UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2006 question paper

9701 CHEMISTRY

9701/02 Paper 2 (Theory 1), maximum raw mark 60

This mark scheme is published as an aid to teachers and students, 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.

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 grade thresholds for various grades are published in the report on the examination for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses.

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UNIVERSITY of CAMBRIDGE
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1	**(a)**	**(i)**	electron	(1)	
		(ii)	towards the positive pole	(1)	
		(iii)	electron has negative charge	(1)	
			electron has very small mass	(1)	**[4]**
	(b)	**(i)**	the number of protons in the nucleus of an atom	(1)	
		(ii)	the nucleus usually contain protons and neutrons	(1)	**[2]**
	(c)		neutrons are uncharged	(1)	
			and are not repelled by protons in the nuclei of atoms	(1)	**[2]**
	(d)		no change	(1)	
			new atom/isotope formed has the same electronic configuration as the original element	(1)	**[2]**
					[Total: 10]
2	**(a)**		molecules	(1)	
			I_2	(1)	**[2]**
	(b)	**(i)**	cations held in 'sea' of delocalised electrons	(1)	
			by strong metallic bonds	(1)	
		(ii)	van der Waals' forces between molecules	(1)	
			van der Waals' forces are weak	(1)	**[4]**
	(c)	**(i)**	oxidising agent	(1)	
		(ii)	iodine is a weaker oxidising agent than chlorine	(1)	**[2]**
					[Total: 8]

3 (a) Allow names or formula throughout **(a)**.

(i) He **or** Ne **or** Ar **or** Kr (1)

(ii) P **or** P_4 - allow As **or** As_4 (1)

(iii) K (1)

(iv) Br/Br_2 (1)

(v) Si (1)

(vi) P - allow S (1) **[6]**

(b) Accept only formulae in **(b)(i)**.

Allow names or formula throughout the rest of **(b)**.

(i) SO_2 **and** SO_3 **or**

P_2O_3/P_4O_6 **and** P_2O_5/P_4O_{10} **or**

NO_2 **and** N_2O_5 **or**

ClO_2 **and** Cl_2O_7

oxides must be from same element (1 + 1)

(ii) Al_2O_3 **or** BeO **or** ZnO (1)

(iii) Li **or** Na **or** K (1)

(iv) Na **or** Mg (1)

(v) F/F_2 **or** Cl/Cl_2 **or** Br/Br_2 (1) **[6]**

[Total: 12]

4 (a) high temperature (above 450 °C) (1)

use of a catalyst (1) **[2]**

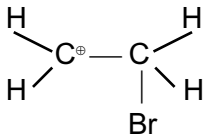
(b) $C_{18}H_{38} \rightarrow C_6H_{14} + C_{12}H_{24}$ (1) **[1]**

(c) **(i)** electrophilic addition (1)

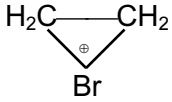
(ii) dipole on Br_2 clearly shown by $\delta+$ and $\delta-$ (1)

curly arrow from π bond of $CH_2=CH_2$ to $Br^{\delta+}$ (1)

formation of carbocation



or



(1)

Br^- formed (1)

attack by lone pair of Br^- on carbocation (1) **[6]**

(d) enthalpy change when 1 mol of a substance (1)

is burnt in an excess of oxygen/air
or undergoes complete combustion
under standard conditions (1) **[2]**

(e) **(i)** heat released = m c δT = 200 x 4.18 x 27.5 (1)

= 22990 J = 23.0 kJ

(If candidate uses 4.2 answer is 23.1 kJ.) (1)

(ii) 23.0 kJ produced from 0.47 g

2059 kJ produced from $\frac{0.47 \times 2059}{23.0}$ g (1)

= 42.08g

(Use of 4.2 gives 41.89 g.)

allow ecf from **(i)** (1) **[4]**

(f) C_3H_6 (1) **[1]**

(g) $-CH(CH_3)CH_2CH(CH_3)CH_2-$ as minimum

allow ecf from **(f)** (1) **[1]**

[Total: 15 max]

5 **Note:** In parts **(a)** and **(b)** the conditions mark is only awarded if the reagent is correct.

(a) **(i)** manganate(VII) ions (1)

cold, dilute (1)

(ii) oxidation (1) **[3]**

(b) **(i)** chlorine (1)

uvl **or** sunlight (1)

(ii) $NaOH(aq)/OH^-(aq)$ (1)

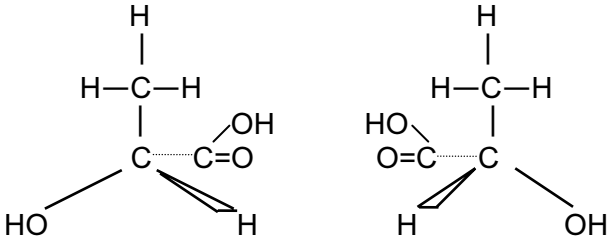
heat (1) **[4]**

Note: Throughout parts **(c)**, **(d)**, and **(e)** penalise **once** a wrongly drawn C–OH bond, e.g. OH-C.

(c) lactic acid $\rightarrow CH_3COCO_2H$ (1)

glycollic acid $\rightarrow HO_2CCO_2H$ (1) **[2]**

(d) central C shown as chiral (C*) (1)



two correct three dimensional structures (1)

correctly displayed (1) **[3]**

(e) $CH_3CH(OH)CO_2CH_2CO_2H$ (1)

$HOCH_2CO_2CH(CH_3)CO_2H$ (1) **[2]**

(f) **(i)** hydrolysis (1)

(ii) hydrogen bonding (1) **[2]**

[Total: 15 max]