JABchem

Past Papers
Nat 5
Chemistry

2018
Marking Scheme

Grade Awarded	Mark Required		% candidates achieving grade
	(/125)	%	
A	92+	73.6%	36.3%
B	78+	62.4%	21.8%
C	64+	51.2%	19.1%
D	50+	40%	14.0%
No award	<50	<40%	8.8%

Section:	Multiple Choice	Extended Answer	Assignment
Average Mark:	17.6 /25	45.6 /75	18.2 /25

2018 National 5 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></td><td>☑A Increasing particle size decreases the reaction rate
☒B Increasing particle size increases the reaction rate
☒C Increasing concentration increases the reaction rate
☒D Adding a catalyst increases the reaction rate</td></tr>
<tr><td>2</td><td>B</td><td></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 0</td></tr>
</table></td></tr>
<tr><td>3</td><td>B</td><td></td><td>☒A Oxygen exists a diatomic O_2 molecules
☑B Helium is a monatomic noble gas in group 0
☒C Bromine exists as diatomic Br_2 molecules
☒D Hydrogen exists as diatomic H_2 molecules</td></tr>
<tr><td>4</td><td>D</td><td></td><td>Hydrogen bromide has the formula HBr using the cross-over rule.
The correct structure for this can only be linear.</td></tr>
<tr><td>5</td><td>A</td><td></td><td>☑A Na atoms have electron arrangement 2,8,1 ∴ Na^+ ions have arrangement 2,8
☒B Mg atoms have electron arrangement 2,8,2 ∴ Mg^+ ions have arrangement 2,8,1
☒C F atoms have electron arrangement 2,7 ∴ F^+ ions have arrangement 2,6
☒D Ne atoms have electron arrangement 2,8 ∴ Na^+ ions have arrangement 2,7</td></tr>
<tr><td>6</td><td>D</td><td></td><td>☒A Bonding type is covalent molecular as it does not conduct and has low mpt/bpt
☒B Bonding type is ionic as is does not conduct as solid but does conduct as liquid
☒C Bonding type is metallic as it conducts both as a solid and a liquid
☑D Bonding type is covalent network as it does no conduct and has very high mpt</td></tr>
<tr><td>7</td><td>C</td><td></td><td>$\text{concentration} = \frac{\text{no. of moles}}{\text{volume}} = \frac{0.1\text{ mol}}{0.25\text{ litres}} = 0.4\text{ mol l}^{-1}$</td></tr>
<tr><td>8</td><td>B</td><td></td><td>☒A An alkaline solution contains more OH^- ions than H^+ ions (still contains some H^+)
☑B An alkaline solution contains more OH^- ions than H^+ ions
☒C An acidic solution contains more H^+ ions than OH^- ions
☒D A neutral solution contains equal numbers of H^+ ions and OH^- ions</td></tr>
<tr><td>9</td><td>C</td><td></td><td>☒A Diluting acids with water increases pH until it reaches pH=7
☒B Diluting acids with water increases pH until it reaches pH=7
☑C Diluting acids with water decreases the H^+ ion concentration as water is added
☒D Diluting acids with water decreases the H^+ ion concentration as water is added</td></tr>
<tr><td>10</td><td>D</td><td></td><td>C_9H_{20} structure drawn is the isomer 3,4-dimethylheptane
☒A C_9H_{20} structure is 2,4-dimethylheptane ∴ different isomer not same structure
☒B C_8H_{18} structure is 3,4-dimethylhexane ∴ different formula not same structure
☒C C_9H_{20} structure is 3,3-dimethylheptane ∴ different isomer not same structure
☑D C_9H_{20} structure is 3,4-dimethylheptane ∴ same formula and same structure</td></tr>
<tr><td>11</td><td>C</td><td></td><td>C_6H_{14} structure drawn is 2-methylpentane
☒A Cyclohexane C_6H_{12} has different formula so cannot be an isomer of C_6H_{14}.
☒B 2-methylpentane again but drawn different so cannot be an isomer.
☑C 3-methylpentane C_6H_{14} so same formula but different structure so is an isomer.
☒D 2-methylbutane C_5H_{12} has different formula so cannot be an isomer of C_6H_{14}.</td></tr>
<tr><td>12</td><td>C</td><td></td><td>☒A Hydrogenation: Adding hydrogen across a C=C double bond to form alkane
☒B Combustion: burning compound in oxygen to form CO_2 and H_2O
☑C Hydration: Adding H_2O across C=C double bond to form alcohol
☒D Reduction: Gaining electrons</td></tr>
</table>

