

JEE MAIN 2023 · QUESTION PAPER

10 Apr 2023 **Shift 2**

86 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	19 Q30 to Q48	10 Q49 to Q58
● Mathematics	19 Q59 to Q77	9 Q78 to Q86
In this PDF	86 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/2023-04-10-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? prepwis.in/feedback · Terms: prepwis.in/terms

Q1 Nuclear Physics

[Step-by-step solution](#) › [prepwise.in/questions/PLI-2HzLEQ](https://www.prepwise.in/questions/PLI-2HzLEQ)

The half life of a radioactive substance is T . The time taken, for disintegrating $\frac{7}{8}$ th part of its original mass will be:

- (A) $8T$ (B) $3T$ (C) T (D) $2T$

Q2 Electrostatics II: Potential & Capacitance

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

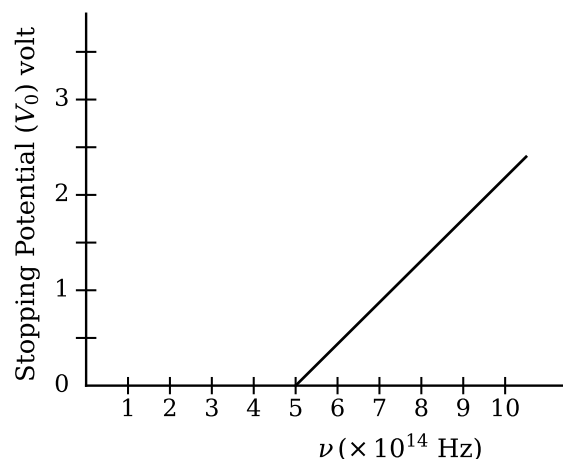
The distance between two plates of a capacitor is d and its capacitance is C_1 , when air is the medium between the plates. If a metal sheet of thickness $\frac{2d}{3}$ and of the same area as plate is introduced between the plates, the capacitance of the capacitor becomes C_2 . The ratio $\frac{C_2}{C_1}$ is

- (A) 1 : 1 (B) 3 : 1 (C) 2 : 1 (D) 4 : 1

Q3 Dual Nature of Radiation & Matter

[Step-by-step solution](#) › [prepwise.in/questions/pOhyh7n2qd](https://www.prepwise.in/questions/pOhyh7n2qd)

The variation of stopping potential (V_0) as a function of the frequency (ν) of the incident light for a metal is shown in figure. The work function of the surface is



- (A) 1.36 eV (B) 18.6 eV (C) 2.98 eV (D) 2.07 eV

Q4 Electromagnetic Waves

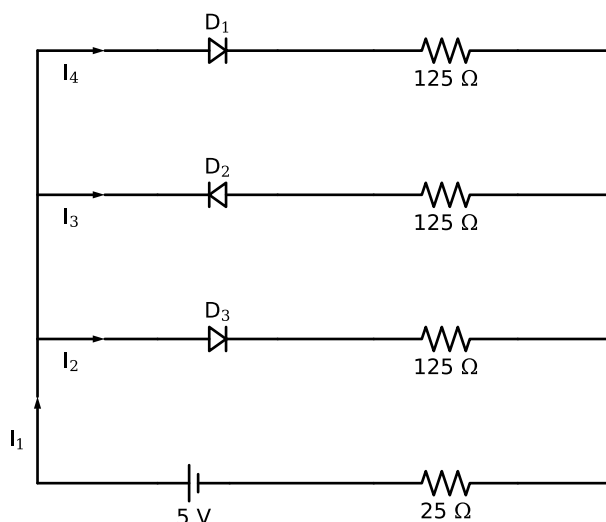
[Step-by-step solution](#) › [prepwise.in/questions/VH7UI86kji](https://www.prepwise.in/questions/VH7UI86kji)

The amplitude of magnetic field in an electromagnetic wave propagating along y -axis is $6.0 \times 10^{-7} \text{ T}$. The maximum value of electric field in the electromagnetic wave is

- (A) $6.0 \times 10^{-7} \text{ Vm}^{-1}$ (B) $5 \times 10^{14} \text{ Vm}^{-1}$ (C) 180 Vm^{-1} (D) $2 \times 10^{15} \text{ Vm}^{-1}$

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If each diode has a forward bias resistance of 25Ω in the below circuit,



Which of the following options is correct:

- (A) $\frac{I_3}{I_4} = 1$ (B) $\frac{I_1}{I_2} = 2$ (C) $\frac{I_2}{I_3} = 1$ (D) $\frac{I_1}{I_2} = 1$

In a metallic conductor, under the effect of applied electric field, the free electrons of the conductor

- (A) move in the straight line paths in the same direction
 (B) move with the uniform velocity throughout from lower potential to higher potential
 (C) drift from higher potential to lower potential.
 (D) move in the curved paths from lower potential to higher potential

The time period of a satellite, revolving above earth's surface at a height equal to R will be

(Given $g = \pi^2 \text{m/s}^2$, R = radius of earth)

- (A) $\sqrt{32R}$ (B) $\sqrt{4R}$ (C) $\sqrt{8R}$ (D) $\sqrt{2R}$

Given below are two statements:

Statement I : Rotation of the earth shows effect on the value of acceleration due to gravity (g)

Statement II : The effect of rotation of the earth on the value of ' g ' at the equator is minimum and that at the pole is maximum.

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

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

A gas mixture consists of 2 moles of oxygen and 4 moles of neon at temperature T . Neglecting all vibrational modes, the total internal energy of the system will be,

- (A) $4RT$ (B) $16RT$ (C) $8RT$ (D) $11RT$

Q10 Thermodynamics[Step-by-step solution](https://www.prepwiset.in/questions/zdmsyl_d19) › prepwiset.in/questions/zdmsyl_d19

A gas is compressed adiabatically, which one of the following statement is NOT true.

