

## JEE MAIN THERMODYNAMICS — PYQS

Max. Marks: 160

Questions: 40

## Section A (MCQ) — 28 questions

**Q.1** Arrange the following isothermal processes in order of the magnitude of the work ( $p - V$ ) involved between states 1 and 2.

- A. Expansion in single stage  $w_A$   
 B. Expansion in multi stages  $w_B$   
 C. Compression in single stage  $w_C$   
 D. Compression in multi stages  $w_D$

Choose the correct option.

[JEE Main 2026 (Online) 6th April Morning Shift]

- (1)  $|w_B| > |w_A| > |w_C| > |w_D|$   
 (2)  $|w_C| > |w_D| > |w_A| > |w_B|$   
 (3)  $|w_C| > |w_D| > |w_B| > |w_A|$   
 (4)  $|w_B| > |w_A| > |w_D| > |w_C|$

Scan or tap for the full solution



**Q.2** Match List - I with List - II.

Given  $V_1$  and  $V_2$  are initial and final volumes respectively.

| Isothermal process |                          | Expression |                                  |
|--------------------|--------------------------|------------|----------------------------------|
| A.                 | Reversible expansion     | I.         | $q = 0$                          |
| B.                 | Free expansion           | II.        | $q = nRT \ln \frac{V_2}{V_1}$    |
| C.                 | Irreversible Compression | III.       | $w = -p_{\text{ext}}(V_2 - V_1)$ |
| D.                 | Cyclic reversible        | IV.        | $\frac{q_{\text{rev}}}{T} = 0$   |

Choose the correct answer from the options given below : [JEE Main 2026 (Online) 6th April Evening Shift]

- (1) A-II, B-III, C-I, D-IV (2) A-II, B-I, C-IV, D-III  
 (3) A-II, B-I, C-III, D-IV (4) A-I, B-II, C-III, D-IV

Scan or tap for the full solution



**Q.3** Consider the following data for the reaction  
 $X_2(g) + Y_2(g) \rightleftharpoons 2XY(g)$

at 600 K. The  $\Delta_r G^\ominus$  (in  $\text{kJ mol}^{-1}$ ) for the reaction is :

| Compound | $\Delta_f H_{600\text{K}}^\ominus$ ( $\text{kJ mol}^{-1}$ ) | $S_{600\text{K}}^\ominus$ ( $\text{J mol}^{-1} \text{K}^{-1}$ ) |
|----------|-------------------------------------------------------------|-----------------------------------------------------------------|
| $XY(g)$  | 42                                                          | 200                                                             |
| $X_2(g)$ | 8                                                           | 140                                                             |
| $Y_2(g)$ | 80                                                          | 250                                                             |

[JEE Main 2026 (Online) 5th April Evening Shift]

- (1) -21000 (2) -10 (3) -1000 (4) -9.012

Scan or tap for the full solution



**Q.4** The correct order of molar heat capacities measured at 298 K and 1 bar is :

[JEE Main 2026 (Online) 5th April Evening Shift]

- (1) Copper(s) > Bromine(l) > Helium(g)  
 (2) Bromine(l) > Copper(s) > Helium(g)  
 (3) Helium(g) > Bromine(l) > Copper(s)  
 (4) Helium(g) > Bromine(l) = Copper(s)

Scan or tap for the full solution



**Q.5** Given below are two statements :

**Statement-I:** For an ideal gas, heat capacity at constant volume is always greater than the heat capacity at constant pressure.

**Statement-II:** In a constant volume process, no work is produced and all the heat withdrawn goes into the chaotic motion and is reflected by a temperature increase of the ideal gas.

In the light of the above statements, choose the correct answer from the options given below

[JEE Main 2026 (Online) 4th April Morning Shift]

- (1) Both Statement-I and Statement-II are true  
 (2) Both Statement-I and Statement-II are false  
 (3) Statement-I is true but Statement-II is false  
 (4) Statement-I is false but Statement-II is true

