

JEE MAIN 2024 · QUESTION PAPER

9 Apr 2024 **Shift 2**

87 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	20 Q1 to Q20	10 Q21 to Q30
● Chemistry	18 Q31 to Q48	9 Q49 to Q57
● Mathematics	20 Q58 to Q77	10 Q78 to Q87
In this PDF	87 questions · answer key at the end	

- 1 Set a 3 hour timer and attempt the paper in one sitting, like the real exam.
- 2 In the 2021 to 2024 papers, Section B asked you to answer any 5 numerical questions per subject. Try each one here.
- 3 Check yourself against the answer key at the end. Every question names its chapter, so you can see where marks went.
- 4 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.

prepwise.in/pyqs/paper/2024-04-09-evening · Free, no signup needed to start

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

Q1 Centre of Mass & Linear Momentum

[Step-by-step solution](#) › [prepwisar.in/questions/CApirA9tVl](https://www.prepwisar.in/questions/CApirA9tVl)

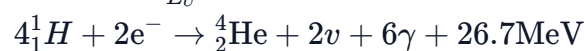
A nucleus at rest disintegrates into two smaller nuclei with their masses in the ratio of 2 : 1. After disintegration they will move:

- (A) in opposite directions with speed in the ratio of 1 : 2 respectively.
- (B) in the same direction with same speed.
- (C) in opposite directions with speed in the ratio of 2 : 1 respectively.
- (D) in opposite directions with the same speed.

Q2 Nuclear Physics

[Step-by-step solution](#) › [prepwisar.in/questions/s3pnDMFLX3](https://www.prepwisar.in/questions/s3pnDMFLX3)

The energy released in the fusion of 2kg of hydrogen deep in the sun is E_H and the energy released in the fission of 2kg of ^{235}U is E_U . The ratio $\frac{E_H}{E_U}$ is approximately: (Consider the fusion reaction as



, energy released in the fission reaction of ^{235}U is 200MeV per fission nucleus and $N_A = 6.023 \times 10^{23}$)

- (A) 7.62
- (B) 25.6
- (C) 9.13
- (D) 15.04

Q3 Atomic Physics

[Step-by-step solution](#) › [prepwisar.in/questions/cp2GbcIOnj](https://www.prepwisar.in/questions/cp2GbcIOnj)

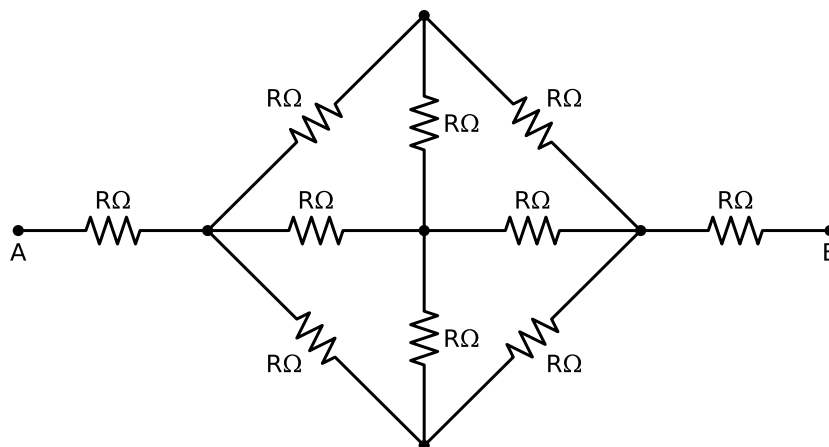
A hydrogen atom in ground state is given an energy of 10.2eV. How many spectral lines will be emitted due to transition of electrons?

- (A) 3
- (B) 6
- (C) 10
- (D) 1

Q4 Current Electricity

[Step-by-step solution](#) › [prepwisar.in/questions/yPtZ49VdUt](https://www.prepwisar.in/questions/yPtZ49VdUt)

The effective resistance between A and B, if resistance of each resistor is R , will be:



- (A) $\frac{8R}{3}$
- (B) $\frac{4R}{3}$
- (C) $\frac{2}{3}R$
- (D) $\frac{5R}{3}$

Q5 Dual Nature of Radiation & Matter

[Step-by-step solution](#) › [prepwisar.in/questions/GCmaLtO6jY](https://www.prepwisar.in/questions/GCmaLtO6jY)

UV light of 4.13eV is incident on a photosensitive metal surface having work function 3.13eV. The maximum kinetic energy of ejected photoelectrons will be:

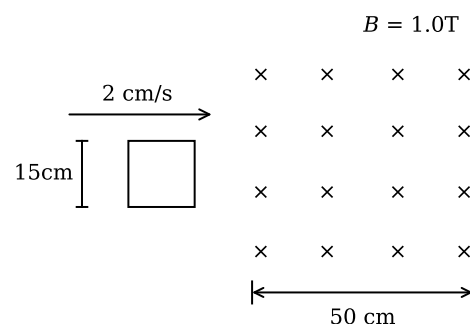
- (A) 4.13 eV
- (B) 1 eV
- (C) 7.26 eV
- (D) 3.13 eV

Attempt this paper online with instant answer checking › [prepwisar.in/pyqs/paper/2024-04-09-evening](https://www.prepwisar.in/pyqs/paper/2024-04-09-evening)

Q6 Electromagnetic Induction[Step-by-step solution](https://www.prepwiser.in/questions/1YOjrt3cKg) > prepwiser.in/questions/1YOjrt3cKg

A square loop of side 15cm being moved towards right at a constant speed of 2cm/s as shown in figure. The front edge enters the 50cm wide magnetic field at $t = 0$. The value of induced emf in the loop at $t = 10$ s will be:

- (A) zero (B) 4.5 mV (C) 0.3 mV (D) 3 mV

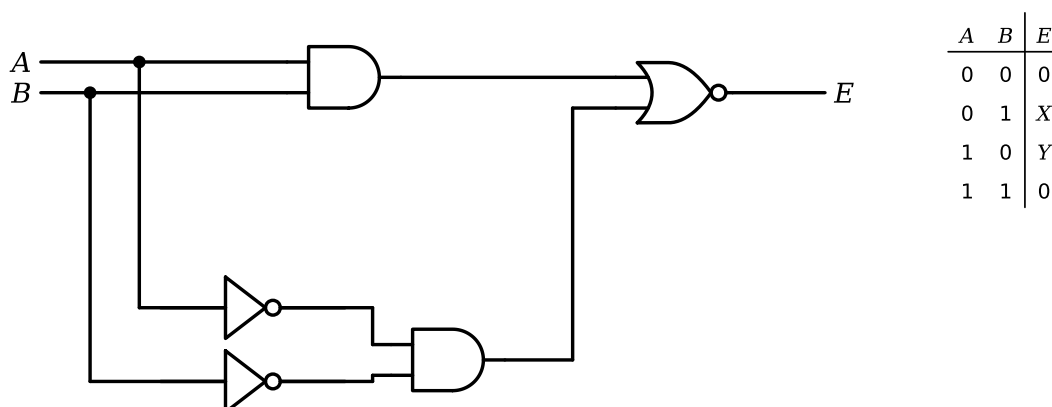
**Q7** Electromagnetic Waves[Step-by-step solution](https://www.prepwiser.in/questions/VjvEc6Nak) > prepwiser.in/questions/VjvEc6Nak

The magnetic field in a plane electromagnetic wave is

$$B_y = (3.5 \times 10^{-7}) \sin (1.5 \times 10^3 x + 0.5 \times 10^{11} t) \text{ T}$$

. The corresponding electric field will be:

- (A) $E_z = 105 \sin (1.5 \times 10^3 x + 0.5 \times 10^{11} t) \text{ Vm}^{-1}$
 (B) $E_y = 10.5 \sin (1.5 \times 10^3 x + 0.5 \times 10^{11} t) \text{ Vm}^{-1}$
 (C) $E_y = 1.17 \sin (1.5 \times 10^3 x + 0.5 \times 10^{11} t) \text{ Vm}^{-1}$
 (D) $E_z = 1.17 \sin (1.5 \times 10^3 x + 0.5 \times 10^{11} t) \text{ Vm}^{-1}$

Q8 Semiconductors & Electronic Devices[Step-by-step solution](https://www.prepwiser.in/questions/WBQ4AaTee_) > prepwiser.in/questions/WBQ4AaTee_

In the truth table of the above circuit the value of X and Y are:

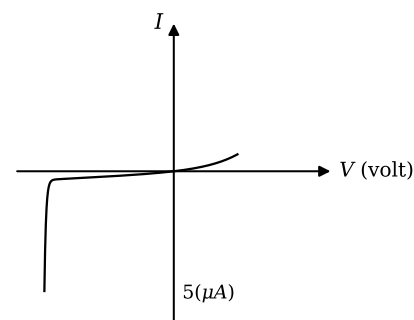
- (A) 1, 1 (B) 0, 1 (C) 1, 0 (D) 0, 0

Q9 Semiconductors & Electronic Devices[Step-by-step solution](https://www.prepwiser.in/questions/4qh0RTBX1w) > prepwiser.in/questions/4qh0RTBX1w

The I - V characteristics of an electronic device shown in the figure.

The device is:

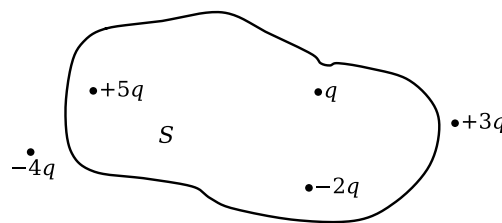
- (A) a solar cell
 (B) a transistor which can be used as an amplifier
 (C) a diode which can be used as a rectifier
 (D) a zener diode which can be used as a voltage regulator



Q10 Electrostatics I: Charges, Field & Gauss's Law[Step-by-step solution > prepwiser.in/questions/U1kDECoInN](https://www.prepwiser.in/questions/U1kDECoInN)

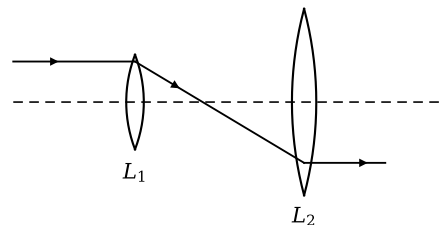
Five charges $+q$, $+5q$, $-2q$, $+3q$ and $-4q$ are situated as shown in the figure. The electric flux due to this configuration through the surface S is:

- (A) $\frac{q}{\epsilon_0}$ (B) $\frac{3q}{\epsilon_0}$ (C) $\frac{5q}{\epsilon_0}$ (D) $\frac{4q}{\epsilon_0}$

**Q11** Ray Optics[Step-by-step solution > prepwiser.in/questions/adAD1e7i3X](https://www.prepwiser.in/questions/adAD1e7i3X)

The following figure represents two biconvex lenses L_1 and L_2 having focal length 10cm and 15cm respectively. The distance between L_1 & L_2 is:

- (A) 25 cm (B) 35 cm (C) 10 cm (D) 15 cm

**Q12** Gravitation[Step-by-step solution > prepwiser.in/questions/_E-q-g_U92](https://www.prepwiser.in/questions/_E-q-g_U92)

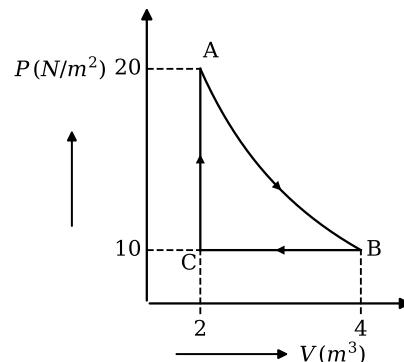
A satellite of 10^3 kg mass is revolving in circular orbit of radius $2R$. If $\frac{10^4 R}{6} \text{ J}$ energy is supplied to the satellite, it would revolve in a new circular orbit of radius (use $g = 10 \text{ m/s}^2$, $R = \text{radius of earth}$)

- (A) 4 R (B) 6 R (C) 2.5 R (D) 3 R

Q13 Thermodynamics[Step-by-step solution > prepwiser.in/questions/DI3HK_HjFW](https://www.prepwiser.in/questions/DI3HK_HjFW)

A real gas within a closed chamber at 27°C undergoes the cyclic process as shown in figure. The gas obeys $PV^3 = RT$ equation for the path A to B . The net work done in the complete cycle is (assuming $R = 8 \text{ J/molK}$):

- (A) -20 J (B) 205 J (C) 225 J (D) 20 J

**Q14** Kinetic Theory of Gases[Step-by-step solution > prepwiser.in/questions/c4mrtitNyY](https://www.prepwiser.in/questions/c4mrtitNyY)

