Past Papers

Standard Grade

Credit

Chemistry

2009

Marking Scheme

2009 Credit	KU		PS	
	/30	%	/30	%
1	+23	77%	+22	73%
2	+17	57%	+14	47%
See general	<17	<57%	<14	<47%

2009 Standard Grade Chemistry Credit Marking Scheme

Question 1a — Answer: A

Carbohydrate	glucose	fructose	maltose	sucrose	starch
Formula	$C_6H_{12}O_6$	$C_6H_{12}O_6$	$C_{12}H_{22}O_{11}$	$C_{12}H_{22}O_{11}$	$(C_6H_{10}O_5)_n$
Reaction with Benedict's Sol	Blue→Brick Red	Blue→Brick Red	Blue→Brick Red	No reaction	No reaction

Question 1b — Answer: F

Ferroxyl indicator turns blue in the presence of Fe^{2+} ions
Ferroxyl indicator turns pink in the presence of OH^- ions

Question 2a — Answer: D

Metal Ion	Strontium	Lithium	Calcium	Barium	Sodium	Potassium
Flame Colour	red	red	orange-red	green	yellow	lilac

Question 2b — Answer: F

Argon atoms have electron arrangement of 2,8,8
Potassium atoms have electron arrangement of 2,8,8,1 ∴ K^+ ions are 2,8,8
Chlorine atoms have electron arrangement of 2,8,7 ∴ Cl^- ions are 2,8,8

Question 3a — Answer: B

Covalent substances do not conduct in any state ∴ Only substances B+C are covalent

- Substance B is covalent network as it has high melting point

Bonding	Solid	Liquid	Solution
Metallic (metals only)	✓	✓	-
Covalent (non-metals only)	×	×	×
Ionic (metals + non-metals)	×	✓	✓

Question 3b — Answer: D

Calcium fluoride is ionic

- Metal + non-metal in substance

Ionic compounds do not conduct as solids but conduct when in liquid state

Question 4a — Answer: C

A base is a substance which neutralises an acid:

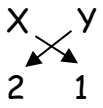
metal hydroxides (alkali)	metal oxides	metal carbonates

Question 4b — Answer: A+C (Both for 1 mark)

aluminium bromide + potassium hydroxide → aluminium hydroxide + potassium bromide
(soluble) (soluble) (insoluble) (soluble)

Question 4c — Answer: F

XY_2



X must have valency 2
Y must have valency 1

Question 5a — Answer: B+E (Both for 1 mark)

Isomers have same molecular formula but different structural formula:
pentene with C=C double bond: C_5H_{10} cyclopentane with ring structure: C_5H_{10}

Question 5b — Answer: C

Compound	ethane	pentene	cyclohexane	pentane	cyclopentane	propene
Boiling Point	-89°C	30°C	81°C	36°C	49°C	-47°C

Question 5c — Answer: B+F (Both for 1 mark)

Alkenes react by addition reactions as they have a C=C double bond

- Alkanes and Cycloalkanes do not have C=C double bond and do not react

Question 6a — Answer: E

Acid rain is formed when sulphur dioxide dissolves in rain water forming an acid

Question 6b — Answer: C

In combustion reactions, substances burn and react with oxygen.

Question 6c — Answer: B,D (1 mark each)

The three reaction involved in corrosion(rusting) of iron are:

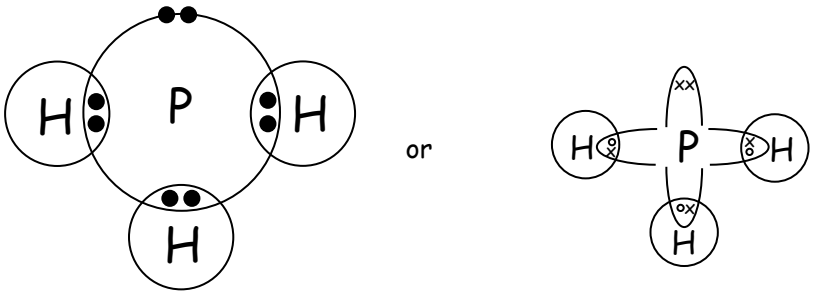
1. $Fe \rightarrow Fe^{2+} + 2e^-$ followed by 2. $Fe^{2+} \rightarrow Fe^{3+} + e^-$
3. $2H_2O + O_2 + 4e^- \rightarrow 4OH^-$

Question 7 — Answer: A,F (1 mark each)

Particle	Location	Charge	Mass
Proton	in nucleus	+1	1 amu
Neutron	in nucleus	0	1 amu
Electron	outside nucleus	-1	approx zero

Question 8 — Answer: C,D (1 mark each)

Property	Fraction 1	Fraction 2	Fraction 3	Fraction 4	Fraction 5	Fraction 6
Viscosity	Low	←	→	→	→	High
Evaporation	Easily	←	→	→	→	Slowly
Flammability	High	←	→	→	→	Low
Boiling Point	Low	←	→	→	→	High

