

JEE MAIN 2024 · QUESTION PAPER

29 Jan 2024 **Shift 2**

89 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	20 Q1 to Q20	10 Q21 to Q30
● Chemistry	19 Q31 to Q49	10 Q50 to Q59
● Mathematics	20 Q60 to Q79	10 Q80 to Q89
In this PDF	89 questions · answer key at the end	

- 1 Set a 3 hour timer and attempt the paper in one sitting, like the real exam.
- 2 In the 2021 to 2024 papers, Section B asked you to answer any 5 numerical questions per subject. Try each one here.
- 3 Check yourself against the answer key at the end. Every question names its chapter, so you can see where marks went.
- 4 Got one wrong? Tap “Step-by-step solution” at the top right of it for the full working, where available.

Attempt this paper online

The same questions in the same order, with instant answer checking and step-by-step solutions where available.

prepwis.in/pyqs/paper/2024-01-29-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 Alternating Current

[Step-by-step solution](#) > prepwiser.in/questions/9MXghCZbux

In an a.c. circuit, voltage and current are given by:

$$V = 100 \sin(100t)V \text{ and } I = 100 \sin\left(100t + \frac{\pi}{3}\right) \text{ mA respectively.}$$

The average power dissipated in one cycle is:

- (A) 5 W (B) 25 W (C) 2.5 W (D) 10 W

Q2 Atomic Physics

[Step-by-step solution](#) > prepwiser.in/questions/dzO_4KKW3

Given below are two statements:

Statement I : Most of the mass of the atom and all its positive charge are concentrated in a tiny nucleus and the electrons revolve around it, is Rutherford's model.

Statement II : An atom is a spherical cloud of positive charges with electrons embedded in it, is a special case of Rutherford's model.

In the light of the above statements, choose the most appropriate 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

Q3 Circular Motion

[Step-by-step solution](#) > prepwiser.in/questions/k8hwsrJkuI

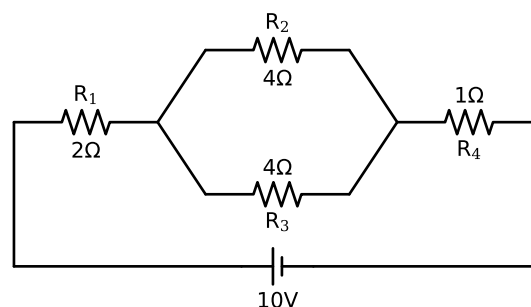
A stone of mass 900g is tied to a string and moved in a vertical circle of radius 1m making 10rpm. The tension in the string, when the stone is at the lowest point is (if $\pi^2 = 9.8$ and $g = 9.8\text{m/s}^2$):

- (A) 17.8 N (B) 97 N (C) 9.8 N (D) 8.82 N

Q4 Current Electricity

[Step-by-step solution](#) > prepwiser.in/questions/hmKbMLJ4LX

In the given circuit, the current in resistance R_3 is:



- (A) 2 A (B) 1.5 A (C) 1 A (D) 2.5 A

Q5 Dual Nature of Radiation & Matter

[Step-by-step solution](#) > prepwiser.in/questions/uxIbdb04aR

Two sources of light emit with a power of 200W. The ratio of number of photons of visible light emitted by each source having wavelengths 300nm and 500nm respectively, will be:

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

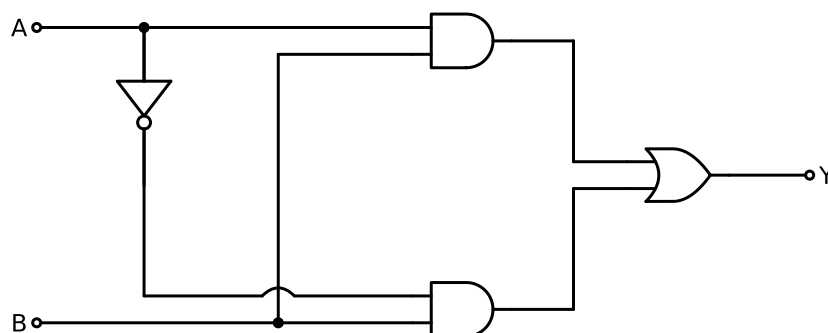
Q6 Electromagnetic Waves

[Step-by-step solution](#) > prepwiser.in/questions/ottk160HCG

A plane electromagnetic wave of frequency 35MHz travels in free space along the X -direction. At a particular point (in space and time) $\vec{E} = 9.6\hat{j}\text{V/m}$. The value of magnetic field at this point is:

- (A) $9.6\hat{j}T$ (B) $3.2 \times 10^{-8}\hat{i}T$ (C) $9.6 \times 10^{-8}\hat{k}T$ (D) $3.2 \times 10^{-8}\hat{k}T$

The truth table for this given circuit is:



(A)

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

(B)

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

(C)

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

(D)

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

An electric field is given by $(6\hat{i} + 5\hat{j} + 3\hat{k})\text{N/C}$. The electric flux through a surface area 30m^2 lying in YZ-plane (in SI unit) is:

(A) 60

(B) 90

(C) 180

(D) 150

If the distance between object and its two times magnified virtual image produced by a curved mirror is 15cm , the focal length of the mirror must be:

(A) -10 cm (B) -12 cm (C) 15 cm (D) $10/3\text{ cm}$

A planet takes 200 days to complete one revolution around the Sun. If the distance of the planet from Sun is reduced to one fourth of the original distance, how many days will it take to complete one revolution:

(A) 20

(B) 50

(C) 100

(D) 25

The temperature of a gas having 2.0×10^{25} molecules per cubic meter at 1.38atm (Given, $k = 1.38 \times 10^{-23}\text{JK}^{-1}$) is:

(A) 500 K

(B) 300 K

(C) 200 K

(D) 100 K

N moles of a polyatomic gas ($f = 6$) must be mixed with two moles of a monoatomic gas so that the mixture behaves as a diatomic gas. The value of N is:

(A) 6

(B) 2

(C) 4

(D) 3

Two particles X and Y having equal charges are being accelerated through the same potential difference. Thereafter they enter normally in a region of uniform magnetic field and describes circular paths of radii R_1 and R_2 respectively. The mass ratio of X and Y is:

- (A) $\left(\frac{R_1}{R_2}\right)$ (B) $\left(\frac{R_2}{R_1}\right)$ (C) $\left(\frac{R_2}{R_1}\right)^2$ (D) $\left(\frac{R_1}{R_2}\right)^2$

A particle is moving in a straight line. The variation of position ' x ' as a function of time ' t ' is given as $x = (t^3 - 6t^2 + 20t + 15) \text{ m}$. The velocity of the body when its acceleration becomes zero is:

- (A) 6 m/s (B) 10 m/s (C) 8 m/s (D) 4 m/s

A small liquid drop of radius R is divided into 27 identical liquid drops. If the surface tension is T , then the work done in the process will be:

- (A) $4\pi R^2 T$ (B) $8\pi R^2 T$ (C) $\frac{1}{8}\pi R^2 T$ (D) $3\pi R^2 T$

A wire of length L and radius r is clamped at one end. If its other end is pulled by a force F , its length increases by l . If the radius of the wire and the applied force both are reduced to half of their original values keeping original length constant, the increase in length will become:

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

The bob of a pendulum was released from a horizontal position. The length of the pendulum is 10m. If it dissipates 10% of its initial energy against air resistance, the speed with which the bob arrives at the lowest point is:

[Use, $g : 10\text{ms}^{-2}$]

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

In Young's double slit experiment, light from two identical sources are superimposing on a screen. The path difference between the two lights reaching at a point on the screen is $7\lambda/4$. The ratio of intensity of fringe at this point with respect to the maximum intensity of the fringe is:

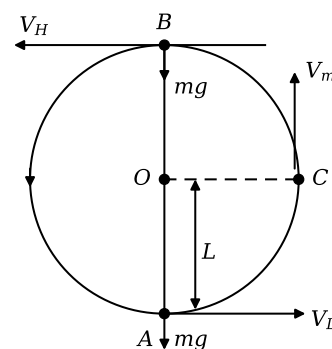
- (A) $\frac{1}{2}$ (B) $\frac{3}{4}$ (C) $\frac{1}{3}$ (D) $\frac{1}{4}$

Attempt this paper online with instant answer checking › [prepwiser.in/pyqs/paper/2024-01-29-evening](https://www.prepwiser.in/pyqs/paper/2024-01-29-evening)

Q19 Circular Motion[Step-by-step solution](https://www.prepwisar.in/questions/rlfVE_DaQF) > prepwisar.in/questions/rlfVE_DaQF

A bob of mass ' m ' is suspended by a light string of length ' L '. It is imparted a minimum horizontal velocity at the lowest point A such that it just completes half circle reaching the top most position B . The ratio of kinetic energies $\frac{(K.E)_A}{(K.E)_B}$ is:

- (A) 5 : 1 (B) 3 : 2 (C) 1 : 5 (D) 2 : 5

**Q20** Units, Dimensions & Errors[Step-by-step solution](https://www.prepwisar.in/questions/omh6j4xVH3) > prepwisar.in/questions/omh6j4xVH3

A physical quantity Q is found to depend on quantities a, b, c by the relation $Q = \frac{a^4 b^3}{c^2}$. The percentage error in a, b and c are 3%, 4% and 5% respectively. Then, the percentage error in Q is:

- (A) 43% (B) 34% (C) 66% (D) 14%

Physics Section B · Numerical value

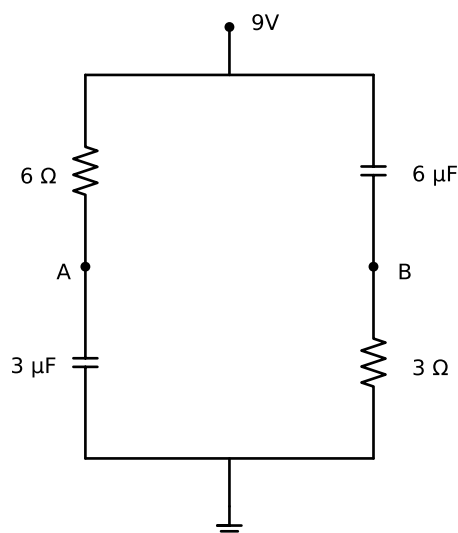
Q21 to Q30

Q21 Atomic Physics **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/N0wYfUgg4Z) > prepwisar.in/questions/N0wYfUgg4Z

Hydrogen atom is bombarded with electrons accelerated through a potential difference of V , which causes excitation of hydrogen atoms. If the experiment is being performed at $T = 0\text{K}$, the minimum potential difference needed to observe any Balmer series lines in the emission spectra will be $\frac{\alpha}{10} V$, where $\alpha =$ _____.

