

Unit 5: Chemical energetics

Subunit 5.1: Enthalpy change, dH

Topical Question No: 1

- 7 A student mixed 25.0 cm^3 of 4.00 mol dm^{-3} hydrochloric acid with an equal volume of 4.00 mol dm^{-3} sodium hydroxide. The initial temperature of both solutions was 15.0°C . The maximum temperature recorded was 30.0°C .

Using these results, what is the enthalpy change of neutralisation of hydrochloric acid?

- A -62.7 kJ mol^{-1}
- B -31.4 kJ mol^{-1}
- C -15.7 kJ mol^{-1}
- D -3.14 kJ mol^{-1}

Topical Question No: 2

- 9 All the reactants and products of an exothermic reaction are gaseous.

Which statement about this reaction is correct?

- A The total bond energy of the products is less than the total bond energy of the reactants, and ΔH for the reaction is negative.
- B The total bond energy of the products is less than the total bond energy of the reactants, and ΔH for the reaction is positive.
- C The total bond energy of the products is more than the total bond energy of the reactants, and ΔH for the reaction is negative.
- D The total bond energy of the products is more than the total bond energy of the reactants, and ΔH for the reaction is positive.

Topical Question No: 3

- 8 Which equation represents the standard enthalpy change of formation of water?

- A $\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{g})$
- B $\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$
- C $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
- D $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$

Topical Question No: 4

- 9 Hess' Law and bond energy data can be used to calculate the enthalpy change of a reaction.

Bromoethane, $\text{CH}_3\text{CH}_2\text{Br}$, can be made by reacting ethene with hydrogen bromide.

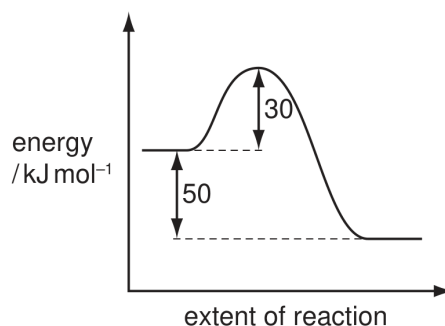


What is the enthalpy change for this reaction?

- A -674 kJ mol^{-1}
- B -64 kJ mol^{-1}
- C $+186 \text{ kJ mol}^{-1}$
- D $+346 \text{ kJ mol}^{-1}$

Topical Question No: 5

- 7 The reaction pathway for a reversible reaction is shown below.



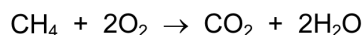
Which statement is correct?

- A The activation energy of the reverse reaction is $+80 \text{ kJ mol}^{-1}$.
- B The enthalpy change for the forward reaction is $+30 \text{ kJ mol}^{-1}$.
- C The enthalpy change for the forward reaction is $+50 \text{ kJ mol}^{-1}$.
- D The enthalpy change for the reverse reaction is $+30 \text{ kJ mol}^{-1}$.

Topical Question No: 6

- 12 Use of the Data Booklet is relevant to this question.

This question should be answered using bond enthalpy data. The equation for the complete combustion of methane is given below.

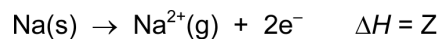
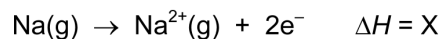
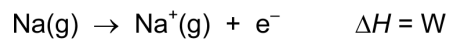


What is the enthalpy change of combustion of methane?

- A $-1530 \text{ kJ mol}^{-1}$
- B $-1184 \text{ kJ mol}^{-1}$
- C -770 kJ mol^{-1}
- D -688 kJ mol^{-1}

Topical Question No: 7

- 2 Equations involving four enthalpy changes are shown.



What is the second ionisation energy of sodium?

- A** X **B** X – W **C** Y – W **D** Z – Y

Topical Question No: 8

- 10 Use of the Data Booklet is relevant to this question.

A student mixed 25 cm³ of 0.10 mol dm⁻³ sodium hydroxide solution with 25 cm³ of 0.10 mol dm⁻³ hydrochloric acid and noted a temperature rise of 2.5 °C.

What is the enthalpy change of the reaction per mole of NaOH?

- A** –209 kJ mol⁻¹
B –104.5 kJ mol⁻¹
C –209 J mol⁻¹
D –522.5 J mol⁻¹

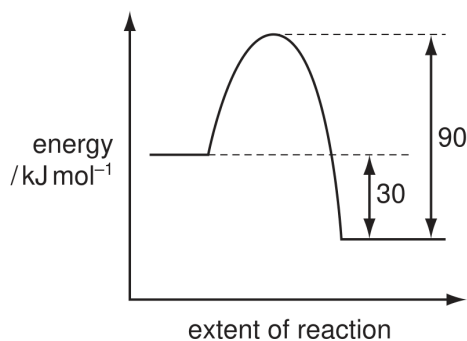
Topical Question No: 9

- 11 Which energy change corresponds to the enthalpy change of atomisation of hydrogen at 298 K?

- A** the bond energy of a H–H bond
B half the bond energy of a H–H bond
C minus half the bond energy of a H–H bond
D minus the bond energy of a H–H bond

Topical Question No: 10

- 32 The diagram shows the reaction pathway for a reversible reaction.



Which statements are correct?

- 1 The enthalpy change for the backward reaction is $+90 \text{ kJ mol}^{-1}$.
- 2 The forward reaction is exothermic.
- 3 The enthalpy change for the forward reaction is -30 kJ mol^{-1} .

Topical Question No: 11

- 3 The enthalpy change of formation of carbon dioxide is -394 kJ mol^{-1} .
The enthalpy change of formation of water is -286 kJ mol^{-1} .
The enthalpy change of formation of methane is -74 kJ mol^{-1} .

What is the enthalpy change of combustion of methane?

- A -892 kJ mol^{-1}
B -606 kJ mol^{-1}
C $+606 \text{ kJ mol}^{-1}$
D $+892 \text{ kJ mol}^{-1}$

Topical Question No: 12

- 8 Which equation represents the standard enthalpy change of formation of ethanol, $\text{C}_2\text{H}_5\text{OH}$?
- A $2\text{C}(\text{g}) + 3\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{C}_2\text{H}_5\text{OH}(\text{l})$
B $2\text{C}(\text{s}) + 3\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{C}_2\text{H}_5\text{OH}(\text{l})$
C $2\text{C}(\text{s}) + 3\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{C}_2\text{H}_5\text{OH}(\text{g})$
D $2\text{C}(\text{g}) + 6\text{H}(\text{g}) + \text{O}(\text{g}) \rightarrow \text{C}_2\text{H}_5\text{OH}(\text{l})$

Answer Key

1. Error
2. Error
3. Error
4. Error
5. Error
6. Error
7. Error
8. Error
9. Error
10. Error
11. Error
12. Error