

JEE MAIN 2024 · QUESTION PAPER

8 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	10 Q49 to Q58
● Mathematics	20 Q59 to Q78	9 Q79 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.

prepwis.in/pyqs/paper/2024-04-08-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?
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Q1 Alternating Current

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

A coil of negligible resistance is connected in series with 90Ω resistor across $120V$, $60Hz$ supply. A voltmeter reads $36V$ across resistance. Inductance of the coil is:

- (A) 0.91 H (B) 0.76 H (C) 2.86 H (D) 0.286 H

Q2 Nuclear Physics

[Step-by-step solution](#) › [prepwise.in/questions/ZjkjVC-nCI](https://www.prepwise.in/questions/ZjkjVC-nCI)

If M_0 is the mass of isotope ${}^{12}_5B$, M_p and M_n are the masses of proton and neutron, then nuclear binding energy of isotope is:

- (A) $(5M_p + 7M_n - M_0)C^2$ (B) $(M_0 - 5M_p - 7M_n)C^2$
(C) $(M_0 - 5M_p)C^2$ (D) $(M_0 - 12M_n)C^2$

Q3 Nuclear Physics

[Step-by-step solution](#) › [prepwise.in/questions/o1LJMfYu8U](https://www.prepwise.in/questions/o1LJMfYu8U)

In a hypothetical fission reaction



The identity of emitted particles (R) is:

- (A) Proton (B) Neutron (C) Electron (D) γ -radiations

Q4 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) › [prepwise.in/questions/u60ngXpxIz](https://www.prepwise.in/questions/u60ngXpxIz)

A capacitor has air as dielectric medium and two conducting plates of area 12cm^2 and they are 0.6cm apart. When a slab of dielectric having area 12cm^2 and 0.6cm thickness is inserted between the plates, one of the conducting plates has to be moved by 0.2cm to keep the capacitance same as in previous case. The dielectric constant of the slab is : (Given $\epsilon_0 = 8.834 \times 10^{-12}\text{F/m}$)

- (A) 1.50 (B) 0.66 (C) 1.33 (D) 1

Q5 Current Electricity

[Step-by-step solution](#) › [prepwise.in/questions/OfNp8VvkrA](https://www.prepwise.in/questions/OfNp8VvkrA)

Water boils in an electric kettle in 20 minutes after being switched on. Using the same main supply, the length of the heating element should be _____ to _____ times of its initial length if the water is to be boiled in 15 minutes.

- (A) increased, $\frac{3}{4}$ (B) increased, $\frac{4}{3}$ (C) decreased, $\frac{3}{4}$ (D) decreased, $\frac{4}{3}$

Q6 Dual Nature of Radiation & Matter

[Step-by-step solution](#) › [prepwise.in/questions/LLhoD1R2-T](https://www.prepwise.in/questions/LLhoD1R2-T)

A proton and an electron have the same de Broglie wavelength. If K_p and K_e be the kinetic energies of proton and electron respectively, then choose the correct relation:

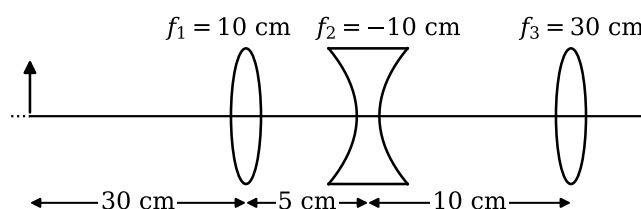
- (A) $K_p > K_e$ (B) $K_p = K_e$ (C) $K_p < K_e$ (D) $K_p = K_e^2$

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Q7 Ray Optics[Step-by-step solution > prepwiser.in/questions/YuLe-iARCr](https://www.prepwiser.in/questions/YuLe-iARCr)

The position of the image formed by the combination of lenses is:

- (A) 15cm (right of second lens)
 (B) 30cm (right of third lens)
 (C) 30cm (left of third lens)
 (D) 15cm (left of second lens)

**Q8** Gravitation[Step-by-step solution > prepwiser.in/questions/IvOKOy6MXu](https://www.prepwiser.in/questions/IvOKOy6MXu)

Two satellite A and B go round a planet in circular orbits having radii $4R$ and R respectively. If the speed of A is $3v$, the speed of B will be:

- (A) $6v$ (B) $\frac{4}{3}v$ (C) $3v$ (D) $12v$

Q9 Thermodynamics[Step-by-step solution > prepwiser.in/questions/2CuEv7UxD7](https://www.prepwiser.in/questions/2CuEv7UxD7)

A diatomic gas ($\gamma = 1.4$) does 100J of work in an isobaric expansion. The heat given to the gas is:

- (A) 150 J (B) 490 J (C) 350 J (D) 250 J

Q10 Kinetic Theory of Gases[Step-by-step solution > prepwiser.in/questions/UX_hSVRLay](https://www.prepwiser.in/questions/UX_hSVRLay)

Given below are two statements:

Statement (I) : The mean free path of gas molecules is inversely proportional to square of molecular diameter.

