

JEE MAIN 2023 · QUESTION PAPER

24 Jan 2023 **Shift 1**

83 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	19 Q1 to Q19	10 Q20 to Q29
● Chemistry	16 Q30 to Q45	9 Q46 to Q54
● Mathematics	19 Q55 to Q73	10 Q74 to Q83
In this PDF	83 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.

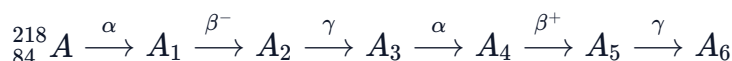
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Answers follow NTA's final answer keys. Typing errors are possible, so check doubtful answers against the official key. Spotted a mistake? prepwis.in/feedback · Terms: prepwis.in/terms

Q1 Nuclear Physics

[Step-by-step solution](#) › [prepwiser.in/questions/thl9jXKMkV](https://www.prepwiser.in/questions/thl9jXKMkV)

Consider the following radioactive decay process



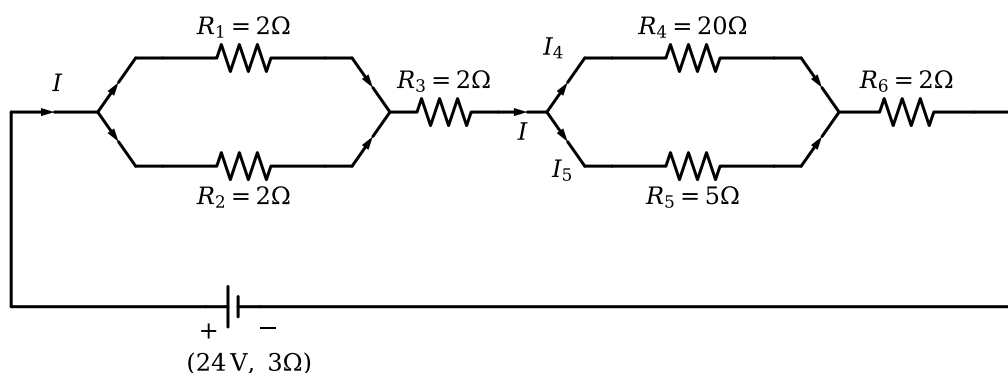
The mass number and the atomic number of A_6 are given by:

- (A) 210 and 84 (B) 210 and 80 (C) 211 and 80 (D) 210 and 82

Q2 Current Electricity

[Step-by-step solution](#) › [prepwiser.in/questions/s1R8SjgDvH](https://www.prepwiser.in/questions/s1R8SjgDvH)

As shown in the figure, a network of resistors is connected to a battery of 24V with an internal resistance of $3\ \Omega$. The currents through the resistors R_4 and R_5 are I_4 and I_5 respectively. The values of I_4 and I_5 are:



- (A) $I_4 = \frac{8}{5}\text{ A}$ and $I_5 = \frac{2}{5}\text{ A}$ (B) $I_4 = \frac{6}{5}\text{ A}$ and $I_5 = \frac{24}{5}\text{ A}$
 (C) $I_4 = \frac{2}{5}\text{ A}$ and $I_5 = \frac{8}{5}\text{ A}$ (D) $I_4 = \frac{24}{5}\text{ A}$ and $I_5 = \frac{6}{5}\text{ A}$

Q3 Dual Nature of Radiation & Matter

[Step-by-step solution](#) › [prepwiser.in/questions/T34If_KLcg](https://www.prepwiser.in/questions/T34If_KLcg)

From the photoelectric effect experiment, following observations are made. Identify which of these are correct.

- A. The stopping potential depends only on the work function of the metal.
 B. The saturation current increases as the intensity of incident light increases.
 C. The maximum kinetic energy of a photo electron depends on the intensity of the incident light.
 D. Photoelectric effect can be explained using wave theory of light.

Choose the correct answer from the options given below:

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

Q4 Electromagnetic Induction

[Step-by-step solution](#) › [prepwiser.in/questions/6Aa20mdFbe](https://www.prepwiser.in/questions/6Aa20mdFbe)

A conducting circular loop of radius $\frac{10}{\sqrt{\pi}}\text{ cm}$ is placed perpendicular to a uniform magnetic field of 0.5 T. The magnetic field is decreased to zero in 0.5 s at a steady rate. The induced emf in the circular loop at 0.25 s is:

- (A) emf = 10 mV (B) emf = 5 mV (C) emf = 100 mV (D) emf = 1 mV

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Q5 Electromagnetic Waves[Step-by-step solution](https://www.prepwiser.in/questions/WsA7QfKm4o) > prepwiser.in/questions/WsA7QfKm4o

In $\vec{E}$ and $\vec{K}$ represent electric field and propagation vectors of the EM waves in vacuum, then magnetic field vector is given by:

(ω - angular frequency):

- (A) $\frac{1}{\omega} (\vec{K} \times \vec{E})$ (B) $\vec{K} \times \vec{E}$ (C) $\omega (\vec{K} \times \vec{E})$ (D) $\omega (\vec{E} \times \vec{K})$

Q6 Semiconductors & Electronic Devices[Step-by-step solution](https://www.prepwiser.in/questions/0xqMtWCRg-) > prepwiser.in/questions/0xqMtWCRg-

Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R
Assertion A : Photodiodes are preferably operated in reverse bias condition for light intensity measurement.

