

JEE MAIN 2024 · QUESTION PAPER

5 Apr 2024 **Shift 2**

82 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	19 Q1 to Q19	10 Q20 to Q29
● Chemistry	16 Q30 to Q45	9 Q46 to Q54
● Mathematics	20 Q55 to Q74	8 Q75 to Q82
In this PDF	82 questions · answer key at the end	

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

Attempt this paper online

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

prepwis.in/pyqs/paper/2024-04-05-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/oLYc0Zqcyg

A series LCR circuit is subjected to an ac signal of 200V, 50Hz. If the voltage across the inductor ($L = 10\text{mH}$) is 31.4V, then the current in this circuit is _____.

- (A) 10 A (B) 10 mA (C) 68 A (D) 63 A

Q2 Atomic Physics

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

The angular momentum of an electron in a hydrogen atom is proportional to : (Where r is the radius of orbit of electron)

- (A) $\frac{1}{r}$ (B) $\frac{1}{\sqrt{r}}$ (C) $\sqrt{r}$ (D) r

Q3 Circular Motion

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

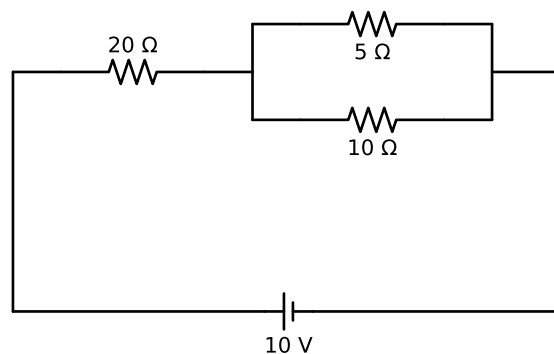
A man carrying a monkey on his shoulder does cycling smoothly on a circular track of radius 9m and completes 120 revolutions in 3 minutes. The magnitude of centripetal acceleration of monkey is (in m/s^2):

- (A) $4\pi^2\text{ms}^{-2}$ (B) $16\pi^2\text{ms}^{-2}$ (C) $57600\pi^2\text{ms}^{-2}$ (D) Zero

Q4 Current Electricity

[Step-by-step solution](#) › prepwiser.in/questions/8sST1fPJsx

The ratio of heat dissipated per second through the resistance 5Ω and 10Ω in the circuit given below is:



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

Q5 Moving Charges & Magnetism

[Step-by-step solution](#) › prepwiser.in/questions/HKHtBU3xld

A galvanometer of resistance 100Ω when connected in series with 400Ω measures a voltage of upto 10V. The value of resistance required to convert the galvanometer into ammeter to read upto 10A is $x \times 10^{-2}\Omega$. The value of x is:

- (A) 2 (B) 20 (C) 800 (D) 200

Q6 Dual Nature of Radiation & Matter

[Step-by-step solution](#) › prepwiser.in/questions/u0b9Y-4CA7

Which of the following statement is not true about stopping potential (V_0)?

- (A) It depends upon frequency of the incident light.
 (B) It is $1/e$ times the maximum kinetic energy of electrons emitted.
 (C) It increases with increase in intensity of the incident light.
 (D) It depends on the nature of emitter material.

Match List I with List II:

	LIST I EM-Wave		LIST II Wavelength Range
A.	Infra-red	I.	$< 10^{-3}$ nm
B.	Ultraviolet	II.	400 nm to 1 nm
C.	X-rays	III.	1 mm to 700 nm
D.	Gamma rays	IV.	1 nm to 10^{-3} nm

Choose the correct answer from the options given below:

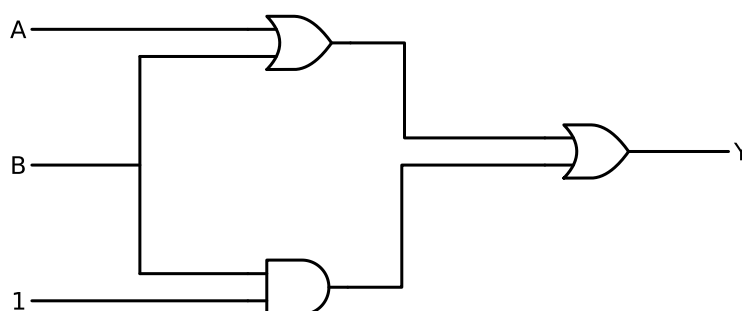
(A) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)

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

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

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

The output (Y) of logic circuit given below is 0 only when:



(A) $A = 0, B = 0$

(B) $A = 0, B = 1$

(C) $A = 1, B = 0$

(D) $A = 1, B = 1$

The vehicles carrying inflammable fluids usually have metallic chains touching the ground:

