

Name of the Student: _____

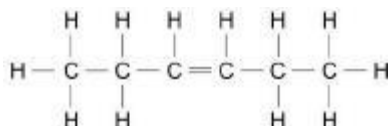
Max. Marks : 22 Marks

Time : 22 Minutes

Mark Schemes

Q1.

(a)

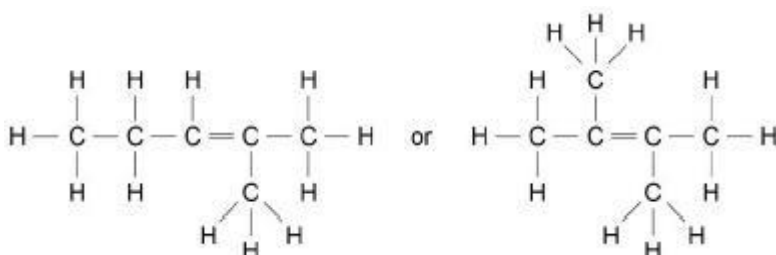


Displayed structure of hex-3-ene (E or Z isomer)

Award 1 mark if correct molecules given in (a) and (b) but they are not displayed structures

1

(b)



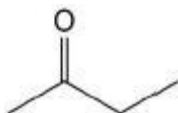
Displayed formula of 2-methylpent-2-ene or 3,4-dimethylbut-2-ene

Allow molecules that are both chain and position isomers, eg
2-methylpent-1-ene, 3-methylpent-1-ene, 4-methylpent-1-ene,
3,3-dimethylbut-1-ene, 2,3-dimethylbut-1-ene, 2-ethylbut-1-ene

Award 1 mark if correct compounds given in part (a) and (b) but they are not displayed formulas

1

(c)

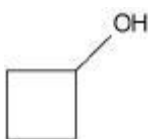


Skeletal formula

Award 1 mark if correct compounds given in part (c) and (d) but they are not skeletal formulas

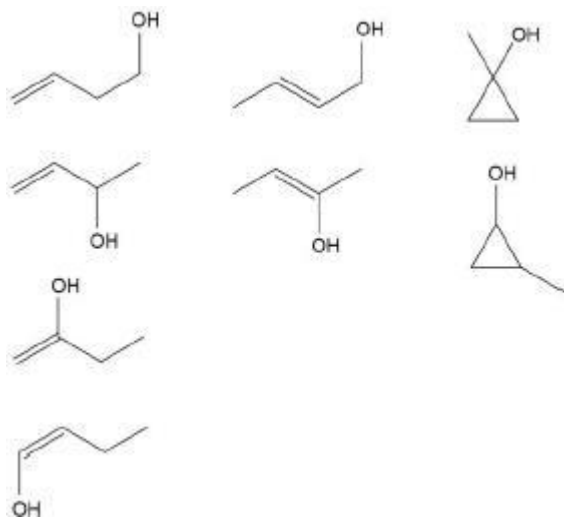
1

(d)



Skeletal formula

Alternative answers:



Award 1 mark if correct compounds given in part (c) and (d) but they are not skeletal formulas

1

(e) **M1** divide %s by relative atomic masses:

$$\text{C } \frac{17.8}{12.0} = 1.48 \quad \text{H } \frac{3.0}{1.0} = 3.00 \quad \text{Br } \frac{79.2}{79.9} = 0.99$$

Allow ECF from **M1** to **M2** for a correct empirical formula for their working in **M1**

1

M2 (1.48 : 3.00 : 0.99 = 3 : 6 : 2) empirical formula = $\text{C}_3\text{H}_6\text{Br}_2$

Allow ECF from **M2** to **M3/4** for compounds that are saturated halogenoalkanes

1

M3,4 any 2 of:

1,1-dibromopropane
1,2-dibromopropane
1,3-dibromopropane
2,2-dibromopropane

2

[8]

Q2.

This question is marked using Levels of Response. Refer to the Mark Scheme Instructions for Examiners for guidance.

Level 3 5-6 marks	All stages are covered and each stage is generally correct and virtually complete. Answer is communicated coherently and shows a logical progression from Stage 1 to Stages 2 and 3 Covers at least 1 point for stage 1, 3 for stage 2 and 3 for stage 3.
Level 2 3-4 marks	All stages are covered but stage(s) may be incomplete or may contain inaccuracies Covers at least 1 point for stage 1 stage 2 and stage 3. OR two stages are covered and are generally correct and virtually complete. Covers at least 1 point for stage 1, and 3 for stage 2 or stage 3 OR 3 for stage 2 and 3 for stage 3 Answer is communicated mainly coherently and shows a logical progression from Stage 1 to Stages 2 and 3.
Level 1 1-2 marks	Two stages are covered but stage(s) may be incomplete or may contain inaccuracies OR only one stage is covered but is generally correct and virtually complete. Answer includes isolated statements but these are not presented in a logical order.
0 marks	Insufficient correct chemistry to gain a mark.

Indicative Chemistry content

Stage 1: infrared

1a) (broad peak) at 3400 cm^{-1} (any value from 3230-3550) indicates OH in alcohols

1b) peak at 1720 cm^{-1} (any value from 1680-1750) indicates C=O

Stage 2: ^1H nmr

2a) peak at 3.9 ppm integration 1 so 1 **H-C-O** AND quartet so adjacent to CH_3 (stated or shown)

2b) peak at 3.7 ppm integration 1 so **HO-C-(stated or shown)**

2c) peak at 2.1 ppm integration 3 so **$\text{H}_3\text{C-C=O}$** AND singlet so no adjacent H (stated or shown)

2d) peak at 1.2 ppm integration 3 so **$\text{H}_3\text{C-}$** AND doublet so adjacent to CH (stated or shown)

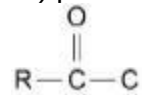
2e) sum of integration values = 8 Hence $\text{C}_4\text{H}_8\text{O}_2$

Stage 3: ^{13}C nmr

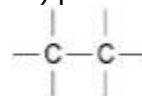
3a) peak at 210 ppm C=O aldehydes or ketones

3b) peak at 75 ppm C-O (alcohols, ethers or esters)

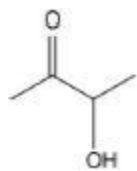
3c) peak at 25 ppm



3d) peak at 20 ppm



3e) structure



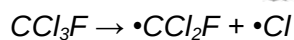
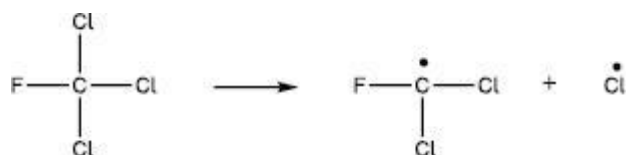
[6]

Q3.

(a) trichlorofluoromethane

1

(b)



radical dot anywhere on each radical

1

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

Allow ECF from **M1** to **M2**

1

M2 molecules of $\text{O}_3 = 3.64 \times 100,000 \times 6.022 \times 10^{23} = 2.19 \times 10^{29}$

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]