Past Papers

Standard Grade

Credit

Chemistry

2008

Marking Scheme

2008 Credit	KU		PS	
	/30	%	/30	%
1	24+	80%	25+	83%
2	19+	63%	18+	60%
See general	<19	<63%	<18	<60%

2008 Standard Grade Chemistry Credit Marking Scheme

Question	Answer	Chemistry Covered
1a	C	Carbon monoxide (CO) is a toxic gas formed by incomplete combustion of carbon in limited air supply. All plastics are carbon-based compounds.
1b	B	78.1% of air is Nitrogen N_2 gas. 20.9% of air is oxygen O_2 gas.
1c	D	The reactants in respiration are glucose $C_6H_{12}O_6$ and oxygen O_2. The products of respiration are carbon dioxide CO_2 and water H_2O.
2a	A+F Both for 1 mark	Particle Size *differs* in box A (powder) and box F (ribbon). Temperature (20°C), concentration (1 mol/l) and type of acid (hydrochloric acid) are the *same* in boxes A+F
2b	B	Copper is not reactive enough to react with hydrochloric acid. Copper is below hydrogen in the electrochemical series (p10 of data booklet)
3a	C+D Both for 1 mark	Compounds containing C=C double bonds can undergo addition polymerisation to become polymers e.g. ethene polymerises to be come poly(ethene)
3b	B+F Both for 1 mark	☒ A – C_2H_6 is ethane, an alkane with general formula C_nH_{2n+2}. ☑ B – C_3H_6 is cyclopropane (cycloalkanes have general formula C_nH_{2n}) and has no C=C bond which decolourises bromine solution ☒ C – C_2H_4 is ethene has a C=C bond which decolourises bromine solution. ☒ D – C_3H_6 is propene has a C=C bond which decolourises bromine solution. ☒ E – C_5H_{12} is pentane, an alkane with general formula C_nH_{2n+2}. ☑ F – C_4H_8 is cyclobutane (cycloalkanes have general formula C_nH_{2n}) and has no C=C bond which decolourises bromine solution
4a	D+F Both for 1 mark	Transition metals are found between groups 2 and 3 on the period table. (see p4 of data booklet)
4b	E	SO_2 is a non-metal oxides which dissolves in water to form an acid. (acid rain if released into atmosphere) [NO_2 also dissolves in rain water to form acid rain]
4c	C	Solutions where the OH^- ion concentration is greater than the H^+ ion concentration are called alkalis. • metal oxides which dissolve in water form alkalis. • sodium oxide is soluble so forms an alkali when dissolved in water • iron oxide and copper oxide are insoluble (p8 of data booklet)
5a	D	acid + alkali (metal hydroxide) → salt + water acid + metal oxide → salt + water ✓ acid + metal carbonate → salt + water + carbon dioxide acid + metal → salt + hydrogen
5b	A,C 1 mark each	☑ A – Redox reactions involve both reduction and oxidation reactions Reduction: $Zn \rightarrow Zn^{2+} + 2e^-$ and Oxidation: $O_2 + 4e^- \rightarrow 2O^{2-}$ ☒ B – Precipitation involves two ions in solution meeting and forming an insoluble salt ☑ C – Combustion reactions involve a substances joining with oxygen ☒ D – There is no acid (H^+ ion) to be neutralised in this equation ☒ E – Displacement reactions require a higher up metal and a lower down metal ion
6	D	Solvent – the liquid which does the dissolving Solute – the substance which is dissolved into the solvent