Reason R : The current in the forward bias is more than the current in the reverse bias for a $p - n$ junction diode.

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

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

Q7 Electrostatics I: Charges, Field & Gauss's Law[Step-by-step solution](https://www.prepwiser.in/questions/eKMTzi8719) > prepwiser.in/questions/eKMTzi8719

If two charges q_1 and q_2 are separated with distance 'd' and placed in a medium of dielectric constant K. What will be the equivalent distance between charges in air for the same electrostatic force?

- (A) $d\sqrt{k}$ (B) $1.5d\sqrt{k}$ (C) $k\sqrt{d}$ (D) $2d\sqrt{k}$

Q8 Gravitation[Step-by-step solution](https://www.prepwiser.in/questions/whw8KZgPwy) > prepwiser.in/questions/whw8KZgPwy

The weight of a body at the surface of earth is 18 N. The weight of the body at an altitude of 3200 km above the earth's surface is (given, radius of earth $R_e = 6400\text{km}$):

- (A) 9.8 N (B) 4.9 N (C) 19.6 N (D) 8 N

Q9 Thermodynamics[Step-by-step solution](https://www.prepwiser.in/questions/9zbz5txE9a) > prepwiser.in/questions/9zbz5txE9a

1 g of a liquid is converted to vapour at 3×10^5 Pa pressure. If 10% of the heat supplied is used for increasing the volume by 1600 cm^3 during this phase change, then the increase in internal energy in the process will be:

- (A) 4800 J (B) 4320 J (C) 432000 J (D) 4.32×10^8 J

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

Given below are two statements:

Statement I : The temperature of a gas is -73°C . When the gas is heated to 527°C , the root mean square speed of the molecules is doubled.

Statement II : The product of pressure and volume of an ideal gas will be equal to translational kinetic energy of the molecules.

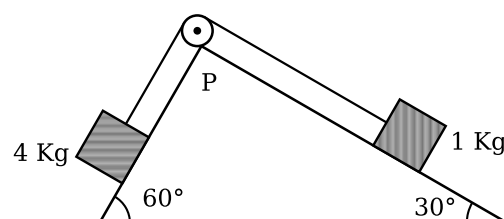
In the light of the above statements, choose the correct answer from the option given below:

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

Q11 Newton's Laws of Motion[Step-by-step solution](#) > [prepwisar.in/questions/F_p1j6g9Pc](https://www.prepwisar.in/questions/F_p1j6g9Pc)

As per given figure, a weightless pulley P is attached on a double inclined frictionless surfaces. The tension in the string (massless) will be (if $g = 10 \text{ m/s}^2$)

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

**Q12** Newton's Laws of Motion[Step-by-step solution](#) > [prepwisar.in/questions/6GeYFq9uGV](https://www.prepwisar.in/questions/6GeYFq9uGV)

Given below are two statements:

Statement I : An elevator can go up or down with uniform speed when its weight is balanced with the tension of its cable.

Statement II : Force exerted by the floor of an elevator on the foot of a person standing on it is more than his/her weight when the elevator goes down with increasing speed.

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

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

Two long straight wires P and Q carrying equal current 10A each were kept parallel to each other at 5 cm distance. Magnitude of magnetic force experienced by 10 cm length of wire P is F_1 . If distance between wires is halved and currents on them are doubled, force F_2 on 10 cm length of wire P will be:

- (A) $\frac{F_1}{8}$ (B) $10 F_1$ (C) $\frac{F_1}{10}$ (D) $8 F_1$

Q14 Moving Charges & Magnetism[Step-by-step solution](#) > [prepwisar.in/questions/8nYwtzIc5G](https://www.prepwisar.in/questions/8nYwtzIc5G)

A circular loop of radius r is carrying current I A. The ratio of magnetic field at the center of circular loop and at a distance r from the center of the loop on its axis is:

- (A) $3\sqrt{2}:2$ (B) $1:3\sqrt{2}$ (C) $2\sqrt{2}:1$ (D) $1:\sqrt{2}$

Q15 Projectile Motion & Relative Motion[Step-by-step solution](#) > [prepwisar.in/questions/WyMLQrj5i8](https://www.prepwisar.in/questions/WyMLQrj5i8)

The maximum vertical height to which a man can throw a ball is 136 m. The maximum horizontal distance upto which he can throw the same ball is:

- (A) 136 m (B) 272 m (C) 68 m (D) 192 m

Q16 Elasticity[Step-by-step solution](#) › prepwiser.in/questions/p5HQ2liRrq

A 100 m long wire having cross-sectional area $6.25 \times 10^{-4} \text{ m}^2$ and Young's modulus is 10^{10} N m^{-2} is subjected to a load of 250 N, then the elongation in the wire will be:

- (A) $6.25 \times 10^{-6} \text{ m}$ (B) $4 \times 10^{-3} \text{ m}$ (C) $4 \times 10^{-4} \text{ m}$ (D) $6.25 \times 10^{-3} \text{ m}$

Q17 Wave Optics[Step-by-step solution](#) › prepwiser.in/questions/ufPgipYFpd

Given below are two statements:

Statement I : If the Brewster's angle for the light propagating from air to glass is θ_B , then the Brewster's angle for the light propagating from glass to air is $\frac{\pi}{2} - \theta_B$

Statement II : The Brewster's angle for the light propagating from glass to air is $\tan^{-1}(\mu_g)$ where μ_g is the refractive index of glass.

