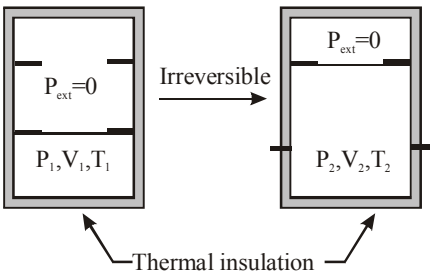
REVISION ASSIGNMENT # 4

CHEMISTRY

SECTION–I : (ii) One or more options correct Type

This section contains **11 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** are correct. **4(–1)**

1. An ideal gas in thermally insulated vessel at internal pressure = P_1, volume = V_1 and absolute temperature = T_1 expands irrversibly against zero external pressure, as shown in the diagram. The final internal pressure, volume and absolute temperature of the gas are P_2, V_2 and T_2, respectively. For this expansion, **[JEE 2014]**



(A) $q = 0$ (B) $T_2 = T_1$ (C) $P_2V_2 = P_1V_1$ (D) $P_2V_2^{\gamma} = P_1V_1^{\gamma}$

2. An ideal gas is expanded from (p_1, V_1, T_1) to (p_2, V_2, T_2) under different conditions. The correct statement(s) among the following is(are) **[JEE 2017]**

(A) The work done on the gas is maximum when it is compressed irreversibly from (p_2, V_2) to (p_1, V_1) against constant pressure p_1

(B) The work done by the gas is less when it is expanded reversibly from V_1 to V_2 under adiabatic conditions as compared to that when expanded reversibly from V_1 to V_2 under isothermal conditions.

(C) The change in internal energy of the gas (i) zero, if it is expanded reversibly with $T_1 = T_2$, and (ii) positive, if it is expanded reversibly under adiabatic conditions with $T_1 \neq T_2$

(D) If the expansion is carried out freely, it is simultaneously both isothermal as well as adiabatic

3. A reversible cyclic process for an ideal gas is shown below. Here, P , V and T are pressure , volume and temperature , respectively. The thermodynamic parameters q, w, H and U are heat, work, enthalpy and internal energy, respectively. **[JEE 2018]**

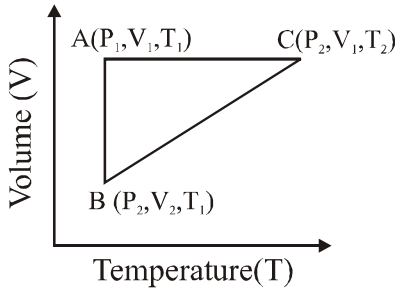
The correct option(s) is (are)

(A) $q_{AC} = \Delta U_{BC}$ and $w_{AB} = P_2 (V_2 - V_1)$

(B) $w_{BC} = P_2 (V_2 - V_1)$ and $q_{BC} = \Delta H_{AC}$

(C) $\Delta H_{CA} < \Delta U_{CA}$ and $q_{AC} = \Delta U_{BC}$

(D) $q_{BC} = \Delta H_{AC}$ and $\Delta H_{CA} > \Delta U_{CA}$



4. A piston filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of 37.0°C. As it does so, it absorbs 208 J of heat. The values of q and w for the process will be :- **[JEE-MAIN-2013]**

(R = 8.314 J/mol K) (ln 7.5 = 2.01)

(A) q = + 208 J, w = – 208 J (B) q = – 208 J, w = – 208 J

(C) q = – 208 J, w = + 208 J (D) q = + 208 J, w = + 208 J

5. Which of the following statements/relationships is not correct in thermodynamic changes ?

(A) $q = -nRT\,\ell n\frac{V_2}{V_1}$ (isothermal reversible expansion of an ideal gas)**[JEE-MAINS(online)-2014]**

(B) For a system at constant volume, heat involved merely changes to internal energy.

