

JEE MAIN 2025 · QUESTION PAPER

28 Jan 2025 Shift 1

72 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	20 Q1 to Q20	5 Q21 to Q25
● Chemistry	17 Q26 to Q42	5 Q43 to Q47
● Mathematics	20 Q48 to Q67	5 Q68 to Q72
In this PDF	72 questions · answer key at the end	

- 1 Set a 3 hour timer and attempt the paper in one sitting, like the real exam.
- 2 Check yourself against the answer key at the end. Every question names its chapter, so you can see where marks went.
- 3 Got one wrong? Tap "Step-by-step solution" at the top right of it for the full working, where available.

Attempt this paper online

The same questions in the same order, with instant answer checking and step-by-step solutions where available.

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Answers follow NTA's final answer keys. Typing errors are possible, so check doubtful answers against the official key. Spotted a mistake? prepwis.in/feedback
· Terms: prepwis.in/terms

Q1 Nuclear Physics

[Step-by-step solution](#) > [prepwiser.in/questions/a7WVYq_tN-](https://www.prepwiser.in/questions/a7WVYq_tN-)

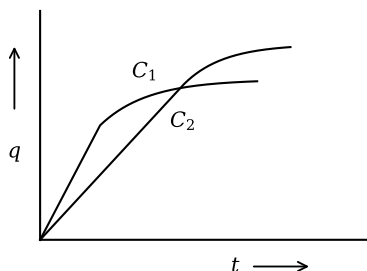
Choose the correct nuclear process from the below options [p : proton, n : neutron, e^- : electron, e^+ : positron, ν : neutrino, $\bar{\nu}$: antineutrino]

- (A) $n \rightarrow p + e^+ + \nu$ (B) $n \rightarrow p + e^- + \bar{\nu}$ (C) $n \rightarrow p + e^+ + \bar{\nu}$ (D) $n \rightarrow p + e^- + \nu$

Q2 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) > [prepwiser.in/questions/eq7l1O8of7](https://www.prepwiser.in/questions/eq7l1O8of7)

Two capacitors C_1 and C_2 are connected in parallel to a battery. Charge-time graph is shown below for the two capacitors. The energy stored with them are U_1 and U_2 , respectively. Which of the given statements is true?



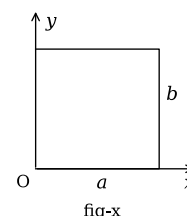
- (A) $C_2 > C_1, U_2 > U_1$ (B) $C_1 > C_2, U_1 > U_2$ (C) $C_2 > C_1, U_2 < U_1$ (D) $C_1 > C_2, U_1 < U_2$

Q3 Centre of Mass & Linear Momentum

[Step-by-step solution](#) > [prepwiser.in/questions/40GtcD03B-](https://www.prepwiser.in/questions/40GtcD03B-)

The center of mass of a thin rectangular plate (fig - x) with sides of length a and b , whose mass per unit area (σ) varies as $\sigma = \frac{\sigma_0 x}{ab}$ (where σ_0 is a constant), would be _____.

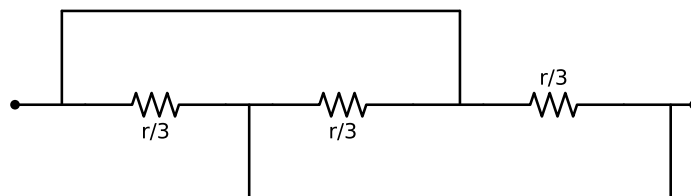
- (A) $(\frac{2}{3}a, \frac{2}{3}b)$ (B) $(\frac{2}{3}a, \frac{b}{2})$ (C) $(\frac{1}{3}a, \frac{b}{2})$ (D) $(\frac{a}{2}, \frac{b}{2})$



Q4 Current Electricity

[Step-by-step solution](#) > [prepwiser.in/questions/kdlR2WWYi2](https://www.prepwiser.in/questions/kdlR2WWYi2)

Find the equivalent resistance between two ends of the following circuit



- (A) r (B) $\frac{r}{6}$ (C) $\frac{r}{3}$ (D) $\frac{r}{9}$

Q5 Current Electricity

[Step-by-step solution](#) > [prepwiser.in/questions/rVAQPQ1pZC](https://www.prepwiser.in/questions/rVAQPQ1pZC)

A wire of resistance R is bent into an equilateral triangle and an identical wire is bent into a square. The ratio of resistance between the two end points of an edge of the triangle to that of the square is

- (A) $8/9$ (B) $9/8$ (C) $32/27$ (D) $27/32$

Q6 Dual Nature of Radiation & Matter

[Step-by-step solution](#) > [prepwiser.in/questions/foZrNIGp6K](https://www.prepwiser.in/questions/foZrNIGp6K)

A proton of mass ' m_p ' has same energy as that of a photon of wavelength ' λ '. If the proton is moving at non-relativistic speed, then ratio of its de Broglie wavelength to the wavelength of photon is.

