JABchem

Past Papers

Standard Grade

Credit

Chemistry

2002

Marking Scheme

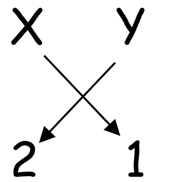
2002 Credit	KU		PS	
	/30	%	/30	%
1	20+	67%	19+	63%
2	14+	47%	13+	43%
See General Paper	<14	<47%	<13	<43%

2002 Standard Grade Chemistry Credit Marking Scheme

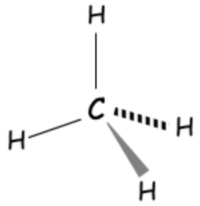
Question	Answer	Chemistry Covered
1a	A+C Both for 1 mark	Fertilisers are soluble salts containing potassium, phosphorus and/or nitrogen
1b	B+F Both for 1 mark	Bases neutralise acids. Bases include metal hydroxides (alkalis), metals oxides and metal carbonates
2a	A	see table below
2b	B+F Both for 1 mark	see table below

Answer	A	B	C	D	E	F
Bonding type	Ionic	Covalent Molecular	Metallic	Covalent Network	Metallic	Covalent Molecular
Reasoning	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. High melting point means covalent network.	Metallic as conducts in both solid and liquid states.	Covalent as no conduction as solid or liquid. High melting point means covalent network.	Metallic as conducts in both solid and liquid states.	Covalent as no conduction as solid or liquid. Low boiling point means covalent molecular

3a — C+E (Both for 1 mark)

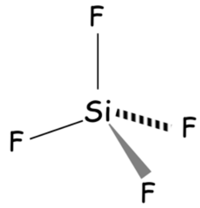
Write down Formulae	Write Down Reverse of Cross Over Rule	Follow arrows to get formula
XY_2		Valency of X=2 Metal X = Magnesium Valency of Y=1 Element = Fluorine

3b — D+E (Both for 1 mark)



Methane CH_4 has tetrahedral shape.

- Si can substitute for C in CH_4 as they are both in group 4.
- F can substitute for H in CH_4 as they both have a valency of 1.



4a — B+D (Both for 1 mark)

Answer	A	B	C	D	E	F
Name	butane	2-methylpropene	cyclobutane	but-1-ene	cyclopropane	2-methylpropane
Homologous Series	alkane	**alkene**	cycloalkane	**alkene**	cycloalkane	alkane

4b — C

Answer	A	B	C	D	E	F
Name	butane	2-methylpropene	cyclobutane	but-1-ene	cyclopropane	2-methylpropane
Homologous Series	alkane	alkene	**cycloalkane**	alkene	cycloalkane	alkane
Formula	C_4H_{10}	C_4H_8	**C_4H_8**	C_4H_8	C_3H_6	C_4H_{10}

5a — C

Answer	A	B	C	D	E
Element	Magnesium	Oxygen	Magnesium	Neon	Oxygen
no. of protons	12	8	12	10	8
no. of neutrons	13	10	12	12	10
Charge	no charge	-2	+2	no charge	no charge
Symbol	$^{25}_{12}Mg$	$^{18}_{8}O^{2-}$	$^{24}_{12}Mg^{2+}$	$^{22}_{10}Ne$	$^{18}_{8}O$

5b — A+C (Both for 1 mark)

Isotopes	
	Same atomic number but different mass number
	Same number of protons but different number of neutrons

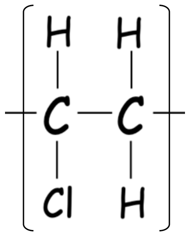
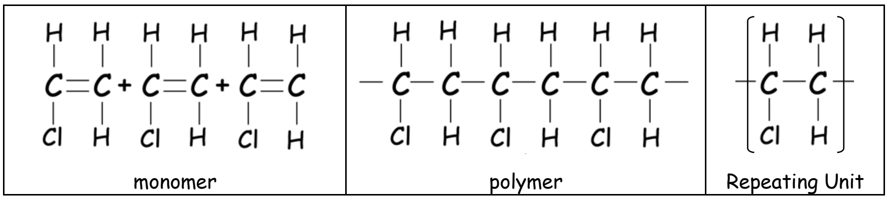
6 — B, E (1 mark each)

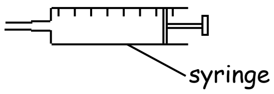
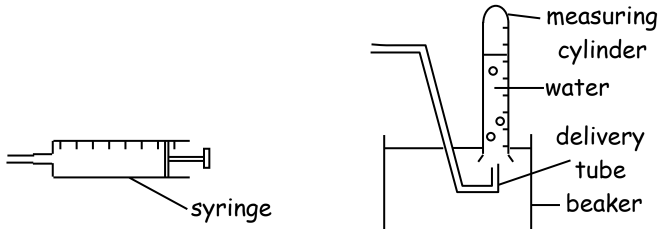
☒A Top number is the mass number which is the number of protons + number of neutrons
☑B No. of neutrons = mass number – atomic number = 14 – 6 = 8
☒C Number of protons = 6 (atomic number). Number of neutrons = mass no – atomic no. = 14 – 6 = 8.
☒D Number of protons = 6 (atomic number). Number of neutrons = mass no – atomic no. = 14 – 6 = 8.
☑E In neutral atoms: no. of protons = no. of electrons
☒F Number of electrons = number of protons = 6. Number of neutrons = mass no – atomic no. = 14–6 = 8.

