Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CHEMISTRY **9701/02**

Paper 2 AS Level Structured Questions **For Examination from 2016**

SPECIMEN MARK SCHEME

1 hour 15 minutes

MAXIMUM MARK: 60

This document consists of **7** printed pages and **1** blank page.

CAMBRIDGE International Examinations

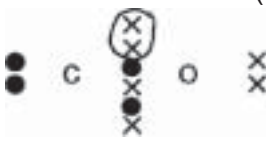
Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or by extra guidance)
AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore
AVP	Alternative valid point (examples given as guidance)

1 **(a)** fewer electrons in Cl_2 than in Br_2 ora (1)
weaker van der Waals' forces in Cl_2 or stronger van der Waals' forces in Br_2 (1) [2]

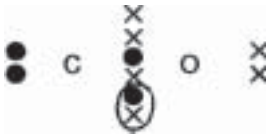
(b) CO has a permanent dipole or N_2 does not (1)
permanent dipole-permanent dipole interactions are stronger than those from induced dipoles 1) [2]

(c) a co-ordinate bond (1)

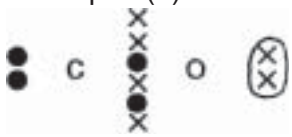


a covalent bond (1)

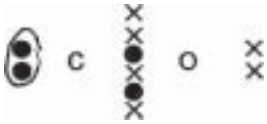
or



a lone pair (1)



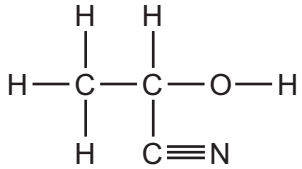
or



penalise any groups of 3 or 4 electrons that are circled [3]

(d) CO and HCN both have a dipole or N_2 does not have a dipole [1]

(e) **(i)**

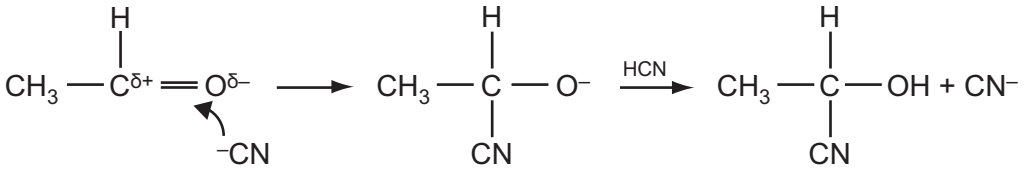


[1]

C ≡ N must be shown

(ii) nucleophilic addition [1]

(iii)



C ═ O dipole correctly shown or correct curly arrow on C ═ O (1)
attack on $C^{\delta+}$ by C of CN^- (1)
correct intermediate (1)
CN^- regenerated (1) [3 max]

[Total: 13]

2 **(a)** **(i)** new graph has lower maximum and maximum is to the right of previous maximum [1]

(ii) **H** is at E_a (1) [1]

(b) the minimum amount of energy molecules must have or energy required (1)
in order for the reaction to take place (1) [2]

(c) **(i)** iron or iron oxide
100 to 500 atm and 400–550 °C
units necessary – allow other correct values and units [1]

(ii) C is placed to the left of H [1]

(iii) more molecules now have energy > E_a [1]

(d) **(i)** reaction 1
has greater E_a (1)
because energy is needed to break covalent bonds (1)

reaction 2
has lower E_a (only valid if converse not awarded for reaction 1)
or actual reaction is $H^+ + OH^- \rightarrow H_2O$
or reaction involves ions (1)
opposite charges attract (1) [4]

(ii) alkaline aqueous iodine (1)
yellow ppt (1) [2]

[Total: 13]

3 **(a)** Accept only symbols.

(i) K or K^+ [1]

(ii) Na – allow K or Li [1]

(iii) C*l* or Br [1]

(iv) Mg or Ca or Li [1]

(b) Accept only formulae.

(i) F_2O [1]

(ii) SO_2 and SO_3
or P_2O_3/P_4O_6 and P_2O_5/P_4O_{10}
or any two from N_2O_3, NO_2/N_2O_4, N_2O_5
or any two from C*l*$_2$O, C*l*O$_2$, C*l*O$_3$, C*l*$_2$O$_7$ (1 + 1) [2]

(iii) SiO_2 or A*l*$_2$O$_3$ or MgO [1]

(iv) giant structure (1)
strong covalent bonds (1) [2]

