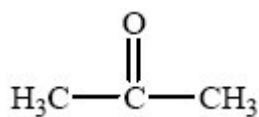


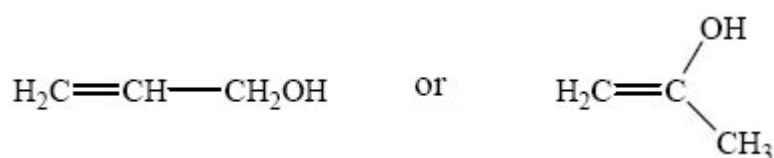
M1. (a) A



allow CH_3COCH_3

1

B



must show $\text{C}=\text{C}$

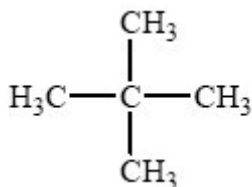
Penalise sticks once per pair

1

(b) C $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$

1

D



NOT cyclopentane which is only C_5H_{10}

Penalise sticks once per pair

1

(c) E $\text{CH}_3\text{CH}_2\text{COOCH}_3$

Allow $\text{C}_2\text{H}_5\text{CO}_2\text{CH}_3$

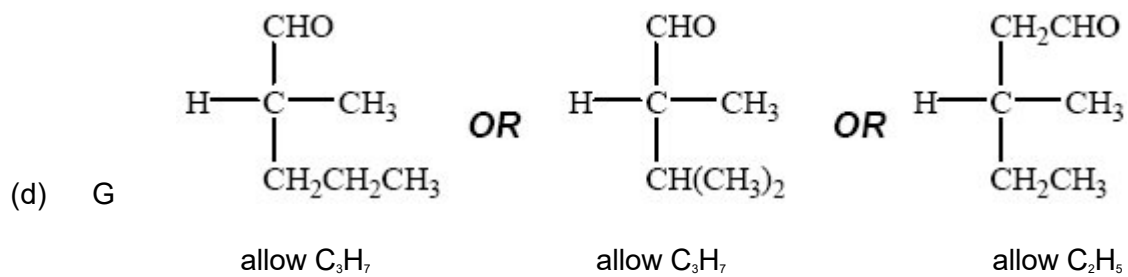
1

F $\text{CH}_3\text{COOCH}_2\text{CH}_3$

Allow $\text{CH}_3\text{CO}_2\text{CH}_2\text{CH}_3$ or $\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$

Penalise sticks once per pair

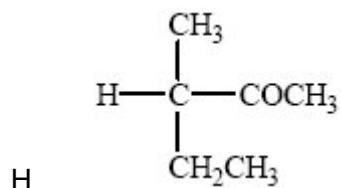
1



not C₅H₁₁, nor C₄H₉

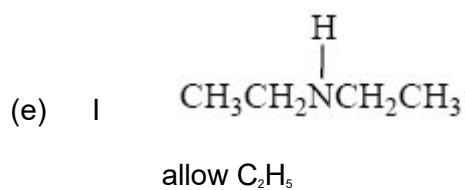
Penalise sticks once per pair

1

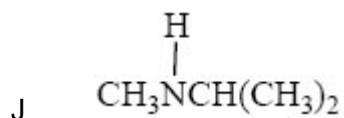


allow C₂H₅

1



1



NOT C₃H₇

Penalise sticks once per pair

1

[10]

M2. (a) GLC or distillation

1

(b) C=O

1

(c) (i) Cl has two isotopes 1

(ii) $\text{CH}_3\overset{+}{\text{C}}=\text{O}$ 1

$\text{C}_4\text{H}_7\text{ClO}^+ \rightarrow \text{CH}_3\overset{+}{\text{C}}=\text{O} + \text{C}_2\text{H}_4\text{Cl}^+$ 1

(d) (i) e.g. CDCl_3 or CCl_4 1

(ii) $\text{Si}(\text{CH}_3)_4$ 1

(e) 0 and 3 1

(f)



(g) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COCl}$ or $(\text{CH}_3)_2\text{CHCOCl}$ 1

