

Physical Chemistry Questions

Solid Lead nitrate is dissolved in 1 litre of water. The solution was found to boil at 100.15°C . When 0.2 mol of NaCl is added to the resulting solution, it was observed that the solution froze at -0.8°C . The solubility product of PbCl_2 formed is _____ $\times 10^{-6}$ at 298K. (Nearest integer) Given : $K_b = 0.5\text{K kgmol}^{-1}$ and $K_f = 1.8\text{ kg mol}^{-1}$. Assume molality to be equal to molarity in all cases.
[29-Jan-2023 Shift 1]

Physical Chemistry Questions

We have three aqueous solutions of NaCl labelled as ' A ', ' B ' and ' C ' with concentration 0.1M, 0.01M & 0.001M, respectively. The value of van t' Hoff factor (i) for these solutions will be in the order.

[1-Feb-2024 Shift 1]

Options:

A. $i_A < i_B < i_C$

B. $i_A < i_C < i_B$

C. $i_A = i_B = i_C$

D. $i_A > i_B > i_C$

Physical Chemistry Questions

Two liquids X and Y form an ideal solution. At 300K , vapour pressure of the solution containing 1mol of X and 3mol of Y is 550mmHg. At the same temperature, if 1 mol of Y is further added to this solution, vapour pressure of the solution increases by 10mmHg. Vapour pressure (in mmH g) of X and Y in their pure states will be, respectively:

- A. 300 and 400
- B. 400 and 600
- C. 500 and 600
- D. 200 and 300

Physical Chemistry Questions

A 5.25% solution of a substance is isotonic with a 1.5% solution of urea (molar mass = 60g mol^{-1}) in the same solvent. If the densities of both the solutions are assumed to be equal to 1.0g cm^{-3} , molar mass of the substance will be

Physical Chemistry Questions

80 mole percent of MgCl_2 is dissociated in aqueous solution. The vapour pressure of 1.0 molal aqueous solution of MgCl_2 at 38°C is _____ mmHg. (Nearest integer)

Given : Vapour pressure of water at 38°C is 50 mm Hg.

[12-Apr-2023 shift 1]

Physical Chemistry Questions

If the boiling points of two solvents X and Y (having same molecular weights) are in the ratio 2 : 1 and their enthalpy of vaporizations are in the ratio 1 : 2, then the boiling point elevation constant of X is m times the boiling point elevation constant of Y. The value of m is _____ (nearest integer)

[8-Apr-2023 shift 2]

Physical Chemistry Questions

The vapour pressure vs. temperature curve for a solution solvent system is shown below: The boiling point of the solvent is _____ °C

Physical Chemistry Questions

The number of pairs of the solution having the same value of the osmotic pressure from the following is

_____.

(Assume 100\% ionization)

- A. $0.500\text{M C}_2\text{H}_5\text{OH(aq)}$ and 0.25M KBr(aq)
- B. $0.100\text{M K}_4[\text{Fe}(\text{CN})_6]\text{(aq)}$ and $0.100\text{M FeSO}_4(\text{NH}_4)_2\text{SO}_4\text{(aq)}$
- C. $0.05\text{M K}_4[\text{Fe}(\text{CN})_6]\text{(aq)}$ and 0.25M NaCl(aq)
- D. 0.15M NaCl(aq) and $0.1\text{M BaCl}_2\text{(aq)}$
- E. $0.02\text{M KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O(aq)}$ and 0.05M KCl(aq)

[25-Jan-2023 Shift 2]

Physical Chemistry Questions

The freezing point depression of a 0.1 m aqueous solution of a monobasic weak acid HA is 0.20 °C. The dissociation constant for the acid is

Given: $(\text{H}_2\text{O}) = 1.8 \text{ K kg mol}^{-1}$, molality \equiv molarity

Physical Chemistry Questions

If a_0 is denoted as the Bohr radius of hydrogen atom, then what is the de-Broglie wavelength (λ) of the electron present in the second orbit of hydrogen atom? [n : any integer]

Most effective Physical Chemistry Questions

For electrons in ' 2 s ' and ' 2 p ' orbitals, the orbital angular momentum values, respectively are

Physical Chemistry Questions

Number of spectral lines obtained in He^+ spectra, when an electron makes transition from fifth excited state to first excited state will be