The temperature of a gas is -78°C and the average translational kinetic energy of its molecules is K . The temperature at which the average translational kinetic energy of the molecules of the same gas becomes $2K$ is:

- (A) -78°C (B) 127°C (C) -39°C (D) 117°C

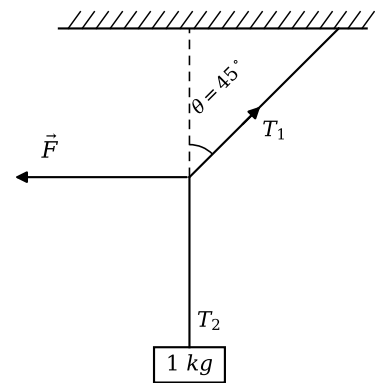
Attempt this paper online with instant answer checking > [prepwiser.in/pyqs/paper/2024-04-09-evening](https://www.prepwiser.in/pyqs/paper/2024-04-09-evening)

Q15 Newton's Laws of Motion[Step-by-step solution](https://www.prepwisar.in/questions/ymTdsIHMDA)

A 1kg mass is suspended from the ceiling by a rope of length 4m. A horizontal force ' F ' is applied at the mid point of the rope so that the rope makes an angle of 45° with respect to the vertical axis as shown in figure. The magnitude of F is:

(Assume that the system is in equilibrium and $g = 10\text{m/s}^2$)

- (A) 1 N (B) 10 N (C) $\frac{10}{\sqrt{2}}\text{N}$ (D) $\frac{1}{10 \times \sqrt{2}}\text{N}$

**Q16** Moving Charges & Magnetism[Step-by-step solution](https://www.prepwisar.in/questions/dnmB41eAIr)

A proton and a deuteron ($q = +e, m = 2.0u$) having same kinetic energies enter a region of uniform magnetic field $\vec{B}$, moving perpendicular to $\vec{B}$. The ratio of the radius r_d of deuteron path to the radius r_p of the proton path is:

- (A) 1 : 2 (B) 1 : 1 (C) $\sqrt{2} : 1$ (D) 1 : $\sqrt{2}$

Q17 Rectilinear Motion[Step-by-step solution](https://www.prepwisar.in/questions/m3jaKcSZsV)

Two cars are travelling towards each other at speed of 20ms^{-1} each. When the cars are 300m apart, both the drivers apply brakes and the cars retard at the rate of 2ms^{-2} . The distance between them when they come to rest is:

- (A) 25 m (B) 100 m (C) 50 m (D) 200 m

Q18 Surface Tension[Step-by-step solution](https://www.prepwisar.in/questions/xQPhrMxVeQ)

The excess pressure inside a soap bubble is thrice the excess pressure inside a second soap bubble. The ratio between the volume of the first and the second bubble is:

- (A) 1 : 9 (B) 1 : 27 (C) 1 : 81 (D) 1 : 3

Q19 Fluid Mechanics[Step-by-step solution](https://www.prepwisar.in/questions/1-e5-Mh2Pq)

A spherical ball of radius $1 \times 10^{-4}\text{m}$ and density 10^5kg/m^3 falls freely under gravity through a distance h before entering a tank of water, If after entering in water the velocity of the ball does not change, then the value of h is approximately:

(The coefficient of viscosity of water is $9.8 \times 10^{-6}\text{Ns/m}^2$)

- (A) 2518 m (B) 2396 m (C) 2249 m (D) 2296 m

Q20 Units, Dimensions & Errors[Step-by-step solution](https://www.prepwisar.in/questions/FjzxoVpkRy)

The de-Broglie wavelength associated with a particle of mass m and energy E is $h/\sqrt{2mE}$. The dimensional formula for Planck's constant is:

- (A) $[M^2L^2T^{-2}]$ (B) $[ML^{-1}T^{-2}]$ (C) $[ML^2T^{-1}]$ (D) $[MLT^{-2}]$

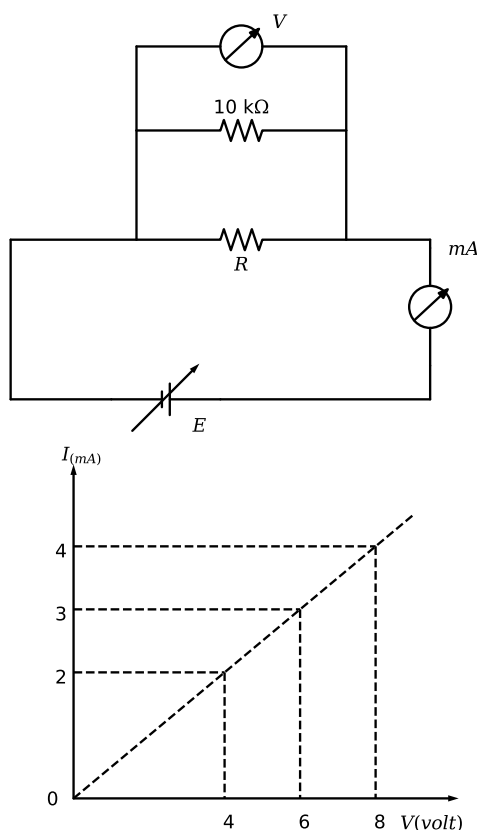
Physics Section B · Numerical value

Q21 to Q30

Q21 Alternating Current **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/IyYUTROWpF)

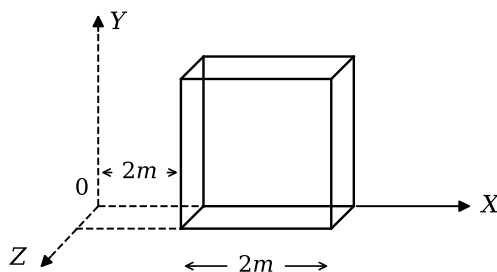
A capacitor of reactance $4\sqrt{3}\Omega$ and a resistor of resistance 4Ω are connected in series with an ac source of peak value $8\sqrt{2}\text{V}$. The power dissipation in the circuit is _____ W.

To determine the resistance (R) of a wire, a circuit is designed below. The V - I characteristic curve for this circuit is plotted for the voltmeter and the ammeter readings as shown in figure. The value of R is _____ Ω .