(C) $w = -nRT\ln\frac{V_2}{V_1}$ (isothermal reversible expansion of an ideal gas)

(D) $\Delta U = 0$ (isothermal reversible expansion of a gas)

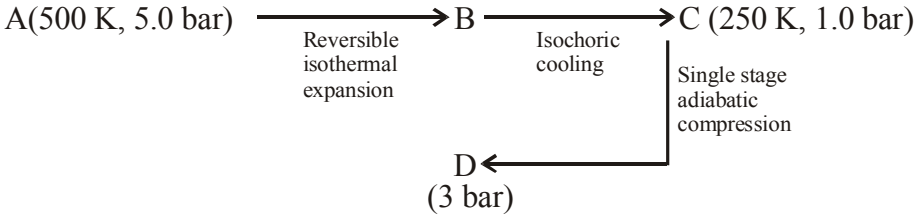
6. An ideal gas undergoes isothermal compression from 5 m^3 to 1 m^3 against a constant external pressure of 4 Nm^{-2}. Heat released in this process is used to increase the temperature of 1 mole of Al. If molar heat capacity of Al is 24 J mol^{-1} K^{-1}, the temperature of Al increases by **[JEE-MAINS(online)-2019]**

(A) $\frac{3}{2}$K (B) $\frac{2}{3}$K (C) 1 K (D) 2 K

7. An insulated container of gas has two chambers separated by an insulating partition. One of the chambers has volume V_1 and contains ideal gas at pressure P_1 and temperature T_1. The other chamber has volume V_2 and contains same ideal gas at pressure P_2 and temperature T_2. If the partition is removed without doing any work on the gas, the final equilibrium temperature of the gas in the container will be :-

(A) $\frac{T_1T_2(P_1V_1+P_2V_2)}{P_1V_1T_2+P_2V_2T_1}$ (B) $\frac{P_1V_1T_1+P_2V_2T_2}{P_1V_1+P_2V_2}$ (C) $\frac{P_1V_1T_2+P_2V_2T_1}{P_1V_1+P_2V_2}$ (D) $\frac{T_1T_2(P_1V_1+P_2V_2)}{P_1V_1T_1+P_2V_2T_2}$

8. Two moles of an ideal gas ($C_{v,m} = \frac{3}{2}R$) is subjected to following change of state



The correct statement is/are

(A) The pressure at B is 2.0 bar (B) The temperature at D is 450 K

(C) ΔH_{CD} = 1000 R (D) ΔU_{BC} = 375 R

9. A real gas is subjected to an adiabatic process from (2 bar, 40 lit., 300 K) to (4 bar, 30 lit., 300 K) against a constant pressure 4 bar the enthalpy change for the process is

(A) Zero (B) 6000 J (C*) 8000 J (D) 80 J

10. Which of the following statement is/are correct ?

(A) Enthalpy can be written as H = f(V,T) for a substance (no physical or chemical change)

(B) Absolute value of enthalpy can not be determined

(C) The heat absorbed during the isothermal expansion of an ideal gas against vacuum is zero

(D) During compression of an ideal gas at constant pressure the temperature of gas decreases.

11. Choose the correct statement(s)

(A) During adiabatic expansion of an ideal gas, magnitude of work obtained is equal to ΔH of gas.

(B) For same change in temperature of ideal gas through adiabatic process, magnitude of W will be same in reversible as well as irreversible process

(C) During an adiabatic reversible expansion of an ideal gas, temperature of the system increases.

(D) For same change in volume of ideal gas, ΔU is less in adiabatic expansion than in isobaric expansion if expansion starts with same intial state.

(iv) Matching List Type

This Section contains **1 multiple choice questions. Each question has matching lists.** The codes for the lists. have choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct. **4(0)**

12. The figures given below depict different processes for a given amount of an ideal gas.

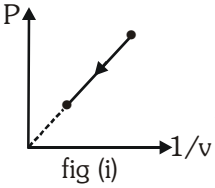
(A) 

fig (i)

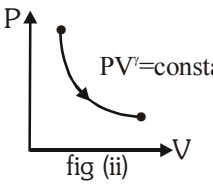
(B) 

fig (ii)

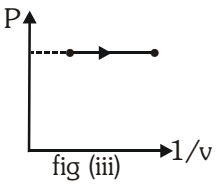
(C) 

fig (iii)