- (A) $\frac{1}{c} \sqrt{\frac{E}{m_p}}$ (B) $\frac{1}{c} \sqrt{\frac{2E}{m_p}}$ (C) $\frac{1}{2c} \sqrt{\frac{E}{m_p}}$ (D) $\frac{1}{c} \sqrt{\frac{E}{2m_p}}$

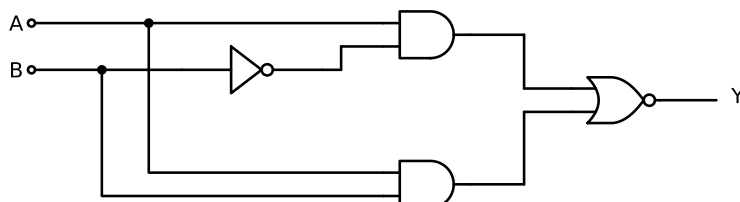
Q7 Electromagnetic Waves[Step-by-step solution](#) > [prepwisar.in/questions/0dcEIuq0KR](#)

Due to presence of an em-wave whose electric component is given by $E = 100 \sin(\omega t - kx) \text{ NC}^{-1}$ a cylinder of length 200 cm holds certain amount of em-energy inside it. If another cylinder of same length but half diameter than previous one holds same amount of em-energy, the magnitude of the electric field of the corresponding em-wave should be modified as

- (A) $50 \sin(\omega t - kx) \text{ NC}^{-1}$ (B) $400 \sin(\omega t - kx) \text{ NC}^{-1}$
 (C) $200 \sin(\omega t - kx) \text{ NC}^{-1}$ (D) $25 \sin(\omega t - kx) \text{ NC}^{-1}$

Q8 Semiconductors & Electronic Devices[Step-by-step solution](#) > [prepwisar.in/questions/wcyO9cLPdz](#)

Which of the following circuits has the same output as that of the given circuit?



- (A) (B)
 (C) (D)

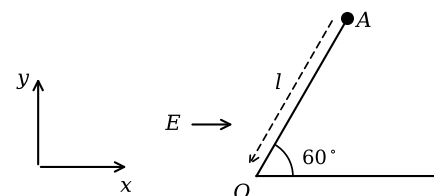
Q9 Electrostatics II: Potential & Capacitance[Step-by-step solution](#) > [prepwisar.in/questions/nIwagBSy0O](#)

Three infinitely long wires with linear charge density λ are placed along the x -axis, y -axis and z -axis respectively. Which of the following denotes an equipotential surface?

- (A) $(x^2 + y^2)(y^2 + z^2)(z^2 + x^2) = \text{constant}$ (B) $xyz = \text{constant}$
 (C) $xy + yz + zx = \text{constant}$ (D) $(x + y)(y + z)(z + x) = \text{constant}$

Q10 Work, Energy & Power[Step-by-step solution](#) > [prepwisar.in/questions/o4eGerNW9w](#)

A particle of mass ' m ' and charge ' q ' is fastened to one end ' A ' of a massless string having equilibrium length l , whose other end is fixed at point ' O '. The whole system is placed on a frictionless horizontal plane and is initially at rest. If uniform electric field is switched on along the direction as shown in figure, then the speed of the particle when it crosses the x -axis is



- (A) $\sqrt{\frac{qEl}{2m}}$ (B) $\sqrt{\frac{qEl}{4m}}$ (C) $\sqrt{\frac{qEl}{m}}$ (D) $\sqrt{\frac{2qEl}{m}}$

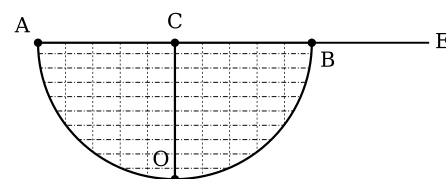
Q11 Ray Optics[Step-by-step solution](#) > [prepwisar.in/questions/N_joG6ePOQ](#)

A thin prism P_1 with angle 4° made of glass having refractive index 1.54, is combined with another thin prism P_2 made of glass having refractive index 1.72 to get dispersion without deviation. The angle of the prism P_2 in degrees is

- (A) 1.5 (B) 16/3 (C) 3 (D) 4

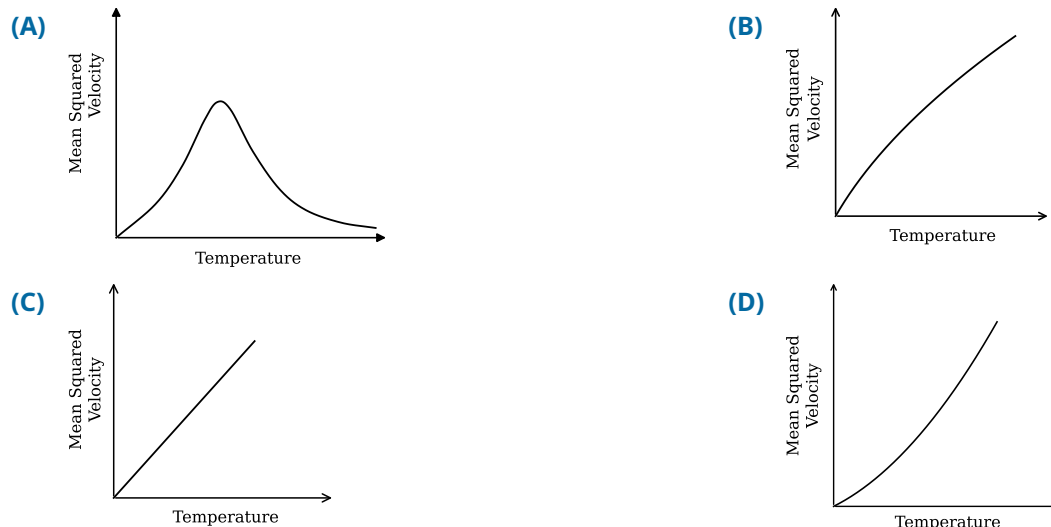
Q12 Ray Optics[Step-by-step solution](#) > [prepwisar.in/questions/suUGTIuMjT](#)