(A) To protect tyres from catching dirt from ground

(B) It is a custom

(C) To alert other vehicles

(D) To conduct excess charge due to air friction to ground and prevent sparking

A satellite revolving around a planet in stationary orbit has time period 6 hours. The mass of planet is one-fourth the mass of earth. The radius orbit of planet is:

(Given = Radius of geo-stationary orbit for earth is 4.2×10^4 km)

(A) 1.68×10^5 km

(B) 1.4×10^4 km

(C) 8.4×10^4 km

(D) 1.05×10^4 km

During an adiabatic process, if the pressure of a gas is found to be proportional to the cube of its absolute temperature, then the ratio of $\frac{C_p}{C_v}$ for the gas is:

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

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

(C) $\frac{7}{5}$

(D) $\frac{9}{7}$

Attempt this paper online with instant answer checking > [prepwisar.in/pyqs/paper/2024-04-05-evening](https://www.prepwisar.in/pyqs/paper/2024-04-05-evening)

Q12 Kinetic Theory of Gases[Step-by-step solution](https://www.prepwisar.in/questions/JQLz5OX5tY) › prepwisar.in/questions/JQLz5OX5tY

If n is the number density and d is the diameter of the molecule, then the average distance covered by a molecule between two successive collisions (i.e. mean free path) is represented by:

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

Q13 Newton's Laws of Motion[Step-by-step solution](https://www.prepwisar.in/questions/HV9GktdGV3) › prepwisar.in/questions/HV9GktdGV3

A particle moves in x - y plane under the influence of a force $\vec{F}$ such that its linear momentum is

$$\vec{p}(t) = \hat{i} \cos(kt) - \hat{j} \sin(kt)$$

. If k is constant, the angle between $\vec{F}$ and $\vec{p}$ will be:

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

Q14 Friction[Step-by-step solution](https://www.prepwisar.in/questions/2vViayAij7) › prepwisar.in/questions/2vViayAij7

A heavy box of mass 50kg is moving on a horizontal surface. If co-efficient of kinetic friction between the box and horizontal surface is 0.3 then force of kinetic friction is:

- (A) 1470 N (B) 147 N (C) 1.47 N (D) 14.7 N

Q15 Moving Charges & Magnetism[Step-by-step solution](https://www.prepwisar.in/questions/Z_ILybUWD) › prepwisar.in/questions/Z_ILybUWD

The electrostatic force ($\vec{F}_1$) and magnetic force ($\vec{F}_2$) acting on a charge q moving with velocity $\vec{v}$ can be written:

- (A) $\vec{F}_1 = q\vec{B}, \vec{F}_2 = q(\vec{B} \times \vec{v})$ (B) $\vec{F}_1 = q\vec{V} \cdot \vec{E}, \vec{F}_2 = q(\vec{B} \cdot \vec{V})$
(C) $\vec{F}_1 = q\vec{E}, \vec{F}_2 = q(\vec{V} \times \vec{B})$ (D) $\vec{F}_1 = q\vec{E}, \vec{F}_2 = q(\vec{B} \times \vec{V})$

Q16 Ray Optics[Step-by-step solution](https://www.prepwisar.in/questions/b5thvo2Oon) › prepwisar.in/questions/b5thvo2Oon

Given below are two statements:

Statement I : When the white light passed through a prism, the red light bends lesser than yellow and violet.

Statement II : The refractive indices are different for different wavelengths in dispersive medium. In the light of the above statements, chose 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

Q17 Work, Energy & Power[Step-by-step solution](https://www.prepwisar.in/questions/ark86jdp0J) › prepwisar.in/questions/ark86jdp0J

A body is moving unidirectionally under the influence of a constant power source. Its displacement in time t is proportional to:

- (A) $t^{2/3}$ (B) $t^{3/2}$ (C) t (D) t^2

Q18 Units, Dimensions & Errors[Step-by-step solution](https://www.prepwisar.in/questions/Z297dOzkry) › prepwisar.in/questions/Z297dOzkry

What is the dimensional formula of ab^{-1} in the equation $(P + \frac{a}{V^2})(V - b) = RT$, where letters have their usual meaning.

- (A) $[M^6L^7T^4]$ (B) $[M^{-1}L^5T^3]$ (C) $[M^0L^3T^{-2}]$ (D) $[ML^2T^{-2}]$

A vernier callipers has 20 divisions on the vernier scale, which coincides with 19th division on the main scale. The least count of the instrument is 0.1mm. One main scale division is equal to _____ mm.