<table>
<tr><td>13</td><td>A</td><td></td><td>☑A pentan-2-ol: five carbons linked by single bonds with –OH group in Carbon No 2
☒B Pentan-4-ol: The –OH group has not given the lowest numbering system
☒C 1-methylbutan-3-ol: Longest continuous chain of carbons with –OH group is 5
☒D 4-methylbutan-1-ol Longest continuous chain of carbons with –OH group is 5</td></tr>
<tr><td>14</td><td>B</td><td></td><td><table>
<tr><td>Alcohol</td><td>Methanol</td><td>Ethanol</td><td>Propanol</td><td>Butanol</td><td>Pentanol</td><td>Hexanol</td><td>Heptanol</td><td>Octanol</td></tr>
<tr><td>Formula</td><td>CH_3OH</td><td>C_2H_5OH</td><td>C_3H_7OH</td><td>C_4H_9OH</td><td>$C_5H_{11}OH$</td><td>$C_6H_{13}OH$</td><td>$C_7H_{15}OH$</td><td>$C_8H_{17}OH$</td></tr>
<tr><td>Melting Point</td><td>low</td><td colspan="6">⟶</td><td>high</td></tr>
<tr><td>Boiling Point</td><td>low</td><td colspan="6">⟶</td><td>high</td></tr>
<tr><td>Solubility</td><td>high</td><td colspan="6">⟵</td><td>low</td></tr>
<tr><td>Strength of Intermolecular Bonds</td><td>low</td><td colspan="6">⟶</td><td>high</td></tr>
</table></td></tr>
<tr><td>15</td><td>B</td><td></td><td>☒A metal beaker used instead of glass beaker to allow heat to conduct better
☑B metal beaker and draught shield should be used for the most accurate result
☒C draught shield should be used to reduce heat loss
☒D draught shield should be used to reduce heat loss</td></tr>
<tr><td>16</td><td>C</td><td></td><td>☒A Alcohol used must be 2 carbon ethanol not 3 carbon propan-1-ol
☒B Alcohol used must be 2 carbon ethanol not 3 carbon propan-1-ol
☑C 2 carbon alcohol and 3 carbon haloalkane with –Cl group on C_2 of three carbons
☒D one of the reactants must be an alcohol with a –OH hydroxyl group</td></tr>
<tr><td>17</td><td>A</td><td></td><td>☑A X is most reactive as it reacts with water. Y is least reactive as it reacts slowest with dilute acid. Z is more reactive than W as Z reacts faster with dilute acid
☒B Y must be the least reactive metal as it has slowest reaction with dilute acid
☒C Z is less reactive than X as Z does not react with water
☒D Y must be the least reactive metal as it has slowest reaction with dilute acid</td></tr>
<tr><td>18</td><td>B</td><td></td><td>❶ $H_{2(g)} \longrightarrow 2H^+_{(aq)} + 2e^-$
❷ $2H_2O_{(l)} + O_{2(g)} + 4e^- \longrightarrow 4OH^-_{(aq)}$

❶x2 $2H_{2(g)} \longrightarrow 4H^+_{(aq)} + 4e^-$
❷ $2H_2O_{(l)} + O_{2(g)} + 4e^- \longrightarrow 4OH^-_{(aq)}$