At room temperature (27°C), the resistance of a heating element is 50Ω . The temperature coefficient of the material is $2.4 \times 10^{-4}^\circ\text{C}^{-1}$. The temperature of the element, when its resistance is 62Ω , is _____ $^\circ\text{C}$.

An electric field $\vec{E} = (2x\hat{i})\text{NC}^{-1}$ exists in space. A cube of side 2m is placed in the space as per figure given below. The electric flux through the cube is _____ Nm^2/C .



A straight magnetic strip has a magnetic moment of 44Am^2 . If the strip is bent in a semicircular shape, its magnetic moment will be _____ Am^2 .

(given $\pi = \frac{22}{7}$)

Q26 Rotational Motion **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/_1UdCq5C8B](https://www.prepwisar.in/questions/_1UdCq5C8B)

A circular disc reaches from top to bottom of an inclined plane of length l . When it slips down the plane, it takes ts . When it rolls down the plane then it takes $\left(\frac{\alpha}{2}\right)^{1/2}ts$, where α is _____.

Q27 Simple Harmonic Motion **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/ZqeakpjqQn](https://www.prepwisar.in/questions/ZqeakpjqQn)

A particle of mass 0.50kg executes simple harmonic motion under force $F = -50(\text{Nm}^{-1})x$. The time period of oscillation is $\frac{x}{35}s$. The value of x is _____.

(Given $\pi = \frac{22}{7}$)

Q28 Wave Optics **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/3xIJZ0_XwF](https://www.prepwisar.in/questions/3xIJZ0_XwF)

Monochromatic light of wavelength 500nm is used in Young's double slit experiment. An interference pattern is obtained on a screen. When one of the slits is covered with a very thin glass plate (refractive index = 1.5), the central maximum is shifted to a position previously occupied by the 4th bright fringe. The thickness of the glass-plate is _____ μm .

Q29 Work, Energy & Power **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/3VfR2r55Yj](https://www.prepwisar.in/questions/3VfR2r55Yj)

A force $(3x^2 + 2x - 5)\text{N}$ displaces a body from $x = 2\text{m}$ to $x = 4\text{m}$. Work done by this force is _____ J.

Q30 Vectors **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/xINPCJfIXr](https://www.prepwisar.in/questions/xINPCJfIXr)

The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to $\vec{A}$ and its magnitude is half that of $\vec{B}$. The angle between vectors $\vec{A}$ and $\vec{B}$ is _____°.

Chemistry Section A · Multiple choice

Q31 to Q48

Q31 Practical Organic Chemistry[Step-by-step solution](#) > [prepwisar.in/questions/CuEwmNmVPN](https://www.prepwisar.in/questions/CuEwmNmVPN)

Which of the following compounds will give silver mirror with ammoniacal silver nitrate?

- A. Formic acid
- B. Formaldehyde
- C. Benzaldehyde
- D. Acetone

Choose the correct answer from the options given below:

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

Q32 Carbohydrates & Biomolecules[Step-by-step solution](#) > [prepwisar.in/questions/YvWKsmVJAM](https://www.prepwisar.in/questions/YvWKsmVJAM)

The incorrect statement about Glucose is:

- (A) Glucose remains in multiple isomeric form in its aqueous solution
- (B) Glucose is soluble in water because of having aldehyde functional group
- (C) Glucose is an aldohexose
- (D) Glucose is one of the monomer unit in sucrose

Q33 Chemical Bonding & Molecular Structure[Step-by-step solution](#) > [prepwisar.in/questions/NS7G_TlStT](https://www.prepwisar.in/questions/NS7G_TlStT)

The correct increasing order for bond angles among BF_3 , PF_3 and ClF_3 is:

- (A) $\text{BF}_3 = \text{PF}_3 < \text{ClF}_3$ (B) $\text{BF}_3 < \text{PF}_3 < \text{ClF}_3$ (C) $\text{ClF}_3 < \text{PF}_3 < \text{BF}_3$ (D) $\text{PF}_3 < \text{BF}_3 < \text{ClF}_3$

The coordination environment of Ca^{2+} ion in its complex with EDTA^{4-} is:

- (A) trigonal prismatic (B) octahedral (C) square planar (D) tetrahedral

The electronic configuration of Einsteinium is:

(Given atomic number of Einsteinium = 99)

- (A) $[\text{Rn}]5f^{13}6d^07s^2$ (B) $[\text{Rn}]5f^{12}6d^07s^2$ (C) $[\text{Rn}]5f^{11}6d^07s^2$ (D) $[\text{Rn}]5f^{10}6d^07s^2$

Give below are two statements:

Statement I : The higher oxidation states are more stable down the group among transition elements unlike p-block elements.

Statement II : Copper can not liberate hydrogen from weak acids.

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

Match List I with List II

	LIST I (Cell)		LIST II (Use/Property/Reaction)
A.	Leclanche cell	I.	Converts energy of combustion into electrical energy
B.	Ni - Cd cell	II.	Does not involve any ion in solution and is used in hearing aids
C.	Fuel cell	III.	Rechargeable
D.	Mercury cell	IV.	Reaction at anode $\text{Zn} \rightarrow \text{Zn}^{2+} + 2e^-$

Choose the correct answer from the options given below:

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

Which out of the following is a correct equation to show change in molar conductivity with respect to concentration for a weak electrolyte, if the symbols carry their usual meaning:

- (A) $\Lambda_m - \Lambda_m^\circ + AC^{\frac{1}{2}} = 0$ (B) $\Lambda_m^2 C + K_a \Lambda_m^{\circ 2} - K_a \Lambda_m \Lambda_m^\circ = 0$
(C) $\Lambda_m - \Lambda_m^\circ - AC^{\frac{1}{2}} = 0$ (D) $\Lambda_m^2 C - K_a \Lambda_m^{\circ 2} + K_a \Lambda_m \Lambda_m^\circ = 0$

The incorrect statement regarding ethyne is

- (A) The carbon - carbon bonds in ethyne is weaker than that in ethene
(B) Both carbons are sp hybridised
(C) The C - C bonds in ethyne is shorter than that in ethene
(D) Ethyne is linear

Q40 Ionic Equilibrium[Step-by-step solution > prepwiser.in/questions/PgMmtknkpn](https://www.prepwiser.in/questions/PgMmtknkpn)