Statement (II) : Average kinetic energy of gas molecules is directly proportional to absolute temperature of gas.

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

Q11 Friction[Step-by-step solution > prepwiser.in/questions/9JgD3Rt0Y4](https://www.prepwiser.in/questions/9JgD3Rt0Y4)

A given object takes n times the time to slide down 45° rough inclined plane as it takes the time to slide down an identical perfectly smooth 45° inclined plane. The coefficient of kinetic friction between the object and the surface of inclined plane is:

- (A) $1 - \frac{1}{n^2}$ (B) $\sqrt{1 - \frac{1}{n^2}}$ (C) $1 - n^2$ (D) $\sqrt{1 - n^2}$

Q12 Moving Charges & Magnetism[Step-by-step solution > prepwiser.in/questions/0D8wRs_pEW](https://www.prepwiser.in/questions/0D8wRs_pEW)

A long straight wire of radius a carries a steady current I . The current is uniformly distributed across its cross section. The ratio of the magnetic field at $\frac{a}{2}$ and $2a$ from axis of the wire is:

- (A) 4 : 1 (B) 3 : 4 (C) 1 : 1 (D) 1 : 4

Q13 Projectile Motion & Relative Motion[Step-by-step solution > prepwiser.in/questions/-kCQnXDlpZ](https://www.prepwiser.in/questions/-kCQnXDlpZ)

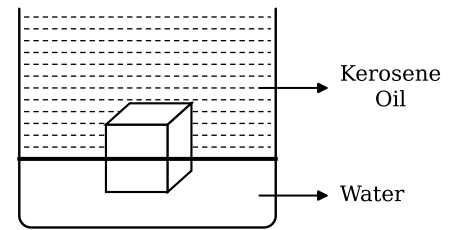
The angle of projection for a projectile to have same horizontal range and maximum height is:

- (A) $\tan^{-1}\left(\frac{1}{2}\right)$ (B) $\tan^{-1}(2)$ (C) $\tan^{-1}\left(\frac{1}{4}\right)$ (D) $\tan^{-1}(4)$

Q14 Fluid Mechanics[Step-by-step solution > prepwiser.in/questions/Muj0PPyqsQ](https://www.prepwiser.in/questions/Muj0PPyqsQ)

A cube of ice floats partly in water and partly in kerosene oil. The ratio of volume of ice immersed in water to that in kerosene oil (specific gravity of Kerosene oil = 0.8, specific gravity of ice = 0.9):

- (A) 5 : 4 (B) 9 : 10 (C) 8 : 9 (D) 1 : 1

**Q15** Rotational Motion[Step-by-step solution > prepwiser.in/questions/-KI0BZkMon](https://www.prepwiser.in/questions/-KI0BZkMon)

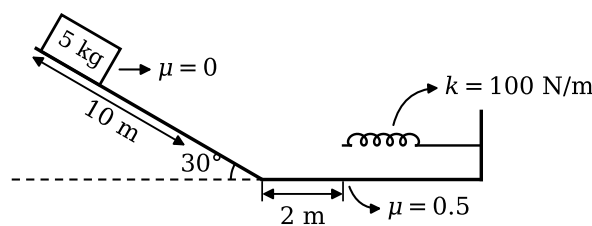
A thin circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing through its centre and perpendicular to its plane with angular velocity ω . If another disc of same dimensions but of mass $M/2$ is placed gently on the first disc co-axially, then the new angular velocity of the system is:

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

Q16 Mechanical Waves[Step-by-step solution > prepwiser.in/questions/Gz5tFzoRcW](https://www.prepwiser.in/questions/Gz5tFzoRcW)

A plane progressive wave is given by $y = 2 \cos 2\pi(330t - x)\text{m}$. The frequency of the wave is:

- (A) 660 Hz (B) 340 Hz (C) 330 Hz (D) 165 Hz

Q17 Work, Energy & Power[Step-by-step solution > prepwiser.in/questions/rJEh3wTsbG](https://www.prepwiser.in/questions/rJEh3wTsbG)

A block is simply released from the top of an inclined plane as shown in the figure above. The maximum compression in the spring when the block hits the spring is:

- (A) $\sqrt{6}\text{m}$ (B) $\sqrt{5}\text{m}$ (C) 1m (D) 2m

Q18 Units, Dimensions & Errors[Step-by-step solution > prepwiser.in/questions/nKJaeen-Cb](https://www.prepwiser.in/questions/nKJaeen-Cb)

If ϵ_0 is the permittivity of free space and E is the electric field, then $\epsilon_0 E^2$ has the dimensions:

- (A) $[\text{ML}^{-1}\text{T}^{-2}]$ (B) $[\text{ML}^2\text{T}^{-2}]$ (C) $[\text{M}^0\text{L}^{-2}\text{TA}]$ (D) $[\text{M}^{-1}\text{L}^{-3}\text{T}^4\text{A}^2]$