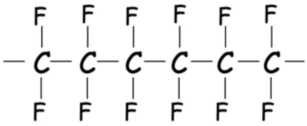
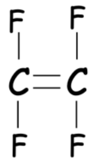
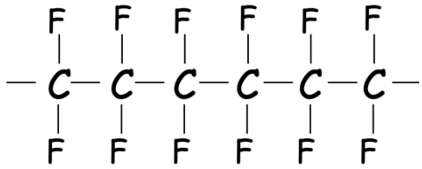
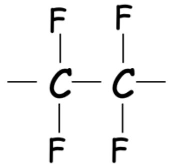
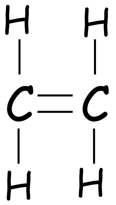
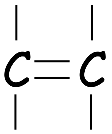
Add ❶'+❷ $2H_{2(g)} + 2H_2O_{(l)} + O_{2(g)} + 4e^- \longrightarrow 4H^+_{(aq)} + 4e^- + 4OH^-_{(aq)}$

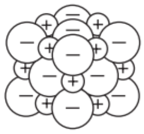
cancel down $2H_{2(g)} + 2H_2O_{(l)} + O_{2(g)} + \cancel{4e^-} \longrightarrow 4H^+_{(aq)} + \cancel{4e^-} + 4OH^-_{(aq)}$

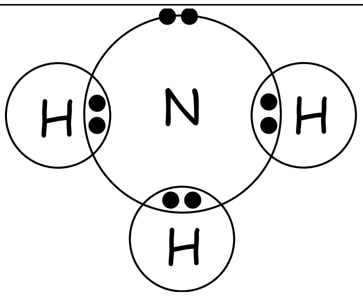
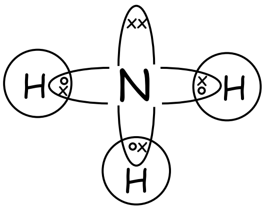
redox $2H_{2(g)} + 2H_2O_{(l)} + O_{2(g)} \longrightarrow 4H^+_{(aq)} + 4OH^-_{(aq)}$</td></tr>
<tr><td>19</td><td>A</td><td></td><td>Order in Electrochemical series $\overbrace{\text{Zinc} \quad \text{Nickel} \quad \underbrace{\text{Tin} \quad \text{Lead}}_{\text{smallest voltage}}}^{\text{largest Voltage}}$</td></tr>
<tr><td>20</td><td>C</td><td></td><td>☒A Ammonium chloride contains the element nitrogen and is soluble
☒B Ammonium phosphate contains elements nitrogen & phosphorus and is soluble
☑C sodium chloride does not contain nitrogen, phosphorus or potassium
☒D Sodium phosphate contains the element phosphorus and is soluble</td></tr>
<tr><td>21</td><td>C</td><td></td><td>☒A Nickel is the catalyst used in the production of margarine from vegetable oil
☒B Platinum is the catalyst in the Ostwald Process where nitric acid is produced
☑C iron is the catalyst in the Haber Process where ammonia is produced
☒D Rhodium is a transition metal used in a catalytic converter in a car</td></tr>
<tr><td>22</td><td>D</td><td></td><td>☒A beta particles bend towards the positive electrode ∴ Y is not a beta particle
☒B alpha particles bend towards the negative electrode ∴ Y is not a alpha particle
☒C beta particles bend towards the positive electrode ∴ X is not a beta particle
☑D X is alpha (bends towards to negative electrode) & Y is gamma (does not bend)</td></tr>
</table>

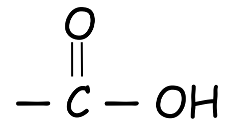
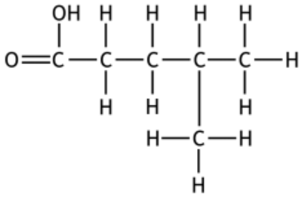
23	D		☒A covalent bonding contains a shared pair of electrons and two nuclei ☒B there is no attraction between negative ions and electrons (they repel) ☒C ionic bonding is the force of attraction between negative ions and positive ions ☑D metallic bonding is the force of attraction between positive ions and delocalised electrons
24	B		☒A neutralisation: reaction of H^+ ions to form H_2O ☑B precipitation: two ions combining to form an insoluble solid. ☒C addition: adding a molecule across a C=C double bond ☒D redox: electrons are transferred between reduction and oxidation reactions
25	D		☒A Filtration (Step Z) must occur before evaporation (Step X) ☒B Neutralisation Step Y must be first step ☒C Neutralisation Step Y must be first step ☑D Order: Neutralisation (Y) followed by Filtration (Z) followed by Evaporation (X)

