

Name of the Student: _____

Max. Marks : 28 Marks

Time : 28 Minutes

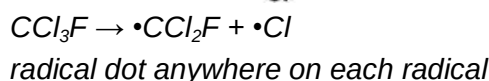
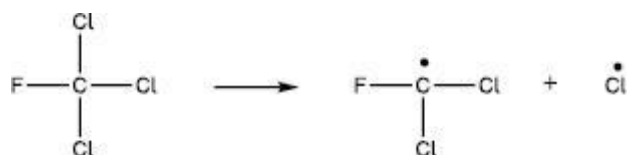
Mark Schemes

Q1.

(a) trichlorofluoromethane

1

(b)



1

(c) **M1** amount of CFC-11 = $\frac{500}{137.5}$ (= 3.64) mol
 Allow ECF from **M1** to **M2**

1

M2 molecules of $O_3 = 3.64 \times 100,000 \times 6.022 \times 10^{23} = 2.19 \times 10^{29}$
 Allow answers in range 2×10^{29} to 2.20×10^{29} (1sf is acceptable as this is an estimate)

1

(d) Absorbs (harmful) ultraviolet / uv (light / radiation)
 Protects us from (harmful) uv
 Ignore other wavelengths / types of light

1

(e) One of these reasons:

- lack of evidence that ozone was being depleted
- lack of alternatives to CFCs
- commercial interest to continue to use CFCs
- hard to obtain international agreement

1

(f) **M1** absorbs infrared radiation
M1 idea of IR being taken in

1

M2 molecule has polar bonds
M2 accept polar molecule

1

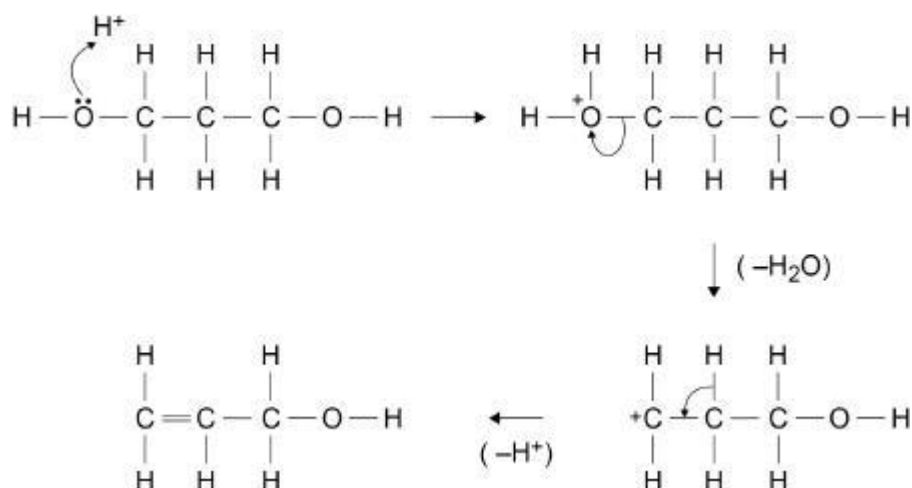
[8]

Q2.

(a) nucleophilic substitution

1

(b) **M1** elimination



1

M2 arrow from lone pair on O to H^+

1

M3 1st intermediate **and** arrow from $C-O^+H_2$ bond to O

1

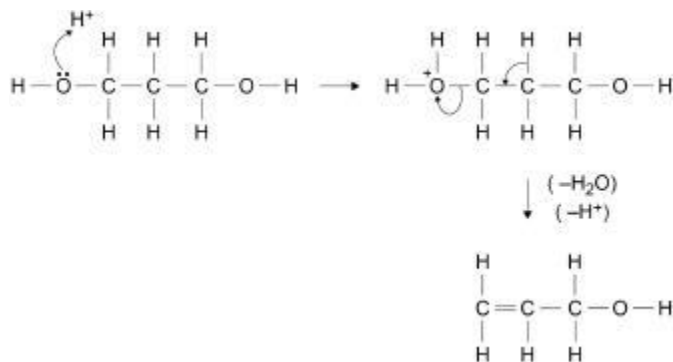
M4 2nd intermediate (carbocation) **and** arrow from a correct $C-H$ bond to correct $C-C$ to form $C=C$

Max 2 of 3 marks (M2-4) for wrong organic reactant (ignore structure of product)

M3 and M4 can be scored in one concurrent step:

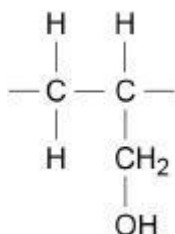
M3 for correct intermediate and arrow from $C-O^+H_2$ bond to O

M4 for arrow from a correct $C-H$ bond to correct $C-C$ to form $C=C$ 1



1

(c)

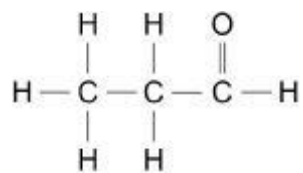


Any correct structural representation

Ignore any brackets and/or n

1

(d)



Structure in any form

1

[7]

Q3.

(a) Dehydration

Allow (acid catalysed) Elimination

M1

Conc H_2SO_4

Allow Conc H_3PO_4

M2

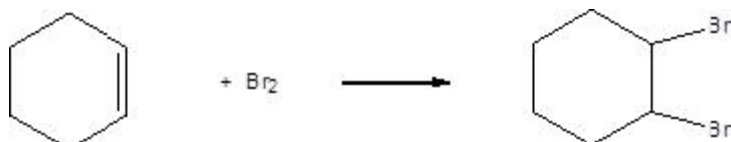
(b) Br_2

Allow bromine (water)

Allow Cl_2 or I_2

Allow O_2 if epoxide route used

M1



allow conseq equation to H_2 , H_2O , HBr , HCl , HI and H_2SO_4

An epoxide is a feasible alternative that could score here and consequentially M3 and M4

M2

NaOH

Or KOH or other suitable strong alkali

M3



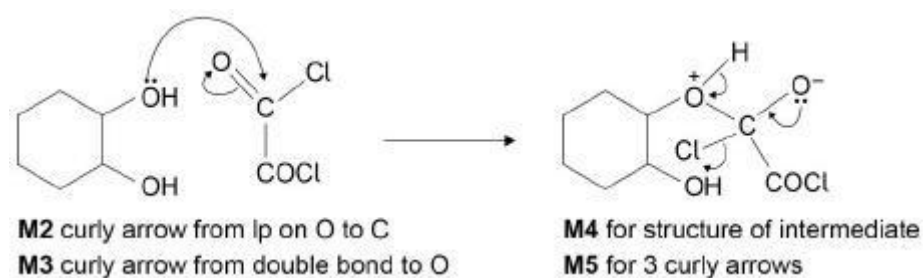
Allow this equation with molecular formulae

M4

(c) **M1** (nucleophilic)addition-elimination

Note lone pair required for M5

M1



M2

M3

M4

M5

(d) Less energy used **OR** Better yield

***OR** reduces practical losses, simpler plant,*

M1

Less waste **OR** Less pollution

***OR** maximises the use of raw materials in the process into useful*