Q19 Experimental Skills[Step-by-step solution > prepwiser.in/questions/0Q8pZ4xMsi](https://www.prepwiser.in/questions/0Q8pZ4xMsi)

There are 100 divisions on the circular scale of a screw gauge of pitch 1mm. With no measuring quantity in between the jaws, the zero of the circular scale lies 5 divisions below the reference line. The diameter of a wire is then measured using this screw gauge. It is found that 4 linear scale divisions are clearly visible while 60 divisions on circular scale coincide with the reference line. The diameter of the wire is:

- (A) 4.65 mm (B) 4.60 mm (C) 4.55 mm (D) 3.35 mm

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Q20 Experimental Skills[Step-by-step solution](https://www.prepwisar.in/questions/5AcYP4tDMP)

Least count of a vernier caliper is $\frac{1}{20N}$ cm. The value of one division on the main scale is 1 mm. Then the number of divisions of main scale that coincide with N divisions of vernier scale is:

- (A) $\left(\frac{2N-1}{2N}\right)$ (B) $\left(\frac{2N-1}{20N}\right)$ (C) $(2N-1)$ (D) $\left(\frac{2N-1}{2}\right)$

Physics Section B · Numerical value

Q21 to Q30

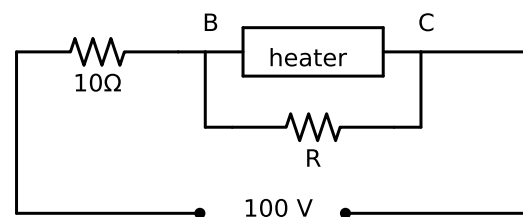
Q21 Alternating Current **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/7BZhkbqpeJ)

An alternating emf $E = 110\sqrt{2} \sin 100t$ volt is applied to a capacitor of $2\mu\text{F}$, the rms value of current in the circuit is _____ mA.

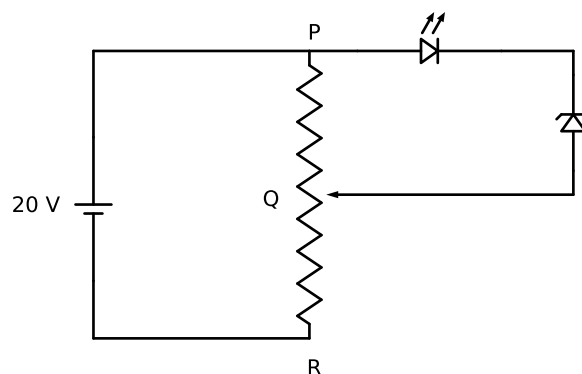
Q22 Current Electricity **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/7WUOcA9rpB)

A heater is designed to operate with a power of 1000W in a 100V line. It is connected in combination with a resistance of 10Ω and a resistance R , to a 100V mains as shown in figure.

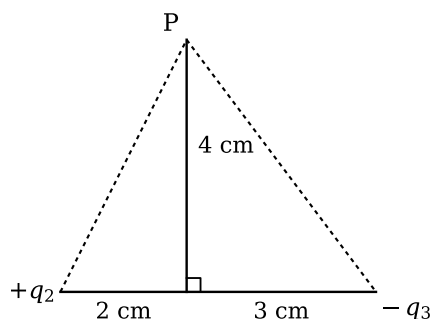
For the heater to operate at 62.5W, the value of R should be _____ Ω .

**Q23** Current Electricity **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/mDD85k6qSr)

A potential divider circuit is connected with a dc source of 20V, a light emitting diode of glow in voltage 1.8V and a zener diode of breakdown voltage of 3.2V. The length (PR) of the resistive wire is 20cm. The minimum length of PQ to just glow the LED is _____ cm.

**Q24** Electrostatics I: Charges, Field & Gauss's Law **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/JcgCJnMvnM)

If the net electric field at point P along Y axis is zero, then the ratio of $\left|\frac{q_2}{q_3}\right|$ is $\frac{8}{5\sqrt{x}}$, where $x =$ _____.

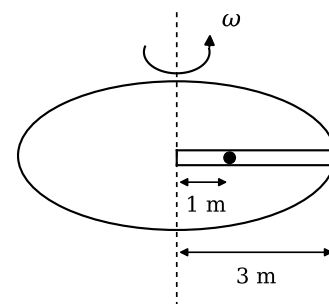
**Q25** Magnetism & Matter **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/n0gO7K01oR)

The coercivity of a magnet is $5 \times 10^3 \text{ A/m}$. The amount of current required to be passed in a solenoid of length 30cm and the number of turns 150, so that the magnet gets demagnetised when inside the solenoid is _____ A.

A body of mass M thrown horizontally with velocity v from the top of the tower of height H touches the ground at a distance of 100m from the foot of the tower. A body of mass $2M$ thrown at a velocity $\frac{v}{2}$ from the top of the tower of height $4H$ will touch the ground at a distance of _____ m.