<table>
<tr><th>Question</th><th>Answer</th><th>Chemistry Covered</th></tr>
<tr><td>9a</td><td><table><tr><td>10</td><td>10</td></tr><tr><td>10</td><td>11</td></tr><tr><td>10</td><td>12</td></tr></table></td><td>Number of Protons = atomic number (lower number)
Number of Neutrons = mass number – atomic number
(top number) (lower number)</td></tr>
<tr><td>9b</td><td>Isotopes</td><td><table><tr><td rowspan="2">Isotopes</td><td>Same atomic number but different mass number</td></tr><tr><td>Same number of protons but different number of neutrons</td></tr></table></td></tr>
<tr><td>9c</td><td>20</td><td>The average atomic mass = 10.2 from masses of 10,11 and 12. The most common type of atom must be 10 as average 10.2 is closest to 10</td></tr>
<tr><td>10a</td><td>Electrolysis</td><td>Electrolysis: Passing electricity through a substance and the substance breaks back down to its elements.</td></tr>
<tr><td>10b</td><td>$(Al^{3+})_2(O^{2-})_3$</td><td>Al^{3+} O^{2-} → 3 2 → $(Al^{3+})_2(O^{2-})_3$</td></tr>
<tr><td>10c</td><td>Ions free to move</td><td><table><tr><td>Solid Ionic Compounds</td><td>Ions unable to move in ionic lattice</td></tr><tr><td>Molten Ionic Compounds</td><td rowspan="2">Ions free to move</td></tr><tr><td>Ionic Compound Solutions</td></tr></table></td></tr>
<tr><td>11a</td><td>Hydrogen + Carbon</td><td><table><tr><td>Colourless Liquid in Test Tube A</td><td>Water formed from burning gas X
∴Hydrogen in water must have come from gas X</td></tr><tr><td>Colourless Liquid in Test Tube B</td><td>Carbon Dioxide formed from burning gas X
∴Carbon in CO_2 must have come from gas X</td></tr></table></td></tr>
<tr><td>11b</td><td><table><tr><td>Observation at A</td><td>Observation at B</td></tr><tr><td>Colourless liquid forms</td><td>No change</td></tr></table></td><td><table><tr><td>Colourless Liquid in Test Tube A</td><td>Water formed from burning hydrogen</td></tr></table></td></tr>
<tr><td>12a</td><td>Covalent</td><td>Hydrogen is a non-metal, chlorine is a non-metal
Type of bonding in hydrogen chloride molecule: Covalent</td></tr>
<tr><td>12b</td><td>Diagram showing:</td><td> 
</td></tr>
<tr><td>13a</td><td>Neutralisation</td><td>Acid + Metal Carbonate → Salt + Water + Carbon Dioxide
hydrochloric acid + calcium carbonate → calcium chloride + water + carbon dioxide</td></tr>
<tr><td>13b(i)</td><td>Gas given off</td><td>The flask loses mass as the gas produced by the chemical reaction leaks out of the top.</td></tr>
<tr><td>13b(ii)</td><td>Line graph showing:</td><td>½ mark – both labels with units
½ mark – both scales
½ mark – points plotted correctly
½ mark – points joined up appropriately</td></tr>
<tr><td>13c</td><td>Answer:
0.81 – 0.86</td><td>The mass loss must be greater than 0.80g but cannot be higher than 0.86g as this is the mass loss at the end of the reaction.</td></tr>
</table>