Q22 Electrostatics II: Potential & Capacitance **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/RL7k6AbQmo) > prepwisar.in/questions/RL7k6AbQmo

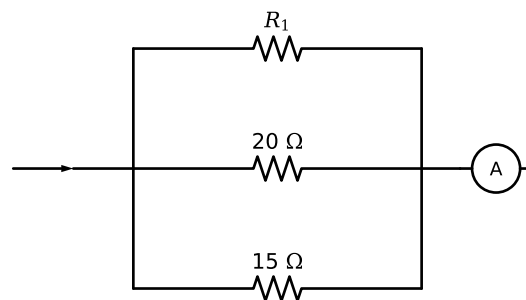
In the given figure, the charge stored in $6\mu\text{F}$ capacitor, when points A and B are joined by a connecting wire is _____ μC .

**Q23** Circular Motion **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/-iqbKFdWLP) > prepwisar.in/questions/-iqbKFdWLP

A particle is moving in a circle of radius 50cm in such a way that at any instant the normal and tangential components of its acceleration are equal. If its speed at $t = 0$ is 4m/s , the time taken to complete the first revolution will be $\frac{1}{\alpha} [1 - e^{-2\pi}] \text{s}$, where $\alpha =$ _____.

Q24 Current Electricity **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/ysQ7kdLmQI](https://www.prepwiser.in/questions/ysQ7kdLmQI)

In the given circuit, the current flowing through the resistance 20Ω is 0.3A , while the ammeter reads 0.9A . The value of R_1 is _____ Ω .

**Q25** Electromagnetic Induction **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/xTVRfeAnZz](https://www.prepwiser.in/questions/xTVRfeAnZz)

A horizontal straight wire 5m long extending from east to west falling freely at right angle to horizontal component of earth's magnetic field $0.60 \times 10^{-4}\text{Wbm}^{-2}$. The instantaneous value of emf induced in the wire when its velocity is 10ms^{-1} is _____ $\times 10^{-3}\text{V}$.

Q26 Moving Charges & Magnetism **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/VltNdSekQW](https://www.prepwiser.in/questions/VltNdSekQW)

A charge of $4.0\mu\text{C}$ is moving with a velocity of $4.0 \times 10^6\text{ms}^{-1}$ along the positive y axis under a magnetic field $\vec{B}$ of strength $(2\hat{k})\text{T}$. The force acting on the charge is $x\hat{i}\text{N}$. The value of x is _____.

Q27 Elasticity **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/PE_TNuTzTT](https://www.prepwiser.in/questions/PE_TNuTzTT)

Two metallic wires P and Q have same volume and are made up of same material. If their area of cross sections are in the ratio $4 : 1$ and force F_1 is applied to P , an extension of Δl is produced. The force which is required to produce same extension in Q is F_2 .

The value of $\frac{F_1}{F_2}$ is _____.

Q28 Rotational Motion **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/HldC7KMScq](https://www.prepwiser.in/questions/HldC7KMScq)

A body of mass 5kg moving with a uniform speed $3\sqrt{2}\text{ms}^{-1}$ in $X - Y$ plane along the line $y = x + 4$. The angular momentum of the particle about the origin will be _____ $\text{kgm}^2\text{s}^{-1}$.

Q29 Simple Harmonic Motion **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/odO0-lyHKG](https://www.prepwiser.in/questions/odO0-lyHKG)

A simple harmonic oscillator has an amplitude A and time period 6π second. Assuming the oscillation starts from its mean position, the time required by it to travel from $x = A$ to $x = \frac{\sqrt{3}}{2}A$ will be $\frac{\pi}{x}\text{s}$, where $x =$ _____.

Q30 Wave Optics **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/e4uqzGxTUB](https://www.prepwiser.in/questions/e4uqzGxTUB)

In a single slit diffraction pattern, a light of wavelength $6000\overset{\circ}{\text{\AA}}$ is used. The distance between the first and third minima in the diffraction pattern is found to be 3mm when the screen is placed 50cm away from slits. The width of the slit is _____ $\times 10^{-4}\text{m}$.

