6.1 Chemical Kinetics

Question Paper

Course	DP IB Chemistry
Section	6. Chemical Kinetics
Topic	6.1 Chemical Kinetics
Difficulty	Easy

Time allowed: 20

Score: /10

Percentage: /100

Question 1

Which of the following factors can affect the value of the activation energy of a reaction? **[1 mark]**

1 the presence of a catalyst

2 changes in temperature

3 changes in the concentration of the reactants

A 1 only **B** 1 and 2 only **C** 3 only **D** 1, 2 and 3

Question 2

The oxidation of butadiene, CH_2=CHCH=CH_2, using air or oxygen, produces the molecule crotonaldehyde, CH_3CH=CHCHO.

One method of oxidation is to pass a mixture of butadiene and oxygen through a hot aqueous solution of palladium(II) ions, $Pd^{2+}(aq)$, which catalyse the reaction.

Which statement about the action of the $Pd^{2+}(aq)$ ions is **not** correct?

A $Pd^{2+}(aq)$ lowers the activation energy for the reaction

B $Pd^{2+}(aq)$ increases the energy of the reacting molecules

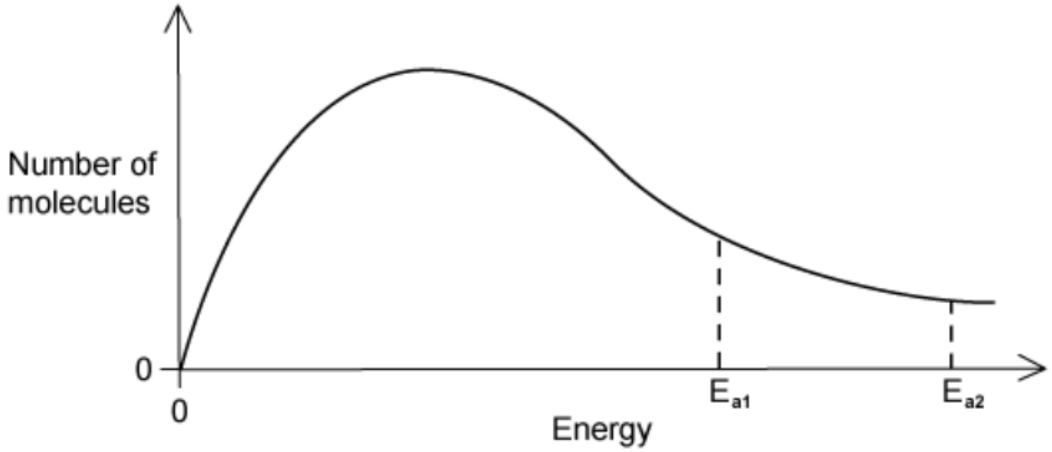
C when $Pd^{2+}(aq)$ is used, the reaction proceeds by a different route

D changing the concentration of the $Pd^{2+}(aq)$ affects the rate of oxidation

[1 mark]

Question 3

The Maxwell-Boltzmann energy distribution curve below describes a mixture of two gases at a given temperature. For a reaction to occur between the gaseous molecules, they must collide with sufficient energy.



Of the two activation energy (E_a) values shown, one is for a catalysed reaction, the other for an uncatalysed one.

When a catalyst is used, which pair of statements is correct?

A	E_{a1} uncatalysed reaction fewer effective collisions	E_{a2} catalysed reaction more effective collisions
B	E_{a1} catalysed reaction fewer effective collisions	E_{a2} uncatalysed reaction more effective collisions
C	E_{a1} uncatalysed reaction more effective collisions	E_{a2} catalysed reaction fewer effective collisions
D	E_{a1} catalysed reaction more effective collisions	E_{a2} uncatalysed reaction fewer effective collisions

[1 mark]

Question 4

Ammonia is manufactured using the Haber process, which is represented by the following equation:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -93 \text{ kJ mol}^{-1}$$

What happens to the rate of the forward and backward reactions when the temperature is increased?

A there is no effect on the backward or forward rate

B both forward and backward rates increase

C the forward rate only increases

D the backward rate only increases

[1 mark]

Question 5

Why does a mixture of hydrogen gas and bromine gas react together faster at a temperature of 500 K than it does at a temperature of 400 K?

1. a higher proportion of effective collisions occurs at 500 K
2. hydrogen molecules and bromine molecules collide more frequently at 500 K
3. the activation energy of the reaction is lower at 500 K

A 1 only **B** 1 and 2 only **C** 3 only **D** 1, 2 and 3

[1 mark]

Question 6

When the pressure of a fixed mass of gaseous reactants is raised at a constant temperature, the rate of reaction increases.

Which of the following statements explain this observation?

1 raising the pressure lowers the activation energy

2 more molecules have energy greater than the activation energy at the higher pressure

3 more collisions occur per second when the pressure is increased

A 1 only **B** 1 and 2 only **C** 3 only **D** 1, 2 and 3

[1 mark]

Question 7

What is the main reason for the increase in reaction rate with increasing temperature?

A The activation energy decreases.

B The activation energy increases.

C The molecules collide more frequently.

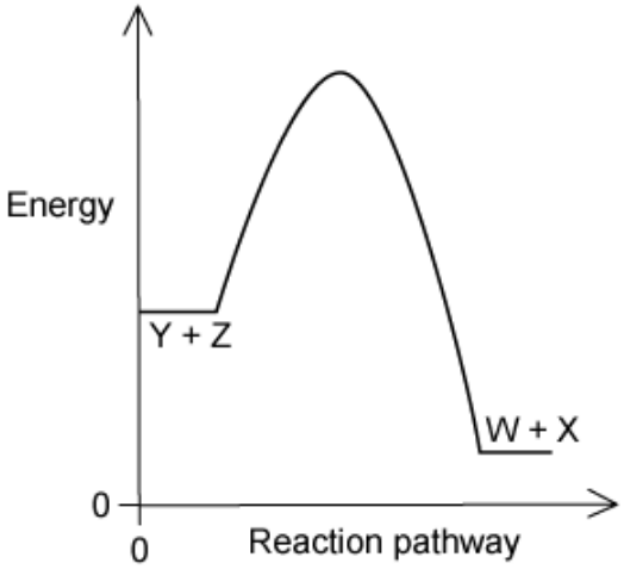
D More molecules have an energy greater than the activation energy.

[1 mark]

Question 8

The diagram represents the reaction pathway for the following reaction:

$$Z(g) + Y(g) \rightarrow X(g) + W(g)$$



What statement is true about the reverse reaction, $W(g) + X(g) \rightarrow Y(g) + Z(g)$?

A it will have a smaller activation energy and a negative ΔH

B it will have a smaller activation energy and a positive ΔH

C it will have a larger activation energy and a negative ΔH

D it will have a larger activation energy and a positive ΔH

[1 mark]

Question 9

A student measured the rate of a reaction at two different temperatures: 40°C and 50°C. They observed that the rate of reaction roughly doubled.

What explains this observation?

A raising the temperature by 10 °C doubles the average velocity of the molecules

B raising the temperature by 10 °C doubles the average kinetic energy of each molecule

C raising the temperature by 10 °C doubles the number of molecules having more than a certain minimum energy

D raising the temperature by 10 °C doubles the number of molecular collisions in a given time

[1 mark]

Question 10

Which statements correctly describe how a catalyst works?

1 a catalyst has no effect on the enthalpy change of the reaction

2 a catalyst increases the rate of the reverse reaction

3 a catalyst increases the average kinetic energy of the reacting particles

A 1 only **B** 1 and 2 only **C** 3 only **D** 1, 2 and 3

[1 mark]