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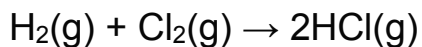
Physical Chemistry

Level & Board	AQA (A-LEVEL)
TOPIC:	KINETICS
PAPER TYPE:	QUESTION PAPER - 3
TOTAL QUESTIONS	10
TOTAL MARKS	47

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Kinetics - 3

1. The gas-phase reaction between hydrogen and chlorine is very slow at room temperature.



(a) Define the term activation energy.

(2)

(b) Give one reason why the reaction between hydrogen and chlorine is very slow at room temperature.

(1)

(c) Explain why an increase in pressure, at constant temperature, increases the rate of reaction between hydrogen and chlorine.

(2)

(d) Explain why a small increase in temperature can lead to a large increase in the rate of reaction between hydrogen and chlorine.

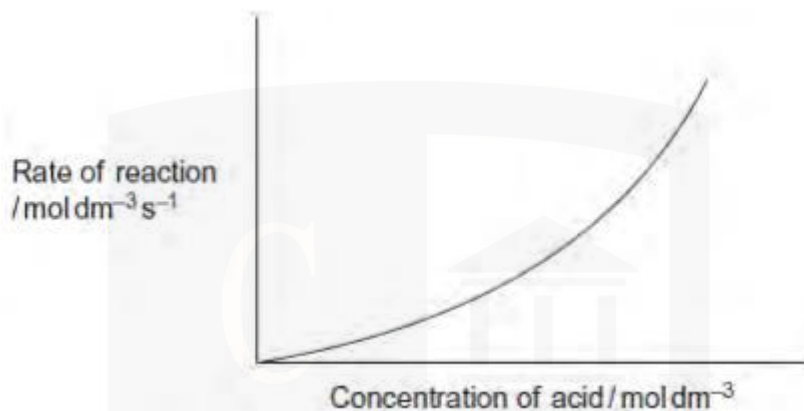
(2)

(e) Give the meaning of the term catalyst.

(1)

(f) Suggest one reason why a solid catalyst for a gas-phase reaction is often in the form of a powder.

- (1)**
2. In an investigation of the rate of reaction between hydrochloric acid and pure magnesium, a student obtained the following curve.



The reaction of magnesium with dilute hydrochloric acid is exothermic.

- (a)** Use your understanding of collision theory to explain why the student did not obtain a straight line.

(3)

- (b)** The magnesium used in a laboratory experiment was supplied as a ribbon.

The ribbon was stored in an open plastic bag exposed to the air.

Explain why it is important to clean the surface of this magnesium ribbon when investigating the rate of its reaction with hydrochloric acid.

(2)

(c) Magnesium ribbon reacts with hot water. Heated magnesium ribbon reacts with steam. State two differences between these reactions.

(2)

(d) Pure magnesium reacts completely with an excess of dilute sulfuric acid.

The reaction of pure calcium with an excess of dilute sulfuric acid is very rapid initially.

This reaction slows down and stops before all of the calcium has reacted.

Use your knowledge of the solubilities of Group 2 sulfates to explain why these reactions of magnesium and calcium with dilute sulfuric acid are so different.

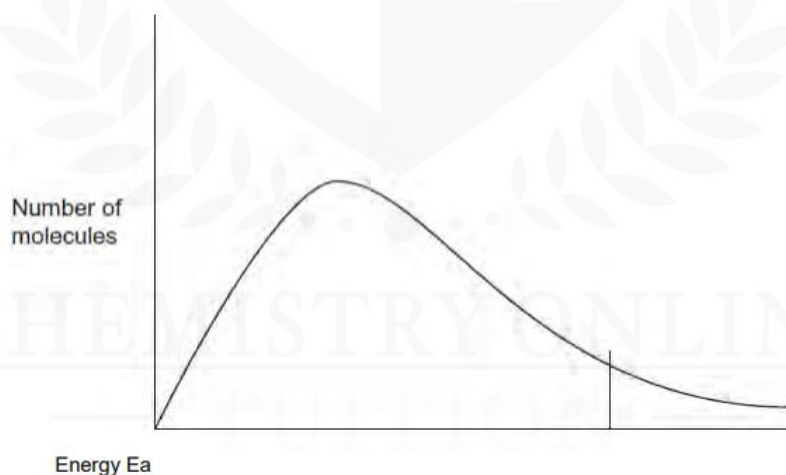
(3)

3. Give one reason why most collisions between gas-phase reactants do not lead to a reaction.

State and explain two ways of speeding up a gas-phase reaction other than by changing the temperature.

4. The diagram shows the Maxwell–Boltzmann distribution for a sample of gas at a fixed temperature. (5)

E_a is the activation energy for the decomposition of this gas.



E_{mp} is the most probable value for the energy of the molecules.

- (a) On the appropriate axis of this diagram, mark the value of E_{mp} for this distribution. On this diagram, sketch a new distribution for the same sample of gas at a lower temperature.