A hemispherical vessel is completely filled with a liquid of refractive index μ . A small coin is kept at the lowest point (O) of the vessel as shown in figure. The minimum value of the refractive index of the liquid so that a person can see the coin from point E (at the level of the vessel) is _____.



- (A) $\frac{3}{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\sqrt{3}$ (D) $\sqrt{2}$

For a particular ideal gas which of the following graphs represents the variation of mean squared velocity of the gas molecules with temperature?



A Carnot engine (E) is working between two temperatures 473 K and 273 K. In a new system two engines - engine E_1 works between 473 K to 373 K and engine E_2 works between 373 K to 273 K. If η_{12} , η_1 and η_2 are the efficiencies of the engines E , E_1 and E_2 , respectively, then

- (A) $\eta_{12} = \eta_1 \eta_2$ (B) $\eta_{12} = \eta_1 + \eta_2$ (C) $\eta_{12} \geq \eta_1 + \eta_2$ (D) $\eta_{12} < \eta_1 + \eta_2$

Consider a long thin conducting wire carrying a uniform current I . A particle having mass " M " and charge " q " is released at a distance " a " from the wire with a speed v_0 along the direction of current in the wire. The particle gets attracted to the wire due to magnetic force. The particle turns round when it is at distance x from the wire. The value of x is [μ_0 is vacuum permeability]

- (A) $a \left[1 - \frac{mv_0}{2q\mu_0 I} \right]$ (B) $ae^{-\frac{4\pi mv_0 a}{q\mu_0 I}}$ (C) $a \left[1 - \frac{mv}{q} \mu_0 I \right]$ (D) $\frac{a}{2}$

In the experiment for measurement of viscosity ' η ' of given liquid with a ball having radius R , consider following statements.

- A. Graph between terminal velocity V and R will be a parabola.
 B. The terminal velocities of different diameter balls are constant for a given liquid.
 C. Measurement of terminal velocity is dependent on the temperature.
 D. This experiment can be utilized to assess the density of a given liquid.
 E. If balls are dropped with some initial speed, the value of η will change.

Choose the correct answer from the options given below:

- (A) C, D and E Only (B) A, B and E Only (C) A, C and D Only (D) B, D and E Only

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Consider following statements:

- A. Surface tension arises due to extra energy of the molecules at the interior as compared to the molecules at the surface, of a liquid.
- B. As the temperature of liquid rises, the coefficient of viscosity increases.
- C. As the temperature of gas increases, the coefficient of viscosity increases
- D. The onset of turbulence is determined by Reynold's number.
- E. In a steady flow two stream lines never intersect.

Choose the correct answer from the options given below:

- (A) B, C, D Only (B) C, D, E Only (C) A, D, E Only (D) A, B, C Only

Given below are two statements : one is labelled as Assertion **A** and the other is labelled as Reason **R**

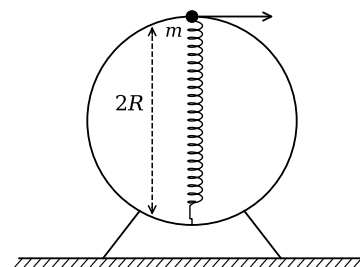
Assertion A: A sound wave has higher speed in solids than gases.

Reason R: Gases have higher value of Bulk modulus than solids.

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

- (A) Both **A** and **R** are true and **R** is the correct explanation of **A**
 (B) **A** is false but **R** is true
 (C) **A** is true but **R** is false
 (D) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**

A bead of mass ' m ' slides without friction on the wall of a vertical circular hoop of radius ' R ' as shown in figure. The bead moves under the combined action of gravity and a massless spring (k) attached to the bottom of the hoop. The equilibrium length of the spring is ' R '. If the bead is released from top of the hoop with (negligible) zero initial speed, velocity of bead, when the length of spring becomes ' R ', would be (spring constant is ' k ', g is acceleration due to gravity)



- (A) $\sqrt{2Rg + \frac{kR^2}{m}}$ (B) $\sqrt{3Rg + \frac{kR^2}{m}}$ (C) $\sqrt{2Rg + \frac{4kR^2}{m}}$ (D) $2\sqrt{gR + \frac{kR^2}{m}}$

Given below are two statements: one is labelled as Assertion **A** and the other is labelled as Reason **R**

Assertion A: In a central force field, the work done is independent of the path chosen.

Reason R: Every force encountered in mechanics does not have an associated potential energy.

