

IB Chemistry HL - R1.2

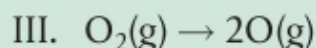
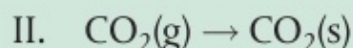
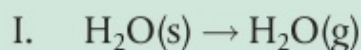
Energy cycles in reactions

Exercises + Practice questions

Official answers appended at the end

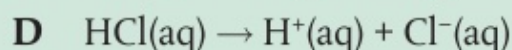
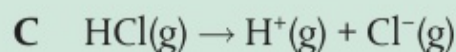
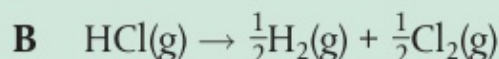
Exercise

Q1. Which of the following processes are endothermic?

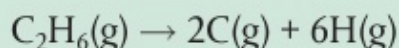


A I and II only **B** I and III only **C** II and III only **D** I, II and III

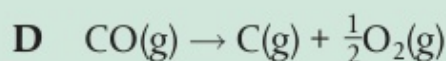
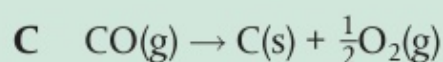
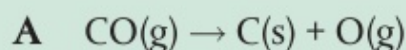
Q2. Identify the equation that represents the bond enthalpy for the H-Cl bond.



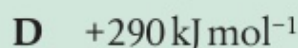
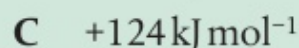
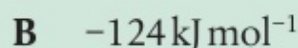
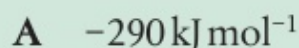
Q3. Identify the bonds that are broken in the following process.



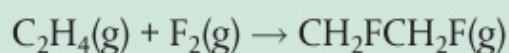
Q4. Which of the following enthalpy changes corresponds to the bond enthalpy of the carbon-oxygen bond in carbon monoxide?



Q5. The hydrogenation of the alkene double bond in unsaturated oils is an important reaction in margarine production. Calculate the enthalpy change when one mole of C=C bonds is hydrogenated from the bond energy data tabulated earlier.



- Q6.** Use bond enthalpy data to calculate the enthalpy change of the reaction between methane and fluorine.



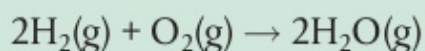
A +557 kJ mol⁻¹

B +65 kJ mol⁻¹

C -65 kJ mol⁻¹

D -557 kJ mol⁻¹

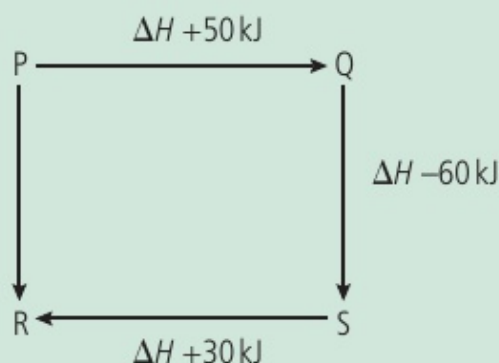
- Q7.** Use bond enthalpy data to calculate $\Delta H^\ominus$ for the reaction:



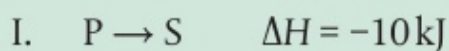
- Q8.** Use the bond enthalpies given earlier to estimate the enthalpy of combustion of ethanol and comment on the reliability of your result.

Exercise

Q10. The diagram illustrates the enthalpy changes for a set of reactions.



Which of the following statements are correct?



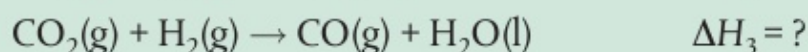
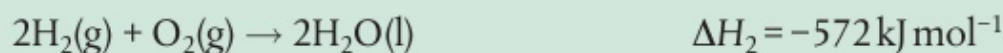
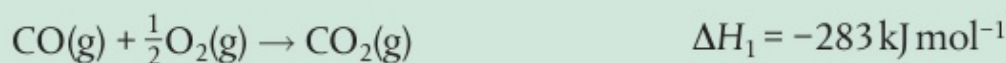
A I and II only

B I and III only

C II and III only

D I, II and III

Q11. The thermochemical equations for three related reactions are shown.



