UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2008 question paper

9701 CHEMISTRY

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

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UNIVERSITY of CAMBRIDGE
International Examinations

1 (a) (i) 2 (1)

(ii) between 104° and 105° (1) [2]

(b)

ethanal	CH_3CHO	**A** (1)
ethanol	CH_3CH_2OH	**C** (1)
methoxymethane	CH_3OCH_3	**A** (1)
2-methylpropane	$(CH_3)_2CHCH_3$	**B** (1)

[4]

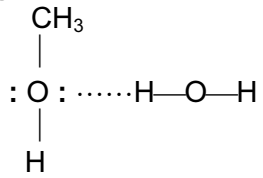
(c) (i) hydrogen bonds (1)

(ii) correct dipole on an -O—H bond (1)

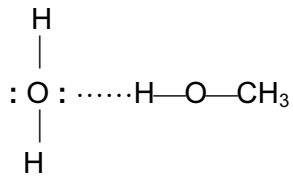
hydrogen bond shown between the lone pair of an O and a H atom in an –OH group (1)

lone pair on O atom of CH_3OH **or** H_2O clearly shown **in the hydrogen bond** (1)

e.g.



or



[4]

(d) hydrogen bonds exist between H_2O molecules (1)

hydrogen bonds cannot form between $C_2H_5OC_2H_5$ molecules (1) [2]

[Total: 12]

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2 **(a)** $F(g) \rightarrow F^{+}(g) + e^{-}$

correct equation (1)

correct state symbols (1) [2]

(b) from Na to Ar, electrons

are added to the same shell/have same shielding (1)

are subject to increasing nuclear charge/proton number (1)

are closer to the nucleus **or** atom gets smaller (1) [3]

(c) **(i)** **A*l* and Mg**

in A*l* outermost electron is in 3p rather than 3s (1)

3p electron is at higher energy
or is further away/is more shielded from nucleus (1)

(ii) **P and S**

for P 3p sub-shell is singly filled
and for S one 3p orbital has paired electrons (1)

paired electrons repel (1) [4]

(d) **(i)** and **(ii)**

element	Na	Mg	A*l*	Si	P	S
melting point	low	------	high	high	low	low
conductivity	high	------	high	moderate	low	low
	(1)		(1)	(1)	(1)	(1)

one mark for each correct column [5]

(e) because they had not been discovered (1) [1]

[Total: 15]

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3 **(a)** high temperature (and/or pressure) provide enough energy (1)

to break N≡N bond
or to provide E_a for N_2/O_2 reaction (1) [2]

(b) **(i)** **two** from C, CO, hydrocarbon, SO_2, H_2S, NO_2/NO_x (1 + 1)

not CO_2, H_2, H_2O, SO_3, NO

(ii) Pt **or** Pd **or** Pt/Rh **or** Pt/Pd/Rh (1)

(iii) $2NO + 2CO \rightarrow 2CO_2 + N_2$
or $2NO + C \rightarrow CO_2 + N_2$ (1) [4]

(c) **(i)** $K_c = \dfrac{[NO]^2[Cl_2]}{[NOCl]^2}$ (1)

units are mol dm^{-3} (1)

(ii) at 230 °C $K_c = \dfrac{(1.46\times10^{-3})^2 \times 1.15\times10^{-2}}{(2.33\times10^{-3})^2}$

$= 4.5 \times 10^{-3}$ mol dm^{-3} (1)

at 465 °C $K_c = \dfrac{(7.63\times10^{-3})^2 \times 2.14\times10^{-4}}{(3.68\times10^{-4})^2}$

$= 9.2 \times 10^{-2}$ mol dm^{-3} (1)

allow ecf on answer to part **(i)**

(iii) endothermic **because** K_c increases with temperature
mark is for explanation
allow ecf on answer to part **(ii)** (1) [5]

(d) **(i)** equilibrium moves to RHS (1)

more moles on RHS (1)

(ii) no change to equilibrium position (1)

[NOCl] and [NO] change by same amount (1) [4]

[Total: 15]

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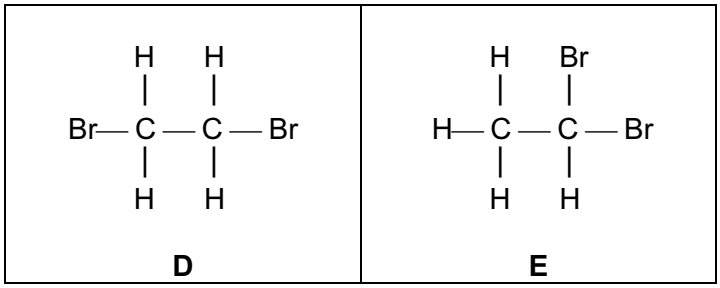
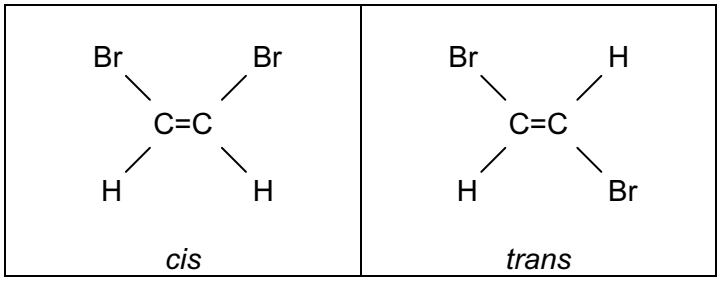
4 (a) (i)



(1) (1)

(ii)



(1) (1)

[4]

(b) (i) hydrogen (1)

nickel catalyst – allow platinum or palladium (1)

(ii) isomer formed **must** be 1,2-dibromoethane (**D** above)

because

cis isomer has one Br atom on **each** carbon atom (1)

mark is for the reason but wrong isomer is penalised [3]

[Total: 7]

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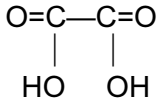
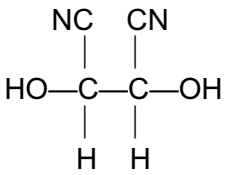
5 **(a)** **(i)** silver or black ppt. (1)

(ii)  **or** HO_2CCO_2H (1)

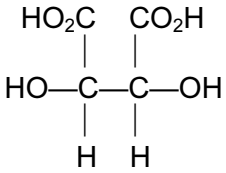
allow anion

[2]

(b) **(i)**  **or** NCCH(OH)CH(OH)CN (1)

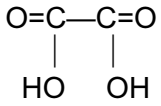
allow NCCH(OH)CHO

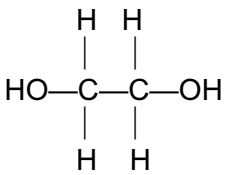
(ii) nucleophilic addition (1)

(iii)  **or** $HO_2CCH(OH)CH(OH)CO_2H$ (1)

allow $HO_2CCH(OH)CHO$ (ecf)

[3]

(c) **(i)**  **or** HO_2CCO_2H (1)

(ii)  **or** HOH_2CCH_2OH (1)

allow HOH_2CCHO

(iii) $NaBH_4$ **or** $LiAlH_4$ **or** H_2/Ni (1) [3]

(d) **both** oxidation **and** reduction **allow** disproportionation (1) [1]

(e) HO—C≡C—OH – candidate's compound must be $C_2H_2O_2$

-OH present (1)

C≡C present (1) [2]

[Total: 11]

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