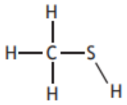
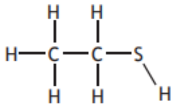
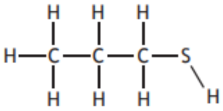
2018 National 5 Chemistry Marking Scheme

Long Qu	Answer	Reasoning
1a	Carbon dioxide	hydrochloric acid + calcium carbonate ⟶ calcium chloride + water + carbon dioxide ACID + METAL CARBONATE ⟶ SALT + WATER + CARBON DIOXIDE
1b(i)	$0.5\ cm^3\ s^{-1}$	$\text{Rate} = \frac{\Delta\text{Quantity}}{\Delta\text{Time}} = \frac{77 - 62\ \text{cm}^3}{50 - 20\ \text{s}} = 0.5\ \text{cm}^3\ \text{s}^{-1}$
1b(ii)	Graph showing:	1 mark One mark is awarded for a graph which shows points plotted rather than bars. 1 mark The axis/axes of the graph has/have suitable scale(s). - plotted points occupies at least half of the width and half of the height of the graph paper - The axes have suitable scales 1 mark The axes of the graph have suitable labels and units. 1 mark 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.
1b(iii)	68±1	Problem Solving: Reading information from a graph.
1c	One answer from:	Greater number of hydrogen ions/H^+ Greater concentration of hydrogen ions/H^+ Greater moles of hydrogen ions/H^+ More H^+ ions
2a(i)	addition	Addition reactions involve the opening up of the 2nd bond in a C=C double bond and single bonds being formed on either side. Addition Polymerisation is when the C=C double bond in the monomer opens up and joins with other monomers to form a long polymer chain.
2a(ii)		 Monomer  Polymer  Repeating Unit
2b		A addition monomer always has the shape:  The monomer given in the question has four fluorine atoms in its corners. The other monomer has four hydrogen atoms in its corners.
3a	Increase the percentage of carbon increases the average heat content	Problem Solving: Spotting a relationship in a table
3b	46.7	gfm FeS_2: (1x56) + (2x32) = 56 + 64 = 120 (1 mark) $\% \text{Fe} = \frac{56}{120} \text{ x } 100 = 46.7\%$ (1 mark)
4a	carbon & hydrogen	A hydrocarbon is a compound containing the elements carbon and hydrogen only.
4b	2-methylpropane or methylpropane	The longest continuous chain of carbons is 3 ∴ name ends in *propane* A 1 carbon side group is called a *methyl* ∴ *methyl*propane The methyl group is on 2nd carbon ∴ 2-methylpropane (It is acceptable to drop the number 2 as the methyl group can only be positioned on carbon number 2)

