

Name of the Student: _____

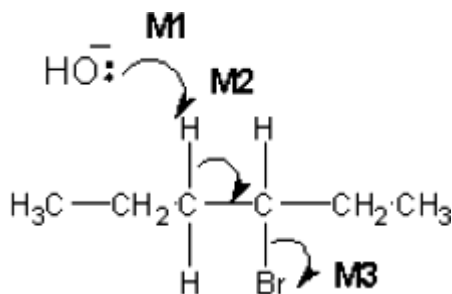
Max. Marks : 26 Marks

Time : 26 Minutes

Mark Schemes

Q1.

(a) (i)



Penalise one mark from their total if half-headed arrows are used

Penalise **M3** for formal charge on C of the C-Br or incorrect partial charges on C-Br

Ignore other partial charges

M1 must show an arrow from the lone pair on oxygen of a negatively charged hydroxide ion to the correct H atom

Penalise once only in any part of the mechanism for a line and two dots to show a bond.

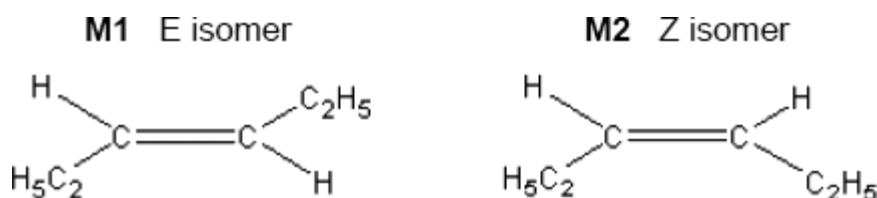
M2 must show an arrow from the correct C-H bond to the correct C-C bond. Only award if an arrow is shown attacking the H atom of the correct C-H bond in **M1**

M3 is independent but **CE=0** if nucleophilic substitution

N.B these are double-headed arrows

3

(ii)



Award 1 mark if both correct stereoisomers but in the wrong places

Accept no other alkenes.

Be reasonably lenient on the bonds to ethyl (or to CH₂CH₃) since the question is about E and Z positions but penalise once only if connection is clearly to the CH₃ of CH₂CH₃

Accept linear structures

2

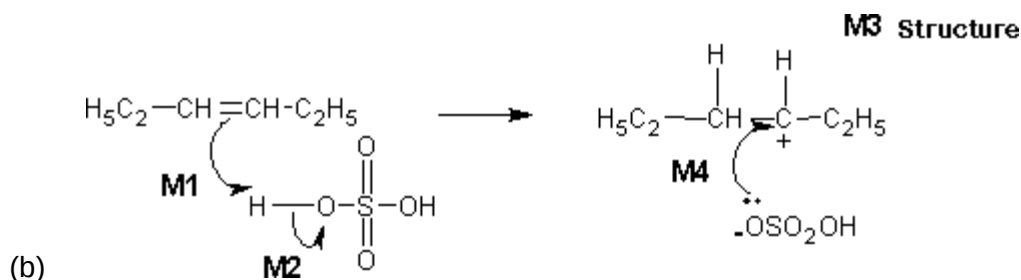
- (iii) **M1** (Compounds / molecules with) the same structural formula
*Penalise **M1** if "same structure"*
- M2** with atoms/bonds/groups arranged differently in space
Ignore references to "same molecular formula" or "same empirical formula" or any reference to "displayed formula"

OR

atoms/bonds/groups that have different spatial arrangements / different orientation.

Mark independently

2



M1 must show an arrow from the double bond towards the H atom of the H – O bond
 OR HO on a compound with molecular formula for H_2SO_4

M1 could be to an H^+ ion and **M2** an independent O – H bond break on a compound with molecular formula for H_2SO_4

***M1** Ignore partial negative charge on the double bond.*

M2 must show the breaking of the O – H bond.

***M2** Penalise partial charges on O – H bond if wrong way and penalise formal charges*

*In **M2** do not penalise incorrect structures for H_2SO_4*

M3 is for the structure of the carbocation.

M4 must show an arrow from the lone pair of electrons on the correct oxygen of the negatively charged ion towards a correct (positively charged) carbon atom.

