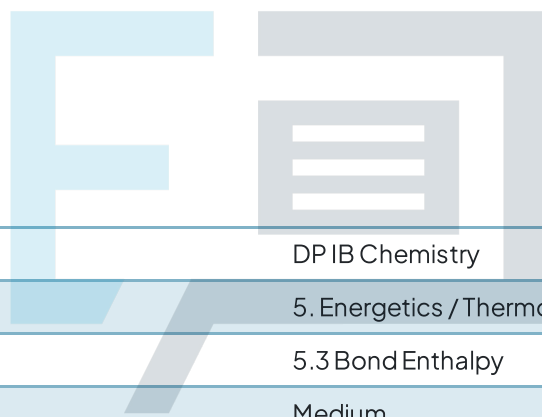




5.3 Bond Enthalpy

Question Paper



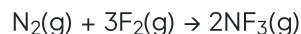
Course	DP IB Chemistry
Section	5. Energetics / Thermochemistry
Topic	5.3 Bond Enthalpy
Difficulty	Medium

Exam Papers Practice

To be used by all students preparing for DP IB Chemistry HL
Students of other boards may also find this useful

Question 1

The standard enthalpy change, ΔH^\ominus , for the following reaction is -246 kJ .



The bond energy of $\text{N}\equiv\text{N}$ is 945 kJ mol^{-1} and $\text{F}-\text{F}$ is 159 kJ mol^{-1}

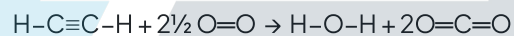
What is the bond energy of the $\text{N}-\text{F}$ bond?

- A. $\frac{246 - (945 + (3 \times 159))}{6}$
- B. $\frac{-246 + (945 + (3 \times 159))}{6}$
- C. $\frac{246 + (945 + (3 \times 159))}{6}$
- D. $246 + (945 + (3 \times 159))$

[1 mark]

Question 2

The complete combustion of ethyne, C_2H_2 , is shown in the equation below.



Using the average bond enthalpies given in the table, what is the enthalpy change of combustion of ethyne?

bond	average bond enthalpy / kJ mol^{-1}
$\text{C}-\text{H}$	a
$\text{C}\equiv\text{C}$	b
$\text{O}=\text{O}$	c
$\text{C}=\text{O}$	d
$\text{O}-\text{H}$	e

- A. $(2e + 4d) - (2a + b + 2\frac{1}{2}c)$
- B. $(2a + b + 2\frac{1}{2}c) - (-2e - 4d)$
- C. $(2a + b + 2\frac{1}{2}c) - (2e + 4d)$
- D. $-e - d + (2a + b + 2\frac{1}{2}c)$

[1 mark]

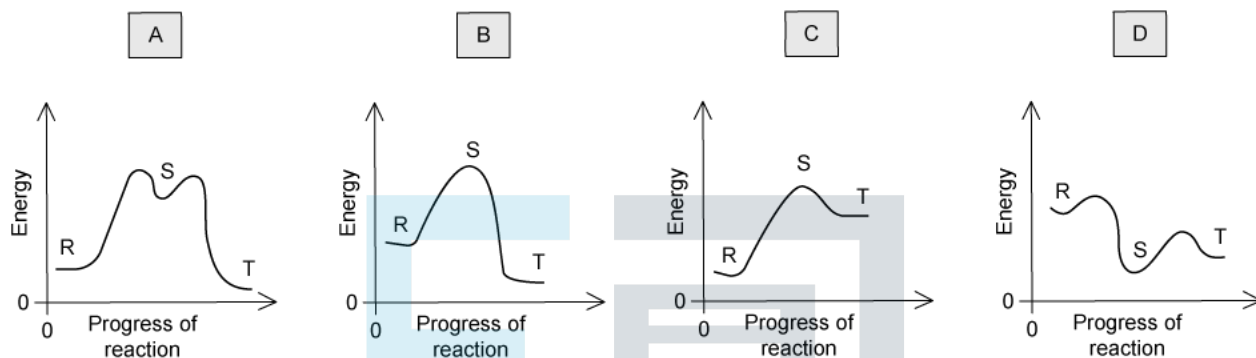
Question 3

Compound *R* into compound *T*, it was found that the reaction proceeded by way of compound *S*, which could be isolated. The following steps were involved.