(A) 5

(B) 2

(C) 1

(D) 0.5

Physics Section B · Numerical value

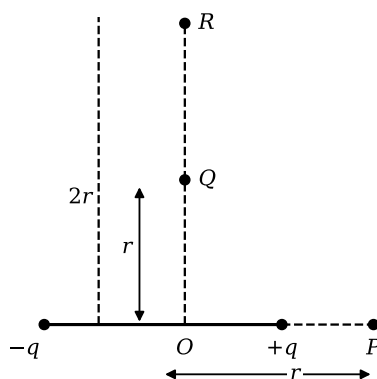
Q20 to Q29

The shortest wavelength of the spectral lines in the Lyman series of hydrogen spectrum is $915 \text{ \AA}$. The longest wavelength of spectral lines in the Balmer series will be _____ $\text{\AA}$.

A wire of resistance 20Ω is divided into 10 equal parts, resulting pairs. A combination of two parts are connected in parallel and so on. Now resulting pairs of parallel combination are connected in series. The equivalent resistance of final combination is _____ Ω .

The current in an inductor is given by $I = (3t + 8)$ where t is in second. The magnitude of induced emf produced in the inductor is 12mV . The self-inductance of the inductor _____ mH.

The electric field at point P due to an electric dipole is E . The electric field at point R on equatorial line will be $\frac{E}{x}$. The value of x :



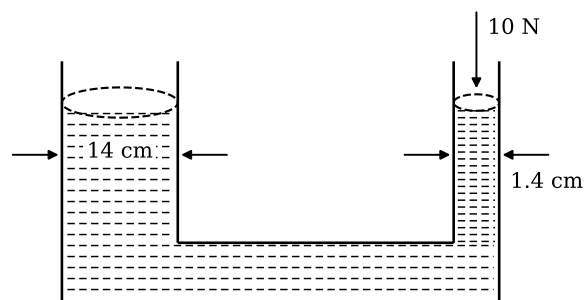
A solenoid of length 0.5m has a radius of 1cm and is made up of ' m ' number of turns. It carries a current of 5A . If the magnitude of the magnetic field inside the solenoid is $6.28 \times 10^{-3}\text{T}$ then the value of m is _____.

The maximum height reached by a projectile is 64m . If the initial velocity is halved, the new maximum height of the projectile is _____ m.

Attempt this paper online with instant answer checking > [prepwisar.in/pyqs/paper/2024-04-05-evening](https://www.prepwisar.in/pyqs/paper/2024-04-05-evening)

Q26 Fluid Mechanics **NUMERICAL**[Step-by-step solution](https://prepwiser.in/questions/nHQFA4idsR)

A hydraulic press containing water has two arms with diameters as mentioned in the figure. A force of 10N is applied on the surface of water in the thinner arm. The force required to be applied on the surface of water in the thicker arm to maintain equilibrium of water is _____ N.

**Q27** Rotational Motion **NUMERICAL**[Step-by-step solution](https://prepwiser.in/questions/O479W0yrnq)

A hollow sphere is rolling on a plane surface about its axis of symmetry. The ratio of rotational kinetic energy to its total kinetic energy is $\frac{x}{5}$. The value of x is _____.

Q28 Wave Optics **NUMERICAL**[Step-by-step solution](https://prepwiser.in/questions/hOOH3hXZJV)

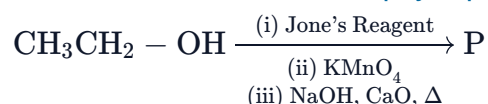
In a single slit experiment, a parallel beam of green light of wavelength 550nm passes through a slit of width 0.20mm. The transmitted light is collected on a screen 100cm away. The distance of first order minima from the central maximum will be $x \times 10^{-5}$ m. The value of x is:

Q29 Mechanical Waves **NUMERICAL**[Step-by-step solution](https://prepwiser.in/questions/8fYgqzNfD2)

A sonometer wire of resonating length 90cm has a fundamental frequency of 400Hz when kept under some tension. The resonating length of the wire with fundamental frequency of 600Hz under same tension _____ cm.

Chemistry Section A · Multiple choice

Q30 to Q45

Q30 Hydrocarbons: Alkanes[Step-by-step solution](https://prepwiser.in/questions/2FoC3NT08X)

Consider the above reaction sequence and identify the major product P.

- (A) Methanoic acid (B) Methoxymethane (C) Methane (D) Methanal

Q31 Carbohydrates & Biomolecules[Step-by-step solution](https://prepwiser.in/questions/JCGN350Vkd)

Coagulation of egg, on heating is because of:

- (A) Denaturation of protein occurs
(B) Biological property of protein remains unchanged
(C) Breaking of the peptide linkage in the primary structure of protein occurs
(D) The secondary structure of protein remains unchanged

Attempt this paper online with instant answer checking > prepwiser.in/pyqs/paper/2024-04-05-evening

Match List I with List II.