For a sparingly soluble salt AB_2 , the equilibrium concentrations of A^{2+} ions and B^- ions are $1.2 \times 10^{-4}M$ and $0.24 \times 10^{-3}M$, respectively. The solubility product of AB_2 is:

- (A) 0.069×10^{-12} (B) 0.276×10^{-12} (C) 6.91×10^{-12} (D) 27.65×10^{-12}

Q41 Atomic Structure[Step-by-step solution > prepwiser.in/questions/sqDLJvBVw3](https://www.prepwiser.in/questions/sqDLJvBVw3)

Match List I with List II

	LIST I (Element)		LIST II (Electronic Configuration)
A.	N	I.	$[Ar]3d^{10}4s^24p^5$
B.	S	II.	$[Ne]3s^23p^4$
C.	Br	III.	$[He]2s^22p^3$
D.	Kr	IV.	$[Ar]3d^{10}4s^24p^6$

Choose the correct answer from the options given below:

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

Q42 p-Block Elements: Part I (Group 13 & 14)[Step-by-step solution > prepwiser.in/questions/J4yuFDqOlz](https://www.prepwiser.in/questions/J4yuFDqOlz)

Match List I with List II

	LIST I		LIST II
A.	Melting Point [K]	I.	$Tl > In > Ga > Al > B$
B.	Ionic Radius [M^{+3}/pm]	II.	$B > Tl > Al \approx Ga > In$
C.	$\Delta_f H_f [kJmol^{-1}]$	III.	$Tl > In > Al > Ga > B$
D.	Atomic Radius [pm]	IV.	$B > Al > Tl > In > Ga$

Choose the correct answer from the options given below:

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

Q43 Mole Concept & Stoichiometry[Step-by-step solution > prepwiser.in/questions/1sPh6AWrwy](https://www.prepwiser.in/questions/1sPh6AWrwy)

The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency ' A ' $\times 10^{12}$ hertz and that has a radiant intensity in that direction of $\frac{1}{B}$, watt per steradian. ' A ' and ' B ' are respectively

- (A) 450 and 683 (B) 540 and $\frac{1}{683}$ (C) 540 and 683 (D) 450 and $\frac{1}{683}$

Q44 General Organic Chemistry (GOC)[Step-by-step solution > prepwiser.in/questions/6rDx8b2-E0](https://www.prepwiser.in/questions/6rDx8b2-E0)

The correct stability order of the following resonance structures of $CH_3 - CH = CH - CHO$ is

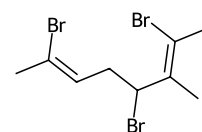


- (A) $II > III > I$ (B) $II > I > III$ (C) $III > II > I$ (D) $I > II > III$

Q45 General Organic Chemistry (GOC)[Step-by-step solution > prepwiser.in/questions/_L8meRJ8W8](https://www.prepwiser.in/questions/_L8meRJ8W8)

Total number of stereo isomers possible for the given structure:

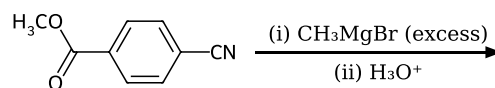
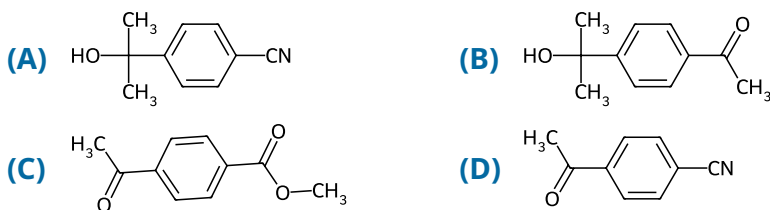
- (A) 4 (B) 2 (C) 8 (D) 3



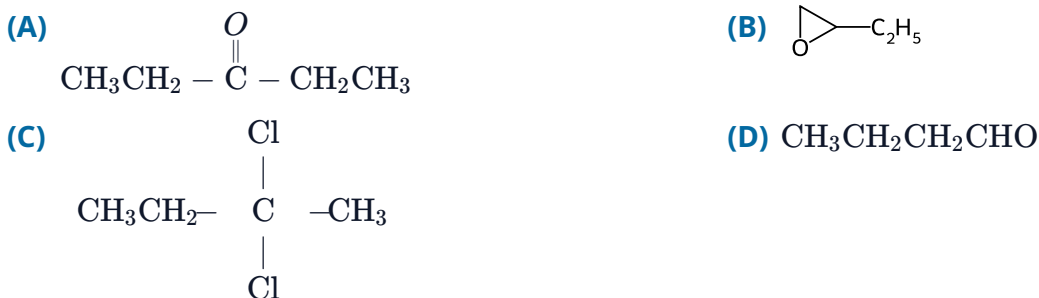
Attempt this paper online with instant answer checking > [prepwiser.in/pyqs/paper/2024-04-09-evening](https://www.prepwiser.in/pyqs/paper/2024-04-09-evening)

Q46 Halogen Derivatives: Haloalkanes & Haloarenes[Step-by-step solution > prepwisar.in/questions/IQdHeLF-Wb](https://www.prepwisar.in/questions/IQdHeLF-Wb)

Major product of the following reaction is

**Q47** Practical Organic Chemistry[Step-by-step solution > prepwisar.in/questions/MRC_y3NHmb](https://www.prepwisar.in/questions/MRC_y3NHmb)

Which of the following compound can give positive iodoform test when treated with aqueous KOH solution followed by potassium hypoiodite.

**Q48** Practical Organic Chemistry[Step-by-step solution > prepwisar.in/questions/YGix8JV-0B](https://www.prepwisar.in/questions/YGix8JV-0B)

Match List I with List II

	LIST I (Test)		LIST II (Observation)
A.	Br_2 water test	I.	Yellow orange or orange red precipitate formed
B.	Ceric ammonium nitrate test	II.	Reddish orange colour disappears
C.	Ferric chloride test	III.	Red colour appears
D.	2, 4 - DNP test	IV.	Blue, Green, Violet or Red colour appear

Choose the correct answer from the options given below:

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

Chemistry Section B · Numerical value

Q49 to Q57

Q49 Chemical Bonding & Molecular Structure **NUMERICAL**[Step-by-step solution > prepwisar.in/questions/UeNIR8LK2G](https://www.prepwisar.in/questions/UeNIR8LK2G)Total number of electrons present in (π^*) molecular orbitals of O_2 , O_2^+ and O_2^- is _____.**Q50** Chemical Kinetics **NUMERICAL**[Step-by-step solution > prepwisar.in/questions/VTogoHwfwg](https://www.prepwisar.in/questions/VTogoHwfwg)

Consider the following first order gas phase reaction at constant temperature



If the total pressure of the gases is found to be 200 torr after 23 sec. and 300 torr upon the complete decomposition of A after a very long time, then the rate constant of the given reaction is _____ $\times 10^{-2} \text{s}^{-1}$ (nearest integer)

[Given: $\log_{10}(2) = 0.301$]Attempt this paper online with instant answer checking > [prepwisar.in/pyqs/paper/2024-04-09-evening](https://www.prepwisar.in/pyqs/paper/2024-04-09-evening)

Consider the following test for a group-IV cation.



