

5.3 Bond Enthalpy

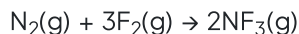
Question Paper

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

Time allowed: 20
Score: /10
Percentage: /100

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}

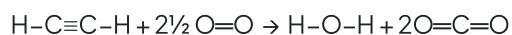
What is the bond energy of the $\text{N}-\text{F}$ bond?

- 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]

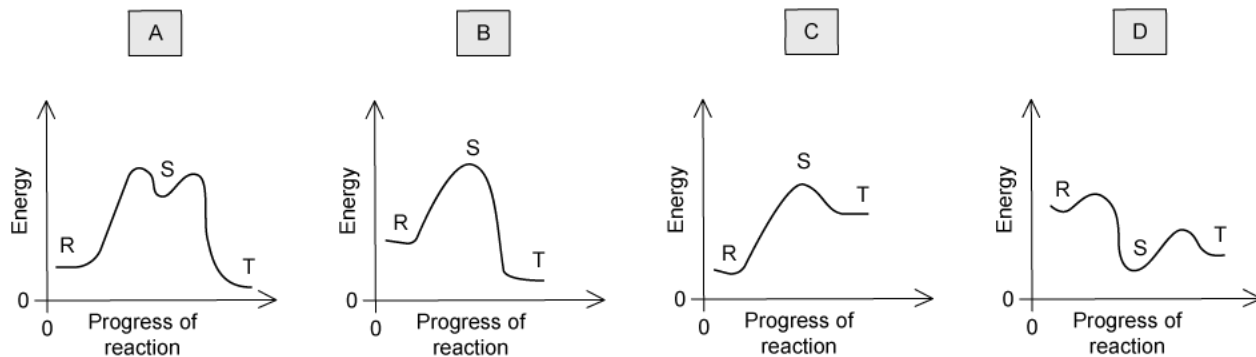
Question 3

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

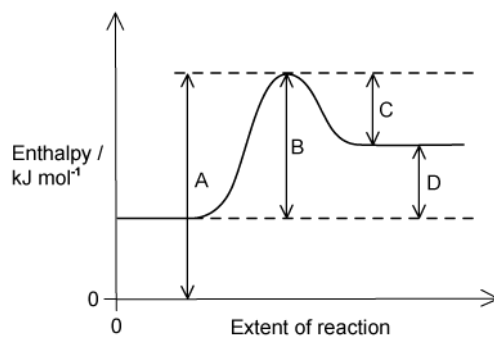
Which reaction profile fits these data?



[1 mark]

Question 4

The reaction pathway for an endothermic reaction is shown.

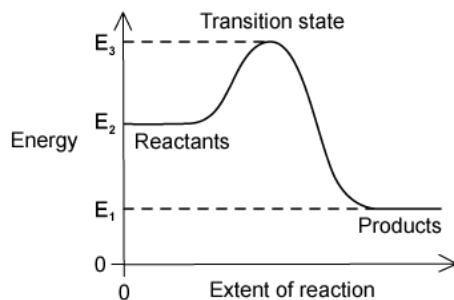


Which arrow represents the activation energy for the reverse reaction?

[1 mark]

Question 5

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



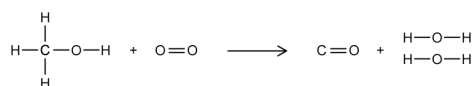
Which expression correctly represents how to calculate the activation energy of the forward reaction?

- 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

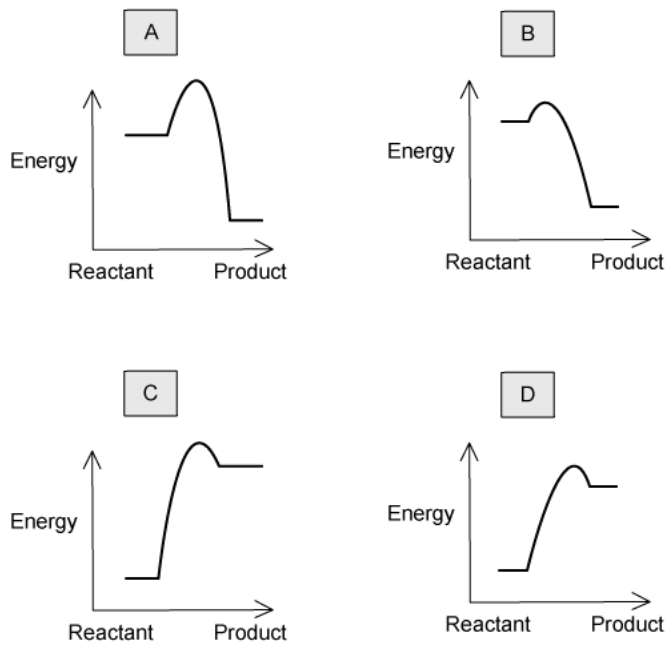
[1 mark]

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.

[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. $\text{O}_3 \rightarrow \text{O}_2 + \text{O}^\bullet$
- II. $\text{O}_2 \rightarrow 2\text{O}^\bullet$
- III. $\text{O}_2 + \text{O}^\bullet \rightarrow \text{O}_3$

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

[1 mark]