	LIST I		LIST II
A.	ICl	I.	T - shape
B.	ICl ₃	II.	Square pyramidal
C.	ClF ₅	III.	Pentagonal bipyramidal
D.	IF ₇	IV.	Linear

Choose the correct answer from the options given below:

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

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

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

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

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

Assertion (A): NH_3 and NF_3 molecule have pyramidal shape with a lone pair of electrons on nitrogen atom. The resultant dipole moment of NH_3 is greater than that of NF_3 .

Reason (R) : In NH_3 , the orbital dipole due to lone pair is in the same direction as the resultant dipole moment of the N – H bonds. F is the most electronegative element.

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) (A) is true but (R) is false

(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)

The number of complexes from the following with no electrons in the t_2 orbital is ____.



(A) 4

(B) 2

(C) 3

(D) 1

The metal atom present in the complex MABXL (where A, B, X and L are unidentate ligands and M is metal) involves sp^3 hybridization. The number of geometrical isomers exhibited by the complex is:

(A) 0

(B) 2

(C) 3

(D) 4

While preparing crystals of Mohr's salt, dil H_2SO_4 is added to a mixture of ferrous sulphate and ammonium sulphate, before dissolving this mixture in water, dil H_2SO_4 is added here to:

(A) prevent the hydrolysis of ferrous sulphate

(B) prevent the hydrolysis of ammonium sulphate

(C) increase the rate of formation of crystals

(D) make the medium strongly acidic

The number of ions from the following that have the ability to liberate hydrogen from a dilute acid is _____.

Ti^{2+} , Cr^{2+} and V^{2+}

- (A) 1 (B) 2 (C) 3 (D) 0

The quantity of silver deposited when one coulomb charge is passed through AgNO_3 solution:

- (A) 0.1g atom of silver (B) 1 chemical equivalent of silver
(C) 1g of silver (D) 1 electrochemical equivalent of silver

For the electro chemical cell

$\text{M} | \text{M}^{2+} || \text{X} | \text{X}^{2-}$

If $E_{(\text{M}^{2+}/\text{M})}^0 = 0.46\text{V}$ and $E_{(\text{X}/\text{X}^{2-})}^0 = 0.34\text{V}$.

Which of the following is correct?

- (A) $E_{\text{cell}} = 0.80\text{V}$
(B) $\text{M} + \text{X} \rightarrow \text{M}^{2+} + \text{X}^{2-}$ is a spontaneous reaction
(C) $E_{\text{cell}} = -0.80\text{V}$
(D) $\text{M}^{2+} + \text{X}^{2-} \rightarrow \text{M} + \text{X}$ is a spontaneous reaction

The correct statements from the following are:

- (A) The decreasing order of atomic radii of group 13 elements is $\text{Tl} > \text{In} > \text{Ga} > \text{Al} > \text{B}$.
(B) Down the group 13 electronegativity decreases from top to bottom.
(C) Al dissolves in dil. HCl and liberates H_2 but conc. HNO_3 renders Al passive by forming a protective oxide layer on the surface.
(D) All elements of group 13 exhibits highly stable +1 oxidation state.
(E) Hybridisation of Al in $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$ ion is sp^3d^2 .

Choose the correct answer from the options given below:

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

Attempt this paper online with instant answer checking › [prepwiser.in/pyqs/paper/2024-04-05-evening](https://www.prepwiser.in/pyqs/paper/2024-04-05-evening)

Given below are two statements:

Statement I : The metallic radius of Na is $1.86\text{\AA}$ and the ionic radius of Na^+ is lesser than $1.86\text{\AA}$

Statement II : Ions are always smaller in size than the corresponding elements.

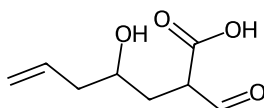
In the light of the above statements, choose the correct answer from the options given below:

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

The number of moles of methane required to produce $11\text{gCO}_2(\text{g})$ after complete combustion is :
 (Given molar mass of methane in gmol^{-1} : 16)

- (A) 0.35 (B) 0.25 (C) 0.5 (D) 0.75

The correct nomenclature for the following compound is:



- (A) 2-carboxy-4-hydroxyhept-7-enal (B) 2-formyl-4-hydroxyhept-7-enoic acid
 (C) 2-carboxy-4-hydroxyhept-6-enal (D) 2-formyl-4-hydroxyhept-6-enoic acid

Match List - I with List - II.