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

Q18 Mechanical Waves[Step-by-step solution](#) › prepwiser.in/questions/axUwvSJkh

A travelling wave is described by the equation

$$y(x, t) = [0.05 \sin(8x - 4t)] \text{ m}$$

The velocity of the wave is : [all the quantities are in SI unit]

- (A) 4 ms^{-1} (B) 2 ms^{-1} (C) 8 ms^{-1} (D) 0.5 ms^{-1}

Q19 Units, Dimensions & Errors[Step-by-step solution](#) › prepwiser.in/questions/qclyiNv_kw

Match List I with List II

	List-I		List-II
A.	Planck's constant (h)	I.	$[M^1 L^2 T^{-2}]$
B.	Stopping potential (Vs)	II.	$[M^1 L^1 T^{-1}]$
C.	Work function (ϕ)	III.	$[M^1 L^2 T^{-1}]$
D.	Momentum (p)	IV.	$[M^1 L^2 T^{-3} A^{-1}]$

Choose the correct answer from the options given below:

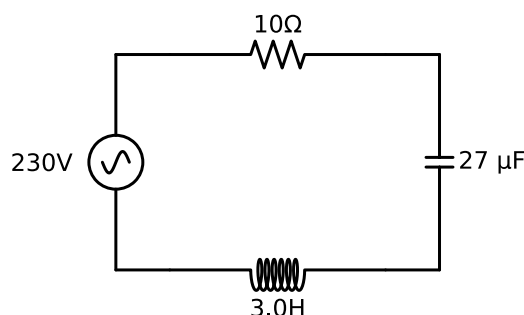
- (A) A-I, B-III, C-IV, D-II (B) A-III, B-IV, C-I, D-II (C) A-II, B-IV, C-III, D-I (D) A-III, B-I, C-II, D-IV

Physics Section B · Numerical value

Q20 to Q29

Q20 Alternating Current **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/MX3fR9mIGi

In the circuit shown in the figure, the ratio of the quality factor and the band width is _____ s.



Q21 Nuclear Physics **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/UhSOBUA0i7

Assume that protons and neutrons have equal masses. Mass of a nucleon is 1.6×10^{-27} kg and radius of nucleus is $1.5 \times 10^{-15} A^{1/3}$ m. The approximate ratio of the nuclear density and water density is $n \times 10^{13}$. The value of n is _____.

Q22 Current Electricity **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/EfyPT7dBPO

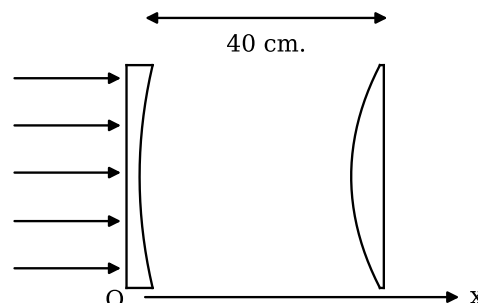
A hollow cylindrical conductor has length of 3.14 m, while its inner and outer diameters are 4 mm and 8 mm respectively. The resistance of the conductor is $n \times 10^{-3} \Omega$. If the resistivity of the material is $2.4 \times 10^{-8} \Omega \text{m}$. The value of n is _____.

Q23 Electrostatics I: Charges, Field & Gauss's Law **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/pTk-hk-Gg7

A stream of a positively charged particles having $\frac{q}{m} = 2 \times 10^{11} \frac{C}{kg}$ and velocity $\vec{v}_0 = 3 \times 10^7 \hat{i} \text{ m/s}$ is deflected by an electric field $1.8 \hat{j} \text{ kV/m}$. The electric field exists in a region of 10 cm along x direction. Due to the electric field, the deflection of the charge particles in the y direction is _____ mm.

Q24 Ray Optics **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/Ev1eKzgZFd

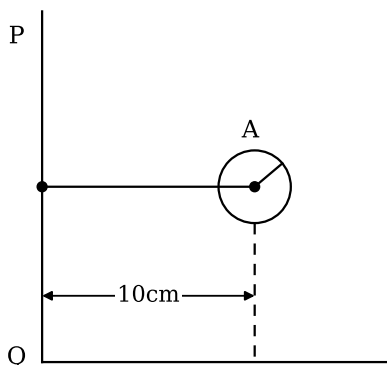
As shown in the figure, a combination of a thin plano concave lens and a thin plano convex lens is used to image an object placed at infinity. The radius of curvature of both the lenses is 30 cm and refraction index of the material for both the lenses is 1.75. Both the lenses are placed at distance of 40 cm from each other. Due to the combination, the image of the object is formed at distance $x =$ _____ cm, from concave lens.

