DPP - Daily Practice Problems

Name : **Date :**

Start Time : **End Time :**

CHEMISTRY 10

SYLLABUS : Thermodynamics-1 (First Law of Thermodynamics, Thermochemical Equations)

Max. Marks : 120 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.

Q.1 What is true regarding complete combustion of gaseous isobutane?

(a) $\Delta H = \Delta E$ (b) $\Delta H > \Delta E$

(c) $\Delta H = \Delta E = 0$ (d) $\Delta H < \Delta E$

Q.2 How much heat is produced when 4.50 g methane gas is burnt in a constant pressure system?

Given : $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$; $\Delta H = -802$ kJ

(a) 225.6 kJ (b) 125.6 kJ

(c) 175.6 kJ (d) 325.6 kJ

Q.3 ΔH_f° for Al_2O_3 is -1670 kJ. Calculate the enthalpy change for the reaction : $4Al + 3O_2 \rightarrow 2Al_2O_3$

(a) -2340 kJ (b) -3340 kJ

(c) -1340 kJ (d) -4320 kJ

Q.4 The specific heats of iodine vapours and solid are 0.031 and 0.055 Cal/g respectively. If heat of sublimation of iodine is 24 Cal/g at 200°C, what is its value at 250°C ?

(a) 22.8 Cal/g (b) 11.2 Cal/g

(c) 12.8 Cal/g (d) 24.4 Cal/g

Q.5 Calculate the heat of neutralization by mixing 200 ml of 0.1M H_2SO_4 and 200 ml of 0.2 M KOH if heat generated by the mixing is 2.3 kJ.

(a) 17.5 kJ (b) 42.5 kJ (c) 57.5 kJ (d) 34.5 kJ

RESPONSE GRID 1. ⓐⓑⓒⓓ 2. ⓐⓑⓒⓓ 3. ⓐⓑⓒⓓ 4. ⓐⓑⓒⓓ 5. ⓐⓑⓒⓓ

Space for Rough Work

Q.6 A system does 100 J of work on surroundings by absorbing 150 J of heat. Calculate the change in internal energy.

(a) 100 J (b) 50 J (c) 25 J (d) 150 J

Q.7 A gas absorbs 200 J of heat and expands against the external pressure of 1.5 atm from a volume of 0.5 litre to 1.0 litre, Calculate the change in internal energy.

(a) 124.25 J (b) 224 J (c) 114 J (d) 154 J

Q.8 Heat of reaction for

$$C_6H_{12}O_6\,(s) + 6O_2\,(g) \rightarrow 6CO_2\,(g) + 6H_2O\,(l)$$

at constant pressure is -651 kcal at 17°C. Calculate the heat of reaction at constant volume at 17°C-

(a) – 554.5 kcal (b) – 654.5 kcal

(c) – 354.5 kcal (d) – 154.5 kcal

Q.9 A sample of gas is compressed by an average pressure of 0.50 atmosphere so as to decrease its volume from 400 cm^3 to 200 cm^3. During the process 8.00 J of heat flows out to surroundings. Calculate the change in internal energy of the system.

(a) 2.13 J (b) 4.17 J (c) 1.13 J (d) 3.52 J

Q.10 The heat of combustion of napthalene ($C_{10}H_8(s)$) at constant volume was measured to be – 5133 kJ mol^{-1} at 298 K. Calculate the value of enthalpy change

(Given R = 8.314 $JK^{-1}\,mol^{-1}$).

(a) – 3137955.14 Joule (b) – 5137955.14 Joule

(c) – 4127955.14 Joule (d) – 3247955.14 Joule

Q.11 A cooking gas cylinder is assumed to contain 11.2kg isobutane. The combustion of isobutane is given by-

$$C_4H_{10}\,(g) + \left(\frac{13}{2}\right) O_2\,(g) \rightarrow 4CO_2\,(g) + 5H_2O(l);$$

$\Delta H = -2658$ kJ

If a family needs 15000 kJ of energy per day for cooking, how long would the cylinder last?

