bond decolourises bromine solution

<table>
<tr><td>13</td><td>B</td><td>79</td><td>
<table>
<tr><td>Structure</td><td></td><td></td><td></td></tr>
<tr><td>Formula</td><td>C_3H_6O</td><td>C_4H_8O</td><td>$C_5H_{10}O$</td></tr>
<tr><td>Relationship</td><td>If n=3 then 2n=6</td><td>If n=4 then 2n=8</td><td>If n=5 then 2n=10</td></tr>
<tr><td>General Formula</td><td>$C_nH_{2n}O$</td><td>$C_nH_{2n}O$</td><td>$C_nH_{2n}O$</td></tr>
</table>
</td></tr>
<tr><td>14</td><td>B</td><td>59</td><td>
Cycloalkanes have a general formula of C_nH_{2n}.
<table>
<tr><td>no of Carbons C_n</td><td>C_3</td><td>C_4</td><td>C_5</td></tr>
<tr><td>Formula C_nH_{2n}</td><td>C_3H_6</td><td>C_4H_8</td><td>C_5H_{10}</td></tr>
<tr><td>gfm</td><td>(3x12)+(6x1) = **42**</td><td>(4x12)+(8x1) = 56</td><td>(5x12)+(10x1) = 70</td></tr>
</table>
</td></tr>
<tr><td>15</td><td>A</td><td>84</td><td>
☑A metallic bonding: attraction between positive ions and delocalised electrons
☒B the positive ion in metallic bonding is formed by the nucleus and the inner shells
☒C ionic bonding: attraction between positive ions and negative ions
☒D covalent bonding: attraction between a shared pair of electrons and two nuclei
</td></tr>
<tr><td>16</td><td>B</td><td>86</td><td>
☒A melting point of 98°C is below the required 600°C
☑B Melting point above 600°C and density below 3g cm^{-3}
☒C density of 6.52 g cm^{-3} is above the required density of 3g cm^{-3}
☒D density of 8.96 g cm^{-3} is above the required density of 3g cm^{-3}
</td></tr>
<tr><td>17</td><td>A</td><td>58</td><td>
☑A aluminium is extracted from ore by electrolysis and Al_2O_3 is insoluble in water
☒B calcium oxide is soluble in water and forms an alkali in water
☒C copper metal is extracted by heating copper ore with carbon/carbon monoxide
☒D lead metal is extracted by heating lead ore with carbon/carbon monoxide
</td></tr>
<tr><td>18</td><td>D</td><td>73</td><td>
☒A electrons travel through connecting wires not the electrolyte solution
☒B electrons travel through connecting wires not the electrolyte solution
☒C electrons travel from aluminium to nickel as aluminium is higher than nickel in ECS
☑D electrons travel from aluminium to nickel through the connecting wires as aluminium is higher than nickel in ECS
</td></tr>
<tr><td>19</td><td>B</td><td>77</td><td>
<table>
<tr><td>Electrochemical Series</td><td>Magnesium</td><td>Zinc (D)</td><td>Iron (A)</td><td>Tin (C)</td><td>Lead (B)</td></tr>
<tr><td>Voltage</td><td colspan="5">smallest Voltage (Magnesium – Zinc)
largest Voltage (Magnesium – Lead)</td></tr>
</table>
</td></tr>
<tr><td>20</td><td>C</td><td>81</td><td>
❶ $Br_{2(l)} + 2e^- \rightarrow 2Br^-_{(aq)}$
❷ $SO_3^{2-}{}_{(aq)} + H_2O_{(l)} \rightarrow SO_4^{2-}{}_{(aq)} + 2H^+_{(aq)} + 2e^-$
Add ❶+❷ $Br_{2(l)} + SO_3^{2-}{}_{(aq)} + H_2O_{(l)} + 2e^- \rightarrow 2Br^-_{(aq)} + SO_4^{2-}{}_{(aq)} + 2H^+_{(aq)} + 2e^-$
cancel down $Br_{2(l)} + SO_3^{2-}{}_{(aq)} + H_2O_{(l)} + \cancel{2e^-} \rightarrow 2Br^-_{(aq)} + SO_4^{2-}{}_{(aq)} + 2H^+_{(aq)} + \cancel{2e^-}$
redox $Br_{2(l)} + SO_3^{2-}{}_{(aq)} + H_2O_{(l)} \rightarrow 2Br^-_{(aq)} + SO_4^{2-}{}_{(aq)} + 2H^+_{(aq)}$
</td></tr>
<tr><td>21</td><td>A</td><td>82</td><td>
<table>
<tr><td>Monomer</td><td>Repeating Unit</td><td>Polymer</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>22</td><td>B</td><td>62</td><td>
☒A iron is the catalyst in the Haber Process not the Ostwald Process
☑B platinum is the catalyst in the Ostwald process which produces nitric acid HNO_3
☒C iron is the catalyst in the Haber Process not the Ostwald Process
☒D ammonia NH_3 is the product of the Haber Process not the Ostwald Process
</td></tr>
</table>

23	C	67	☒A All ^{222}Rn atom have same half-life due to having the same proton : neutron ratio ☒B All ^{222}Rn atom have same half-life due to having the same proton : neutron ratio ☑C ^{222}Rn has p:n ratio of 136:86 and the half-life is the same for all atoms of ^{222}Rn ☒D The intensity of the radiation would change by having different size plants but the time taken for the radiation to halve (half-life) would remain the same.
