6.1 Chemical Kinetics

Question Paper

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

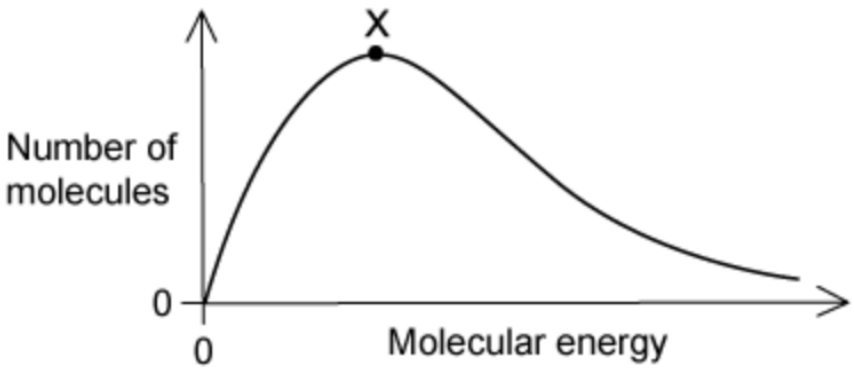
Time allowed: 20

Score: /10

Percentage: /100

Question 1

The distribution of molecular energies in a sample of a gas at a given temperature is shown by the Boltzmann distribution graph below.



If the temperature is increased, what will happen to the position of point X?

A fewer molecules possess the most probable energy value so X will shift to the right

B fewer molecules possess the most probable energy value so X will shift to the left

C more molecules possess the most probable energy value so X will shift to the left

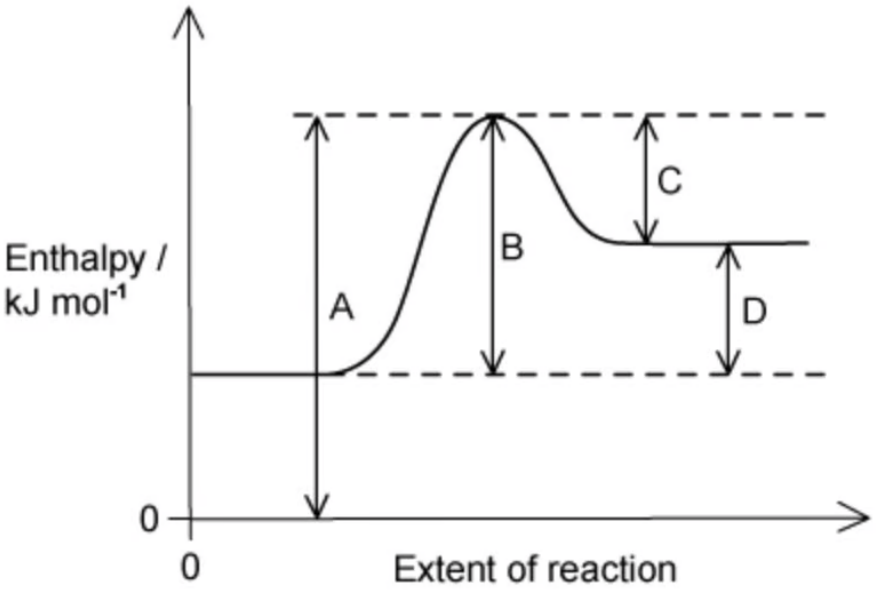
D the position of X will stay the same but the area under the distribution curve increases

[1 mark]

Question 2

The diagram shows a reaction pathway for an endothermic reaction.

Which arrow represents the activation energy for the forward reaction?