Scan or tap for the full solution



**Q.6** Consider the following data.

- (i)  $2\text{Al}(s) + 6\text{HCl}(aq) \rightarrow \text{Al}_2\text{Cl}_6(aq) + 3\text{H}_2(g) + 1200 \text{ kJ/mol}$   
 (ii)  $\text{H}_2(g) + \text{Cl}_2(g) \rightarrow 2\text{HCl}(g) + 164 \text{ kJ/mol}$   
 (iii)  $\text{HCl}(g) + aq \rightarrow \text{HCl}(aq) + 83 \text{ kJ/mol}$   
 (iv)  $\text{Al}_2\text{Cl}_6(s) + aq \rightarrow \text{Al}_2\text{Cl}_6(aq) + 663 \text{ kJ/mol}$

The enthalpy of formation of anhydrous solid  $\text{Al}_2\text{Cl}_6$  is :

[JEE Main 2026 (Online) 2nd April Morning Shift]

- (1)  $-648 \text{ kJ mol}^{-1}$  (2)  $-1350 \text{ kJ mol}^{-1}$   
 (3)  $-2002 \text{ kJ mol}^{-1}$  (4)  $-1527 \text{ kJ mol}^{-1}$

Scan or tap for the full solution



**Q.7** Gas 'A' undergoes change from state 'X' to state 'Y'. In this process, the heat absorbed and work done by the gas is 10 J and 18 J respectively. Now gas is brought back to state 'X' by another process during which 6 J of heat is evolved. In the reverse process of 'Y' to 'X',

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 18 J of the work is done by the gas 'A'.  
 (2) 2 J of the work is done by the gas 'A'.  
 (3) 12 J of the work is done on the gas 'A' by the surrounding.  
 (4) 14 J of the work is done on the gas 'A' by the surrounding.

Scan or tap for the full solution



**Q.8**  $20.0 \text{ dm}^3$  of an ideal gas 'X' at 600 K and 0.5 MPa undergoes isothermal reversible expansion until pressure of the gas is 0.2 MPa. Which of the following option is correct?

(Given:  $\log 2 = 0.3010$  and  $\log 5 = 0.6989$ )

[JEE Main 2026 (Online) 28th January Morning Shift]

- (1)  $w = -9.1 \text{ kJ}$ ,  $\Delta U = 0$ ,  $\Delta H = 0$ ,  $q = 9.1 \text{ kJ}$   
 (2)  $w = 9.1 \text{ J}$ ,  $\Delta U = 9.1 \text{ J}$ ,  $\Delta H = 0$ ;  $q = 0$   
 (3)  $w = -3.9 \text{ kJ}$ ,  $\Delta U = 0$ ,  $\Delta H = 0$ ;  $q = 3.9 \text{ kJ}$   
 (4)  $w = +4.1 \text{ kJ}$ ,  $\Delta U = 0$ ,  $\Delta H = 0$ ;  $q = -4.1 \text{ kJ}$

Scan or tap for the full solution



**Q.9** The plot of  $\log_{10} K$  vs  $\frac{1}{T}$  gives a straight line. The intercept and slope respectively are (where K is the equilibrium constant).

[JEE Main 2026 (Online) 28th January Evening Shift]

- (1)  $-\frac{\Delta S^\circ R}{2.303}$ ,  $\frac{\Delta H^\circ R}{2.303}$  (2)  $-\frac{\Delta H^\circ}{2.303R}$ ,  $\frac{\Delta S^\circ}{2.303R}$   
 (3)  $\frac{\Delta S^\circ}{2.303R}$ ,  $-\frac{\Delta H^\circ}{2.303R}$  (4)  $\frac{2.303R}{\Delta H^\circ}$ ,  $\frac{2.303R}{\Delta S^\circ}$

Scan or tap for the full solution



**Q.10** Match the LIST-I with LIST-II

| List-I Isothermal process for ideal gas system |                      | List-II Work done ( $\$V_f > V_i\$$ ) |         |
|------------------------------------------------|----------------------|---------------------------------------|---------|
| A.                                             | Reversible expansion | I.                                    | $w = 0$ |

| List-I Isothermal process for ideal gas system |                          | List-II Work done ( $\$V_f > V_i\$$ ) |                                               |
|------------------------------------------------|--------------------------|---------------------------------------|-----------------------------------------------|
| B.                                             | Free expansion           | II.                                   | $w = -nRT \ln \left( \frac{V_f}{V_i} \right)$ |
| C.                                             | Irreversible expansion   | III.                                  | $w = -p_{\text{ex}}(V_f - V_i)$               |
| D.                                             | Irreversible compression | IV.                                   | $w = -p_{\text{ex}}(V_i - V_f)$               |