Physical Chemistry Questions

If wavelength of the first line of the Paschen series of hydrogen atom is 720 nm, then the wavelength of the second line of this series is _____nm

Physical Chemistry Questions

The number of s-electrons present in an ion with 55 protons in its unipositive state is

Physical Chemistry Questions

The wave function (Ψ) of 2s is given by

$$\Psi_{2s} = \frac{1}{2\sqrt{2\pi}} \left(\frac{1}{a_0} \right)^{3/2} \left(2 - \frac{r}{a_0} \right) e^{-r/2a_0}$$

At $r=r_0$, radial node is formed. Thus, r_0 in terms of a_0

[30-Jan-2023 Shift 2]

The number of electrons in the orbitals of sub-shell of $n = 4$ are

- A. $r_0 = a_0$
- B. $r_0 = 4a_0$
- C. $r_0 = a_0^2$
- D. $r_0 = 2a_0$

Most effective Physical Chemistry Questions

Which one of the following sets of ions represents a collection of isoelectronic species?

[1-Feb-2023 Shift 2]

Options:

A. Li^+ , Na^+ , Mg^{2+} , Ca^{2+} .

B. Ba^{2+} , Sr^{2+} , K^+ , Ca^{2+}

C. CN^{3-} , O^{2-} , F^- , S^{2-}

D. K^+ , Cl^- , Ca^{2+} , Sc^{3+}

Physical Chemistry Questions

If the radius of the 3rd Bohr's orbit of hydrogen atom is r_3 and the radius of 4th Bohr's orbit is r_4 . Then :

[26-Jun-2022-Shift-1]

a) $r_4 = \frac{9}{16} r_3$

b) $r_4 = \frac{16}{9} r_3$

c) $r_4 = \frac{3}{4} r_3$

d) $r_4 = \frac{4}{3} r_3$

Physical Chemistry Questions

The number of radial and angular nodes in 4d orbital are, respectively

Physical Chemistry Questions

If the uncertainty in velocity and position of a minute particle in space are, $2.4 \times 10^{-26}(\text{ms}^{-1})$ and $10^{-7}(\text{m})$ respectively. The mass of the particle in g is_____ (Nearest integer)
(Given : $h = 6.626 \times 10^{-34} \text{ Js}$)

Physical Chemistry Questions

If the work function of a metal is $6.63 \times 10^{-19} \text{J}$, the maximum wavelength of the photon required to remove a photoelectron from the metal is ____ nm. (Nearest integer)

[Given : $h = 6.63 \times 10^{-34} \text{Js}$, and $c = 3 \times 10^8 \text{ms}^{-1}$]

[28-Jun-2022-Shift-1]

Physical Chemistry Questions

For a reaction, $\text{N}_2\text{O}_5 \longrightarrow 2\text{NO}_2 + \frac{1}{2}\text{O}_2$
in a constant volume container, no products were present initially. The final pressure of the system when 50% of reaction gets completed is

- A. $5/2$ times of initial pressure
- B. $7/2$ times of initial pressure
- C. $7/4$ times of initial pressure
- D. 5 times of initial pressure

Physical Chemistry Questions

Rate law for a reaction between A and B is given $r = k[A]^n[B]^m$
If concentration of A is doubled and concentration of B is halved from their initial value, the ratio of new rate of reaction to the initial rate of reaction

Physical Chemistry Questions

Half life of zero order reaction A gives Products is 1 hour, when initial concentration of reactant is 2 mol/L . The time required to decrease concentration of A from 0.50 to 0.25 mol/L is

Physical Chemistry Questions

The rate of first order reaction is $0.04\text{molL}^{-1}\text{s}^{-1}$ at 10 minutes and $0.03\text{molL}^{-1}\text{s}^{-1}$ at 20 minutes after initiation. Half life of the reaction is _____ minutes. (Given $\log 2 = 0.3010$, $\log 3 = 0.4771$)

Physical Chemistry Questions

NO_2 required for a reaction is produced by decomposition of N_2O_5 in CCl_4 as by equation $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$

The initial concentration of N_2O_5 is 3molL^{-1} and it is 2.75molL^{-1} after 30 minutes. The rate of formation of NO_2 is $x \times 10^{-3}\text{molL}^{-1}\text{min}^{-1}$, value of x is_____

Physical Chemistry Questions

Integrated rate law equation for a first order gas phase reaction is given by (where P_i is initial pressure and P_t is total pressure at time t)

Physical Chemistry Questions

$r = k[A]$ for a reaction, 50% of A is decomposed in 120 minutes. The time taken for 90% decomposition of A is _____ minutes

Physical Chemistry Questions

The ratio of $^{14}\text{C}/^{12}\text{C}$ in a piece of wood is $1/8$ part that of atmosphere. If half life of ^{14}C is 5730 years, the age of wood sample is years.

