

JEE MAIN 2024 · QUESTION PAPER

6 Apr 2024 Shift 1

89 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	20 Q31 to Q50	9 Q51 to Q59
• Mathematics	20 Q60 to Q79	10 Q80 to Q89
In this PDF		
89 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/2024-04-06-morning · 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? prepwis.in/feedback · Terms: prepwis.in/terms

Q1 Alternating Current

[Step-by-step solution](https://www.prepwiser.in/questions/DWHFKG8a7z) › prepwiser.in/questions/DWHFKG8a7z

Given below are two statements:

Statement I : In an LCR series circuit, current is maximum at resonance.

Statement II : Current in a purely resistive circuit can never be less than that in a series LCR circuit when connected to same voltage source.

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

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

Q2 Atomic Physics

[Step-by-step solution](https://www.prepwiser.in/questions/Os0Z8Nh0o1) › prepwiser.in/questions/Os0Z8Nh0o1

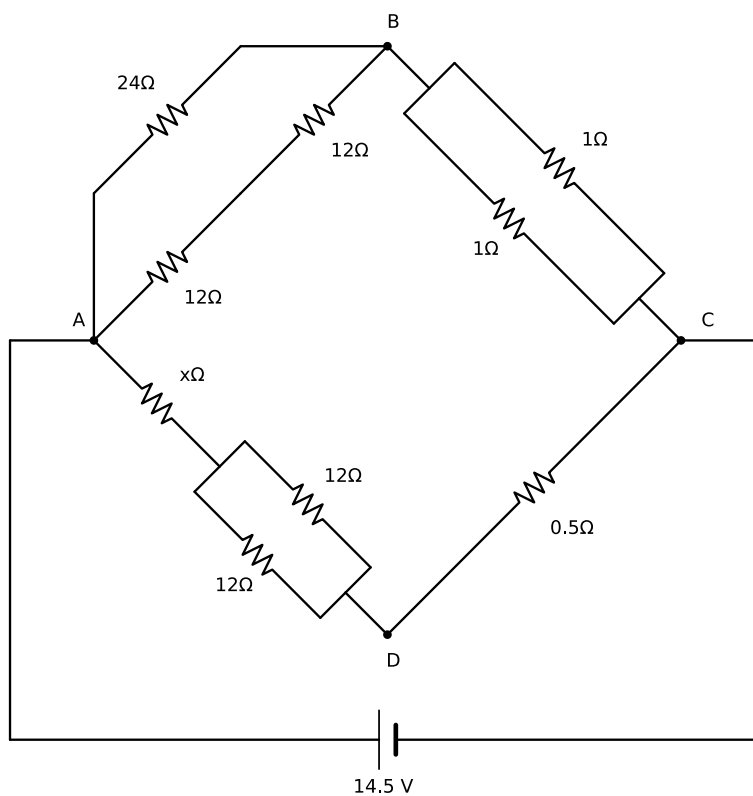
The ratio of the shortest wavelength of Balmer series to the shortest wavelength of Lyman series for hydrogen atom is:

- (A) 1 : 2 (B) 1 : 4 (C) 2 : 1 (D) 4 : 1

Q3 Current Electricity

[Step-by-step solution](https://www.prepwiser.in/questions/GveP0LP0as) › prepwiser.in/questions/GveP0LP0as

The value of unknown resistance (x) for which the potential difference between B and D will be zero in the arrangement shown, is:



- (A) 3 Ω (B) 42 Ω (C) 6 Ω (D) 9 Ω

Q4 Dual Nature of Radiation & Matter[Step-by-step solution](#) › prepwiser.in/questions/TPgIKmIv0j

Which of the following phenomena does not explain by wave nature of light.

- A. reflection
- B. diffraction
- C. photoelectric effect
- D. interference
- E. polarization

Choose the most appropriate answer from the options given below:

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

Q5 Dual Nature of Radiation & Matter[Step-by-step solution](#) › prepwiser.in/questions/VEpfrT3Vgp

In photoelectric experiment energy of 2.48eV irradiates a photo sensitive material. The stopping potential was measured to be 0.5V . Work function of the photo sensitive material is:

- (A) 1.98 eV (B) 1.68 eV (C) 2.48 eV (D) 0.5 eV

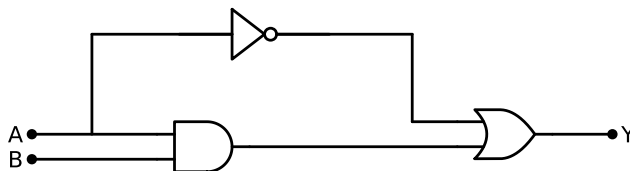
Q6 Electromagnetic Waves[Step-by-step solution](#) › prepwiser.in/questions/Uv3ZSfKFPz

Electromagnetic waves travel in a medium with speed of $1.5 \times 10^8 \text{ms}^{-1}$. The relative permeability of the medium is 2.0. The relative permittivity will be:

- (A) 4 (B) 1 (C) 2 (D) 5

Q7 Semiconductors & Electronic Devices[Step-by-step solution](#) › prepwiser.in/questions/DKLXaroweh

