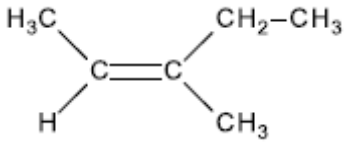
Practice Question Set For A-Level
**Subject : Chemistry**
**Paper-2 Topic: Alkenes**

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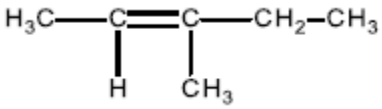
**Name of the Student**:_____
**Max. Marks : 21 Marks** **Time : 21 Minutes**

Mark Schemes

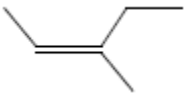
Q1.

(a) 

*Must show all 4 groups bonded to C=C*
*Allow $CH_3-$ for methyl group; allow $C_2H_5$ for ethyl group*
*Allow correct structure of the style*

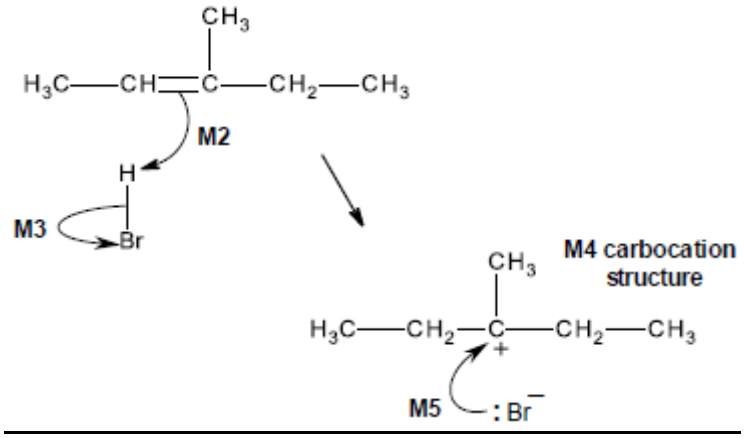


*Allow correct skeletal structure*



**1**

(b) M1 <u>electrophilic addition</u>




NB the arrows here are double-headed

**1**

M2 must show an arrow from the double bond towards the H atom of the H-Br molecule

**1**

M3 must show the breaking of the H-Br bond

**1**

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M4 is for the structure of the tertiary carbocation

**1**

M5 must show an arrow from the lone pair of electrons on the negatively charged bromide ion towards the positively charged atom (of either a secondary or) of a tertiary carbocation

**1**

M6 3-bromo-3-methylpentane is <u>formed from $3^{y}$ carbocation</u>
OR
2-bromo-3-methylpentane is <u>formed from $2^{y}$ carbocation</u>

**1**

M7 <u>$3^{y}$ carbocation more stable than $2^{y}$</u>

**1**

***M2-M5*** *Penalise one mark from their total if half-headed arrows are used*

***M2*** *Ignore partial negative charge on the double bond*

***M3*** *Penalise incorrect partial charges on H-Br bond and penalise formal charges*

*Penalise* ***M4*** *if there is a bond drawn to the positive charge*

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

***Max 3 of any 4 marks (M2-5)*** *for wrong organic reactant or wrong organic product (if shown) or secondary carbocation*

***Max 2 of any 4 marks in the mechanism*** *for use of bromine*

*Do not penalise the "correct" use of "sticks"*

*For* ***M5****, credit attack on a partially positively charged carbocation structure but penalise* ***M4***

***M6 is high demand and must refer to product being formed from/via correct class of carbocation***

***M7 is high demand and must be clear answer refers to stability of carbocations (intermediates) not products***

***Candidate that states that products are carbocations would lose M6 and M7***

***M6,7*** *allow carbonium ion in place of carbocation; or a description of carbocation in terms of alkyl groups/ number of carbon atoms joined to a positive C*

*When asked to outline a mechanism, candidates are* ***expected*** *to draw a mechanism with curly arrows (specification 3.3.1.2). On this occasion only we would allow a detailed description as shown.*

***M2*** *must describe the movement of a pair of electrons / curly arrow from the C=C towards the H atom of the H-Br molecule*

***M3*** *must describe the breaking of the H-Br bond with the bonding pair of electrons moving to the Br / curly arrow from H-Br bond to Br*

***M4*** *is for the structure of the tertiary carbocation (i.e. positive C bonded to one methyl and two ethyl groups)*

***M5*** *must describe the movement of a pair of electrons from the $Br^{-}$ ion to the positive C atom of the carbocation / curly arrow from the lone pair of electrons on the negatively charged bromide ion towards the positively charged C atom (of either a secondary or) of a tertiary carbocation*

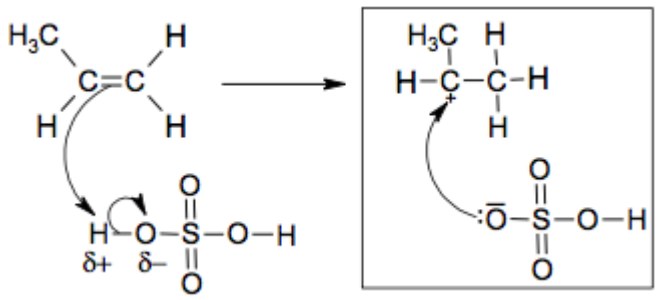
**[8]**

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Q1.

(a) Electrophilic addition

**1**



*M2 = curly arrow from C=C towards H of H−O on 'their' sulfuric acid*

*M3 = curly arrow to break H−O*

*Penalise incorrect dipole/full charges*

*M4 = intermediate*

*M5 = correct anion, lone pair on correct O and curly arrow from that lone pair to C+ on their carbocation*

***IGNORE** position of minus sign unless displayed structure*

***IGNORE** product*

**1**
**1**
**1**
**1**

Major product/propan-2-ol formed via most stable
carbocation/carbonium ion
secondary carbocation/carbonium ion more stable (than primary) or
reverse argument

*M6 for idea of carbocation stability*

*This statement gets M6 and M7*

***NOT** stability of alcohols*

**1**
**1**

(b) Hot/High T (and High P)

***ALLOW** 200-450 C/473-723 K (Quoted)*

**1**

($SiO_2$ coated in) phosphoric acid (catalyst)

***NOT** (aq)*

**1**

*advantages of fermentation*

- Low(er) T and P / lower energy use
- Less use of non-renewable fossil fuels/renewable/sustainable (resources)
- Low(er) equipment/plant/capital costs

***IGNORE** carbon neutral*

*max 2*

**1**
**1**

*Disadvantages of fermentation*

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- Slow(er) reaction
- Low atom economy
- Impure product/extra purification/distillation required
- Batch process/labour intensive/difficult to automate
- Land used for sugar crops (so not available for food crops)

***IGNORE*** *low yield*

*Max 2*

**1**

**1**

**[13]**

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