- (A) There is no heat supplied to the system
- (B) The temperature of the gas increases.
- (C) There is no change in the internal energy
- (D) The change in the internal energy is equal to the work done on the gas.

Q11 Electromagnetic Induction[Step-by-step solution](https://www.prepwiset.in/questions/uUgoM3AmXP) › prepwiset.in/questions/uUgoM3AmXP

A bar magnet is released from rest along the axis of a very long vertical copper tube. After some time the magnet will

- (A) move down with almost constant speed
- (B) move down with an acceleration equal to g
- (C) move down with an acceleration greater than g
- (D) oscillate inside the tube

Q12 Magnetism & Matter[Step-by-step solution](https://www.prepwiset.in/questions/9Yp5GgFjCx) › prepwiset.in/questions/9Yp5GgFjCx

Given below are two statements:

Statement I : For diamagnetic substance, $-1 \leq \chi < 0$, where χ is the magnetic susceptibility.

Statement II : Diamagnetic substances when placed in an external magnetic field, tend to move from stronger to weaker part of the field.

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 correct but Statement II is false
- (C) Both Statement I and Statement II are False
- (D) Statement I is incorrect but Statement II is true.

Q13 Projectile Motion & Relative Motion[Step-by-step solution](https://www.prepwiset.in/questions/L_1jyQdNf6) › prepwiset.in/questions/L_1jyQdNf6

Two projectiles are projected at 30° and 60° with the horizontal with the same speed. The ratio of the maximum height attained by the two projectiles respectively is:

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

Q14 Rectilinear Motion[Step-by-step solution](https://www.prepwiset.in/questions/8Jcfr78CHf) › prepwiset.in/questions/8Jcfr78CHf

A person travels x distance with velocity v_1 and then x distance with velocity v_2 in the same direction. The average velocity of the person is v , then the relation between v , v_1 and v_2 will be.

- (A) $V = V_1 + V_2$
- (B) $V = \frac{v_1 + v_2}{2}$
- (C) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$
- (D) $\frac{2}{V} = \frac{1}{v_1} + \frac{1}{v_2}$

Q15 Elasticity[Step-by-step solution](https://www.prepwiset.in/questions/fTE7Gft4IP) › prepwiset.in/questions/fTE7Gft4IP

Young's moduli of the material of wires A and B are in the ratio of $1 : 4$, while its area of cross sections are in the ratio of $1 : 3$. If the same amount of load is applied to both the wires, the amount of elongation produced in the wires A and B will be in the ratio of

[Assume length of wires A and B are same]

- (A) $1 : 12$
- (B) $1 : 36$
- (C) $12 : 1$
- (D) $36 : 1$

Q16 Newton's Laws of Motion[Step-by-step solution](#) › prepwiser.in/questions/4IKUSfwc17

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

Assertion A : An electric fan continues to rotate for some time after the current is switched off.

Reason R : Fan continues to rotate due to inertia of motion.

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

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

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

The ratio of intensities at two points P and Q on the screen in a Young's double slit experiment where phase difference between two waves of same amplitude are $\pi/3$ and $\pi/2$, respectively are

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

Q18 Simple Harmonic Motion[Step-by-step solution](#) › prepwiser.in/questions/1v5Uv26cuW

For a periodic motion represented by the equation

$$y = \sin \omega t + \cos \omega t$$

the amplitude of the motion is

- (A) 1 (B) $\sqrt{2}$ (C) 0.5 (D) 2

Q19 Experimental Skills[Step-by-step solution](#) › prepwiser.in/questions/4tnYdp0DWr

In an experiment with vernier callipers of least count 0.1mm, when two jaws are joined together the zero of vernier scale lies right to the zero of the main scale and 6th division of vernier scale coincides with the main scale division. While measuring the diameter of a spherical bob, the zero of vernier scale lies in between 3.2cm and 3.3cm marks, and 4th division of vernier scale coincides with the main scale division. The diameter of bob is measured as

- (A) 3.18cm (B) 3.22cm (C) 3.26cm (D) 3.25cm

Physics Section B · Numerical value

Q20 to Q29

Q20 Atomic Physics **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/7n9kg8o9H0

If $917 \text{ \AA}$ be the lowest wavelength of Lyman series then the lowest wavelength of Balmer series will be _____ $\text{ \AA}$.

Q21 Current Electricity **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/P9-5cinXZO

A rectangular parallelepiped is measured as $1\text{cm} \times 1\text{cm} \times 100\text{cm}$. If its specific resistance is $3 \times 10^{-7} \Omega\text{m}$, then the resistance between its two opposite rectangular faces will be _____ $\times 10^{-7} \Omega$.

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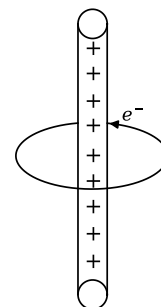
Q22 Electromagnetic Induction **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/M_jOYXVfdI) > prepwiser.in/questions/M_jOYXVfdI

A square loop of side 2.0cm is placed inside a long solenoid that has 50 turns per centimetre and carries a sinusoidally varying current of amplitude 2.5A and angular frequency 700rad s^{-1} . The central axes of the loop and solenoid coincide. The amplitude of the emf induced in the loop is $x \times 10^{-4}\text{V}$. The value of x is _____.

