UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2006 question paper

0620 CHEMISTRY

0620/03 Paper 3, maximum raw mark 80

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

The minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the Report on the Examination for this session.

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International Examinations

1 **(a)** compounds are highly coloured **[1]**
used as catalysts **[1]**
more than one oxidation state **[1]**
Four boxes ticked that include three correct choices [2]
Four boxes ticked that include two correct choices [1]
Four boxes ticked that include one correct choices [0]
Five boxes ticked [0]

(b) **(i)** period 4 **[1]**

(ii) 26*p* and 30*n* **[1]**

(c) **(i)** limestone **[1]**

(ii) slag **[1]**

(iii) iron ore **[1]**

(d) to burn **or** provide heat **[1]**
to make carbon monoxide **[1]**

(e) mild steel cars **or** machinery **or** fridges etc. **[1]**
stainless steel cutlery **or** chemical plants etc. **[1]**

[TOTAL = 12]

2 **(a)** X
W
Z
Y **[2]**
For most reactive X and least Y [1] **ONLY**
All other responses [0]

(b) magnesium W **[1]**
copper Y **[1]**

(c) **(i)** goes "pop" with burning splint **[1]**
or mixed with air and ignited goes pop
NOT glowing splint

(ii) test and observable result **[1]**
universal indicator goes blue
or pH paper goes blue
or high pH, accept 13, 14
or ammonium ion gives off ammonia
or with metallic cations forms a precipitate **[1]**
NOT litmus
ONLY accept - neutralises acids with an observable result,
e.g. becomes warm.

(iii) Group 1 **[1]**

(iv) electrolysis **[1]**
COND molten **[1]**

[TOTAL = 10]

3 **(a)** ammonia 10
hydrochloric acid 1
sodium hydroxide 13
ethanoic acid 4
All correct **[2]**
Two correct [1]

(b) With strong acid bulb brighter **[1]**
faster rate of bubbles **[1]**
OR corresponding comments for weak acid

(c) proton **NOT** hydrogen ion **[1]**
H^+ not conditional on proton **[1]**
Only way for [2] is proton and H^+

(d) **(i)** CaO and MgO **[1]**

(ii) CO_2 and SO_2 **[1]**

(iii) Al_2O_3 **[1]**

(iv) CO **[1]**

[TOTAL = 10]

4 **(a)** 4 Ge atoms around 1 Ge **[1]**
Looks tetrahedral **or** stated to be **[1]**

(b) **(i)** Graphite has layers **[1]**
COND that can move/slip
or weak bonds between layers **[1]**

Graphite has delocalised/free/mobile electrons **[1]**

(ii) property and use **[1]**

property	use
soft	lubricant **or** pencils
OR good conductor	electrodes **or** in electric motors

(c) **(i)** CO_2 and SiO_2 **or** XO_2 **[1]**

(ii) CO_2 molecular **or** simple molecules **or** simple covalent **[1]**
SiO_2 macromolecular **or** giant covalent **[1]**

(d) Ge_2H_6 **[1]**

[TOTAL = 10]

5 **(a)** **(i)** Burn sulphur in air (or oxygen) **[1]**

(ii) as a bleach **[1]**

(iii) kill bacteria/micro-organisms **[1]**
NOT prevents food going bad or rotten or decaying

(b) **(i)** decrease **[1]**

(ii) exothermic **[1]**
COND increase temperature favours back reaction so it is endothermic, so forward reaction must be exothermic **[1]**
OR any similar explanation will be awarded the mark, for example
The forward reaction is not favoured by an increase in temperature so it is exothermic (rather than endothermic)

(iii) Low enough for good yield **[1]**
High enough for (economic) rate **[1]**
Any similar explanation will be awarded the mark
NOT just that it is the optimum temperature

(iv) bubble into (conc) sulphuric acid **[1]**
add water **[1]**
NOT consequential

[TOTAL = 10]

6 **(a)** **(i)** Any bond that is broken C-H **or** O=O **[1]**

Bond that is formed C=O **or** O-H **[1]**
Do not insist on double bonds

(ii) More energy is released forming bonds **[1]**
than is used breaking bonds **[1]**
For just - more energy released than used [1]
For - energy is released forming bonds and it is used breaking bonds [1]

(b) **(i)** U **[1]**
235 **[1]**

(ii) treatment of cancer, autoradiographs, tracer, sterilising food, surgical equipment, measuring thickness, checking welds **[1]**

(c) **(i)** reductant zinc **[1]**
oxidant hydrogen (ions) **[1]**

(ii) magnesium instead of zinc **or** increase concentration of acid **or** copper instead of iron **[1]**

(iii) sacrificial protection **or** stop iron/steel rusting **or** galvanising **[1]**

(d) **(i)** pink **or** purple **[1]**
to colourless **or** decolourised **[1]**
NOT red **NOT** clear

(ii) $2I^- - 2e = I_2$ **[2]**
unbalanced **ONLY** [1]

[TOTAL = 15]

7 **(a)** **(i)** any correct equation **[1]**

(ii) structural formulae from but-1-ene, but-2-ene, methylpropene **or** cyclobutane Any **TWO** **[2]**

(b) **(i)** light **or** 200°C **or** lead tetraethyl **[1]**

(ii) substitution **or** photochemical **or** chlorination **or** free radical or halogenation **[1]**

(iii) 1-chlorobutane, 2-chlorobutane, dichlorobutane etc.
Any **TWO** **[2]**

(c) **(i)** $CH_3CH_2CH_2OH$ **or** $CH_3CH(OH)CH_3$ **[1]**

(ii) $CH_3CH(Br)CH_2Br$ **[1]**
NOT 1,3-dibromopropane

(d) moles of CH_3-CH = CH_2 reacted = 1.4/42 = 0.033 **[1]**
conseq
maximum moles of CH_3-CH(I)-CH_3 that could be formed = 0.033 **[1]**
conseq
maximum mass of 2-iodopropane that could be formed = 5.61 g **[1]**
accept 170 x 0.033 = 5.61 and 170 x 0.033333 = 5.67
conseq unless greater than 100%
percentage yield 4.0/5.67 x 100 = 70.5% **[1]**
Do not mark consequently to a series of small integers. There has to be a serious attempt to answer the question, then consequential marking is appropriate.

[TOTAL = 13]

[For paper 12+10+10+10+10+15+13 = 80]