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

- (A) **A** is false but **R** is true
 (B) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**
 (C) **A** is true but **R** is false
 (D) Both **A** and **R** are true and **R** is the correct explanation of **A**

Q21 Units, Dimensions & Errors **NUMERICAL**

[Step-by-step solution](#) > [prepwisar.in/questions/4z3Qsj2pi5](https://www.prepwisar.in/questions/4z3Qsj2pi5)

In a measurement, it is asked to find modulus of elasticity per unit torque applied on the system. The measured quantity has dimension of $[M^a L^b T^c]$. If $b = 3$, the value of c is _____.

Q22 Rotational Motion **NUMERICAL**

[Step-by-step solution](#) > [prepwisar.in/questions/7JRp6Bsj-F](https://www.prepwisar.in/questions/7JRp6Bsj-F)

Two iron solid discs of negligible thickness have radii R_1 and R_2 and moment of inertia I_1 and I_2 , respectively. For $R_2 = 2R_1$, the ratio of I_1 and I_2 would be $1/x$, where $x =$ _____.

Q23 Rotational Motion **NUMERICAL**

[Step-by-step solution](#) > [prepwisar.in/questions/AcmdmQwFib](https://www.prepwisar.in/questions/AcmdmQwFib)

The moment of inertia of a solid disc rotating along its diameter is 2.5 times higher than the moment of inertia of a ring rotating in similar way. The moment of inertia of a solid sphere which has same radius as the disc and rotating in similar way, is n times higher than the moment of inertia of the given ring. Here, $n =$ _____ Consider all the bodies have equal masses.

Q24 Wave Optics **NUMERICAL**

[Step-by-step solution](#) > [prepwisar.in/questions/3vtIjt18ZD](https://www.prepwisar.in/questions/3vtIjt18ZD)

A double slit interference experiment performed with a light of wavelength 600 nm forms an interference fringe pattern on a screen with 10 th bright fringe having its centre at a distance of 10 mm from the central maximum. Distance of the centre of the same 10 th bright fringe from the central maximum when the source of light is replaced by another source of wavelength 660 nm would be _____ mm.

Q25 Experimental Skills **NUMERICAL**

[Step-by-step solution](#) > [prepwisar.in/questions/MdCoXaR2m8](https://www.prepwisar.in/questions/MdCoXaR2m8)

A tiny metallic rectangular sheet has length and breadth of 5 mm and 2.5 mm, respectively. Using a specially designed screw gauge which has pitch of 0.75 mm and 15 divisions in the circular scale, you are asked to find the area of the sheet. In this measurement, the maximum fractional error will be $\frac{x}{100}$ where x is _____.

Chemistry Section A · Multiple choice

Q26 to Q42

Q26 Aldehydes & Ketones

[Step-by-step solution](#) > [prepwisar.in/questions/UIWZLkdV2r](https://www.prepwisar.in/questions/UIWZLkdV2r)

Both acetaldehyde and acetone (individually) undergo which of the following reactions?

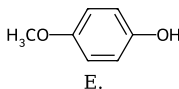
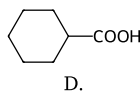
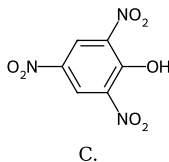
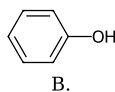
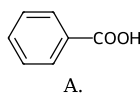
- A. Iodoform Reaction
- B. Cannizaro Reaction
- C. Aldol Condensation
- D. Tollen's Test
- E. Clemmensen Reduction

Choose the correct answer from the options given below:

- (A) C and E Only (B) A, B and D Only (C) A, C and E Only (D) B, C and D Only

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The compounds that produce CO_2 with aqueous NaHCO_3 solution are:



Choose the correct answer from the options given below:

- (A) A and C Only (B) A, B and E Only (C) A and B Only (D) A, C and D Only

Given below are two statements:

Statement I : D-glucose pentaacetate reacts with 2,4 -dinitrophenylhydrazine

Statement II : Starch, on heating with concentrated sulfuric acid at 100°C and 2 – 3atmosphere pressure produces glucose.

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

- (A) Statement I is true but Statement II is false (B) Both Statement I and Statement II are true
(C) Statement I is false but Statement II is true (D) Both Statement I and Statement II are false

Consider 'n' is the number of lone pair of electrons present in the equatorial position of the most stable structure of ClF_3 . The ions from the following with 'n' number of unpaired electrons are

- A. V^{3+}
B. Ti^{3+}
C. Cu^{2+}
D. Ni^{2+}
E. Ti^{2+}

Choose the correct answer from the options given below:

- (A) B and D Only (B) A, D and E Only (C) B and C Only (D) A and C Only

The molecules having square pyramidal geometry are

- (A) BrF_5 & PCl_5 (B) SbF_5 & PCl_5 (C) BrF_5 & XeOF_4 (D) SbF_5 & XeOF_4

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$[A]_0 / \text{mol L}^{-1}$	$t_{1/2} / \text{min}$
0.100	200
0.025	100

For a given reaction $R \rightarrow P$, $t_{1/2}$ is related to $[A]_0$ as given in table.

Given: $\log 2 = 0.30$

Which of the following is true?

