

Questions with Answer Keys

MathonGo

Q1 (20 July 2021 Shift 1)

An average person needs about 10000 kJ energy per day. The amount of glucose (molar mass = 180.0 g mol^{-1}) needed to meet this energy requirement is ____ g.

(Use : $\Delta_c H(\text{ glucose }) = -2700 \text{ kJ mol}^{-1}$)

Q2 (20 July 2021 Shift 2)

For a given chemical reaction $A \rightarrow B$ at 300 K the free energy change is $-49.4 \text{ kJ mol}^{-1}$ and the enthalpy of reaction is 51.4 kJ mol^{-1} . The entropy change of the reaction is ____ $\text{JK}^{-1} \text{ mol}^{-1}$

Q3 (22 July 2021 Shift 1)

If the standard molar enthalpy change for combustion of graphite powder is $-2.48 \times 10^2 \text{ kJ mol}^{-1}$, the amount of heat generated on combustion of 1 g of graphite powder is ____ kJ. (Nearest integer)

Q4 (25 July 2021 Shift 1)

At 298.2 K the relationship between enthalpy of bond dissociation (in kJ mol^{-1}) for hydrogen (E_H) and its isotope, deuterium (E_D), is best described by:

(1) $E_H = \frac{1}{2} E_D$

(2) $E_H = E_D$

(3) $E_H = E_D - 7.5$

(4) $E_H = 2E_D$

Q5 (25 July 2021 Shift 1)

At 298 K, the enthalpy of fusion of a solid (X) is 2.8 kJ mol^{-1} and the enthalpy of vaporisation of the liquid (X) is 98.2 kJ mol^{-1} . The enthalpy of sublimation of the substance (X) in kJ mol^{-1} is (in nearest integer)

Questions with Answer Keys

MathonGo

Q6 (25 July 2021 Shift 2)

A system does 200 J of work and at the same time absorbs 150 J of heat. The magnitude of the change in internal energy is J. (Nearest integer)

Q7 (27 July 2021 Shift 1)

For water at 100°C and 1 bar,

$$\Delta_{\text{vap}} H - \Delta_{\text{vap}} U =$$

$$\times 10^2 \text{ J mol}^{-1}$$

(Round off to the Nearest Integer)

$$[\text{Use: } R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}]$$

[Assume volume of H₂O(l) is much smaller than volume of H₂O(g). Assume H₂O(g) treated as an ideal gas]

Q8 (27 July 2021 Shift 2)

When 400 mL of 0.2M H₂SO₄ solution is mixed with 600 mL of 0.1M NaOH solution, the

increase in temperature of the final solution is -10^{-2} K. (Round off to the nearest integer).

[Use : $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}$:

$$\Delta_{\text{r}}H = -57.1 \text{ kJ mol}^{-1}]$$

Specific heat of H₂O = 4.18 J K⁻¹ g⁻¹

density of H₂O = 1.0 g cm⁻³

Assume no change in volume of solution on mixing.

Questions with Answer Keys

MathonGo

//. mathongo //.

Answer Key

//. mathongo //.

Q1 (667)

Q2 (360)

Q3 (21)

Q4 (3)

//. mathongo //.

Q5 (101)

Q6 (50)

Q7 (31)

Q8 (2)

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

//. mathongo //.

#MathBoleTohMathonGo

Hints and Solutions

MathonGo

Q1

1 mole glucose give 2700 kJ energy so mole of glucose needed for 10^5 kJ energy $= \frac{10000}{2700} = 370$ moles

wt. of glucose $= 3.10 \times 180$

$= 666.666$

≈ 667 gm

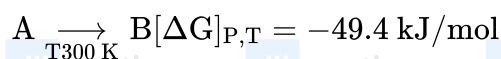
$$\frac{Y_{\text{Benzene}}}{Y_{\text{M.B}}} = \frac{P_{\text{B}}^0 X_{\text{B}}}{P_{\text{M.B}}^0 X_{\text{M.B}}} = \frac{70 \times 1}{20 \times 1} = \frac{7}{2}$$

$$Y_{\text{Benzene}} = \frac{7}{9} = 77.77 \times 10^{-2}$$

$$= 78 \times 10^{-12}$$

Q2

Given chemical reaction:



$$\Delta H_{\text{rxn}} = 51.4 \text{ kJ/mol}$$

$$\Delta S_{\text{rxn}} = ?$$

\Rightarrow From the relation $[\Delta G]_{\text{P,T}} = \Delta H - T\Delta S$

$$\Rightarrow \Delta S_{\text{rxn}} = \frac{\Delta H_{\text{rxn}} - [\Delta G]_{\text{P,T}}}{T}$$

$$= \frac{[51.4 - (-49.4)] \times 1000}{300} \frac{\text{J}}{\text{molK}}$$

$$\Rightarrow \Delta S_{\text{rxn}} = 336 \frac{\text{J}}{\text{molK}}$$

Q3

1 mol graphite $= 12$ gm C

$$\text{Ans.} = \frac{248}{12} = 20.67 \text{ kJ/gm heat evolved}$$

Q4

Enthalpy of bond dissociation (kJ/mole) at 298.2 K For, hydrogen $= 435.88$ For, Deuterium $= 443.35$

$$E_{\text{H}} \simeq E_{\text{D}} - 7.5$$

Q5

#MathBoleTohMathonGo

Hints and Solutions

MathonGo

$$\Delta H_{ab} = \Delta H_{fis} + \Delta H_{vqp}$$

$$= 2.8 + 98.2$$

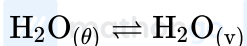
$$= 101 \text{ kJ/mol}$$

Q6

$$w = -200 \text{ J}, q = +150 : \Delta U = q + w$$

$$\Delta U = 150 - 200 = -50 \text{ J} : \text{magnitude} = 50 \text{ J} = |\Delta U|$$

Q7



$$\Delta H = \Delta U + \Delta n_g RT$$

for 1 mole waters ;

$$\Delta n_g = 1$$

$$\therefore \Delta n_g RT = 1 \text{ mol} \times 8.31 \text{ J/mol} \cdot \text{K} \times 373 \text{ K}$$

$$= 3099.63 \text{ J} \cong 31 \times 10^2 \text{ J}$$

Q8

$$n_{\text{H}^+} = \frac{400 \times 0.2}{1000} \times 2 = 0.16$$

$$n_{\text{OH}^-} = \frac{600 \times 0.1}{1000} = 0.06$$

Now, heat liberated from reaction

= heat gained by solutions

$$\text{or, } 0.06 \times 57.1 \times 10^3$$

$$= (1000 \times 1.0) \times 4.18 \times \Delta T$$

$$\therefore \Delta T = 0.8196 \text{ K}$$

$$= 81.96 \times 10^{-2} \text{ K} \approx 82 \times 10^{-2} \text{ K}$$