The correct truth table for the following logic circuit is:



- (A)

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1
- (B)

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	1
- (C)

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	0
- (D)

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

Q8 Electrostatics I: Charges, Field & Gauss's Law[Step-by-step solution](#) › prepwiser.in/questions/epW-w2LER2

σ is the uniform surface charge density of a thin spherical shell of radius R . The electric field at any point on the surface of the spherical shell is:

- (A) $\sigma/\epsilon_0 R$ (B) σ/ϵ_0 (C) $\sigma/2\epsilon_0$ (D) $\sigma/4\epsilon_0$

Q9 Gravitation[Step-by-step solution](#) › prepwiser.in/questions/iBYg3f6OfK

To project a body of mass m from earth's surface to infinity, the required kinetic energy is (assume, the radius of earth is R_E , g = acceleration due to gravity on the surface of earth):

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

Q10 Thermodynamics[Step-by-step solution > prepwiser.in/questions/3MVbTxewj](https://www.prepwiser.in/questions/3MVbTxewj)

The specific heat at constant pressure of a real gas obeying $PV^2 = RT$ equation is:

- (A) R (B) $C_V + R$ (C) $C_V + \frac{R}{2V}$ (D) $\frac{R}{3} + C_V$

Q11 Kinetic Theory of Gases[Step-by-step solution > prepwiser.in/questions/9ckTnXyPRI](https://www.prepwiser.in/questions/9ckTnXyPRI)

A sample contains mixture of helium and oxygen gas. The ratio of root mean square speed of helium and oxygen in the sample, is:

- (A) $\frac{1}{2\sqrt{2}}$ (B) $\frac{1}{4}$ (C) $\frac{2\sqrt{2}}{1}$ (D) $\frac{1}{32}$

Q12 Newton's Laws of Motion[Step-by-step solution > prepwiser.in/questions/ds07ui2lgI](https://www.prepwiser.in/questions/ds07ui2lgI)

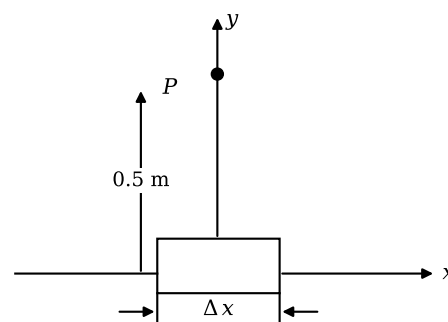
A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (where $m_2 > m_1$). If the acceleration of the system is $\frac{g}{\sqrt{2}}$, then the ratio of the masses $\frac{m_1}{m_2}$ is:

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

Q13 Moving Charges & Magnetism[Step-by-step solution > prepwiser.in/questions/ZjxSTWP2rx](https://www.prepwiser.in/questions/ZjxSTWP2rx)

An element $\Delta l = \Delta x \hat{i}$ is placed at the origin and carries a large current $I = 10\text{A}$. The magnetic field on the y -axis at a distance of 0.5m from the elements Δx of 1cm length is:

- (A) $10 \times 10^{-8}\text{T}$ (B) $8 \times 10^{-8}\text{T}$
(C) $4 \times 10^{-8}\text{T}$ (D) $12 \times 10^{-8}\text{T}$

**Q14** Rectilinear Motion[Step-by-step solution > prepwiser.in/questions/ADArQfYfH2](https://www.prepwiser.in/questions/ADArQfYfH2)

A train starting from rest first accelerates uniformly up to a speed of 80km/h for time t , then it moves with a constant speed for time $3t$. The average speed of the train for this duration of journey will be (in km/h):

- (A) 70 (B) 40 (C) 30 (D) 80

Q15 Fluid Mechanics[Step-by-step solution > prepwiser.in/questions/0pi_vxYsog](https://www.prepwiser.in/questions/0pi_vxYsog)

A small ball of mass m and density ρ is dropped in a viscous liquid of density ρ_0 . After sometime, the ball falls with constant velocity. The viscous force on the ball is:

- (A) $mg \left(1 - \frac{\rho_0}{\rho}\right)$ (B) $mg \left(\frac{\rho_0}{\rho} - 1\right)$ (C) $mg(1 - \rho\rho_0)$ (D) $mg \left(1 + \frac{\rho}{\rho_0}\right)$

Q16 Work, Energy & Power[Step-by-step solution > prepwiser.in/questions/fb4cKNH1cC](https://www.prepwiser.in/questions/fb4cKNH1cC)

A bullet of mass 50g is fired with a speed 100m/s on a plywood and emerges with 40m/s . The percentage loss of kinetic energy is:

- (A) 44% (B) 16% (C) 84% (D) 32%

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Q17 Work, Energy & Power[Step-by-step solution](#) > [prepwisar.in/questions/IYCUN-LZ38](https://www.prepwisar.in/questions/IYCUN-LZ38)

Four particles A, B, C, D of mass $\frac{m}{2}, m, 2m, 4m$, have same momentum, respectively. The particle with maximum kinetic energy is:

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

Q18 Units, Dimensions & Errors[Step-by-step solution](#) > [prepwisar.in/questions/WmkX1vnrHe](https://www.prepwisar.in/questions/WmkX1vnrHe)