[1 mole of isobutane = 2658 kJ]

(a) 22 days (b) 28 days (c) 32 days (d) 34 days

Q.12 For a gaseous reaction : $2A_2(g) + 5B_2(g) \rightarrow 2A_2B_5(g)$ at 27°C the heat change at constant pressure is found to be –50160J. Calculate the value of internal energy change (ΔE). Given that R = 8.314 J/K mol.

(a) –34689 J (b) –37689 J

(c) –27689 J (d) –38689 J

Q.13 Calculate the work performed when 2 moles of hydrogen expands isothermally and reversibly at 25°C from 15 to 50 litres.

(a) –1436 calories (b) –1318 calories

(c) –1215 calories (d) –1172 calories

Q.14 Which one of the following equations does not correctly represent the first law of thermodynamics for the given process?

(a) isothermal process : $q = -w$

(b) cyclic process : $q = -w$

(c) expansion of gas into vacuum : $\Delta U = q$

(d) adiabatic process : $\Delta V = -w$

Q.15 From the following data of ΔH of the following reactions,

$C(s) + \frac{1}{2} O_2\,(g) \rightarrow CO\,(g)\,;\ \Delta H = -110$ kJ

and $C\,(s) + H_2O\,(g) \rightarrow CO\,(g) + H_2\,(g)\,;\ \Delta H = 132$ kJ.

Calculate the mole composition of the mixture of oxygen and steam on being passed over coke at 1273K, keeping the reaction temperature constant.

(a) 0.3 : 1 (b) 2.1 : 1 (c) 0.6 : 1 (d) 1 : 1

Q.16 200 ml of KOH and 200 ml of HNO_3 of same molarity are mixed together and liberated 3.426 kJ of heat. Determine the molarity of each solution.

(a) 0.1 mole (b) 1.3 mole (c) 0.7 mole (d) 0.3 mole

Q.17 The work done in ergs for the reversible expansion of one mole of an ideal gas from a volume of 10 litres to 20 litres at 25°C is

(a) $2.303 \times 298 \times 0.082 \log 2$

(b) $298 \times 10^7 \times 8.31 \times 2.303 \log 2$

(c) $2.303 \times 298 \times 0.082 \log 0.5$

(d) $8.31 \times 10^7 \times 298 - 2.303 \log 0.5$

RESPONSE GRID

6. ⓐⓑⓒⓓ 7. ⓐⓑⓒⓓ 8. ⓐⓑⓒⓓ 9. ⓐⓑⓒⓓ 10. ⓐⓑⓒⓓ

11. ⓐⓑⓒⓓ 12. ⓐⓑⓒⓓ 13. ⓐⓑⓒⓓ 14. ⓐⓑⓒⓓ 15. ⓐⓑⓒⓓ

16. ⓐⓑⓒⓓ 17. ⓐⓑⓒⓓ

Space for Rough Work

Q.18 For the reaction

$CH_3COOH(l) • 2O_2(g) \rightleftharpoons 2CO_2(g) • 2H_2O(l)$ at 25°C

and 1 atm. pressure, • H • • 874kJ. Then the change in internal energy (• E) is

(a) – 874 kJ (b) – 871.53 kJ
(c) – 876.47 kJ (d) + 874 kJ

Q.19 One mole of an ideal gas is allowed to expand reversibly and adiabatically from a temperature of 27°C. If the work done during the process is 3 kJ, then final temperature of the gas is ($C_v = 20\ J / K$)

(a) 100 K (b) 150 K (c) 195 K (d) 255 K

Q.20 In a closed insulated container, a liquid is stirred with a paddle to increase its temperature. In this process, which of the following is true ?

(a) • E• W• Q• 0 (b) • E• ●,Q• W• 0
(c) • E• W• 0,Q• 0 (d) • E• Q• 0, W• 0

Q.21 One mole of an ideal gas is allowed to expand freely and adiabatically into vacuum until its volume has doubled. A statement which is not true concerning this expression is

(a) • H• 0 (b) • S• 0
(c) • E• 0 (d) W• 0

DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :

(a) 1, 2 and 3 are correct
(b) 1 and 2 are correct
(c) 2 and 4 are correct
(d) 1 and 3 are correct

Q.22 Which of the following processes have positive value for ΔH?