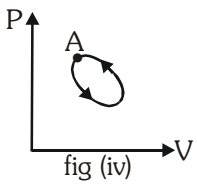
(D) 

fig (iv)

Column-I		**Column-II**	
(P)	In Fig (i)	(A)	Net heat is absorbed by the system
(Q)	In Fig (ii)	(B)	Net work is done on the system
(R)	In Fig (iii)	(C)	Net heat is rejected by the system
(S)	In Fig (iv)	(D)	Net work is done by the system
		(5)	Net internal energy remains constant

Code:

	P	**Q**	**R**	**S**
(A)	1, 4, 5	4	2, 3	2. 3.5
(B)	1, 4, 5	4	2, 3	2, 3
(C)	1, 2, 4	2	1, 4	2, 3
(D)	1, 2	2	1, 4	3, 5

SECTION-III : (Integer Value Correct Type)

This section contains **9 questions**. The answer to each question is **a single digit Integer**, ranging from **0 to 9** (both inclusive) **4(–1)**

1. An ideal gas undergoes expansion from A(10 atm, 1 litre) to B(1 atm, 10 litre), first against 5 atm and then against 1 atm, isothermally. Calculate the amount of heat absorbed (in litre. atm)

Fill your answer as sum of digits (excluding decimal places) till you get the single digit answer.

2. 2 moles of an ideal gas is compressed from (1 bar, 2L) to 2 bar isothermally. Calculate magnitude of minimum possible work involved in the change (in Joules). (Given : 1 bar L = 100 J) (ln 2 = 0.7)

Fill your answer as sum of digits (excluding decimal places) till you get the single digit answer.

3. A monoatomic ideal gas undergoing irreversible adiabatic compression from 4L to 1L against 1 bar pressure. Calculate the enthalpy change of gas. (Given: 1 bar-L = 100 J)

Fill your answer as sum of digits (excluding decimal places) till you get the single digit answer.

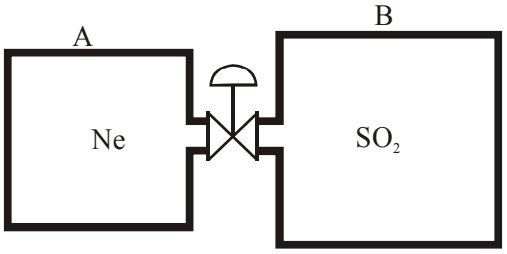
4. At 500 kilobar pressure, density of diamond and graphite are 3 g/cc and 2 g/cc respectively, at certain temperature 'T'. Find the value $|\Delta H - \Delta U|$ (kJ/mole) for the conversion of 1 mole of graphite to 1 mole of diamond at temperature 'T' :

Fill your answer as sum of digits (excluding decimal places) till you get the single digit answer.

5. Two rigid adiabatic vessels A and B which initially, contains two gases at different temperatures are connected by pipe line with valve of negligible volume. The vessel 'A' contains 2 moles Ne gas $\left(C_{p,m} = \frac{5}{2}R\right)$ at 300 K, vessel 'B' contains 3 moles of SO_2 gas ($C_{p,m}$ = 4 R) at 400 K. The volume of A & B vessel is 4 and 6 litre respectively. The final total pressure (in atm) when valve is opened and 12 Kcal heat supplied through it to vessels.

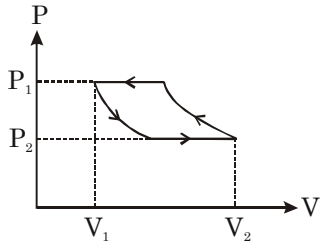
[Use : R = 2 cal/mol. K and R = 0.08 L. atm / mol K as per desire]

Fill your answer as sum of digits (excluding decimal places) till you get the single digit answer.