To find the spring constant (k) of a spring experimentally, a student commits 2% positive error in the measurement of time and 1% negative error in measurement of mass. The percentage error in determining value of k is:

- (A) 5% (B) 3% (C) 1% (D) 4%

Q19 Units, Dimensions & Errors[Step-by-step solution](#) > [prepwisar.in/questions/yppH3EQPfl](https://www.prepwisar.in/questions/yppH3EQPfl)

Match List I with List II

	LIST I		LIST II
A.	Torque	I.	$[M^1 L^1 T^{-2} A^{-2}]$
B.	Magnetic field	II.	$[L^2 A^1]$
C.	Magnetic moment	III.	$[M^1 T^{-2} A^{-1}]$
D.	Permeability of free space	IV.	$[M^1 L^2 T^{-2}]$

Choose the correct answer from the options given below:

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

Q20 Experimental Skills[Step-by-step solution](#) > [prepwisar.in/questions/qYHWCiKAi5](https://www.prepwisar.in/questions/qYHWCiKAi5)

While measuring diameter of wire using screw gauge the following readings were noted. Main scale reading is 1mm and circular scale reading is equal to 42 divisions. Pitch of screw gauge is 1mm and it has 100 divisions on circular scale. The diameter of the wire is $\frac{x}{50}$ mm. The value of x is:

- (A) 42 (B) 71 (C) 21 (D) 142

Physics Section B · Numerical value

Q21 to Q30

Q21 Alternating Current **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/lB3bCNWmhv](https://www.prepwisar.in/questions/lB3bCNWmhv)

When a dc voltage of 100V is applied to an inductor, a dc current of 5A flows through it. When an ac voltage of 200V peak value is connected to inductor, its inductive reactance is found to be $20\sqrt{3}\Omega$. The power dissipated in the circuit is _____ W.

Q22 Atomic Physics **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/f3qJoOAAbh](https://www.prepwisar.in/questions/f3qJoOAAbh)

Radius of a certain orbit of hydrogen atom is $8.48 \text{ } \overset{\circ}{A}$. If energy of electron in this orbit is E/x . then $x = \underline{\hspace{1cm}}$ (Given $a_0 = 0.529 \text{ } \overset{\circ}{A}$, E = energy of electron in ground state).

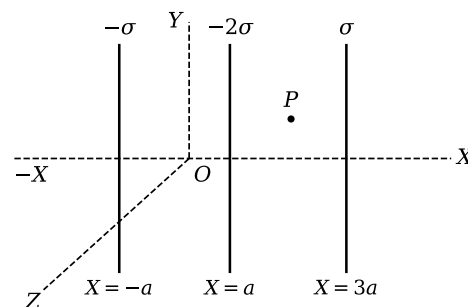
Q23 Current Electricity **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/2ShinZ6MM1](https://www.prepwisar.in/questions/2ShinZ6MM1)

A wire of resistance R and radius r is stretched till its radius became $r/2$. If new resistance of the stretched wire is xR , then value of x is _____.

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Q24 Electrostatics I: Charges, Field & Gauss's Law **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/hAG_U444iO](https://www.prepwiser.in/questions/hAG_U444iO)

Three infinitely long charged thin sheets are placed as shown in figure. The magnitude of electric field at the point P is $\frac{x\sigma}{\epsilon_0}$. The value of x is _____ (all quantities are measured in SI units).

**Q25** Ray Optics **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/leELowcDWt](https://www.prepwiser.in/questions/leELowcDWt)

The refractive index of prism is $\mu = \sqrt{3}$ and the ratio of the angle of minimum deviation to the angle of prism is one. The value of angle of prism is _____°.

Q26 Rotational Motion **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/JNf_kb6SHH](https://www.prepwiser.in/questions/JNf_kb6SHH)

If the radius of earth is reduced to three-fourth of its present value without change in its mass then value of duration of the day of earth will be _____ hours 30 minutes.

Q27 Magnetism & Matter **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/ZYeOjMm4Bc](https://www.prepwiser.in/questions/ZYeOjMm4Bc)

A circular coil having 200 turns, $2.5 \times 10^{-4} \text{m}^2$ area and carrying $100 \mu\text{A}$ current is placed in a uniform magnetic field of 1T. Initially the magnetic dipole moment ($\vec{M}$) was directed along $\vec{B}$. Amount of work, required to rotate the coil through 90° from its initial orientation such that $\vec{M}$ becomes perpendicular to $\vec{B}$, is _____ μJ .

Q28 Surface Tension **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/BZJqMvz8kp](https://www.prepwiser.in/questions/BZJqMvz8kp)

A big drop is formed by coalescing 1000 small droplets of water. The ratio of surface energy of 1000 droplets to that of energy of big drop is $\frac{10}{x}$. The value of x is _____.

Q29 Simple Harmonic Motion **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/RksqJFXht1](https://www.prepwiser.in/questions/RksqJFXht1)

A particle is doing simple harmonic motion of amplitude 0.06m and time period 3.14s. The maximum velocity of the particle is _____ cm/s.

