UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2011 question paper for the guidance of teachers

0620 CHEMISTRY

0620/31 Paper 3 (Extended Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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	IGCSE – October/November 2011	0620	31

1 (a) (i) lithium oxide / strontium oxide [1]

(ii) sulfur dioxide / nitrogen dioxide [1]

(iii) aluminium oxide [1]

(iv) carbon monoxide [1]
accept: correct formulae

(b) sulfur dioxide [1]
burn (fossil) fuel containing sulfur / volcanoes [1]
nitrogen dioxide [1]
reaction of nitrogen and oxygen [1]
high temperatures / in car engine [1]
not: exhaust

(c) (i) strontium oxide [1]
accept: aluminium oxide

(ii) use correct formula [1]
cond: charges on ions
6x and 2o around oxygen [1]
ignore: electrons around Li

2 (a) (i) (waste gases) from animals [1]
decaying vegetation / anaerobic decay [1]
accept: decomposition of organic material / natural gas

(ii) carbon dioxide [1]
water [1]

(b) photosynthesis removes carbon dioxide from the atmosphere [1]
both respiration and combustion produce carbon dioxide [1]
any **two** of the following: [2]
plants photosynthesis changes carbon dioxide into carbohydrates
(burning) of fossil fuels / named fuel / petrol / alkanes
respiration by living organisms to obtain energy from
carbon–containing compounds
comment that the balance between these processes determines the percentage of carbon dioxide

3 **(a)** **(i)** bauxite [1]

(ii) lowers melting point [1]
better conductor / reduces amount of energy needed / reduces cost / more economic / makes process viable / conserves energy [1]

(iii) aluminium more reactive than copper / aluminium higher in reactivity series [1]
hydrogen not aluminium formed at cathode [1]

(b) $Al^{3+} + 3e \rightarrow Al$ [1]
$2O^{2-} \rightarrow O_2 + 4e$ [2]
note: not balanced = 1
oxygen reacts with carbon (anode) to form carbon dioxide / $C + O_2 \rightarrow CO_2$ [1]
note: if mark(s) for an electrode reaction are not awarded then allow aluminium ions accept electrons / are reduced [1]
oxide ion loses electrons / is oxidised [1]
max 4

(c) **(i)** protective oxide layer [1]

(ii) aluminium low density / light [1]
aluminium is a good conductor [1]
strength / prevent sagging / allows greater separation of pylons / core made of steel because it is strong [1]

4 **(a)** rate of forward reaction equals rate of back reaction [1]
concentrations do not change / macroscopic properties remain constant (with time) [1]
accept: amounts

(b) **(i)** increase [1]
reaction 2 [1]
Vr > Vp [1]

(ii) same [1]
reaction 1 [1]
Vr = Vp [1]

(iii) decrease [1]
reaction 3 [1]
Vp > Vr [1]
accept: moles of gas / molecules of gas as an alternative to volume

5 (a) (i) rate of reaction decreases / gradient decreases [1]
because <u>concentration</u> of bromine decreases [1]
reaction stops because all bromine is used up [1]

(ii) initial rate greater / gradient greater [1]
because bigger surface area / more particles of iron exposed [1]
or:
final mass the same [1]
because mass of bromine is the same so the same mass of iron is used [1]

(iii) increase / decrease / change rate of stirring / not stirred [1]
measure new rate / compare results [1]

(b) (i) Fe to Fe^{2+} [1]
because oxidation is electron loss / increase in oxidation number [1]

(ii) Fe [1]

(c) add sodium hydroxide solution / ammonia(aq) [1]
Fe^{2+} <u>green precipitate</u> [1]
Fe^{3+} <u>brown precipitate</u> [1]

6 (a) (i) correct structural formula of ethanoic acid [1]
allow: –OH **not:** –COOH

(ii) correct structural formula of ethanol [1]
allow: –OH

(b) (i) ethyl ethanoate [1]

(ii) $–OC_6H_4COOCH_2CH_2O–$
correct ester linkage [1]
correct repeat units [1]
continuation [1]
accept: boxes if it is clear what the box represents

(iii) any **two** from:
long time to decay
landfill sites
visual pollution / litter
danger to animals
poisonous gases when burnt [2]
accept: any correct suggestion

(c) synthetic – only two monomers [1]
protein – many different monomers [1]
or:
protein has 1 C=O and 1N–H [1]
nylon has 2 C=O / 2N–H [1]
or:
synthetic – one monomer is a dicarboxylic acid and the other is a diamine [1]
protein all monomers are amino acids [1]

7 **(a)** **(i)** any Group 1 metal [1]
accept: LiOH

(ii) $Cu(OH)_2 \rightarrow CuO + H_2O$ [2]
note: products only = 1

(iii) reactivity of metals / metals have different reactivities [1]

(b) **(i)** zinc oxide, nitrogen dioxide, oxygen [2]
note: two correct = 1

(ii) $2KNO_3 \rightarrow 2KNO_2 + O_2$ [2]
note: unbalanced = 1, correct word equation = 1

(c) calculation:
M_r for $NaHCO_3$ = 84 g; M_r for Na_2O = 62 g; M_r for NaOH = 40 g
M_r for Na_2CO_3 = 106 g

(i) number of moles of $NaHCO_3$ used = 3.36/84 = 0.04 [1]

(ii) if residue is Na_2O, number of moles of Na_2O = 2.12/62
=0.034 / 0.03

if residue is NaOH, number of moles of NaOH = 2.12/40
= 0.053 / 0.05

if reside is Na_2CO_3, number of moles of Na_2CO_3 = 2.12/106 =0.02 all three correct [2]
note: two correct = 1

(iii) equation 3 [1]
mole ratio 2:1 agrees with equation [1]