	LIST I (Pair of Compounds)		LIST II (Isomerism)
A.	n-propanol and Isopropanol	I.	Metamerism
B.	Methoxypropane and ethoxyethane	II.	Chain Isomerism
C.	Propanone and propanal	III.	Position Isomerism
D.	Neopentane and Isopentane	IV.	Functional Isomerism

Choose the correct answer from the options given below:

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

Attempt this paper online with instant answer checking › [prepwiser.in/pyqs/paper/2024-04-05-evening](https://www.prepwiser.in/pyqs/paper/2024-04-05-evening)

Given below are two statements:

Statement I : On passing $\text{HCl}_{(g)}$ through a saturated solution of BaCl_2 , at room temperature white turbidity appears.

Statement II : When HCl gas is passed through a saturated solution of NaCl , sodium chloride is precipitated due to common ion effect.

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

Chemistry Section B · Numerical value

Q46 to Q54

Q46 Mole Concept & Stoichiometry NUMERICAL

[Step-by-step solution](https://www.prepwisar.in/questions/WmvOvPJ_e0) › prepwisar.in/questions/WmvOvPJ_e0

In the Claisen-Schmidt reaction to prepare 351g of dibenzalacetone using 87g of acetone, the amount of benzaldehyde required is _____ g. (Nearest integer)

Q47 Chemical Bonding & Molecular Structure NUMERICAL

[Step-by-step solution](https://www.prepwisar.in/questions/Q8qhaFTP68) › prepwisar.in/questions/Q8qhaFTP68

Number of compounds from the following with zero dipole moment is _____.



Q48 Chemical Kinetics NUMERICAL

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

Consider the following single step reaction in gas phase at constant temperature.



The initial rate of the reaction is recorded as r_1 when the reaction starts with 1.5atm pressure of A and 0.7atm pressure of B. After some time, the rate r_2 is recorded when the pressure of C becomes 0.5atm. The ratio $r_1 : r_2$ is _____ $\times 10^{-1}$. (Nearest integer)

Q49 d & f Block Elements NUMERICAL

[Step-by-step solution](https://www.prepwisar.in/questions/qZrY4v1YRK) › prepwisar.in/questions/qZrY4v1YRK

The fusion of chromite ore with sodium carbonate in the presence of air leads to the formation of products A and B along with the evolution of CO_2 . The sum of spin-only magnetic moment values of A and B is _____ B.M. (Nearest integer)

[Given atomic number: C : 6, Na : 11, O : 8, Fe : 26, Cr : 24]

Attempt this paper online with instant answer checking › [prepwisar.in/pyqs/paper/2024-04-05-evening](https://www.prepwisar.in/pyqs/paper/2024-04-05-evening)

Considering acetic acid dissociates in water, its dissociation constant is 6.25×10^{-5} . If 5mL of acetic acid is dissolved in 1 litre water, the solution will freeze at $-x \times 10^{-2}^\circ\text{C}$, provided pure water freezes at 0°C .

$x = \underline{\hspace{2cm}}$. (Nearest integer)

Given : $(K_f)_{\text{water}} = 1.86\text{Kkgmol}^{-1}$

density of acetic acid is 1.2gcm^{-3} .

molar mass of water = 18gcmol^{-1} .

molar mass of acetic acid = 60gcmol^{-1} .

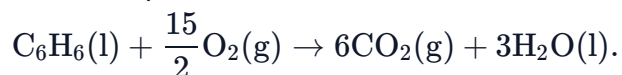
density of water = 1gcm^{-3}

Acetic acid dissociates as



In an atom, total number of electrons having quantum numbers $n = 4$, $|m_l| = 1$ and $m_s = -\frac{1}{2}$ is $\underline{\hspace{2cm}}$.

Combustion of 1 mole of benzene is expressed at



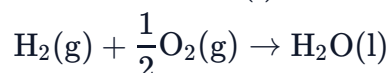
The standard enthalpy of combustion of 2mol of benzene is $-x'\text{kJ}$. $x = \underline{\hspace{2cm}}$.

Given:

1. standard Enthalpy of formation of 1mol of $\text{C}_6\text{H}_6(l)$, for the reaction $6\text{C}(\text{graphite}) + 3\text{H}_2(g) \rightarrow \text{C}_6\text{H}_6(l)$ is 48.5kJmol^{-1} .

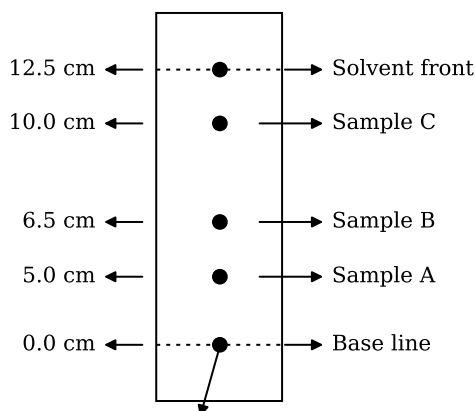
2. Standard Enthalpy of formation of 1mol of $\text{CO}_2(g)$, for the reaction $\text{C}(\text{graphite}) + \text{O}_2(g) \rightarrow \text{CO}_2(g)$ is -393.5kJmol^{-1} .