(1) $H_2(g) \rightarrow 2H(g)$
(2) $H^+(aq) + OH^-(aq) \rightarrow H_2O\,(l)$
(3) $H(g) \rightarrow H^+(g) + e^-$
(4) $H_2O(l) \rightarrow H_2O(s)$

Q.23 Choose the correct options for the process at 25°C of dissolving 1.00 mol of KCl in large excess of water.

$\Delta_f H^{\bullet}\ [K^+(aq)] = -251.2\ kJ\ mol^{-1}$
$\Delta_f H^{o}\ [Cl^-(aq)] = -167.08\ kJ\ mol^{-1}$
$\Delta_f H^{o}\ [KCl] = -437.6\ kJ\ mol^{-1}$

(1) $\Delta_r H^{\bullet}$ for the reaction is + 19.3 kJ mol^{-1}
(2) $\Delta_r H^{\bullet}$ for the reaction is + 12.3 kJ mol^{-1}
(3) The process does not represent an ionisation reaction
(4) The process represent an ionisation reaction

Q.24 Which statement is incorrect –

(1) $\left(\frac{dH}{dT}\right)_p < \left(\frac{dE}{dT}\right)_v$ (2) $\left(\frac{dH}{dT}\right)_p + \left(\frac{dE}{dT}\right)_v = R$

(3) $\left(\frac{dH}{dT}\right)_p = \left(\frac{dE}{dT}\right)_v$ (4) $\left(\frac{dH}{dT}\right)_p > \left(\frac{dE}{dT}\right)_v$

DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :

A student performed a number of experiments on thermodynamics. In one experiment, he took a closed vessel in which he dissolved 28 g of Fe in HCl at 27°C. In another experiment, he dissolved the same amount of iron but in an open vessel. However, he compressed the gas to 10 atm pressure at 27°C and then again allowed to expand it isothermally and reversibly until the pressure fell down to 1 atm.

Q.25 In the first experiment, the work done by the system is

(a) 1246 J (b) zero
(c) 2492 J (d) 1145 J

Q.26 In the second experiment, the work done by the system, if the gas were not condensed, would have been nearly

(a) 1246 J (b) zero
(c) 2492 J (d) 1145 J

Q.27 The work done by the compressed gas would be nearly

(a) 1250 J (b) 2500 J
(c) 4000 J (d) 5000 J

RESPONSE GRID					
	18. ⓐⓑⓒⓓ	**19.** ⓐⓑⓒⓓ	**20.** ⓐⓑⓒⓓ	**21.** ⓐⓑⓒⓓ	**22.** ⓐⓑⓒⓓ
	23. ⓐⓑⓒⓓ	**24.** ⓐⓑⓒⓓ	**25.** ⓐⓑⓒⓓ	**26.** ⓐⓑⓒⓓ	**27.** ⓐⓑⓒⓓ

Space for Rough Work

DIRECTIONS (Q. 28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(c) Statement -1 is False, Statement-2 is True.

(d) Statement -1 is True, Statement-2 is False.

Q.28 Statement 1 : T, P and V are state variables or state functions.

Statement 2 : Their values depends on the state of the system and how it is reached.

Q.29 Statement 1 : For an isothermal reversible process $Q = -w$ i.e. work done by the system equals the heat absorbed by the system.

Statement 2 : Enthalpy change (• H) is zero for isothermal process.

Q.30 Statement 1 : Zeroth law can also be termed as law of thermal equilibrium.

Statement 2 : Two objects in thermal equilibrium with the third one, are in thermal equilibrium with each other.

