

PYQSide

JEE MAIN THERMODYNAMICS — WORK DONE IN THERMODYNAMIC PROCESSES (REVERSIBLE, IRREVERSIBLE, FREE EXPANSION) — PYQS

Max. Marks: 40

Questions: 10

Section A (MCQ)

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) $|w_B| > |w_A| > |w_D| > |w_C|$

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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

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Q.3 20.0 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) $w = +4.1 \text{ kJ}$, $\Delta U = 0$, $\Delta H = 0$; $q = -4.1 \text{ kJ}$

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Q.4 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.	$w = 0$
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

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Q.5 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 dm^3 to 20 dm^3 at 300 K.	I.	4
B.	Work done in irreversible isothermal expansion of 1 mol ideal gas from 1 m^3 to 3 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]

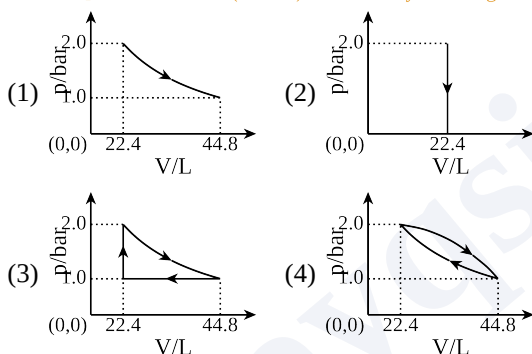
- (1) A-I, B-II, C-III, D-IV (2) A-III, B-II, C-IV, D-I
(3) A-II, B-I, C-III, D-IV (4) A-II, B-III, C-I, D-IV

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Q.6 Which of the following graphs between pressure 'p' versus volume 'V' represents the maximum work done?

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



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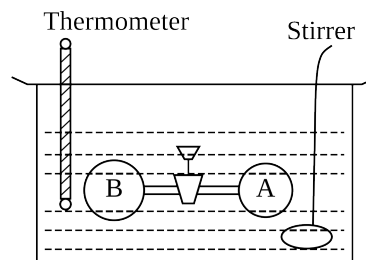


Q.7 One mole of an ideal gas expands isothermally and reversibly from 10 dm^3 to 20 dm^3 at 300 K. ΔU , q and work done in the process respectively are
Given: $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$
 $\ln 10 = 2.3$
 $\log 2 = 0.30$
 $\log 3 = 0.48$

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

- (1) 0, 21.84 kJ, - 1.726 J
(2) 0, 21.84 kJ, 21.84 kJ
(3) 0, 1.718 kJ, - 1.718 kJ
(4) 0, - 17.18 kJ, 1.718 J

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Q.8

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) $dU \neq 0$

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Q.9 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) $a > b > c > d$

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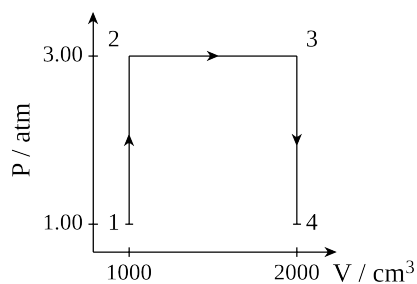


Section B (Numerical)

Q.10 A perfect gas (0.1 mol) having $\bar{C}_V = 1.50R$ (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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ANSWER KEY

Section A (MCQ)

Ques.	1	2	3	4	5	6	7	8	9		
Ans.	3	3	1	3	4	1	3	2	1		

Section B (Numerical)

Ques.	10							
Ans.	304							