- A. The order of the reaction is $1/2$.
 B. If $[A]_0$ is 1 M, then $t_{1/2}$ is $200\sqrt{10}$ min
 C. The order of the reaction changes to 1 if the concentration of reactant changes from 0.100 M to 0.500 M.
 D. $t_{1/2}$ is 800 min for $[A]_0 = 1.6$ M

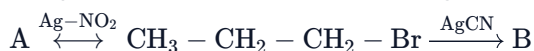
Choose the correct answer from the options given below:

- (A) A and C Only (B) A, B and D Only (C) A and B Only (D) C and D Only

The metal ion whose electronic configuration is not affected by the nature of the ligand and which gives a violet colour in non-luminous flame under hot condition in borax bead test is

- (A) Cr^{3+} (B) Ti^{3+} (C) Ni^{2+} (D) Mn^{2+}

The products A and B in the following reactions, respectively are



- (A) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{ONO}$, $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CN}$
 (B) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{NO}_2$, $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CN}$
 (C) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{ONO}$, $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{NC}$
 (D) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{NO}_2$, $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{NC}$

A weak acid HA has degree of dissociation x . Which option gives the correct expression of $(\text{pH} - \text{pK}_a)$?

- (A) $\log \left(\frac{1-x}{x} \right)$ (B) 0 (C) $\log(1+2x)$ (D) $\log \left(\frac{x}{1-x} \right)$

The incorrect decreasing order of atomic radii is

- (A) $\text{Si} > \text{P} > \text{Cl} > \text{F}$ (B) $\text{Mg} > \text{Al} > \text{C} > \text{O}$
 (C) $\text{Al} > \text{B} > \text{N} > \text{F}$ (D) $\text{Be} > \text{Mg} > \text{Al} > \text{Si}$

Consider the following elements In, Tl, Al, Pb, Sn and Ge. The most stable oxidation states of elements with highest and lowest first ionisation enthalpies, respectively, are

- (A) +4 and +1 (B) +4 and +3 (C) +1 and +4 (D) +2 and +3

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Given below are two statements:

Statement I: In the oxalic acid vs KMnO_4 (in the presence of dil H_2SO_4) titration the solution needs to be heated initially to 60°C , but no heating is required in Ferrous ammonium sulphate (FAS) vs KMnO_4 titration (in the presence of dil H_2SO_4)

Statement II: In oxalic acid vs KMnO_4 titration, the initial formation of MnSO_4 takes place at high temperature, which then acts as catalyst for further reaction. In the case of FAS vs KMnO_4 , heating oxidizes Fe^{2+} into Fe^{3+} by oxygen of air and error may be introduced in the experiment.

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

- (A) Statement I is false but Statement II is true
 (B) Statement I is true but Statement II is false
 (C) Both Statement I and Statement II are true
 (D) Both Statement I and Statement II are false

Match the List - I with List - II

	List - I (Redox Reaction)		List - II (Type of Redox Reaction)
(A)	$\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \xrightarrow{\Delta} \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$	(I)	Disproportionation reaction
(B)	$2\text{NaH}(\text{s}) \xrightarrow{\Delta} 2\text{Na}(\text{s}) + \text{H}_2(\text{g})$	(II)	Combination reaction
(C)	$\text{V}_2\text{O}_5(\text{s}) + 5\text{Ca}(\text{s}) \xrightarrow{\Delta} 2\text{V}(\text{s}) + 5\text{CaO}(\text{s})$	(III)	Decomposition reaction
(D)	$2\text{H}_2\text{O}_2(\text{aq}) \xrightarrow{\Delta} 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$	(IV)	Displacement reaction

Choose the correct answer from the options given below:

- (A) A-III, B-IV, C-I, D-II
 (B) A-IV, B-I, C-II, D-III
 (C) A-II, B-III, C-I, D-IV
 (D) A-II, B-III, C-IV, D-I

Which of the following oxidation reactions are carried out by both $\text{K}_2\text{Cr}_2\text{O}_7$ and KMnO_4 in acidic medium?

- A. $\text{I}^- \rightarrow \text{I}_2$
 B. $\text{S}^{2-} \rightarrow \text{S}$
 C. $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+}$
 D. $\text{I}^- \rightarrow \text{IO}_3^-$
 E. $\text{S}_2\text{O}_3^{2-} \rightarrow \text{SO}_4^{2-}$

Choose the correct answer from the options given below:

- (A) A, B and C Only
 (B) C, D and E Only
 (C) B, C and D Only
 (D) A, D and E Only

What is the freezing point depression constant of a solvent, 50 g of which contain 1 g non volatile solute (molar mass 256g mol^{-1}) and the decrease in freezing point is 0.40 K ?

- (A) 4.43K kg mol^{-1}
 (B) 3.72K kg mol^{-1}
 (C) 5.12K kg mol^{-1}
 (D) 1.86K kg mol^{-1}

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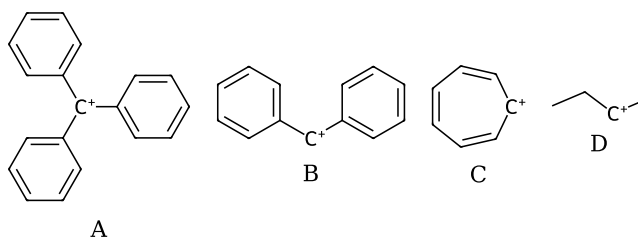
In a multielectron atom, which of the following orbitals described by three quantum numbers will have same energy in absence of electric and magnetic fields?