RESPONSE GRID	28. ⓐⓑⓒⓓ	29. ⓐⓑⓒⓓ	30. ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM SHEET 10 - CHEMISTRY

Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	36	Qualifying Score	56
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS

(10)

(1) **(d)** $C_4H_{10}(g) + 6.5O_2(g) \rightarrow 4CO_2(g) + 5H_2O_{(l)}$

$\Delta n = [4 - 7.5] = -3.5$

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

$\therefore \Delta H < \Delta E$

(2) **(a)** Given $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$; $\Delta H = -802$ kJ

$\because$ 16 g CH_4 on burning produces heat = 802 kJ

$\therefore$ 4.5 g CH_4 on burning produces heat

$= \dfrac{802 \times 4.5}{16} = 225.6 \text{kJ}$

(3) **(b)** Given $2Al + \frac{3}{2}O_2 \rightarrow Al_2O_3$; $\Delta H = -1670$ kJ

Multiplying it by 2.

Then $4Al + 3O_2 \rightarrow 2Al_2O_3$

$\Delta H = 2 \times (-1670) = -3340$ kJ

(4) **(a)** $I_{2\,(solid)} \rightarrow I_{2\,(vapour)}$; $\Delta H = 24$ Cal/g at 200°C

$\Delta C_p = C_p$ of product $- C_p$ of reactant

$\Delta C_p = 0.031 - 0.055 = -0.024$ Cal/g

As $\Delta H_2 - \Delta H_1 = \Delta C_p(T_2 - T_1)$

$\therefore \Delta H_2 - 24 = -0.024(523 - 473)$

$\therefore \Delta H_2 = 22.8$ Cal/g

(5) **(c)** M_{eq} of $H_2SO_4 = 200 \times 0.1 \times 2 = 40$

M_{eq} KOH $= 200 \times 0.2 = 40$

$\because$ 40 M_{eq} of H_2SO_4 and 40 M_{eq} of KOH on mixing gives heat 2.3 kJ

$\therefore$ 1000 M_{eq} of H_2SO_4 and 1000 M_{eq} of KOH on mixing gives heat $= \dfrac{2.3 \times 1000}{40}$ kJ $= 57.5$ kJ

(6) **(b)** $W = -100J$, $q = 150J$

$\because q = \Delta E - W$

$\therefore 150 = \Delta E - (-100) = 150 - 100$

$\Delta E = 50J$

(7) **(a)** $W = -P\Delta V = -1.5(1 - 0.5)$

$= -0.75$ atm-litre $= -0.75 \times 101$ Joule

$q = 200J$

$\because q = \Delta E - W$

$200 = \Delta E - (-0.75 \times 101)$

$\Delta E = 124.25$ Joule

(8) **(b)** $\Delta H = \Delta E + \Delta n RT$

Given $\Delta H = -651 \times 10^3$ cal., $R = 2$ cal.,

$T = 290K$ and $\Delta n = 6 + 6 - 6 = 6$

$\therefore \Delta E = -651 \times 10^3 - 6 \times 2 \times 290 = -654480$ cal

$= -654.5$ kcal

(9) **(a)** Here $\Delta V = 200 - 400 = -200 \text{ cm}^3$

We know 1 Litre = 1000 cm^3

$\Rightarrow \Delta V = -0.2L$.

External pressure (P) = 0.50

Work done $= -P\Delta V = +0.50(0.2) = +0.1$ atm L.

and 1 litre atmosphere = 101.3 Joule

$\therefore W = +10.13$ Joule

According to F.L.O.T.

$q = \Delta E - W$ then $\Delta E = q + W$

Given $q = -8.00$ J

$\Rightarrow \Delta E = -8 + 10.13 = 2.13$ Joule

(10) **(b)** The combustion reaction of napthalene.

$C_{10}H_8(s) + 12O_{2(g)} \rightarrow 10CO_{2(g)} + 4H_2O_{(l)}$;

$\Delta E = -5133$ kJ

$\Delta n = 10 - 12 = -2$ mol.

Now applying the relation.

$\Delta H = \Delta E + (\Delta n)_g RT$

$= -5133 \times 10^3 + (-2)(8.314)(298)$

$= -5133000J - 4955.14J$

$= -5137955.14$ Joule

(11) **(d)** $\because$ 58 g isobutane provides energy = 2658 kJ

$\therefore$ 11.2×10^3 g isobutane provides energy

$= \dfrac{2658 \times 11.2 \times 10^3}{58}$ kJ $= 513268.9$ kJ

The daily requirement of energy = 15000kJ

$\therefore$ Cylinder will last $= \dfrac{513268.9}{15000} = 34$ days

(12) **(b)** $2A_2(g) + 5B_2(g) \rightarrow 2A_2B_5(g)$; $\Delta H = -50160J$

$\Delta n = 2 - (5 + 2) = -5$ mol.