24	D	55	☒A alpha particles are stopped by paper ∴ would not be able to escape through skin ☒B long half-life would result in radiation escaping for potentially years to come. ☒C alpha particles are stopped by paper ∴ would not be able to escape through skin ☑D an isotope with beta particles released which are able to escape the skin and a short half-life is the best combination for this treatment.
25	C	80	☒A Beaker is an inaccurate method to measure volume. ☒B Measuring cylinder is not as accurate as a 25cm^3 pipette for measuring volume ☑C Most accurate method for measuring 25cm^3 is to use a 25cm^3 pipette. ☒D Conical flask is an inaccurate method of measuring volume as it has no markings

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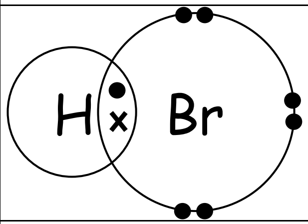
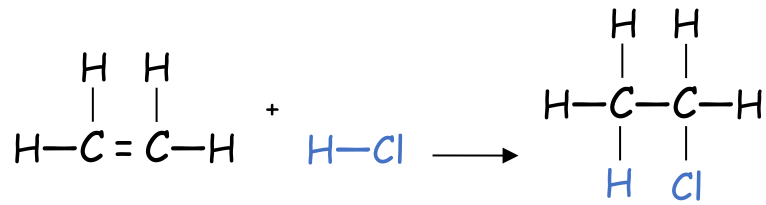
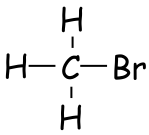
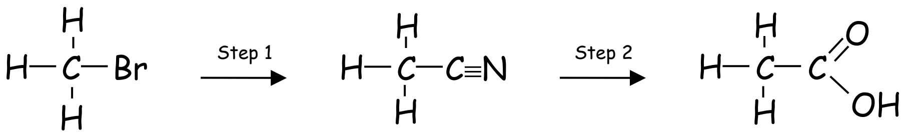
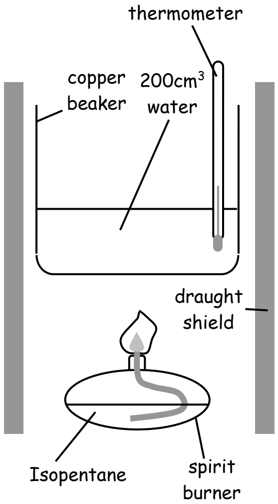
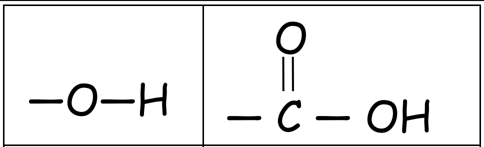
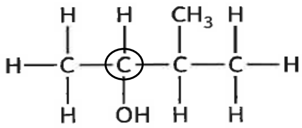
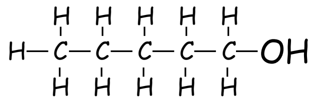
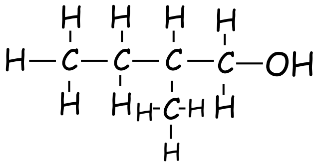
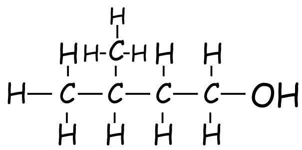
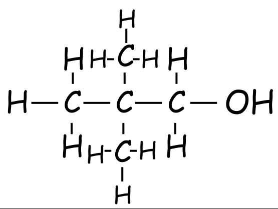
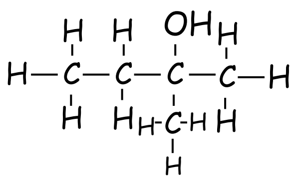
<table>
<tr><th>Long Qu</th><th>Answer</th><th>Reasoning</th></tr>
<tr><td>1a(i)</td><td>Beta</td><td>
<table>
<tr><th>Radiation</th><th>Alpha</th><th>Beta</th><th>Gamma</th></tr>
<tr><td>Mass</td><td>4</td><td>0</td><td>No mass</td></tr>
<tr><td>Charge</td><td>2</td><td>-1</td><td>No charge</td></tr>
<tr><td>Stopped by</td><td>Paper</td><td>Aluminium</td><td>Thick lead</td></tr>
<tr><td>Deflection</td><td>Towards negative</td><td>Towards positive</td><td>No defection</td></tr>
<tr><td>Use</td><td>Smoke detectors</td><td>Measuring thickness of paper in paper mill</td><td>Radiotherapy cancer treatment</td></tr>
</table>
</td></tr>
<tr><td>1a(ii)</td><td>Xenon</td><td>$$^{131}_{53}I \rightarrow {}^{0}_{-1}e + {}^{131}_{54}Xe$$</td></tr>
<tr><td>1b(i)</td><td>15 days</td><td>
<table>
<tr><th>Fraction</th><th>Number of half-lives</th></tr>
<tr><td>1</td><td>0</td></tr>
<tr><td>$^{1}/_{2}$</td><td>1</td></tr>
<tr><td>$^{1}/_{4}$</td><td>2</td></tr>
<tr><td>$^{1}/_{8}$</td><td>3</td></tr>
</table>
1 half-life = 5 days
3 half-lives = 15 days
</td></tr>
<tr><td>1b(ii)</td><td>Caesium-137</td><td>Caesium-137 levels would take 30 years to reach half of its original value and some caesium-137 would remain in the environments for over 200 years. The other radioisotopes have a half-life of in the days and the vast majority of the other radioisotopes would have decayed over 2-3 months.</td></tr>
<tr><td>2a</td><td>Graph showing:</td><td>
<table>
<tr><th>1 mark</th><th>1 mark</th></tr>