[10]

M3. (a) chromatography (allow GLC TLC GC HPLC)
allow any qualification 1

(b) 5 1

Allow 320(.0) or 322(.0)

1

(c) Use of excess air/oxygen or high temperature (over 800 °C)
or remove chlorine-containing compounds before incineration

1

(d) (i) $\text{Si}(\text{CH}_3)_4$ allow $\text{SiC}_4\text{H}_{12}$
allow displayed formula and do not penalise sticks
Not TMS

1

(ii) 3

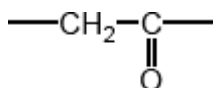
1

[6]

M4.(a) OH alcohols

1

(b) (i) 2.6



Ignore any group on RHS

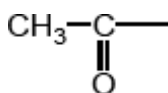
*Must clearly indicate relevant **two** H on a C next to C=O*

On LHS, penalise H or CH or CH_2 or CH_3

Ignore missing trailing bonds or attached R groups

1

(ii) 2.2

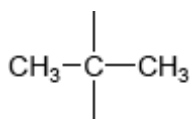


Ignore all groups on RHS

*Must clearly indicate relevant **three** H on C next to C=O*

Ignore missing trailing bonds or attached R group

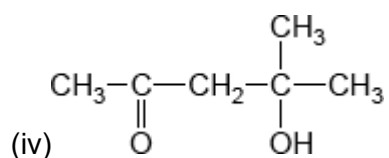
(iii) 1.2

Or in words: two equivalent CH₃ groups*Must clearly indicate two equivalent methyl groups.*

Penalise attached H

Ignore missing trailing bonds or attached R groups

1



(iv)

1

[5]

M5. (a) (i) Single reagent

If wrong single reagent, CE = zero

Incomplete single reagent (e.g. carbonate) or wrong formula (e.g. NaCO₃) loses reagent mark, but mark on

For “no reaction” allow “nothing”

Different reagents

If different tests on E and F; both reagents and any follow on chemistry must be correct for first (reagent) mark.

Reagent must react: i.e. not allow Tollens on G (ketone) – no reaction.

Second and third marks are for correct observations.

i.e. for different tests on E and F, if one reagent is correct and one wrong, can score max 1 for correct observation with correct reagent.

PCl₅ PCl₃SOCl₂

1

E ester

$\text{Na}_2\text{CO}_3/\text{NaHCO}_3$ named carbonate

metal e.g. Mg

no reaction

no reaction

named indicator

no effect

No reaction

1

F acid

$\text{Na}_2\text{CO}_3/\text{NaHCO}_3$ named carbonate

Effervescence or CO_2

metal e.g. Mg

Effervescence or H_2

named indicator

acid colour

fumes

1

(ii) Single reagent

If wrong single reagent, CE = zero

Incomplete single reagent (e.g. carbonate) or wrong formula (e.g. NaCO_3) loses reagent mark, but mark on

For “no reaction” allow “nothing”

Different reagents

If different tests on E and F; **both** reagents and any follow on chemistry must be correct for first (reagent) mark.

Reagent must react: i.e. not allow Tollens on

G (ketone) – no reaction.

Second and third marks are for correct observations.

1

i.e. for different tests on E and F, if one reagent is correct and one wrong, can score max 1 for correct observation with correct reagent.

G ketone

AgNO₃

no reaction

Na₂CO₃/NaHCO₃ named carbonate

water

no reaction

named indicator

no effect

Named alcohol

no reaction

Named amine or ammonia

no reaction

1

H Acyl chloride

AgNO₃

(white) ppt

Na₂CO₃/NaHCO₃ named carbonate

Effervescence or CO₂ or fumes or exothermic

water

fumes

named indicator

acid colour

Named alcohol

Smell or fumes

Named amine or ammonia

fumes

1

Allow iodoform test or Brady's reagent (2,4,dnph) test (both positive for G)

(iii) Single reagent

If wrong single reagent, CE = zero
Incomplete single reagent (e.g. carbonate) or wrong formula (e.g. NaCO_3) loses reagent mark, but mark on

For "no reaction" allow "nothing"

Different reagents

If different tests on E and F; **both** reagents and any follow on chemistry must be correct for first (reagent) mark.