Q30 Vectors **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/-5PVkLM5LU](https://www.prepwiser.in/questions/-5PVkLM5LU)

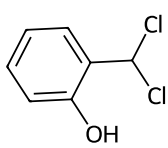
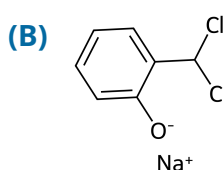
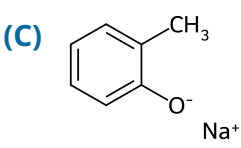
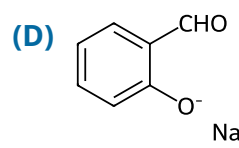
For three vectors $\vec{A} = (-x\hat{i} - 6\hat{j} - 2\hat{k})$, $\vec{B} = (-\hat{i} + 4\hat{j} + 3\hat{k})$ and $\vec{C} = (-8\hat{i} - \hat{j} + 3\hat{k})$, if $\vec{A} \cdot (\vec{B} \times \vec{C}) = 0$, then value of x is _____.

Chemistry Section A · Multiple choice

Q31 to Q50

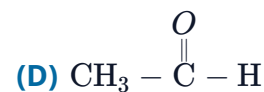
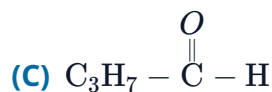
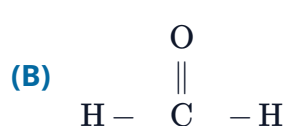
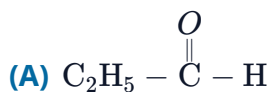
Q31 Alcohols, Phenols & Ethers[Step-by-step solution](#) > [prepwiser.in/questions/SIORK8I_k](https://www.prepwiser.in/questions/SIORK8I_k)

In Reimer - Tiemann reaction, phenol is converted into salicylaldehyde through an intermediate. The structure of intermediate is _____.

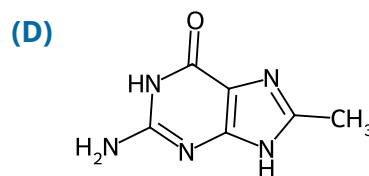
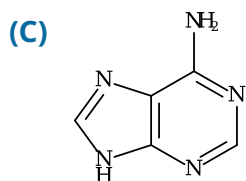
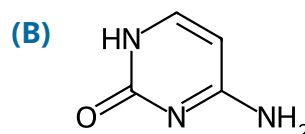
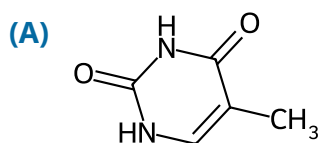
- (A)  (B)  (C)  (D) 

Q32 Aldehydes & Ketones[Step-by-step solution](https://www.prepwiser.in/questions/AAYOdtwZg1) > prepwiser.in/questions/AAYOdtwZg1

Which among the following aldehydes is most reactive towards nucleophilic addition reactions?

**Q33** Carbohydrates & Biomolecules[Step-by-step solution](https://www.prepwiser.in/questions/znxpr3zGnc) > prepwiser.in/questions/znxpr3zGnc

DNA molecule contains 4 bases whose structure are shown below. One of the structures is not correct, identify the incorrect base structure.

**Q34** Chemical Bonding & Molecular Structure[Step-by-step solution](https://www.prepwiser.in/questions/YABl6JeJFW) > prepwiser.in/questions/YABl6JeJFW

Match List I with List II

	LIST I (Compound/Species)		LIST II (Shape/Geometry)
A.	SF_4	I.	Tetrahedral
B.	BrF_3	II.	Pyramidal
C.	BrO_3^-	III.	See saw
D.	NH_4^+	IV.	Bent T-Shape

Choose the correct answer from the options given below:

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

Q35 Chemical Bonding & Molecular Structure[Step-by-step solution](https://www.prepwiser.in/questions/ZKuBnfiebz) > prepwiser.in/questions/ZKuBnfiebz

Match List I with List II

	LIST I (Molecule/Species)		LIST II (Property/Shape)
A.	SO_2Cl_2	I.	Paramagnetic
B.	NO	II.	Diamagnetic
C.	NO_2^-	III.	Tetrahedral
D.	I_3^-	IV.	Linear

Choose the correct answer from the options given below:

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

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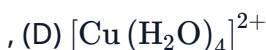
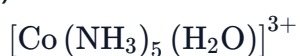
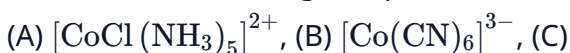
Match List I with List II

	LIST I (Compound)		LIST II (Uses)
A.	Idoform	I.	Fire extinguisher
B.	Carbon tetrachloride	II.	Insecticide
C.	CFC	III.	Antiseptic
D.	DDT	IV.	Refrigerants

Choose the correct answer from the options given below:

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

Consider the following complexes



The correct order of A, B, C and D in terms of wavenumber of light absorbed is:

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

Match List I with List II

	LIST I (Hybridization)		LIST II (Orientation in Shape)
A.	sp^3	I.	Trigonal bipyramidal
B.	dsp^2	II.	Octahedral
C.	sp^3d	III.	Tetrahedral
D.	sp^3d^2	IV.	Square planar

