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

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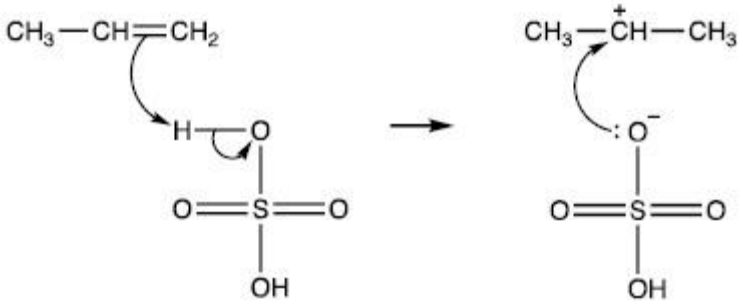
Exam Preparation and Free Resources

Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Mark Schemes

Q1.

(a) **M1** electrophilic addition



*All arrows are double-headed. Penalise one mark from the total for **M2-5** if half headed arrows are used.*

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

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

1

M2 must show an arrow from the double bond towards the H atom of the H_2SO_4 molecule

*For **M2/3**, the full structure of H_2SO_4 does not need to be shown, but the key features for the mechanism should be shown and the formula must be correct. Penalise only once in **M2/3** an incorrect but genuine attempt at the structure of sulfuric acid*

***M2** ignore partial negative charges on the double bond*

1

M3 must show the breaking of the H-O bond in H_2SO_4

***M3** penalise incorrect partial charges on the H–O bond and penalise formal charges*

1

M4 is for the structure of the correct carbocation

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

1

M5 must show an arrow from the lone pair of electrons on the negatively charged oxygen of HSO_4^- towards the positively charged atom of their carbocation drawn

***Max 3 of 4 marks** (**M2-5**) for wrong organic reactant or wrong carbocation (ignore structure of product)*

1

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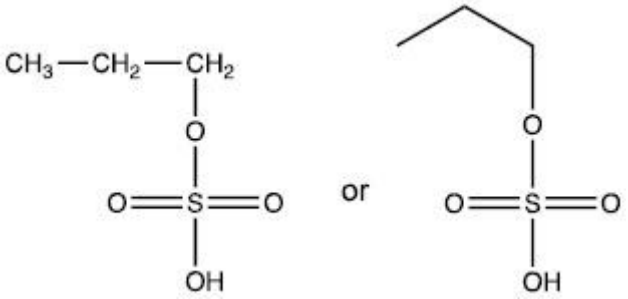
*If attack is shown from C=C to H^+ rather than H_2SO_4, then allow **M2** but not **M3***

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

*For **M5**, the full structure of HSO_4^- is not essential, but attack must come from a lone pair on an individual oxygen on HSO_4^-, but the – sign could by anywhere on the ion (e.g.: OSO_3H^-)*

(b)



Any correct structural formula, including OSO_3H bonded through O to correct C

1

(c) **M1** idea that **E** is formed from/via more stable carbocation

***M1-2** Allow carbonium ion in place of carbocation*

1

M2 idea that 2^y carbocation is more stable than 1^y carbocation

***M2** Allow descriptions in terms of number of alkyl groups attached to positive C atom*

1

Ignore reference to inductive effect

*Penalise **M1** if answer suggests that the products are carbocations (but could score **M2**)*

*In order to access **M1** and/or **M2** there must be some reference to carbocations (carbonium ions) by name or structure or description*

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Q2.

(a) Thermometer and bung in flask with bulb level with side arm.

Must be cross section diagram with no gaps at joints

1

Condenser jacket with water in at bottom and out at top.

1

(b) Liquids are immiscible

Allow don't mix, forms two layers (stated or implied)

Allow it is insoluble

Ignore density or reference to solutions

1

(c) Liquid goes clear / not cloudy

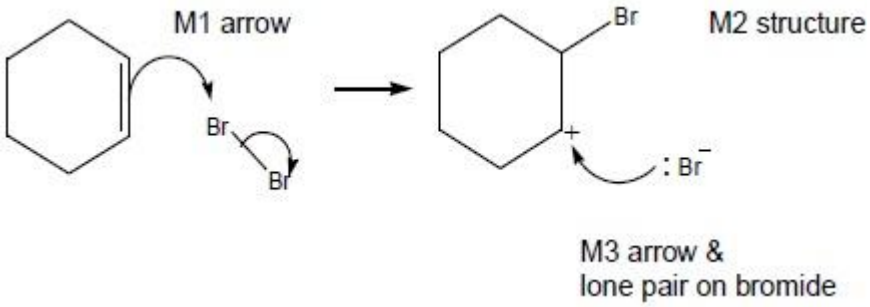
Ignore colourless

1

(d)

Via moles	*Via mass*	*Via volume*	
Amount cyclohexanol (= 14.4/100) = 0.144 mol	Amount cyclohexanol (= 14.4/100) = 0.144 mol	Amount cyclohexanol (= 14.4/100) = 0.144 mol	**M1**
Mass cyclohexene formed = 4.15 x 0.81 = 3.36 g	Mass cyclohexene formed = 4.15 x 0.81 = 3.36 g	Mass of cyclohexene expected (= 0.144 × 82.0 = 11.808 g) OR M1 × 82	**M2**
amount cyclohexene obtained (= 3.36/82.0 = 0.0410 mol) OR M2/82.0	mass of cyclohexene expected (= 0.144 × 82.0 = 11.808 g) OR = M1 × 82.0	volume of cyclohexene expected (= 11.808/0.810 = 14.577cm^3) OR M2/0.810	**M3**
$\%\text{Yield} = \frac{0.0410}{0.144} \times 100$ OR $\frac{M3}{M1} \times 100$	$\%\text{Yield} = \frac{3.36}{11.808} \times 100$ OR $\frac{M2}{M3} \times 100$	$\%\text{Yield} = \frac{4.15}{14.577} \times 100$ OR $\frac{4.15}{M3} \times 100$	**M4**
= 28.5% (must be 3 sf)	= 28.5% (must be 3 sf)	= 28.5% (must be 3 sf)	
Only award M5 if answer is to 3sf and follows some attempt at % yield calculation in M4			**M5**

(e)



*Lose **M1** if*

Full charges on Br−Br

OR

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Wrong partial charges on Br−Br

OR

Arrow is to Br^+ ion (formed in a preliminary step)

*Any C shown in the ring must have the correct number of hydrogens attached to score **M2***

3

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