A-LEVEL PAPER 2 PP2 MS

          Organic points

(1)     Curly arrows: must show movement of a pair of electrons,  
i.e. from bond to atom or from lp to atom / space  
e.g.



(2)     Structures

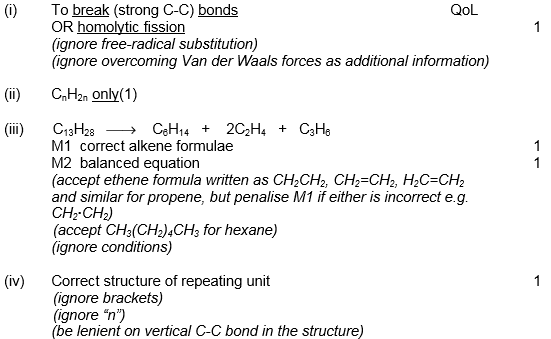
penalise sticks (i.e. ) once per paper



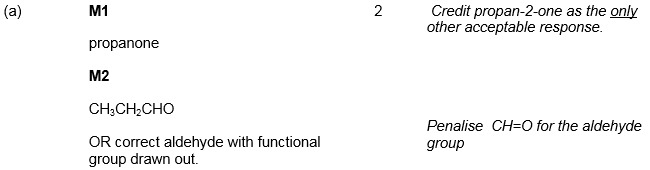
Penalise once per paper

          allow CH3– or –CH3 or  or CH3    or   H3C–

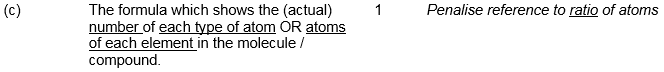
**1.**

 **[5]**

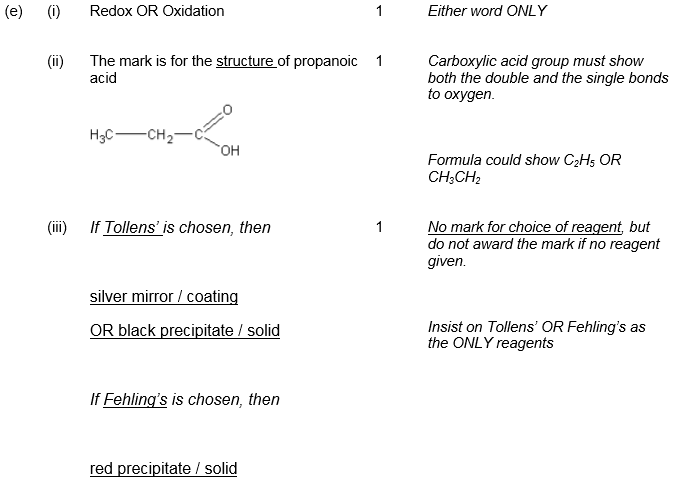
**2.**

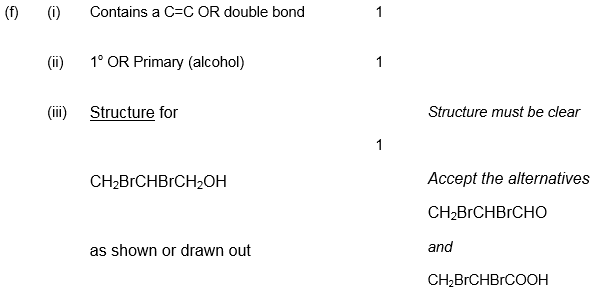
****

****

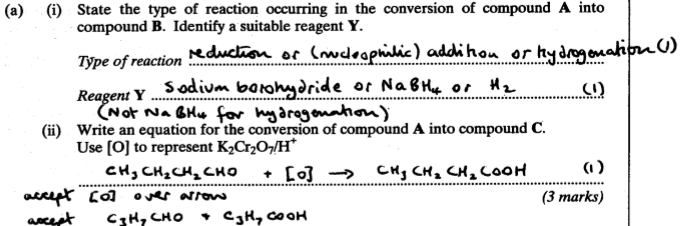
****

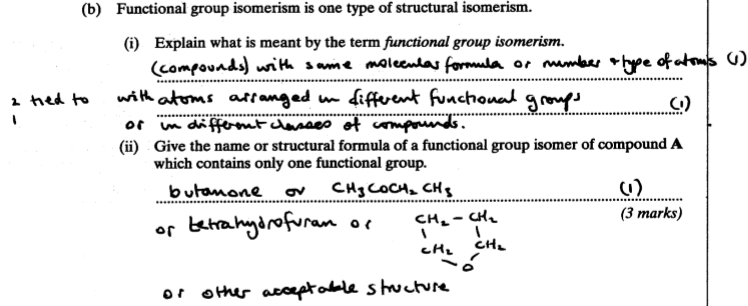
****

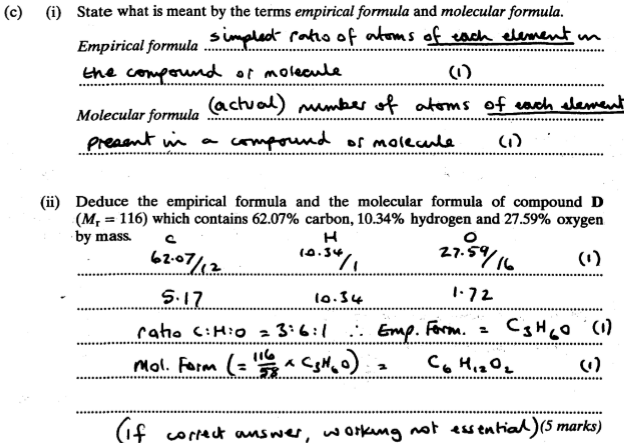
****

** [12]**

**3.**

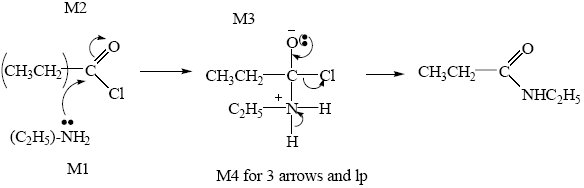
****

****

** [11]**

**4.**          (a)     (nucleophilic) addition-elimination

**1**

****

**4**

N-ethylpropanamide

*minus on NH2 loses M1  
M2 not allowed independent of M1, but allow M1 for correct attack on C+  
+C=O loses M2  
only allow M4 after correct or very close M3  
lose M4 for Cl– removing H+ in mechanism, but ignore HCl as a product  
Not N-ethylpropaneamide*

**1**

(b)     CH3CN or ethan(e)nitrile or ethanonitrile

*not ethanitrile  
but allow correct formula with ethanitrile*

**1**

for each step wrong or no reagent loses condition mark

*contradiction loses mark*

**1**

Step 1    Cl2uv or above 300 °C

*wrong or no reagent loses condition mark*

**1**

Step 2    KCN

**1**

aq and alcoholic (both needed)

*allow uv light/(sun)light/uv radiation*

**1**

Step 3    H2/Ni or LiAlH4 or Na/C2H5OH

*not CN– but mark on  
NOT HCN or KCN + acid, and this loses condition mark  