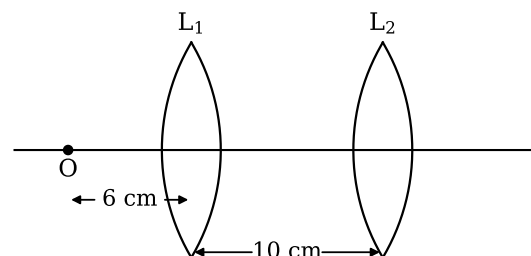
(Take, $\pi = \frac{22}{7}$)

Q23 Electrostatics I: Charges, Field & Gauss's Law **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/OeJ4R4JOoi) > prepwiser.in/questions/OeJ4R4JOoi

An electron revolves around an infinite cylindrical wire having uniform linear charge density $2 \times 10^{-8}\text{Cm}^{-1}$ in circular path under the influence of attractive electrostatic field as shown in the figure. The velocity of electron with which it is revolving is _____ $\times 10^6\text{ms}^{-1}$. Given mass of electron = $9 \times 10^{-31}\text{kg}$

**Q24** Ray Optics **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/XFPjna4pI_) > prepwiser.in/questions/XFPjna4pI_

A point object, 'O' is placed in front of two thin symmetrical coaxial convex lenses L_1 and L_2 with focal length 24cm and 9cm respectively. The distance between two lenses is 10cm and the object is placed 6cm away from lens L_1 as shown in the figure. The distance between the object and the image formed by the system of two lenses is _____ cm.

**Q25** Moving Charges & Magnetism **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/xeoTr-c4RW) > prepwiser.in/questions/xeoTr-c4RW

A straight wire carrying a current of 14A is bent into a semi-circular arc of radius 2.2cm as shown in the figure. The magnetic field produced by the current at the centre (O) of the arc is _____ $\times 10^{-4}\text{T}$

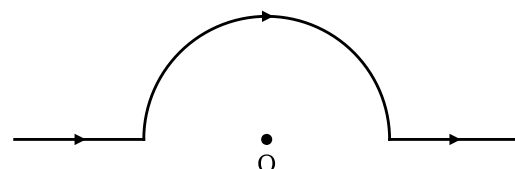
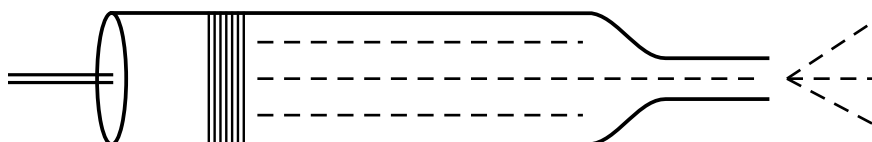
**Q26** Fluid Mechanics **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/_-EeOmcGt7) > prepwiser.in/questions/_-EeOmcGt7

Figure below shows a liquid being pushed out of the tube by a piston having area of cross section 2.0cm^2 . The area of cross section at the outlet is 10mm^2 . If the piston is pushed at a speed of 4cms^{-1} , the speed of outgoing fluid is _____ cms^{-1}

**Q27** Rotational Motion **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/basFzwOKVo) > prepwiser.in/questions/basFzwOKVo

A force of $-P\hat{k}$ acts on the origin of the coordinate system. The torque about the point $(2, -3)$ is $P(a\hat{i} + b\hat{j})$, The ratio of $\frac{a}{b}$ is $\frac{x}{2}$. The value of x is -

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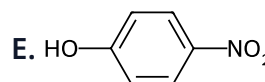
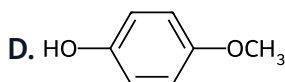
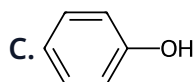
A rectangular block of mass 5 kg attached to a horizontal spiral spring executes simple harmonic motion of amplitude 1 m and time period 3.14 s . The maximum force exerted by spring on block is _____ N

If the maximum load carried by an elevator is 1400 kg (600 kg - Passengers + 800 kg - elevator), which is moving up with a uniform speed of 3 ms^{-1} and the frictional force acting on it is 2000 N , then the maximum power used by the motor is _____ kW ($g = 10\text{ m/s}^2$)

Chemistry Section A · Multiple choice

Q30 to Q48

The correct order for acidity of the following hydroxyl compound is:

A. CH_3OH B. $(\text{CH}_3)_3\text{COH}$ 

Choose the correct answer from the options given below:

(A) $\text{E} > \text{C} > \text{D} > \text{A} > \text{B}$ (B) $\text{D} > \text{E} > \text{C} > \text{A} > \text{B}$ (C) $\text{E} > \text{D} > \text{C} > \text{B} > \text{A}$ (D) $\text{C} > \text{E} > \text{D} > \text{B} > \text{A}$

Incorrect method of preparation for alcohols from the following is:

(A) Hydroboration-oxidation of alkene.

(B) Reaction of Ketone with RMgBr followed by hydrolysis.

(C) Ozonolysis of alkene.

(D) Reaction of alkyl halide with aqueous NaOH .

The reaction used for preparation of soap from fat is:

(A) an addition reaction

(B) alkaline hydrolysis reaction

(C) reduction reaction

(D) an oxidation reaction

The correct order of the number of unpaired electrons in the given complexes is

A. $[\text{Fe}(\text{CN})_6]^{3-}$ B. $[\text{FeF}_6]^{3-}$ C. $[\text{CoF}_6]^{3-}$ D. $[\text{Cr}(\text{oxalate})_3]^{3-}$ E. $[\text{Ni}(\text{CO})_4]$

Choose the correct answer from the options given below:

(A) $\text{E} < \text{A} < \text{B} < \text{D} < \text{C}$ (B) $\text{A} < \text{E} < \text{D} < \text{C} < \text{B}$ (C) $\text{A} < \text{E} < \text{C} < \text{B} < \text{D}$ (D) $\text{E} < \text{A} < \text{D} < \text{C} < \text{B}$