Choose the correct answer from the options given below:

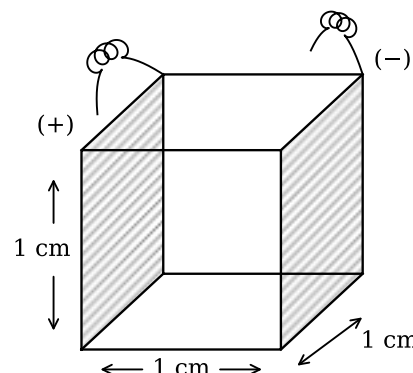
- (A) A-III, B-I, C-IV, D-II (B) A-III, B-IV, C-I, D-II (C) A-IV, B-III, C-I, D-II (D) A-II, B-I, C-IV, D-III

The number of element from the following that do not belong to lanthanoids is Eu, Cm, Er, Tb, Yb and Lu

- (A) 3 (B) 1 (C) 4 (D) 5

A conductivity cell with two electrodes (dark side) are half filled with infinitely dilute aqueous solution of a weak electrolyte. If volume is doubled by adding more water at constant temperature, the molar conductivity of the cell will -

- (A) depend upon type of electrolyte
(B) increase sharply
(C) decrease sharply
(D) remain same or can not be measured accurately



Given below are two statements:

Statement I : Gallium is used in the manufacturing of thermometers.

Statement II : A thermometer containing gallium is useful for measuring the freezing point (256K) of brine solution.

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

Which of the following material is not a semiconductor.

- (A) Copper oxide (B) Graphite (C) Silicon (D) Germanium

The electron affinity value are negative for

- A. $\text{Be} \rightarrow \text{Be}^-$
B. $\text{N} \rightarrow \text{N}^-$
C. $\text{O} \rightarrow \text{O}^{2-}$
D. $\text{Na} \rightarrow \text{Na}^-$
E. $\text{Al} \rightarrow \text{Al}^-$

Choose the most appropriate answer from the options given below:

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

The density of ' x ' M solution (' x ' molar) of NaOH is 1.12g mL^{-1} , while in molality, the concentration of the solution is 3m (3 molal). Then x is

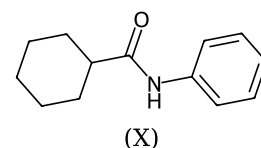
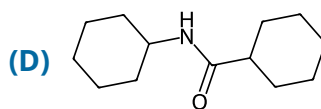
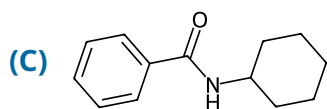
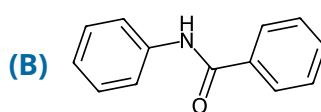
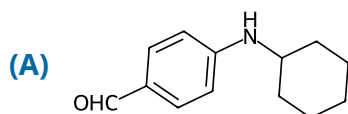
(Given : Molar mass of NaOH is 40g/mol)

- (A) 3.8 (B) 3.0 (C) 3.5 (D) 2.8

Functional group present in sulphonic acids is:

- (A) $-\text{SO}_2$ (B) $\begin{array}{c} \text{—S—OH} \\ || \\ \text{O} \end{array}$ (C) $-\text{SO}_3\text{H}$ (D) $-\text{SO}_4\text{H}$

Which of the following is metamer of the given compound (X)?



At -20°C and 1atm pressure, a cylinder is filled with equal number of H_2 , I_2 and HI molecules for the reaction $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, the K_p for the process is $x \times 10^{-1}$.

$x =$ _____.

[Given: $R = 0.082\text{LatmK}^{-1}\text{mol}^{-1}$]

- (A) 2 (B) 1 (C) 10 (D) 0.01

Given below are two statements:

Statement I : Picric acid is 2,4,6 - trinitrotoluene.

Statement II : Phenol - 2,4 - disulphonic acid is treated with Conc. HNO_3 to get picric acid.

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

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

Which of the following statements are correct?

- A. Glycerol is purified by vacuum distillation because it decomposes at its normal boiling point.
 B. Aniline can be purified by steam distillation as aniline is miscible in water.
 C. Ethanol can be separated from ethanol water mixture by azeotropic distillation because it forms azeotrope.
 D. An organic compound is pure, if mixed M.P. is remained same.

Choose the most appropriate answer from the options given below:

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

Match List I with List II

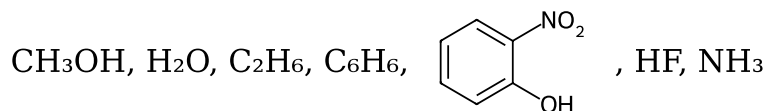
	LIST I (Precipitating reagent and conditions)		LIST II (Cation)
A.	$\text{NH}_4\text{Cl} + \text{NH}_4\text{OH}$	I.	Mn^{2+}
B.	$\text{NH}_4\text{OH} + \text{Na}_2\text{CO}_3$	II.	Pb^{2+}
C.	$\text{NH}_4\text{OH} + \text{NH}_4\text{Cl} + \text{H}_2\text{S}$ gas	III.	Al^{3+}
D.	dilute HCl	IV.	Sr^{2+}