<tr><td>The axes of the graph have suitable labels and units.</td><td>All data points plotted accurately (within a half box tolerance) with either a line of best fit drawn or plots joined. This mark can only be accessed if linear scales for both axes have been provided.</td></tr>
</table>
</td></tr>
<tr><td>2b</td><td>5.33</td><td>$$\text{Rate} = \frac{\Delta\text{Quantity}}{\Delta\text{Time}} = \frac{48 - 32}{4 - 1} = 5.33\ \text{cm}^3\ \text{min}^{-1}$$</td></tr>
<tr><td>2c</td><td>Mass of flask + contents</td><td>The flask and contents will decrease in mass as the hydrogen gas escapes from the flask. Mass can then be used to measure the rate of reaction by using change in mass as ΔQuantity in the above rate equation.</td></tr>
<tr><td>2d</td><td>48</td><td>Using the same mass of calcium and the same volume of water means the same volume of hydrogen gas will be produced.
The increased temperature will increase the reaction rate but it will still produce the same 48cm^3 but in less time.</td></tr>
<tr><td>3a</td><td>ammonia and carbon dioxide</td><td>Problem Solving: gathering information from a passage</td></tr>
<tr><td>3b</td><td>1.625</td><td>$$32.5\%\ \text{of}\ 5\text{kg} = \frac{32.5}{100} \times 5\text{kg} = 1.625\text{kg}$$</td></tr>
<tr><td>3c</td><td>
<table>
<tr><td>hydrogen</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td>hydroxide</td></tr>
</table>
</td><td>
<table>
<tr><th>Solution Type</th><th>Description</th><th></th><th></th></tr>
<tr><td>Acidic Solution</td><td>Concentration of H^+ ions</td><td>></td><td>Concentration of OH^- ions</td></tr>
<tr><td>Neutral Solution</td><td>Concentration of H^+ ions</td><td>=</td><td>Concentration of OH^- ions</td></tr>
<tr><td>Alkaline Solution</td><td>Concentration of H^+ ions</td><td><</td><td>Concentration of OH^- ions</td></tr>
</table>
</td></tr>
<tr><td>3d</td><td>Not toxic or flammable</td><td>Problem Solving: gathering information from a passage</td></tr>
<tr><td>3e(i)</td><td>Contains two elements essential to healthy plant growth</td><td>Nitrogen, Phosphorus and Potassium are the three elements essential for healthy plant growth. Diammonium hydrogen phosphate $(NH_4)_2HPO_4$ contains two from nitrogen, phosphorus and potassium. A single nutrient fertiliser would contain only one of those three elements.</td></tr>
</table>

3e(ii)	21.2	gfm $(NH_4)_2HPO_4$: (2x14) + (8x1) + (1x1) + (1x31) + (4x16) = 132g (1 mark) $\% N = \frac{(2\times14)}{132} \times 100 = 21.2\%$ (1 mark)
4a(i)	addition	HBr molecule adds across the C=C double bond by addition reaction. Molecules which add across a C=C double bond to form one product: F_2, Cl_2, Br_2, I_2, H_2 Molecules which add across a C=C double bond to usually form two product: H_2O, HF, HCl, HBr, HI
4a(ii)		
4a(iii)	HCl or hydrogen chloride	
4b(i)		
4b(ii)	Vinegar	Pure ethanoic acid (old name acetic acid) is diluted in water to make vinegar.
