

JEE MAIN 2023 · QUESTION PAPER

11 Apr 2023 **Shift 2**

80 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	19 Q1 to Q19	9 Q20 to Q28
● Chemistry	15 Q29 to Q43	10 Q44 to Q53
● Mathematics	18 Q54 to Q71	9 Q72 to Q80
In this PDF	80 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/2023-04-11-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 Atomic Physics

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

The energy of He^+ ion in its first excited state is, (The ground state energy for the Hydrogen atom is -13.6eV):

- (A) -13.6eV (B) -27.2eV (C) -3.4eV (D) -54.4eV

Q2 Electrostatics I: Charges, Field & Gauss's Law

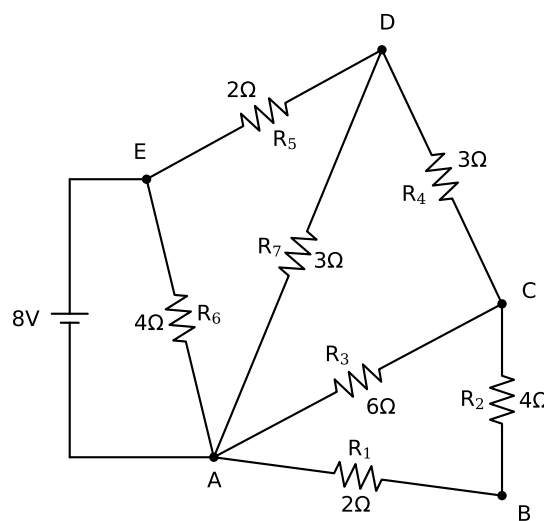
[Step-by-step solution](#) › [prepwisar.in/questions/zqewXRpSlz](https://www.prepwisar.in/questions/zqewXRpSlz)

A capacitor of capacitance C is charged to a potential V . The flux of the electric field through a closed surface enclosing the positive plate of the capacitor is:

- (A) Zero (B) $\frac{CV}{\epsilon_0}$ (C) $\frac{CV}{2\epsilon_0}$ (D) $\frac{2CV}{\epsilon_0}$

Q3 Current Electricity

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



The current flowing through R_2 is:

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

Q4 Dual Nature of Radiation & Matter

[Step-by-step solution](#) › [prepwisar.in/questions/EP175IngHP](https://www.prepwisar.in/questions/EP175IngHP)

The ratio of the de-Broglie wavelengths of proton and electron having same Kinetic energy:

(Assume $m_p = m_e \times 1849$)

- (A) 1:43 (B) 1:62 (C) 2:43 (D) 1:30

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Q5 Electromagnetic Induction[Step-by-step solution](#) > prepwiser.in/questions/UOCxsPc4QW

Given below are two statements: one is labelled as Assertion **A** and the other is labelled as Reason **R**
Assertion A: A bar magnet dropped through a metallic cylindrical pipe takes more time to come down compared to a non-magnetic bar with same geometry and mass.

Reason R: For the magnetic bar, Eddy currents are produced in the metallic pipe which oppose the motion of the magnetic bar.

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

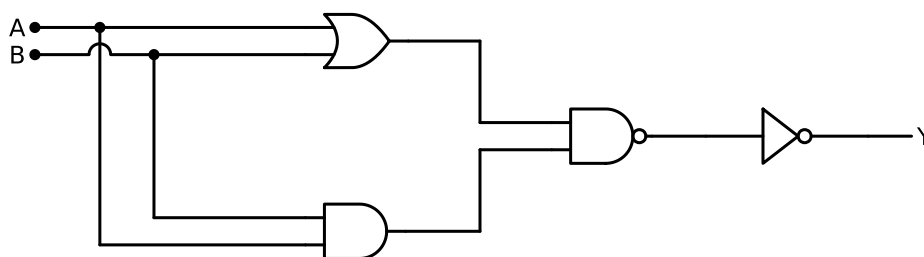
Q6 Electromagnetic Waves[Step-by-step solution](#) > prepwiser.in/questions/grAI9rDnRQ

A plane electromagnetic wave of frequency 20MHz propagates in free space along x-direction. At a particular space and time, $\vec{E} = 6.6\hat{j}\text{V/m}$. What is $\vec{B}$ at this point?