Choose the correct answer from the options given below:

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

Q51 Chemical Bonding & Molecular Structure **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/NlxfbBII8](#)

Number of molecules from the following which can exhibit hydrogen bonding is _____. (nearest integer)

**Q52** Chemical Kinetics **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/YJhC2IqjbM](#)

Time required for 99.9% completion of a first order reaction is _____ times the time required for completion of 90% reaction. (nearest integer)

Q53 d & f Block Elements **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/Bda1K00K4w](#)

The difference in the 'spin-only' magnetic moment values of KMnO_4 and the manganese product formed during titration of KMnO_4 against oxalic acid in acidic medium is _____ BM. (nearest integer)

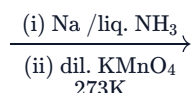
Q54 d & f Block Elements **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/ynMX6VSvRr](#)

Among CrO , Cr_2O_3 and CrO_3 , the sum of spin-only magnetic moment values of basic and amphoteric oxides is _____ 10^{-2}BM (nearest integer).

(Given atomic number of Cr is 24)

Q55 Hydrocarbons: Alkenes & Alkynes **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/H6mSOdky15](#)

The major product of the following reaction is P.



'P'

Number of oxygen atoms present in product 'P' is _____. (nearest integer)

Q56 Solutions & Colligative Properties **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/GYyqOkohGw](#)

Consider the dissociation of the weak acid HX as given below



[K_a : dissociation constant]

The osmotic pressure of 0.03M aqueous solution of HX at 300K is _____ $\times 10^{-2}$ bar (nearest integer).

[Given: $R = 0.083\text{Lbarmol}^{-1}\text{K}^{-1}$]

Q57 Atomic Structure **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/sNc_fZh8PP](#)

Frequency of the de-Broglie wave of electron in Bohr's first orbit of hydrogen atom is _____ $\times 10^{13}\text{Hz}$ (nearest integer).

[Given: R_H (Rydberg constant) = $2.18 \times 10^{-18}\text{J}$, h (Plank's constant) = $6.6 \times 10^{-34}\text{J.s.}$]

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An ideal gas, $\overline{C}_V = \frac{5}{2}R$, is expanded adiabatically against a constant pressure of 1 atm until it doubles in volume. If the initial temperature and pressure is 298K and 5atm, respectively then the final temperature is _____ K (nearest integer).

[$\overline{C}_V$ is the molar heat capacity at constant volume]

9.3g of pure aniline upon diazotisation followed by coupling with phenol gives an orange dye. The mass of orange dye produced (assume 100% yield/conversion) is _____ g. (nearest integer)

Mathematics Section A · Multiple choice

Q60 to Q79

If $A(3, 1, -1)$, $B(\frac{5}{3}, \frac{7}{3}, \frac{1}{3})$, $C(2, 2, 1)$ and $D(\frac{10}{3}, \frac{2}{3}, \frac{-1}{3})$ are the vertices of a quadrilateral $ABCD$, then its area is

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

The shortest distance between the lines $\frac{x-3}{2} = \frac{y+15}{-7} = \frac{z-9}{5}$ and $\frac{x+1}{2} = \frac{y-1}{1} = \frac{z-9}{-3}$ is

- (A) $8\sqrt{3}$ (B) $6\sqrt{3}$ (C) $5\sqrt{3}$ (D) $4\sqrt{3}$

The interval in which the function $f(x) = x^x$, $x > 0$, is strictly increasing is

- (A) $(0, \infty)$ (B) $(0, \frac{1}{e}]$ (C) $[\frac{1}{e^2}, 1)$ (D) $[\frac{1}{e}, \infty)$

A circle is inscribed in an equilateral triangle of side of length 12. If the area and perimeter of any square inscribed in this circle are m and n , respectively, then $m + n^2$ is equal to

- (A) 408 (B) 414 (C) 312 (D) 396

$$\int_0^{\pi/4} \frac{\cos^2 x \sin^2 x}{(\cos^3 x + \sin^3 x)^2} dx \text{ is equal to}$$

- (A) 1/9 (B) 1/6 (C) 1/3 (D) 1/12

Let $y = y(x)$ be the solution of the differential equation $(2x \log_e x) \frac{dy}{dx} + 2y = \frac{3}{x} \log_e x$, $x > 0$ and $y(e^{-1}) = 0$. Then, $y(e)$ is equal to

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

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Q66 Differential Equations[Step-by-step solution](#) › [prepwiser.in/questions/OhBoGioppT](#)

Let $y = y(x)$ be the solution of the differential equation $(1 + x^2) \frac{dy}{dx} + y = e^{\tan^{-1} x}$, $y(1) = 0$. Then $y(0)$ is

- (A) $\frac{1}{4} (e^{\pi/2} - 1)$ (B) $\frac{1}{2} (1 - e^{\pi/2})$ (C) $\frac{1}{4} (1 - e^{\pi/2})$ (D) $\frac{1}{2} (e^{\pi/2} - 1)$

Q67 Differentiation[Step-by-step solution](#) › [prepwiser.in/questions/JCljZ1WLCO](#)