Physical Chemistry Questions

The number of correct statement/s from the following is____

- A. Larger the activation energy, smaller is the value of the rate constant.
- B. The higher is the activation energy, higher is the value of the temperature coefficient.
- C. At lower temperatures, increase in temperature causes more change in the value of k than at higher temperature.
- D. A plot of $\ln k$ vs $1/T$ is a straight line with slope equal to $-E_a/R$

[24-Jan-2023 Shift 1]

Physical Chemistry Questions

The specific conductance of 0.0025M acetic acid is $5 \times 10^{-5} \text{Scm}^{-1}$ at a certain temperature. The dissociation constant of acetic acid is _____ $\times 10^{-7}$.
Consider limiting molar conductivity of CH_3COOH as $400 \text{Scm}^2\text{mol}^{-1}$

Physical Chemistry Questions

For lead storage battery pick the correct statements

- A. During charging of battery, PbSO_4 on anode is converted into PbO_2
 - B. During charging of battery, PbSO_4 on cathode is converted into PbO_2
 - C. Lead storage battery consists of grid of lead packed with PbO_2 as anode
 - D. Lead storage battery has $\sim 38\%$ solution of sulphuric acid as an electrolyte
- Choose the correct answer from the options given below:

[12-Apr-2023 shift 1]

Physical Chemistry Questions

The resistance of a conductivity cell containing 0.01M KCl solution at 298K is 1750Ω . If the conductivity of 0.01M KCl solution at 298K is $0.152 \times 10^{-3} \text{Scm}^{-1}$, then the cell constant of the conductivity cell is _____ $\times 10^{-3} \text{cm}^{-1}$

Most effective Physical Chemistry Questions

A solution of $\text{Fe}_2(\text{SO}_4)_3$ is electrolyzed for 'x' min with a current of 1.5A to deposit 0.3482g of Fe. The value of x is [nearest integer]

Given : $1F = 96500\text{C mol}^{-1}$ Atomic mass of Fe = 56gmol^{-1}

Most effective Physical Chemistry Questions

The amount of charge in F (Faraday) required to obtain one mole of iron from Fe_3O_4 is _____. (Nearest Integer)

Most effective Physical Chemistry Questions

Potassium chlorate is prepared by electrolysis of KCl in basic solution as shown by following equation.



A current of x A has to be passed for 10h to produce 10.0g of potassium chlorate. the value of x is _____.

(Nearest integer)

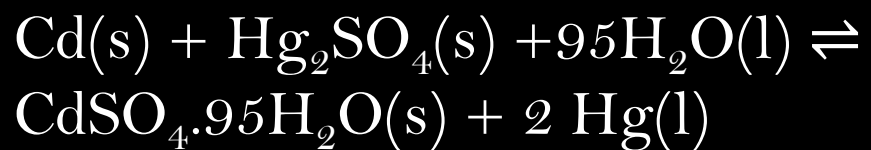
(Molar mass of $\text{KClO}_3 = 122.6\text{g mol}^{-1}$,

$F = 96500\text{C}$)

[20 Jul 2021 Shift 2]

Most effective Physical Chemistry Questions

Consider the following cell reaction,



The value of E_{cell}° is 4.315V at 25°C .

If $\Delta H^\circ = -825.2 \text{ kJ mol}^{-1}$, the standard entropy change ΔS° in JK^{-1} is....

