
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.

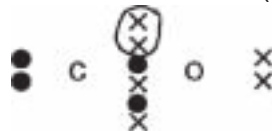
Mark scheme abbreviations

;	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)
<u>underline</u>	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 or a (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]

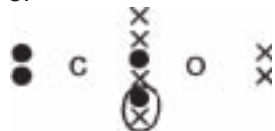
- (c) a co-ordinate bond (1)



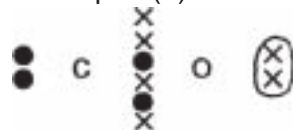
a covalent bond (1)



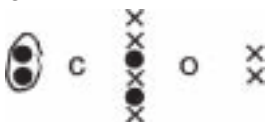
or



a lone pair (1)



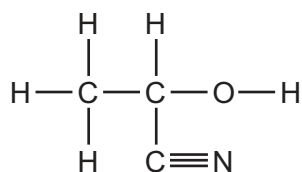
or



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]

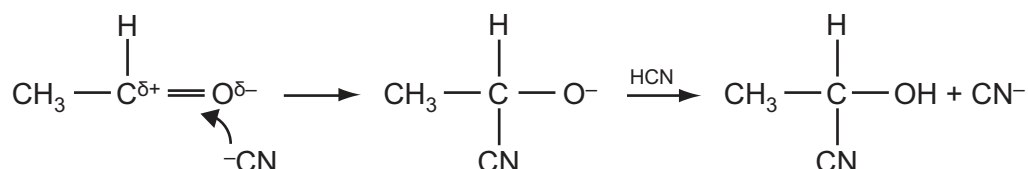
- (e) (i)



$\text{C}\equiv\text{N}$ must be shown [1]

- (ii) nucleophilic addition [1]

(iii)



C = O dipole correctly shown or correct curly arrow on C = O (1)

attack on C^{δ+} 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 $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$
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) Cl or Br [1]
- (iv) Mg or Ca or Li [1]

(b) Accept only formulae.

