



Thermochemistry DPP-1 Solutions

Chapter: Basics of Thermochemistry

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*"Success is not final, failure is not fatal: It is the courage to continue that counts."
"Main Naruto Uzumaki hoon... aur ek din main Hokage banunga! Dattebayo!"*

Q1. The formation of water from $H_2(g)$ and $O_2(g)$ is an exothermic process.

Exothermic matlab reactants ki energy zyada hoti hai aur products ki energy kam hoti hai. Yahaan $H_2 + O_2$ ki chemical energy water se zyada hai. Isliye reaction heat release karta hai.

Final Answer: (A)

Q2. Which plot represents an exothermic reaction?

Exothermic reaction ke energy diagram mein products niche (lower enthalpy) hote hain reactants se. Jo plot mein products neeche hain \rightarrow wahi correct hai.

Final Answer: (A) Plot with products below reactants (exothermic curve).

Q3. Why are enthalpy changes of formation of N_2O and NO positive?

N_2 bond bahut strong hai (triple bond, high bond energy). Usko todne ke liye energy deni padti hai \rightarrow reaction endothermic. Isliye ΔH positive hota hai.

Final Answer: (A)

Q4. ΔH for $C(\text{diamond}) \rightarrow C(\text{graphite})$ is -453.5 cal. What does this suggest?

Negative ΔH matlab graphite ki energy diamond se kam hai. Jo kam energy mein hota hai \rightarrow woh jyada stable hota hai.

Final Answer: (C)

Q5. Which heat of reaction indicates least stable product?

Endothermic (+ve ΔH) ka matlab product unstable hai. Aur jitna zyada +ve, utna hi unstable.

Final Answer: (D)

Q6. Exothermic reaction among given examples?

Diamond \rightarrow Graphite ka ΔH negative hota hai. Baaki sab ya toh decomposition hai ya bond breaking \rightarrow endothermic.

Final Answer: (C)

Q7. For $3O_2 \rightarrow 2O_3$, $\Delta H = +ve$. What does it indicate?

Positive ΔH matlab O_3 ki energy O_2 se zyada hai. Jiska energy zyada, woh unstable hota hai.

Final Answer: (B)

Q8. P(white) \rightarrow P(red), $\Delta H = -18.4$ kJ. Interpret.

Negative ΔH matlab red P ki energy white P se kam hai \rightarrow red P jyada stable. Reaction spontaneously hota hai white \rightarrow red.

Final Answer: (D)

Q9. Compare enthalpies: $H_2 + Cl_2 \rightarrow 2HCl(g)$ vs $2HCl(l)$.

Liquid banne par condensation heat bhi release hoti hai. Isliye $HCl(l)$ banne ka ΔH jyada negative hota hai.

Final Answer: (B)

Q10. Two H atoms combine to form H_2 . Energy of molecule?

Bond formation releases energy \rightarrow system ki energy decrease hoti hai. Isliye H_2 ki energy atoms se kam hai.

Final Answer: (C)

Q1. 1 g graphite burnt in bomb calorimeter ($C=20.7$ kJ/K). $\Delta T = 1$ K. Find ΔH per mol.

Calorimeter heat = $C\Delta T$. Divide by moles of C burnt to get per mol enthalpy change.

Step-wise Solution: $q = 20.7 \times 1 = 20.7$ kJ. Moles C = $1/12 = 0.0833$ mol. $\Delta H = 20.7/0.0833 = 248.4$ kJ/mol.

Final Answer: -248.4 kJ mol⁻¹

Q2. 1.6 g NH₄NO₃ decomposed. $\Delta T = -6$ K, $C=1.25$ kJ/K. Find molar ΔH .

Temp decrease \rightarrow endothermic. Total heat absorbed = $C\Delta T$.

Step-wise Solution: $q = 1.25 \times (-6) = -7.5$ kJ. Moles = $1.6/80 = 0.02$. Per mol = $-7.5/0.02 = -375$ kJ.

Final Answer: $+375$ kJ mol⁻¹

Q3. Bomb calorimeter $C=500$ J/ $^{\circ}$ C, $\Delta T = 2^{\circ}$ C for 0.1 g CH₄. Find ΔE per mol.

Heat released = $C\Delta T$. Divide by moles of CH₄ burnt.

Step-wise Solution: $q = 500 \times 2 = 1000$ J. Moles = $0.1/16 = 0.00625$. Per mol = $1000 / 0.00625 = 160$ kJ.

Final Answer: -160 kJ mol⁻¹

Q4. 19 g Cu at 87 $^{\circ}$ C in 55.55 g water (18.3 $^{\circ}$ C). Final T=20.4 $^{\circ}$ C. Find c_{Cu} .

Heat lost by Cu = Heat gained by water. Use $q = mc\Delta T$ for both.

Step-wise Solution: $q_{water} = 55.55 \times 4.184 \times (20.4-18.3) = 486.8$ J. $q_{Cu} = 19 \times c \times (87-20.4) = 19 \times c \times 66.6$. Equating $\rightarrow c = 0.39$ J g⁻¹ $^{\circ}$ C⁻¹.

Final Answer: 0.39 J g⁻¹ $^{\circ}$ C⁻¹

Q5. Gas A evolves 250 kJ/mol. For 0.2 mol, $\Delta T = 2$ K. Find calorimeter heat capacity.

Heat released = $n\Delta H$. Divide by temperature rise for calorimeter capacity.

Step-wise Solution: $q = 0.2 \times 250 = 50$ kJ. $C = q/\Delta T = 50/2 = 25$ kJ/K.

Final Answer: 25 kJ K⁻¹

Q6. Combustion of ethanol gives 1364.47 kJ/mol. Find ΔH .

By definition, enthalpy of combustion = heat released per mol. So $\Delta H = -q$.

Final Answer: -1364.47 kJ mol⁻¹
