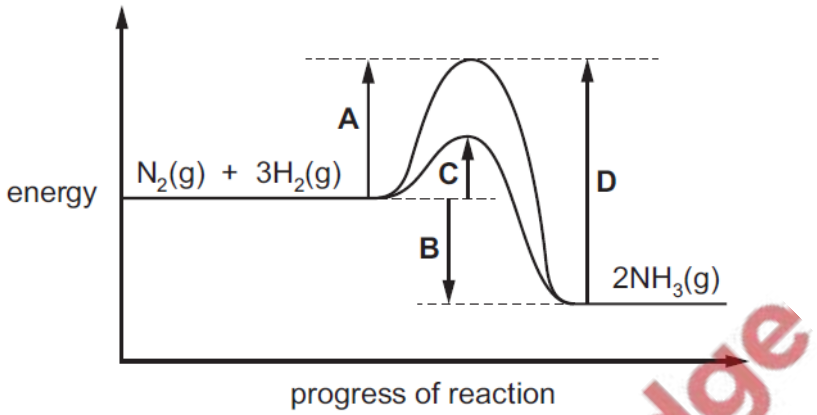
Chemical energetics – 2020 O Level

1. Nov/2021/Paper_11/No.20

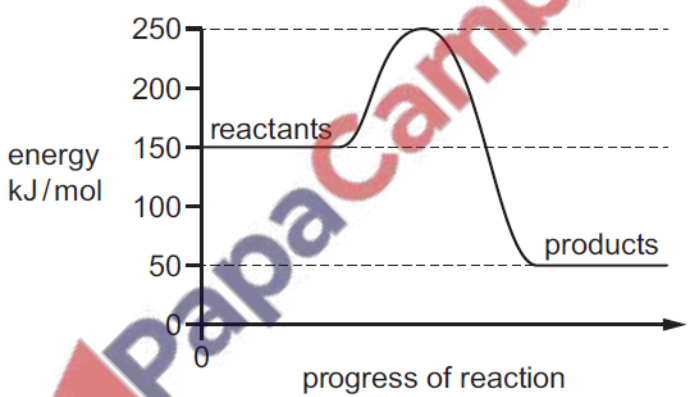
The energy profile diagram for both the catalysed and uncatalysed reactions between N_2 and H_2, in the Haber process, is shown.

What is the activation energy for the formation of NH_3 in the presence of a catalyst?



2. Nov/2021/Paper_12/No.20

The energy profile diagram of a chemical reaction is shown.



What is the value of the activation energy of the reaction?

A –200 kJ/mol **B** –100 kJ/mol **C** +100 kJ/mol **D** +200 kJ/mol

3. Nov/2021/Paper_12/No.21

Which statement describes the conversion of magnesium atoms to magnesium ions?

A The change is reduction because there has been a gain of electrons.

B The change is oxidation because there has been a loss of electrons.

C The change is reduction because there has been a loss of electrons.

D The change is oxidation because there has been a gain of electrons.

4. Jun/2020/Paper_21/No.3

The equation for the decomposition of hydrogen peroxide is shown.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

A sample containing 1.00 mol of hydrogen peroxide is completely decomposed.

This sample releases 98.0 kJ of heat energy.

(a) Calculate the heat energy released when 680 g of hydrogen peroxide is completely decomposed.

heat energy released ..... kJ [2]

(b) Use ideas about bond breaking and bond forming to explain why the decomposition of hydrogen peroxide is exothermic.

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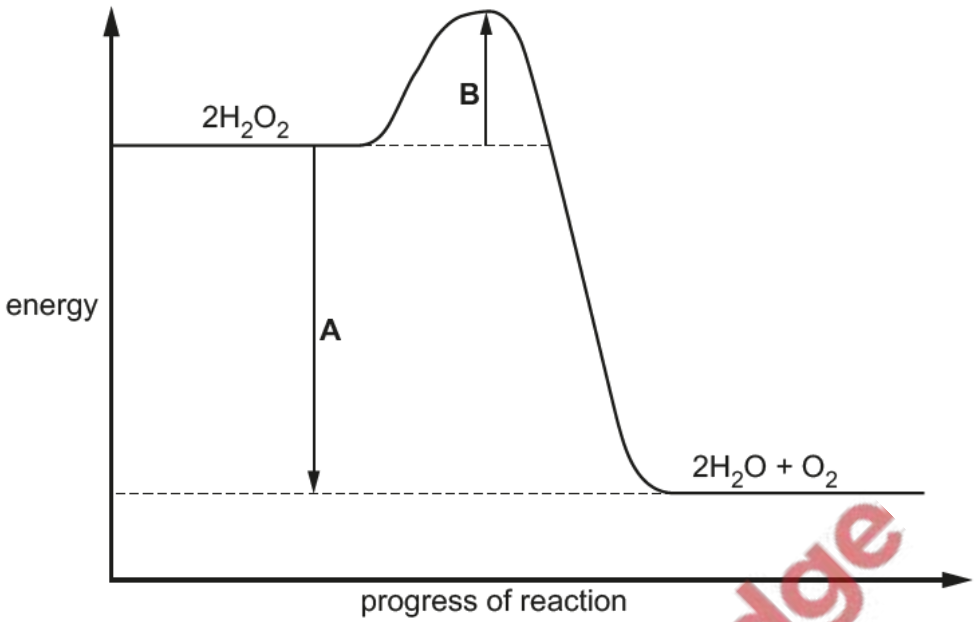
..... [2]

(c) The energy profile diagram for the decomposition of hydrogen peroxide is shown.



Identify the energy changes.

change **A** .....

change **B** .....

[2]

(d) The rate of decomposition of hot H_2O_2 is greater than that of cold H_2O_2.

Use ideas about particles to explain why.

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..... [2]

[Total: 8]

5. Jun/2020/Paper_22/No.2

Hydrogen reacts with oxygen as shown in the equation.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$$

A sample containing 1.00 mol of hydrogen, H_2, is completely combusted.

This sample releases 286 kJ of heat energy.

(a) Calculate the heat energy released when 25.0 g of hydrogen is completely combusted.

heat energy released ..... kJ [2]

(b) Use ideas about bond breaking and bond forming to explain why this reaction is exothermic.

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..... [2]

(c) The reaction shown also represents the overall process that occurs within a hydrogen-oxygen fuel cell.

(i) Describe one advantage of using a hydrogen-oxygen fuel cell to power a motor vehicle rather than burning gasoline.

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..... [1]

(ii) Complete the equations for the two electrode reactions that happen in a hydrogen-oxygen fuel cell.

$H_2 \rightarrow$ ..... $+ 2e^-$

$O_2 + 4H^+ + 4e^- \rightarrow$ .....

[2]

[Total: 7]