Choose the correct answer from the options given below:

[JEE Main 2026 (Online) 24th January Morning Shift]

- (1) A-IV, B-I, C-III, D-II (2) A-I, B-III, C-II, D-IV  
 (3) A-II, B-I, C-III, D-IV (4) A-IV, B-II, C-III, D-I

Scan or tap for the full solution



**Q.11** The heats of atomisation of methane and ethane are 'x'  $\text{kJ mol}^{-1}$  and 'y'  $\text{kJ mol}^{-1}$  respectively. The longest wavelength ( $\lambda$ ) of light capable of breaking the C-C bond can be expressed in SI unit as :

[JEE Main 2026 (Online) 24th January Evening Shift]

- (1)  $\frac{N_A hc}{250(y - 6x)}$  (2)  $N_A hc \left( y - \frac{6x}{4} \right)^{-1}$   
 (3)  $\frac{hc}{1000} \left( \frac{y - 6x}{4} \right)^{-1}$  (4)  $\frac{N_A hc}{250(4y - 6x)}$

Scan or tap for the full solution



**Q.12** A cup of water at  $5^\circ\text{C}$  (system) is placed in a microwave oven and the oven is turned on for one minute during which the water begins to boil. Which of the following options is true?

[JEE Main 2026 (Online) 23rd January Morning Shift]

- (1)  $q = +ve$ ,  $w = -ve$ ,  $\Delta U = +ve$   
 (2)  $q = +ve$ ,  $w = 0$ ,  $\Delta U = -ve$   
 (3)  $q = +ve$ ,  $w = -ve$ ,  $\Delta U = -ve$   
 (4)  $q = -ve$ ,  $w = -ve$ ,  $\Delta U = -ve$

Scan or tap for the full solution



**Q.13** Match the LIST-I with LIST-II

| List-I Thermodynamic Process |                                                                                                                                                          | List-II Magnitude in kJ |      |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------|
| A.                           | Work done in reversible, isothermal expansion of 2 mol of ideal gas from $2 \text{ dm}^3$ to $20 \text{ dm}^3$ at 300 K.                                 | I.                      | 4    |
| B.                           | Work done in irreversible isothermal expansion of 1 mol ideal gas from $1 \text{ m}^3$ to $3 \text{ m}^3$ at 300 K against a constant pressure of 3 kPa. | II.                     | 11.5 |

| List-I Thermodynamic Process |                                                                                                                                          | List-II Magnitude in kJ |   |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---|
| C.                           | Change in internal energy for adiabatic expansion of 1 mol ideal gas with change of temperature = 320 K and $\bar{C}_V = \frac{3}{2}R$ . | III.                    | 6 |
| D.                           | Change in enthalpy at constant pressure of 1 mol ideal gas with change of temperature = 337 K and $\bar{C}_p = \frac{5}{2}R$ .           | IV.                     | 7 |

Choose the correct answer from the options given below :

[JEE Main 2026 (Online) 22nd January Morning Shift]

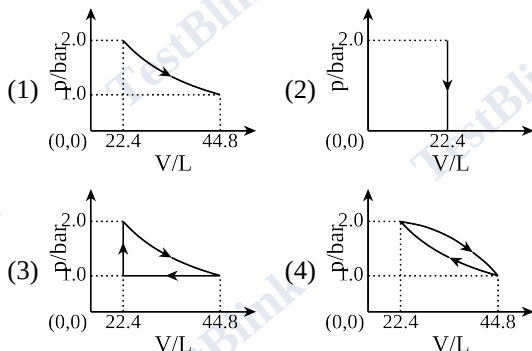
- (1) A-I, B-II, C-III, D-IV (2) A-III, B-II, C-IV, D-I  
(3) A-II, B-I, C-III, D-IV (4) A-II, B-III, C-I, D-IV

Scan or tap for the full solution



**Q.14** Which of the following graphs between pressure 'p' versus volume 'V' represents the maximum work done?

[JEE Main 2026 (Online) 21st January Morning Shift]