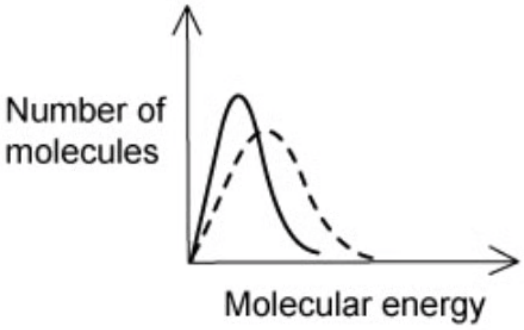
[1 mark]

Question 3

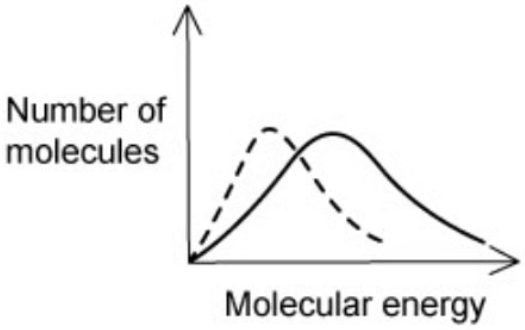
The dotted-line curve on each graph below represents the corresponding distribution for a gas at 300 K.

Which solid-line curve most accurately represents the distribution of molecular energies in the same gas at 500 K?

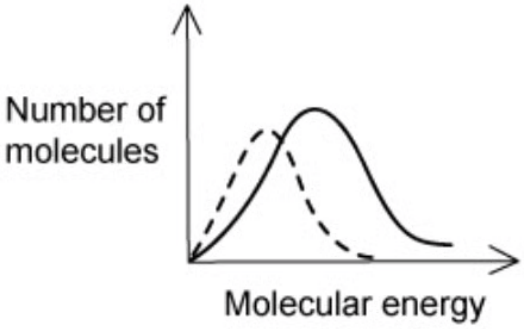
A



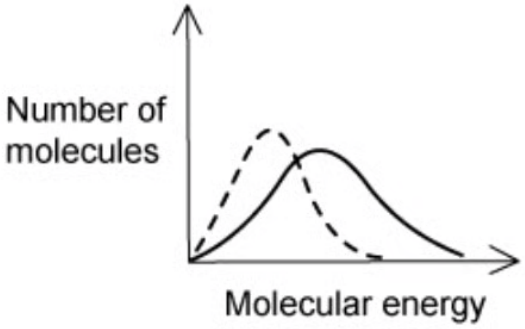
B



C



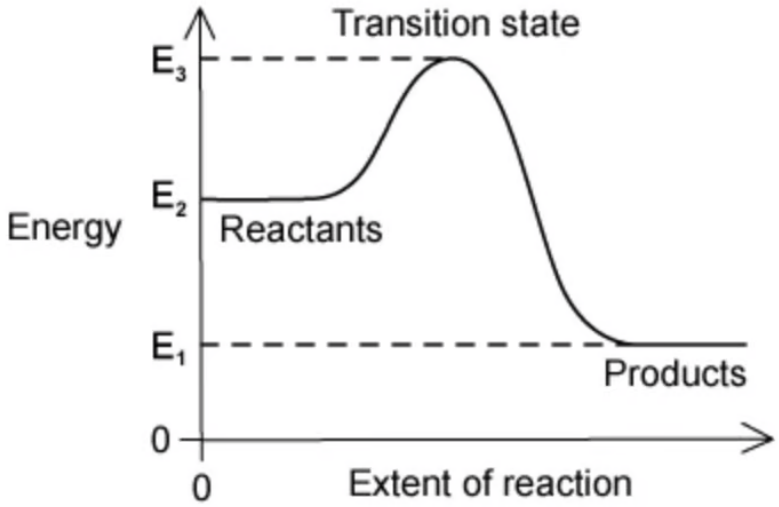
D



[1 mark]

Question 4

The energies of the reactants, the products and the transition state of a reaction are shown in the reaction pathway diagram below.



Which expression correctly represents how to calculate the activation energy of the forward reaction?