7a	A+B Both for 1 mark	☑ A – fructose is a monosaccharide with formula $C_6H_{12}O_6$ ☑ B – glucose is a monosaccharide with formula $C_6H_{12}O_6$ ☒ C – maltose is a disaccharide with formula $C_{12}H_{22}O_{11}$ ☒ D – sucrose is a disaccharide with formula $C_{12}H_{22}O_{11}$ ☒ E – starch is a long chain polysaccharide of many glucose molecules joined together
7b	E	Starch is a long chain polysaccharide made up of many glucose units joined together by condensation polymerisation.
8	C,E 1 mark each	☒ A – acid (rain) will react with iron metal and speed up corrosion/rusting. ☒ B – A base is a substance which neutralises acids ☑ C – acid indigestion is treated with bases (e.g. chalk) to neutralise the acid ☒ D – acids have pH below 7 so neutralisation will increase pH of acids up to 7 ☑ E – nitric acid + potassium hydroxide ⟶ potassium nitrate + water
9	B,E 1 mark each	☒ A – calcium oxide is soluble (p5 of data booklet) ☑ B – Reaction releases heat energy (in question) so reaction is exothermic. ☒ C – $Ca(OH)_2$ calcium hydroxide is an alkali ☒ D – This reaction releases heat energy so there will be a temperature rise. ☑ E – $CaO + H_2O \longrightarrow Ca(OH)_2$ 1mol 1mol 0.1mol 0.1mol

Question	Answer	Chemistry Covered
10a	Halogens	Fluorine and chlorine are found in Group 7 of Periodic Table: Group 1 Alkali Metals | Group 7 Halogens | Group 7 Noble Gases | Block Between Groups 2-3 Transition Metals
10b	positive then electrons	Covalent bonds are formed when two non-metal atoms share a pair of electrons to help achieve a stable electron outer shell.
10c	The lower the size of X the higher the energy to break bond	Explanation beyond question: The smaller size of element X is due to fewer electron shells. As any covalent bond is formed between electrons in the outer shell, the smaller the size of the atom, the closer the covalent bond is to the nucleus. The nucleus is positive and it has more attraction to the electrons in the bond the closer it is to the bond. This means more energy is required to break a bond when the bond is closer to the nucleus.
11a	Hydroxide OH^-	From p10 of data booklet: $2H_2O + O_2 + 4e^- \longrightarrow 4OH^-$ For rusting/corrosion to occur, both water and oxygen are required to be present and they are needed to accept the electrons produced by the corrosion of iron : $Fe \rightarrow Fe^{2+} + 2e^-$
11b	increased rate of rusting	Salt, found in seawater, increases the rate of rusting/corrosion.
11c	Sacrificial	Sacrificial protection: A higher up metal will corrode and protect a lower down metal from corrosion.
12a(i)	line graph with	½ mark – both labels with units ½ mark – both scales ½ mark – points plotted correctly ½ mark – points joined up appropriately
12a(ii)	13±1	Answer will be correct if taken from your graph.
12b	$\underline{2}NaN_3 \longrightarrow N_2 + \underline{2}Na$	Balancing Equation Exercise [Clue: Get 6 Nitrogens on both sides]
12c	non-flammable	Airbags are used when a vehicle crashes. A flammable gas would be undesirable at such a time.

13a — conducts electricity

Carbon (graphite) is the only non-metal element which conducts electricity

13b — $2Cl^- \longrightarrow Cl_2 + 2e^-$

From p7 pf data booklet: $Cl_2 + 2e^- \longrightarrow 2Cl^-$
Question asks for the formation of chlorine so reverse equation

13c — ions free to move in solution but not in solid

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

In a solid ionic compound, ions are held tightly together in a lattice and are not free to move ∴solid ionic is a non-conductor.
When molten or dissolved in water, the lattice of ions breaks up and the ions are able to move ∴liquid and solution ionic compounds conduct.

14a — carbon + hydrogen + oxygen

Carbohydrate
carbon hydrogen oxygen

14b — sucrose

Carbohydrate must be sucrose (can't be starch, glucose, fructose or maltose)
Iodine solution turns blue/black with starch ∴ no starch present.
Benedict's solution turns brick red with glucose, fructose and maltose but not sucrose ∴ glucose, fructose and maltose not present.