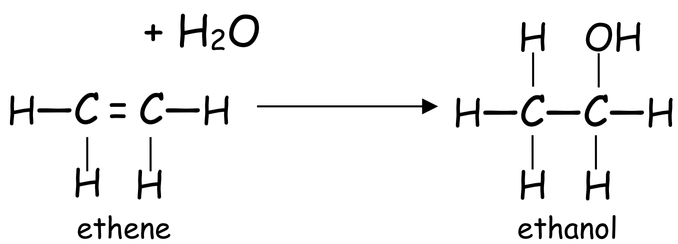
7a — F

☒A Combustion Reaction: $C_4H_{10} + 6\frac{1}{2}O_2 \rightarrow 4CO_2 + 5H_2O$
☒B Neutralisation Reaction: $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$
☒C Redox Reaction: $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$
☒D Redox Reaction: $2Li + 2H_2O \rightarrow 2LiOH + H_2$
☒E Reduction of copper ore by heating with carbon: $2CuO + C \rightarrow 2Cu + CO_2$
☑F No Reaction: Displacement reactions only proceed if metal is higher up than ion

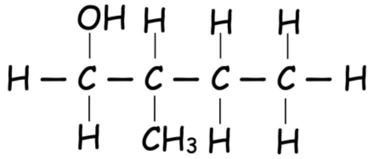
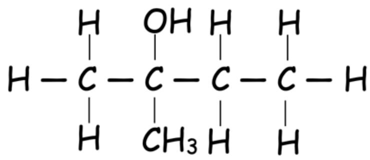
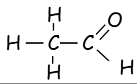
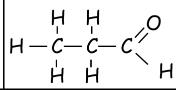
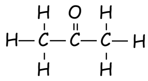
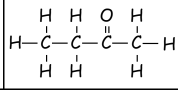
7b	A, B 1 mark each	☑A Hydrocarbons burn in oxygen to for carbon dioxide and water ☑B metal carbonates react with dilute acids to form salt + water + carbon dioxide ☒C MAZIT metals react with dilute acids to form salt + hydrogen gas ☒D Reactive metals in Group 1 react with cold water: Group 1 metal + water → salt + hydrogen ☒E Carbon removes oxygen from copper to form carbon dioxide: $2CuO + C \rightarrow CO_2 + 2Cu$ ☒F Displacement reaction: Cu not high enough in Reactivity Series to displace Zn from its ion
8a	A+D Both for 1 mark	☑A Combustion of hydrogen ☒B Displacement Reaction ☒C Oxidation of Fe^{2+} ions ☑D Combustion of methane ☒E reduction reaction involved in corrosion where oxygen and water accept electrons ☒F Reductions of Fe^{2+} ions
8b	C, E 1 mark each	☑ C – iron metal oxidises to Fe^{2+} ions then Fe^{2+} ions further oxidise to become Fe^{3+} ions: $Fe^{2+} \rightarrow Fe^{3+} + e^-$ ☑ E – water and oxygen are required to accept electrons during rusting: $2H_2O + O_2 + 4e^- \rightarrow 4OH^-$
9	C, F 1 mark each	☒A Fluorine has an electron arrangement of 2,7 and becomes stable by gaining an electron ☒B Fluorine is a non-metal and tends to gain electrons to get a stable electron arrangement ☑C Fluorine has an electron arrangement of 2,7. On gaining 1 electron it becomes stable 2,8 ☒D Fluorine atoms have 9 electrons and oxygen atoms have 8 electrons. ☒E Fluorine atoms have 9 electrons and chlorine atoms have 17 electrons. ☑F Iodine and fluorine are both in group 7 (Halogens) and both have 7 outer electrons.