- (A) $-2.2 \times 10^{-8}\hat{i}\text{T}$ (B) $2.2 \times 10^{-8}\hat{i}\text{T}$ (C) $2.2 \times 10^{-8}\hat{k}\text{T}$ (D) $-2.2 \times 10^{-8}\hat{k}\text{T}$

Q7 Semiconductors & Electronic Devices[Step-by-step solution](#) > prepwiser.in/questions/SgIjc03wPo

The logic operations performed by the given digital circuit is equivalent to:



- (A) NOR (B) AND (C) NAND (D) OR

Q8 Ray Optics[Step-by-step solution](#) > prepwiser.in/questions/L73fkOejzS

When one light ray is reflected from a plane mirror with 30° angle of reflection, the angle of deviation of the ray after reflection is:

- (A) 140° (B) 130° (C) 120° (D) 110°

Q9 Gravitation[Step-by-step solution](#) > prepwiser.in/questions/kV5Ja3ckoT

A space ship of mass $2 \times 10^4\text{kg}$ is launched into a circular orbit close to the earth surface. The additional velocity to be imparted to the space ship in the orbit to overcome the gravitational pull will be (if $g = 10\text{m/s}^2$ and radius of earth = 6400km):

- (A) $7.9(\sqrt{2} - 1)\text{km/s}$ (B) $11.2(\sqrt{2} - 1)\text{km/s}$ (C) $7.4(\sqrt{2} - 1)\text{km/s}$ (D) $8(\sqrt{2} - 1)\text{km/s}$

Q10 Gravitation[Step-by-step solution](#) > prepwiser.in/questions/zfMpS-GHZb

If V is the gravitational potential due to sphere of uniform density on it's surface, then it's value at the center of sphere will be:-

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

Q11 Thermodynamics[Step-by-step solution > prepwise.in/questions/CnjRtGGD91](https://www.prepwise.in/questions/CnjRtGGD91)

The Thermodynamic process, in which internal energy of the system remains constant is

- (A) Isobaric (B) Isochoric (C) Adiabatic (D) Isothermal

Q12 Kinetic Theory of Gases[Step-by-step solution > prepwise.in/questions/txOuRXm2r3](https://www.prepwise.in/questions/txOuRXm2r3)

The root mean square speed of molecules of nitrogen gas at 27°C is approximately : (Given mass of a nitrogen molecule = $4.6 \times 10^{-26}\text{kg}$ and take Boltzmann constant $k_B = 1.4 \times 10^{-23}\text{JK}^{-1}$)

- (A) 91 m/s (B) 1260 m/s (C) 27.4 m/s (D) 523 m/s

Q13 Newton's Laws of Motion[Step-by-step solution > prepwise.in/questions/RJIM6ZrMnc](https://www.prepwise.in/questions/RJIM6ZrMnc)

A body of mass 500g moves along x-axis such that its velocity varies with displacement x according to the relation $v = 10\sqrt{x}\text{m/s}$ the force acting on the body is:-

- (A) 166 N (B) 5 N (C) 25 N (D) 125 N

Q14 Moving Charges & Magnetism[Step-by-step solution > prepwise.in/questions/74wt5zDaxk](https://www.prepwise.in/questions/74wt5zDaxk)

An electron is allowed to move with constant velocity along the axis of current carrying straight solenoid.

- A. The electron will experience magnetic force along the axis of the solenoid.
B. The electron will not experience magnetic force.
C. The electron will continue to move along the axis of the solenoid.
D. The electron will be accelerated along the axis of the solenoid.
E. The electron will follow parabolic path-inside the solenoid.

Choose the correct answer from the options given below:

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

Q15 Projectile Motion & Relative Motion[Step-by-step solution > prepwise.in/questions/ciFam7txHS](https://www.prepwise.in/questions/ciFam7txHS)

A projectile is projected at 30° from horizontal with initial velocity 40ms^{-1} . The velocity of the projectile at $t = 2\text{s}$ from the start will be : (Given $g = 10\text{m/s}^2$)

- (A) $20\sqrt{3}\text{ms}^{-1}$ (B) Zero (C) 20ms^{-1} (D) $40\sqrt{3}\text{ms}^{-1}$

Q16 Fluid Mechanics[Step-by-step solution > prepwise.in/questions/VrQNe-kI2n](https://www.prepwise.in/questions/VrQNe-kI2n)

Eight equal drops of water are falling through air with a steady speed of 10cm/s . If the drops coalesce, the new velocity is:-

