UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

0620 CHEMISTRY

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

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International Examinations

Page 2	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2010	0620	31

1 **(i)** sulfur [1]

(ii) iodine [1]

(iii) copper **ignore** (II) [1]

(iv) calcium [1]

(v) helium [1]
not name of a compound
accept correct symbols

2 **(i)** chloromethane [1]
cond biggest molecular mass / biggest mass of one mole / its molecules move slowest / heaviest molecule / highest density [1]
accept atomic mass if correct numerical value given
ignore it is the heaviest (gas) / biggest molecule
accept particles or molecules
not atoms

(ii) carbon dioxide / calcium carbonate [1]
not methane
water [1]
sodium chloride / brine / seawater [1]

(iii) chlorine [1]
not chlorine water
cond light / UV / heat / high temperature if numerical value given about $200^{o}C$ / lead tetraethyl [1]
not warm

(iv) oxygen and nitrogen (in air) [1]
not from fuel, negates mark 1
(react) at high temperatures / lightning / in engine [1]
not combustion or exhaust, negates mark 2

(v) $2O_3 \rightarrow 3O_2$ [2]
not balanced = [1]

3 **(a)** **(i)** bubbles / effervescence / hydrogen / gas pushes up / lifts metal [1]

(ii) does not react with <u>acid</u> / zinc and iron react with <u>acid</u> [1]
not just unreactive

(b) **(i)** with copper / first experiment [1]

(ii) copper acts as a <u>catalyst</u> [1]

(c) **(i)** smaller gradient [1]
not rate is slower

(ii) same final volume of hydrogen / same level (on graph) [1]

(d) temperature / heat [1]
increase temperature – reaction faster particles have more energy **/** particles move faster / particles collide more frequently / more particles have enough energy to react
not more excited
accept arguments for a decrease in temperature [1]

powdered
greater surface area
greater collision rate / more particles exposed (to acid)
any **two** [2]
not concentration / light / catalyst / pressure

4 **(a)** **(i)** ethanol [1]
CH_3-CH_2-OH [1]

propanoic acid [1]
CH_3-CH_2-COOH [1]
independent marking, no ecf
accept C_2H_5
not – HO

(ii) type of compound – salt / sodium carboxylate / alkanoate [1]
not soap / sodium stearate etc
use – soap / cleaning / detergent [1]

(iii) terylene / PET / Dacron / diolen / mylar / crimplene [1]

(b) **(i)** polyamide / amide / peptide / polypeptide [1]

(ii) correct amide linkage <u>NHCO then CONH</u> [1]
cond to mark 1, 2 monomers (different shading in box) [1]
cond continuation (to **ONE** correct linkage) [1]

OR nylon 6
only one linkage – NHCO [1]
cond only one monomer [1]
cond continuation (to correct linkage) [1]

(iii) use locating agent [1]
measure distance travelled by sample / travelled by solvent front [1]
cond this is $R_f = 0.5$ [1]
for mark 3, either mark 1 or mark 2 must be awarded

accept run a chromatogram of glycine [1]
compare with sample
same position [1] max [2]

Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2010	0620	31

5 **(a)** **(i)** macromolecular / giant covalent / giant atomic [1]
all atoms held in position / in tetrahedral structure / to four other carbon atoms / <u>all</u> strong bonds [1]

(ii) jewellery / drilling / cutting / engraving / cutting edges in scalpels [1]
mark first use offered

(iii) layer structure / sheets [1]
molecules / ions in layers = [0]
layers can slide (over each other) [1]

(iv) lubricant / pencils / electrodes [1]
mark first use offered

(b) **(i)** 4e between carbon and oxygens [1]
2 non-bonding pairs on both oxygens [1]
cond correct coding – only scored if marks 1 and 2 awarded [1]
ignore O_2 in atom

(ii) 4O around each Si [1]
2Si around each O [1]
must refer to diagram **not** valencies **or** electron distributions

(iii) SiO_2 has higher mp or bp
SiO_2 is a solid, CO_2 is a gas (at rtp)
(when both are solids) then SiO_2 is harder
has higher density
SiO_2 insoluble, CO_2 soluble [2]
any **two**, comparison needed

6 **(a)** <u>rates</u> equal [1]
concentrations do not change / macroscopic properties remain constant [1]
accept amounts do not change

(b) endothermic [1]
cond favoured by high temperatures [1]

(c) **(i)** move to left [1]
cond bigger volume / more moles etc [1]
do not insist on "gas"

(ii) less yellow solid / more brown liquid [1]
accept yellow to brown / less solid more liquid / goes brown

7 **(a)** a transition element has more than one oxidation state or valency [1]
accept different oxidation states

(b) by removing oxygen concentration of O_2 decreases [1]
prevents the back reaction / equilibrium shifts to right [1]

(c) oxidation number reduced (from (+) 4 to 0) [1]
accept accepts electrons **or** accepts four electrons
if number given must be 4

(d) low density / lightweight / light [1]
propellers / fittings on ships / inert anodes in electrolysis / hip replacements / ship building / chemical plants / cathodic protection / diving equipment [1]

(e) **(i)** percentage of oxygen = 31.6 % [1]

(ii) calculate the number of moles of atoms for each element

number of moles of Ti = 31.6/48 = 0.66

number of moles of O = 31.6/16 = 1.98 **accept** 2 [1]
both correct for one mark

(iii) the simplest <u>whole number ratio</u> for moles of atoms:

Fe	:	Ti	:	O
1		1		3

[1]

(iv) formula is $FeTiO_3$ **accept** $TiFeO_3$ [1]
must be whole numbers from **(iii)** or cancelled numbers from **(iii)**
mark **ecf** throughout

8 **(a)** same general formula
same chemical properties
same functional group
physical properties vary in predictable way
common methods of preparation
consecutive members differ by CH_2
any **two** [2]
mark first two
ignore others unless it contradicts a point which has been awarded a mark

(b) **(i)** $2HCOOH + CaCO_3 \rightarrow Ca(HCOO)_2 + CO_2 + H_2O$ [2]
not balanced = [1]

(ii) zinc + methanoic acid → zinc methanoate + hydrogen [2]
[1] for each product

(iii) protected by <u>oxide</u> layer [1]

(c) butanoic acid [1]
CH_3-CH_2-CH_2-COOH / $C_4H_8O_2$ / C_3H_7COOH / C_4H_7OOH [1]
C_2H_4O [1]
mark **ecf** to molecular formula