Question	Answer	Chemistry Covered
10a	cracking	Cracking turns less useful long chain saturated hydrocarbons into shorter hydrocarbons, the unsaturated ones being useful for making plastics
10b(i)		
10b(ii)	hydrogen chloride or carbon monoxide	PVC releases poisonous hydrogen chloride gas when burnt plastics release poisonous carbon monoxide when burnt
11a(i)	hydrolysis	Hydrolysis: starch + water $\longrightarrow$ glucose
11a(ii)	fructose or maltose	<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>Reaction with Benedict's Solution</td><td>turns brick red</td><td>turns brick red</td><td>turns brick red</td><td>no change</td><td>no change</td></tr><tr><td>Type</td><td>monosaccharide</td><td>monosaccharide</td><td>disaccharide</td><td>disaccharide</td><td>polysaccharide</td></tr></table>
11a(iii)	enzymes denature at high temperatures	At high temperature (well above 37°C), enzymes change shape and denature. This stops the enzyme from breaking down the starch into glucose and this is why there is no colour change with Benedict's solution
11b	$C_6H_{12}O_6$	<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>
12a(i)	$TiCl_4 + 2H_2O$ $\downarrow$ $TiO_2 + 4HCl$	$TiCl_4 + 2H_2O \longrightarrow TiO_2 + 4HCl$
12a(ii)	covalent bonding	Covalent compounds have lower melting/boiling points and can be liquids and gases at room temperature. Ionic compounds have higher melting points are all solid at room temp.
12b	60%	gfm TiO_2 = (1x48) + (2x16) = 48 + 32 = 80g $\%Ti = \frac{\text{mass of Ti}}{\text{gfm}} \times 100 = \frac{48}{80} \times 100 = 60\%$
13a	$Cu + 2Ag^+ \rightarrow Cu^{2+} + 2Ag$	$Cu + 2Ag^+ + 2NO_3^- \longrightarrow Cu^{2+} + 2Ag + 2NO_3^-$ Cancel out any spectator ions which appear on both sides $Cu + 2Ag^+ + \cancel{2NO_3^-} \longrightarrow Cu^{2+} + 2Ag + \cancel{2NO_3^-}$ Re-write equation omitting spectator ions $Cu + 2Ag^+ \longrightarrow Cu^{2+} + 2Ag$
13b	$Cu \rightarrow Cu^{2+} + 2e^-$	Redox Reaction: $Cu + 2Ag^+ \longrightarrow Cu^{2+} + 2Ag$ Separate equations: $2Ag^+ \longrightarrow 2Ag$; $Cu \longrightarrow Cu^{2+}$ Reduction: $2e^- + 2Ag^+ \longrightarrow 2Ag$ Oxidation: $Cu \longrightarrow Cu^{2+} + 2e^-$
13c(i)	copper silver silver nitrate solution	In cells, a metal electrode is placed in a solution of its own ions e.g. silver in silver nitrate solution

<table>
<tr><td>13c(ii)</td><td>precipitate produced in ion bridge</td><td>sodium carbonate will react with copper nitrate to form copper carbonate precipitate. Sodium carbonate will react with silver nitrate to form silver carbonate precipitate. Precipitate may stop ion bridge from completing the circuit.</td></tr>
<tr><td>14a</td><td>
</td><td>

Gas Syringe
Collection Over Water
(some CO_2 will dissolve in water)</td></tr>
<tr><td>14b</td><td>Line graph</td><td>½ mark - both labels with units
½ mark - points plotted correctly
½ mark - both scales
½ mark - points joined</td></tr>
<tr><td>14c</td><td>~22cm^3 (from graph)</td><td>Estimate the value from the graph at 20 seconds</td></tr>
<tr><td>14d</td><td>$(Na^+)_2CO_3^{2-}$</td><td><table>
<tr><td>Write down Valency below each ion's symbol</td><td>Put in Cross-over Arrows</td><td>Follow arrows and cancel down to get formula</td></tr>
<tr><td>Na CO_3^{2-}
1 2</td><td>Na CO_3^{2-}
1 2</td><td>Na_2CO_3
Work out charges on ions. If more than one of ion put ion in brackets and number outside
$(Na^+)_2CO_3^{2-}$</td></tr>
</table></td></tr>
<tr><td>15a</td><td><table>
<tr><th>Metal</th><th>Extraction Method</th></tr>
<tr><td>mercury</td><td>heat alone</td></tr>
<tr><td>lead</td><td>heat + carbon</td></tr>
<tr><td>magnesium</td><td>molten electrolysis</td></tr>
</table></td><td><table>
<tr><th>Method</th><th>Reactivity</th><th colspan="6">Metals Made this Method</th></tr>
<tr><td>heat alone</td><td>least reactive</td><td>Hg</td><td>Ag</td><td>Au</td><td>Pt</td><td></td><td></td></tr>
<tr><td>heat + carbon</td><td>Medium reactive</td><td>Zn</td><td>Fe</td><td>Sn</td><td>Pb</td><td>Cu</td><td></td></tr>
<tr><td>molten electrolysis</td><td>Most Reactive</td><td>K</td><td>Na</td><td>Li</td><td>Ca</td><td>Mg</td><td>Al</td></tr>
</table></td></tr>
<tr><td>15b(i)</td><td>Blast furnace</td><td>Iron is made in a blast furnace</td></tr>
<tr><td>15b(ii)</td><td>1120 tonnes</td><td>1mol Fe_2O_3 = (2x56) + (3x16) = 112 + 48 = 160g
$\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{1600g}{160g\ mol^{-1}} = 10mol$
$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$
1mol 2mol
10mol 20mol
1mol Fe = 56g
mass = no. of mol x gfm = 20mol x 56g mol^{-1} = 1120g
160g Fe_2O_3 produces 1120g of Fe
∴ 160tonnes Fe_2O_3 produces 1120tonnes of Fe</td></tr>
<tr><td>16a</td><td>carbon dioxide</td><td>glucose $\xrightarrow[\text{(no air)}]{\text{yeast enzymes}}$ ethanol + carbon dioxide
$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$</td></tr>
<tr><td>16b</td><td>alcohol kills the yeast</td><td>At ~15% alcohol, the yeast is poisoned by the alcohol. Drinks made by fermentation alone have a maximum alcohol concentration of ~16%. Drinks with an alcohol concentration greater than this have to be made using distillation.</td></tr>
<tr><td>16c(i)</td><td>Addition
Or
Hydration</td><td>Addition: molecule adds across the C=C double bond