Match List I with List II

	List - I Complex		List - II Crystal Field splitting energy (Δ_0)
A.	$[Ti(H_2O)_6]^{2+}$	I.	-1.2
B.	$[V(H_2O)_6]^{2+}$	II.	-0.6
C.	$[Mn(H_2O)_6]^{3+}$	III.	0
D.	$[Fe(H_2O)_6]^{3+}$	IV.	-0.8

Choose the correct answer from the options given below:

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

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

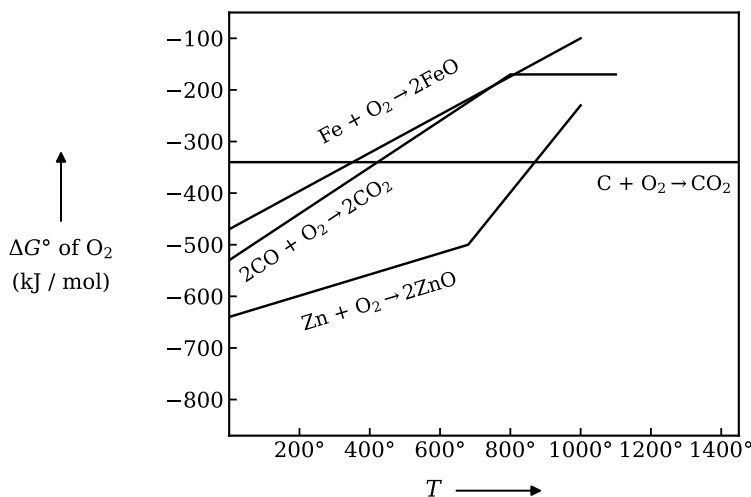
Assertion A : Physical properties of isotopes of hydrogen are different.

Reason R : Mass difference between isotopes of hydrogen is very large.

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

Gibbs energy vs T plot for the formation of oxides is given below.



For the given diagram, the correct statement is -

- (A) At $600^\circ C$, C can reduce FeO (B) At $600^\circ C$, C can reduce ZnO
 (C) At $600^\circ C$, CO can reduce ZnO (D) At $600^\circ C$, CO cannot reduce FeO

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

Assertion **A** : The energy required to form Mg^{2+} from Mg is much higher than that required to produce Mg^+

Reason **R** : Mg^{2+} is small ion and carry more charge than Mg^+

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

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

Buna-S can be represented as:

- (A) $\left[-\text{CH}_2 - \text{CH} = \text{CH} - \text{CH}_2 - \overset{\text{C}_6\text{H}_5}{\underset{|}{\text{CH}}} - \text{CH}_2 - \right]_n$
 (B) $\left[\text{CH}_2 - \text{CH} = \overset{\text{C}_6\text{H}_5}{\underset{|}{\text{C}}} - \text{CH} = \text{CH} - \text{CH}_2 - \right]_n$
 (C) $\left[-\text{CH}_2 - \text{CH} = \text{CH} - \text{CH} = \overset{\text{C}_6\text{H}_5}{\underset{|}{\text{C}}} - \text{CH}_2 - \right]_n$
 (D) $\left[\text{CH} = \text{CH} - \text{CH} = \text{CH} - \overset{\text{C}_6\text{H}_5}{\underset{|}{\text{CH}}} - \text{CH}_2 - \right]_n$

The correct order of metallic character is:

- (A) $\text{K} > \text{Be} > \text{Ca}$ (B) $\text{Ca} > \text{K} > \text{Be}$ (C) $\text{K} > \text{Ca} > \text{Be}$ (D) $\text{Be} > \text{Ca} > \text{K}$

Number of water molecules in washing soda and soda ash respectively are:

- (A) 1 and 0 (B) 10 and 1 (C) 1 and 10 (D) 10 and 0

The correct relationships between unit cell edge length ' a ' and radius of sphere ' r ' for face-centred and body-centred cubic structures respectively are:

- (A) $r = 2\sqrt{2}a$ and $\sqrt{3}r = 4a$ (B) $r = 2\sqrt{2}a$ and $4r = \sqrt{3}a$
 (C) $2\sqrt{2}r = a$ and $\sqrt{3}r = 4a$ (D) $2\sqrt{2}r = a$ and $4r = \sqrt{3}a$

Given below are two statements: one is labelled as Assertion **A** and the other is labelled as Reason **R**
Assertion **A**: 3.1500g of hydrated oxalic acid dissolved in water to make 250.0mL solution will result in 0.1M oxalic acid solution.

Reason **R**: Molar mass of hydrated oxalic acid is 126g mol^{-1}

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

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

Match List I with List II

	List - I		List - II (Δ_0)
A.	16 g of $\text{CH}_4(\text{g})$	I.	Weighs 28 g
B.	1 g of $\text{H}_2(\text{g})$	II.	60.2×10^{23} electrons
C.	1 mole of $\text{N}_2(\text{g})$	III.	Weighs 32 g
D.	0.5 mol of $\text{SO}_2(\text{g})$	IV.	Occupies 11.4 L volume of STP

Choose the correct answer from the options given below:

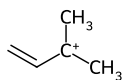
- (A) A-II, B-III, C-IV, D-I (B) A-II, B-IV, C-I, D-III (C) A-I, B-III, C-II, D-IV (D) A-II, B-IV, C-III, D-I

Ferric chloride is applied to stop bleeding because -

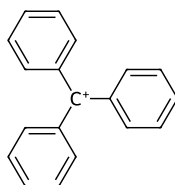
- (A) FeCl_3 reacts with the constituents of blood which is a positively charged sol.
(B) Blood absorbs FeCl_3 and forms a complex.
(C) Cl^- ions cause coagulation of blood.
(D) Fe^{3+} ions coagulate blood which is a negatively charged sol.