$\Delta H = \Delta E + (\Delta n)_g RT$

$-50160 = \Delta E + (\Delta n)_g RT$

$\Delta E = -50160 - (-5)(8.314)(300)$

$= -50160 + 12471 = -37689$ J

(13) **(a)** We have,

$W = -2.303 \, nRT \log \dfrac{V_2}{V_1}$

$= -2.303 \times 2 \times 2 \times 298 \times \log \dfrac{50}{15} = -1436$ calories.

(14) **(d)** Acc. to Ist law of thermodynamics, $\Delta U = q + w$

For isothermal process, $\Delta U = 0$, $\therefore q = -w$

For cyclic process, $\Delta U = 0$, $\therefore q = -w$

For adiabatic process, $q = 0$. Hence, $\Delta U = w$

For expansion into vacuum, $w = 0$. Hence, $\Delta U = q$.

$\therefore$ only (d) is incorrect.

(15) **(c)** From the question we see that the first reaction is exothermic and the second one is endothermic. Thus, if a mixture of oxygen and steam (H_2O) is passed over coke and at the same time, temperature does not change, the composition should be such that ΔH of both the reactions are numerically equal.

In the first reaction, consumption of ½ mole of O_2 evolves 110 kJ of energy while in the second reaction, for 1 mole of steam (H_2O), 132 kJ of energy is absorbed.

$$\therefore \text{ Mole of } O_2 \text{ needed to evolve 132 kJ} = \frac{0.5}{110} \times 132$$
$$= 0.6$$

$\therefore$ Mole ratio of O_2 and steam $(H_2O) = 0.6 : 1$

(16) **(d)** Let the molarity of KOH and HNO_3 solutions is x.

$\therefore$ 200 ml of x mole KOH solution

$$= \frac{200}{1000} \times x \text{ mole } OH^- \text{ ions}$$

$= 0.2$ x mole OH^- ions

Similarly, 200 ml of x mole HNO_3 solution

$$= \frac{200}{1000} \times x \text{ mole } H^+ \text{ ions}$$

$= 0.2$ x mole H^+ ions

$$\underset{0.2x}{H^+ (aq)} + \underset{0.2x}{OH^- (aq)} \rightarrow \underset{0.2x}{H_2O (\ell)}$$

Heat evolved during formation of 1 mole $H_2O = 57.1$ kJ

$\therefore$ Heat evolved during formation of 0.2 x mole H_2O
$= 57.1 \times 0.2 \times x$ kJ

However, given heat evolved = 3.426 kJ.

$\therefore 57.1 \times 0.2x = 3.426$ kJ

$$\text{or } x = \frac{3.426}{57.1 \times 0.2} = 0.3 \text{ mole.}$$

(17) **(b)** $W = 2.303\, nRT \log \frac{V_2}{V_1}$

$$= 2.303 \times 1 \times 8.314 \times 10^7 \times 298 \log \frac{20}{10}$$

$$= 298 \times 10^7 \times 8.314 \times 2.303 \log 2$$

(18) **(a)** For this reaction $\Delta n = 0$ thus $\Delta E = \Delta H$.

(19) **(b)** Given number of moles = 1

Initial temperature = 27°C = 300K

Work done by the system = 3 kJ = 3000 J

It will be (–) because work is done by the system.

Heat capacity at constant volume $(C_v) = 20$ J / K

We know that work done

$W = -nC_v (T_2 - T_1)$; $3000 = -1 \times 20 (T_2 - 300)$

$3000 = -20T_2 + 6000$

$$20T_2 = 3000;\ T_2 = \frac{3000}{20} = 150\text{K}$$

(20) **(c)** As the system is closed and insulated, no heat enters or leaves the system, i.e. $Q = 0$; $\therefore \Delta E = Q + W = W$.