- (A) 40cm/s (B) 16cm/s (C) 10cm/s (D) 5cm/s

Q17 Sound Waves[Step-by-step solution > prepwise.in/questions/jUFama2ogk](https://www.prepwise.in/questions/jUFama2ogk)

A car P travelling at 20ms^{-1} sounds its horn at a frequency of 400Hz . Another car Q is travelling behind the first car in the same direction with a velocity 40ms^{-1} . The frequency heard by the passenger of the car Q is approximately [Take, velocity of sound = 360ms^{-1}]

- (A) 485 Hz (B) 514 Hz (C) 421 Hz (D) 471 Hz

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If force (F), velocity (V) and time (T) are considered as fundamental physical quantity, then dimensional formula of density will be:

- (A) $FV^{-2}T^2$ (B) FV^4T^{-6} (C) $F^2V^{-2}T^6$ (D) $FV^{-4}T^{-2}$

When vector $\vec{A} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ is subtracted from vector $\vec{B}$, it gives a vector equal to $2\hat{j}$. Then the magnitude of vector $\vec{B}$ will be:

- (A) 3 (B) $\sqrt{33}$ (C) $\sqrt{6}$ (D) $\sqrt{5}$

Physics Section B · Numerical value

Q20 to Q28

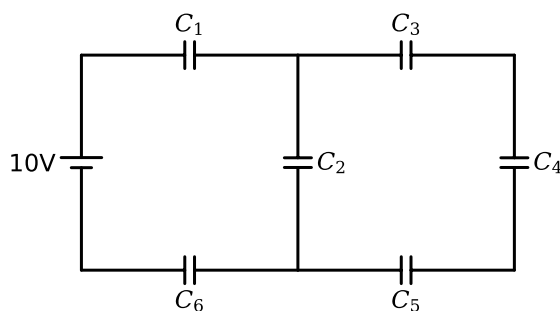
A coil has an inductance of 2H and resistance of 4Ω . A 10V is applied across the coil. The energy stored in the magnetic field after the current has built up to its equilibrium value will be $\times 10^{-2}\text{J}$.

A nucleus disintegrates into two nuclear parts, in such a way that ratio of their nuclear sizes is $1 : 2^{1/3}$. Their respective speed have a ratio of $n : 1$. The value of n is _____.

In the given circuit,

$$C_1 = 2\mu\text{F}, C_2 = 0.2\mu\text{F}, C_3 = 2\mu\text{F}, C_4 = 4\mu\text{F}, C_5 = 2\mu\text{F}, C_6 = 2\mu\text{F}$$

, The charge stored on capacitor C_4 is _____ μC .

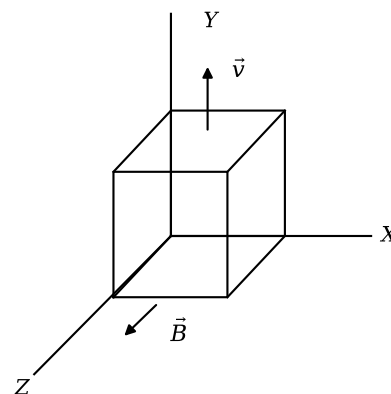


Two identical cells each of emf 1.5V are connected in series across a 10Ω resistance. An ideal voltmeter connected across 10Ω resistance reads 1.5V. The internal resistance of each cell is _____ Ω .

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Q24 Electromagnetic Induction **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/W1ASU0QPFH) > prepwiser.in/questions/W1ASU0QPFH

A metallic cube of side 15cm moving along y -axis at a uniform velocity of 2ms^{-1} . In a region of uniform magnetic field of magnitude 0.5T directed along z -axis. In equilibrium the potential difference between the faces of higher and lower potential developed because of the motion through the field will be _____ mV.

**Q25** Surface Tension **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/Y8AjlA8KAQ) > prepwiser.in/questions/Y8AjlA8KAQ

The surface tension of soap solution is $3.5 \times 10^{-2}\text{Nm}^{-1}$. The amount of work done required to increase the radius of soap bubble from 10cm to 20cm is _____ $\times 10^{-4}\text{J}$.
(take $\pi = 22/7$)

Q26 Mechanical Waves **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/Ji6D15W8vG) > prepwiser.in/questions/Ji6D15W8vG

A wire of density $8 \times 10^3\text{kg/m}^3$ is stretched between two clamps 0.5m apart. The extension developed in the wire is $3.2 \times 10^{-4}\text{m}$. If $Y = 8 \times 10^{10}\text{N/m}^2$, the fundamental frequency of vibration in the wire will be _____ Hz.