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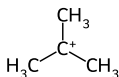
The decreasing order of hydride affinity for following carbocations is:



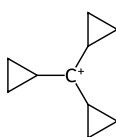
A.



B.



C.



D.

Choose the correct answer from the options given below:

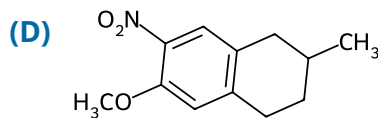
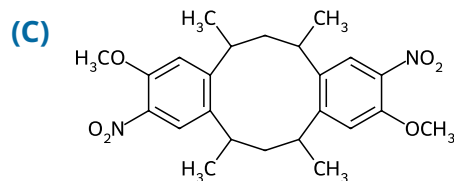
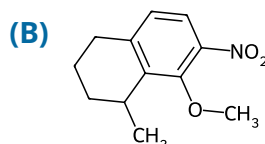
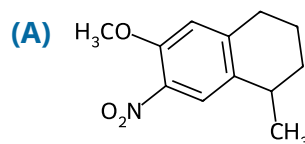
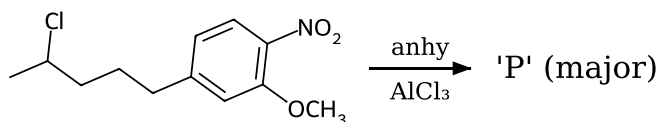
(A) A, C, D, B

(B) C, A, B, D

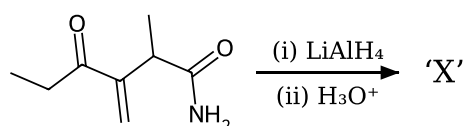
(C) A, C, B, D

(D) C, A, D, B

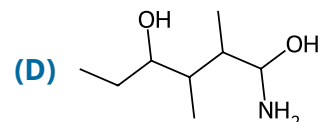
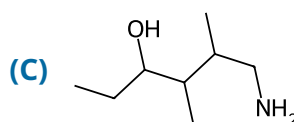
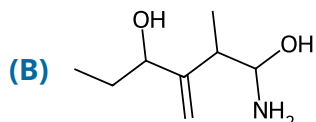
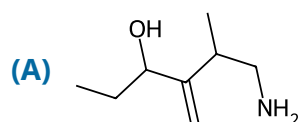
The major product 'P' formed in the given reaction is:



In the reaction given below:



The product 'X' is:



In Carius tube, an organic compound 'X' is treated with sodium peroxide to form a mineral acid 'Y'. The solution of BaCl_2 is added to 'Y' to form a precipitate 'Z'. 'Z' is used for the quantitative estimation of an extra element. 'X' could be

- (A) Cytosine (B) Methionine (C) Chloroxyleneol (D) A nucleotide

Chemistry Section B · Numerical value

Q49 to Q58

Q49 Chemical Bonding & Molecular Structure NUMERICAL

[Step-by-step solution](https://www.prepwise.in/questions/gVW4cpRo9A) > prepwise.in/questions/gVW4cpRo9A

The number of molecules from the following which contain only two lone pair of electrons is _____
 $\text{H}_2\text{O}, \text{N}_2, \text{CO}, \text{XeF}_4, \text{NH}_3, \text{NO}, \text{CO}_2, \text{F}_2$

Q50 Chemical Kinetics NUMERICAL

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

The number of **incorrect** statement/s from the following is _____

- A. The successive half lives of zero order reactions decreases with time.
B. A substance appearing as reactant in the chemical equation may not affect the rate of reaction
C. Order and molecularity of a chemical reaction can be a fractional number
D. The rate constant units of zero and second order reaction are $\text{molL}^{-1}\text{s}^{-1}$ and $\text{mol}^{-1}\text{Ls}^{-1}$ respectively

Q51 d & f Block Elements NUMERICAL

[Step-by-step solution](https://www.prepwise.in/questions/FAe9nxGgO7) > prepwise.in/questions/FAe9nxGgO7

For a metal ion, the calculated magnetic moment is 4.90 BM. This metal ion has _____ number of unpaired electrons.

Q52 Electrochemistry NUMERICAL

[Step-by-step solution](https://www.prepwise.in/questions/FhpYShzBb0) > prepwise.in/questions/FhpYShzBb0

The specific conductance of 0.0025 M acetic acid is $5 \times 10^{-5} \text{Scm}^{-1}$ at a certain temperature. The dissociation constant of acetic acid is _____ $\times 10^{-7}$ (Nearest integer)

Consider limiting molar conductivity of CH_3COOH as $400 \text{Scm}^2\text{mol}^{-1}$

Q53 p-Block Elements: Part II (Group 15-18) NUMERICAL

[Step-by-step solution](https://www.prepwise.in/questions/nLDz1Je-m6) > prepwise.in/questions/nLDz1Je-m6

The difference in the oxidation state of Xe between the oxidised product of Xe formed on complete hydrolysis of XeF_4 is _____

Q54 Redox Reactions NUMERICAL

[Step-by-step solution](https://www.prepwise.in/questions/0GVTmaEwZU) > prepwise.in/questions/0GVTmaEwZU

In alkaline medium, the reduction of permanganate anion involves a gain of _____ electrons.