Chemistry Section A · Multiple choice

Q31 to Q49

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

Phenol treated with chloroform in presence of sodium hydroxide, which further hydrolyzed in presence of an acid results

- | | |
|---------------------------|----------------------|
| (A) Salicylic acid | (B) Benzene-1,2-diol |
| (C) 2-Hydroxybenzaldehyde | (D) Benzene-1,3-diol |

Match List I with List II

	List - I (Compound)		List - II (pK _a value)
(A)	Ethanol	(I)	10.0
(B)	Phenol	(II)	15.9
(C)	m-Nitrophenol	(III)	7.1
(D)	p-Nitrophenol	(IV)	8.3

Choose the correct answer from the options given below:

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

Match List I with List II

	List - I (Bio Polymer)		List - II (Monomer)
(A)	Starch	(I)	nucleotide
(B)	Cellulose	(II)	α -glucose
(C)	Nucleic acid	(III)	β -glucose
(D)	Protein	(IV)	α -amino acid

Choose the correct answer from the options given below:

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

A reagent which gives brilliant red precipitate with Nickel ions in basic medium is

- (A) dimethyl glyoxime (B) sodium nitroprusside
(C) meta-dinitrobenzene (D) neutral FeCl₃

Which of the following acts as a strong reducing agent? (Atomic number:

Ce = 58, Eu = 63, Gd = 64, Lu = 71)

- (A) Eu²⁺ (B) Gd³⁺ (C) Lu³⁺ (D) Ce⁴⁺

Which of the following statements are correct about Zn, Cd and Hg?

- A. They exhibit high enthalpy of atomization as the d-subshell is full.
B. Zn and Cd do not show variable oxidation state while Hg shows +I and +II.
C. Compounds of Zn, Cd and Hg are paramagnetic in nature.
D. Zn, Cd and Hg are called soft metals.

Choose the most appropriate from the options given below:

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

Attempt this paper online with instant answer checking › [prepwiser.in/pyqs/paper/2024-01-29-evening](https://www.prepwiser.in/pyqs/paper/2024-01-29-evening)

The correct IUPAC name of K_2MnO_4 is

- (A) Potassium tetraoxidomanganate (VI) (B) Dipotassium tetraoxidomanganate (VII)
(C) Potassium tetraoxopermanganate (VI) (D) Potassium tetraoxidomanganese (VI)

Alkyl halide is converted into alkyl isocyanide by reaction with

- (A) KCN (B) NH_4CN (C) NaCN (D) AgCN

On passing a gas, 'X', through Nessler's reagent, a brown precipitate is obtained. The gas 'X' is

- (A) Cl_2 (B) CO_2 (C) NH_3 (D) H_2S

Given below are two statements:

Statement I : Fluorine has most negative electron gain enthalpy in its group.

Statement II : Oxygen has least negative electron gain enthalpy in its group.

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

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

The element having the highest first ionization enthalpy is

- (A) C (B) Al (C) Si (D) N

Anomalous behavior of oxygen is due to its

- (A) large size and low electronegativity (B) small size and high electronegativity
(C) small size and low electronegativity (D) large size and high electronegativity

Match List I with List II

	List - I (Spectral Series for Hydrogen)		List - II (Spectral Region/Higher Energy State)
(A)	Lyman	(I)	Infrared region
(B)	Balmer	(II)	UV region
(C)	Paschen	(III)	Infrared region
(D)	Pfund	(IV)	Visible region

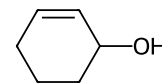
Choose the correct answer from the options given below:

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

Attempt this paper online with instant answer checking > [prepwiser.in/pyqs/paper/2024-01-29-evening](https://www.prepwiser.in/pyqs/paper/2024-01-29-evening)

Q44 General Organic Chemistry (GOC)[Step-by-step solution](https://www.prepwiser.in/questions/cLJnm8XZH)

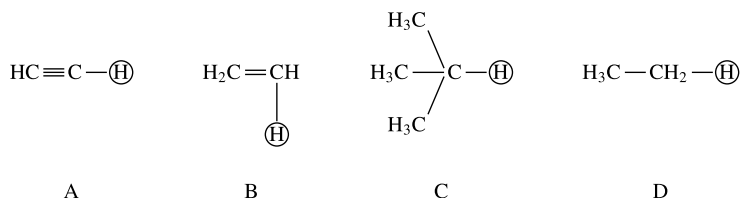
According to IUPAC system, the compound is named as



- (A) Cyclohex-2-en-1-ol (B) 1-Hydroxyhex-2-ene
(C) Cyclohex-1-en-3-ol (D) Cyclohex-1-en-2-ol

Q45 General Organic Chemistry (GOC)[Step-by-step solution](https://www.prepwiser.in/questions/j9AAU5kwiB)

The ascending acidity order of the following H atoms is



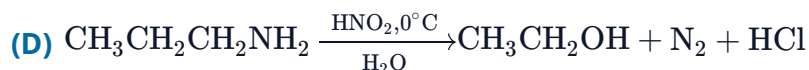
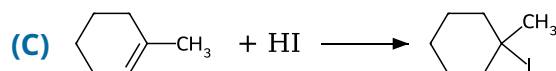
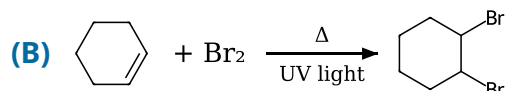
- (A) $\text{A} < \text{B} < \text{D} < \text{C}$ (B) $\text{A} < \text{B} < \text{C} < \text{D}$ (C) $\text{D} < \text{C} < \text{B} < \text{A}$ (D) $\text{C} < \text{D} < \text{B} < \text{A}$

Q46 General Organic Chemistry (GOC)[Step-by-step solution](https://www.prepwiser.in/questions/lsMjT9wvnS)

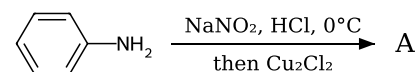
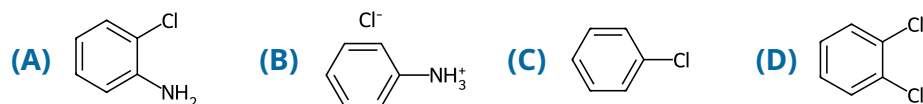
Which one of the following will show geometrical isomerism?