Q27 Rotational Motion **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/9eFAa-iiI5) > prepwiser.in/questions/9eFAa-iiI5

A circular plate is rotating in horizontal plane, about an axis passing through its center and perpendicular to the plate, with an angular velocity ω . A person sits at the center having two dumbbells in his hands. When he stretches out his hands, the moment of inertia of the system becomes triple. If E be the initial Kinetic energy of the system, then final Kinetic energy will be $\frac{E}{x}$. The value of x is

Q28 Work, Energy & Power **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/Ix0-UC7JLd) > prepwiser.in/questions/Ix0-UC7JLd

A block of mass 5kg starting from rest pulled up on a smooth incline plane making an angle of 30° with horizontal with an effective acceleration of 1ms^{-2} . The power delivered by the pulling force at $t = 10\text{s}$ from the start is _____ W.

[use $g = 10\text{ms}^{-2}$]

(calculate the nearest integer value)

Q29 Carboxylic Acids & Their Derivatives[Step-by-step solution](#) › prepwiser.in/questions/1M2HgaLtP1

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

Assertion A : A solution of the product obtained by heating a mole of glycine with a mole of chlorine in presence of red phosphorous generates chiral carbon atom.

Reason R : A molecule with 2 chiral carbons is always optically active.

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

Q30 Chemical Kinetics[Step-by-step solution](#) › prepwiser.in/questions/K8KeMYQbbu

For a chemical reaction $A + B \rightarrow \text{Product}$, the order is 1 with respect to A and B.

Rate $\text{mol L}^{-1} \text{S}^{-1}$	[A] mol L^{-1}	[B] mol L^{-1}
0.10	20	0.5
0.40	x	0.5
0.80	40	y

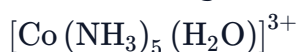
What is the value of x and y ?

- (A) 80 and 4 (B) 160 and 4 (C) 80 and 2 (D) 40 and 4

Q31 Coordination Compounds[Step-by-step solution](#) › prepwiser.in/questions/6W8p4n0o9h

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

Assertion A: $[\text{CoCl}(\text{NH}_3)_5]^{2+}$ absorbs at lower wavelength of light with respect to



Reason R : It is because the wavelength of the light absorbed depends on the oxidation state of the metal ion.

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

Q32 Coordination Compounds[Step-by-step solution](#) › prepwiser.in/questions/2ZgpGveYCG

If Ni^{2+} is replaced by Pt^{2+} in the complex $[\text{NiCl}_2\text{Br}_2]^{2-}$, which of the following properties are expected to get changed?

- A. Geometry
B. Geometrical isomerism
C. Optical isomerism
D. Magnetic properties

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

Match List I with List II

	LIST I Complex		LIST II Colour
A.	$Mg(NH_4)PO_4$	I.	brown
B.	$K_3[Co(NO_2)_6]$	II.	white
C.	$MnO(OH)_2$	III.	yellow
D.	$Fe_4[Fe(CN)_6]_3$	IV.	blue

Choose the correct answer from the options given below:

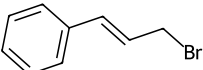
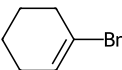
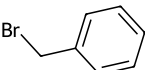
- (A) A-II, B-IV, C-I, D-III (B) A-II, B-III, C-I, D-IV (C) A-III, B-IV, C-II, D-I (D) A-II, B-III, C-IV, D-I

The magnetic moment is measured in Bohr Magnetron (BM).

Spin only magnetic moment of Fe in $[Fe(H_2O)_6]^{3+}$ and $[Fe(CN)_6]^{3-}$ complexes respectively is:

- (A) 3.87 B.M. and 1.732 B.M. (B) 5.92 B.M. and 1.732 B.M.
 (C) 6.92 B.M. in both (D) 4.89 B.M. and 6.92 B.M.

Compound from the following that will not produce precipitate on reaction with $AgNO_3$ is:

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

Which hydride among the following is less stable?