**Q25** Thermometry & Calorimetry **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/JJFZM3jsDd

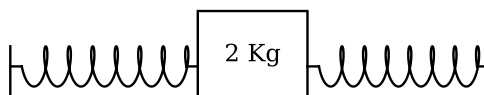
A hole is drilled in a metal sheet. At 27°C , the diameter of hole is 5 cm. When the sheet is heated to 177°C , the change in the diameter of hole is $d \times 10^{-3}$ cm. The value of d will be _____ if coefficient of linear expansion of the metal is $1.6 \times 10^{-5} / ^\circ\text{C}$.

Q26 Rotational Motion **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/0vag88PMpm

Solid sphere A is rotating about an axis PQ. If the radius of the sphere is 5 cm then its radius of gyration about PQ will be $\sqrt{x}$ cm. The value of x is _____.



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A block of a mass 2 kg is attached with two identical springs of spring constant 20 N/m each. The block is placed on a frictionless surface and the ends of the springs are attached to rigid supports (see figure). When the mass is displaced from its equilibrium position, it executes a simple harmonic motion. The time period of oscillation is $\frac{\pi}{\sqrt{x}}$ in SI unit. The value of x is _____.

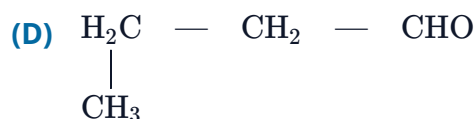
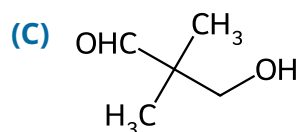
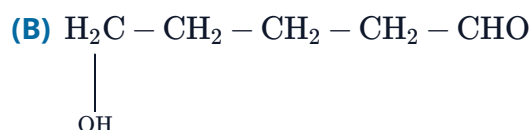
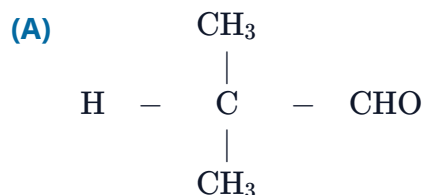
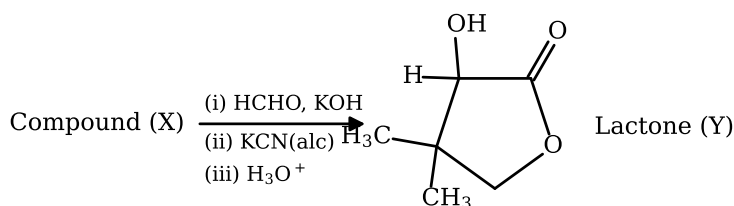
A spherical body of mass 2 kg starting from rest acquires a kinetic energy of 10000 J at the end of 5th second. The force acted on the body is _____ N.

Vectors $a\hat{i} + b\hat{j} + \hat{k}$ and $2\hat{i} - 3\hat{j} + 4\hat{k}$ are perpendicular to each other when $3a + 2b = 7$, the ratio of a to b is $\frac{x}{2}$. The value of x is _____.

Chemistry Section A · Multiple choice

Q30 to Q45

Compound (X) undergoes following sequence of reactions to give the Lactone (Y).



Decreasing order of the hydrogen bonding in following forms of water is correctly represented by

- A. Liquid water
- B. Ice
- C. Impure water

Choose the correct answer from the options given below:

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

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Order of Covalent bond;

A. $KF > KI$; $LiF > KF$

B. $KF < KI$; $LiF > KF$

C. $SnCl_4 > SnCl_2$; $CuCl > NaCl$

D. $LiF > KF$; $CuCl < NaCl$

E. $KF < KI$; $CuCl > NaCl$

Choose the correct answer from the options given below:

(A) B, C only

(B) A, B only

(C) C, E only

(D) B, C, E only

Given below are two statements:

Statement I : Noradrenaline is a neurotransmitter.

Statement II : Low level of noradrenaline is not the cause of depression in human.

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

(A) Both Statement I and Statement II are incorrect

(B) Statement I is correct but Statement II is incorrect

(C) Both Statement I and Statement II are correct

(D) Statement I is incorrect but Statement II is correct

The primary and secondary valencies of cobalt respectively in $[Co(NH_3)_5Cl]Cl_2$ are:

(A) 2 and 8

(B) 2 and 6

(C) 3 and 5

(D) 3 and 6

An ammoniacal metal salt solution gives a brilliant red precipitate on addition of dimethylglyoxime.

The metal ion is:

(A) Co^{2+}

(B) Fe^{2+}

(C) Ni^{2+}

(D) Cu^{2+}

Assertion A : Hydrolysis of an alkyl chloride is a slow reaction but in the presence of NaI , the rate of the hydrolysis increases.

Reason R : I^- is a good nucleophile as well as a good leaving group.

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

(A) A is true but R is false

(B) A is false but R is true

(C) Both A and R are true and R is the correct explanation of A

(D) Both A and R are true but R is NOT the correct explanation of A

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Match List I with List II

	List-I		List-II
A.	Reverberatory furnace	I.	Pig Iron
B.	Electrolytic cell	II.	Aluminium
C.	Blast furnace	III.	Silicon
D.	Zone Refining furnace	IV.	Copper

Choose the correct answer from the options given below:

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

Which of the Phosphorus oxoacid can create silver mirror from AgNO_3 solution?