5	Open Question:	**3 mark answer**: Demonstrates a **good understanding** of the chemistry involved. A good comprehension of the chemistry has provided in a logically correct, including a statement of the principles involved and the application of these to respond to the problem. **2 mark answer**: Demonstrates a **reasonable understanding** of the chemistry involved, making some statement(s) which are relevant to the situation, showing that the problem is understood. **1 mark answer**: Demonstrates a **limited understanding** of the chemistry involved. The candidate has made some statement(s) which are relevant to the situation, showing that at least a little of the chemistry within the problem is understood.
6a	2-methylbutane	**2-methylbutane** 2-methyl: Methyl $-CH_3$ group on C_2 butane: Longest carbon chain has four carbons (no C=C double bonds)
6b(i)	Fuel	A fuel is a substance which burns to release heat energy
6b(ii)	$C_5H_{12} + 8O_2$ ↓ $5CO_2 + 6H_2O$	$C_5H_{12} + 8O_2 \longrightarrow 5CO_2 + 6H_2O$
6b(iii)	10.032	heat energy = specific heat capacity × mass × change in Temperature $E_h = c \times m \times \Delta T$ $E_h = 4.18\ kJ\ kg^{-1}\ {}^{o}C^{-1} \times 0.2kg \times 12^{o}C$ $E_h = 10.032\ kJ$

<table>
<tr><td>6b(iv)</td><td>
</td><td></td></tr>
<tr><td>7a(i)</td><td>43.9</td><td>gfm NaCl = (1x23)+(1x35.5) = 23+35.5 = 58.5g
no. of mol = volume x concentration = 0.5 litres x 1.5 mol l^{-1} = 0.75mol
mass = no. of mol x gfm = 0.75mol x 58.5g mol^{-1} = 43.9g</td></tr>
<tr><td>7a(ii)</td><td>Balance or Weighing Bottle</td><td></td></tr>
<tr><td>7b(i)</td><td>106.7</td><td>Average Volume = $\frac{105 + 107 + 108}{3} = \frac{320}{3}$ = 106.7°C</td></tr>
<tr><td>7b(ii)</td><td>Table showing:</td><td><table>
<tr><th>Concentration (mol l^{-1})</th><th>Boiling Point (°C)</th></tr>
<tr><td>0.5</td><td>101.3</td></tr>
<tr><td>1.0</td><td>104.0</td></tr>
<tr><td>1.5</td><td>106.7</td></tr>
</table></td></tr>
<tr><td>7c</td><td>Line Graph</td><td></td></tr>
<tr><td>7d</td><td>Increase in concentration, increase in boiling point</td><td>Problem Solving: Drawing conclusion from table of information</td></tr>
<tr><td>8a</td><td>sulphuric acid</td><td>acid + metal oxide → salt + water
sulphuric acid + copper oxide → copper sulphate + water
acid + metal hydroxide → salt + water
sulphuric acid + barium hydroxide → barium sulphate + water</td></tr>
<tr><td>8b</td><td>Hydrogen</td><td>acid + metal carbonate → salt + water + carbon dioxide
sulphuric acid + sodium carbonate → sodium sulphate + water + carbon dioxide
acid + metal → salt + hydrogen
sulphuric acid + magnesium → magnesium sulphate + hydrogen</td></tr>
<tr><td>8c</td><td>Don't start to fizz when more carbonate is added</td><td>Sodium carbonate will react with sulphuric acid to form sodium sulphate, water and carbon dioxide. When the carbonate runs out, the fizzing will stop. More carbonate is added and stirred until the fizzing stops again. This is repeated until adding carbonate does not start to fizz showing that there is no acid remaining.</td></tr>
<tr><td>8d</td><td>barium sulphate</td><td><table>
<tr><td>Salt</td><td>copper sulphate</td><td>barium sulphate</td><td>sodium sulphate</td><td>magnesium sulphate</td></tr>
<tr><td>Solubility</td><td>soluble</td><td>insoluble</td><td>soluble</td><td>soluble</td></tr>
</table></td></tr>
<tr><td>8e</td><td>Reaction of acids to form water</td><td>A neutralisation reaction is the reaction of an acid with a base to form water. A salt is also produced in the reaction.</td></tr>
</table>

<table>
<tr><td>9a</td><td>Answer including one from:</td><td>Same: Atomic number / Number of protons
Different: Mass number / Number of neutrons</td></tr>
<tr><td>9b</td><td>Full outer shell</td><td>Atoms with a full outer shell are very stable and therefore unreactive.