3. Standard and Enthalpy of formation of 1mol of $\text{H}_2\text{O}(l)$, for the reaction



is -286kJmol^{-1} .

Using the given figure, the ratio of R_f values of sample A and sample C is $x \times 10^{-2}$. Value of x is _____.



Samples (A, B, C)
Fig : Paper chromatography of Samples

Xg of ethanamine was subjected to reaction with NaNO_2/HCl followed by hydrolysis to liberate N_2 and HCl . The HCl generated was completely neutralised by 0.2 moles of NaOH . X is _____ g.

Mathematics Section A · Multiple choice

Q55 to Q74

Let (α, β, γ) be the image of the point $(8, 5, 7)$ in the line $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-2}{5}$. Then $\alpha + \beta + \gamma$ is equal to:

- (A) 16 (B) 20 (C) 18 (D) 14

If the constant term in the expansion of $\left(\frac{\sqrt[5]{3}}{x} + \frac{2x}{\sqrt[3]{5}}\right)^{12}$, $x \neq 0$, is $\alpha \times 2^8 \times \sqrt[5]{3}$, then 25α is equal to:

- (A) 724 (B) 742 (C) 693 (D) 639

Let the circle $C_1 : x^2 + y^2 - 2(x + y) + 1 = 0$ and C_2 be a circle having centre at $(-1, 0)$ and radius 2. If the line of the common chord of C_1 and C_2 intersects the y-axis at the point P, then the square of the distance of P from the centre of C_1 is:

- (A) 4 (B) 6 (C) 2 (D) 1

Let ABCD and AEFG be squares of side 4 and 2 units, respectively. The point E is on the line segment AB and the point F is on the diagonal AC. Then the radius r of the circle passing through the point F and touching the line segments BC and CD satisfies:

- (A) $r = 1$ (B) $2r^2 - 4r + 1 = 0$ (C) $2r^2 - 8r + 7 = 0$ (D) $r^2 - 8r + 8 = 0$

Let

$$S_1 = \{z \in \mathbf{C} : |z| \leq 5\}, S_2 = \left\{z \in \mathbf{C} : \operatorname{Im} \left(\frac{z+1-\sqrt{3}i}{1-\sqrt{3}i} \right) \geq 0 \right\}$$

and $S_3 = \{z \in \mathbf{C} : \operatorname{Re}(z) \geq 0\}$. Then the area of the region $S_1 \cap S_2 \cap S_3$ is:

- (A) $\frac{125\pi}{24}$ (B) $\frac{125\pi}{6}$ (C) $\frac{125\pi}{12}$ (D) $\frac{125\pi}{4}$

Let

$$\beta(m, n) = \int_0^1 x^{m-1} (1-x)^{n-1} dx, m, n > 0$$

. If

$$\int_0^1 (1-x^{10})^{20} dx = a \times \beta(b, c)$$

, then $100(a+b+c)$ equals _____.

- (A) 2012 (B) 1021 (C) 1120 (D) 2120

The differential equation of the family of circles passing through the origin and having centre at the line $y = x$ is:

- (A) $(x^2 - y^2 + 2xy) dx = (x^2 - y^2 + 2xy) dy$ (B) $(x^2 + y^2 - 2xy) dx = (x^2 + y^2 + 2xy) dy$
 (C) $(x^2 + y^2 + 2xy) dx = (x^2 + y^2 - 2xy) dy$ (D) $(x^2 - y^2 + 2xy) dx = (x^2 - y^2 - 2xy) dy$

If

$$y(\theta) = \frac{2 \cos \theta + \cos 2\theta}{\cos 3\theta + 4 \cos 2\theta + 5 \cos \theta + 2}$$

, then at $\theta = \frac{\pi}{2}$, $y'' + y' + y$ is equal to:

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

Let $f, g : \mathbf{R} \rightarrow \mathbf{R}$ be defined as:

$$f(x) = |x-1| \text{ and } g(x) = \begin{cases} e^x, & x \geq 0 \\ x+1, & x \leq 0. \end{cases}$$

Then the function $f(g(x))$ is

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

Attempt this paper online with instant answer checking > [prepwisar.in/pyqs/paper/2024-04-05-evening](https://www.prepwisar.in/pyqs/paper/2024-04-05-evening)

Q64 Continuity & Differentiability[Step-by-step solution](https://www.prepwiser.in/questions/IBQduDd5PM) › prepwiser.in/questions/IBQduDd5PM

