JABchem

Past Papers

Standard Grade

Credit

Chemistry

2005

Marking Scheme

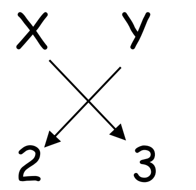
2005 Credit	KU		PS	
	/30	%	/30	%
1	23+	77%	23+	77%
2	16+	53%	17+	57%
See General Paper	<16	<53%	<17	<57%

2005 Standard Grade Chemistry Credit Marking Scheme

Question	Answer	Chemistry Covered
1a	B	see table below

Answer	A	B	C	D	E	F
Element	argon	potassium	magnesium	chlorine	phosphorus	sulphur
Flame Colour	Not listed in data booklet	lilac	Not listed in data booklet	Not listed in data booklet	Not listed in data booklet	Not listed in data booklet

Question	Answer	Chemistry Covered
1b	A	Ca atoms have electron arrangement of 2,8,8,2 Ca^{2+} ions have electron arrangement of 2,8,8. Argon also has an electron arrangement of 2,8,8 (page 6 of data booklet)
1c	E+F Both for 1 mark	see table below

Write down Formulae	Write Down Reverse of Cross Over Rule	Follow arrows to get formula
X_3Y_2		Valency of X=2 Element = Sulphur Valency of Y=3 Element = Phosphorus

Question	Answer	Chemistry Covered
2a	A	see table below
2b	E	see table below

Property	Fraction A	Fraction B	Fraction C	Fraction D	Fraction E
Name	Refinery Gas	Naphtha/Gasoline	Kerosene	Gas Oils	Residue
Use	Camping Gas	Petrol	Aircraft Fuel	Diesel	Tar
Chain Length	C_1-C_4	C_4-C_{10}	C_{10}-C_{16}	C_{16}-C_{20}	C_{20}+
Viscosity	Low	⟵	⟶	⟶	High
Evaporation	Easily	⟵	⟶	⟶	Slowly
Flammability	High	⟵	⟶	⟶	Low
Boiling Point	Low	⟵	⟶	⟶	High

Question	Answer	Chemistry Covered
3a	E	see table below
3b	C+D Both for 1 mark	see table below

Answer	A	B	C	D	E
Carbohydrate	glucose	fructose	maltose	sucrose	starch
Formula	$C_6H_{12}O_6$	$C_6H_{12}O_6$	$C_{12}H_{22}O_{11}$	$C_{12}H_{22}O_{11}$	$(C_6H_{10}O_5)_n$
Solubility	Soluble	Soluble	Soluble	Soluble	Insoluble
Type	monosaccharide	monosaccharide	disaccharide	disaccharide	polysaccharide

Question	Answer	Chemistry Covered
4a	E	To be a gas at 0°C, the boiling point must be below 0°C
4b	A+E Both for 1 mark	see table below

Answer	A	B	C	D	E	F
Bonding type	Covalent Molecular	Metallic	Metallic	Ionic	Covalent Molecular	Covalent Network
Reasoning	Covalent as no conduction as a solid or liquid. Low boiling point means covalent molecular	Metallic as conducts in both solid and liquid states.	Metallic as conducts in both solid and liquid states.	Ionic as it does not conduct in the solid state but does conduct in the liquid state.	Covalent as no conduction as solid or liquid. Low boiling point means covalent molecular	Covalent as no conduction as solid or liquid. High melting point means covalent network.

Question	Answer	Chemistry Covered
5a	F	see table below

Polymer	poly(ethene)	poly(propene)	poly(chloroethene)	polystyrene
Monomer	ethene	propene	chloroethene	styrene

Question	Answer	Chemistry Covered
5b	B+E Both for 1 mark	see table below

Answer	A	B	C	D	E	F
Homologous Series	alkane	cycloalkane	alkane	alkene	alkene	alkene
General Formula	C_nH_{2n+2}	**C_nH_{2n}**	C_nH_{2n+2}	C_nH_{2n}	**C_nH_{2n}**	C_nH_{2n}
Reaction with Bromine Solution	no reaction	**no reaction**	no reaction	quickly decolourises	**no reaction**	quickly decolourises