If $f(x) = \begin{cases} x^3 \sin\left(\frac{1}{x}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$, then

- (A) $f''(0) = 0$ (B) $f''(0) = 1$ (C) $f''\left(\frac{2}{\pi}\right) = \frac{24-\pi^2}{2\pi}$ (D) $f''\left(\frac{2}{\pi}\right) = \frac{12-\pi^2}{2\pi}$

Q68 Limits[Step-by-step solution](#) › [prepwiser.in/questions/ZHZFfYfRQ](#)

Let $f : (-\infty, \infty) - \{0\} \rightarrow \mathbb{R}$ be a differentiable function such that $f'(1) = \lim_{a \rightarrow \infty} a^2 f\left(\frac{1}{a}\right)$. Then

$$\lim_{a \rightarrow \infty} \frac{a(a+1)}{2} \tan^{-1}\left(\frac{1}{a}\right) + a^2 - 2 \log_e a$$

is equal to

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

Q69 Relations & Functions (Basic)[Step-by-step solution](#) › [prepwiser.in/questions/UONcQzV6XS](#)

The function $f(x) = \frac{x^2+2x-15}{x^2-4x+9}$, $x \in \mathbb{R}$ is

- (A) both one-one and onto. (B) onto but not one-one.
(C) neither one-one nor onto. (D) one-one but not onto.

Q70 Determinants[Step-by-step solution](#) › [prepwiser.in/questions/yFfIxbjTya](#)

For $\alpha, \beta \in \mathbb{R}$ and a natural number n , let

$$A_r = \begin{vmatrix} r & 1 & \frac{n^2}{2} + \alpha \\ 2r & 2 & n^2 - \beta \\ 3r - 2 & 3 & \frac{n(3n-1)}{2} \end{vmatrix}$$

. Then $2A_{10} - A_8$ is

- (A) $4\alpha + 2\beta$ (B) 0 (C) $2n$ (D) $2\alpha + 4\beta$

Q71 Parabola[Step-by-step solution](#) › [prepwiser.in/questions/7La6C3j7Dx](#)

Let C be the circle of minimum area touching the parabola $y = 6 - x^2$ and the lines $y = \sqrt{3}|x|$. Then, which one of the following points lies on the circle C ?

- (A) (1, 2) (B) (2, 2) (C) (1, 1) (D) (2, 4)

Q72 Permutations & Combinations[Step-by-step solution](#) › [prepwiser.in/questions/SH_xNe5k0p](#)

The number of triangles whose vertices are at the vertices of a regular octagon but none of whose sides is a side of the octagon is

- (A) 56 (B) 16 (C) 24 (D) 48

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A company has two plants A and B to manufacture motorcycles. 60% motorcycles are manufactured at plant A and the remaining are manufactured at plant B . 80% of the motorcycles manufactured at plant A are rated of the standard quality, while 90% of the motorcycles manufactured at plant B are rated of the standard quality. A motorcycle picked up randomly from the total production is found to be of the standard quality. If p is the probability that it was manufactured at plant B , then $126p$ is

- (A) 54 (B) 66 (C) 56 (D) 64

Let α, β be the distinct roots of the equation $x^2 - (t^2 - 5t + 6)x + 1 = 0, t \in \mathbb{R}$ and $a_n = \alpha^n + \beta^n$. Then the minimum value of $\frac{a_{2023} + a_{2025}}{a_{2024}}$ is

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

Let $A = \{n \in [100, 700] \cap \mathbb{N} : n \text{ is neither a multiple of 3 nor a multiple of 4}\}$. Then the number of elements in A is

- (A) 300 (B) 310 (C) 290 (D) 280

Let the relations R_1 and R_2 on the set $X = \{1, 2, 3, \dots, 20\}$ be given by $R_1 = \{(x, y) : 2x - 3y = 2\}$ and $R_2 = \{(x, y) : -5x + 4y = 0\}$. If M and N be the minimum number of elements required to be added in R_1 and R_2 , respectively, in order to make the relations symmetric, then $M + N$ equals

- (A) 16 (B) 12 (C) 8 (D) 10

The mean and standard deviation of 20 observations are found to be 10 and 2, respectively. On rechecking, it was found that an observation by mistake was taken 8 instead of 12. The correct standard deviation is

- (A) 1.94 (B) $\sqrt{3.96}$ (C) $\sqrt{3.86}$ (D) 1.8

Let the area of the region enclosed by the curves $y = 3x, 2y = 27 - 3x$ and $y = 3x - x\sqrt{x}$ be A . Then $10A$ is equal to

- (A) 172 (B) 154 (C) 162 (D) 184

Let a variable line of slope $m > 0$ passing through the point $(4, -9)$ intersect the coordinate axes at the points A and B . The minimum value of the sum of the distances of A and B from the origin is

- (A) 30 (B) 15 (C) 10 (D) 25

Q80 Three Dimensional Geometry **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/0KPK1J0aB9](https://www.prepwisar.in/questions/0KPK1J0aB9)

Let P be the point $(10, -2, -1)$ and Q be the foot of the perpendicular drawn from the point $R(1, 7, 6)$ on the line passing through the points $(2, -5, 11)$ and $(-6, 7, -5)$. Then the length of the line segment PQ is equal to _____.