Let, $f : [-1, 2] \rightarrow \mathbf{R}$ be given by $f(x) = 2x^2 + x + [x^2] - [x]$, where $[t]$ denotes the greatest integer less than or equal to t . The number of points, where f is not continuous, is:

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

Q65 Determinants[Step-by-step solution](https://www.prepwiser.in/questions/5tZgXFtDSx) › prepwiser.in/questions/5tZgXFtDSx

The values of m, n , for which the system of equations

$$\begin{aligned}x + y + z &= 4, \\2x + 5y + 5z &= 17, \\x + 2y + mz &= n\end{aligned}$$

has infinitely many solutions, satisfy the equation:

- (A) $m^2 + n^2 - m - n = 46$ (B) $m^2 + n^2 + mn = 68$
(C) $m^2 + n^2 - mn = 39$ (D) $m^2 + n^2 + m + n = 64$

Q66 Determinants[Step-by-step solution](https://www.prepwiser.in/questions/cs6wFBRvVf) › prepwiser.in/questions/cs6wFBRvVf

Let $\alpha\beta \neq 0$ and

$$A = \begin{bmatrix} \beta & \alpha & 3 \\ \alpha & \alpha & \beta \\ -\beta & \alpha & 2\alpha \end{bmatrix}$$

. If

$$B = \begin{bmatrix} 3\alpha & -9 & 3\alpha \\ -\alpha & 7 & -2\alpha \\ -2\alpha & 5 & -2\beta \end{bmatrix}$$

is the matrix of cofactors of the elements of A , then $\det(AB)$ is equal to:

- (A) 64 (B) 343 (C) 125 (D) 216

Q67 Permutations & Combinations[Step-by-step solution](https://www.prepwiser.in/questions/15RyYxWQYP) › prepwiser.in/questions/15RyYxWQYP

Let the set $S = \{2, 4, 8, 16, \dots, 512\}$ be partitioned into 3 sets A, B, C with equal number of elements such that $A \cup B \cup C = S$ and

$$A \cap B = B \cap C = A \cap C = \phi$$

. The maximum number of such possible partitions of S is equal to:

- (A) 1640 (B) 1520 (C) 1710 (D) 1680

Q68 Permutations & Combinations[Step-by-step solution](https://www.prepwiser.in/questions/VUgfkmuIEe) › prepwiser.in/questions/VUgfkmuIEe

60 words can be made using all the letters of the word BHBJO, with or without meaning. If these words are written as in a dictionary, then the 50th word is:

- (A) OBBJH (B) HBBJO (C) OBBHJ (D) JBBOH

Q69 Probability: Basic[Step-by-step solution](https://www.prepwiser.in/questions/aBn4aF1WxA) › prepwiser.in/questions/aBn4aF1WxA

The coefficients a, b, c in the quadratic equation $ax^2 + bx + c = 0$ are from the set $\{1, 2, 3, 4, 5, 6\}$. If the probability of this equation having one real root bigger than the other is p , then $216p$ equals:

- (A) 38 (B) 76 (C) 57 (D) 19

Q70 Sequences & Series[Step-by-step solution](#) › prepwiser.in/questions/znkSDKGABW

For $x \geq 0$, the least value of K , for which $4^{1+x} + 4^{1-x}, \frac{K}{2}, 16^x + 16^{-x}$ are three consecutive terms of an A.P., is equal to:

- (A) 10 (B) 4 (C) 8 (D) 16

Q71 Vectors[Step-by-step solution](#) › prepwiser.in/questions/ioc_2xR4pl

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

$$(\vec{c} + \hat{i}) \times (\vec{a} + \vec{b} + \hat{i}) = \vec{a} \times (\vec{c} + \hat{i})$$

. If $\vec{a} \cdot \vec{c} = -29$, then $\vec{c} \cdot (-2\hat{i} + \hat{j} + \hat{k})$ is equal to:

- (A) 15 (B) 10 (C) 5 (D) 12

Q72 Vectors[Step-by-step solution](#) › prepwiser.in/questions/d6swncO03V

Consider three vectors $\vec{a}, \vec{b}, \vec{c}$. Let $|\vec{a}| = 2$, $|\vec{b}| = 3$ and $\vec{a} = \vec{b} \times \vec{c}$. If $\alpha \in [0, \frac{\pi}{3}]$ is the angle between the vectors $\vec{b}$ and $\vec{c}$, then the minimum value of $27|\vec{c} - \vec{a}|^2$ is equal to:

- (A) 124 (B) 110 (C) 121 (D) 105

Q73 Area Under Curves[Step-by-step solution](#) › prepwiser.in/questions/sT7X9Dkm5v