- A. $n = 1, l = 0, m_l = 0$
 B. $n = 2, l = 0, m_l = 0$
 C. $n = 2, l = 1, m_l = 1$
 D. $n = 3, l = 2, m_l = 1$
 E. $n = 3, l = 2, m_l = 0$

Choose the correct answer from the options given below:

- (A) B and C Only (B) C and D Only (C) A and B Only (D) D and E Only

The correct order of stability of following carbocations is:

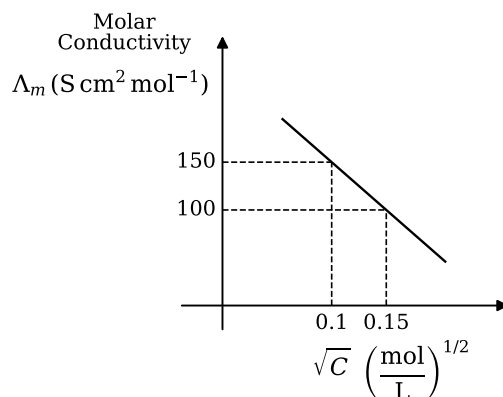


- (A) $A > B > C > D$ (B) $C > B > A > D$ (C) $B > C > A > D$ (D) $C > A > B > D$

Chemistry Section B · Numerical value

Q43 to Q47

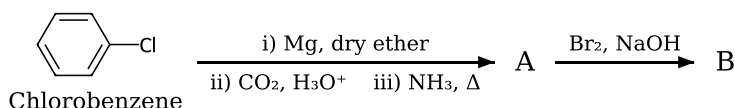
Given below is the plot of the molar conductivity vs $\sqrt{\text{concentration}}$ for KCl in aqueous solution.



If, for the higher concentration of KCl solution, the resistance of the conductivity cell is 100Ω , then the resistance of the same cell with the dilute solution is 'x' Ω

The value of x is _____ (Nearest integer)

Consider the following sequence of reactions:



11.25 mg of chlorobenzene will produce _____ $\times 10^{-1}$ mg of product B.

(Consider the reactions result in complete conversion.)

[Given molar mass of C, H, O, N and Cl as 12, 1, 16, 14 and 35.5g mol^{-1} respectively]

Q45 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/Lw8JF3MVRl](#)

The molarity of a 70% (mass/mass) aqueous solution of a monobasic acid (X) is _____ $\times 10^{-1}$ M (Nearest integer)

[Given: Density of aqueous solution of (X) is 1.25 g mL^{-1}

Molar mass of the acid is 70 g mol^{-1}]

Q46 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/A0ZVPsEdkm](#)

Quantitative analysis of an organic compound (X) shows following % composition.

C: 14.5%

Cl : 64.46%

H: 1.8 %

(Empirical formula mass of the compound (X) is _____ $\times 10^{-1}$

(Given molar mass in g mol^{-1} of C : 12, H : 1, O : 16, Cl : 35.5)

Q47 Chemical Thermodynamics **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/AZnlqSqEck](#)

The formation enthalpies, $\Delta H_f^\ominus$ for $\text{H}_{(\text{g})}$ and $\text{O}_{(\text{g})}$ are 220.0 and $250.0 \text{ kJ mol}^{-1}$, respectively, at 298.15 K , and $\Delta H_f^\ominus$ for $\text{H}_2\text{O}_{(\text{g})}$ 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 _____ kJ mol^{-1} (nearest integer).

Mathematics Section A · Multiple choice

Q48 to Q67

Q48 Three Dimensional Geometry[Step-by-step solution](#) > [prepwiser.in/questions/taTgnbyyoy](#)

Let $A(x, y, z)$ be a point in xy -plane, which is equidistant from three points $(0, 3, 2)$, $(2, 0, 3)$ and $(0, 0, 1)$.

Let $B = (1, 4, -1)$ and $C = (2, 0, -2)$. Then among the statements

(S1): $\triangle ABC$ is an isosceles right angled triangle, and

(S2) : the area of $\triangle ABC$ is $\frac{9\sqrt{2}}{2}$,

- (A) both are false (B) only (S2) is true (C) only (S1) is true (D) both are true

Q49 Three Dimensional Geometry[Step-by-step solution](#) > [prepwiser.in/questions/wVstijCg64](#)

If the image of the point $(4, 4, 3)$ in the line $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-1}{3}$ is (α, β, γ) , then $\alpha + \beta + \gamma$ is equal to

- (A) 12 (B) 9 (C) 7 (D) 8

Q50 Applications of Derivatives[Step-by-step solution](#) > [prepwiser.in/questions/525wsJE6DG](#)

The sum of all local minimum values of the function

$$f(x) = \begin{cases} 1 - 2x, & x < -1 \\ \frac{1}{3}(7 + 2|x|), & -1 \leq x \leq 2 \\ \frac{11}{18}(x - 4)(x - 5), & x > 2 \end{cases}$$

is

- (A) $\frac{167}{72}$ (B) $\frac{157}{72}$ (C) $\frac{171}{72}$ (D) $\frac{131}{72}$

Q51 Circles[Step-by-step solution](#) > [prepwiser.in/questions/_0m4cR8P7l](#)