- (A) NH_3 (B) HF (C) LiH (D) BeH_2

Given below are two statements:

Statement I : In the metallurgy process, sulphide ore is converted to oxide before reduction.

Statement II : Oxide ores in general are easier to reduce.

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

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

Which one of the following pairs is an example of polar molecular solids?

- (A) $HCl(s)$, $AlN(s)$ (B) $MgO(s)$, $SO_2(s)$ (C) $SO_2(s)$, $NH_3(s)$ (D) $SO_2(s)$, $CO_2(s)$

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One mole of P_4 reacts with 8 moles of $SOCl_2$ to give 4 moles of A, x mole of SO_2 and 2 moles of B. A, B and x respectively are:

- (A) $POCl_3$, S_2Cl_2 and 4 (B) PCl_3 , S_2Cl_2 and 4 (C) $POCl_3$, S_2Cl_2 and 2 (D) PCl_3 , S_2Cl_2 and 2

Given below are two statements:

Statement I : Ethene at 333 to 343K and 6-7 atm pressure in the presence of $AlEt_3$ and $TiCl_4$ undergoes addition polymerization to give LDP.

Statement II : Caprolactam at 533-543K in H_2O through step growth polymerizes to give Nylon 6.

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

Alkali metal from the following with least melting point is:

- (A) Rb (B) Na (C) K (D) Cs

What weight of glucose must be dissolved in 100g of water to lower the vapour pressure by 0.20mmHg?

(Assume dilute solution is being formed)

Given : Vapour pressure of pure water is 54.2mmHg at room temperature. Molar mass of glucose is 180gmol^{-1}

- (A) 3.69 g (B) 2.59 g (C) 3.59 g (D) 4.69 g

A solution is prepared by adding 2g of "X" to 1 mole of water. Mass percent of "X" in the solution is:

- (A) 20% (B) 10% (C) 2% (D) 5%

Chemistry Section B · Numerical value

Q44 to Q53

Number of compounds from the following which will not produce orange red precipitate with Benedict solution is _____.

Glucose, maltose, sucrose, ribose, 2-deoxyribose, amylose, lactose

The maximum number of lone pairs of electrons on the central atom from the following species is _____.

ClO_3^- , XeF_4 , SF_4 and I_3^-

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The number of correct statements from the following is _____

- A. E_{cell} is an intensive parameter
- B. A negative $E^\ominus$ means that the redox couple is a stronger reducing agent than the H^+/H_2 couple.
- C. The amount of electricity required for oxidation or reduction depends on the stoichiometry of the electrode reaction.
- D. The amount of chemical reaction which occurs at any electrode during electrolysis by a current is proportional to the quantity of electricity passed through the electrolyte.

The number of possible isomeric products formed when 3-chloro-1-butene reacts with HCl through carbocation formation is _____.

$\text{Mg}(\text{NO}_3)_2 \cdot \text{XH}_2\text{O}$ and $\text{Ba}(\text{NO}_3)_2 \cdot \text{YH}_2\text{O}$, represent formula of the crystalline forms of nitrate salts. Sum of X and Y is _____.

The volume of hydrogen liberated at STP by treating 2.4g of magnesium with excess of hydrochloric acid is _____ $\times 10^{-2}\text{L}$

Given : Molar volume of gas is 22.4L at STP.

Molar mass of magnesium is 24gmol^{-1}

The number of correct statements from the following is _____.

- A. For 1s orbital, the probability density is maximum at the nucleus
- B. For 2s orbital, the probability density first increases to maximum and then decreases sharply to zero.
- C. Boundary surface diagrams of the orbitals encloses a region of 100% probability of finding the electron.
- D. p and d-orbitals have 1 and 2 angular nodes respectively.
- E. probability density of p-orbital is zero at the nucleus

The number of correct statements about modern adsorption theory of heterogeneous catalysis from the following is _____

- A. The catalyst is diffused over the surface of reactants.
- B. Reactants are adsorbed on the surface of the catalyst.
- C. Occurrence of chemical reaction on the catalyst's surface through formation of an intermediate.
- D. It is a combination of intermediate compound formation theory and the old adsorption theory.
- E. It explains the action of the catalyst as well as those of catalytic promoters and poisons.

The total number of intensive properties from the following is _____

Volume, Molar heat capacity, Molarity, $E^\ominus$ cell, Gibbs free energy change, Molar mass, Mole

4.5 moles each of hydrogen and iodine is heated in a sealed ten litre vessel. At equilibrium, 3 moles of HI were found. The equilibrium constant for $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$ is _____.