$R \rightarrow S$; ΔH is positive

$S \rightarrow T$; ΔH is negative

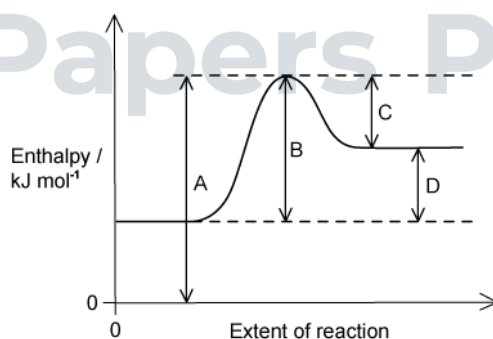
Which reaction profile fits these data?



[1 mark]

Question 4

The reaction pathway for an endothermic reaction is shown.

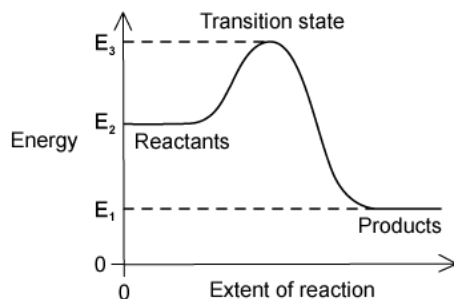


Which arrow represents the activation energy for the reverse reaction?

[1 mark]

Question 5

The reaction pathway shows the energies of the reactants, the products and the transition state of a reaction.



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

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

[1 mark]

Question 6

The incomplete combustion of methanol can produce carbon monoxide and water:



Some enthalpy data is given in the table.

	C-H	C-O	O-H	O=O	C=O
Mean bond dissociation enthalpy / kJ mol ⁻¹	414	358	463	498	804

What is the enthalpy change for this incomplete combustion of methanol?

- A. $(414 + 358 + 463 + 498) - (463 + 804)$
- B. $(4 \times 463 + 804) - (3 \times 414 + 358 + 463 + 498)$
- C. $(4 \times 414 + 358 + 498) - (4 \times 463 + 804)$
- D. $(3 \times 414 + 358 + 463 + 498) - (4 \times 463 + 804)$

[1 mark]

Question 7

Which of the following statements about *bond enthalpy* are true?

- I. A bond enthalpy may be inaccurate when compared to data tables because it is not an average value
- II. Average bond enthalpies are valid for all states of matter
- III. Bond enthalpies may be inaccurate as they do not account for intermolecular forces

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

[1 mark]



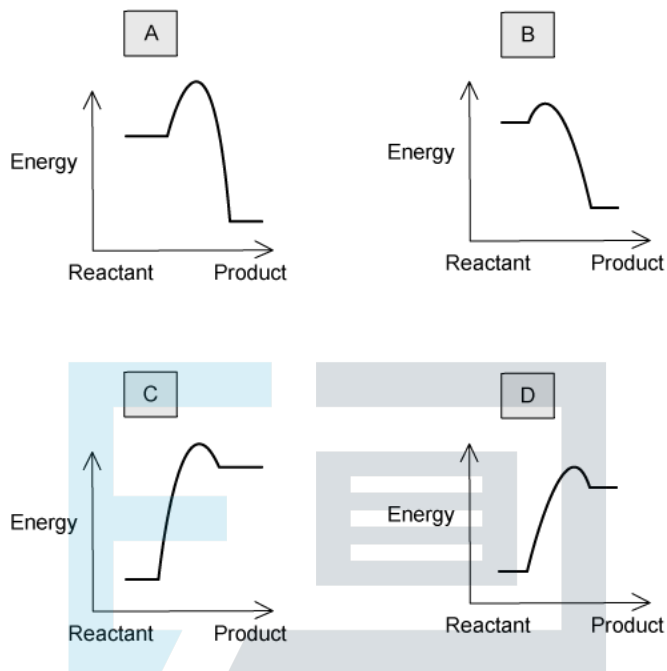
Exam Papers Practice

Question 8

Four possible reactions (A, B, C and D) of the following equation are measured at the same temperature.



Which reaction pathway diagram shows the reaction occurring rapidly with an overall negative enthalpy value?



- A.
- B.
- C.
- D.

Exam Papers Practice

[1 mark]

Question 9

Which combination about bond breaking and bond formation energy changes is correct?

	Bond breaking	Bond formation
A	endothermic	endothermic
B	endothermic	exothermic
C	exothermic	endothermic
D	exothermic	exothermic

[1 mark]

Question 10

Which reactions are involved in maintaining the concentration of ozone in the upper atmosphere?

- I. $O_3 \rightarrow O_2 + O^\bullet$
- II. $O_2 \rightarrow 2O^\bullet$
- III. $O_2 + O^\bullet \rightarrow O_3$

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

[1 mark]



Exam Papers Practice