<table>
<tr><td>4c</td><td>stronger intermolecular</td><td>The process of evaporation/boiling does not change the strong covalent bonds inside a molecule. Boiling/evaporation is dependent on the weaker intermolecular bonds between molecules.
The higher boiling point of butane compared to isobutene is due to the stronger intermolecular bonds between butane molecules compared to isobutene molecules.</td></tr>
<tr><td>4d</td><td>150-154°C</td><td><table>
<tr><td>Alkane</td><td>Pentane</td><td>Hexane</td><td>Heptane</td><td>Octane</td><td>Nonane</td></tr>
<tr><td>Boiling Point (°C)</td><td>36</td><td>69</td><td>98</td><td>126</td><td>-</td></tr>
<tr><td>Difference:</td><td>▨</td><td>33</td><td>29</td><td>28</td><td>Prediction: 27</td><td>▨</td></tr>
<tr><td>Prediction:</td><td>-</td><td>-</td><td>-</td><td>-</td><td>153</td></tr>
</table></td></tr>
<tr><td>5a</td><td>Sodium azide, potassium nitrate and silicon dioxide</td><td>Problem Solving: Gathering information from a passage</td></tr>
<tr><td>5b</td><td>Potassium</td><td><table>
<tr><td>Element</td><td>Ion</td><td>Flame Colour</td></tr>
<tr><td>Barium</td><td>Ba^{2+}</td><td>Green</td></tr>
<tr><td>Potassium</td><td>K^+</td><td>Lilac</td></tr>
<tr><td>Calcium</td><td>Ca^{2+}</td><td>Orange-red</td></tr>
<tr><td>Sodium</td><td>Na^+</td><td>Yellow</td></tr>
</table>
<table>
<tr><td>Element</td><td>Ion</td><td>Flame Colour</td></tr>
<tr><td>Copper</td><td>Cu^{2+}</td><td>Blue-green</td></tr>
<tr><td>Strontium</td><td>Sr^{2+}</td><td>Red</td></tr>
<tr><td>Lithium</td><td>Li^+</td><td>Red</td></tr>
<tr><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>5c</td><td>SiO_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 to get formula</td></tr>
<tr><td>Si O
4 2</td><td>$\begin{matrix} Si & & O \\ & \times & \\ 4 & & 2 \end{matrix}$</td><td>$Si_2O_4$
Cancel Down
SiO_2</td></tr>
</table></td></tr>
<tr><td>5d</td><td>44</td><td>Total volume given off is the maximum height attained by the graph.</td></tr>
<tr><td>6a(i)</td><td>2</td><td>The two lines on the graph represent the two different isotopes of boron with mass numbers of 10 and 11.</td></tr>
<tr><td>6a(ii)</td><td>10.8</td><td>$\text{ram} = \frac{(10\text{x}20) + (11\text{x}80)}{100} = \frac{200+880}{100} = 10.8$</td></tr>
<tr><td>6b</td><td>$^{14}_{6}C$</td><td>Atomic number = number of protons = 6
Mass number = no. of protons + no. of neutrons = 6+8 = 14</td></tr>
<tr><td>7a</td><td>Lattice</td><td>Ionic compounds have a structure of alternating positive and negative ions in each direction.
This structure is called a lattice structure.
</td></tr>
<tr><td>7b(i)</td><td>Ions are free to move</td><td>In the solid state, ions are locked together in a lattice structure and cannot move. The circuit cannot be completed without the movement of ions.
In the liquid/molten state or the solution state, ions are free to move and will compete the circuit.</td></tr>
<tr><td>7b(ii)</td><td>oxidation</td><td><table>
<tr><td>$2Cl^-_{(aq)}$</td><td>$\longrightarrow$</td><td>$Cl_{2(g)}$</td><td>+</td><td>$2e^-$</td></tr>
<tr><td>chloride ions</td><td></td><td>chlorine gas</td><td></td><td>Loss of two electrons
by the reactants</td></tr>
</table></td></tr>
<tr><td>7b(iii)</td><td>One answer from:</td><td><table>
<tr><td>Allows products to be identified</td><td>To make sure that only one product is produced at each electrode</td><td>To separate the strontium from the chlorine</td></tr>
</table></td></tr>
<tr><td>8</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 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.</td><td>Demonstrates a reasonable 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 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.</td></tr>
</table></td></tr>
</table>