The spin-only magnetic moment value of the metal complex C is _____ BM (Nearest integer)

A transition metal 'M' among Sc, Ti, V, Cr, Mn and Fe has the highest second ionisation enthalpy.

The spin-only magnetic moment value of M^+ ion is _____ BM (Near integer)

(Given atomic number

Sc : 21, Ti : 22, V : 23, Cr : 24, Mn : 25, Fe : 26

)

Number of oxygen atoms present in chemical formula of fuming sulphuric acid is _____.

The vapor pressure of pure benzene and methyl benzene at 27°C is given as 80 Torr and 24 Torr, respectively. The mole fraction of methyl benzene in vapor phase, in equilibrium with an equimolar mixture of those two liquids (ideal solution) at the same temperature is _____ $\times 10^{-2}$ (nearest integer)

Based on Heisenberg's uncertainty principle, the uncertainty in the velocity of the electron to be found within an atomic nucleus of diameter 10^{-15}m is _____ $\times 10^9\text{ms}^{-1}$ (nearest integer)

[Given : mass of electron = $9.1 \times 10^{-31}\text{kg}$, Plank's constant (h) = $6.626 \times 10^{-34}\text{Js}$] (Value of $\pi = 3.14$)

When $\Delta H_{\text{vap}} = 30\text{kJ/mol}$ and

$$\Delta S_{\text{vap}} = 75\text{Jmol}^{-1}\text{K}^{-1}$$

, then the temperature of vapour, at one atmosphere is _____ K.

Number of compounds from the following which cannot undergo Friedel-Crafts reactions is: _____

toluene, nitrobenzene, xylene, cumene, aniline, chlorobenzene, *m*-nitroaniline, *m*-dinitrobenzene

Q58 Three Dimensional Geometry

[Step-by-step solution](#) · [prepwisar.in/questions/nNiICGoa7m](https://www.prepwisar.in/questions/nNiICGoa7m)

Consider the line L passing through the points $(1, 2, 3)$ and $(2, 3, 5)$. The distance of the point $(\frac{11}{3}, \frac{11}{3}, \frac{19}{3})$ from the line L along the line $\frac{3x-11}{2} = \frac{3y-11}{1} = \frac{3z-19}{2}$ is equal to

- (A) 6 (B) 3 (C) 5 (D) 4

Q59 Binomial Theorem

[Step-by-step solution](#) · [prepwisar.in/questions/8LIX7XJ78r](https://www.prepwisar.in/questions/8LIX7XJ78r)

The sum of the coefficient of $x^{2/3}$ and $x^{-2/5}$ in the binomial expansion of $(x^{2/3} + \frac{1}{2}x^{-2/5})^9$ is

- (A) 19/4 (B) 69/16 (C) 63/16 (D) 21/4

Q60 Complex Numbers

[Step-by-step solution](#) · [prepwisar.in/questions/ZLflz51AXu](https://www.prepwisar.in/questions/ZLflz51AXu)

Let z be a complex number such that the real part of $\frac{z-2i}{z+2i}$ is zero. Then, the maximum value of $|z - (6 + 8i)|$ is equal to

- (A) 8 (B) 12 (C) 10 (D) ∞

Q61 Definite Integration

[Step-by-step solution](#) · [prepwisar.in/questions/otHB9cB-RW](https://www.prepwisar.in/questions/otHB9cB-RW)

The integral

$$\int_{1/4}^{3/4} \cos \left(2 \cot^{-1} \sqrt{\frac{1-x}{1+x}} \right) dx$$

is equal to

- (A) $-1/2$ (B) $-1/4$ (C) $1/4$ (D) $1/2$

Q62 Limits

[Step-by-step solution](#) · [prepwisar.in/questions/zUJKQ8gMnP](https://www.prepwisar.in/questions/zUJKQ8gMnP)

$$\lim_{x \rightarrow \frac{\pi}{2}} \left(\frac{\int_{x^3}^{(\pi/2)^3} (\sin(2t^{1/3}) + \cos(t^{1/3})) dt}{(x - \frac{\pi}{2})^2} \right)$$

is equal to

- (A) $\frac{3\pi^2}{2}$ (B) $\frac{9\pi^2}{8}$ (C) $\frac{5\pi^2}{9}$ (D) $\frac{11\pi^2}{10}$

Q63 Definite Integration

[Step-by-step solution](#) · [prepwisar.in/questions/pbsf8SpUjq](https://www.prepwisar.in/questions/pbsf8SpUjq)

The value of the integral $\int_{-1}^2 \log_e (x + \sqrt{x^2 + 1}) dx$ is

- (A) $\sqrt{5} - \sqrt{2} + \log_e \left(\frac{7 + 4\sqrt{5}}{1 + \sqrt{2}} \right)$ (B) $\sqrt{2} - \sqrt{5} + \log_e \left(\frac{7 + 4\sqrt{5}}{1 + \sqrt{2}} \right)$
 (C) $\sqrt{5} - \sqrt{2} + \log_e \left(\frac{9 + 4\sqrt{5}}{1 + \sqrt{2}} \right)$ (D) $\sqrt{2} - \sqrt{5} + \log_e \left(\frac{9 + 4\sqrt{5}}{1 + \sqrt{2}} \right)$

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Q64 Definite Integration[Step-by-step solution](#) › [prepwiser.in/questions/uU93L8Hq7p](https://www.prepwiser.in/questions/uU93L8Hq7p)

Let

$$\int_0^x \sqrt{1 - (y'(t))^2} dt = \int_0^x y(t) dt, 0 \leq x \leq 3, y \geq 0, y(0) = 0$$