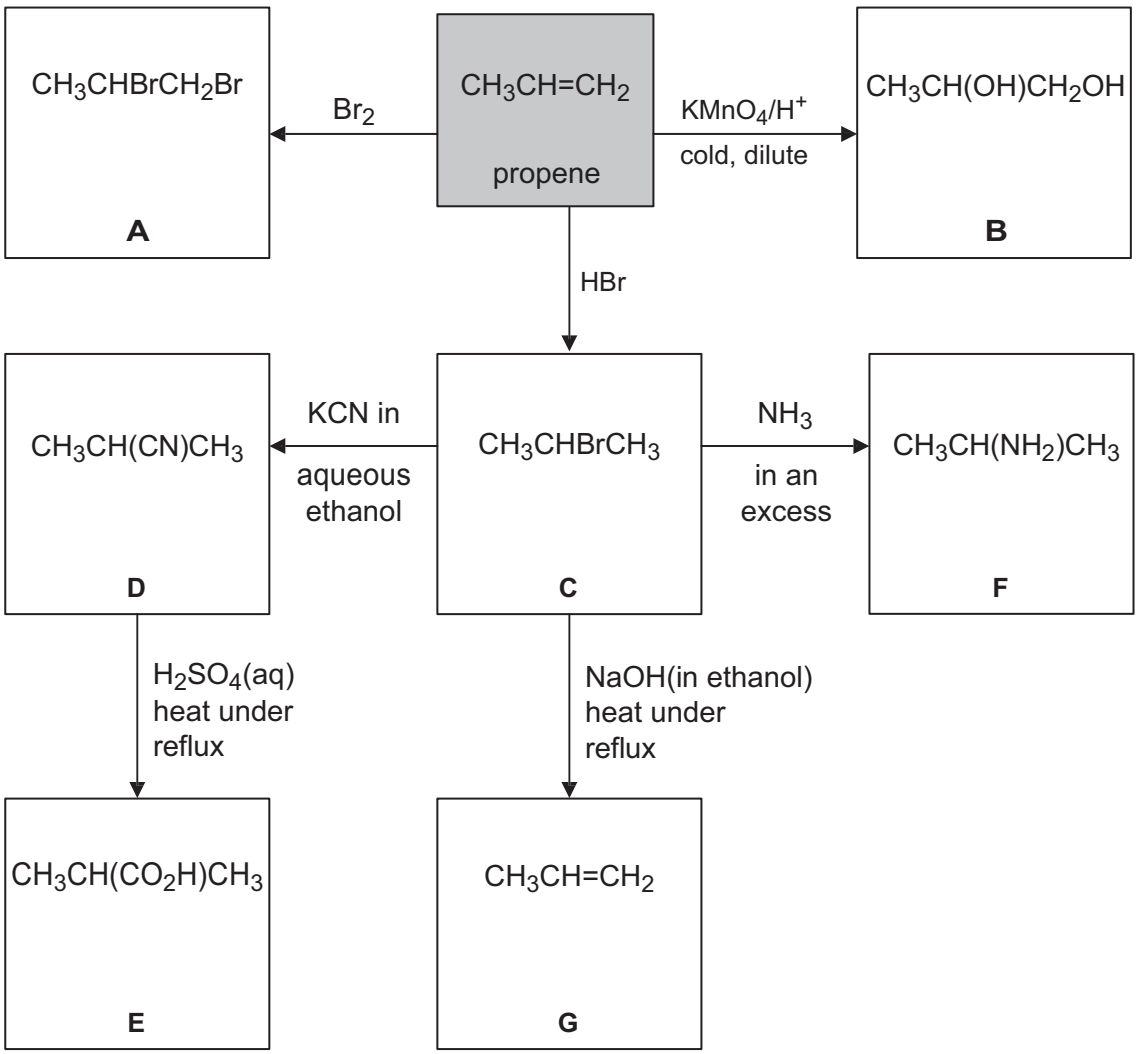
(c) **(i)** octahedral [1]

(ii) I atom is larger than C*l* atom (1)

cannot pack 7 F atoms around C*l* atom
or can pack 7 F atoms around I atom (1) [2]

[Total: 13]

4 (a)



1 for each correct structure (7 × 1) [7]

(b) (i) $CH_3CH_2CH_2Br$ [1]

(ii) inductive effect of alkyl groups (1)
stabilises secondary carbocation cf primary (1) [2]

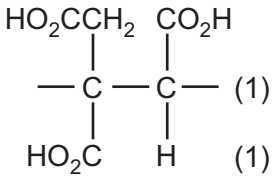
[Total: 10]

5 **(a)** **(i)** same molecular formula
but different structural formula/structure [1]

(ii) asymmetric C atom/chiral centre present (1)
>C=C< bond present (1) [2]

(b) **(i)** no because there is no chiral carbon atom present [1]

(ii)



(1) (1)

[2]

(c) C : H : O = $\frac{35.8}{12} : \frac{4.5}{1} : \frac{59.7}{16}$ this mark is for correct use of A_r values (1)

C : H : O = 2.98 : 4.5 : 3.73
C : H : O = 1 : 1.5 : 1.25 this mark is for evidence of correct calculation (1)
gives empirical formula of **W** is $C_4H_6O_5$ [2]

(d) $n(OH^-)$ = 1. 00 × 29.4/1000 = 0.0294 (1)

n(**W**) = $\frac{1.97}{134}$ = 0.0147 (1)

no. of $-CO_2H$ groups present

in one molecule of **W** = $\frac{0.0294}{0.0147}$ = 2 (1) [3]

[Total: 11]

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