A $E_1 - E_2$ **B** $E_2 - E_1$ **C** $E_2 - E_3$ **D** $E_3 - E_2$

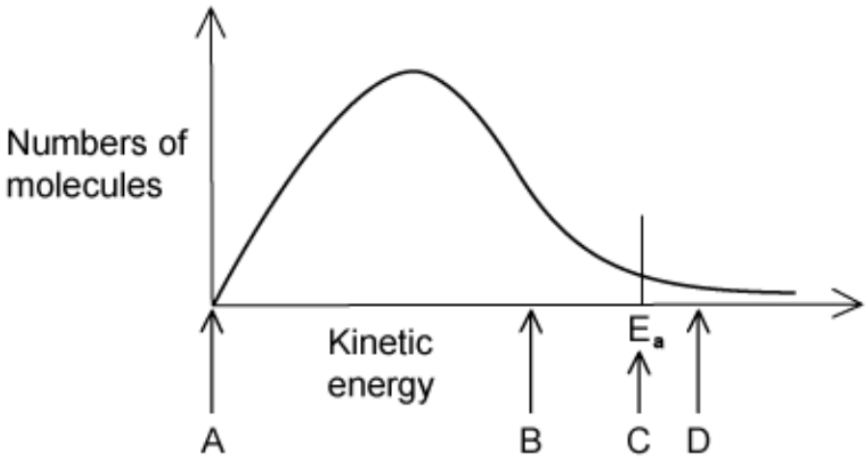
[1 mark]

Question 5

The diagram below represents, for a given temperature, the Boltzmann distribution of the kinetic energy of the molecules in a mixture of two gases that react slowly together without a catalyst.

The activation energy for the reaction, E_a, is marked for the uncatalysed reaction

What would the position of E_a be if the reaction took place with an effective catalyst?



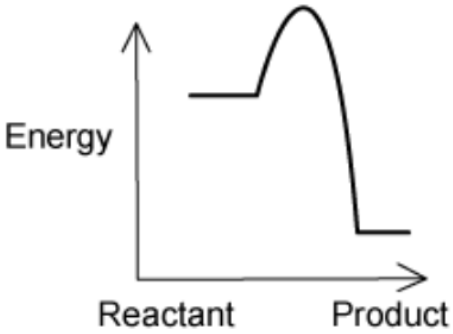
[1 mark]

Question 6

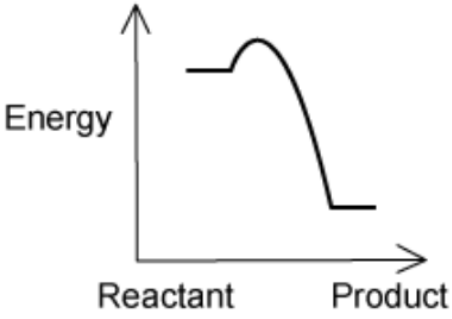
Four possible energy profiles are shown below, for reactions carried out at the same temperature.

Which energy profile shows a reaction that is likely to proceed most rapidly and with a good yield?

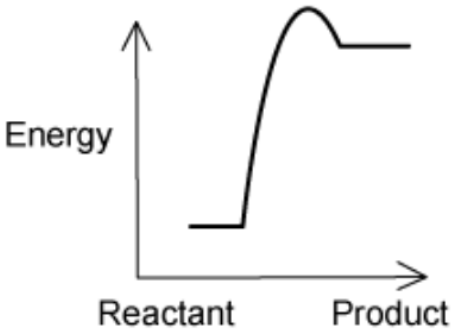
A



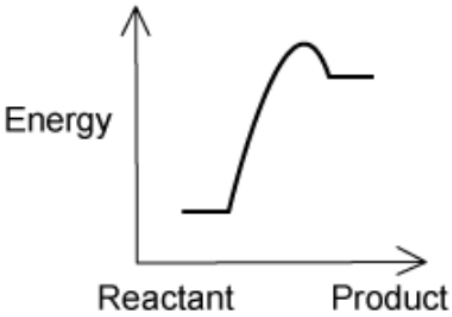
B



C



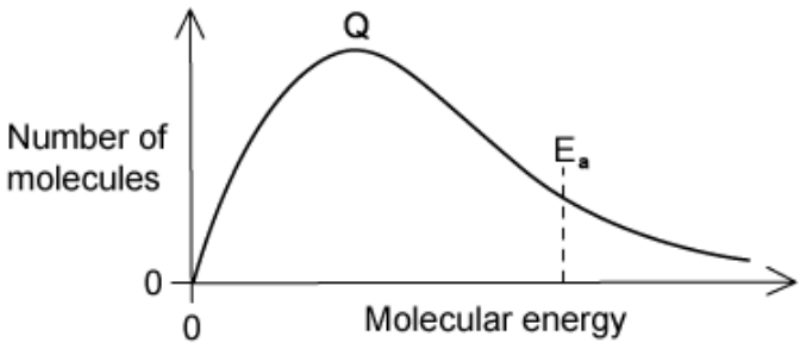
D



[1 mark]

Question 7

The diagram shows a Boltzmann distribution of molecular energies for a gaseous mixture. The distribution has a peak, labelled Q on the diagram.