- (A) $\text{H}_4\text{P}_2\text{O}_5$ (B) $\text{H}_4\text{P}_2\text{O}_7$ (C) $(\text{HPO}_3)_n$ (D) $\text{H}_4\text{P}_2\text{O}_6$

Match List I with List II

	List-I		List-II
A.	Chlorophyll	I.	Na_2CO_3
B.	Soda ash	II.	CaSO_4
C.	Dentistry, Ornamental work	III.	Mg^{2+}
D.	Used in white washing	IV.	$\text{Ca}(\text{OH})_2$

Choose the correct answer from the options given below:

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

Reaction of BeO with ammonia and hydrogen fluoride gives A which on thermal decomposition gives BeF_2 and NH_4F . What is 'A'?

- (A) $(\text{NH}_4)\text{Be}_2\text{F}_5$ (B) $(\text{NH}_4)_2\text{BeF}_4$ (C) $(\text{NH}_4)\text{BeF}_3$ (D) H_3NBeF_3

In the depression of freezing point experiment

- A. Vapour pressure of the solution is less than that of pure solvent
 B. Vapour pressure of the solution is more than that of pure solvent
 C. Only solute molecules solidify at the freezing point
 D. Only solvent molecules solidify at the freezing point

Choose the most appropriate answer from the options given below:

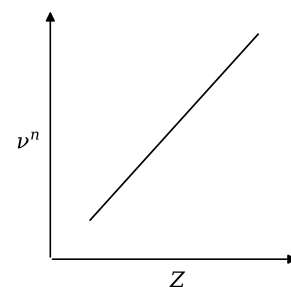
- (A) A and C only (B) A only (C) A and D only (D) B and C only

The magnetic moment of a transition metal compound has been calculated to be 3.87 B.M. The metal ion is

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

Q43 Atomic Structure[Step-by-step solution](https://www.prepwiser.in/questions/g_q7IRP5bL)

It is observed that characteristic X-ray spectra of elements show regularity. When frequency to the power "n" i.e. ν^n of X-rays emitted is plotted against atomic number "Z", following graph is obtained.



The value of 'n' is:

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

Q44 Surface Chemistry[Step-by-step solution](https://www.prepwiser.in/questions/P9II3iBLjj)

Statement I : For colloidal particles, the values of colligative properties are of small order as compared to values shown by true solutions at same concentration.

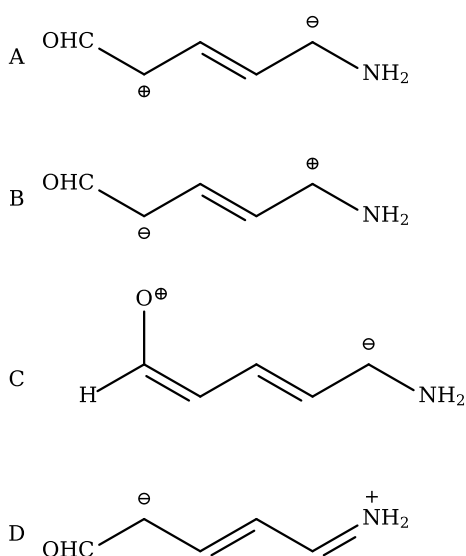
Statement II : For colloidal particles, the potential difference between the fixed layer and the diffused layer of same charges is called the electrokinetic potential or zeta potential.

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

Q45 General Organic Chemistry (GOC)[Step-by-step solution](https://www.prepwiser.in/questions/rYenWWtv2q)

Increasing order of stability of the resonance structures is:

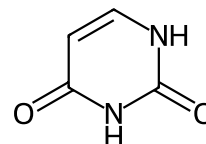


Choose the correct answer from the options given below:

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

Q46 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/F0QrSfcPze) > prepwisar.in/questions/F0QrSfcPze

Uracil is a base present in RNA with the following structure. % of N in uracil is _____



Given:

Molar mass N = 14 g mol⁻¹

O = 16 g mol⁻¹

C = 12 g mol⁻¹

H = 1 g mol⁻¹

Q47 Coordination Compounds **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/dqWaWMLwPj) > prepwisar.in/questions/dqWaWMLwPj

The d-electronic configuration of [CoCl₄]²⁻ in tetrahedral crystal field in e^mtⁿ. Sum of "m" and "number of unpaired electrons" is _____

Q48 Electrochemistry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/tNso5cPY5N) > prepwisar.in/questions/tNso5cPY5N

At 298 K, a 1 litre solution containing 10 mmol of Cr₂O₇²⁻ and 100 mmol of Cr³⁺ shows a pH of 3.0.