(Nearest integer)

[Given, Faraday constant = 96487 C mol^{-1}]

Most effective Physical Chemistry Questions

108g of silver (molar mass 108 gmol^{-1}) is deposited at cathode from AgNO_3 (aq) solution by a certain quantity of electricity. The volume (in L) of oxygen gas produced at 273K and 1 bar pressure from water by the same quantity of electricity is

Most effective Physical Chemistry Questions

For a certain reaction at 300K, $K = 10$, then ΔG° for the same reaction is _____ $\times 10^{-1} \text{ kJmol}^{-1}$. (Given $R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$)

Most effective Physical Chemistry Questions

One mole of an ideal gas at 350K is in a 2.0L vessel of thermally conducting walls, which are in contact with the surroundings. It undergoes isothermal reversible expansion from 2.0L to 3.0L against a constant pressure of 4 atm. The change in entropy of the surroundings (ΔS) is _____ JK^{-1}

Most effective Physical Chemistry Questions

30.4 kJ of heat is required to melt one mole of sodium chloride and the entropy change at the melting point is _____ $28.4 \text{ JK}^{-1} \text{ mol}^{-1}$ at 1 atm. The melting point of sodium chloride is K. (Nearest Integer)
[15-Apr-2023 shift 1]

Most effective Physical Chemistry Questions

The pH of a 0.01 M weak acid is found to be 5 . Now the acid solution is diluted with excess of water so that the pH of the solution changes to 6 .

The new concentration of the diluted weak acid is given as . The value of
is _____ (nearest integer)

Most effective Physical Chemistry Questions

One litre buffer solution was prepared by adding 0.10 mol each of and in deionised water. The change in pH on addition of 0.05 mol of HCl to the above solution is

Most effective Physical Chemistry Questions

For the reaction $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$, $K_p = 0.492 \text{ atm}$ at 300K . K_c for the reaction at same temperature is $\times 10^{-2}$

Physical Chemistry Questions

K_{sp} for Cr(OH)₃ is 1.6×10^{-30} . What is the molar solubility of this salt in water?

Options:

- A. $\sqrt{5} \times 1.8 \times 10^{-30}$
- B. $(1.8 \times 10^{-30})/27$
- C. $\sqrt[4]{(1.6 \times 10^{-30}/27)}$ ✓
- D. $\sqrt{2} \times 1.6 \times 10^{-30}$



$$K_{sp} = s \cdot (3s)^3$$
$$= 27s^4$$

$$27s^4 = 1.6 \times 10^{-30}$$

$$s = \sqrt[4]{\frac{1.6 \times 10^{-30}}{27}}$$

Physical Chemistry Questions

The solubility of CdSO_4 in water is $8.0 \times 10^{-4} \text{ mol L}^{-1}$. Its solubility in $0.01\text{M H}_2\text{SO}_4$ solution is $\times 10^{-6} \text{ mol L}^{-1}$.

Physical Chemistry Questions

For the reaction $X_2Y(g) \rightleftharpoons X_2(g) + \frac{1}{2}Y_2(g)$, the equation representing correct relationship between degree of dissociation (x) and K_p is _____.

Physical Chemistry Questions

The pH of a 0.01 M weak acid is found to be 5. Now the acid solution is diluted with excess of water so that the pH changes to 6. The new concentration is $x \times 10^{-4}\text{M}$. Find x .

Physical Chemistry Questions

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Physical Chemistry Questions

The pH of ammonium phosphate solution, if pK_a of phosphoric acid and pK_b of ammonium hydroxide are 5.23 and 4.75 respectively, is

.....

Physical Chemistry Questions

One litre buffer solution was prepared by adding 0.10 mol each of NH_3 and NH_4Cl in deionised water. The change in pH on addition of 0.05 mol of HCl is

_____ $\times 10^{-2}$.

Physical Chemistry Questions

The number of moles of NH_3 that must be added to 2L of 0.80M AgNO_3 to reduce $[\text{Ag}^+]$ to $5.0 \times 10^{-8}\text{M}$ is _____.

[Kformation for $[\text{Ag}(\text{NH}_3)_2]^+ = 1.0 \times 10^8]$

Physical Chemistry Questions

Consider the equilibrium: $\text{CO(g)} + 3\text{H}_2\text{(g)} \rightleftharpoons \text{CH}_4\text{(g)} + \text{H}_2\text{O(g)}$

If pressure increases by two fold at constant temperature:

- (A) Concentration of reactants and products increases
- (B) Equilibrium will shift in forward direction
- (C) Equilibrium constant increases
- (D) Equilibrium constant remains unchanged as concentration of reactant and product remain same

Physical Chemistry Questions

An analyst wants to convert 1L HCl of pH = 1 to pH = 2. Volume of water needed is _____ mL.