Scan or tap for the full solution



**Q.15** Consider the following data :

$$\Delta_f H^\circ (\text{methane, g}) = -X \text{ kJ mol}^{-1}$$

$$\text{Enthalpy of sublimation of graphite} = Y \text{ kJ mol}^{-1}$$

$$\text{Dissociation enthalpy of } H_2 = Z \text{ kJ mol}^{-1}$$

The bond enthalpy of C-H bond is given by :

[JEE Main 2026 (Online) 21st January Evening Shift]

- (1)  $\frac{X+Y+2Z}{4}$  (2)  $\frac{X+Y+4Z}{2}$   
(3)  $\frac{-X+Y+Z}{4}$  (4)  $X+Y+Z$

Scan or tap for the full solution



**Q.16** Total enthalpy change for freezing of 1 mol of water at  $10^\circ\text{C}$  to ice at  $-10^\circ\text{C}$  is \_\_\_\_\_

$$(\text{Given: } \Delta_{\text{fus}} H = x \text{ kJ/mol})$$

$$C_p[H_2O(l)] = y \text{ J mol}^{-1} \text{ K}^{-1}$$

$$C_p[H_2O(s)] = z \text{ J mol}^{-1} \text{ K}^{-1})$$

[JEE Main 2025 (Online) 7th April Morning Shift]

- (1)  $-x-10y-10z$  (2)  $x-10y-10z$   
(3)  $-10(100x+y+z)$  (4)  $10(100x+y+z)$

Scan or tap for the full solution



**Q.17** The hydration energies of  $K^+$  and  $Cl^-$  are  $-x$  and  $-y$  kJ/mol respectively. If the lattice energy of KCl is  $-z$  kJ/mol, then the heat of solution of KCl is :

[JEE Main 2025 (Online) 7th April Evening Shift]

- (1)  $x+y+z$  (2)  $z-(x+y)$   
(3)  $-z-(x+y)$  (4)  $x-y-z$

Scan or tap for the full solution



**Q.18** The correct statement amongst the following is :

[JEE Main 2025 (Online) 7th April Evening Shift]

- (1) The standard state of a pure gas is the pure gas at a pressure of 1 bar and temperature 273 K.  
(2)  $\Delta_f H^\circ_{500}$  is zero for  $O_2(g)$ .  
(3)  $\Delta_f H^\circ_{298}$  is zero for  $O(g)$ .  
(4) The term 'standard state' implies that the temperature is  $0^\circ\text{C}$ .

Scan or tap for the full solution



**Q.19** One mole of an ideal gas expands isothermally and reversibly from  $10 \text{ dm}^3$  to  $20 \text{ dm}^3$  at 300 K.  $\Delta U$ ,  $q$  and work done in the process respectively are

$$\text{Given: } R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$$

$$\ln 10 = 2.3$$

$$\log 2 = 0.30$$

$$\log 3 = 0.48$$

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 0, 21.84 kJ,  $-1.726 \text{ J}$   
(2) 0, 21.84 kJ, 21.84 kJ  
(3) 0, 1.718 kJ,  $-1.718 \text{ J}$   
(4) 0,  $-17.18 \text{ kJ}$ , 1.718 J

Scan or tap for the full solution



**Q.20** Let us consider a reversible reaction at temperature,  $T$ . In this reaction, both  $\Delta H$  and  $\Delta S$  were observed to have positive values. If the equilibrium temperature is  $T_e$ , then the reaction becomes spontaneous at:

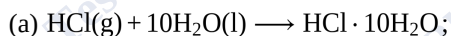
[JEE Main 2025 (Online) 4th April Morning Shift]

- (1)  $T_e > T$  (2)  $T > T_e$  (3)  $T = T_e$  (4)  $T_e = 5T$

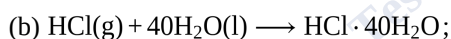
Scan or tap for the full solution



**Q.21** Consider the given data :



$$\Delta H = -69.01 \text{ kJ mol}^{-1}$$



$$\Delta H = -72.79 \text{ kJ mol}^{-1}$$

Choose the correct statement :

[JEE Main 2025 (Online) 4th April Evening Shift]

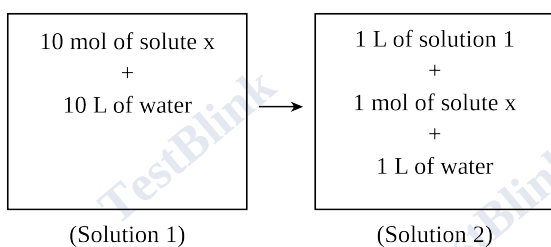
- (1) The heat of dilution for the HCl ( $\text{HCl} \cdot 10\text{H}_2\text{O}$  to  $\text{HCl} \cdot 40\text{H}_2\text{O}$ ) is  $3.78 \text{ kJ mol}^{-1}$ .
- (2) Dissolution of gas in water is an endothermic process.
- (3) The heat of solution depends on the amount of solvent.
- (4) The heat of formation of HCl solution is represented by both (a) and (b).

