UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary and Advanced Level

MARK SCHEME for the June 2005 question paper

9701 CHEMISTRY

9701/02 **Paper 2 (Structured Questions), maximum raw mark 60**

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. This shows the basis on which Examiners were initially instructed to award marks. It does 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*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2005 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

Grade thresholds for Syllabus 9701 (Chemistry) in the June 2005 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 2	60	48	42	27

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.

June 2005

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 9701/02

CHEMISTRY
Paper 2 (Structured Questions)

UNIVERSITY of CAMBRIDGE
International Examinations

1 **(a)** same proton no./atomic no./no. of protons **(1)**
different mass no./nucleon no./no. of neutrons **(1)** **[2]**

(b)

	number of		
isotope	protons	neutrons	electrons
^{56}Fe	**26**	**30**	**26**
^{59}Co	**27**	**32**	**27**
	(1)	**(1)**	**(1)**

give one mark for each correct column
allow **(1)** if no column is correct but one row is correct **[3]**

(c) **(i)** weighted mean/average mass
of an atom (not element) **(1)**
compared with ^{12}C **(1)**
one atom of ^{12}C has a mass of exactly 12 **(1)**
[relative to $^{1}/_{12}{}^{th}$ the mass of a ^{12}C atom would get 2]

or

mass of 1 mol of atoms **(1)**
compared with ^{12}C **(1)**
1 mol of ^{12}C has a mass of 12 g **(1)**

(ii) $A_r = \frac{54 \times 5.84 + 56 \times 91.68 + 57 \times 2.17}{100}$ **(1)**

$= \frac{5573.13}{100} = 55.7$ to 3 sf **(1)**

allow 55.9 if A_r is calculated using 99.69 instead of 100 **[5]**

[Total: 10]

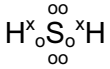
2 **(a)** **1** $S + O_2 \rightarrow SO_2$ **(1)**
2 $2SO_2 + O_2 \rightleftharpoons 2SO_3$ equil **(1)** equation **(1)**
3 $SO_3 + H_2O \rightarrow H_2SO_4$ **(1)**

Allow sequences that start with SO_2
and include $H_2S_2O_7$ before H_2SO_4.

Equilibrium mark is only scored if $\rightleftharpoons$ only appears in
the SO_2/SO_3 equation. **[4]**

(b) vanadium pentoxide/vanadium(V) oxide/V_2O_5 **(1)** **[1]**

(c) **(i)**



(1)

(ii) non-linear/bent/V-shaped **(1)**

(iii) H_2O has hydrogen bonds/H_2S does not <u>or</u>
H_2S has van der Waals' forces only **(1)**

hydrogen bonds are stronger
than van der Waals' forces <u>or</u>
H_2S has weaker intermolecular bonds
than H_2O **(1)** **[4]**

(d) (i) $2H_2S + 3O_2 \rightarrow 2H_2O + 2SO_2$ **(1)**
from -2 **(1)** to +4 **(1)**
allow e.c.f. on equation

(ii) 68.2g H_2S react with 3 x 24 dm^3 O_2 **(1)**
8.65g H_2S react with $\frac{3 \times 24 \times 8.65}{68.2}$ = 9.13 dm^3 **(1)**
allow 9.16 dm^3 if H_2S = 68 is used
allow e.c.f on **(d)(i)** **[5]**

(e) (i) an acid that is partially dissociated into ions **(1)**

(ii) $H_2S(g) + H_2O(l) \rightarrow H_3O^+(aq) + HS^-(aq)$

<u>or</u>

$H_2S(g) + aq \rightarrow H^+(aq) + HS^-(aq)$

<u>or</u>

$H_2S(aq) \rightarrow H^+(aq) + HS^-(aq)$
equation **(1)** state symbols **(1)** **[3]**

[Total: 17]

3 **(a)**
A $MgSO_4$
B $MgCl_2$
C $MgCO_3$
D MgO
E $Mg(OH)_2$
F $Mg(NO_3)_2$

Accept name or formula
but penalise when name and formula do not agree **(6 x 1)** **[6]**

(b) (i) Mg to cpd **A**
$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$ **(1)**
cpd **C** to cpd **D**
$MgCO_3 \rightarrow MgO + CO_2$ **(1)**
cpd **F to** cpd **D**
$2Mg(NO_3)_2 \rightarrow 2MgO + 4NO_2 + O_2$ **(1)** **[3]**

(ii) $Mg(OH)_2 \rightarrow MgO + H_2O$ **(1)** **[1]**

[Total: 10]

4 **(a) (i)** stage I $C\ell_2$/chlorine **(1)**
uvl/sunlight **(1)**

stage II KCN **(1)**
heat in ethanol **(1)**

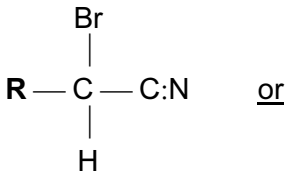
(ii) stage III Br_2 **(1)**
uvl/sunlight **(1)** **[6]**

(b) stage IV H_2SO_4(aq)/HCℓ(aq) <u>or</u>
NaOH(aq) followed by H^+ **(1)**
heat/reflux **(1)**

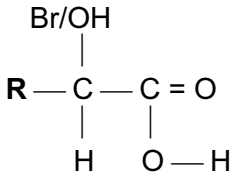
stage V NaOH(aq) **(1)**
heat **(1)** **[4]**

(c) (i) a carbon atom in a molecule attached to
four different atoms or groups of atoms **(1)**

(ii)



<u>or</u>



correct cpd correctly displayed **(1)**
one correct isomer shown as 3D **(1)**
both isomers shown in
mirror object/mirror image arrangement **(1)** **[4]**

[Total: 13 max]

5 **(a)** C:H:O = $\frac{66.7}{12} : \frac{11.1}{1} : \frac{22.2}{16}$ **(1)**

= 5.56 : 11.1 : 1.39

= 4 : 8 : 1

C_4H_8O = 72 molecular formula = C_4H_8O **(1)** **[2]**

(b) **(i)** presence of C=C/alkene/unsaturated **(1)**

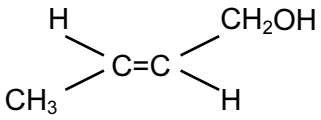
(ii) -OH group (in $-CO_2H$ or -OH) present **(1)** **[2]**

(c) **(i)** aldehyde/ketone/carbonyl **(1)**

(ii) primary alcohol **(1)** **[2]**

(d) restricted rotation about a C = C bond **(1)**
two different groups on each side of C = C **(1)** **[2]**

(e)



one fully correct structure **(1)**
two fully correct structures with
correctly labelled cis-trans **(1)**

allow **(1)** for correctly labelled cis-trans structures
that are C_4H_8O but incorrect **[2]**

[Total: 10]