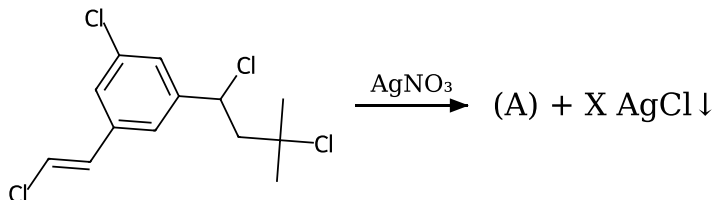
Given: Cr₂O₇²⁻ → Cr³⁺; E° = 1.330V

and $\frac{2.303RT}{F} = 0.059 \text{ V}$

The potential for the half cell reaction is x × 10⁻³ V. The value of x is _____

Q49 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/CIAiIoaErb) > prepwisar.in/questions/CIAiIoaErb

Number of moles of AgCl formed in the following reaction is _____

**Q50** Ionic Equilibrium **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/RzTxZLec3u) > prepwisar.in/questions/RzTxZLec3u

The dissociation constant of acetic acid is x × 10⁻⁵. When 25 mL of 0.2 M CH₃COONa solution is mixed with 25 mL of 0.02 M CH₃COOH solution, the pH of the resultant solution is found to be equal to 5. The value of x is _____

Q51 Solid State **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/SUNkgEmyC_) > prepwisar.in/questions/SUNkgEmyC_

When Fe_{0.93}O is heated in presence of oxygen, it converts to Fe₂O₃. The number of correct statement/s from the following is _____

A. The equivalent weight of Fe_{0.93}O is $\frac{\text{Molecular weight}}{0.79}$

B. The number of moles of Fe²⁺ and Fe³⁺ in 1 mole of Fe_{0.93}O is 0.79 and 0.14 respectively

C. Fe_{0.93}O is metal deficient with lattice comprising of cubic closed packed arrangement of O²⁻ ions

D. The % composition of Fe²⁺ and Fe³⁺ in Fe_{0.93}O is 85% and 15% respectively

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Q52 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/RoYRLeoMIP](https://www.prepwisar.in/questions/RoYRLeoMIP)

5 g of NaOH was dissolved in deionized water to prepare a 450 mL stock solution. What volume (in mL) of this solution would be required to prepare 500 mL of 0.1 M solution? _____

Given : Molar Mass of Na, O and H is 23, 16 and 1 g mol⁻¹ respectively

Q53 Atomic Structure **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/pej3Xd5LwL](https://www.prepwisar.in/questions/pej3Xd5LwL)

If wavelength of the first line of the Paschen series of hydrogen atom is 720 nm, then the wavelength of the second line of this series is _____ nm. (Nearest integer)

Q54 Chemical Thermodynamics **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/QD8RyGDozP](https://www.prepwisar.in/questions/QD8RyGDozP)

For independent process at 300 K

Process	$\Delta H/\text{kJmol}^{-1}$	$\Delta S/\text{JK}^{-1}$
A	-25	-80
B	-22	40
C	25	-50
D	22	20

The number of non-spontaneous process from the following is _____

Mathematics Section A · Multiple choice

Q55 to Q73

Q55 Three Dimensional Geometry[Step-by-step solution](#) > [prepwisar.in/questions/wKqWM0bkRv](https://www.prepwisar.in/questions/wKqWM0bkRv)

The distance of the point (7, -3, -4) from the plane passing through the points (2, -3, 1), (-1, 1, -2) and (3, -4, 2) is:

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

Q56 Three Dimensional Geometry[Step-by-step solution](#) > [prepwisar.in/questions/Hv2WS_xpRN](https://www.prepwisar.in/questions/Hv2WS_xpRN)

The distance of the point (-1, 9, -16) from the plane

$2x + 3y - z = 5$ measured parallel to the line

$\frac{x+4}{3} = \frac{2-y}{4} = \frac{z-3}{12}$ is:

- (A) $13\sqrt{2}$ (B) 26 (C) $20\sqrt{2}$ (D) 31

Q57 Binomial Theorem[Step-by-step solution](#) > [prepwisar.in/questions/iOHamyxbqY](https://www.prepwisar.in/questions/iOHamyxbqY)

The value of $\sum_{r=0}^{22} {}^{22}C_r {}^{23}C_r$ is

- (A) ${}^{44}C_{23}$ (B) ${}^{45}C_{23}$ (C) ${}^{44}C_{22}$ (D) ${}^{45}C_{24}$

Q58 Complex Numbers[Step-by-step solution](#) > [prepwisar.in/questions/SIKH11pM1r](https://www.prepwisar.in/questions/SIKH11pM1r)

Let $p, q \in \mathbb{R}$ and $(1 - \sqrt{3}i)^{200} = 2^{199}(p + iq)$, $i = \sqrt{-1}$ then $p + q + q^2$ and $p - q + q^2$ are roots of the equation.