Scan or tap for the full solution



**Q.22** Which of the following properties will change when system containing solution 1 will become solution 2 ?

[JEE Main 2025 (Online) 3rd April Morning Shift]



- |                         |                   |
|-------------------------|-------------------|
| (1) Molar heat capacity | (2) Concentration |
| (3) Gibbs free energy   | (4) Density       |

Scan or tap for the full solution



**Q.23** Given below are two statements:

**Statement-I:** When a system containing ice in equilibrium with water (liquid) is heated, heat is absorbed by the system and there is no change in the temperature of the system until whole ice gets melted.

**Statement-II:** At melting point of ice, there is absorption of heat in order to overcome intermolecular forces of attraction within the molecules of water in ice and kinetic energy of molecules is not increased at melting point.

In the light of the above statements, choose the correct answer from the options given below

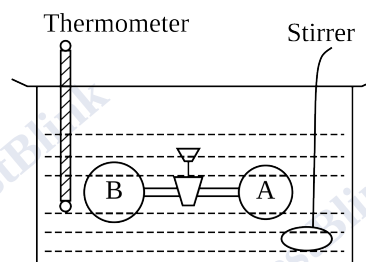
[JEE Main 2025 (Online) 3rd April Evening Shift]

- (1) Both Statement-I and Statement-II are false
- (2) Statement-I is true but Statement-II is false
- (3) Both Statement-I and Statement-II are true
- (4) Statement-I is false but Statement-II is true

Scan or tap for the full solution



**Q.24**



Two vessels A and B are connected via stopcock. The vessel A is filled with a gas at a certain pressure. The entire assembly is immersed in water and is allowed to come to thermal equilibrium with water. After opening the stopcock the gas from vessel A expands into vessel B and no change in temperature is observed in the thermometer. Which of the following statement is true ?

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1)  $dq \neq 0$
- (2) The pressure in the vessel B before opening the stopcock is zero
- (3)  $dw \neq 0$
- (4)  $dU \neq 0$

Scan or tap for the full solution



**Q.25** Arrange the following in order of magnitude of work done by the system/on the system at constant temperature.

- (a)  $|w_{\text{reversible}}|$  for expansion in infinite stages.
- (b)  $|w_{\text{irreversible}}|$  for expansion in single stage.
- (c)  $|w_{\text{reversible}}|$  for compression in infinite stages.
- (d)  $|w_{\text{irreversible}}|$  for compression in single stage.

Choose the correct answer from the options given below: [JEE Main 2025 (Online) 2nd April Evening Shift]

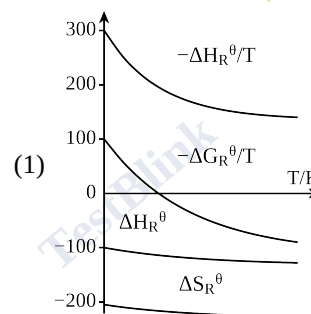
- (1)  $d > c = a > b$
- (2)  $c = a > d > b$
- (3)  $a > c > b > d$
- (4)  $a > b > c > d$

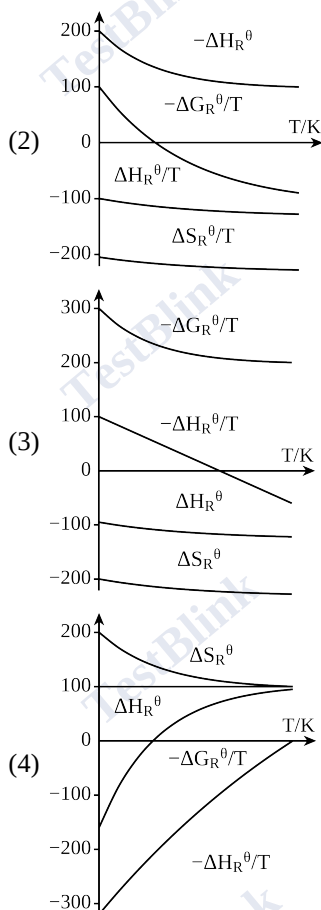
Scan or tap for the full solution



**Q.26** Which of the following graphs correctly represents the variation of thermodynamic properties of Haber's process?