Physical Chemistry Questions

If equal volumes of AB_2 and XY (both are salts) aqueous solutions are mixed, which of the following combination will give a precipitate of AY_2 at 300 K ? (Given at 300 K) for $K_{sp}(AY_2) = 5.2 \times 10^{-7}$

Physical Chemistry Questions

In aqueous solution the ionization constants for carbonic acid are $K_1 = 4.2 \times 10^{-7}$ and $K_2 = 4.8 \times 10^{-11}$. For a saturated 0.034M solution, select correct statement:

- A. $[\text{CO}_3^{2-}] = 0.034\text{M}$
- B. $[\text{CO}_3^{2-}] > [\text{HCO}_3^-]$
- C. $[\text{H}^+] \approx [\text{HCO}_3^-]$
- D. $[\text{H}^+] = 2[\text{CO}_3^{2-}]$

Physical Chemistry Questions

The molar conductance of an infinitely dilute solution of ammonium chloride was found to be $185 \text{ S cm}^2/\text{mol}$ and the ionic conductance of hydroxyl and chloride ions are $70 \text{ S cm}^2/\text{mol}$ respectively. If molar conductance of 0.02 M solution of ammonium hydroxide is $85.5 \text{ S cm}^2/\text{mol}$, its degree of dissociation is given by $X \times 10^{-1}$. The value of X is _____. (Nearest integer)

Physical Chemistry Questions

An aqueous solution of HCl with pH 1.0 is diluted by adding equal volume of water (ignoring dissociation of water). The pH of HCl solution would

Options:

- A. increase to 1.3
- B. reduce to 0.5
- C. increase to 2
- D. remain same

Physical Chemistry Questions

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 change in internal energy are:

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

Options:

- A. 368 K and 500 J
- B. 348 K and 300 J
- C. 378 K and 300 J
- D. 378 K and 500 J

Physical Chemistry Questions

One mole of ideal gas expands isothermally and reversibly from 10dm^3 to 20dm^3 at 300 K . Find ΔU , q and w .

Given: $R = 8.3\text{ J K}^{-1}\text{mol}^{-1}$, $\ln 2 = 0.693$

Physical Chemistry Questions

Consider the 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 = $-3267.0 \text{ kJ mol}^{-1}$

Heat of formation of benzene is _____ kJ mol^{-1} .

Physical Chemistry Questions

For reaction $A \rightleftharpoons B$ at 298K, find $\log K$.

Given: $\Delta H^\circ = -54.07 \text{ kJ mol}^{-1}$, $\Delta S^\circ = 10 \text{ JK}^{-1}\text{mol}^{-1}$ ($2.303 \times 8.314 \times 298 = 5705$)

Physical Chemistry Questions

An endothermic reaction is non-spontaneous at freezing point but spontaneous at boiling point. Choose correct option for ΔH and ΔS .

- A. Both ΔH and ΔS are (–ve)
- B. ΔH is (+ve) but ΔS is (–ve)
- C. ΔH is (–ve) but ΔS is (+ve)
- D. Both ΔH and ΔS are (+ve)

Physical Chemistry Questions

Two vessels A and B connected via stopcock. Vessel A filled with gas. After opening stopcock, gas expands and no temperature change observed. Which statement is true?

Options:

- A. $dq \neq 0$
- B. The pressure in vessel B before opening was zero
- C. $dw \neq 0$
- D. $dU \neq 0$

Physical Chemistry Questions

Resonance in X_2Y can be represented as $X\equiv X + \frac{1}{2}Y=Y \rightarrow X_2Y$

$\Delta H_f(X_2Y) = 80 \text{ kJ mol}^{-1}$. Find magnitude of resonance energy.

Given: Bond energies $X\equiv X=940$, $X=X=410$, $Y=Y=500$, $X=Y=602 \text{ kJ mol}^{-1}$

Physical Chemistry Questions

Given -



Which of the following is correct?

- A. Heat of dilution = 3.78 kJ mol^{-1}
- B. Dissolution is endothermic
- C. Heat of solution depends on amount of solvent
- D. Heat of formation represented by both

Physical Chemistry Questions

Liquid in thermally insulated closed vessel at 25°C is mechanically stirred from outside. Correct option for thermodynamic parameters?