**Q47** Hydrocarbons: Alkenes & Alkynes[Step-by-step solution](https://www.prepwiser.in/questions/dDIxa5pbPZ)

Which of the following reaction is correct?

**Q48** Amines & Diazonium Salts[Step-by-step solution](https://www.prepwiser.in/questions/qZ0eCZ-JYC)

The product A formed in the following reaction is

**Q49** Purification & Characterisation of Organic Compounds[Step-by-step solution](https://www.prepwiser.in/questions/AULr2gqWtD)

Chromatographic technique/s based on the principle of differential adsorption is / are

- A. Column chromatography
B. Thin layer chromatography
C. Paper chromatography

Choose the most appropriate answer from the options given below:

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

Q50 Chemical Bonding & Molecular Structure **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/AJ4fwuATXn

The total number of 'Sigma' and 'Pi' bonds in 2-formylhex-4-enoic acid is _____.

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

The total number of molecules with zero dipole moment among



and SO_2 is _____.

Q52 Chemical Bonding & Molecular Structure **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/9Ao2nfGPmN

The total number of anti bonding molecular orbitals, formed from $2s$ and $2p$ atomic orbitals in a diatomic molecule is _____.

Q53 Nuclear & Radiochemistry **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/9HQ-Ykcg_A

The half-life of radioisotope bromine - 82 is 36 hours. The fraction which remains after one day is _____ $\times 10^{-2}$.

(Given $\text{antilog } 0.2006 = 1.587$)

Q54 Electrochemistry **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/qgv4bYJR8C

A constant current was passed through a solution of AuCl_4^- ion between gold electrodes. After a period of 10.0 minutes, the increase in mass of cathode was 1.314g. The total charge passed through the solution is _____ $\times 10^{-2}\text{F}$.

(Given atomic mass of $\text{Au} = 197$)

Q55 Qualitative Analysis: Salt Analysis **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/qGu7H2ARyd

The oxidation number of iron in the compound formed during brown ring test for NO_3^- iron is _____.

Q56 Mole Concept & Stoichiometry **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/LeAyyOiVu-

If 50mL of 0.5M oxalic acid is required to neutralise 25mL of NaOH solution, the amount of NaOH in 50mL of given NaOH solution is _____ g.

Q57 Solutions & Colligative Properties **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/RzVRuLL_wf

Molality of 0.8 M H_2SO_4 solution (density 1.06 g cm^{-3}) is _____ $\times 10^{-3} \text{ m}$.

Q58 Chemical Thermodynamics **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/ZI-H6EuIff

Standard enthalpy of vapourisation for CCl_4 is 30.5 kJ mol^{-1} . Heat required for vapourisation of 284g of CCl_4 at constant temperature is _____ kJ.

(Given molar mass in g mol^{-1} ; $\text{C} = 12$, $\text{Cl} = 35.5$)

Q59 Chemical Equilibrium **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/9etbBIOCKj

The following concentrations were observed at 500K for the formation of NH_3 from N_2 and H_2 . At equilibrium; $[\text{N}_2] = 2 \times 10^{-2}\text{M}$, $[\text{H}_2] = 3 \times 10^{-2}\text{M}$ and $[\text{NH}_3] = 1.5 \times 10^{-2}\text{M}$. Equilibrium constant for the reaction is _____.

Q60 Vectors

[Step-by-step solution](#) › prepwiser.in/questions/6jng1VMMeMK

Let $P(3, 2, 3)$, $Q(4, 6, 2)$ and $R(7, 3, 2)$ be the vertices of $\triangle PQR$. Then, the angle $\angle QPR$ is

- (A) $\cos^{-1}\left(\frac{7}{18}\right)$ (B) $\frac{\pi}{6}$ (C) $\cos^{-1}\left(\frac{1}{18}\right)$ (D) $\frac{\pi}{3}$

Q61 Applications of Derivatives

[Step-by-step solution](#) › prepwiser.in/questions/rC047JsIdr

The function $f(x) = \frac{x}{x^2 - 6x - 16}$, $x \in \mathbb{R} - \{-2, 8\}$

- (A) decreases in $(-\infty, -2) \cup (-2, 8) \cup (8, \infty)$
 (B) increases in $(-\infty, -2) \cup (-2, 8) \cup (8, \infty)$
 (C) decreases in $(-2, 8)$ and increases in $(-\infty, -2) \cup (8, \infty)$
 (D) decreases in $(-\infty, -2)$ and increases in $(8, \infty)$