Small water droplets of radius 0.01mm are formed in the upper atmosphere and falling with a terminal velocity of 10cm/s . Due to condensation, if 8 such droplets are coalesced and formed a larger drop, the new terminal velocity will be _____ cm/s .

A circular table is rotating with an angular velocity of $\omega\text{rad/s}$ about its axis (see figure). There is a smooth groove along a radial direction on the table. A steel ball is gently placed at a distance of 1m on the groove. All the surfaces are smooth. If the radius of the table is 3m , the radial velocity of the ball w.r.t. the table at the time ball leaves the table is $x\sqrt{2}\omega\text{m/s}$, where the value of x is _____.



An object of mass 0.2kg executes simple harmonic motion along x axis with frequency of $\left(\frac{25}{\pi}\right)\text{Hz}$. At the position $x = 0.04\text{m}$ the object has kinetic energy 0.5J and potential energy 0.4J . The amplitude of oscillation is _____ cm .

Two slits are 1mm apart and the screen is located 1m away from the slits. A light of wavelength 500nm is used. The width of each slit to obtain 10 maxima of the double slit pattern within the central maximum of the single slit pattern is _____ $\times 10^{-4}\text{m}$.

Chemistry Section A · Multiple choice

Q31 to Q48

Which one the following compounds will readily react with dilute NaOH ?

- (A) $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$ (B) $\text{C}_2\text{H}_5\text{OH}$ (C) $\text{C}_6\text{H}_5\text{OH}$ (D) $(\text{CH}_3)_3\text{COH}$

The shape of carbocation is:

- (A) tetrahedral (B) diagonal pyramidal (C) diagonal (D) trigonal planar

When ψ_A and ψ_B are the wave functions of atomic orbitals, then σ^* is represented by:

- (A) $\psi_A + 2\psi_B$ (B) $\psi_A - \psi_B$ (C) $\psi_A - 2\psi_B$ (D) $\psi_A + \psi_B$

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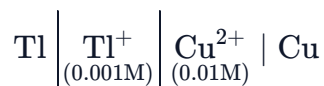
Q34 Chemical Kinetics[Step-by-step solution](https://www.prepwiser.in/questions/D-rjPI3qj1) › prepwiser.in/questions/D-rjPI3qj1

For a reaction $A \xrightarrow{K_1} B \xrightarrow{K_2} C$ If the rate of formation of B is set to be zero then the concentration of B is given by:

- (A) $(K_1 - K_2)[A]$ (B) $(K_1 + K_2)[A]$ (C) $K_1 K_2 [A]$ (D) $(K_1 / K_2)[A]$

Q35 Electrochemistry[Step-by-step solution](https://www.prepwiser.in/questions/B1q_ABGBcX) › prepwiser.in/questions/B1q_ABGBcX

The emf of cell

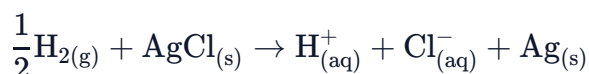


is 0.83V at 298K. It could be increased by:

- (A) increasing concentration of Tl^+ ions
(B) increasing concentration of Cu^{2+} ions
(C) increasing concentration of both Tl^+ and Cu^{2+} ions
(D) decreasing concentration of both Tl^+ and Cu^{2+} ions

Q36 Electrochemistry[Step-by-step solution](https://www.prepwiser.in/questions/LY8KkNa5w4) › prepwiser.in/questions/LY8KkNa5w4

The reaction;



occurs in which of the following galvanic cell:

- (A) $\text{Pt} \left| \text{H}_{2(g)} \right| \text{HCl}_{(\text{soln.})} \left| \text{AgNO}_{3(aq)} \right| \text{Ag}$ (B) $\text{Ag} \left| \text{AgCl}_{(s)} \right| \text{KCl}_{(\text{soln.})} \left| \text{AgNO}_{3(aq)} \right| \text{Ag}$
(C) $\text{Pt} \left| \text{H}_{2(g)} \right| \text{KCl}_{(\text{soln.})} \left| \text{AgCl}_{(s)} \right| \text{Ag}$ (D) $\text{Pt} \left| \text{H}_{2(g)} \right| \text{HCl}_{(\text{soln.})} \left| \text{AgCl}_{(s)} \right| \text{Ag}$

Q37 d & f Block Elements[Step-by-step solution](https://www.prepwiser.in/questions/7x3jrNq8hC) › prepwiser.in/questions/7x3jrNq8hC

Given below are two statements:

Statement (I) : Fusion of MnO_2 with KOH and an oxidising agent gives dark green K_2MnO_4 .

Statement (II) : Manganate ion on electrolytic oxidation in alkaline medium gives permanganate ion.

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 false (D) Both Statement I and Statement II are true

Q38 Halogen Derivatives: Haloalkanes & Haloarenes[Step-by-step solution](https://www.prepwiser.in/questions/9rPJlwS0YO) › prepwiser.in/questions/9rPJlwS0YO

Given below are two statements:

Statement (I): $\text{S}_\text{N}2$ reactions are 'stereospecific', indicating that they result in the formation of only one stereo-isomer as the product.