Hydration: H_2O molecule adds across the C=C double bond</td></tr>
</table>

<table>
<tr><td>16c(ii)</td><td>One from:</td><td>
2-methylbutan-1-ol
or

2-methylbutan-2-ol</td></tr>
<tr><td>17a(i)</td><td>$C_nH_{2n}O$</td><td><table>
<tr><td>Type</td><td>Aldehyde</td><td>Aldehyde</td><td>Ketone</td><td>Ketone</td></tr>
<tr><td>Structure</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Formula</td><td>C_2H_4O</td><td>C_3H_6O</td><td>C_3H_6O</td><td>C_4H_8O</td></tr>
<tr><td>Relationship</td><td>If n=2 then 2n=4</td><td>If n=3 then 2n=6</td><td>If n=3 then 2n=6</td><td>If n=4 then 2n=8</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><td>$C_nH_{2n}O$</td></tr>
</table></td></tr>
<tr><td>17a(ii)</td><td>Answer to include:</td><td>Alcohol with an –OH on end form aldehydes
or Alcohol with –OH group in middle of chain form ketones</td></tr>
<tr><td>17b</td><td>aluminium is too reactive</td><td>Aluminium is much higher up Electrochemical/Reactivity series than copper</td></tr>
<tr><td>18a</td><td>readily available</td><td>Cost of raw materials to make the product is a key factor in efficient production</td></tr>
<tr><td>18b</td><td>hydrogen</td><td>Water and north sea gas(methane) both contain hydrogen. Air contains no hydrogen but contains nitrogen, the other reactant to make ammonia</td></tr>
<tr><td>18c</td><td>ammonium phosphate</td><td>Ammonia forms ammonium hydroxide in water and is neutralised by phosphoric acid:
ammonium hydroxide + phosphoric acid $\longrightarrow$ ammonium phosphate + water</td></tr>
<tr><td>18d(i)</td><td>The higher the temp the lower the % yield</td><td>Pick same pressure for each line and read % Yield on y-axis
e.g. at 100 atmospheres pressure:<table>
<tr><td>Temperature</td><td>200°C</td><td>300°C</td><td>400°C</td><td>500°C</td></tr>
<tr><td>Yield at 100 atm pressure</td><td>81%</td><td>53%</td><td>26%</td><td>10%</td></tr>
</table></td></tr>
<tr><td>18d(ii)</td><td>Ammonia breaks down before reaching 100% NH_3</td><td>$N_2 + 3H_2 \longrightarrow 2NH_3$ reaction never reaches 100% NH_3 as the NH_3 breaks back down to the reactants.</td></tr>
<tr><td>19a(i)</td><td>20.1cm^3</td><td>Ignore 1st titre (rough titre) when calculating average volume.
average titre = $\frac{20.0 + 20.2}{2} = \frac{40.2}{2}$ = 20.1cm^3</td></tr>
<tr><td>19a(ii)</td><td>0.00201mol</td><td>no. of mol = volume × concentration
= 0.0201litres × 0.1 mol/l
= 0.00201 mol</td></tr>
<tr><td>19b</td><td>0.0804 mol/l</td><td>sodium hydroxide + ethanoic acid $\longrightarrow$ sodium ethanoate + water
1mol 1mol
0.00201mol 0.00201mol
concentration = $\frac{\text{no. of mol}}{\text{volume}} = \frac{0.00201\text{mol}}{0.025\text{litres}}$ = 0.0804 mol l^{-1}</td></tr>
</table>