Q62 Applications of Derivatives

[Step-by-step solution](#) › prepwiser.in/questions/C2I37EQaNy

The function $f(x) = 2x + 3(x)^{\frac{2}{3}}$, $x \in \mathbb{R}$, has

- (A) exactly one point of local minima and no point of local maxima
 (B) exactly one point of local maxima and exactly one point of local minima
 (C) exactly two points of local maxima and exactly one point of local minima
 (D) exactly one point of local maxima and no point of local minima

Q63 Complex Numbers

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

Let r and θ respectively be the modulus and amplitude of the complex number $z = 2 - i(2 \tan \frac{5\pi}{8})$, then (r, θ) is equal to

- (A) $(2 \sec \frac{11\pi}{8}, \frac{11\pi}{8})$ (B) $(2 \sec \frac{3\pi}{8}, \frac{3\pi}{8})$ (C) $(2 \sec \frac{5\pi}{8}, \frac{3\pi}{8})$ (D) $(2 \sec \frac{3\pi}{8}, \frac{5\pi}{8})$

Q64 Differential Equations

[Step-by-step solution](#) › prepwiser.in/questions/L8TgS3vFnI

If $\sin\left(\frac{y}{x}\right) = \log_e |x| + \frac{\alpha}{2}$ is the solution of the differential equation

$$x \cos\left(\frac{y}{x}\right) \frac{dy}{dx} = y \cos\left(\frac{y}{x}\right) + x$$

and $y(1) = \frac{\pi}{3}$, then α^2 is equal to

- (A) 12 (B) 9 (C) 4 (D) 3

Q65 Differentiation

[Step-by-step solution](#) › prepwiser.in/questions/IDn10MkfO7

Let $y = \log_e \left(\frac{1-x^2}{1+x^2} \right)$, $-1 < x < 1$. Then at $x = \frac{1}{2}$, the value of $225(y' - y'')$ is equal to

- (A) 732 (B) 736 (C) 742 (D) 746

Q66 Inverse Trigonometric Functions

[Step-by-step solution](#) › prepwiser.in/questions/ZMS75tyagU

Let $x = \frac{m}{n}$ (m, n are co-prime natural numbers) be a solution of the equation $\cos(2 \sin^{-1} x) = \frac{1}{9}$ and let α, β ($\alpha > \beta$) be the roots of the equation $mx^2 - nx - m + n = 0$. Then the point (α, β) lies on the line

- (A) $3x - 2y = -2$ (B) $3x + 2y = 2$ (C) $5x + 8y = 9$ (D) $5x - 8y = -9$

Let

$$A = \begin{bmatrix} 2 & 1 & 2 \\ 6 & 2 & 11 \\ 3 & 3 & 2 \end{bmatrix}$$

and

$$P = \begin{bmatrix} 1 & 2 & 0 \\ 5 & 0 & 2 \\ 7 & 1 & 5 \end{bmatrix}$$

. The sum of the prime factors of $|P^{-1}AP - 2I|$ is equal to

- (A) 66 (B) 27 (C) 23 (D) 26

Number of ways of arranging 8 identical books into 4 identical shelves where any number of shelves may remain empty is equal to

- (A) 18 (B) 16 (C) 12 (D) 15

An integer is chosen at random from the integers $1, 2, 3, \dots, 50$. The probability that the chosen integer is a multiple of atleast one of 4, 6 and 7 is

- (A) $\frac{8}{25}$ (B) $\frac{9}{50}$ (C) $\frac{14}{25}$ (D) $\frac{21}{50}$

If $\log_e a, \log_e b, \log_e c$ are in an A.P. and

$$\log_e a - \log_e 2b, \log_e 2b - \log_e 3c, \log_e 3c - \log_e$$

a are also in an A.P, then $a : b : c$ is equal to

- (A) $6 : 3 : 2$ (B) $9 : 6 : 4$ (C) $25 : 10 : 4$ (D) $16 : 4 : 1$

If each term of a geometric progression $a_1, a_2, a_3, \dots$ with $a_1 = \frac{1}{8}$ and $a_2 \neq a_1$, is the arithmetic mean of the next two terms and $S_n = a_1 + a_2 + \dots + a_n$, then $S_{20} - S_{18}$ is equal to

- (A) -2^{15} (B) 2^{15} (C) -2^{18} (D) 2^{18}

If R is the smallest equivalence relation on the set $\{1, 2, 3, 4\}$ such that $\{(1, 2), (1, 3)\} \subset R$, then the number of elements in R is _____.

- (A) 15 (B) 10 (C) 12 (D) 8

If the mean and variance of five observations are $\frac{24}{5}$ and $\frac{194}{25}$ respectively and the mean of the first four observations is $\frac{7}{2}$, then the variance of the first four observations is equal to

- (A) $\frac{5}{4}$ (B) $\frac{4}{5}$ (C) $\frac{105}{4}$ (D) $\frac{77}{12}$

Q74 Trigonometric Equations[Step-by-step solution](https://www.prepwiser.in/questions/fAQ3fZqLqo) › prepwiser.in/questions/fAQ3fZqLqo

The sum of the solutions $x \in \mathbb{R}$ of the equation $\frac{3 \cos 2x + \cos^3 2x}{\cos^6 x - \sin^6 x} = x^3 - x^2 + 6$ is