NOT NaBH4Sn/HCl (forms aldehyde!)  
ignore conditions*

**1**

**[12]**

**5.** (a)    Sn / HCl   ***OR***   Fe / HCl      not conc H2SO4 nor any HNO3

Ignore subsequent use of NaOH

*Ignore reference to Sn as a catalyst with the acid*

*Allow H2 (Ni / Pt) but penalise wrong metal*

*But NOT NaBH4 LiAlH4 Na / C2H5OH*

**1**

**Equation must use molecular formulae**

C6H4N2O4 + 12 [H]

*12[H] and 4H2O without correct molecular formula scores 1 out of 2*

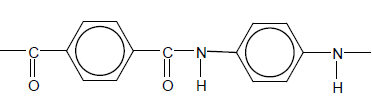
**1**

→C6H8N2 + 4H2O

*Allow .... + 6H2 if H2 / Ni used*

*Allow −CONH− or −COHN− or −C6H4−*

**1**

****

*Mark two halves separately: lose 1 each for*

*•  error in diamine part*

*•  error in diacid part*

*•  error in peptide link*

*•  missing trailing bonds at one or both ends*

*•  either or both of H or OH on ends*

*Ignore n*

**2**

(b)     CH2

**1**

In benzene 120°

**1**

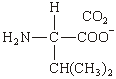
In cyclohexane 109° 28’ or 109½°

*Allow 108° - 110°*

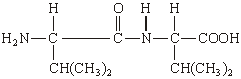
If only one angle stated without correct qualification, no mark awarded

**1**

**[8]**

**6.**     (a)     (i)       **(1)**

*ignore Na+ unless covalently bonded*

(ii)      **(1)**

*must be dipeptide, not polymer nor anhydride  
allow –CONH– or –COHN–*

*allow zwitterion*

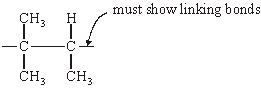
(iii)     hydrogen bonding **(1)**

*QL*

*Allow with dipole-dipole or v derWaals, but not dipole-dipole etc alone*

**3**

(b)     (i)      *Type of polymerisation*: addition(al) **(1)**

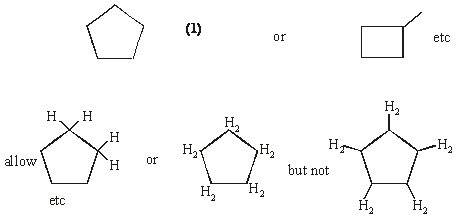
*Repeating unit*:  **(1)**

*not multiples*

*allow n*

(ii)     CH3CH=CHCH2CH3 **(1)** C2H5

(iii)