***M4** NOT HSO_4^-*

*For **M4**, credit as shown or $\text{^-OSO}_3\text{H}$ ONLY with the negative charge anywhere on this ion*

OR correctly drawn out with the negative charge placed correctly on oxygen

Penalise once only in any part of the mechanism for a line and two dots to show a bond

NB The arrows here are double-headed

Max 3 of any 4 marks for wrong organic reactant or wrong organic product (if shown)

Accept the correct use of "sticks"

4

[11]

Q2.

(a) **M1 Safety (in Process 1)**

Sodium hydroxide / alkali is corrosive / harmful / caustic or sodium hydroxide is alkali(ne)

Ignore references to chromium compounds

OR

Bromine compounds are toxic / poisonous

"Carbon-neutral" alone is insufficient for M2

M2 Environmental

Ignore references to greenhouse gases

Process 2 could be used as a carbon sink / for carbon capture

OR

uses waste / recycled CO₂ / CO₂ from the factory / CO₂ from the bioethanol (or biofuel) production

OR

reduces or limits the amount of CO₂ released / given out (into the atmosphere)

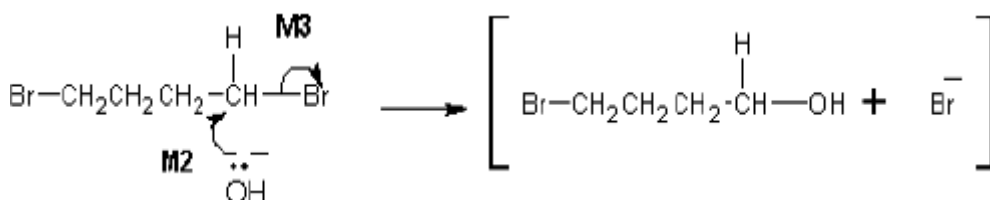
OR

Process 2 uses renewable glucose / renewable resource(s)

2

(b) (i) **M1 nucleophilic substitution**

For M1, both words required



M2 must show an arrow from the lone pair of electrons on the oxygen atom of the negatively charged hydroxide ion to the C atom.

Penalise M2 if covalent NaOH / KOH is used

Penalise one mark from M2 or M3 if half-headed arrows are used

M3 must show the movement of a pair of electrons from the C-Br bond to the Br atom. Mark **M3** independently provided it is from the original molecule

Penalise M3 for formal charge on C of the C-Br or incorrect partial charges on C-Br

Penalise once only for a line and two dots to show a bond.

For **M2** and **M3** award full marks for an S_N1 mechanism

For M2 and M3, maximum 1 of 2 marks for the mechanism if wrong reactant is used.

Penalise M3 if an extra arrow is drawn from the Br of the C-Br bond to, for example, K⁺

Accept the correct use of "sticks"

(ii) **M1** B

M2 C

M3 A

3

(c) **M1** fermentation

*Mark **M2** to **M4** independently*

Three conditions in any order for M2 to M4

Penalise "bacteria" and "phosphoric acid" using the list principle

M2 (enzymes from) yeast or zymase

M3 $25^{\circ}\text{C} \leq T \leq 42^{\circ}\text{C}$ OR $298\text{ K} \leq T \leq 315\text{ K}$

Ignore reference to "aqueous" or "water", "closed container", "pressure", "lack of oxygen", "concentration of ethanol" and "batch process" (i.e. not part of the list principle)

M4 anaerobic / no oxygen / no air OR neutral pH

4

(d) **M1** primary OR 1° (alcohol)

Mark independently

M2 acidified potassium or sodium dichromate

*For **M2**, it must be a whole reagent and/or correct formulae*

OR H_2SO_4 / $\text{K}_2\text{Cr}_2\text{O}_7$ OR H^+ / $\text{K}_2\text{Cr}_2\text{O}_7$

Do not penalise incorrect attempt at formula if name is correct or vice versa

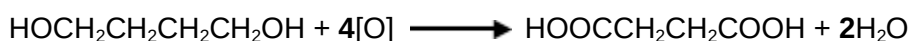
Accept phonetic spelling

If oxidation state given in name, it must be correct.

*For **M2** accept acidified potassium manganate(VII)*

OR correct combination of formula and name

M3



*For **M3** structures must be correct and not molecular formula*

3

[15]