What happens when an effective catalyst is added to the mixture?

A the height of the peak remains the same, and the activation energy moves to the left

B the height of the peak decreases and the activation energy moves to the left

C the height of the peak remains the same, and the activation energy moves to the right

D the height of the peak decreases and the activation energy moves to the right

[1 mark]

Question 8

A student performs to reactions and measures the rate of product formation.

Reaction 1: 1.5g of solid calcium carbonate is added to 100 cm^3 of 0.5 M hydrochloric acid

Reaction 2: 100 cm^3 of distilled water is then added to 100 cm^3 of 0.5 M hydrochloric acid then 1.5g of solid calcium carbonate is added

The rate of reaction 1 was faster than the rate of reaction 2.

Which of the following 3 hypotheses correctly describes the difference in the rate?

1 Adding water reduces the frequency of collisions between reactant molecules.

2 Adding water reduces the proportion of effective collisions between reactant molecules.

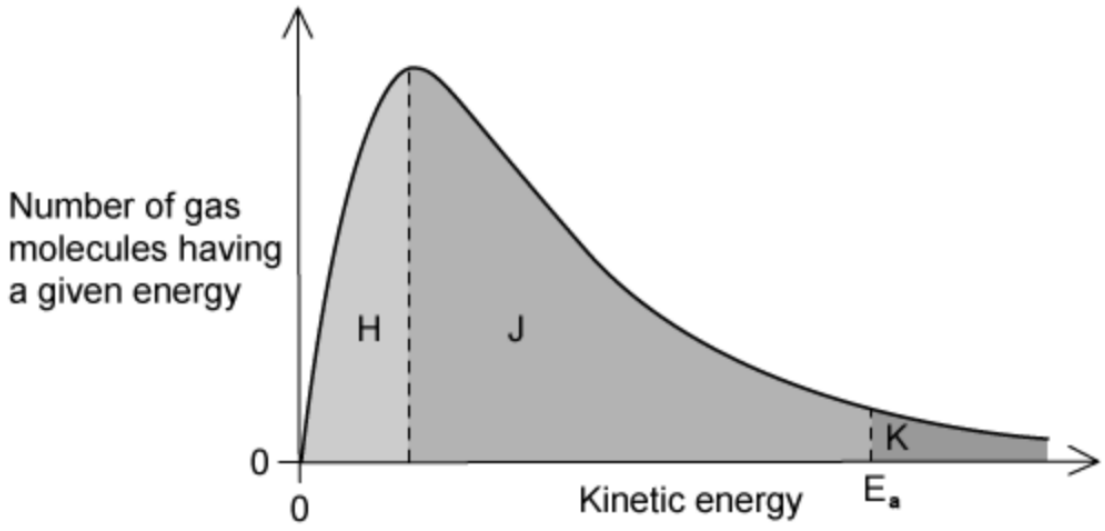
3 Adding water reduces the proportion of reactant molecules possessing the activation energy.

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

[1 mark]

Question 9

The Boltzmann distribution shows the number of molecules that have particular kinetic energy at a constant temperature.



If the temperature is decreased by 10 °C, what happens to the size of the areas labelled *H, J* and *K*?

	H	*J*	*K*
A	decreases	decreases	decreases
B	decreases	increases	decreases
C	increases	decreases	decreases
D	increases	decreases	increases

[1 mark]

Question 10

Zinc reacts with copper sulfate according to the following equation:

$$Zn(s) + CuSO_4(aq) \rightarrow Cu(s) + ZnSO_4(aq)$$

Rates of reaction can be found by measuring how certain properties change during the course of the reaction. Which of these properties could be used?

I. Change in volume

II. Change in temperature

III. Change in colour

A I and II only

B I and III only

C II and III only

D I, II and III

[1 mark]