Mathematics Section A · Multiple choice

Q54 to Q71

Q54 Three Dimensional Geometry

Step-by-step solution > [prepwisar.in/questions/8UuILnLlyL](https://www.prepwisar.in/questions/8UuILnLlyL)

Let the line passing through the points $P(2, -1, 2)$ and $Q(5, 3, 4)$ meet the plane $x - y + z = 4$ at the point R. Then the distance of the point R from the plane $x + 2y + 3z + 2 = 0$ measured parallel to the line $\frac{x-7}{2} = \frac{y+3}{2} = \frac{z-2}{1}$ is equal to:

- (A) $\sqrt{31}$ (B) $\sqrt{189}$ (C) $\sqrt{61}$ (D) 3

Q55 Three Dimensional Geometry

Step-by-step solution > [prepwisar.in/questions/l-Z-Csk1pv](https://www.prepwisar.in/questions/l-Z-Csk1pv)

Let P be the plane passing through the points $(5, 3, 0)$, $(13, 3, -2)$ and $(1, 6, 2)$. For $\alpha \in \mathbb{N}$, if the distances of the points $A(3, 4, \alpha)$ and $B(2, \alpha, a)$ from the plane P are 2 and 3 respectively, then the positive value of a is:

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

Q56 Binomial Theorem

Step-by-step solution > [prepwisar.in/questions/T2vVgxZon5](https://www.prepwisar.in/questions/T2vVgxZon5)

The sum of the coefficients of three consecutive terms in the binomial expansion of $(1 + x)^{n+2}$, which are in the ratio 1 : 3 : 5, is equal to:

- (A) 63 (B) 92 (C) 25 (D) 41

Q57 Binomial Theorem

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

If the 1011^{th} term from the end in the binomial expansion of $\left(\frac{4x}{5} - \frac{5}{2x}\right)^{2022}$ is 1024 times 1011^{th} term from the beginning, then $|x|$ is equal to

- (A) $\frac{5}{16}$ (B) 8 (C) 12 (D) 15

Q58 Complex Numbers

Step-by-step solution > [prepwisar.in/questions/2ggNaZZTpK](https://www.prepwisar.in/questions/2ggNaZZTpK)

For $a \in \mathbb{C}$, let

$$A = \{z \in \mathbb{C} : \operatorname{Re}(a + \bar{z}) > \operatorname{Im}(\bar{a} + z)\}$$

and

$$B = \{z \in \mathbb{C} : \operatorname{Re}(a + \bar{z}) < \operatorname{Im}(\bar{a} + z)\}$$

. Then among the two statements:

(S1): If $\operatorname{Re}(a), \operatorname{Im}(a) > 0$, then the set A contains all the real numbers

(S2): If $\operatorname{Re}(a), \operatorname{Im}(a) < 0$, then the set B contains all the real numbers,

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

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Q59 Definite Integration[Step-by-step solution](https://www.prepwiser.in/questions/njYxyHwom4) › prepwiser.in/questions/njYxyHwom4

If $f : \mathbb{R} \rightarrow \mathbb{R}$ be a continuous function satisfying

$$\int_0^{\frac{\pi}{2}} f(\sin 2x) \sin x dx + \alpha \int_0^{\frac{\pi}{4}} f(\cos 2x) \cos x dx = 0$$

, then the value of α is:

(A) $-\sqrt{3}$

(B) $\sqrt{2}$

(C) $-\sqrt{2}$

(D) $\sqrt{3}$

Q60 Definite Integration[Step-by-step solution](https://www.prepwiser.in/questions/-xXv46FdCc) › prepwiser.in/questions/-xXv46FdCc

Let the function $f : [0, 2] \rightarrow \mathbb{R}$ be defined as

$$f(x) = \begin{cases} e^{\min\{x^2, x-[x]\}}, & x \in [0, 1) \\ e^{[x] - \log_e x}, & x \in [1, 2] \end{cases}$$

where $[t]$ denotes the greatest integer less than or equal to t . Then the value of the integral $\int_0^2 x f(x) dx$ is:

(A) $2e - 1$

(B) $2e - \frac{1}{2}$

(C) $1 + \frac{3e}{2}$

(D) $(e - 1) \left(e^2 + \frac{1}{2} \right)$

Q61 Differential Equations[Step-by-step solution](https://www.prepwiser.in/questions/VkvS1fjBem) › prepwiser.in/questions/VkvS1fjBem

Let $y = y(x)$ be the solution of the differential equation

$$\frac{dy}{dx} + \frac{5}{x(x^5 + 1)} y = \frac{(x^5 + 1)^2}{x^7}, x > 0$$

. If $y(1) = 2$, then $y(2)$ is equal to:

(A) $\frac{693}{128}$

(B) $\frac{697}{128}$

(C) $\frac{637}{128}$

(D) $\frac{679}{128}$

Q62 Ellipse[Step-by-step solution](https://www.prepwiser.in/questions/DYGI4aDTxv) › prepwiser.in/questions/DYGI4aDTxv

If the radius of the largest circle with centre $(2, 0)$ inscribed in the ellipse $x^2 + 4y^2 = 36$ is r , then $12r^2$ is equal to:

(A) 72

(B) 92

(C) 115

(D) 69

Q63 Relations & Functions (Basic)[Step-by-step solution](https://www.prepwiser.in/questions/liX00KBbpa) › prepwiser.in/questions/liX00KBbpa

The domain of the function $f(x) = \frac{1}{\sqrt{[x]^2 - 3[x] - 10}}$ is : (where $[x]$ denotes the greatest integer less than or equal to x)

(A) $(-\infty, -2) \cup [6, \infty)$

(B) $(-\infty, -3] \cup [6, \infty)$

(C) $(-\infty, -2) \cup (5, \infty)$

(D) $(-\infty, -3] \cup (5, \infty)$

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Let f and g be two functions defined by

$$f(x) = \begin{cases} x + 1, & x < 0 \\ |x - 1|, & x \geq 0 \end{cases}$$

and

$$g(x) = \begin{cases} x + 1, & x < 0 \\ 1, & x \geq 0 \end{cases}$$

Then $(g \circ f)(x)$ is:

- (A) continuous everywhere but not differentiable at $x = 1$
 (B) differentiable everywhere
 (C) not continuous at $x = -1$
 (D) continuous everywhere but not differentiable exactly at one point

If the system of linear equations

$$7x + 11y + \alpha z = 13$$

$$5x + 4y + 7z = \beta$$

$$175x + 194y + 57z = 361$$

has infinitely many solutions, then $\alpha + \beta + 2$ is equal to:

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

$$\begin{vmatrix} x+1 & x & x \\ x & x+\lambda & x \\ x & x & x+\lambda^2 \end{vmatrix} = \frac{9}{8}(103x + 81)$$

, then $\lambda, \frac{\lambda}{3}$ are the roots of the equation:

- (A) $4x^2 + 24x - 27 = 0$ (B) $4x^2 - 24x + 27 = 0$
 (C) $4x^2 - 24x - 27 = 0$ (D) $4x^2 + 24x + 27 = 0$

If the letters of the word MATHS are permuted and all possible words so formed are arranged as in a dictionary with serial numbers, then the serial number of the word THAMS is:

- (A) 103 (B) 104 (C) 102 (D) 101

Let a, b, c and d be positive real numbers such that $a + b + c + d = 11$. If the maximum value of $a^5 b^3 c^2 d$ is 3750β , then the value of β is

- (A) 110 (B) 108 (C) 90 (D) 55

Let $A = \{1, 3, 4, 6, 9\}$ and $B = \{2, 4, 5, 8, 10\}$. Let R be a relation defined on $A \times B$ such that

$$R = \{(a_1, b_1), (a_2, b_2) : a_1 \leq b_2$$

and $b_1 \leq a_2\}$. Then the number of elements in the set R is:

- (A) 180 (B) 26 (C) 52 (D) 160

Let the mean of 6 observations 1, 2, 4, 5, x and y be 5 and their variance be 10. Then their mean deviation about the mean is equal to:

- (A) $\frac{10}{3}$ (B) $\frac{8}{3}$ (C) $\frac{7}{3}$ (D) 3

If four distinct points with position vectors $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$ are coplanar, then $[\vec{a} \vec{b} \vec{c}]$ is equal to:

- (A) $[\vec{d} \vec{b} \vec{a}] + [\vec{a} \vec{c} \vec{d}] + [\vec{d} \vec{b} \vec{c}]$ (B) $[\vec{b} \vec{c} \vec{d}] + [\vec{d} \vec{a} \vec{c}] + [\vec{d} \vec{b} \vec{a}]$
 (C) $[\vec{a} \vec{d} \vec{b}] + [\vec{d} \vec{c} \vec{a}] + [\vec{d} \vec{b} \vec{c}]$ (D) $[\vec{d} \vec{c} \vec{a}] + [\vec{b} \vec{d} \vec{a}] + [\vec{c} \vec{d} \vec{b}]$

Mathematics Section B · Numerical value

Q72 to Q80

Let the line $l : x = \frac{1-y}{-2} = \frac{z-3}{\lambda}, \lambda \in \mathbb{R}$ meet the plane $P : x + 2y + 3z = 4$ at the point (α, β, γ) . If the angle between the line l and the plane P is $\cos^{-1}\left(\sqrt{\frac{5}{14}}\right)$, then $\alpha + 2\beta + 6\gamma$ is equal to _____.

Let

$$S = \left\{ z \in \mathbb{C} - \{i, 2i\} : \frac{z^2 + 8iz - 15}{z^2 - 3iz - 2} \in \mathbb{R} \right\}$$

. If $\alpha - \frac{13}{11}i \in S, \alpha \in \mathbb{R} - \{0\}$, then $242\alpha^2$ is equal to _____.

Let $A = \{1, 2, 3, 4, 5\}$ and $B = \{1, 2, 3, 4, 5, 6\}$. Then the number of functions $f : A \rightarrow B$ satisfying $f(1) + f(2) = f(4) - 1$ is equal to _____.

Let the tangent to the parabola $y^2 = 12x$ at the point $(3, \alpha)$ be perpendicular to the line $2x + 2y = 3$. Then the square of distance of the point $(6, -4)$ from the normal to the hyperbola $\alpha^2 x^2 - 9y^2 = 9\alpha^2$ at its point $(\alpha - 1, \alpha + 2)$ is equal to _____.

Let the probability of getting head for a biased coin be $\frac{1}{4}$. It is tossed repeatedly until a head appears. Let N be the number of tosses required. If the probability that the equation $64x^2 + 5Nx + 1 = 0$ has no real root is $\frac{p}{q}$, where p and q are coprime, then $q - p$ is equal to _____.

The number of points, where the curve

$$f(x) = e^{8x} - e^{6x} - 3e^{4x} - e^{2x} + 1, x \in \mathbb{R}$$

cuts x -axis, is equal to _____.

For $k \in \mathbb{N}$, if the sum of the series $1 + \frac{4}{k} + \frac{8}{k^2} + \frac{13}{k^3} + \frac{19}{k^4} + \dots$ is 10, then the value of k is _____.

Let $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\vec{b} = \hat{i} + \hat{j} - \hat{k}$. If $\vec{c}$ is a vector such that $\vec{a} \cdot \vec{c} = 11$, $\vec{b} \cdot (\vec{a} \times \vec{c}) = 27$ and $\vec{b} \cdot \vec{c} = -\sqrt{3}|\vec{b}|$, then $|\vec{a} \times \vec{c}|^2$ is equal to _____.

If A is the area in the first quadrant enclosed by the curve $C : 2x^2 - y + 1 = 0$, the tangent to C at the point $(1, 3)$ and the line $x + y = 1$, then the value of $60A$ is _____.

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Physics

1. A	2. B	3. B	4. A	5. D	6. C	7. B	8. C
9. D	10. A	11. D	12. D	13. C	14. B	15. A	16. A
17. C	18. D	19. B	20. 625	21. 2	22. 4	23. 5	24. 150
25. 264	26. 80	27. 3	28. 300				

Chemistry

29. C	30. C	31. A	32. B	33. B	34. B	35. B	36. D
37. A	38. C	39. B	40. C	41. D	42. A	43. B	44. 2
45. 3	46. 4	47. 4	48. 6	49. 224	50. 3	51. 3	52. 4
53. 1							

Mathematics

54. D	55. B	56. A	57. A	58. A	59. C	60. B	61. A
62. B	63. A	64. D	65. B	66. B	67. A	68. C	69. D
70. B	71. D	72. 11	73. 1680	74. 360	75. 116	76. 27	77. 2
78. 2	79. 285	80. 16					

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