(21) **(d)** W = 0 is not true.

(22) **(d)**

(1) $H_2(g) \rightarrow 2H(g)$. It involves breaking of bond between H–H which needs energy. $\therefore\ \Delta H = +$ ve

(2) $H^+(aq) + OH^- (aq) \rightarrow H_2O(l)$. It involves bond formation which results in release of energy.
$\therefore\ \Delta H = -$ ve

(3) $H(g) \rightarrow H^+(g) + e^-$. This is ionization, which needs energy.
$\therefore\ \Delta H = +$ ve

(4) $H_2O\,(l) \rightarrow H_2O(s)$. Phase transformation from $(l) \rightarrow (s)$. It involves cooling. Hence, $\Delta H = -$ ve

$\therefore$ (d) is correct answer.

(23) **(d)** $\underset{1\ \text{mol}}{KCl(s)} + \underset{\text{excess}}{H_2O(\ell)} \rightarrow K^+(aq) + Cl^-(aq)\ \Delta_r H^0 = ?$

$$\Delta_r H^0 = [\Delta_f H^0 (K^+(aq)) + \Delta_f H^0 (Cl^-(aq))] - [\Delta_f H^0 (KCl)]$$

$= [-251.2 + (-167.08)]\ \text{kJ mol}^{-1} - [-437.6\ \text{kJ mol}^{-1}]$

$= -418.28\ \text{kJ mol}^{-1} + 437.6\ \text{kJ mol}^{-1}$

$\Delta_r H^0 = +19.3\ \text{kJ mol}^{-1}$

This process does not represent an ionisation reaction.

The process here involves dissolution of KCl(s) in water and formation of $K^+(aq)$ and $Cl^-(aq)$ by dissociation.

(24) **(a)** As $C_p > C_v$

$$\Rightarrow \left(\frac{dH}{dT}\right)_p > \left(\frac{dE}{dT}\right)_v \left(\because \left(\frac{dH}{dT}\right)_p = C_p \text{ and } \left(\frac{dE}{dT}\right)_v = C_v\right)$$

$$\text{Also } C_p - C_v = R \Rightarrow \left(\frac{dH}{dT}\right)_p - \left(\frac{dE}{dT}\right)_v = R$$

(25) **(b)** $Fe + 2HCl \longrightarrow FeCl_2 + H_2$

56g

28 g Fe will produce $H_2 = 0.5$ mole at S.T.P

As the reaction is carried out in a closed vessel,

$\Delta V = 0 \quad \therefore \quad W = -P_{ext} \times \Delta V = 0$

(26) **(a)** When reaction is carried out in open vessel,

External pressure = 1 atm.

Initial volume = 0 (as no gas is present)

Final volume at 27°C and 1 atm can be calculated as:

$$PV = nRT$$

$$\therefore \quad V = \frac{nRT}{P}$$

$$= \frac{0.5 \times 0.0821 \times 300}{1}$$

$$= 12.3\ L$$

$$\therefore \quad \Delta V = V_{final} - V_{initial} = 12.3\ L$$

$$W = -P_{ext} \Delta V$$

$$= -1 \times 12.3$$

$$= -12.3\ L\,atm$$

$$= -12.3 \times 101.3\ J = -1246\ J$$

(27) **(a)** Work done by the compressed gas $= -nRT \log \frac{P_1}{P_2}$

$$= -0.5 \times 8.314 \times 300 \log \frac{10}{1}$$

$$= 1247\ J$$

(28) **(d)** Values of state functions depend only on the state of the system and not on how it is reached.

(29) **(b)** In an isothermal process change in internal energy (ΔE) is zero (as it is a function of temperature).

∴ According to first law of thermodynamics

$\therefore \quad Q + w = \Delta E$, hence $Q = -w$ (if $\Delta E = 0$)

If a system undergoes a changes in which internal energy of the system remains constant (i.e., $\Delta E = 0$), then $-w = Q$.

This means that work done by the system equals the heat absorbed by the system.

(30) **(a)** Zeroth law of temperature can also be summarized as two objects at different temperature in thermal contact with each other tend to move towards the same temperature.