Statement (II): $\text{S}_\text{N}1$ reactions generally result in formation of product as racemic mixtures.

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

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

Given below are two statements:

Statement (I) : A Buffer solution is the mixture of a salt and an acid or a base mixed in any particular quantities

Statement (II) : Blood is naturally occurring buffer solution whose pH is maintained by $\text{H}_2\text{CO}_3/\text{HCO}_3^-$ concentrations.

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

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

The equilibrium $\text{Cr}_2\text{O}_7^{2-} \rightleftharpoons 2\text{CrO}_4^{2-}$ is shifted to the right in:

- (A) a weakly acidic medium (B) a basic medium
(C) a neutral medium (D) an acidic medium

Identify the correct statements about p-block elements and their compounds.

- (A) Non metals have higher electronegativity than metals.
(B) Non metals have lower ionisation enthalpy than metals.
(C) Compounds formed between highly reactive nonmetals and highly reactive metals are generally ionic.
(D) The non-metal oxides are generally basic in nature.
(E) The metal oxides are generally acidic or neutral in nature.

Choose the correct answer from the options given below:

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

Identify the incorrect statements about group 15 elements:

- (A) Dinitrogen is a diatomic gas which acts like an inert gas at room temperature.
(B) The common oxidation states of these elements are -3 , $+3$ and $+5$.
(C) Nitrogen has unique ability to form $p\pi - p\pi$ multiple bonds.
(D) The stability of $+5$ oxidation states increases down the group.
(E) Nitrogen shows a maximum covalency of 6.

Choose the correct answer from the options given below:

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

In qualitative test for identification of presence of phosphorous, the compound is heated with an oxidising agent. Which is further treated with nitric acid and ammonium molybdate respectively. The yellow coloured precipitate obtained is:

- (A) $\text{Na}_3\text{PO}_4 \cdot 12\text{MoO}_3$ (B) $(\text{NH}_4)_3\text{PO}_4 \cdot 12(\text{NH}_4)_2\text{MoO}_4$
(C) $\text{MoPO}_4 \cdot 21\text{NH}_4\text{NO}_3$ (D) $(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3$

The correct sequence of acidic strength of the following aliphatic acids in their decreasing order is:

$\text{CH}_3\text{CH}_2\text{COOH}$, CH_3COOH , $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$, HCOOH

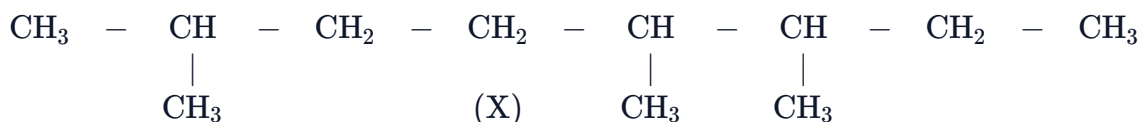
(A) $\text{HCOOH} > \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} > \text{CH}_3\text{CH}_2\text{COOH} > \text{CH}_3\text{COOH}$

(B) $\text{HCOOH} > \text{CH}_3\text{COOH} > \text{CH}_3\text{CH}_2\text{COOH} > \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$

(C) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} > \text{CH}_3\text{CH}_2\text{COOH} > \text{CH}_3\text{COOH} > \text{HCOOH}$

(D) $\text{CH}_3\text{COOH} > \text{CH}_3\text{CH}_2\text{COOH} > \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} > \text{HCOOH}$

IUPAC name of following hydrocarbon(X) is:



(A) 2,5,6-Trimethyloctane

(B) 2-Ethyl-2,6-diethylheptane

(C) 3,4,7-Trimethyloctane

(D) 2-Ethyl-3,6-dimethylheptane

Given below are two statements:

Statement (I) : All the following compounds react with p-toluenesulfonyl chloride.

$\text{C}_6\text{H}_5\text{NH}_2$ $(\text{C}_6\text{H}_5)_2\text{NH}$ $(\text{C}_6\text{H}_5)_3\text{N}$

Statement (II) : Their products in the above reaction are soluble in aqueous NaOH.

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) Both Statement I and Statement II are true

(C) Both Statement I and Statement II are false

(D) Statement I is true but Statement II is false

Given below are two statements:

Statement (I) : Kjeldahl method is applicable to estimate nitrogen in pyridine.

Statement (II) : The nitrogen present in pyridine can easily be converted into ammonium sulphate in Kjeldahl method.

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

(A) Both Statement I and Statement II are true

(B) Both Statement I and Statement II are false

(C) Statement I is true but Statement II is false

(D) Statement I is false but Statement II is true

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Match List I with List II

	LIST I (Test)		LIST II (Identification)
A.	Bayer's test	I.	Phenol
B.	Ceric ammonium nitrate test	II.	Aldehyde
C.	Phthalein dye test	III.	Alcoholic-OH group
D.	Schiff's test	IV.	Unsaturation

Choose the correct answer from the options given below:

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

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

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

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

Chemistry Section B · Numerical value

Q49 to Q58

Q49 Aldehydes & Ketones NUMERICAL

Step-by-step solution > [prepwiser.in/questions/d8hXr4EujR](https://www.prepwiser.in/questions/d8hXr4EujR)

Two moles of benzaldehyde and one mole of acetone under alkaline conditions using aqueous NaOH after heating gives x as the major product. The number of π bonds in the product x is ____.