Let the equation of the circle, which touches x -axis at the point $(a, 0)$, $a > 0$ and cuts off an intercept of length b on y - $axis$ be $x^2 + y^2 - \alpha x + \beta y + \gamma = 0$. If the circle lies below x - $axis$, then the ordered pair $(2a, b^2)$ is equal to

- (A) $(\alpha, \beta^2 + 4\gamma)$ (B) $(\alpha, \beta^2 - 4\gamma)$ (C) $(\gamma, \beta^2 - 4\alpha)$ (D) $(\gamma, \beta^2 + 4\alpha)$

Q52 Complex Numbers[Step-by-step solution](#) > [prepwiser.in/questions/kY7pdaveya](#)

Let O be the origin, the point A be $z_1 = \sqrt{3} + 2\sqrt{2}i$, the point $B(z_2)$ be such that $\sqrt{3}|z_2| = |z_1|$ and $\arg(z_2) = \arg(z_1) + \frac{\pi}{6}$. Then

- (A) area of triangle ABO is $\frac{11}{4}$ (B) area of triangle ABO is $\frac{11}{\sqrt{3}}$
(C) ABO is a scalene triangle (D) ABO is an obtuse angled isosceles triangle

Q53 Definite Integration[Step-by-step solution](#) > prepwiser.in/questions/ii6-d4ihQp

If $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{96x^2 \cos^2 x}{(1+e^x)} dx = \pi (\alpha\pi^2 + \beta)$, $\alpha, \beta \in \mathbb{Z}$, then $(\alpha + \beta)^2$ equals

- (A) 196 (B) 100 (C) 64 (D) 144

Q54 Definite Integration[Step-by-step solution](#) > prepwiser.in/questions/HUm48yia

Let for some function $y = f(x)$, $\int_0^x tf(t)dt = x^2 f(x)$, $x > 0$ and $f(2) = 3$. Then $f(6)$ is equal to

- (A) 1 (B) 6 (C) 2 (D) 3

Q55 Functions (Advanced)[Step-by-step solution](#) > prepwiser.in/questions/n7-OzVwN8k

If $f(x) = \frac{2^x}{2^x + \sqrt{2}}$, $x \in \mathbb{R}$, then $\sum_{k=1}^{81} f\left(\frac{k}{82}\right)$ is equal to

- (A) 82 (B) $81\sqrt{2}$ (C) 41 (D) $\frac{81}{2}$

Q56 Functions (Advanced)[Step-by-step solution](#) > prepwiser.in/questions/CyRzrYpj7u

Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be a function defined by $f(x) = (2 + 3a)x^2 + \left(\frac{a+2}{a-1}\right)x + b$, $a \neq 1$. If

$f(x+y) = f(x) + f(y) + 1 - \frac{2}{7}xy$, then the value of $28 \sum_{i=1}^5 |f(i)|$ is

- (A) 735 (B) 675 (C) 715 (D) 545

Q57 Inverse Trigonometric Functions[Step-by-step solution](#) > prepwiser.in/questions/5EOdP9i3UH

$\cos\left(\sin^{-1} \frac{3}{5} + \sin^{-1} \frac{5}{13} + \sin^{-1} \frac{33}{65}\right)$ is equal to:

- (A) $\frac{33}{65}$ (B) 1 (C) $\frac{32}{65}$ (D) 0

Q58 Parabola[Step-by-step solution](#) > prepwiser.in/questions/pQxbj-JZhA

Let ABCD be a trapezium whose vertices lie on the parabola $y^2 = 4x$. Let the sides AD and BC of the trapezium be parallel to y -axis. If the diagonal AC is of length $\frac{25}{4}$ and it passes through the point $(1, 0)$, then the area of ABCD is

- (A) $\frac{75}{8}$ (B) $\frac{125}{8}$ (C) $\frac{25}{2}$ (D) $\frac{75}{4}$

Q59 Circles[Step-by-step solution](#) > prepwiser.in/questions/zqooBGII2C

Let ${}^nC_{r-1} = 28$, ${}^nC_r = 56$ and ${}^nC_{r+1} = 70$. Let $A(4 \cos t, 4 \sin t)$, $B(2 \sin t, -2 \cos t)$ and $C(3r - n, r^2 - n - 1)$ be the vertices of a triangle ABC, where t is a parameter. If $(3x - 1)^2 + (3y)^2 = \alpha$, is the locus of the centroid of triangle ABC, then α equals

- (A) 18 (B) 8 (C) 20 (D) 6

Q60 Permutations & Combinations[Step-by-step solution](#) > prepwiser.in/questions/qMSdSbWd7V

The number of different 5 digit numbers greater than 50000 that can be formed using the digits 0, 1, 2, 3, 4, 5, 6, 7, such that the sum of their first and last digits should not be more than 8, is

- (A) 5720 (B) 5719 (C) 4608 (D) 4607

Q61 Probability: Basic[Step-by-step solution](#) > prepwiser.in/questions/2v0wlKobG5

Two number k_1 and k_2 are randomly chosen from the set of natural numbers. Then, the probability that the value of $i^{k_1} + i^{k_2}$, ($i = \sqrt{-1}$) is non-zero, equals

- (A) $\frac{3}{4}$ (B) $\frac{1}{2}$ (C) $\frac{1}{4}$ (D) $\frac{2}{3}$

Q62 Probability: Advanced[Step-by-step solution](#) > prepwiser.in/questions/7TW3FroQiR

