A-LEVEL PAPER 2 PP1 MS

|  |  |  |
| --- | --- | --- |
| **1.** |  | |
|  |  | |
|  |  | |
|  | **[9]** | |
| **2.** |  | |
|  |  | |
|  |  | |
|  | **[8]** | |
| **3.** | (a) |  |
|  | (b) |  |

|  |  |  |
| --- | --- | --- |
|  | (c) | **[11]** |

**4.**            CH3CH2COCl + AlCl3 → [CH3CH2CO]+ + AlCl4–;

*(penalise wrong alkyl group once at first error)*

*(position of + on electrophile can be on O or C or outside [ ]) (penalise wrong curly arrow in the equation or lone pair on AlCl3)*

**1**

|  |  |
| --- | --- |
| *(M1 arrow from within hexagon to C or to + on C)*  *(don’t penalise position of + on C of RCO+)* | *(horseshoe must not extend beyond C2 to C6 but can be smaller)*  *(+ not too close to C1)*  *(penalise M2 if CH*3 *chain wrong again but allow M1 and M3)*  *(M3 arrow into hexagon unless Kekule)*  *(allow M3 arrow independent of M2 structure)* |

**3**



*(or can be gained in mechanism);*

**1**

**[5]**

**5.**       (a)     3-hydroxybutanal

*ignore number 1   i.e. allow 3-hydroxybutan-1-al*

*not hydroxyl*

**1**

(b)     

**1**

= 1.1

**1**

mol–1 dm3 s–1

**1**

(c)     planar or flat C=O or molecule

*allow planar molecule*

**1**

equal probability of attack from above or below

*must be equal; not attack of OH–*

**1**

(d)     (i)      Step 1 if wrong – no mark for explanation.

**1**

involves ethanal and OH– or species/ “molecules”  
in rate equation

**1**

(ii)     (B-L) acid or proton donor

*not Lewis acid*

**1**

(iii)     nucleophilic addition

*QOL*

**1**

(iv)

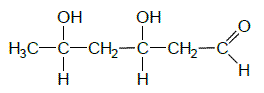


*not allow M2 before M1, but allow M1 attack on C+ after non-scoring carbonyl arrow*

*ignore error in product*

**2**

(e)



**1**

**[13]**

**6.** (a)     (i)      3CH3OH

*Not molecular formula*

**1**

HOCH2CH(OH)CH2OH

**1**

(ii)     →   19CO2   +   19H2O

*Or doubled*

**1**

C17H35COOCH3 + 27½ or 55/2 O2

*Consequential on correct right-hand side*

**1**

(b)    (i)       A 0.7

**1**

Ethanol 6.4

**1**

Water 3.6

**1**

(ii)     No effect

*If wrong, CE= 0*

**1**

Equal moles on each side of equation ***OR*** V cancels

*Ignore moles of gas*

**1**

(iii)    M1 

*Must have all brackets but allow ( )*

**1**

(iv)    M2 

*If Kc wrong can only score M4 for units consequential to their Kc working in (b)(iv)*

**1**

M3 0.55 (min 2dp)

**1**

M4 No units

**1**

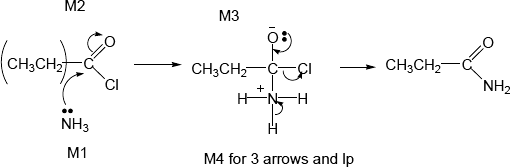
**[13]**

**7.** (a)    (Nucleophilic) addition-elimination

*•   Minus sign on NH3 loses M1(but not M4 also)*

*•   M2 not allowed independent of M1, but*

**1**

****

*•   allow M1 for correct attack on C+*

*•   + rather than δ+ on C=O loses M2*

*•* ***If Cl lost with C=O breaking, max1 for M1***

*•* ***M3*** *for correct structure with charges but lp on O is part of* ***M4***

*•   only allow* ***M4*** *after correct/very close* ***M3***

*•   For* ***M4****, ignore NH3 removing H+ but lose* ***M4*** *for Cl– removing    H+ in mechanism,*

*•   but ignore HCl shown as a product*

**4**

propanamide (Ignore -1- )

*penalise other numbers*

*penalise propaneamide and N-propanamide*

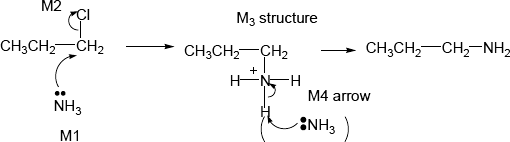
**1**

(b)     Nucleophilic substitution

*•     Minus sign on NH3 loses M1 (not M4 also)*

*•   + rather than δ+ on C=O loses M2*

**1**

****

*•   ALLOW SN1 so allow M2 for loss of Cl– before attack of NH3     on C+ for M1*