Q55 Solutions & Colligative Properties NUMERICAL

[Step-by-step solution](https://www.prepwise.in/questions/IQtUR6ggew) > prepwise.in/questions/IQtUR6ggew

An aqueous solution of volume 300cm^3 contains 0.63 g of protein. The osmotic pressure of the solution at 300 K is 1.29 mbar. The molar mass of the protein is _____ gmol^{-1}

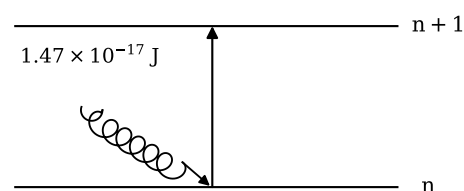
Given : $R = 0.083 \text{ L bar K}^{-1} \text{mol}^{-1}$

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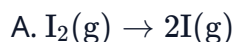
Q56 Atomic Structure **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/4I9AuL-VG_) › prepwisar.in/questions/4I9AuL-VG_

The electron in the n^{th} orbit of Li^{2+} is excited to $(n + 1)$ orbit using the radiation of energy $1.47 \times 10^{-17} \text{ J}$ (as shown in the diagram). The value of n is _____

Given: $R_H = 2.18 \times 10^{-18} \text{ J}$

**Q57** Chemical Thermodynamics **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/uHQhm9mHI0) › prepwisar.in/questions/uHQhm9mHI0

The number of endothermic process/es from the following is _____.



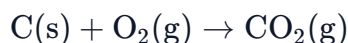
B.



C.



D.



E. Dissolution of ammonium chloride in water

Q58 Chemical Equilibrium **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/Fe9dFHku2d) › prepwisar.in/questions/Fe9dFHku2d

For the given reaction, if the initial pressure is 450 mmHg and the pressure at time t is 720 mmHg at a constant temperature T and constant volume V . The fraction of $\text{A}(\text{g})$ decomposed under these conditions is $x \times 10^{-1}$. The value of x is _____ (nearest integer)

Mathematics Section A · Multiple choice

Q59 to Q77

Q59 Three Dimensional Geometry[Step-by-step solution](https://www.prepwisar.in/questions/qzvM0850p8) › prepwisar.in/questions/qzvM0850p8

Let the image of the point $P(1, 2, 6)$ in the plane passing through the points $A(1, 2, 0)$, $B(1, 4, 1)$ and $C(0, 5, 1)$ be $Q(\alpha, \beta, \gamma)$. Then $(\alpha^2 + \beta^2 + \gamma^2)$ is equal to:

(A) 76

(B) 62

(C) 70

(D) 65

Q60 Three Dimensional Geometry[Step-by-step solution](https://www.prepwisar.in/questions/za1zKG10CF) › prepwisar.in/questions/za1zKG10CF

Let the line $\frac{x}{1} = \frac{6-y}{2} = \frac{z+8}{5}$ intersect the lines $\frac{x-5}{4} = \frac{y-7}{3} = \frac{z+2}{1}$ and $\frac{x+3}{6} = \frac{3-y}{3} = \frac{z-6}{1}$ at the points A and B respectively. Then the distance of the mid-point of the line segment AB from the plane $2x - 2y + z = 14$ is:

(A) 3

(B) $\frac{10}{3}$

(C) 4

(D) $\frac{11}{3}$

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Q61 Inverse Trigonometric Functions[Step-by-step solution](#) › prepwiser.in/questions/IZHek3hPMC

Let $g(x) = f(x) + f(1-x)$ and $f''(x) > 0, x \in (0, 1)$. If g is decreasing in the interval $(0, a)$ and increasing in the interval $(a, 1)$, then

$$\tan^{-1}(2\alpha) + \tan^{-1}\left(\frac{1}{\alpha}\right) + \tan^{-1}\left(\frac{\alpha+1}{\alpha}\right)$$

is equal to:

(A) $\frac{3\pi}{4}$

(B) π

(C) $\frac{5\pi}{4}$

(D) $\frac{3\pi}{2}$

Q62 Binomial Theorem[Step-by-step solution](#) › prepwiser.in/questions/M79ILfAYcY

Let the number $(22)^{2022} + (2022)^{22}$ leave the remainder α when divided by 3 and β when divided by 7. Then $(\alpha^2 + \beta^2)$ is equal to:

(A) 13

(B) 10

(C) 20

(D) 5

Q63 Binomial Theorem[Step-by-step solution](#) › prepwiser.in/questions/TR466t234y

If the coefficients of x and x^2 in $(1+x)^p(1-x)^q$ are 4 and -5 respectively, then $2p+3q$ is equal to:

(A) 66

(B) 60

(C) 69

(D) 63

Q64 Straight Lines[Step-by-step solution](#) › prepwiser.in/questions/r4X8MKXcn-

Let A be the point $(1, 2)$ and B be any point on the curve $x^2 + y^2 = 16$. If the centre of the locus of the point P, which divides the line segment AB in the ratio 3 : 2 is the point $C(\alpha, \beta)$, then the length of the line segment AC is:

(A) $\frac{3\sqrt{5}}{5}$

(B) $\frac{6\sqrt{5}}{5}$

(C) $\frac{2\sqrt{5}}{5}$

(D) $\frac{4\sqrt{5}}{5}$

Q65 Complex Numbers[Step-by-step solution](#) › prepwiser.in/questions/p5pbpozIzw

Let

$$S = \left\{ z = x + iy : \frac{2z - 3i}{4z + 2i} \text{ is a real number} \right\}$$

. Then which of the following is NOT correct?