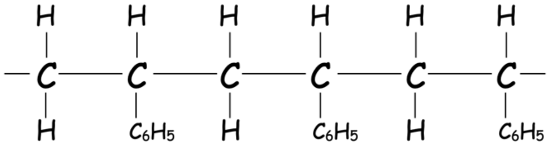
Question	Answer	Chemistry Covered
5c	D,E 1 mark each	Diagram of but-1-ene C_4H_8 in question:

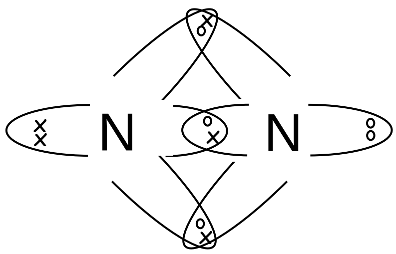
Answer	A	B	C	D	E	F
Name	2-methylpropane	cyclopropane	butane	2-methylpropene	cyclobutane	propene
Formula	C_4H_{10}	C_3H_6	C_4H_{10}	**C_4H_8**	**C_4H_8**	C_3H_6

Isomers have same formula but have different structure (and therefore name)

Question	Answer	Chemistry Covered
6	F	☒ A Reduction: gain of electrons (electrons before the arrow on LEFT) ☒ B Precipitation: 2 ions in solution meet and form an insoluble solid ☒ C Displacement: Higher up metal displaces lower down metal from its ion ☒ D Hydrolysis: molecule splits into smaller molecules with water added across break ☒ E Neutralisation: acids reacting with bases to form salt and water ☑ F Oxidation: loss of electrons (electrons after the arrow on RIGHT)

7	B,E 1 mark each	☒A magnesium reacts with both hydrochloric acid and sulphuric acid ☑B all acids have a pH below 7 ☒C both acids conduct electricity as they both contain ions ☒D hydrochloric acid produces chlorine during electrolysis but sulphuric acid does not. ☑E all acids contain more H^+ ions than pure water
8	A,D 1 mark each	☑A Metal X is less reactive than copper so is less readily oxidised ☒B Metal X is more reactive than silver so X oxide is more stable than silver oxide ☒C X is lower in Electrochemical Series so Magnesium would displace X from X nitrate ☑D nickel is more reactive than X so nickel would react with acid more vigorously. ☒E As X is less reactive than zinc, X is more readily oxidised than zinc
9	C,F 1 mark each	☒A Equation shows the neutralisation of H^+ and OH^- into water ☒B Equation shows the reverse reaction. 2nd Step in rusting is $Fe^{2+} \rightarrow Fe^{3+} + e^-$ ☑C First step in rusting/corrosion of iron: $Fe \rightarrow Fe^{2+} + 2e^-$ ☒D Equation shows the reverse reaction. 1st Step in rusting is $Fe \rightarrow Fe^{2+} + 2e^-$ ☒E Equation shows oxidation of Hydrogen and is not a step in rusting/corrosion. ☑F The water and oxygen required for corrosion/rusting accepts the electrons from the oxidation of iron metal atoms