Q81 Binomial Theorem **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/F5mYgU0hGB](https://www.prepwisar.in/questions/F5mYgU0hGB)

If the second, third and fourth terms in the expansion of $(x + y)^n$ are 135, 30 and $\frac{10}{3}$, respectively, then $6(n^3 + x^2 + y)$ is equal to _____.

Q82 Definite Integration **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/bBym8MARRX](https://www.prepwisar.in/questions/bBym8MARRX)

Let

$$r_k = \frac{\int_0^1 (1 - x^7)^k dx}{\int_0^1 (1 - x^7)^{k+1} dx}, k \in \mathbb{N}$$

. Then the value of $\sum_{k=1}^{10} \frac{1}{7(r_k - 1)}$ is equal to _____.

Q83 Inverse Trigonometric Functions **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/pi10Rd8Pi8](https://www.prepwisar.in/questions/pi10Rd8Pi8)

For $n \in \mathbb{N}$, if $\cot^{-1} 3 + \cot^{-1} 4 + \cot^{-1} 5 + \cot^{-1} n = \frac{\pi}{4}$, then n is equal to _____.

Q84 Vectors **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/G7c5UCXi4I](https://www.prepwisar.in/questions/G7c5UCXi4I)

Let $\alpha\beta\gamma = 45$; $\alpha, \beta, \gamma \in \mathbb{R}$. If $x(\alpha, 1, 2) + y(1, \beta, 2) + z(2, 3, \gamma) = (0, 0, 0)$ for some $x, y, z \in \mathbb{R}$, $xyz \neq 0$, then $6\alpha + 4\beta + \gamma$ is equal to _____.

Q85 Parabola **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/di1udBGE4i](https://www.prepwisar.in/questions/di1udBGE4i)

Let a conic C pass through the point $(4, -2)$ and $P(x, y)$, $x \geq 3$, be any point on C . Let the slope of the line touching the conic C only at a single point P be half the slope of the line joining the points P and $(3, -5)$. If the focal distance of the point $(7, 1)$ on C is d , then $12d$ equals _____.

Q86 Parabola **NUMERICAL**

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

Let L_1, L_2 be the lines passing through the point $P(0, 1)$ and touching the parabola $9x^2 + 12x + 18y - 14 = 0$. Let Q and R be the points on the lines L_1 and L_2 such that the $\triangle PQR$ is an isosceles triangle with base QR . If the slopes of the lines QR are m_1 and m_2 , then $16(m_1^2 + m_2^2)$ is equal to _____.

Q87 Quadratic Equations & Polynomial Inequalities **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/OB0IG1qIEt](https://www.prepwisar.in/questions/OB0IG1qIEt)

Let x_1, x_2, x_3, x_4 be the solution of the equation $4x^4 + 8x^3 - 17x^2 - 12x + 9 = 0$ and

$$(4 + x_1^2)(4 + x_2^2)(4 + x_3^2)(4 + x_4^2) = \frac{125}{16}m$$

. Then the value of m is _____.

Q88 Sequences & Series **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/bLoICDV7mD](https://www.prepwisar.in/questions/bLoICDV7mD)

Let the first term of a series be $T_1 = 6$ and its r^{th} term $T_r = 3T_{r-1} + 6^r$, $r = 2, 3, \dots, n$. If the sum of the first n terms of this series is $\frac{1}{5}(n^2 - 12n + 39)(4 \cdot 6^n - 5 \cdot 3^n + 1)$, then n is equal to _____.

Let $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}$, $\vec{b} = 3\hat{i} + 4\hat{j} - 5\hat{k}$ and a vector $\vec{c}$ be such that

$$\vec{a} \times (\vec{b} + \vec{c}) + \vec{b} \times \vec{c} = \hat{i} + 8\hat{j} + 13\hat{k}$$

. If $\vec{a} \cdot \vec{c} = 13$, then $(24 - \vec{b} \cdot \vec{c})$ is equal to _____.

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Physics

1.	C	2.	D	3.	C	4.	A	5.	A	6.	C	7.	B	8.	B	9.	C	10.	C
11.	C	12.	C	13.	C	14.	A	15.	A	16.	C	17.	D	18.	A	19.	D	20.	B
21.	250	22.	16	23.	16	24.	2	25.	60	26.	13	27.	5	28.	1	29.	12	30.	4

Chemistry

31.	B	32.	B	33.	D	34.	B	35.	B	36.	B	37.	A	38.	B	39.	B	40.	D
41.	B	42.	B	43.	D	44.	B	45.	C	46.	C	47.	C	48.	A	49.	A	50.	A
51.	5	52.	3	53.	6	54.	877	55.	2	56.	76	57.	658	58.	274	59.	20		

Mathematics

60.	A	61.	D	62.	D	63.	A	64.	B	65.	A	66.	B	67.	C	68.	A	69.	C
70.	A	71.	D	72.	B	73.	A	74.	B	75.	A	76.	D	77.	B	78.	C	79.	D
80.	13	81.	806	82.	65	83.	47	84.	55	85.	75	86.	68	87.	221	88.	6	89.	46

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