SECTION–IV : SUBJECTIVE

1. An ideal gas is carried through a thermodynamic cycle.



$P_1 = 2$ bar $\quad V_1 = \dfrac{1}{\ell n 10}$ litre

$P_2 = 1$ bar $\quad V_2 = \dfrac{8}{\ell n 10}$ litre

Consisting of two isobaric and two isothermal processes. Calculate the net work in the entire cycle in litre bar. $\left(\log_{10}^{2} = 0.3\right)$

2. Pressure over 1000 mL of a liquid is gradually increased from 1 bar to 1001 bar under adiabatic conditions. If the final volume of the liquid is 990 mL, calculate ΔU and ΔH of the process, assuming linear variation of volume with pressure.

3. 3 dm^3 of an ideal monoatomic gas at 600 K and 32 bar expands until pressure of the gas is 1bar Calculate q, w, ΔU and ΔH for the process if the expansion is :

(Use : R = 0.08 bar litre/mol-K, = 2 cal / mol-K)

(i) Isothermal and reversible

(ii) Adiabatic and reversible

(iii) Isothermal and adiabatic

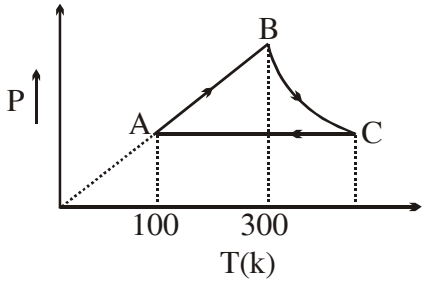
(iv) Against 1 bar and adiabatic

(v) Against 1 bar and isothermal.

4. What is ΔU when 2.0 mole of liquid water vaporises at 100°C ? The heat of vaporisation, ΔH_{vapour} of water at 100°C is 40.66 kJ mol^{-1}.

5. When 1 mole of ice melt at 0°C and at constant pressure of 1 atm, 1440 calories of heat are absorbed by the system. The molar volumes of ice and water are 0.0196 and 0.0180 litre respectively. Calculate ΔH and ΔU for the reaction.

6. Calculate the net work done in the following cycle for one mol of an ideal gas (in calorie), where in process BC, PT = constant. (R = 2cal/mol-K).



7. For 1 mole of ideal monoatomic gas if $\frac{P}{V^2}$ = constant and initial temperature is 100 K. If gas is expanded from 1 L to 2 L then find (a) heat capacity (b) total heat absorbed (c) work (d) change in internal energy.

(Assume R = 0.0821 $\frac{L-atm}{mole-k}$, 1 L-atm = 24 cal)

8. Calculate the work done by system in an irreversible (single step) adiabatic expansion of 1 mole of a polyatomic gas ($\gamma = 4/3$) from 400 K and pressure 10 atm to 1 atm.

9. 2 mole of an ideal gas undergoes isothermal compression along three different paths if it's initial state is (2 bar, 4 litre) in all three process.

(i) Reversible compression from till 20 bar.

(ii) A single stage compression against a constant external pressure of 20 bar

(iii) A two stage compression consisting initially of compression against a constant external pressure of 10 bar until $P_{gas}=P_{ext}$, followed by compression against a constant pressure of 20 bar until $P_{gas}=P_{ext}$.

Calculate the work (in bar. L) for each of these processes and for which of the irreversible processes is the magnitude of the work greater ? [Given : R = 0.08 bar. L/mole.K]

SECTION–V : Matrix-Match Type

This Section contains **1 question**. Question has **four statements** (A, B, C and D) given in **Column I** and five statements (P, Q, R, S and T) in **Column II**. Any given statement in Column I can have correct matching with **ONE** or **MORE** statement(s) given in Column II. For example, if for a given question, statement B matches with the statements given in Q and R, then for the particular question, against statement B, darken the bubbles corresponding to Q and R in the ORS. **8(0)**

1. Match the column

	Column–I		**Column–II**
(A)	Isothermal vaporisation of water at 100°C & 1 atm	(P)	$\Delta T = 0$
(B)	Isothermal reversible expansion of an ideal gas	(Q)	$\Delta U = 0$
(C)	Adiabatic free expansion of ideal gas	(R)	$\Delta H = 0$
(D)	Isochoric heating of an ideal gas	(S)	$q = 0$
		(T)	$w = 0$