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

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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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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°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]

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