The area enclosed between the curves $y = x|x|$ and $y = x - |x|$ is:

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

Q74 Straight Lines[Step-by-step solution](#) › prepwiser.in/questions/q9pYsfRqzh

Let $A(-1, 1)$ and $B(2, 3)$ be two points and P be a variable point above the line AB such that the area of $\triangle PAB$ is 10. If the locus of P is $ax + by = 15$, then $5a + 2b$ is:

- (A) $-\frac{12}{5}$ (B) $-\frac{6}{5}$ (C) 6 (D) 4

Mathematics Section B · Numerical value

Q75 to Q82

Q75 Three Dimensional Geometry **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/X1eQs62iKa

Let the point $(-1, \alpha, \beta)$ lie on the line of the shortest distance between the lines $\frac{x+2}{-3} = \frac{y-2}{4} = \frac{z-5}{2}$ and $\frac{x+2}{-1} = \frac{y+6}{2} = \frac{z-1}{0}$. Then $(\alpha - \beta)^2$ is equal to _____.

Q76 Definite Integration **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/zHWpiAwwkz

If

$$f(t) = \int_0^{\pi} \frac{2x dx}{1 - \cos^2 t \sin^2 x}, 0 < t < \pi$$

, then the value of $\int_0^{\frac{\pi}{2}} \frac{\pi^2 dt}{f(t)}$ equals _____.

Attempt this paper online with instant answer checking › [prepwiser.in/pyqs/paper/2024-04-05-evening](#)

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

$$\frac{dy}{dx} + \frac{2x}{(1+x^2)^2}y = xe^{\frac{1}{1+x^2}}; y(0) = 0.$$

Then the area enclosed by the curve $f(x) = y(x)e^{-\frac{1}{(1+x^2)}}$ and the line $y - x = 4$ is _____.

Let $a > 0$ be a root of the equation $2x^2 + x - 2 = 0$. If

$$\lim_{x \rightarrow \frac{1}{a}} \frac{16(1 - \cos(2 + x - 2x^2))}{(1 - ax)^2} = \alpha + \beta\sqrt{17}$$

, where $\alpha, \beta \in \mathbb{Z}$, then $\alpha + \beta$ is equal to _____.

Let a line perpendicular to the line $2x - y = 10$ touch the parabola $y^2 = 4(x - 9)$ at the point P. The distance of the point P from the centre of the circle $x^2 + y^2 - 14x - 8y + 56 = 0$ is _____.

If

$$1 + \frac{\sqrt{3} - \sqrt{2}}{2\sqrt{3}} + \frac{5 - 2\sqrt{6}}{18} + \frac{9\sqrt{3} - 11\sqrt{2}}{36\sqrt{3}} + \frac{49 - 20\sqrt{6}}{180} + \dots$$

upto $\infty = 2 + \left(\sqrt{\frac{b}{a}} + 1\right) \log_e\left(\frac{a}{b}\right)$, where a and b are integers with $\gcd(a, b) = 1$, then $11a + 18b$ is equal to _____.

Let the mean and the standard deviation of the probability distribution

X	α	1	0	-3
P(X)	$\frac{1}{3}$	K	$\frac{1}{6}$	$\frac{1}{4}$

be μ and σ , respectively. If $\sigma - \mu = 2$, then $\sigma + \mu$ is equal to _____.

The number of solutions of $\sin^2 x + (2 + 2x - x^2) \sin x - 3(x - 1)^2 = 0$, where $-\pi \leq x \leq \pi$, is _____.

Answer key: JEE Main 2024 · 5 Apr · 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/2024-04-05-evening

Physics

1.	A	2.	C	3.	B	4.	B	5.	B	6.	C	7.	B	8.	A
9.	D	10.	D	11.	B	12.	A	13.	A	14.	B	15.	C	16.	A
17.	B	18.	D	19.	B	20.	6588	21.	5	22.	4	23.	16	24.	500
25.	16	26.	1000	27.	2	28.	275	29.	60						

Chemistry

30.	C	31.	A	32.	B	33.	D	34.	C	35.	A	36.	A	37.	C
38.	D	39.	D	40.	B	41.	D	42.	B	43.	D	44.	C	45.	D
46.	318	47.	6	48.	315	49.	6	50.	19	51.	6	52.	6535	53.	50
54.	9														

Mathematics

55.	D	56.	C	57.	C	58.	D	59.	C	60.	D	61.	D	62.	D
63.	A	64.	C	65.	C	66.	D	67.	D	68.	A	69.	A	70.	A
71.	C	72.	A	73.	C	74.	A	75.	25	76.	1	77.	18	78.	170
79.	10	80.	76	81.	5	82.	2								

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/2024-04-05-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.