(3)

(b) With reference to the Maxwell–Boltzmann distribution, explain why a decrease in temperature decreases the rate of decomposition of this gas.

(2)

5. The rate of the reaction between substance A and substance B was studied in a series of experiments carried out at the same temperature. In each experiment the initial rate was measured using different concentrations of A and B.

These results were used to deduce the order of reaction with respect to A and the order of reaction with respect to B.

(a) What is meant by the term order of reaction with respect to A?

(1)

(b) When the concentrations of A and B were both doubled, the initial rate increased by a factor of 4.

Deduce the overall order of the reaction.

(1)

(c) In another experiment, the concentration of A was increased by a factor of three and the concentration of B was halved.

This caused the initial rate to increase by a factor of nine.

i. Deduce the order of reaction with respect to A and the order with respect to B.

(2)

ii. Write a rate equation for the reaction and suggest suitable units for the rate constant.

(2)

6. For each of the following reactions, identify a catalyst and name the organic product of the reaction.

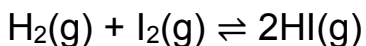
(a) The fermentation of an aqueous solution of glucose.

(2)

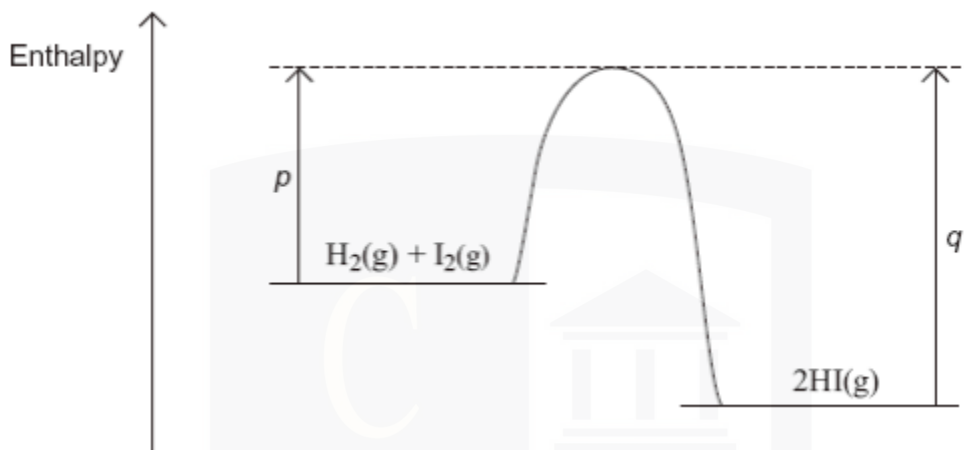
(b) The hydration of but-2-ene.

(2)

7. An equation for the equilibrium reaction between hydrogen, iodine and hydrogen iodide is shown below.



The curve in the diagram below illustrates the reaction profile for this



equilibrium reaction without a catalyst.

(a) Use the diagram to deduce whether the formation of hydrogen iodide from hydrogen and iodine is exothermic or endothermic.

(1)

(b) State what the diagram suggests about the sum of the bond enthalpies for the reactant molecules compared with the product molecules.

(1)

8. In a sample of a gas, which statement regarding the molecules is accurate?

- A.** At a specific temperature, they all move at a uniform velocity.
- B.** At a given temperature, their average kinetic energy remains constant.
- C.** When the temperature increases, there is a greater number of molecules with the most probable energy.
- D.** When the temperature decreases, there is a reduction in the number of molecules with the mean energy.

(Total 1 mark)

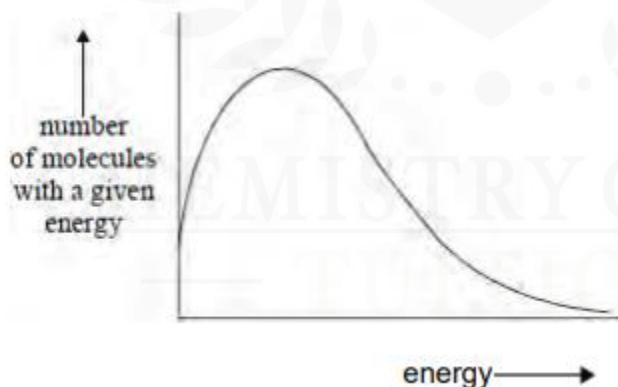
9. The rate of a chemical reaction may be increased by an increase in reactant concentration, by an increase in temperature and by the addition of a catalyst.

State which, if any, of these changes involves a different activation energy.

Explain your answer.

(5)

10. The total area under the distribution curve represents.



- I am Sorry !!!!!
- A. total energy
 - B. activation energy
 - C. total number of reacting molecules.
 - D. total number of molecules present.

(Total 1 mark)



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- Founder & CEO of Chemistry Online Tuition Ltd.
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