[JEE Main 2025 (Online) 2nd April Evening Shift]





Scan or tap for the full solution

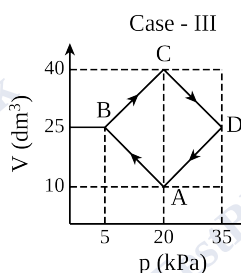


**Q.27** 500 J of energy is transferred as heat to 0.5 mol of Argon gas at 298 K and 1.00 atm. The final temperature and the change in internal energy respectively are: Given:  $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) 368 K and 500 J      (2) 348 K and 300 J  
(3) 378 K and 300 J      (4) 378 K and 500 J

Scan or tap for the full solution

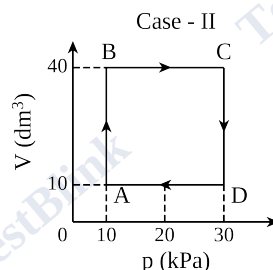
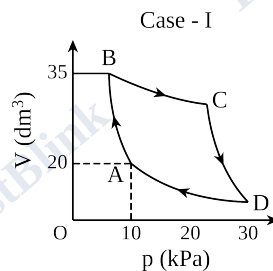


**Q.28**

An ideal gas undergoes a cyclic transformation starting from the point A and coming back to the same point by tracing the path  $A \rightarrow B \rightarrow C \rightarrow D \rightarrow A$  as shown in the three cases above.

Choose the correct option regarding  $\Delta U$  :

[JEE Main 2025 (Online) 28th January Evening Shift]



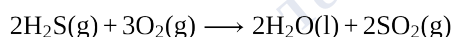
- (1)  $\Delta U(\text{Case-III}) > \Delta U(\text{Case-II}) > \Delta U(\text{Case-I})$   
(2)  $\Delta U(\text{Case-I}) > \Delta U(\text{Case-II}) > \Delta U(\text{Case-III})$   
(3)  $\Delta U(\text{Case-I}) = \Delta U(\text{Case-II}) = \Delta U(\text{Case-III})$   
(4)  $\Delta U(\text{Case-I}) > \Delta U(\text{Case-III}) > \Delta U(\text{Case-II})$

Scan or tap for the full solution



### Section B (Numerical) — 12 questions

**Q.29** Consider the reaction



The magnitude of enthalpy change for the reaction in  $\text{kJ mol}^{-1}$  is \_\_\_\_\_. (Nearest integer)

Given :  $\Delta_f H^\ominus(\text{H}_2\text{S}) = -20.1 \text{ kJ mol}^{-1}$

$\Delta_f H^\ominus(\text{H}_2\text{O}) = -286.0 \text{ kJ mol}^{-1}$

$\Delta_f H^\ominus(\text{SO}_2) = -297.0 \text{ kJ mol}^{-1}$

[JEE Main 2026 (Online) 8th April Evening Shift]

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**Q.30** Consider the reaction  $X \rightleftharpoons Y$  at 300 K. If  $\Delta H^\ominus$  and  $K$  are  $28.40 \text{ kJ mol}^{-1}$  and  $1.8 \times 10^{-7}$  at the same temperature, then the magnitude of  $\Delta S^\ominus$  for the reaction in  $\text{J K}^{-1} \text{ mol}^{-1}$  is \_\_\_\_\_. (Nearest integer)  
(Given :  $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$ ,  $\ln 10 = 2.3$ ,  $\log 3 = 0.48$ ,  $\log 2 = 0.30$ )

[JEE Main 2026 (Online) 6th April Morning Shift]

Scan or tap for the full solution



**Q.31** If 3.365 g of ethanol (l) is burnt completely in a bomb calorimeter at 298.15 K, the heat produced is 99.472 kJ. The  $|\Delta H_f^\ominus|$  of ethanol at 298.15 K is \_\_\_\_\_  $\times 10^2 \text{ kJ mol}^{-1}$ . (Nearest integer)