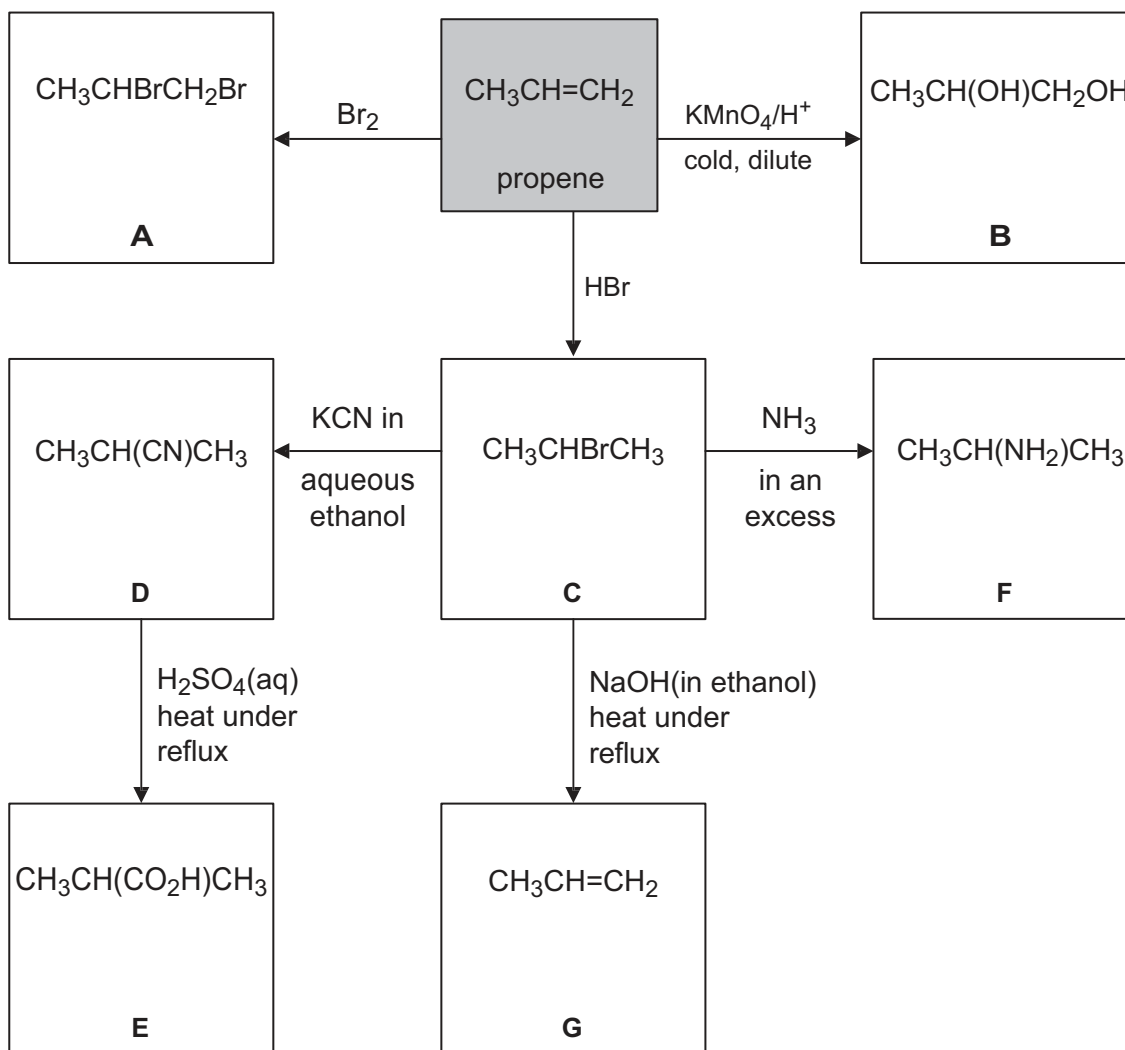
- (i) F₂O [1]
- (ii) SO₂ and SO₃
or P₂O₃/P₄O₆ and P₂O₅/P₄O₁₀
or any two from N₂O₃, NO₂/N₂O₄, N₂O₅
or any two from Cl₂O, ClO₂, ClO₃, Cl₂O₇ (1 + 1) [2]
- (iii) SiO₂ or Al₂O₃ or MgO [1]
- (iv) giant structure (1)
strong covalent bonds (1) [2]

- (c) (i) octahedral [1]
- (ii) I atom is larger than Cl atom (1)

cannot pack 7 F atoms around Cl 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) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$

[1]

(ii) inductive effect of alkyl groups (1)
stabilises secondary carbocation of 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)
- $$\begin{array}{c}
 \text{HO}_2\text{CCH}_2 \quad \text{CO}_2\text{H} \\
 | \qquad \qquad | \\
 \text{---C---C---} \quad (1) \\
 | \qquad \qquad | \\
 \text{HO}_2\text{C} \quad \text{H} \quad (1)
 \end{array}$$
- [2]
- (c) $\text{C} : \text{H} : \text{O} = \frac{35.8}{12} : \frac{4.5}{1} : \frac{59.7}{16}$ this mark is for correct use of A_r values (1)
 $\text{C} : \text{H} : \text{O} = 2.98 : 4.5 : 3.73$
 $\text{C} : \text{H} : \text{O} = 1 : 1.5 : 1.25$ this mark is for evidence of correct calculation (1)
 gives empirical formula of **W** is $\text{C}_4\text{H}_6\text{O}_5$ [2]
- (d) $n(\text{OH}^-) = 1.00 \times 29.4/1000 = 0.0294$ (1)
 $n(\text{W}) = \frac{1.97}{134} = 0.0147$ (1)
 no. of $-\text{CO}_2\text{H}$ groups present
 in one molecule of **W** = $\frac{0.0294}{0.0147} = 2$ (1) [3]

[Total: 11]

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