Q50 Carbohydrates & Biomolecules NUMERICAL

Step-by-step solution > [prepwiser.in/questions/g3rxkarsIS](https://www.prepwiser.in/questions/g3rxkarsIS)

The total number of carbon atoms present in tyrosine, an amino acid, is ____.

Q51 Chemical Bonding & Molecular Structure NUMERICAL

Step-by-step solution > [prepwiser.in/questions/n-0K9oYq6B](https://www.prepwiser.in/questions/n-0K9oYq6B)

Number of molecules having bond order 2 from the following molecules is ____.



Q52 Coordination Compounds NUMERICAL

Step-by-step solution > [prepwiser.in/questions/9WrvPYmLIS](https://www.prepwiser.in/questions/9WrvPYmLIS)

Total number of unpaired electrons in the complex ions $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{NiCl}_4]^{2-}$ is ____.

Q53 Mole Concept & Stoichiometry NUMERICAL

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

A solution is prepared by adding 1 mole ethyl alcohol in 9 mole water. The mass percent of solute in the solution is ____ (Integer answer) (Given : Molar mass in g mol^{-1} Ethyl alcohol : 46 water : 18)

Q54 Mole Concept & Stoichiometry NUMERICAL

Step-by-step solution > [prepwiser.in/questions/5gBjleXk0R](https://www.prepwiser.in/questions/5gBjleXk0R)

Molality of an aqueous solution of urea is 4.44m. Mole fraction of urea in solution is $x \times 10^{-3}$, Value of x is ____ (Integer answer)

Q55 Atomic Structure NUMERICAL

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

Wavenumber for a radiation having $5800 \text{ \AA}$ wavelength is $x \times 10 \text{ cm}^{-1}$ The value of x is ____ (Integer answer)

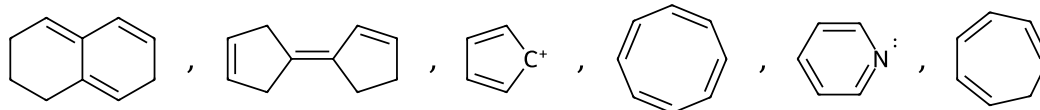
Q56 Chemical Thermodynamics NUMERICAL

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

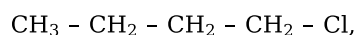
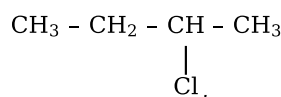
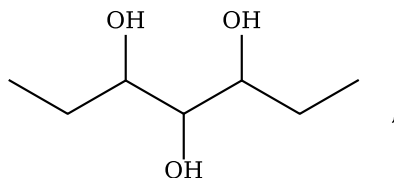
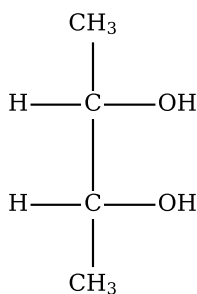
$\Delta_{\text{vap}} H^\ominus$ for water is $+40.79 \text{ kJ mol}^{-1}$ at 1 bar and 100°C . Change in internal energy for this vapourisation under same condition is ____ kJ mol^{-1} . (Integer answer) (Given $R = 8.3 \text{ JK}^{-1} \text{ mol}^{-1}$)

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Total number of aromatic compounds among the following compounds is ____.



The number of optically active compounds from the following is ____.



Mathematics Section A · Multiple choice

Q59 to Q78

If the shortest distance between the lines $\frac{x-\lambda}{2} = \frac{y-4}{3} = \frac{z-3}{4}$ and $\frac{x-2}{4} = \frac{y-4}{6} = \frac{z-7}{8}$ is $\frac{13}{\sqrt{29}}$, then a value of λ is:

(A) $\frac{13}{25}$

(B) 1

(C) -1

(D) $-\frac{13}{25}$

If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, $a > 0$ has a local maximum at $x = \alpha$ and a local minimum at $x = \alpha^2$, then α and α^2 are the roots of the equation:

(A) $x^2 - 6x + 8 = 0$

(B) $8x^2 - 6x + 1 = 0$

(C) $8x^2 + 6x - 1 = 0$

(D) $x^2 + 6x + 8 = 0$

If the term independent of x in the expansion of $(\sqrt{ax^2} + \frac{1}{2x^3})^{10}$ is 105, then a^2 is equal to:

(A) 6

(B) 4

(C) 2

(D) 9

If the image of the point $(-4, 5)$ in the line $x + 2y = 2$ lies on the circle $(x + 4)^2 + (y - 3)^2 = r^2$, then r is equal to:

(A) 2

(B) 3

(C) 4

(D) 1

The sum of all possible values of $\theta \in [-\pi, 2\pi]$, for which $\frac{1+i\cos\theta}{1-2i\cos\theta}$ is purely imaginary, is equal to:

(A) 4π

(B) 3π

(C) 2π

(D) 5π

Let

$$\int_{\alpha}^{\log_e 4} \frac{dx}{\sqrt{e^x - 1}} = \frac{\pi}{6}$$

. Then e^{α} and $e^{-\alpha}$ are the roots of the equation:

- (A) $2x^2 - 5x + 2 = 0$ (B) $x^2 - 2x - 8 = 0$ (C) $2x^2 - 5x - 2 = 0$ (D) $x^2 + 2x - 8 = 0$

Let $y = y(x)$ be the solution curve of the differential equation $\sec y \frac{dy}{dx} + 2x \sin y = x^3 \cos y$, $y(1) = 0$.Then $y(\sqrt{3})$ is equal to:

- (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{12}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$

Let

$$f(x) = \begin{cases} -a & \text{if } -a \leq x \leq 0 \\ x + a & \text{if } 0 < x \leq a \end{cases}$$

where $a > 0$ and $g(x) = (f(|x|) - |f(x)|)/2$. Then the function $g : [-a, a] \rightarrow [-a, a]$ is

- (A) neither one-one nor onto. (B) both one-one and onto.
(C) one-one. (D) onto

For $a, b > 0$, let

$$f(x) = \begin{cases} \frac{\tan((a+1)x) + b \tan x}{x}, & x < 0 \\ 3, & x = 0 \\ \frac{\sqrt{ax+b^2x^2} - \sqrt{ax}}{b\sqrt{ax}\sqrt{x}}, & x > 0 \end{cases}$$

be a continuous function at $x = 0$. Then $\frac{b}{a}$ is equal to:

- (A) 4 (B) 5 (C) 8 (D) 6

If $\alpha \neq a, \beta \neq b, \gamma \neq c$ and

$$\begin{vmatrix} \alpha & b & c \\ a & \beta & c \\ a & b & \gamma \end{vmatrix} = 0$$

, then

$$\frac{a}{\alpha - a} + \frac{b}{\beta - b} + \frac{\gamma}{\gamma - c}$$

is equal to:

- (A) 2 (B) 3 (C) 1 (D) 0

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Q69 Determinants[Step-by-step solution](#) › [prepwiser.in/questions/b1mmgMtUpk](#)

If the system of equations $x + 4y - z = \lambda$, $7x + 9y + \mu z = -3$, $5x + y + 2z = -1$ has infinitely many solutions, then $(2\mu + 3\lambda)$ is equal to:

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

Q70 Permutations & Combinations[Step-by-step solution](#) › [prepwiser.in/questions/3qASTdR_Xq](#)

The number of ways five alphabets can be chosen from the alphabets of the word MATHEMATICS, where the chosen alphabets are not necessarily distinct, is equal to:

- (A) 179 (B) 177 (C) 175 (D) 181

Q71 Probability: Advanced[Step-by-step solution](#) › [prepwiser.in/questions/V5FFJloPJ0](#)

There are three bags X , Y and Z . Bag X contains 5 one-rupee coins and 4 five-rupee coins; Bag Y contains 4 one-rupee coins and 5 five-rupee coins and Bag Z contains 3 one-rupee coins and 6 five-rupee coins. A bag is selected at random and a coin drawn from it at random is found to be a one-rupee coin. Then the probability, that it came from bag Y , is:

- (A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{5}{12}$ (D) $\frac{1}{4}$

Q72 Sequences & Series[Step-by-step solution](#) › [prepwiser.in/questions/pZCpzyz3GM](#)

In an increasing geometric progression of positive terms, the sum of the second and sixth terms is $\frac{70}{3}$ and the product of the third and fifth terms is 49. Then the sum of the 4th, 6th and 8th terms is equal to:

- (A) 78 (B) 96 (C) 91 (D) 84

Q73 Relations & Functions (Basic)[Step-by-step solution](#) › [prepwiser.in/questions/NMhrebfgIW](#)

Let $A = \{2, 3, 6, 8, 9, 11\}$ and $B = \{1, 4, 5, 10, 15\}$. Let R be a relation on $A \times B$ defined by $(a, b)R(c, d)$ if and only if $3ad - 7bc$ is an even integer. Then the relation R is

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

Q74 Vectors[Step-by-step solution](#) › [prepwiser.in/questions/aGfBFbIbvi](#)

Let

$$\vec{a} = 4\hat{i} - \hat{j} + \hat{k}, \vec{b} = 11\hat{i} - \hat{j} + \hat{k}$$

and $\vec{c}$ be a vector such that

$$(\vec{a} + \vec{b}) \times \vec{c} = \vec{c} \times (-2\vec{a} + 3\vec{b})$$

. If $(2\vec{a} + 3\vec{b}) \cdot \vec{c} = 1670$, then $|\vec{c}|^2$ is equal to:

- (A) 1600 (B) 1618 (C) 1627 (D) 1609

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Let

$$\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} + 3\hat{j} - 5\hat{k}$$

and $\vec{c} = 3\hat{i} - \hat{j} + \lambda\hat{k}$ be three vectors. Let $\vec{r}$ be a unit vector along $\vec{b} + \vec{c}$. If $\vec{r} \cdot \vec{a} = 3$, then 3λ is equal to:

(A) 21

(B) 25

(C) 27

(D) 30

The area of the region in the first quadrant inside the circle $x^2 + y^2 = 8$ and outside the parabola $y^2 = 2x$ is equal to:

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

If the line segment joining the points $(5, 2)$ and $(2, a)$ subtends an angle $\frac{\pi}{4}$ at the origin, then the absolute value of the product of all possible values of a is:

(A) 4

(B) 8

(C) 6

(D) 2

If the value of $\frac{3 \cos 36^\circ + 5 \sin 18^\circ}{5 \cos 36^\circ - 3 \sin 18^\circ}$ is $\frac{a\sqrt{5}-b}{c}$, where a, b, c are natural numbers and $\gcd(a, c) = 1$, then $a + b + c$ is equal to:

(A) 54

(B) 52

(C) 50

(D) 40

Mathematics Section B · Numerical value

Q79 to Q87

Let $P(\alpha, \beta, \gamma)$ be the image of the point $Q(1, 6, 4)$ in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$. Then $2\alpha + \beta + \gamma$ is equal to _____

Let A be the region enclosed by the parabola $y^2 = 2x$ and the line $x = 24$. Then the maximum area of the rectangle inscribed in the region A is _____.

Let $\alpha|x| = |y|e^{xy-\beta}$, $\alpha, \beta \in \mathbb{N}$ be the solution of the differential equation $xdy - ydx + xy(xdy + ydx) = 0$, $y(1) = 2$. Then $\alpha + \beta$ is equal to _____

Let S be the focus of the hyperbola $\frac{x^2}{3} - \frac{y^2}{5} = 1$, on the positive x -axis. Let C be the circle with its centre at $A(\sqrt{6}, \sqrt{5})$ and passing through the point S . If O is the origin and SAB is a diameter of C , then the square of the area of the triangle OSB is equal to _____.

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If

$$\alpha = \lim_{x \rightarrow 0^+} \left(\frac{e^{\sqrt{\tan x}} - e^{\sqrt{x}}}{\sqrt{\tan x} - \sqrt{x}} \right)$$

and $\beta = \lim_{x \rightarrow 0} (1 + \sin x)^{\frac{1}{2} \cot x}$ are the roots of the quadratic equation $ax^2 + bx - \sqrt{e} = 0$, then $12 \log_e(a + b)$ is equal to _____.

The number of distinct real roots of the equation $|x + 1||x + 3| - 4|x + 2| + 5 = 0$, is _____

Let $a, b, c \in \mathbf{N}$ and $a < b < c$. Let the mean, the mean deviation about the mean and the variance of the 5 observations 9, 25, a, b, c be 18, 4 and $\frac{136}{5}$, respectively. Then $2a + b - c$ is equal to _____

Let a ray of light passing through the point (3, 10) reflects on the line $2x + y = 6$ and the reflected ray passes through the point (7, 2). If the equation of the incident ray is $ax + by + 1 = 0$, then $a^2 + b^2 + 3ab$ is equal to _____.

If $\int \frac{1}{\sqrt[5]{(x-1)^4(x+3)^6}} dx = A \left(\frac{\alpha x - 1}{\beta x + 3} \right)^B + C$, where C is the constant of integration, then the value of $\alpha + \beta + 20AB$ is _____.

Answer key: JEE Main 2024 · 8 Apr · Shift 2

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Physics

1.	B	2.	A	3.	B	4.	A	5.	C	6.	C	7.	B	8.	A
9.	C	10.	B	11.	A	12.	C	13.	D	14.	D	15.	D	16.	C
17.	D	18.	A	19.	C	20.	D	21.	22	22.	5	23.	5	24.	5
25.	10	26.	100	27.	40	28.	2	29.	6	30.	2				

Chemistry

31.	C	32.	D	33.	B	34.	D	35.	B	36.	D	37.	D	38.	D
39.	C	40.	B	41.	D	42.	B	43.	D	44.	B	45.	A	46.	C
47.	B	48.	D	49.	9	50.	9	51.	2	52.	2	53.	22	54.	74
55.	1724	56.	38	57.	1	58.	1								

Mathematics

59.	B	60.	A	61.	B	62.	A	63.	B	64.	A	65.	D	66.	A
67.	D	68.	D	69.	D	70.	A	71.	B	72.	C	73.	C	74.	B
75.	B	76.	C	77.	A	78.	B	79.	11	80.	128	81.	4	82.	40
83.	6	84.	2	85.	33	86.	1	87.	7						

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