

AQA – Kinetics – A2 2023 Chemistry P2 & P3

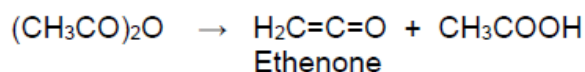
1. No.9

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This question is about ethanoic anhydride.

In the gas phase, ethanoic anhydride $(\text{CH}_3\text{CO})_2\text{O}$ decomposes to form ethenone.

The equation is



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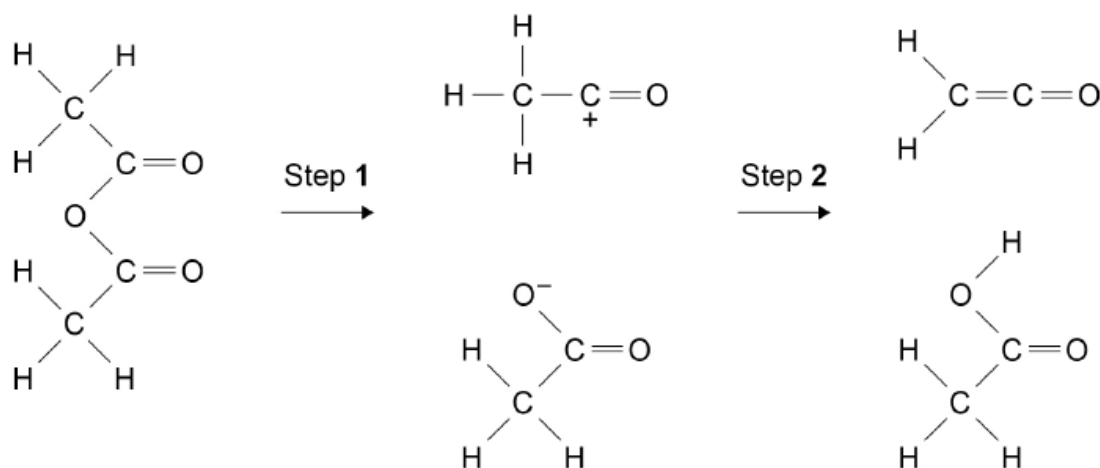
Ethenone is the simplest member of the ketene homologous series.
Ketenes all contain one $\text{C}=\text{C}$ double bond and one $\text{C}=\text{O}$ double bond.

Deduce the general formula for the ketene homologous series.

[1 mark]

0 9 . 2

Figure 11 shows an incomplete suggested mechanism for the decomposition of ethanoic anhydride.

Figure 11

Complete the mechanism in **Figure 11** by adding three curly arrows and any relevant lone pairs of electrons.

[3 marks]

09.3

For a chemical reaction the relationship between the rate constant, k , and the temperature, T , is shown by the Arrhenius equation.

$$k = Ae^{\frac{-E_a}{RT}}$$

For the decomposition of gaseous ethanoic anhydride

the activation energy, $E_a = 34.5 \text{ kJ mol}^{-1}$

the Arrhenius constant, $A = 1.00 \times 10^{12} \text{ s}^{-1}$

At temperature T_1 the rate constant, $k = 2.48 \times 10^8 \text{ s}^{-1}$

Calculate T_1

The gas constant, $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$

[3 marks]

T_1 _____ K

09.4

Sketch the Maxwell–Boltzmann distribution of molecular energies for gaseous ethanoic anhydride at temperature T_1 and at a higher temperature T_2

Include a label for each axis, and mark on the appropriate axis a typical position for the activation energy.

Explain why the rate of reaction is faster at T_2

[5 marks]



Explanation

2. No.12

The rate of reaction is greater when a catalyst is used, without changing the temperature.

Which statement explains why the rate of reaction is greater with a catalyst?

[1 mark]

- A** The collision frequency increases because the catalysed reaction has a lower activation energy.
- B** The collision frequency increases because there is an increase in the average energy of the particles.
- C** The proportion of successful collisions increases because the catalysed reaction has a lower activation energy.
- D** The proportion of successful collisions increases because there is an increase in the average energy of the particles.

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3. No.27

Which process does **not** involve a heterogeneous catalyst?

[1 mark]

- A** catalytic cracking of alkanes
- B** Contact process
- C** decomposition of ozone
- D** Haber process

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