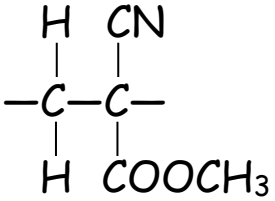
<table>
<tr><td>14a(i)</td><td>Ostwald</td><td>Ammonia + Oxygen $\xrightarrow[\text{catalyst}]{\text{platinum}}$ Nitrogen Dioxide + Water
Nitrogen Dioxide dissolves in Water to make Nitric Acid</td></tr>
<tr><td>14a(ii)</td><td>Exothermic Reaction
Or heat given off</td><td>The Ostwald process is exothermic and the heat energy released during the reaction is enough to keep the reaction hot enough to proceed, as long as there is enough reactants to continue reaction.</td></tr>
<tr><td>14a(iii)</td><td>water</td><td>NO_2 dissolves in water to form nitric acid (air must be present)</td></tr>
<tr><td>14b</td><td>35%</td><td>1 mol NH_4NO_3 = (2x14) + (4x1) + (3x16) = 28 + 4 + 48 = 80g
$\%N = \frac{\text{Weight of N}}{\text{Weight of } NH_4NO_3} = \frac{28}{80} \times 100 = 35\%$</td></tr>
<tr><td>15a</td><td>Y - X - W - Z</td><td rowspan="2">
<table>
<tr><th>Metal</th><th>Reasoning</th><th>Possible Metals</th></tr>
<tr><td>Y</td><td>Y is most reactive metal as it is the only one which reacts with cold water. Magnesium, and the metals above magnesium in the reactivity series, react with cold water</td><td>Potassium
Sodium
Lithium
Calcium
Magnesium</td></tr>
<tr><td>X</td><td>X is 2nd most reactive metal:
Reacts with dilute acid — Above copper in reactivity series
No Reaction with cold water — Below magnesium in reactivity series</td><td>Aluminium
Zinc
Iron
Tin
Lead</td></tr>
<tr><td>W</td><td>W is 3rd most Reactive metal:
No reaction with dilute acid — Copper or below in reactivity series
No Reaction on heating metal oxide — Above Mercury in reactivity series</td><td>Copper</td></tr>
<tr><td>Z</td><td>Z is least reactive metal is it the only metal to release the metal when its metal oxide is heated.</td><td>Mercury
Silver
Gold
Platinum</td></tr>
</table>
</td></tr>
<tr><td>15b</td><td>Hydrogen</td></tr>
<tr><td>15c</td><td>
<table>
<tr><td>Metal Y
One from:</td><td>Potassium
Sodium
Lithium
Calcium
Magnesium</td></tr>
<tr><td>Metal Z
One from:</td><td>Mercury
Silver
Gold
Platinum</td></tr>
</table>
</td></tr>
<tr><td>16a</td><td>Hydrolysis</td><td>starch + water $\longrightarrow$ glucose
$(C_6H_{10}O_5)_n + nH_2O \longrightarrow nC_6H_{12}O_6$</td></tr>
<tr><td>16b</td><td>$C_6H_{12}O_6$
$\downarrow$
$2C_2H_5OH + 2CO_2$</td><td>glucose $\xrightarrow[\text{(no air)}]{\text{yeast}}$ alcohol + carbon dioxide
$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$</td></tr>
<tr><td>16c</td><td>Distillation</td><td>Distillation is the separation of compounds with different boiling points: ethanol boils at 78°C and water boils at 100°C</td></tr>
<tr><td>16d</td><td>5</td><td>1 mol C_2H_5OH = (2x12) + (6x1) + (1x16) = 24 + 6 + 16 = 46g
no. of mol = $\frac{\text{mass}}{\text{gfm}} = \frac{230g}{46g\ mol^{-1}}$ = 5mol</td></tr>
<tr><td>17a</td><td>Oxidation</td><td>Oxidation is loss of electrons (electrons after the arrow)
Reduction is gain of electrons (electrons before the arrow)</td></tr>
<tr><td>17b</td><td>(←——————)
From Right to Left
or from Y to X</td><td>The reaction at electrode Y produces electrons: $2I^- \rightarrow I_2 + 2e^-$
Electrons travel from electrode Y to electrode X
The reaction at electrode X uses up these electrons: $Br_2 + 2e^- \rightarrow Br_2$</td></tr>
<tr><td>17c</td><td>(½mark)
Add starch
(½mark)
turns blue/black</td><td>Starch turns blue/black in the presence of iodine
∴ Iodine turns blue/black in the presence of starch</td></tr>
</table>

17d

$Br_2 + 2e^- \rightarrow 2Br^-$

Solution at electrode X contains Bromine Br_2 which reacts with the electrons travelling through the wires from electrode Y to form Bromide Br^- ions. This equation is found on p10 of data booklet.

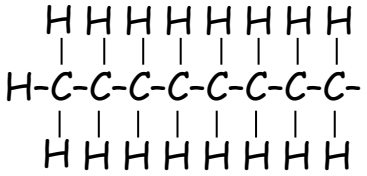
18a



A repeating unit is a 2 carbon segment of the main chain

18b

Group	carbon	hydrogen
octyl	8	17



18c

carbon monoxide
or
hydrogen cyanide

Toxic Gas	Carbon monoxide	Hydrogen chloride	Hydrogen cyanide
Plastic burned	All plastics	Poly(chloroethene) (PVC)	Superglue or Polyurethane

19a

216-221

Alkane	C_9H_{20}	$C_{10}H_{22}$	$C_{11}H_{24}$	$C_{12}H_{26}$
Boiling point	151°C	174°C	196°C	217°C
Difference		23°C	22°C	21°C	

If difference between $C_{11}H_{24}$ and $C_{12}H_{26}$ is in line with previous differences, difference = 21°C ∴boiling point of $C_{12}H_{26}$ = 217°C

19b

Homologous series

Homologous series are families of compounds with similar chemical properties and a general formula:
e.g. alkanes. Alkenes, cycloalkanes and alkanols

19c

9

1mol of C_9H_{20} = (9x12) + (20x1) = 108 + 20 = 128g

$$\text{no. of mol} = \frac{\textbf{mass}}{\textbf{gfm}} = \frac{6.4g}{128g\ mol^{-1}} = 0.05mol$$

$$C_9H_{20} + 14O_2 \longrightarrow 9CO_2 + 10H_2O$$

1mol — 10mol
0.05mol — 0.5mol

1mol of H_2O = (2x1) + (1x16) = 2 + 16 = 18g

mass = **no.** of mol x **gfm** = 0.5mol x 18g mol^{-1} = 9g

19d