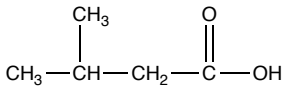
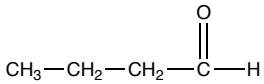
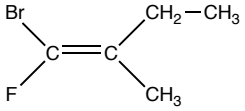
1 Name the following compounds. (12)

a) 

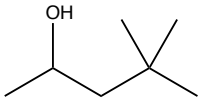
3-methylbutanoic acid

b) 

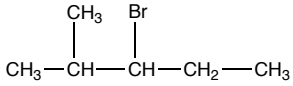
butanal

c) 

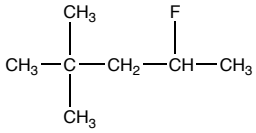
Z 1-bromo-1-fluoro-2-methylbut-1-ene

d) 

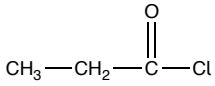
4,4-dimethylpentan-2-ol

e) 

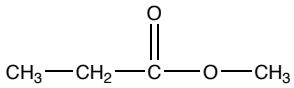
3-bromo-2-methylpentane

f) 

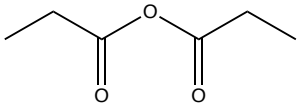
2-fluoro-4,4-dimethylpentane

g) 

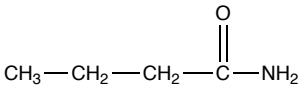
propanoyl chloride

h) 

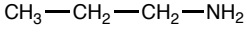
methyl propanoate

i) 

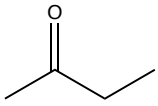
propanoic anhydride

j) 

butanamide

k) 

butanamine (or butylamine)

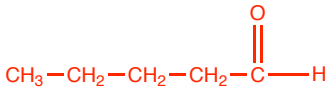
l) 

butanone

2 a) What are structural isomers?

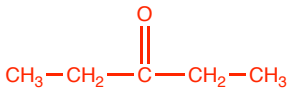
✓ **molecules with same molecular formula but different structure** (1)

b) Draw and name a functional group isomer of pentan-2-one.



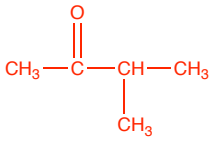
✓ **pentanal** (2)

c) Draw and name a position isomer of pentan-2-one.



✓ **pentan-3-one** (2)

d) Draw and name a chain isomer of pentan-2-one.



✓ **2-methylbutanone** (2)

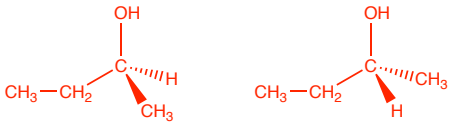
3 a) Define the terms *stereoisomers*.

✓ **molecules with same structural formula**

✓ **but different arrangement of atoms in space** (2)

2-Bromobutane reacts with potassium hydroxide to form a mixture of five organic products. Two of these products are alcohols and three are alkenes. The two alcohols are stereoisomers of each other. Two of the alkenes are stereoisomers of each other, while the third alkene is a structural isomer the other two alkenes.

b) Name and show the structures of these two alcohols to show their stereoisomerism. Explain how the stereoisomerism occurs in the alcohols.



✓ **structure of butan-2-ol**

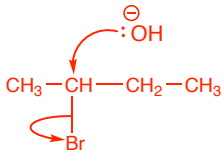
✓ **3D structures of both enantiomers**

✓ **both stereoisomers are butan-2-ol**

✓ **they each contain a C atom with 4 different groups attached** (4)

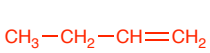
c) Name and outline the mechanism to form one of these alcohols. State the role of the hydroxide ions.

- ✓ **nucleophilic substitution**
- ✓ **OH^- = nucleophile**
- ✓ ✓

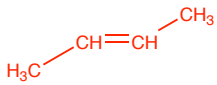


(4)

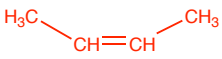
d) Name and show the structures of the three alkenes. Identify the pair that are stereoisomers of each other, and the one that is a structural isomer of these two. Explain how the stereoisomerism occurs in the two alkenes.



✓ **but-1-ene**



✓ ***E* but-2-ene**



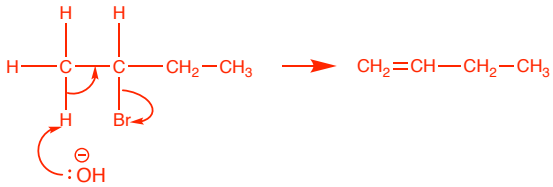
✓ ***Z* but-2-ene**

- ✓ ***E* but-2-ene and *Z* but-2-ene are a pair of stereoisomers**
- ✓ **but-1-ene is a structural isomer of the *E* but-2-ene and *Z* but-2-ene**
- ✓ ***E* but-2-ene and *Z* but-2-ene contain a C=C bond that cannot rotate and each C has two different groups attached**

(6)

e) Name and outline the mechanism to form the alkene that is a structural isomer of the other two. State the role of the hydroxide ions.

- ✓ **elimination**
- ✓ **OH^- = base**
- ✓ ✓ ✓



(5)

The two alcohols were separated from the mixture of products by fractional distillation.

f) Explain why the alcohols have higher boiling points than the alkenes.

- ✓ **alcohols are stronger forces between molecules**
- ✓ **alcohols have hydrogen bonds between molecules**
- ✓ **alkenes have van der Waals' forces between molecules**

(3)

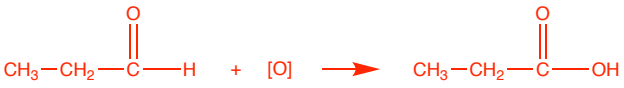
g) Plane polarised light was passed through the mixture of alcohols. Suggest why the plane of the light did not rotate.

- ✓ **racemic mixture / equal amounts of the two enantiomers**

(1)

4 Write an equation for each of the following reactions. You should write all organic compounds using structural formulae.

a) propanal + Tollen's reagent



(2)

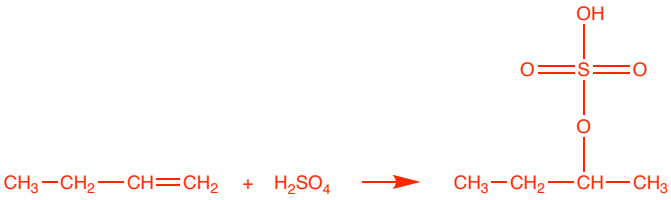
b) 2-bromobutane + excess conc NH_3

(2)

c) ethane + excess fluorine (in the presence of uv light)

(2)

d) but-1-ene + conc sulfuric acid



(2)

Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can draw structures			Can draw mechanisms accurately		
Good SPG			Understands structural isomerism			Can explain relative boiling points		
Explanations are clear			Understands stereoisomerism			Effect of enantiomers on polarised light		
Explanations have sufficient depth			Knows basic AS reactions					
Can use IUPAC for naming			Can write organic equations					