Options:

- A. $\Delta U = 0, q < 0, w > 0$
- B. $\Delta U > 0, q = 0, w > 0$
- C. $\Delta U = 0, q = 0, w = 0$
- D. $\Delta U < 0, q = 0, w > 0$

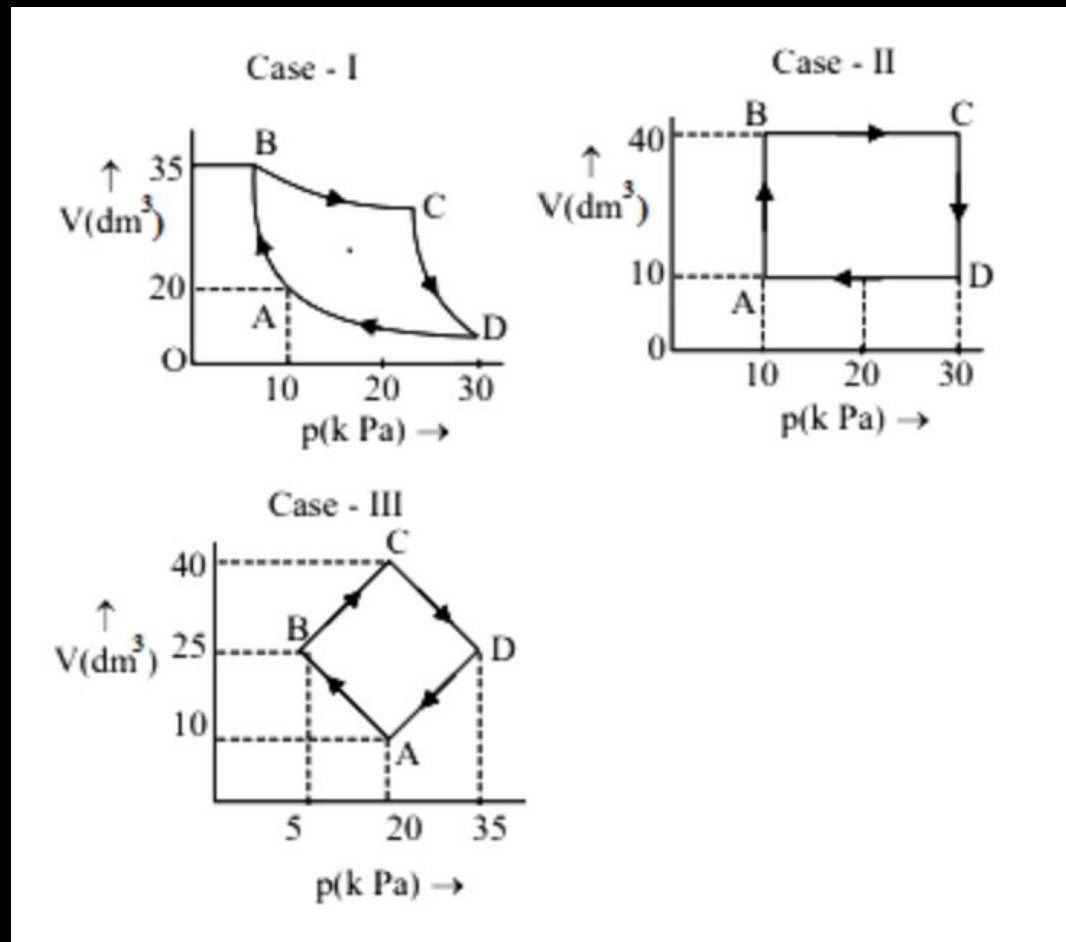
Physical Chemistry Questions

Arrange work done in order of magnitude for processes at constant temperature using PV graphs.

- (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.

Physical Chemistry Questions

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 ΔU :



Physical Chemistry Questions

Hydration energies of K^+ and Cl^- are $-x$ and $-y$ kJ/mol. Lattice energy of KCl is $-z$ kJ/mol. Heat of solution of KCl is:

Physical Chemistry Questions

0.3g ethane combustion at 27°C in bomb calorimeter. Temperature rises by 0.5°C. Heat capacity = 20 kJ K⁻¹. Heat evolved at constant pressure is _____ kJ mol⁻¹.