<table>
<tr><th>Question</th><th>Answer</th><th>Chemistry Covered</th></tr>
<tr><td>10a(i)</td><td>$Zn \rightarrow Zn^{2+} + 2e^-$</td><td>Equation for reduction of Zn^{2+} ions to Zn atoms is on page 10 of data booklet. Oxidation is the reverse of reaction in data booklet</td></tr>
<tr><td>10a(ii)</td><td>sacrificial</td><td>This is an example of galvanising iron/steel to protect it, it is sacrificial protection where a higher up metal (zinc) protects a lower down metal (iron)</td></tr>
<tr><td>10b</td><td>cobalt is less reactive than iron</td><td>electrons move from iron to cobalt to sacrificially protect the cobalt</td></tr>
<tr><td>11a</td><td>Diagram showing:</td><td></td></tr>
<tr><td>11b</td><td>92.3%</td><td>gfm C_8H_8 = (8x12) + (8x1) = 96 + 8 = 104g
$\%C = \frac{\text{mass of C}}{\text{gfm}} \times 100 = \frac{96}{104} \times 100 = 92.3\%$</td></tr>
<tr><td>12a</td><td>C_nH_{2n+2}</td><td><table>
<tr><td>Homologous Series</td><td>Alkanes</td><td>Alkenes</td><td>Cycloalkanes</td><td>Alcohols</td><td>Carboxylic Acids</td></tr>
<tr><td>General Formula</td><td>C_nH_{2n+2}</td><td>C_nH_{2n}</td><td>C_nH_{2n}</td><td>$C_nH_{2n+1}OH$</td><td>$C_nH_{2n+1}COOH$</td></tr>
</table></td></tr>
<tr><td>12b(i)</td><td>150-160°C</td><td><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><td>Nonane</td></tr>
<tr><td>Boiling Pt (°C)</td><td>-162</td><td>-89</td><td>-42</td><td>-2</td><td>36</td><td>69</td><td>98</td><td>126</td><td>-</td></tr>
<tr><td>Difference (°C)</td><td></td><td>73</td><td>47</td><td>40</td><td>34</td><td>30</td><td>29</td><td>28</td><td>(27)</td></tr>
<tr><td>Estimate (°C)</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>153</td></tr>
</table></td></tr>
<tr><td>12b(ii)</td><td>lower temperature or less energy required</td><td>Catalyst can use less energy to perform the same reaction improving safety and efficiency/costs</td></tr>
<tr><td>12c</td><td>iodomethane and iodopropane</td><td>1C from iodomethane and 3C from iodopropane join together to form 4C alkane</td></tr>
<tr><td>13a(i)</td><td>2</td><td>^6Li and ^7Li isotopes present in sample</td></tr>
<tr><td>13a(ii)</td><td>6.9</td><td>r.a.m. $= \frac{6\times10 + 7\times90}{100} = \frac{60 + 630}{100} = \frac{690}{100} = 6.9$</td></tr>
<tr><td>13b</td><td><table>
<tr><td>Particle</td><td>Number</td></tr>
<tr><td>proton</td><td>3</td></tr>
<tr><td>neutron</td><td>4</td></tr>
<tr><td>electron</td><td>2</td></tr>
</table></td><td>no. of protons = atomic number (bottom number)
no. of neutrons = mass number – atomic number
no. of electrons = number of protons – charge</td></tr>
<tr><td>14a</td><td>to ensure all acid has reacted/neutralised</td><td>When enough copper carbonate has been added, there will be no acid left in the beaker. Excess copper carbonate will lie on the bottom and the acid will be completely neutralised.</td></tr>
<tr><td>14b</td><td>Step 4: Filter contents of beaker

Step 5: Evaporate water</td><td>Step 4 Filtration: removes the unreacted/excess copper carbonate powder from the bottom of the beaker
Step 5: Evaporation: turns the filtrate copper chloride solution into crystals of copper chloride</td></tr>
<tr><td>15a</td><td>
</td><td>Any diagram with overlapping of 3 half-filled electron clouds and a non-bonding pair of electrons</td></tr>
<tr><td>15b(i)</td><td>Ostwald Process</td><td>$NH_3 + O_2 \xrightarrow[\text{catalyst}]{\text{Pt}} NO_2 + H_2O$
NO_2 gas dissolves in water to form nitric acid HNO_3</td></tr>
</table>