What is the value of ΔH_3 ?

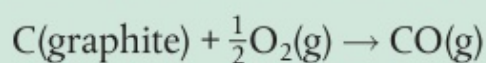
A $+289 \text{ kJ mol}^{-1}$

B -3 kJ mol^{-1}

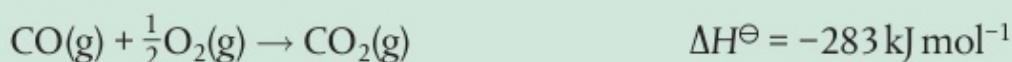
C -289 kJ mol^{-1}

D -855 kJ mol^{-1}

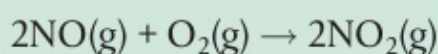
Q12. Calculate the enthalpy change, $\Delta H^\ominus$, for the reaction:



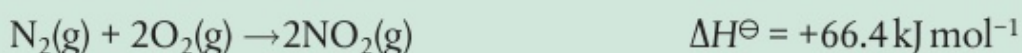
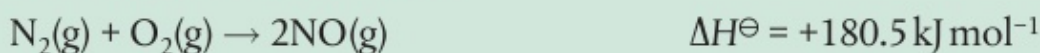
from the information below:



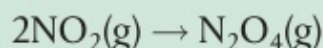
Q13. Calculate the enthalpy change, $\Delta H^\ominus$, for the reaction:



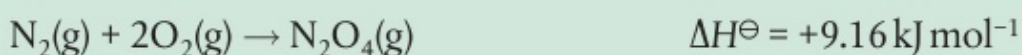
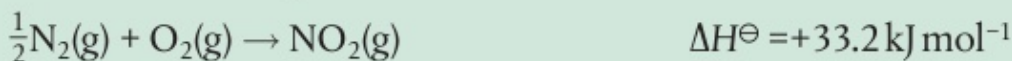
from the information below:



Q14. Calculate the enthalpy change for the dimerization of nitrogen dioxide:



from the following data:



Exercise

- Q15.** Which of the following does **not** have a standard enthalpy change of formation value of zero at 25 °C and 1.00×10^5 Pa?
- A $\text{Cl}_2(\text{g})$ B $\text{I}_2(\text{s})$ C $\text{Br}_2(\text{g})$ D $\text{Na}(\text{s})$
- Q16.** Which of the following **does** have an enthalpy change of formation of zero at 25 °C and 1.00×10^5 Pa?
- A $\text{O}_3(\text{g})$ B $\text{S}_8(\text{s})$ C $\text{C}_{60}(\text{s})$ D $\text{I}_2(\text{aq})$
- Q17.** Identify the equation which corresponds to an enthalpy change of formation.
- A $\text{CuSO}_4(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu}(\text{s})$
B $\text{Cu}(\text{s}) + \text{S}(\text{s}) + 2\text{O}_2(\text{g}) \rightarrow \text{CuSO}_4(\text{aq})$
C $5\text{H}_2\text{O}(\text{l}) + \text{CuSO}_4(\text{s}) \rightarrow \text{CuSO}_4 \cdot 5\text{H}_2\text{O}(\text{s})$
D $\text{Cu}(\text{s}) + \text{S}(\text{s}) + 2\text{O}_2(\text{g}) \rightarrow \text{CuSO}_4(\text{s})$
- Q18.** The enthalpy changes of combustion of hydrogen and methane are given in Section 14 of the data booklet. Calculate the maximum amount of energy available from burning 1.00 g of each of the gases.
- Q19.** The standard enthalpy changes for the combustion of propane, $\text{C}_3\text{H}_8(\text{g})$, and butane, $\text{C}_4\text{H}_{10}(\text{g})$, are given in Section 14 of the data booklet.
- (a) Give the equations for the complete combustion of propane and butane.
(b) Identify the fuel which releases the most energy when a 1.0 g sample is burnt.