Given: Standard enthalpy for combustion of graphite =  $-393.5 \text{ kJ mol}^{-1}$

Standard enthalpy of formation of water (l) =  $-285.8 \text{ kJ mol}^{-1}$

Molar mass in  $\text{g mol}^{-1}$  of C, H, O are 12, 1 and 16 respectively

[JEE Main 2026 (Online) 4th April Evening Shift]

Scan or tap for the full solution



- Q.32** At the transition temperature  $T$ ,  $A \rightleftharpoons B$  and  $\Delta G^\circ = 105 - 35 \log T$  where  $A$  and  $B$  are two states of substance  $X$ . The transition temperature in  $^\circ\text{C}$  when pressure is 1 atm is \_\_\_\_\_. (Nearest integer)

[JEE Main 2026 (Online) 2nd April Morning Shift]

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- Q.33** If the enthalpy of sublimation of  $\text{Li}$  is  $155 \text{ kJ mol}^{-1}$ , enthalpy of dissociation of  $\text{F}_2$  is  $150 \text{ kJ mol}^{-1}$ , ionization enthalpy of  $\text{Li}$  is  $520 \text{ kJ mol}^{-1}$ , electron gain enthalpy of  $\text{F}$  is  $-313 \text{ kJ mol}^{-1}$ , standard enthalpy of formation of  $\text{LiF}$  is  $-594 \text{ kJ mol}^{-1}$ . The magnitude of lattice enthalpy of  $\text{LiF}$  is \_\_\_\_\_  $\text{kJ mol}^{-1}$ . (Nearest Integer)

[JEE Main 2026 (Online) 22nd January Evening Shift]

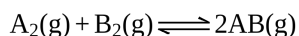
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- Q.34** Use the following data :

| Substance              | $\Delta_f H^\ominus(500 \text{ K})$<br>$\text{kJ mol}^{-1}$ | $S^\ominus(500 \text{ K})$<br>$\text{JK}^{-1} \text{mol}^{-1}$ |
|------------------------|-------------------------------------------------------------|----------------------------------------------------------------|
| $\text{AB(g)}$         | 32                                                          | 222                                                            |
| $\text{A}_2(\text{g})$ | 6                                                           | 146                                                            |
| $\text{B}_2(\text{g})$ | x                                                           | 280                                                            |

One mole each of  $\text{A}_2(\text{g})$  and  $\text{B}_2(\text{g})$  are taken in a 1 L closed flask and allowed to establish the equilibrium at 500 K.



The value of  $x$  (in  $\text{kJ mol}^{-1}$ ) is \_\_\_\_\_. (Nearest integer)

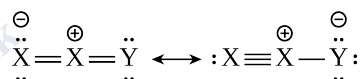
(Given :  $\log K = 2.2$ ,  $R = 8.3 \text{ J K}^{-1} \text{mol}^{-1}$ )

[JEE Main 2026 (Online) 21st January Morning Shift]

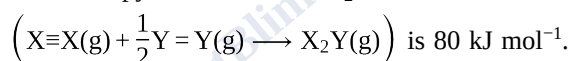
Scan or tap for the full solution



- Q.35** Resonance in  $\text{X}_2\text{Y}$  can be represented as



The enthalpy of formation of  $\text{X}_2\text{Y}$



The magnitude of resonance energy of  $\text{X}_2\text{Y}$  is \_\_\_\_\_  $\text{kJ mol}^{-1}$  (nearest integer value).

**Given:** Bond energies of  $\text{X} \equiv \text{X}$ ,  $\text{X} = \text{X}$ ,  $\text{Y} = \text{Y}$  and  $\text{X} = \text{Y}$  are 940, 410, 500, and  $602 \text{ kJ mol}^{-1}$  respectively.