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

Q75 Three Dimensional Geometry[Step-by-step solution](https://www.prepwiser.in/questions/Q_iambFjFD) › prepwiser.in/questions/Q_iambFjFD

Let a unit vector $\hat{u} = x\hat{i} + y\hat{j} + z\hat{k}$ make angles $\frac{\pi}{2}$, $\frac{\pi}{3}$ and $\frac{2\pi}{3}$ with the vectors

$$\frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{k}, \frac{1}{\sqrt{2}}\hat{j} + \frac{1}{\sqrt{2}}\hat{k}$$

and $\frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$ respectively. If

$$\vec{v} = \frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j} + \frac{1}{\sqrt{2}}\hat{k}$$

then $|\hat{u} - \vec{v}|^2$ is equal to

- (A) $\frac{11}{2}$ (B) $\frac{5}{2}$ (C) 7 (D) 9

Q76 Vectors[Step-by-step solution](https://www.prepwiser.in/questions/wXmx0oc8WD) › prepwiser.in/questions/wXmx0oc8WD

Let

$$\overrightarrow{OA} = \vec{a}, \overrightarrow{OB} = 12\vec{a} + 4\vec{b} \text{ and } \overrightarrow{OC} = \vec{b}$$

, where O is the origin. If S is the parallelogram with adjacent sides OA and OC, then

$\frac{\text{area of the quadrilateral OABC}}{\text{area of S}}$ is equal to _____.

- (A) 7 (B) 6 (C) 8 (D) 10

Q77 Straight Lines[Step-by-step solution](https://www.prepwiser.in/questions/_HWRhuE5Cs) › prepwiser.in/questions/_HWRhuE5Cs

Let A be the point of intersection of the lines $3x + 2y = 14$, $5x - y = 6$ and B be the point of intersection of the lines $4x + 3y = 8$, $6x + y = 5$. The distance of the point $P(5, -2)$ from the line AB is

- (A) $\frac{13}{2}$ (B) 8 (C) $\frac{5}{2}$ (D) 6

Q78 Straight Lines[Step-by-step solution](https://www.prepwiser.in/questions/guLGLKJTEw) › prepwiser.in/questions/guLGLKJTEw

The distance of the point (2, 3) from the line $2x - 3y + 28 = 0$, measured parallel to the line $\sqrt{3}x - y + 1 = 0$, is equal to

- (A) $3 + 4\sqrt{2}$ (B) $6\sqrt{3}$ (C) $4 + 6\sqrt{3}$ (D) $4\sqrt{2}$

Q79 Indefinite Integration[Step-by-step solution](https://www.prepwiser.in/questions/EjDDpeHrXv) › prepwiser.in/questions/EjDDpeHrXv

If $\int \frac{\sin^{\frac{3}{2}} x + \cos^{\frac{3}{2}} x}{\sqrt{\sin^3 x \cos^3 x \sin(x-\theta)}} dx = A\sqrt{\cos \theta \tan x - \sin \theta} + B\sqrt{\cos \theta - \sin \theta \cot x} + C$, where C is the integration constant, then AB is equal to

- (A) $2 \sec \theta$ (B) $8 \operatorname{cosec}(2\theta)$ (C) $4 \operatorname{cosec}(2\theta)$ (D) $4 \sec \theta$

Q80 Three Dimensional Geometry **NUMERICAL**

[Step-by-step solution](#) › [prepwiser.in/questions/44MSDCGqje](https://www.prepwiser.in/questions/44MSDCGqje)

Let O be the origin, and M and N be the points on the lines $\frac{x-5}{4} = \frac{y-4}{1} = \frac{z-5}{3}$ and $\frac{x+8}{12} = \frac{y+2}{5} = \frac{z+11}{9}$ respectively such that MN is the shortest distance between the given lines. Then $\vec{OM} \cdot \vec{ON}$ is equal to _____.

Q81 Binomial Theorem **NUMERICAL**

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

Remainder when $64^{32^{32}}$ is divided by 9 is equal to _____.

Q82 Complex Numbers **NUMERICAL**

[Step-by-step solution](#) › [prepwiser.in/questions/isklJhUx5S](https://www.prepwiser.in/questions/isklJhUx5S)

Let α, β be the roots of the equation $x^2 - \sqrt{6}x + 3 = 0$ such that $\text{Im}(\alpha) > \text{Im}(\beta)$. Let a, b be integers not divisible by 3 and n be a natural number such that $\frac{\alpha^{99}}{\beta} + \alpha^{98} = 3^n(a + ib), i = \sqrt{-1}$. Then $n + a + b$ is equal to _____.

Q83 Limits **NUMERICAL**

[Step-by-step solution](#) › [prepwiser.in/questions/Vm9qme5NHG](https://www.prepwiser.in/questions/Vm9qme5NHG)

Let the slope of the line $45x + 5y + 3 = 0$ be $27r_1 + \frac{9r_2}{2}$ for some $r_1, r_2 \in \mathbb{R}$. Then

$$\lim_{x \rightarrow 3} \left(\int_3^x \frac{8t^2}{\frac{3r_2x}{2} - r_2x^2 - r_1x^3 - 3x} dt \right)$$

is equal to _____.