**4**

**[7]**

**7.** (a)     CH3COCl   +   AlCl3    CH3CO+   +   AlCl4–

*Allow RHS as *

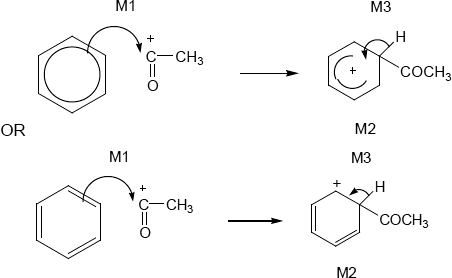
*Allow + on C or O in equation but + must be on C in mechanism below*

*Ignore curly arrows in equation even if wrong.*

**1**

AlCl4– + H+  AlCl3 + HCl

**1**

****

*• M1 arrow from within hexagon*

*to C or to + on C*

*• + must be on C of RCO in mechanism*

*• + in intermediate not too close to C1*

*• gap in horseshoe must be centred approximately around C1*

*• M3 arrow into hexagon unless Kekule*

*• allow M3 arrow independent of M2 structure*

*• ignore base removing H for M3*

*•* ***NO*** *mark for name of mechanism*

**3**

Phenylethanone             ignore 1 in name, penalise other numbers

*Note: this is the sixth marking point in (a)*

**1**

(b)     M1 about electrons

methyl group has (positive) inductive effect OR increases electron density on   
benzene ring OR pushes electrons OR is electron releasing

*Ignore reference to delocalisation*

**1**

M2 about attraction

electrophile attracted more

or benzene ring better nucleophile

*Allow intermediate ion stabilised*

***M2 only awarded after correct or close M1***

**1**

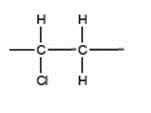
**[8]**

**8.**      (a)     Benzene-1,2-dicarboxylic acid

*Allow 1,2-benzenedicarboxylic acid*

**1**

(b)



*Must show all bonds including trailing bonds*

*Ignore n*

**1**

(c)     (i)      2 C2H5OH

*NB Two ethanols*

**1**

H2O

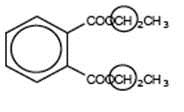
*but only one water*

**1**

(ii)     6 or six

**1**

(iii)



*Ignore overlap with O to the left or H to the*

*right, but must only include this one carbon.*

*either or allow both (as they are identical)*

**1**

(d)     (i)      Rate = *k*[DEP]

*Must have brackets but can be ( )*

**1**

(ii)     Any **two** of

•        experiment repeated/continued over a long period

•        repeated by independent body/other scientists/avoiding  
bias

•        investigate breakdown products

•        results made public

*Not just repetition*

*Ignore animal testing*

**2 max**

**[9]**

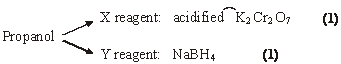
**9.**          (a)     X contains > C=O **(1)**

*if X and Y reversed lose this mark but allow remaining max 6/7*

** X is CH3CH2COOH **(1)**

**** Y is CH3CH2CH2OH **(1)**

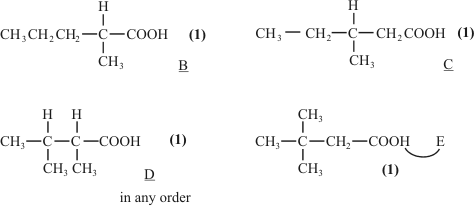
**** A is  **(1)**

****

Conc H2SO4 : catalyst **(1)**

**7**

(b)



**4**

(c)             3.1 – 3.9 **(1)**

****   2.1 – 2.6 **(1)**

a: quartet **(1)**  3 adjacent H **(1)**

b: triplet **(1)**  2 adjacent H **(1)**

**6**

(d)     3269 cm–1 OH  alcohol **(1)**

**** G is  (1)

**2**

**Notes**

(a)     first mark for C=O stated or shown in **X**

*Ignore wrong names*

**Y** CH3CH2CH2OH  
allow C3H7 in **A** if **Y** correct or vice versa  
Allow **(1)** for **A** if correct conseq to wrong **X** and **Y**

          other oxidising agents: acidified KMnO4; Tollens; Fehlings

          other reducing agents: LiAlH4; Na/ethanol; Ni/H2; Zn or Sn or Fe/HCl

(b)     give **(1)** for carboxylic acid stated or COOH shown in each suggestion  
**(1)** for correct **E**any 2 out of 3 for **B**, **C** or **D**allow C3H7 for either the **B** or **D** shown on the mark scheme  
i.e. a correct structure labelled **B**, **C** or **D** or **E** will gain 2.

(c)     protons a – *quartet* must be correct to score *3 adjacent H* mark. Same for b

(d)     allow **(1)** for any OH (alcohol) shown correctly in any structure – ignore extra functional groups. Structure must be completely correct to gain second mark

**[19]**

|  |  |  |
| --- | --- | --- |
| **10.** | (a) |  |
|  | (b) |  |
|  | (c) |  |
|  | (d) |  |
|  | (e) |  |
|  | (f) |  |
|  |  | |
|  | (g) |  |
|  | (h) |  |
|  | (i) |  |
|  | (j) | **[14]** |