Three defective oranges are accidentally mixed with seven good ones and on looking at them, it is not possible to differentiate between them. Two oranges are drawn at random from the lot. If x denote the number of defective oranges, then the variance of x is

- (A) $26/75$ (B) $14/25$ (C) $18/25$ (D) $28/75$

The sum, of the squares of all the roots of the equation $x^2 + |2x - 3| - 4 = 0$, is

- (A) $6(2 - \sqrt{2})$ (B) $3(3 - \sqrt{2})$ (C) $3(2 - \sqrt{2})$ (D) $6(3 - \sqrt{2})$

Let $\langle a_n \rangle$ be a sequence such that $a_0 = 0$, $a_1 = \frac{1}{2}$ and $2a_{n+2} = 5a_{n+1} - 3a_n$, $n = 0, 1, 2, 3, \dots$. Then $\sum_{k=1}^{100} a_k$ is equal to

- (A) $3a_{100} + 100$ (B) $3a_{100} - 100$ (C) $3a_{99} - 100$ (D) $3a_{99} + 100$

Let T_r be the r^{th} term of an A.P. If for some m , $T_m = \frac{1}{25}$, $T_{25} = \frac{1}{20}$, and $20 \sum_{r=1}^{25} T_r = 13$, then $5m \sum_{r=m}^{2m} T_r$ is equal to

- (A) 98 (B) 126 (C) 112 (D) 142

The relation $R = \{(x, y) : x, y \in \mathbb{Z} \text{ and } x + y \text{ is even}\}$ is:

- (A) reflexive and transitive but not symmetric (B) reflexive and symmetric but not transitive
(C) an equivalence relation (D) symmetric and transitive but not reflexive

The area (in sq. units) of the region $\{(x, y) : 0 \leq y \leq 2|x| + 1, 0 \leq y \leq x^2 + 1, |x| \leq 3\}$ is

- (A) $\frac{32}{3}$ (B) $\frac{64}{3}$ (C) $\frac{17}{3}$ (D) $\frac{80}{3}$

Mathematics Section B · Numerical value

Q68 to Q72

If $\alpha = 1 + \sum_{r=1}^6 (-3)^{r-1} {}^{12}C_{2r-1}$, then the distance of the point $(12, \sqrt{3})$ from the line $\alpha x - \sqrt{3}y + 1 = 0$ is _____.

Let $E_1 : \frac{x^2}{9} + \frac{y^2}{4} = 1$ be an ellipse. Ellipses E_i 's are constructed such that their centres and eccentricities are same as that of E_1 , and the length of minor axis of E_i is the length of major axis of E_{i+1} ($i \geq 1$). If A_i is the area of the ellipse E_i , then $\frac{5}{\pi} \left(\sum_{i=1}^{\infty} A_i \right)$, is equal to _____.

Let $f(x) = \begin{cases} 3x, & x < 0 \\ \min\{1 + x + [x], x + 2[x]\}, & 0 \leq x \leq 2 \\ 5, & x > 2 \end{cases}$

where $[.]$ denotes greatest integer function. If α and β are the number of points, where f is not continuous and is not differentiable, respectively, then $\alpha + \beta$ equals _____.

Let M denote the set of all real matrices of order 3×3 and let $S = \{-3, -2, -1, 1, 2\}$. Let

$$S_1 = \{A = [a_{ij}] \in M : A = A^T \text{ and } a_{ij} \in S, \forall i, j\},$$

$$S_2 = \{A = [a_{ij}] \in M : A = -A^T \text{ and } a_{ij} \in S, \forall i, j\},$$

$$S_3 = \{A = [a_{ij}] \in M : a_{11} + a_{22} + a_{33} = 0 \text{ and } a_{ij} \in S, \forall i, j\}.$$

If $n(S_1 \cup S_2 \cup S_3) = 125\alpha$, then α equals _____.

Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{d} = \vec{a} \times \vec{b}$. If $\vec{c}$ is a vector such that $\vec{a} \cdot \vec{c} = |\vec{c}|$, $|\vec{c} - 2\vec{a}|^2 = 8$ and the angle between $\vec{d}$ and $\vec{c}$ is $\frac{\pi}{4}$, then $|10 - 3\vec{b} \cdot \vec{c}| + |\vec{d} \times \vec{c}|^2$ is equal to _____.

Answer key: JEE Main 2025 · 28 Jan · Shift 1

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Physics

1. B	2. A	3. B	4. D	5. C	6. D	7. C	8. A
9. A	10. C	11. C	12. D	13. C	14. D	15. B	16. C
17. B	18. C	19. B	20. B	21. 0	22. 16	23. 4	24. 11
25. 3							

Chemistry

26. C	27. D	28. C	29. B	30. C	31. B	32. C	33. D
34. D	35. D	36. B	37. C	38. D	39. A	40. C	41. D
42. D	43. 150	44. 93	45. 125	46. 1655	47. 466		

Mathematics

48. C	49. B	50. B	51. B	52. D	53. B	54. A	55. D
56. B	57. D	58. D	59. C	60. D	61. A	62. D	63. A
64. B	65. B	66. C	67. B	68. 5	69. 54	70. 5	71. 1613
72. 6							

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