Valence  $\text{X}$ : 3,  $\text{Y}$ : 2

[JEE Main 2025 (Online) 8th April Evening Shift]

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- Q.36** Given :

$$\Delta_{\text{sub}} H^\ominus[\text{C (graphite)}] = 710 \text{ kJ mol}^{-1}$$

$$\Delta_{\text{C-H}} H^\ominus = 414 \text{ kJ mol}^{-1}$$

$$\Delta_{\text{H-H}} H^\ominus = 436 \text{ kJ mol}^{-1}$$

$$\Delta_{\text{C=C}} H^\ominus = 611 \text{ kJ mol}^{-1}$$

The  $\Delta_f H^\ominus$  for  $\text{CH}_2=\text{CH}_2$  is \_\_\_\_\_  $\text{kJ mol}^{-1}$  (nearest integer value)

[JEE Main 2025 (Online) 3rd April Morning Shift]

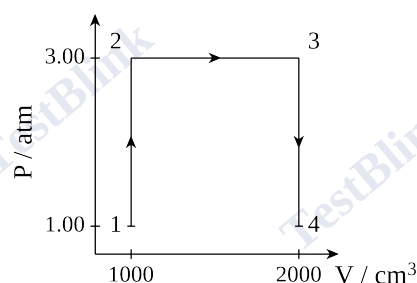
Scan or tap for the full solution



- Q.37** A perfect gas (0.1 mol) having  $\bar{C}_v = 1.50 R$  (independent of temperature) undergoes the following transformation from point 1 to point 4. If each step is reversible, the total work done ( $w$ ) while going from point 1 to point 4 is (–) \_\_\_\_\_ J (nearest integer)

[Given:  $R = 0.082 \text{ L atm K}^{-1} \text{mol}^{-1}$ ]

[JEE Main 2025 (Online) 3rd April Evening Shift]



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- Q.38** A sample of  $n$ -octane (1.14 g) was completely burnt in excess of oxygen in a bomb calorimeter, whose heat capacity is  $5 \text{ kJ K}^{-1}$ . As a result of combustion reaction, the temperature of the calorimeter is increased by 5 K. The magnitude of the heat of combustion of octane at constant volume is \_\_\_\_\_  $\text{kJ mol}^{-1}$  (nearest integer).

[JEE Main 2025 (Online) 3rd April Evening Shift]

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- Q.39** The formation enthalpies,  $\Delta_f H^\ominus$  for  $\text{H(g)}$  and  $\text{O(g)}$  are 220.0 and  $250.0 \text{ kJ mol}^{-1}$ , respectively, at 298.15 K, and  $\Delta_f H^\ominus$  for  $\text{H}_2\text{O(g)}$  is  $-242.0 \text{ kJ mol}^{-1}$  at the same temperature. The average bond enthalpy of the O–H bond in water at 298.15 K is \_\_\_\_\_  $\text{kJ mol}^{-1}$  (nearest integer).

[JEE Main 2025 (Online) 28th January Morning Shift]

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**Q.40** Consider the following data:

Heat of formation of  $\text{CO}_2(\text{g}) = -393.5 \text{ kJ mol}^{-1}$

Heat of formation of  $\text{H}_2\text{O}(\text{l}) = -286.0 \text{ kJ mol}^{-1}$

Heat of combustion of benzene =  $-3267.0 \text{ kJ mol}^{-1}$

The heat of formation of benzene is \_\_\_\_\_  $\text{kJ mol}^{-1}$ . (Nearest integer)

[JEE Main 2025 (Online) 28th January Evening Shift]

Scan or tap for the  
full solution



## ANSWER KEY

### Section A (MCQ) — 28 questions

| Ques. | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 |
|-------|----|----|----|----|----|----|----|----|----|----|----|
| Ans.  | 3  | 3  | 2  | 2  | 4  | 4  | 4  | 1  | 3  | 3  | 4  |
| Ques. | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| Ans.  | 1  | 4  | 1  | 1  | 3  | 2  | 2  | 3  | 2  | 3  | 3  |
| Ques. | 23 | 24 | 25 | 26 | 27 | 28 |    |    |    |    |    |
| Ans.  | 3  | 2  | 1  | 1  | 2  | 3  |    |    |    |    |    |

### Section B (Numerical) — 12 questions

| Ques. | 29   | 30  | 31   | 32  | 33   | 34 | 35 |
|-------|------|-----|------|-----|------|----|----|
| Ans.  | 1126 | 34  | 3    | 727 | 1031 | 70 | 98 |
| Ques. | 36   | 37  | 38   | 39  | 40   |    |    |
| Ans.  | 25   | 304 | 2500 | 466 | 48   |    |    |