- (A) $x^2 + 4x - 1 = 0$ (B) $x^2 - 4x + 1 = 0$ (C) $x^2 + 4x + 1 = 0$ (D) $x^2 - 4x - 1 = 0$

Q59 Differential Equations[Step-by-step solution](#) > [prepwisar.in/questions/DgvSkfK_jl](https://www.prepwisar.in/questions/DgvSkfK_jl)

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

- (A) $2 - e$ (B) 3 (C) 1 (D) e

Q60 Inverse Trigonometric Functions[Step-by-step solution](https://www.prepwiser.in/questions/zm0EVA802s) > prepwiser.in/questions/zm0EVA802s

$$\tan^{-1} \left(\frac{1 + \sqrt{3}}{3 + \sqrt{3}} \right) + \sec^{-1} \left(\sqrt{\frac{8 + 4\sqrt{3}}{6 + 3\sqrt{3}}} \right)$$

is equal to:

- (A) $\frac{\pi}{2}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{4}$

Q61 Limits[Step-by-step solution](https://www.prepwiser.in/questions/qea0zJfXoO) > prepwiser.in/questions/qea0zJfXoO

$$\lim_{t \rightarrow 0} \left(1^{\frac{1}{\sin^2 t}} + 2^{\frac{1}{\sin^2 t}} + \dots + n^{\frac{1}{\sin^2 t}} \right)^{\sin^2 t}$$

is equal to

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

Q62 Continuity & Differentiability[Step-by-step solution](https://www.prepwiser.in/questions/TyzIyXZ_jz) > prepwiser.in/questions/TyzIyXZ_jz

Let

$$f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & , x \neq 0 \\ 0 & , x = 0 \end{cases}$$

Then at $x = 0$

- (A) f is continuous but f' is not continuous (B) f and f' both are continuous
(C) f is continuous but not differentiable (D) f' is continuous but not differentiable

Q63 Matrices[Step-by-step solution](https://www.prepwiser.in/questions/ePQelJYndZ) > prepwiser.in/questions/ePQelJYndZIf A and B are two non-zero $n \times n$ matrices such that $A^2 + B = A^2B$, then:

- (A) $A^2B = I$ (B) $A^2 = I$ or $B = I$ (C) $A^2B = BA^2$ (D) $AB = I$

Q64 Determinants[Step-by-step solution](https://www.prepwiser.in/questions/gp5lqJII-a) > prepwiser.in/questions/gp5lqJII-aLet α be a root of the equation $(a - c)x^2 + (b - a)x + (c - b) = 0$ where a, b, c are distinct real numbers such that the matrix

$$\begin{bmatrix} \alpha^2 & \alpha & 1 \\ 1 & 1 & 1 \\ a & b & c \end{bmatrix}$$

is singular. Then, the value of

$$\frac{(a - c)^2}{(b - a)(c - b)} + \frac{(b - a)^2}{(a - c)(c - b)} + \frac{(c - b)^2}{(a - c)(b - a)}$$

is

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

Q65 Parabola[Step-by-step solution](https://www.prepwiser.in/questions/9m7cBdK54c) > prepwiser.in/questions/9m7cBdK54cLet a tangent to the curve $y^2 = 24x$ meet the curve $xy = 2$ at the points A and B. Then the mid points of such line segments AB lie on a parabola with the:

- (A) length of latus rectum 2 (B) directrix $4x = -3$
(C) directrix $4x = 3$ (D) length of latus rectum $\frac{3}{2}$

Let N denote the number that turns up when a fair die is rolled. If the probability that the system of equations

$$x + y + z = 1$$

$$2x + Ny + 2z = 2$$

$$3x + 3y + Nz = 3$$

has unique solution is $\frac{k}{6}$, then the sum of value of k and all possible values of N is:

- (A) 18 (B) 21 (C) 20 (D) 19

Let Ω be the sample space and $A \subseteq \Omega$ be an event.

Given below are two statements:

(S1) : If $P(A) = 0$, then $A = \phi$

(S2) : If $P(A) = 1$, then $A = \Omega$

Then:

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

The equation $x^2 - 4x + [x] + 3 = x[x]$, where $[x]$ denotes the greatest integer function, has:

- (A) exactly two solutions in $(-\infty, \infty)$ (B) no solution
(C) a unique solution in $(-\infty, \infty)$ (D) a unique solution in $(-\infty, 1)$

For three positive integers p, q, r , $x^{pq^2} = y^{qr} = z^{p^2r}$ and $r = pq + 1$ such that $3, 3 \log_y x, 3 \log_z y, 7 \log_x z$ are in A.P. with common difference $\frac{1}{2}$. Then $r - p - q$ is equal to

- (A) 12 (B) -6 (C) 6 (D) 2

The relation $R = \{(a, b) : \gcd(a, b) = 1, 2a \neq b, a, b \in \mathbb{Z}\}$ is:

- (A) reflexive but not symmetric (B) transitive but not reflexive
(C) symmetric but not transitive (D) neither symmetric nor transitive

Let PQR be a triangle. The points A, B and C are on the sides QR, RP and PQ respectively such that

$\frac{QA}{AR} = \frac{RB}{BP} = \frac{PC}{CQ} = \frac{1}{2}$. Then $\frac{\text{Area}(\Delta PQR)}{\text{Area}(\Delta ABC)}$ is equal to:

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

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Q72 Vectors[Step-by-step solution](#) › [prepwisar.in/questions/ivjue5eS6g](https://www.prepwisar.in/questions/ivjue5eS6g)