. Then at $x = 2$, $y'' + y + 1$ is equal to

- (A) $\sqrt{2}$ (B) 2 (C) $1/2$ (D) 1

Q65 Differentiation[Step-by-step solution](#) › [prepwiser.in/questions/ad0_n6HEvn](https://www.prepwiser.in/questions/ad0_n6HEvn)If $\log_e y = 3 \sin^{-1} x$, then $(1 - x^2)y'' - xy'$ at $x = \frac{1}{2}$ is equal to

- (A) $9e^{\pi/2}$ (B) $9e^{\pi/6}$ (C) $3e^{\pi/2}$ (D) $3e^{\pi/6}$

Q66 Trigonometric Ratios & Identities[Step-by-step solution](#) › [prepwiser.in/questions/kVlg0d6-z9](https://www.prepwiser.in/questions/kVlg0d6-z9)Let the range of the function $f(x) = \frac{1}{2 + \sin 3x + \cos 3x}$, $x \in \mathbb{R}$ be $[a, b]$. If α and β are respectively the A.M. and the G.M. of a and b , then $\frac{\alpha}{\beta}$ is equal to

- (A) π (B) $\sqrt{\pi}$ (C) $\sqrt{2}$ (D) 2

Q67 Hyperbola[Step-by-step solution](#) › [prepwiser.in/questions/IJQq8iaGAN](https://www.prepwiser.in/questions/IJQq8iaGAN)Let the foci of a hyperbola H coincide with the foci of the ellipse $E : \frac{(x-1)^2}{100} + \frac{(y-1)^2}{75} = 1$ and the eccentricity of the hyperbola H be the reciprocal of the eccentricity of the ellipse E . If the length of the transverse axis of H is α and the length of its conjugate axis is β , then $3\alpha^2 + 2\beta^2$ is equal to

- (A) 225 (B) 237 (C) 242 (D) 205

Q68 Limits[Step-by-step solution](#) › [prepwiser.in/questions/8i13wcj5Gt](https://www.prepwiser.in/questions/8i13wcj5Gt) $\lim_{x \rightarrow 0} \frac{e - (1+2x)^{\frac{1}{2x}}}{x}$ is equal to

- (A) $-\frac{2}{e}$ (B) $e - e^2$ (C) 0 (D) e

Q69 Matrices[Step-by-step solution](#) › [prepwiser.in/questions/rGARex-8JU](https://www.prepwiser.in/questions/rGARex-8JU)

Let

$$B = \begin{bmatrix} 1 & 3 \\ 1 & 5 \end{bmatrix}$$

and A be a 2×2 matrix such that $AB^{-1} = A^{-1}$. If $BCB^{-1} = A$ and $C^4 + \alpha C^2 + \beta I = O$, then $2\beta - \alpha$ is equal to

- (A) 16 (B) 10 (C) 8 (D) 2

Q70 Probability: Basic[Step-by-step solution](#) › [prepwiser.in/questions/ijPHxzphup](https://www.prepwiser.in/questions/ijPHxzphup)If an unbiased dice is rolled thrice, then the probability of getting a greater number in the i^{th} roll than the number obtained in the $(i-1)^{\text{th}}$ roll, $i = 2, 3$, is equal to

- (A) $5/54$ (B) $2/54$ (C) $1/54$ (D) $3/54$

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Q71 Sequences & Series[Step-by-step solution](https://www.prepwiser.in/questions/vr0xuCV4-0) › prepwiser.in/questions/vr0xuCV4-0

Let $\alpha, \beta; \alpha > \beta$, be the roots of the equation $x^2 - \sqrt{2}x - \sqrt{3} = 0$. Let $P_n = \alpha^n - \beta^n, n \in \mathbb{N}$. Then

$$(11\sqrt{3} - 10\sqrt{2})P_{10} + (11\sqrt{2} + 10)P_{11} - 11P_{12}$$

is equal to

- (A) $10\sqrt{3}P_9$ (B) $11\sqrt{3}P_9$ (C) $11\sqrt{2}P_9$ (D) $10\sqrt{2}P_9$

Q72 Sequences & Series[Step-by-step solution](https://www.prepwiser.in/questions/kdsuzExt5A) › prepwiser.in/questions/kdsuzExt5A

Let $a, ar, ar^2, \dots$ be an infinite G.P. If $\sum_{n=0}^{\infty} ar^n = 57$ and $\sum_{n=0}^{\infty} a^3 r^{3n} = 9747$, then $a + 18r$ is equal to

- (A) 27 (B) 38 (C) 31 (D) 46

Q73 Statistics[Step-by-step solution](https://www.prepwiser.in/questions/Gpy_3MUdxv) › prepwiser.in/questions/Gpy_3MUdxv

If the variance of the frequency distribution

x	c	$2c$	$3c$	$4c$	$5c$	$6c$
f	2	1	1	1	1	1

is 160, then the value of $c \in \mathbb{N}$ is

- (A) 5 (B) 8 (C) 6 (D) 7

Q74 Vectors[Step-by-step solution](https://www.prepwiser.in/questions/MIVVxod0_f) › prepwiser.in/questions/MIVVxod0_f

Between the following two statements:

Statement I : Let $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - \hat{k}$. Then the vector $\vec{r}$ satisfying $\vec{a} \times \vec{r} = \vec{a} \times \vec{b}$ and $\vec{a} \cdot \vec{r} = 0$ is of magnitude $\sqrt{10}$.

Statement II : In a triangle ABC , $\cos 2A + \cos 2B + \cos 2C \geq -\frac{3}{2}$.

- (A) Both Statement I and Statement II are correct.
 (B) Both Statement I and Statement II are incorrect.
 (C) Statement I is correct but Statement II is incorrect.
 (D) Statement I is incorrect but Statement II is correct.