(A) $y + x^2 + y^2 \neq -\frac{1}{4}$

(B) $(x, y) = (0, -\frac{1}{2})$

(C) $x = 0$

(D) $y \in \left(-\infty, -\frac{1}{2}\right) \cup \left(-\frac{1}{2}, \infty\right)$

Q66 Definite Integration[Step-by-step solution](#) › prepwiser.in/questions/0B1HMhXTdi

Let f be a continuous function satisfying

$$\int_0^t (f(x) + x^2) dx = \frac{4}{3}t^3, \forall t > 0$$

. Then $f\left(\frac{\pi^2}{4}\right)$ is equal to:

(A) $-\pi\left(1 + \frac{\pi^3}{16}\right)$

(B) $\pi\left(1 - \frac{\pi^3}{16}\right)$

(C) $-\pi^2\left(1 + \frac{\pi^2}{16}\right)$

(D) $\pi^2\left(1 - \frac{\pi^2}{16}\right)$

Q67 Ellipse[Step-by-step solution](#) > [prepwiser.in/questions/Lzi8OC57J0](https://www.prepwiser.in/questions/Lzi8OC57J0)

Let a circle of radius 4 be concentric to the ellipse $15x^2 + 19y^2 = 285$. Then the common tangents are inclined to the minor axis of the ellipse at the angle:

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

Q68 Determinants[Step-by-step solution](#) > [prepwiser.in/questions/zH9jDExEXw](https://www.prepwiser.in/questions/zH9jDExEXw)

If

$$A = \frac{1}{5!6!7!} \begin{bmatrix} 5! & 6! & 7! \\ 6! & 7! & 8! \\ 7! & 8! & 9! \end{bmatrix}$$

, then $|\text{adj}(\text{adj}(2A))|$ is equal to:

- (A) 2^{12} (B) 2^{20} (C) 2^8 (D) 2^{16}

Q69 Permutations & Combinations[Step-by-step solution](#) > [prepwiser.in/questions/KNP9SAcE8K](https://www.prepwiser.in/questions/KNP9SAcE8K)

Eight persons are to be transported from city A to city B in three cars of different makes. If each car can accommodate at most three persons, then the number of ways, in which they can be transported, is:

- (A) 560 (B) 1680 (C) 3360 (D) 1120

Q70 Probability: Advanced[Step-by-step solution](#) > [prepwiser.in/questions/xf6npbTcWb](https://www.prepwiser.in/questions/xf6npbTcWb)

Let a die be rolled n times. Let the probability of getting odd numbers seven times be equal to the probability of getting odd numbers nine times. If the probability of getting even numbers twice is $\frac{k}{2^{15}}$, then k is equal to:

- (A) 15 (B) 60 (C) 30 (D) 90

Q71 Sequences & Series[Step-by-step solution](#) > [prepwiser.in/questions/KBIJI1Ye_y](https://www.prepwiser.in/questions/KBIJI1Ye_y)

If $S_n = 4 + 11 + 21 + 34 + 50 + \dots$ to n terms, then $\frac{1}{60} (S_{29} - S_9)$ is equal to:

- (A) 227 (B) 226 (C) 220 (D) 223

Q72 Relations & Functions (Basic)[Step-by-step solution](#) > [prepwiser.in/questions/PB-IfFnwWX](https://www.prepwiser.in/questions/PB-IfFnwWX)

Let $A = \{2, 3, 4\}$ and $B = \{8, 9, 12\}$. Then the number of elements in the relation

$$R = \{((a_1, b_1), (a_2, b_2)) \in (A \times B, A \times B) : a_1$$

divides b_2 and a_2 divides $b_1\}$ is:

- (A) 18 (B) 24 (C) 36 (D) 12

Q73 Statistics[Step-by-step solution](#) > [prepwiser.in/questions/XCLO4ol2JO](https://www.prepwiser.in/questions/XCLO4ol2JO)

Let μ be the mean and σ be the standard deviation of the distribution

x_i	0	1	2	3	4	5
f_i	$k+2$	$2k$	k^2-1	k^2-1	k^2+1	$k-3$

where $\sum f_i = 62$. If $[x]$ denotes the greatest integer $\leq x$, then $[\mu^2 + \sigma^2]$ is equal to:

- (A) 9 (B) 8 (C) 6 (D) 7

Let

$$S = \left\{ x \in \left(-\frac{\pi}{2}, \frac{\pi}{2} \right) : 9^{1-\tan^2 x} + 9^{\tan^2 x} = 10 \right\}$$

and $\beta = \sum_{x \in S} \tan^2 \left(\frac{x}{3} \right)$, then $\frac{1}{6}(\beta - 14)^2$ is equal to:

(A) 16

(B) 32

(C) 8

(D) 64

Q75 Vectors

Step-by-step solution > [prepwiser.in/questions/VL8nIob2Ng](https://www.prepwiser.in/questions/VL8nIob2Ng)Let $\vec{a} = 2\hat{i} + 7\hat{j} - \hat{k}$, $\vec{b} = 3\hat{i} + 5\hat{k}$ and $\vec{c} = \hat{i} - \hat{j} + 2\hat{k}$. Let $\vec{d}$ be a vector which is perpendicular to both $\vec{a}$ and $\vec{b}$, and $\vec{c} \cdot \vec{d} = 12$. Then $(-\hat{i} + \hat{j} - \hat{k}) \cdot (\vec{c} \times \vec{d})$ is equal to:

(A) 24

(B) 42

(C) 44

(D) 48

Q76 Vectors

Step-by-step solution > [prepwiser.in/questions/1cpEy5cISV](https://www.prepwiser.in/questions/1cpEy5cISV)If the points P and Q are respectively the circumcenter and the orthocentre of a $\triangle ABC$, then

$$\vec{PA} + \vec{PB} + \vec{PC}$$

is equal to:

(A) $\vec{QP}$ (B) $\vec{PQ}$ (C) $2\vec{PQ}$ (D) $2\vec{QP}$

Q77 Indefinite Integration

Step-by-step solution > [prepwiser.in/questions/falJ8u7GbB](https://www.prepwiser.in/questions/falJ8u7GbB)For $\alpha, \beta, \gamma, \delta \in \mathbb{N}$, if $\int \left(\left(\frac{x}{e} \right)^{2x} + \left(\frac{e}{x} \right)^{2x} \right) \log_e x dx = \frac{1}{\alpha} \left(\frac{x}{e} \right)^{\beta x} - \frac{1}{\gamma} \left(\frac{e}{x} \right)^{\delta x} + C$, where $e = \sum_{n=0}^{\infty} \frac{1}{n!}$ and C is constant of integration, then $\alpha + 2\beta + 3\gamma - 4\delta$ is equal to:

(A) -8

(B) -4

(C) 1

(D) 4

Mathematics Section B · Numerical value

Q78 to Q86

Q78 Three Dimensional Geometry **NUMERICAL**Step-by-step solution > [prepwiser.in/questions/cG1vTrq7B](https://www.prepwiser.in/questions/cG1vTrq7B)Let the foot of perpendicular from the point A(4, 3, 1) on the plane P : $x - y + 2z + 3 = 0$ be N. If B(5, α , β), $\alpha, \beta \in \mathbb{Z}$ is a point on plane P such that the area of the triangle ABN is $3\sqrt{2}$, then $\alpha^2 + \beta^2 + \alpha\beta$ is equal to _____.Q79 Applications of Derivatives **NUMERICAL**Step-by-step solution > [prepwiser.in/questions/djMjvQE9f5](https://www.prepwiser.in/questions/djMjvQE9f5)Let the quadratic curve passing through the point (-1, 0) and touching the line $y = x$ at (1, 1) be $y = f(x)$. Then the x-intercept of the normal to the curve at the point (α , $\alpha + 1$) in the first quadrant is _____.Q80 Differential Equations **NUMERICAL**Step-by-step solution > [prepwiser.in/questions/B04TG4OwOe](https://www.prepwiser.in/questions/B04TG4OwOe)Let the tangent at any point P on a curve passing through the points (1, 1) and $\left(\frac{1}{10}, 100 \right)$, intersect positive x-axis and y-axis at the points A and B respectively. If PA : PB = 1 : k and $y = y(x)$ is the solution of the differential equation $e^{\frac{dy}{dx}} = kx + \frac{k}{2}$, $y(0) = k$, then $4y(1) - 6 \log_e 3$ is equal to _____.Q81 Inverse Trigonometric Functions **NUMERICAL**Step-by-step solution > [prepwiser.in/questions/AW8xb6B8_r](https://www.prepwiser.in/questions/AW8xb6B8_r)If the domain of the function $f(x) = \sec^{-1} \left(\frac{2x}{5x+3} \right)$ is $[\alpha, \beta) \cup (\gamma, \delta]$, then $|3\alpha + 10(\beta + \gamma) + 21\delta|$ is equal to _____.

Q82 Determinants **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/6vXjI6FqWx](https://www.prepwise.in/questions/6vXjI6FqWx)

Let S be the set of values of λ , for which the system of equations

$$6\lambda x - 3y + 3z = 4\lambda^2,$$

$$2x + 6\lambda y + 4z = 1,$$

$3x + 2y + 3\lambda z = \lambda$ has no solution. Then $12 \sum_{i \in S} |\lambda|$ is equal to _____.

Q83 Permutations & Combinations **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/BX2ET1hqm6](https://www.prepwise.in/questions/BX2ET1hqm6)

The sum of all the four-digit numbers that can be formed using all the digits 2, 1, 2, 3 is equal to _____.

Q84 Sequences & Series **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/bUyGXG3DxC](https://www.prepwise.in/questions/bUyGXG3DxC)

Suppose $a_1, a_2, 2, a_3, a_4$ be in an arithmetico-geometric progression. If the common ratio of the corresponding geometric progression is 2 and the sum of all 5 terms of the arithmetico-geometric progression is $\frac{49}{2}$, then a_4 is equal to _____.

Q85 Area Under Curves **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/-hp3R1qmgB](https://www.prepwise.in/questions/-hp3R1qmgB)

If the area of the region $\{(x, y) : |x^2 - 2| \leq y \leq x\}$ is A , then $6A + 16\sqrt{2}$ is equal to _____.

Q86 Straight Lines **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/ib1WAdFFH8](https://www.prepwise.in/questions/ib1WAdFFH8)

Let the equations of two adjacent sides of a parallelogram $ABCD$ be $2x - 3y = -23$ and $5x + 4y = 23$. If the equation of its one diagonal AC is $3x + 7y = 23$ and the distance of A from the other diagonal is d , then $50d^2$ is equal to _____.

Answer key: JEE Main 2023 · 10 Apr · Shift 2

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Physics

1.	B	2.	B	3.	D	4.	C	5.	B	6.	D	7.	A	8.	B
9.	D	10.	C	11.	A	12.	A	13.	C	14.	D	15.	C	16.	C
17.	D	18.	B	19.	A	20.	3668	21.	3	22.	44	23.	8	24.	34
25.	2	26.	80	27.	3	28.	20	29.	48						

Chemistry

30.	A	31.	C	32.	B	33.	D	34.	A	35.	D	36.	A	37.	C
38.	A	39.	C	40.	D	41.	D	42.	C	43.	B	44.	D	45.	B
46.	A	47.	A	48.	B	49.	3	50.	1	51.	4	52.	66	53.	2
54.	3	55.	40535	56.	1	57.	4	58.	3						

Mathematics

59.	D	60.	C	61.	B	62.	D	63.	D	64.	A	65.	B	66.	B
67.	B	68.	D	69.	B	70.	B	71.	D	72.	C	73.	B	74.	B
75.	C	76.	B	77.	D	78.	7	79.	11	80.	4	81.	24	82.	24
83.	26664	84.	16	85.	27	86.	529								

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