Q84 Definite Integration **NUMERICAL**

[Step-by-step solution](#) › [prepwiser.in/questions/lBxhEn5dot](https://www.prepwiser.in/questions/lBxhEn5dot)

If

$$\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \sqrt{1 - \sin 2x} dx = \alpha + \beta\sqrt{2} + \gamma\sqrt{3}$$

, where α, β and γ are rational numbers, then $3\alpha + 4\beta - \gamma$ is equal to _____.

Q85 Limits **NUMERICAL**

[Step-by-step solution](#) › [prepwiser.in/questions/DkcpCm8xNV](https://www.prepwiser.in/questions/DkcpCm8xNV)

Let

$$f(x) = \sqrt{\lim_{r \rightarrow x} \left\{ \frac{2r^2 [(f(r))^2 - f(x)f(r)]}{r^2 - x^2} - r^3 e^{\frac{f(r)}{r}} \right\}}$$

be differentiable in $(-\infty, 0) \cup (0, \infty)$ and $f(1) = 1$. Then the value of ea , such that $f(a) = 0$, is equal to _____.

Q86 Determinants **NUMERICAL**

[Step-by-step solution](#) › [prepwiser.in/questions/k_vyzXNb5G](https://www.prepwiser.in/questions/k_vyzXNb5G)

Let for any three distinct consecutive terms a, b, c of an A.P, the lines $ax + by + c = 0$ be concurrent at the point P and $Q(\alpha, \beta)$ be a point such that the system of equations

$$\begin{aligned} x + y + z &= 6, \\ 2x + 5y + \alpha z &= \beta \text{ and} \end{aligned}$$

$x + 2y + 3z = 4$, has infinitely many solutions. Then $(PQ)^2$ is equal to _____.

Q87 Parabola **NUMERICAL**

[Step-by-step solution](#) › [prepwiser.in/questions/AA6Td8X00d](https://www.prepwiser.in/questions/AA6Td8X00d)

Let $P(\alpha, \beta)$ be a point on the parabola $y^2 = 4x$. If P also lies on the chord of the parabola $x^2 = 8y$ whose mid point is $(1, \frac{5}{4})$, then $(\alpha - 28)(\beta - 8)$ is equal to _____.

Let the set $C = \{(x, y) \mid x^2 - 2^y = 2023, x, y \in \mathbb{N}\}$. Then $\sum_{(x,y) \in C} (x + y)$ is equal to _____.

Let the area of the region $\{(x, y) : 0 \leq x \leq 3, 0 \leq y \leq \min\{x^2 + 2, 2x + 2\}\}$ be A. Then 12A is equal to _____.

Answer key: JEE Main 2024 · 29 Jan · Shift 2

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

Numbers match the question numbers above. For full working, open the solution link at the top right of each question.

Attempt this paper online with instant answer checking › prepwiser.in/pyqs/paper/2024-01-29-evening

Physics

1.	C	2.	B	3.	C	4.	C	5.	B	6.	D	7.	B	8.	C	9.	A	10.	D
11.	A	12.	C	13.	D	14.	C	15.	B	16.	A	17.	D	18.	A	19.	A	20.	B
21.	121	22.	36	23.	8	24.	30	25.	3	26.	32	27.	16	28.	60	29.	2	30.	2

Chemistry

31.	C	32.	C	33.	D	34.	A	35.	A	36.	D	37.	A	38.	D	39.	C	40.	C
41.	D	42.	B	43.	A	44.	A	45.	D	46.	A	47.	C	48.	C	49.	C	50.	22
51.	3	52.	4	53.	63	54.	2	55.	1	56.	4	57.	815	58.	56	59.	417		

Mathematics

60.	D	61.	A	62.	B	63.	B	64.	D	65.	B	66.	C	67.	D	68.	D	69.	D
70.	B	71.	A	72.	B	73.	A	74.	D	75.	B	76.	C	77.	D	78.	C	79.	B
80.	9	81.	1	82.	49	83.	12	84.	6	85.	2	86.	113	87.	192	88.	46	89.	164

PrepWiser is an independent practice platform and is not affiliated with the National Testing Agency (NTA). Questions are from official JEE Main papers; answers follow NTA's final answer keys.



Attempt this paper online

Done with the paper version? Take the same paper online: check each answer instantly and read step-by-step solutions where available. It is free, and you can start without signing up.



- 1 Scan the code to open this paper online, or go to prepwisser.in/pyqs/paper/2024-01-29-evening.
- 2 Mark the questions you got wrong. Each one names its chapter at the top left.
- 3 Practise those chapters next with the free chapter-wise PYQ PDFs at prepwisser.in/pyq-pdfs.

Also free on PrepWiser

All JEE Main 2024 papers

Every shift of 2024 as a PDF, and the year's questions chapter-wise: prepwisser.in/pyq-pdfs/jee-main/2024/

Chapter-wise PYQ PDFs

Every chapter with answer keys, 2020 to 2026: prepwisser.in/pyq-pdfs/

Daily Arena

10 questions from one chapter, every day: prepwisser.in/arena

Spotted a mistake in this PDF? Tell us at prepwisser.in/feedback.