Reagent must react: i.e. not allow Tollens on G (ketone) – no reaction.

Second and third marks are for correct observations.

i.e. for different tests on E and F, if one reagent is correct and one wrong, can score max 1 for correct observation with correct reagent.

1

J Primary alcohol

$\text{K}_2\text{Cr}_2\text{O}_7 / \text{H}^+$

goes green

$\text{KMnO}_4 / \text{H}^+$

decolourised / goes brown

Lucas test (ZnCl_2/HCl)

Penalise missing H^+ but mark on

1

K Tertiary alcohol

$\text{K}_2\text{Cr}_2\text{O}_7 / \text{H}^+$

No reaction

KMnO₄/ H⁺

no reaction

Lucas test (ZnCl₂/HCl)

Rapid cloudiness

1

If uses subsequent tests e.g. Tollens/Fehlings, test must be on product of oxidation

(b) (i) 3,3-dimethylbutan-1-ol

Allow 3,3-dimethyl-1-butanol

1

4

1

Triplet on three

1

(ii) 2-methylpentan-2-ol

Allow 2-methyl-2-pentanol

1

5

1

Singlet or one or no splitting

1

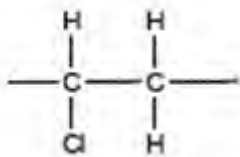
[15]

M6. (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

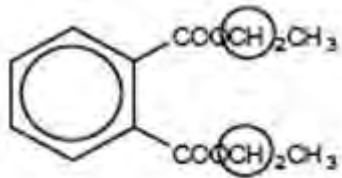
H₂O
but only one water

1

- (ii) 6 or six

1

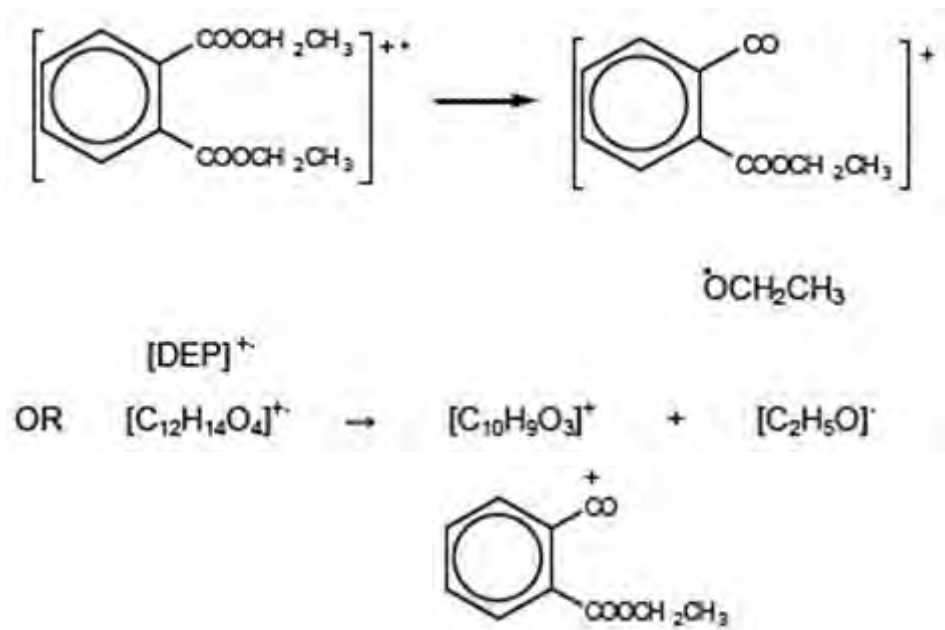
- (iii)



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)



Allow + on C or O in

1

Dot must be on O in radical

1

- (e) (i) Rate = $k[\text{DEP}]$
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

[11]