9a(i)	contains $C=C$ double bond	Saturated: All bonds between carbons are single bonds and it does not decolourise bromine solution quickly. Unsaturated: At least one $C=C$ double bond between carbons and will decolourise bromine solution quickly.
9a(ii)	Bromine solution decolourises	Bromine Br_2 adds across a $C=C$ double bond by addition reaction. Each bromine joins across where the $C=C$ double bond used to be and leaves a $C-C$ single bond in its place. Bromine solution is yellow/orange and decolourises (loses its colour) when it adds across the $C=C$ double bond.
9b	472.8	heat energy = specific heat capacity × mass × change in Temperature $E_h = c \times m \times \Delta T$ $E_h = 1.97\text{ kJ kg}^{-1}\,^{o}C^{-1} \times 1.5\text{kg} \times 20^{o}C$ $E_h = 472.8\text{ kJ}$
10a(i)	$N_2 + 3H_2 \rightleftharpoons 2NH_3$	$N_2 + H_2 \rightleftharpoons NH_3$ 2xN atoms on LHS but only 1xN atom on RHS ∴ Double NH_3 $N_2 + H_2 \rightleftharpoons 2NH_3$ 2xH atoms on LHS but 6xH atoms on RHS ∴ treble H_2 $N_2 + 3H_2 \rightleftharpoons 2NH_3$
10a(ii)	One answer from:	Reaction is reversible Reaction occurs in both directions The reaction is at equilibrium
10b	Answer showing:	 or 
10c	Ostwald Process	ammonia + oxygen $\xrightarrow[\text{catalyst}]{\text{platinum}}$ nitrogen monoxide + water $4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O$ $4NO \xrightarrow{\text{oxygen}} NO_2 \xrightarrow{\text{water}}$ Nitric Acid
10d	ammonium nitrate	ammonia + water ⟶ ammonium hydroxide ammonium hydroxide + nitric acid ⟶ ammonium nitrate + water
11a	Arrow showing flow through wires from magnesium/right to copper/left	Electrons travel through wires while ions flow through the solution. Electrons travel from higher metal in electrochemical series *(magnesium on right)* to metal lower down electrochemical series *(copper on left)*.
11b	One answer from:	Completes the circuit/cell allows ions to flow/move/transfer (between the two beakers) provide ions to complete circuit/cell

<table>
<tr><td>11c</td><td>$Cu^{2+} + 2e^{-} \longrightarrow Cu$</td><td>Reduction is the gain of electrons by the reactant.
Cu^{2+} ions will gain 2 electrons to become Cu metal.</td></tr>
<tr><td>11d</td><td>Insoluble</td><td>Magnesium phosphate is insoluble (p8 of data booklet) and the ions are not able to move so the circuit would not be complete.</td></tr>
<tr><td>12a</td><td>Alpha Particles are stopped by paper</td><td>
<table>
<tr><td>Radiation</td><td>Alpha</td><td>Beta</td><td>Gamma</td></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>12b</td><td>14.8</td><td>
<table>
<tr><td>Number of half-lives</td><td>Fraction</td></tr>
<tr><td>0</td><td>1</td></tr>
<tr><td>1</td><td>$^{1}/_{2}$</td></tr>
<tr><td>2</td><td>$^{1}/_{4}$</td></tr>
<tr><td>3</td><td>$^{1}/_{8}$</td></tr>
<tr><td>4</td><td>$^{1}/_{16}$</td></tr>
</table>
1 half-life = 3.7 years 4 half-lives = 4x3.7years = 14.8years</td></tr>
<tr><td>12c</td><td>increases
stays the same</td><td>$^{204}_{81}Tl \rightarrow ^{204}_{82}Pb + ^{0}_{-1}e$</td></tr>
<tr><td>13a(i)</td><td>Carboxyl group</td><td>
<table>
<tr><td>—O—H</td><td>$-\overset{\overset{\displaystyle O}{\|}}{C}-OH$</td></tr>
<tr><td>hydroxyl group</td><td>carboxyl group</td></tr>
</table>
</td></tr>
<tr><td>13a(ii)</td><td>134</td><td>Gfm $C_4H_6O_5$ = (4x12)+(6x1)+(5x16) = 48 + 6 + 80 = 134g</td></tr>
<tr><td>13b</td><td>As halogen atom goes down group 7 the acidity decreases.</td><td>
<table>
<tr><td colspan="4">Any correct statement linking acidity to the position of the halogen</td></tr>
<tr><td>The acidity (of the carboxylic acids) decreases going down the group</td><td>As you go (up) from iodine to fluorine the acidity increases</td><td>The one at the top (of the group) has the highest acidity</td><td>The one that has the lowest acidity is at the bottom (of the group)</td></tr>
</table>
</td></tr>
<tr><td>13c</td><td></td><td>The carbon with the hydroxyl –OH group changes. 2 hydrogens are removes and replaces with a C=O group forming a carboxyl –COOH group on that carbon.
Any structure of 4-methylpentanoic acid is correct.</td></tr>
<tr><td>14a</td><td>C</td><td>Sample C is only sample with chloride ion concentration below 0.25 g l^{-1}</td></tr>
<tr><td>14b(i)</td><td>Pipette</td><td>A pipette is the most appropriate piece of equipment to measure exact volume of liquids. They are more accurate that using measuring cylinders and beakers.</td></tr>
<tr><td>14b(ii)</td><td>One answer from:</td><td>
<table>
<tr><td>2 & 4 are concordant</td><td>They are within 0·2cm^3</td><td>They are within 0·1 or 0·1 apart</td><td>Titration 1 and 3 or the other two are not concordant or not within 0·2 of each other</td></tr>
</table>
</td></tr>
<tr><td>14b(iii)</td><td>0.000161</td><td>no. of moles = volume x concentration = 0.00805litres x 0.02mol l^{-1}
= 0.000161mol</td></tr>
<tr><td>15a</td><td>Diamond(s) anvil cell</td><td>Problem Solving Question</td></tr>
</table>

