Carbonyls MS

1. (a) (i) <u>silver</u> mirror ✓

ALLOW *Ag(s)* ***OR*** *Ag mirror* ***OR*** *precipitate* ***OR*** *ppt* ***OR*** *solid*
ALLOW *brown* ***OR*** *black* ***OR*** *grey*

1

(ii) $HOCH_2COOH$ ✓

ALLOW *$CH_2OHCOOH$* ***OR*** *CH_2OHCO_2H* ***OR*** *$HOCH_2CO_2H$* ***OR*** *displayed* ***OR*** *skeletal formula* ***OR*** *$HOCH_2COO^-$*
DO NOT ALLOW *C_2H_4O* ***OR*** *2-hydroxyethanoic acid*

1

(b) $HOCH_2CHO + 3[O] \longrightarrow HOOCCOOH + H_2O$
reagents ✓ both products ✓

ALLOW *displayed/skeletal formula/COOHCOOH* ✓✓

if molecular formula used $C_2H_4O_2 + 3[O] \longrightarrow C_2H_2O_4 + H_2O$
max = 1 ✓

Any correctly balanced equation for partial oxidation *can score 1 mark* ✓

$HOCH_2CHO + [O] \longrightarrow HOCH_2COOH$
OR
$HOCH_2CHO + 2[O] \longrightarrow OHCCOOH + H_2O$
OR
$HOCH_2CHO + [O] \longrightarrow OHCCHO + H_2O$
OR
$HOCH_2CHO + 2[O] \longrightarrow HOOCCHO + H_2O$

2

(c) (i) $HOCH_2CH_2OH$ ✓

ALLOW *$HO(CH_2)_2OH$* ***OR*** *$(CH_2OH)_2$* ***OR*** *skeletal formula* ***OR*** *displayed formula*

DO NOT ALLOW *molecular formula ($C_2H_6O_2$)*

1

(ii) curly arrow from H^- to $C^{\delta+}$ ✓
dipoles <u>and</u> curly arrow from C=O bond to O ✓

ALLOW *curly arrow to C even if dipole missing or incorrect*

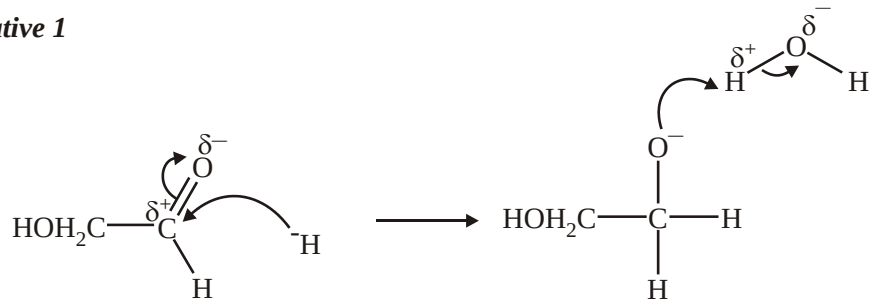
intermediate ✓

curly arrow from intermediate to $H^{\delta+}$ in H_2O/ H^+ and if H_2O is used it must show the curly arrow from the O–H bond to the O ✓

lone pairs are not essential

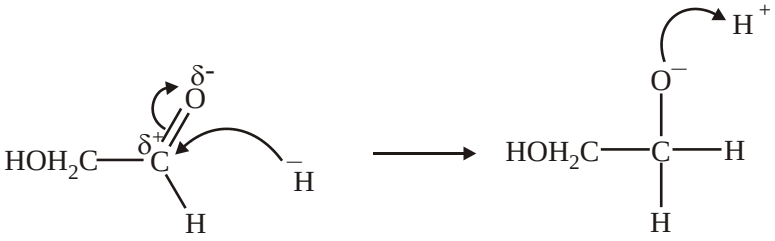
ALLOW *maximum of 3 marks if incorrect starting material is used*

Alternative 1

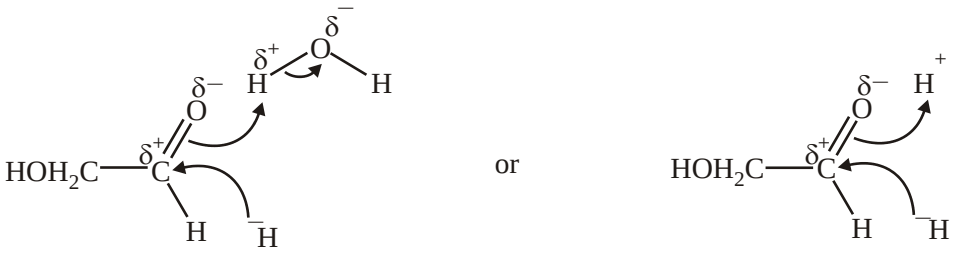


Alternative 2

products are not required



Alternative 3



Alternative 3 *scores all 4 marks even though the intermediate is not shown*

4

[9]

2. (a) (i) Tollens' reagent / ammoniacal silver nitrate **(1)**

silver mirror / precipitate **(1)**

butanoate / butanoic acid / unambiguous formula or structure **(1)** 3

(ii) **Any of:**

Br_2 – decolourises – (electrophilic) addition
Na – fizzes – redox
$SOCl_2$ /PCl_5 /acid chloride – white fumes – substitution/chlorination
carboxylic acid + conc H_2SO_4 /acid chloride – sweet smell – esterification/ condensation

test **(1)** - observation **(1)** - type of reaction **(1)** 3

NOT
2-4DNPH to give no precipitate

(b) recrystallise /purify (the precipitate) **(1)**

measure melting point **(1)**

compare with known values **(1)** 3

[9]