PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 45

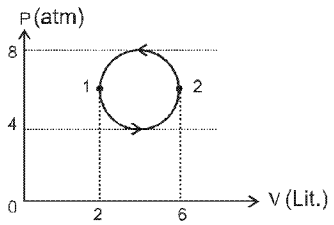
Total Marks : 35

Max. Time : 38 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.2	(3 marks, 3 min.)	[6, 6]
Multiple choice objective ('–1' negative marking) Q.3 to Q.4	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.5 to Q.7	(4 marks, 5 min.)	[12, 15]
Comprehension ('–1' negative marking) Q.8 to Q.10	(3 marks, 3 min.)	[9, 9]

1. For a reversible process, calculate magnitude of work done from the following PV diagram :



(A) 4π (B) 6π (C) 2π (D) 0

2. 2 mole of an ideal gas expands isothermally and reversibly from 1 L to 10 L at 300 K. What is the internal energy change :

(A) 4.98 kJ (B) 11.47 kJ (C) –11.47 kJ (D) 0 kJ

3.* For isothermal expansion of an ideal gas sample, the correct relation(s) is/are : (Consider all quantities with sign according to IUPAC convention and the reversible and irreversible processes are carried out between same initial and final states.)

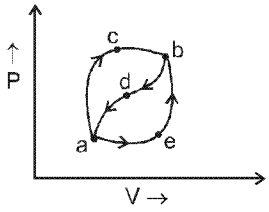
(A) $W_{rev} > W_{irrev}$ (B) $W_{irrev} > W_{rev}$ (C) $q_{rev} < q_{irrev}$ (D) $\Delta E_{rev} = \Delta E_{irrev}$

4.* 1 mole of argon gas is expanded isothermally and reversibly from 10L to 100L. Which of the following options is/are incorrect for the process :

(A) $\Delta E = 0$ (B) $W = 0$

(C) heat supplied (q) = 0 (D) $\Delta T = 0$

5. When a system is taken from state 'a' to state 'b' in fig. along path 'acb', 100 J of heat flows into the system and the system does 40 J of work. How much heat flows into the system along path 'aeb' if work done by the system is 20 J? The system returns from 'b' to 'a' along path 'bda'. If the work done on the system is 30 J, does the system absorb or liberate heat ? How much ?

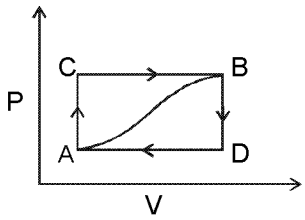


6. Calculate the energy needed to raise the temperature of 20 g iron from 25ºC to 500ºC, if specific heat capacity of iron is 0.45 $J^{o}C^{-1}g^{-1}$.

7. The energy required to vapourise one mole of benzene at it's boiling point is 31.2 kJ mol^{-1}. For how long a 100 W electric heater has to be operated in order to vaporize a 100 g sample of benzene at it's boiling temperature ?

Comprehension # (Q.8 to Q.10)

When a system is taken from state A to state B along path ACB as shown in figure below, 80 J of heat flows into the system and the system does 30 J of work. Now answer the following questions :



8. How much heat flows into the system along path ADB if the work done by the system is 10 J :

(A) 40 J (B) 60 J (C) 80 J (D)

100 J

9. When the system is returned from state B to A along the curved path, the work done on the system is 20 J. Does the system absorb or liberate heat and how much :

(A) 70 J ; heat is liberated. (B) 60 J ; heat is liberated.

(C) 70 J ; heat is absorbed. (D) 60 J ; heat is absorbed.

10. If $E_D - E_A = -40J$, then the heat corresponding to the processes AD and DB is respectively :

(A) q_{AD} = 30 J and q_{DB} = – 90 J (B) q_{AD} = – 60 J and q_{DB} = 30 J

(C) q_{AD} = 30 J and q_{DB} = 90 J (D) q_{AD} = – 30 J and q_{DB} = 90 J

Answer Key

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1.	(A)	**2.**	(D)	**3.***	(BD)	**4.**	(BC)	**5.**	**– 90 J**
6.	4275 J.	**7.**	6.66 min. (400 sec)	**8.**	(B)	**9.**	(A)	**10.**	(D)

Hints & Solutions

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5. $\Delta U_{ab} = Q_{abc} + W_{abc}$

or $\Delta U_{ab} = 100 - 40 = 60$ J

$\Delta U_{ab} = Q_{aeb} + W_{aeb}$

or $60 = Q_{aeb} - 20$

or $Q_{aeb} = \mathbf{80\ J}$ **Ans.**

$\Delta U_{ba} = -60$ J

$W_{bda} = 30$ J

$\Delta U_{ba} = Q_{bda} + W_{bda}$

or $Q_{bda} = \Delta U_{ba} - W_{bda}$

or $\boxed{Q_{bda} = -60 - 30 = \mathbf{-90\ J}}$ **Ans.**

Since Q_{bda} is (–)ve ∴ Heat is liberated from the system.

6. 4275 J.

7. 6.66 min. (400 sec)

8. Since $\Delta E = q + w$

$= 80 - 30 = 50$

So for ADB

$\Delta E = q + w$

$50 = q - 10$

$q = 60\ J$

9. For B to A,

$\Delta E = -50\ J$

$w = +20\ J$

$q = -50 - 20 = -70$

heat is liberate.

10. In ADB process, DB process is isochoric so $w_{DB} = 0$

So, $\Delta E_{AD} = q_{AD} + w_{AD}$

$-40 = q_{AD} + (-10)$

$q_{AD} = -30\ J$

Now, $q_{AB} = q_{AD} + q_{DB}$

$60 = -30 + q_{DB}$

$q_{DB} = 90\ J$