14c — 0.0033

no. of mol. = **v**olume x **c**oncentration
= 0.33l x 0.01 mol/l
= 0.0033 mol

15a — (i) 1
(ii) Electron or e

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

15b(i)

Particle	Number
proton	90
neutron	144

No of protons = atomic number = 90

No of neutrons = mass no. – atomic no. = 234 – 90 = 144

15b(ii) — 84

Atomic numbers on bottom must add up on both sides of equation:
Left Hand Side: Total atomic number = 86
Right Hand Side: Total atomic number = X + 2
∴X+2 = 86 ∴ X = 86 - 2 = 84

16a — 68.3%

1 mol $PbSO_4$ = 207 + 32 + (4x16) = 207 + 32 + 64 = 303g

$$\%Pb = \frac{\text{mass of Pb}}{\text{mass of } PbSO_4} \times 100 = \frac{207}{303} \times 100 = 68.3\%$$

16b

Metal	Extraction
Aluminium	molten electrolysis
Lead	heat with carbon

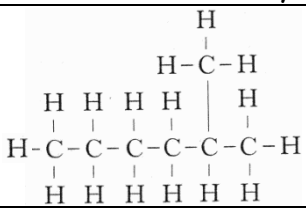
Aluminium is too reactive to be made by heating with carbon. Carbon is not powerful enough to take oxygen away from aluminium in aluminium oxide. Molten electrolysis is the best method to split oxygen from aluminium.

16c — X is less reactive than Lead and Aluminium

The least reactive metals (e.g. mercury, silver and gold) can be made by heating their ores and the metals are formed without the need of carbon being present.

16d — reduction

Reduction is gain of electrons: $Al^{3+} + 3e^- \longrightarrow Al$

17a(i)	no reaction	Magnesium will not displace its own ions from solution as they have the same reactivity.
17a(ii)	reaction occurred	Magnesium is higher up than zinc so magnesium metal will displace zinc ions: $Mg(s) + Zn^{2+}(aq) \longrightarrow Mg^{2+}(aq) + Zn(s)$
17b(i)	$2NO_3^-(aq)$	Spectator ions are ions which appear on both sides of the arrow chemically unchanged. They can be cancelled out of both sides.
17b(ii)	filtration	Solid copper metal will stay in the filter paper (residue) and magnesium nitrate solution will go through the filter paper (filtrate)
18a	lightning	Nitrogen N_2 gas has a very unreactive N≡N triple bond. High voltage sparks provide enough energy to break this bond which is the first step in making nitrogen dioxide NO_2 gas.
18b	nitrifying bacteria	Nitrifying bacteria, found in root nodules of leguminous plants like clover, beans and peas, *fix* atmospheric nitrogen gas into nitrate compounds which the plant can absorb through its roots.
18c	ammonia NH_3	$N_{2(g)} + 3H_{2(g)} \xrightarrow{\text{iron catalyst}} 2NH_{3(g)}$ nitrogen hydrogen ammonia
18d	higher the temp, the lower the solubility	Problem Solving graph interpretation question
19a		Each molecule has a CH_3- group sticking off the 2nd carbon atom from right hand side. This is the 2-methyl part of the name. The length of the main chain corresponds to the 2nd half of the name: **hex**ane means there are **6** carbons in the main chain. Carbons make 4 bonds and hydrogens make 1 bond each.
19b	isomers	Isomers have the *same* molecular formula but *different* structural formula
19c	20-27	Figure estimate must lie between 47 and 2 to be correct.
20a	28g	1 mole Fe_2O_3 = (2x56) + (3x16) = 112 + 48 = 160g no. of mol = $\frac{\textbf{m}\text{ass}}{\textbf{gfm}} = \frac{40g}{160g\ mol^{-1}} = 0.25mol$ $2Al + Fe_2O_3 \longrightarrow 2Fe + Al_2O_3$ 1mol 2mol 0.25mol 0.5mol 1mol Fe = 1x56 = 56g **m**ass = **n**o. of mol x **gfm** = 0.5mol x 56g mol^{-1} = 28g
20b	3+	Fe with valency 3 will give formula of Fe_2O_3 via cross-over rule. Iron with valency of 3 will give iron ions with 3+ charge (Fe^{3+})
20c(i)	air provides the oxygen needed for $C + O_2 \longrightarrow CO_2$	Air contains 21% oxygen. Oxygen is required to burn Carbon into Carbon Dioxide in the 1st equation.
20c(ii)	iron would be a solid at temp below 1535°C	If the iron formed was allowed to turn into a solid (at a temp below 1535°C), there would be no way to remove the iron from the blast furnace without shutting down the furnace.