<table>
<tr><td>Element</td><td>Helium</td><td>Neon</td><td>Argon</td><td>Krypton</td><td>Xenon</td><td>Radon</td></tr>
<tr><td>Electron Arrangement</td><td>2</td><td>2,8</td><td>2,8,8</td><td>2,8,18,8</td><td>2,8,18,18,8</td><td>2,8,18,32,18,8</td></tr>
</table></td></tr>
<tr><td>9c(i)</td><td>Equation showing:</td><td>$XeF_2 + F_2 \longrightarrow XeF_6$</td></tr>
<tr><td>9c(ii)</td><td>covalent molecular</td><td>Xenon hexafluoride is covalent as it contains only non-metals atoms in its structure. The melting point of 49°C indicates that weak intermolecular attractions are found between molecules giving a covalent molecular structure. The melting point is too low for a covalent network structure.</td></tr>
<tr><td>9c(iii)A</td><td>35</td><td>Catalysts speed up reactions without being used up in that reaction. The same mass of catalyst at the start remains at the end.</td></tr>
<tr><td>9c(iii)B</td><td>£277.60</td><td>35g of catalyst must be obtained from four 10g tubs.
1 tub catalyst = £69.40 ∴ 4 tubs catalyst = £69.40 x 4 = £277.60</td></tr>
<tr><td>10a</td><td>Answer containing:</td><td>Family of compounds with similar/same chemical properties
a general formula</td></tr>
<tr><td>10b(i)</td><td>Hydroxyl group</td><td>
<table><tr><td>hydroxyl group</td><td>carboxyl group</td></tr></table></td></tr>
<tr><td>10b(ii)</td><td>Secondary</td><td>
The circled carbon shown has attached to it:
2 carbons
1 hydrogen
1 oxygen</td></tr>
<tr><td>10b(iii)</td><td>One structure from:</td><td>
<table>
<tr><td>Structure</td><td>Name</td><td>Number of hydrogens attached to carbon with functional group</td><td>Type of Alcohol</td></tr>
<tr><td></td><td>pentan-1-ol</td><td>2</td><td>primary</td></tr>
<tr><td></td><td>2-methylbutan-1-ol</td><td>2</td><td>primary</td></tr>
<tr><td></td><td>3-methylbutan-1-ol</td><td>2</td><td>primary</td></tr>
<tr><td></td><td>2,2-dimethylbutan-1-ol</td><td>2</td><td>primary</td></tr>
<tr><td></td><td>2-methylbutan-2-ol</td><td>0</td><td>tertiary</td></tr>
</table></td></tr>
<tr><td>11a(i)</td><td>Relights a glowing splint</td><td>
<table>
<tr><td>Gas</td><td>Oxygen</td><td>Hydrogen</td><td>Carbon Dioxide</td></tr>
<tr><td>Gas Test</td><td>relights a glowing splint</td><td>burns with a pop</td><td>turns lime water milky</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>11a(ii)</td><td>$K^+ClO_3^-$</td><td>K is in group 1 and forms K^+ ions.