Let

$$\vec{u} = \hat{i} - \hat{j} - 2\hat{k}, \vec{v} = 2\hat{i} + \hat{j} - \hat{k}, \vec{v} \cdot \vec{w} = 2$$

and

$$\vec{v} \times \vec{w} = \vec{u} + \lambda \vec{v}$$

. Then $\vec{u} \cdot \vec{w}$ is equal to:

(A) $-\frac{2}{3}$

(B) $\frac{3}{2}$

(C) 2

(D) 1

Q73 Area Under Curves[Step-by-step solution](#) › [prepwisar.in/questions/BKMwPN0oNU](https://www.prepwisar.in/questions/BKMwPN0oNU)The area enclosed by the curves $y^2 + 4x = 4$ and $y - 2x = 2$ is:

(A) $\frac{22}{3}$

(B) 9

(C) $\frac{23}{3}$

(D) $\frac{25}{3}$

Mathematics Section B · Numerical value

Q74 to Q83

Q74 Three Dimensional Geometry **NUMERICAL**[Step-by-step solution](#) › [prepwisar.in/questions/jlUboTKJ2H](https://www.prepwisar.in/questions/jlUboTKJ2H)The shortest distance between the lines $\frac{x-2}{3} = \frac{y+1}{2} = \frac{z-6}{2}$ and $\frac{x-6}{3} = \frac{1-y}{2} = \frac{z+8}{0}$ is equal to _____**Q75** Binomial Theorem **NUMERICAL**[Step-by-step solution](#) › [prepwisar.in/questions/UV8r9YJcom](https://www.prepwisar.in/questions/UV8r9YJcom)

Suppose

$$\sum_{r=0}^{2023} r^{2023} C_r = 2023 \times \alpha \times 2^{2022}$$

. Then the value of α is _____**Q76** Definite Integration **NUMERICAL**[Step-by-step solution](#) › [prepwisar.in/questions/oKfwKKEUht](https://www.prepwisar.in/questions/oKfwKKEUht)The value of $12 \int_0^3 |x^2 - 3x + 2| dx$ is _____**Q77** Definite Integration **NUMERICAL**[Step-by-step solution](#) › [prepwisar.in/questions/9kpTFPQSmS](https://www.prepwisar.in/questions/9kpTFPQSmS)

The value of

$$\frac{8}{\pi} \int_0^{\frac{\pi}{2}} \frac{(\cos x)^{2023}}{(\sin x)^{2023} + (\cos x)^{2023}} dx$$

is _____

Q78 Ellipse **NUMERICAL**[Step-by-step solution](#) › [prepwisar.in/questions/E787z9Jxk7](https://www.prepwisar.in/questions/E787z9Jxk7)Let C be the largest circle centred at (2, 0) and inscribed in the ellipse $\frac{x^2}{36} + \frac{y^2}{16} = 1$. If $(1, \alpha)$ lies on C, then $10\alpha^2$ is equal to _____**Q79** Ellipse **NUMERICAL**[Step-by-step solution](#) › [prepwisar.in/questions/kZrb1VKfII](https://www.prepwisar.in/questions/kZrb1VKfII)Let a tangent to the curve $9x^2 + 16y^2 = 144$ intersect the coordinate axes at the points A and B. Then, the minimum length of the line segment AB is _____Attempt this paper online with instant answer checking › [prepwisar.in/pyqs/paper/2023-01-24-morning](https://www.prepwisar.in/pyqs/paper/2023-01-24-morning)

A boy needs to select five courses from 12 available courses, out of which 5 courses are language courses. If he can choose at most two language courses, then the number of ways he can choose five courses is _____

The number of 9 digit numbers, that can be formed using all the digits of the number 123412341 so that the even digits occupy only even places, is _____.

Let $\lambda \in \mathbb{R}$ and let the equation E be $|x|^2 - 2|x| + |\lambda - 3| = 0$. Then the largest element in the set $S = \{x + \lambda : x \text{ is an integer solution of E}\}$ is _____

The 4th term of GP is 500 and its common ratio is $\frac{1}{m}$, $m \in \mathbb{N}$. Let S_n denote the sum of the first n terms of this GP. If $S_6 > S_5 + 1$ and $S_7 < S_6 + \frac{1}{2}$, then the number of possible values of m is _____

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Physics

1. B	2. C	3. D	4. A	5. A	6. D	7. A	8. D
9. B	10. A	11. D	12. D	13. D	14. C	15. B	16. B
17. D	18. D	19. B	20. 10	21. 11	22. 2	23. 2	24. 120
25. 12	26. 110	27. 5	28. 40	29. 1			

Chemistry

30. A	31. B	32. D	33. B	34. D	35. C	36. C	37. B
38. A	39. A	40. B	41. C	42. B	43. B	44. B	45. C
46. 25	47. 7	48. 917	49. 2	50. 10	51. 4	52. 180	53. 492
54. 2							

Mathematics

55. D	56. B	57. B	58. B	59. C	60. B	61. B	62. A
63. C	64. A	65. C	66. C	67. B	68. C	69. D	70. D
71. D	72. D	73. B	74. 14	75. 1012	76. 22	77. 2	78. 118
79. 7	80. 546	81. 60	82. 5	83. 12			

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