Class 11 Chemistry · Chapter 5: Thermodynamics

Worksheet · 20 marks · about 40 minutes · based on NCERT

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1. An ideal gas expands isothermally from one bulb into a second, evacuated bulb when the stopcock between them is opened. Which of the following is not zero for this change? [1]

(a) q (b) w
(c) ΔS of the gas (d) ΔU

2. Which of the following has a standard enthalpy of formation equal to zero at 298 K? [1]

(a) C(diamond) (b) S(rhombic)
(c) $Br_2(g)$ (d) $O_3(g)$

3. A sealed glass ampoule containing a reaction mixture is dipped in a water bath at 60 °C. Taking the ampoule and its contents as the system, it is [1]

(a) an open system (b) a closed system
(c) an isolated system (d) an adiabatic system

4. The entropy of which of the following approaches zero as the temperature approaches absolute zero? [1]

(a) a pure crystalline solid (b) a supercooled liquid
(c) a solution of two solids (d) any substance cooled to 0 K

5. A 200 g block of a metal absorbs 3.6 kJ of heat and its temperature rises by 20 K. The specific heat of the metal is [1]

(a) 1.11 J g^{-1} K^{-1} (b) 18 J g^{-1} K^{-1}
(c) 0.90 J g^{-1} K^{-1} (d) 9.0×10^{-4} J g^{-1} K^{-1}

6. A reaction has positive ΔH and positive ΔS. Explain why it is non-spontaneous at low temperature but spontaneous at high temperature, and why such reactions are often carried out at high temperature. [2]

7. A cylinder holds 2 mol of nitrogen at 300 K. A partition divides it into two equal halves. For one half, state whether each of these changes from its value for the whole gas: (i) volume, (ii) temperature, (iii) molar volume, (iv) enthalpy. Give the reason in one line. [2]

8. For a solid X at a certain temperature, $\Delta_{sub}H^{\ominus}$ = 62.0 kJ mol^{-1} and $\Delta_{fus}H^{\ominus}$ = 8.0 kJ mol^{-1}. Find $\Delta_{vap}H^{\ominus}$ of liquid X at the same temperature, and name the property of enthalpy that makes this possible. [2]

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9. Classify each as an open, closed or isolated system, with a reason: (i) hot tea in a tightly closed thermos flask; (ii) a sealed steel can of juice cooling in a refrigerator; (iii) water boiling in an uncovered pan. Which of them also has an adiabatic boundary? [3]

10. A reaction at 300 K and constant pressure has $\Delta_r H = +30.0$ kJ mol^{-1}, and the total entropy change of system and surroundings is -20 J K^{-1} mol^{-1}. (a) Find ΔS_{surr} and ΔS_{sys}. (b) Is the reaction spontaneous? (c) Find ΔG from $\Delta H - T\Delta S_{sys}$ and show that it equals $-T\Delta S_{total}$. [3]

11. In a reversible isothermal expansion at 300 K, 1.00 mol of an ideal gas absorbs 3.46 kJ of heat. Find ΔU, w, and the factor by which the volume increased. ($R = 8.314$ J K^{-1} mol^{-1}; $\ln 4 = 1.386$) [3]