Negative ion must balance the charge of the positive ion ∴ ClO_3^-</td></tr>
<tr><td>11b(i)</td><td>Releases energy to surroundings</td><td><table>
<tr><th>Type of Reaction</th><th>Definition</th></tr>
<tr><td>Exothermic</td><td>Reaction which releases energy to surroundings</td></tr>
<tr><td>Endothermic</td><td>Reaction which takes in energy from the surroundings</td></tr>
</table></td></tr>
<tr><td>11b(ii)</td><td>Potassium</td><td><table>
<tr><th>Element</th><th>Ion</th><th>Flame Colour</th><th>Element</th><th>Ion</th><th>Flame Colour</th></tr>
<tr><td>Barium</td><td>Ba^{2+}</td><td>Green</td><td>Copper</td><td>Cu^{2+}</td><td>Blue-green</td></tr>
<tr><td>Potassium</td><td>K^+</td><td>Lilac</td><td>Strontium</td><td>Sr^{2+}</td><td>Red</td></tr>
<tr><td>Calcium</td><td>Ca^{2+}</td><td>Orange-red</td><td>Lithium</td><td>Li^+</td><td>Red</td></tr>
<tr><td>Sodium</td><td>Na^+</td><td>Yellow</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>11c</td><td>2.4</td><td>gfm $C_6H_{12}O_6$ = (6x12)+(12x1)+(6x16) = 72+12+96 = 180g
no. of mol = $\frac{\textbf{mass}}{\textbf{gfm}} = \frac{2.25}{180}$ = 0.0125mol
$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
$C_6H_{12}O_6$: 1mol, 0.0125mol; $6O_2$: 6mol, 0.075mol
gfm O_2 = 2x16 = 32g
mass = no. of mol x gfm = 0.075 x 32 = 2.4g</td></tr>
<tr><td>12a(i)</td><td>decreases</td><td><table>
<tr><td>Element</td><td>Na</td><td>Mg</td><td>Al</td><td>Si</td><td>P</td><td>S</td><td>Cl</td></tr>
<tr><td>Covalent Radius (pm)</td><td>160</td><td>140</td><td>124</td><td>114</td><td>109</td><td>104</td><td>100</td></tr>
</table></td></tr>
<tr><td>12a(ii)</td><td>increases</td><td><table>
<tr><td>Group 1 Element</td><td>H</td><td>Li</td><td>Na</td><td>K</td><td>Rb</td></tr>
<tr><td>Covalent Radius (pm)</td><td>32</td><td>130</td><td>160</td><td>200</td><td>215</td></tr>
</table></td></tr>
<tr><td>12a(iii)</td><td>201</td><td><table>
<tr><td>Group 2 Element</td><td>Be</td><td>Mg</td><td>Ca</td><td>Sr</td></tr>
<tr><td>Covalent Radius (pm)</td><td>99</td><td>140</td><td>174</td><td>-</td></tr>
<tr><td>Difference</td><td>41 (Be–Mg)</td><td>34 (Mg–Ca)</td><td>27 (Ca–Sr)</td><td></td></tr>
<tr><td>Prediction</td><td>-</td><td>-</td><td>-</td><td>201</td></tr>
</table></td></tr>
<tr><td>12b</td><td>234</td><td>Covalent Radius of Br = 117 picometres (from table)
Distance between nuclei = 2x covalent radius = 2x117pm = 234pm</td></tr>
<tr><td>12c(i)</td><td>2,8</td><td>sodium atom Na = 2,8,1 ∴ sodium ion Na^+ = 2,8</td></tr>
<tr><td>12c(ii)</td><td>Na^+ has less occupied electron shells</td><td><table>
<tr><th>Particle</th><th>Na atom</th><th>Na^+ ion</th></tr>
<tr><td>Electron Arrangement</td><td>2,8,1</td><td>2,8</td></tr>
<tr><td>No of occupied electron shells</td><td>3</td><td>2</td></tr>
</table></td></tr>
<tr><td>13</td><td>Open Question:</td><td><table>
<tr><th>3 mark answer</th><th>2 mark answer</th><th>1 mark answer</th></tr>
<tr><td>Demonstrates a <u>good</u> understanding of the chemistry involved. A good comprehension of the chemistry has provided in a logically correct, including a statement of the principles involved and the application of these to respond to the problem.</td><td>Demonstrates a <u>reasonable</u> understanding of the chemistry involved, making some statement(s) which are relevant to the situation, showing that the problem is understood.</td><td>Demonstrates a <u>limited</u> understanding of the chemistry involved. The candidate has made some statement(s) which are relevant to the situation, showing that at least a little of the chemistry within the problem is understood.</td></tr>
</table></td></tr>
</table>