Q75 Vectors[Step-by-step solution](https://www.prepwiser.in/questions/FbU6Wv1KXu) › prepwiser.in/questions/FbU6Wv1KXu

Let

$$\vec{a} = 2\hat{i} + \alpha\hat{j} + \hat{k}, \vec{b} = -\hat{i} + \hat{k}, \vec{c} = \beta\hat{j} - \hat{k}$$

, where α and β are integers and $\alpha\beta = -6$. Let the values of the ordered pair (α, β) , for which the area of the parallelogram of diagonals $\vec{a} + \vec{b}$ and $\vec{b} + \vec{c}$ is $\frac{\sqrt{21}}{2}$, be (α_1, β_1) and (α_2, β_2) . Then $\alpha_1^2 + \beta_1^2 - \alpha_2\beta_2$ is equal to

- (A) 21 (B) 24 (C) 19 (D) 17

Q76 Area Under Curves[Step-by-step solution](https://www.prepwiser.in/questions/nIqq_bG7Op) › prepwiser.in/questions/nIqq_bG7Op

The area (in square units) of the region enclosed by the ellipse $x^2 + 3y^2 = 18$ in the first quadrant below the line $y = x$ is

- (A) $\sqrt{3}\pi + 1$ (B) $\sqrt{3}\pi$ (C) $\sqrt{3}\pi - \frac{3}{4}$ (D) $\sqrt{3}\pi + \frac{3}{4}$

Two vertices of a triangle ABC are $A(3, -1)$ and $B(-2, 3)$, and its orthocentre is $P(1, 1)$. If the coordinates of the point C are (α, β) and the centre of the circle circumscribing the triangle PAB is (h, k) , then the value of $(\alpha + \beta) + 2(h + k)$ equals

(A) 81

(B) 15

(C) 51

(D) 5

Mathematics Section B · Numerical value

Q78 to Q87

Q78 Three Dimensional Geometry NUMERICAL

Step-by-step solution › prepwiser.in/questions/-_VVRQ7rgd

The square of the distance of the image of the point $(6, 1, 5)$ in the line $\frac{x-1}{3} = \frac{y}{2} = \frac{z-2}{4}$, from the origin is _____.

Q79 Applications of Derivatives NUMERICAL

Step-by-step solution › prepwiser.in/questions/zF7kE5o6o5

Let the set of all values of p , for which $f(x) = (p^2 - 6p + 8)(\sin^2 2x - \cos^2 2x) + 2(2 - p)x + 7$ does not have any critical point, be the interval (a, b) . Then $16ab$ is equal to _____.

Q80 Differential Equations NUMERICAL

Step-by-step solution › prepwiser.in/questions/6gEgw9CCua

For a differentiable function $f : \mathbb{R} \rightarrow \mathbb{R}$, suppose $f'(x) = 3f(x) + \alpha$, where $\alpha \in \mathbb{R}$, $f(0) = 1$ and $\lim_{x \rightarrow -\infty} f(x) = 7$. Then $9f(-\log_e 3)$ is equal to _____.

Q81 Relations & Functions (Basic) NUMERICAL

Step-by-step solution › prepwiser.in/questions/Z_kRmhNcht

Let $A = \{(x, y) : 2x + 3y = 23, x, y \in \mathbb{N}\}$ and $B = \{x : (x, y) \in A\}$. Then the number of one-one functions from A to B is equal to _____.

Q82 Inverse Trigonometric Functions NUMERICAL

Step-by-step solution › prepwiser.in/questions/qJb2IZSTBQ

Let the inverse trigonometric functions take principal values. The number of real solutions of the equation $2\sin^{-1} x + 3\cos^{-1} x = \frac{2\pi}{5}$, is _____.

Q83 Determinants NUMERICAL

Step-by-step solution › prepwiser.in/questions/IuGmC8xtK1

Consider the matrices:

$$A = \begin{bmatrix} 2 & -5 \\ 3 & m \end{bmatrix}, B = \begin{bmatrix} 20 \\ m \end{bmatrix}$$

and

$$X = \begin{bmatrix} x \\ y \end{bmatrix}$$

. Let the set of all m , for which the system of equations $AX = B$ has a negative solution (i.e., $x < 0$ and $y < 0$), be the interval (a, b) . Then $8 \int_a^b |A| dm$ is equal to _____.

Q84 Parabola NUMERICAL

Step-by-step solution › prepwiser.in/questions/11jO3r2ccl

Let A, B and C be three points on the parabola $y^2 = 6x$ and let the line segment AB meet the line L through C parallel to the x -axis at the point D . Let M and N respectively be the feet of the perpendiculars from A and B on L . Then $\left(\frac{AM \cdot BN}{CD}\right)^2$ is equal to _____.

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Q85 Parabola **NUMERICAL**

[Step-by-step solution](#) › prepwiser.in/questions/r0MrfPWa4f

Consider the circle $C : x^2 + y^2 = 4$ and the parabola $P : y^2 = 8x$. If the set of all values of α , for which three chords of the circle C on three distinct lines passing through the point $(\alpha, 0)$ are bisected by the parabola P is the interval (p, q) , then $(2q - p)^2$ is equal to _____.

Q86 Permutations & Combinations **NUMERICAL**

[Step-by-step solution](#) › prepwiser.in/questions/qG2OF9x8z4

The number of integers, between 100 and 1000 having the sum of their digits equals to 14, is _____.

Q87 Sequences & Series **NUMERICAL**

[Step-by-step solution](#) › prepwiser.in/questions/fCGxJU5S1F

If

$$\left(\frac{1}{\alpha+1} + \frac{1}{\alpha+2} + \dots + \frac{1}{\alpha+1012} \right) - \left(\frac{1}{2 \cdot 1} + \frac{1}{4 \cdot 3} + \frac{1}{6 \cdot 5} + \dots + \frac{1}{2024 \cdot 2023} \right) = \frac{1}{2024}$$
, then α is equal to _____.

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Physics

1. A	2. A	3. D	4. A	5. B	6. A	7. A	8. A
9. D	10. D	11. A	12. B	13. B	14. D	15. B	16. C
17. B	18. B	19. A	20. C	21. 4	22. 2500	23. 1027	24. 16
25. 28	26. 3	27. 22	28. 4	29. 58	30. 150		

Chemistry

31. C	32. B	33. C	34. B	35. C	36. C	37. C	38. D
39. A	40. C	41. C	42. A	43. C	44. C	45. C	46. B
47. C	48. A	49. 6	50. 3	51. 0	52. 6	53. 7	54. 23
55. 58	56. 400	57. 4					

Mathematics

58. B	59. D	60. B	61. B	62. B	63. D	64. D	65. A
66. C	67. A	68. D	69. B	70. A	71. A	72. C	73. D
74. D	75. C	76. B	77. D	78. 62	79. 252	80. 61	81. 24
82. 0	83. 450	84. 36	85. 80	86. 70	87. 1011		

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