<table>
<tr><td>15b(i)</td><td>1.9million or 1900000</td><td>1000gigapascals $\longleftrightarrow$ 10million atmospheres
190 gigapascals $\longleftrightarrow$ 10million atmospheres x $^{190}/_{1000}$
= 1.9 million atmospheres</td></tr>
<tr><td>15b(ii)</td><td>Light bulb would not light up</td><td>Pressurised sodium becomes an insulator.
Circuit will not be complete and the bulb will not light up.</td></tr>
<tr><td>15c</td><td>Fe_2O_3
↓
$O_2 + Fe_5O_7$</td><td>Problem Solving Question</td></tr>
<tr><td>16a(i)</td><td>Homologous Series</td><td>Homologous Series are families of compounds that have similar chemical properties and a general formula.</td></tr>
<tr><td>16a(ii)</td><td>$C_nH_{2n+1}SH$
or
$C_nH_{2n+2}S$
or
$C_nH_{2n+1}HS$</td><td>
<table>
<tr><td>Name</td><td>Methanethiol</td><td>Ethanethiol</td><td>Propanethiol</td></tr>
<tr><td>Structure</td><td></td><td></td><td></td></tr>
<tr><td>Formula</td><td>CH_3SH</td><td>C_2H_5SH</td><td>C_3H_7SH</td></tr>
<tr><td>Relationship</td><td>If n=1, 2n+1=3</td><td>If n=2, 2n+1=5</td><td>If n=3, 2n+1=7</td></tr>
<tr><td>General Formula</td><td>$C_nH_{2n+1}SH$</td><td>$C_nH_{2n+1}SH$</td><td>$C_nH_{2n+1}SH$</td></tr>
</table>
</td></tr>
<tr><td>16b</td><td>Any answer from:</td><td>
<table>
<tr><td>Sulphur oxide</td><td>Sulphur monoxide</td><td>Sulphur dioxide</td><td>Sulphur trioxide</td></tr>
</table>
</td></tr>
<tr><td>16c</td><td>960</td><td>

gfm CH_3OH = (1x12)+(4x1)+(1x16) = 12+4+16 = 32g

$$\textbf{no. of mol} = \frac{\textbf{mass}}{\textbf{gfm}} = \frac{640g}{32g\ mol^{-1}} = 20mol$$

$$CH_3OH + H_2S \longrightarrow CH_3SH + H_2O$$

1mol 1mol
20mol 20mol

gfm CH_3SH = (1x12)+(4x1)+(1x32) = 12+4+32 = 48g

$$\textbf{mass} = \textbf{no. of mol} \times \textbf{gfm} = 20mol \times 48g\ mol^{-1} = 960g$$

</td></tr>
<tr><td>17</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>
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