*•   only allow M4 after correct/very close M3*

*•   For M4, ignore NH3 removing H+ but lose M4 for Cl– removing H+ in mechanism,*

Propylamine (ignore number 1)

*•   but ignore HCl shown as a product*

**4**

or propan-1-amine or 1-aminopropane (number 1 needed)

*penalise other numbers*

*allow 1-propanamine*

**1**

(c)     electron rich ring or benzene or pi cloud repels nucleophile/ammonia

*Allow*

*•   C–Cl bond is short/stronger than in haloalkane*

*•   C–Cl is less polar than in haloalkane*

*•   resonance stabilisation between ring and Cl*

**1**

**[13]**

**6.** (a)    M1        Ester **1**

*If Ester 2, can score M3 only.*

**1**

M2        peak at δ = 4.1     due to    

*When marking M2 and M3, check any annotation of structures in the stem at the top of the page.*

**1**

M3        (δ = 4.1 peak is) quartet as adjacent / next to / attached to CH3

**1**

M4        Other spectrum quartet at δ = 2.1-2.6 (or value in this range)

**1**

(b)     M1        Quaternary (alkyl) ammonium salt / bromide

**1**

M2        CH3Br or bromomethane

*Penalise contradictory formula and name.*

**1**

M3        Excess ( CH3Br or bromomethane)

*Mention of acid eg H2SO4 OR alkali eg NaOH loses both M2 and M3.*

**1**

M4        Nucleophilic substitution

*Can only score M3 if reagent correct.*

*Ignore alcohol or ethanol (conditions) or Temp.*

**1**

**[8]**

**9.** (a)

|  |  |  |
| --- | --- | --- |
| Reagent (1) | P (ketone) | **S** (2° alcohol) |
| Acidified K2Cr2O7 | no reaction | (orange to) green |
| Acidified KMnO4 | no reaction | (purple to) colourless |
| I2 / NaOH | Yellow ppt | no reaction |
| Named RCOOH with HCl or H2SO4 | no reaction | fruity or sweet smell |
| Named RCOCl | no reaction | Misty fumes |
| *Allow names including potassium permanganate*  *Wrong or no reagent CE = 0*  *Penalise incorrect formulae or incomplete reagent, such as K2Cr2O7 or acidified dichromate, but mark on.* | *Allow no change or nvc but penalise nothing or no observation*  *If 2 reagents added sequentially or 2 different reagents used for P and S then CE = 0* | |
| **1** | **1** | **1** |

(b)     Tollens’ (1) and silver mirror / solid (1)

or

Fehling’s / Benedicts (1) and red ppt (1)

**1**

(c)     **G**

P

*If not P then no marks for clip*

**1**

5 OR five

**1**

(d)     C4H12Si

*Must be molecular formula*

*Wrong substance CE = 0 for clip*

**1**

Any **two** from

•        One or single peak OR all (four) carbon atoms are equivalent or one environment

**1**

•        upfield from others or far away from others or far to right

•        non toxic OR inert

•        low boiling point or volatile or easy removed from sample

*Ignore and don’t credit single peak linked to 12 equivalent H or has a peak at δ = 0*

*but use list principle for wrong statements*

**1**

**1**

(e)     Figure 1 is **R**

*If not* ***R*** *cannot score M2*

M1

**1**

90−150 (ppm) or value in range is (two peaks for) C = C / alkene

M2

**1**

Figure 2 is **T**

*If not* ***T*** *cannot score M4 or M5*

M3

**1**

50-90 (ppm) or value in range is C—O or alcohol or ether

M4

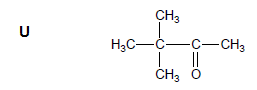
**1**

two peaks (so not S which would have only one)

M5

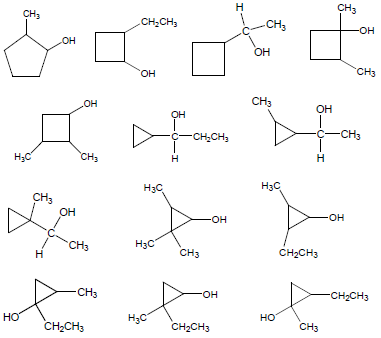
**1**

(f)



**1**

**V** Answers include



*Not allow* ***S***

******

*because* ***V*** *must be an isomer of* ***S***

**[17]**

**10.** 6 / six

**[1]**

|  |  |
| --- | --- |
| **11.** |  |
|  |  |
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|  |  |
|  |  |
|  |  |