<table>
<tr><td>15b(ii)</td><td>The reaction is exothermic or gives out heat</td><td>The reaction in the Ostwald Process gives out enough heat energy to maintain the high temperature once the reaction is hot enough to get started</td></tr>
<tr><td>16a</td><td>Equation showing:</td><td>$2HCl + Na_2S_2O_3 \longrightarrow 2NaCl + S + SO_2 + H_2O$</td></tr>
<tr><td>16b(i)</td><td>Line graph question</td><td>½ mark – both labels with units
½ mark – both scales
½ mark – points plotted correctly
½ mark – points joined</td></tr>
<tr><td>16b(ii)</td><td>~15 second
(depends on how your graph is drawn!)</td><td>Extrapolate line (i.e. extend line to right following trend on graph)
Find 60°C on x-axis, follow line up to estimate value on y-axis at point</td></tr>
<tr><td>16b(iii)</td><td>as temp increases the speed increases</td><td>NB the question specifically asks about speed of reaction and not the time taken for the reaction. Answer must talk about speed of reaction</td></tr>
<tr><td>16c</td><td>concentration / volume of solutions
darkness of X/size of conical flask</td><td>Vague answers like amount of solution and strength of solution are not accepted</td></tr>
<tr><td>17a</td><td>$C_6H_{12}O_6$</td><td><table>
<tr><td>Carbohydrate</td><td>glucose</td><td>fructose</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>17b(i)</td><td>Hydrolysis</td><td>Hydrolysis is a chemical reaction where polymers e.g. starch are broken down to their monomers (e.g. glucose)</td></tr>
<tr><td>17b(ii)</td><td>Temperature too high or
Enzyme is denatured at high temp</td><td>Enzymes work best at 37°C and a permanently reshaped at high temperature and don't work again (denatured)</td></tr>
<tr><td>18a</td><td>$CuO + H_2 \rightarrow Cu + H_2O$</td><td><table>
<tr><td>Name</td><td>Notes on How to Work Out Formula</td></tr>
<tr><td>copper(II) oxide</td><td>Use crossover rule to work out formula (Copper has valency 2)</td></tr>
<tr><td>hydrogen</td><td>Hydrogen is a diatomic element with formula H_2</td></tr>
<tr><td>copper</td><td>Copper is a metal element and comes in single Cu atoms</td></tr>
<tr><td>water</td><td>Water is hydrogen oxide with formula H_2O.</td></tr>
</table></td></tr>
<tr><td>18b</td><td>turns red/brown colour</td><td>red/brown coloured copper metal is formed</td></tr>
<tr><td>18c</td><td>calcium is too reactive to remove oxygen from calcium</td><td>Calcium is too high up electrochemical/reactivity series for extraction of the metal from the ore by this method.</td></tr>
<tr><td>19a</td><td>Arrow showing movement of electron through wires from A(left) to B(right)</td><td>Reaction at Electrode A produces electrons
Reaction at electrode B accepts electrons
∴ electrons travel from A to B through wires</td></tr>
<tr><td>19b</td><td>To complete the circuit</td><td>Ions in electrolyte are able to flow and complete the circuit between the electrodes</td></tr>
<tr><td>19c</td><td>covalent or not ionic</td><td>Sugar is a carbohydrate ∴ C, H & O in sugar ∴ non-metals only ∴ covalent bonding</td></tr>
<tr><td>19d(i)</td><td>Transition Metals</td><td>Platinum is listed as a transition metal on page 4 of data booklet</td></tr>
<tr><td>19d(ii)</td><td>Turns harmful gases into harmless gases</td><td>Catalytic convertors catalyse the following reactions:<table><tr><td>$CO \rightarrow CO_2$</td><td>$NO_2 \rightarrow N_2$</td><td>unburnt hydrocarbons $\rightarrow CO_2 + H_2O$</td></tr></table></td></tr>
<tr><td>20a</td><td>$Al_2(SO_4)_3$</td><td>A salt is formed from the reaction of an acid with either a metal or a base.
$2Al + 3H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 3H_2$
Metal + Acid ⟶ Salt + Hydrogen</td></tr>
<tr><td>20b</td><td>0.15</td><td>1 mol Al = 31g
$\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{1.35g}{27g\ mol^{-1}} = 0.05mol$
$2Al + 3H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 3H_2$
2mol → 3mol
0.05mol → 0.075mol
1mol H_2 = 2x1 = 2g
$\text{mass} = \text{no. of mol} \times \text{gfm} = 0.075mol \times 2g\ mol^{-1} = 0.15g$</td></tr>
</table>