

JEE MAIN 2024 · QUESTION PAPER

6 Apr 2024 Shift 2

83 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	19 Q1 to Q19	10 Q20 to Q29
● Chemistry	17 Q30 to Q46	8 Q47 to Q54
● Mathematics	19 Q55 to Q73	10 Q74 to Q83
In this PDF	83 questions · answer key at the end	

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

Attempt this paper online

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

prepwisar.in/pyqs/paper/2024-04-06-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?
prepwisar.in/feedback · Terms: prepwisar.in/terms

Q1 Atomic Physics

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

The longest wavelength associated with Paschen series is : (Given $R_H = 1.097 \times 10^7 \text{SI unit}$)

- (A) $2.973 \times 10^{-6} \text{m}$ (B) $1.876 \times 10^{-6} \text{m}$ (C) $1.094 \times 10^{-6} \text{m}$ (D) $3.646 \times 10^{-6} \text{m}$

Q2 Circular Motion

[Step-by-step solution](#) › [prepwiser.in/questions/qQVqdW0wCD](https://www.prepwiser.in/questions/qQVqdW0wCD)

A car of 800kg is taking turn on a banked road of radius 300m and angle of banking 30° . If coefficient of static friction is 0.2 then the maximum speed with which car can negotiate the turn safely: ($g = 10 \text{m/s}^2$, $\sqrt{3} = 1.73$)

- (A) 51.4 m/s (B) 102.8 m/s (C) 70.4 m/s (D) 264 m/s

Q3 Current Electricity

[Step-by-step solution](#) › [prepwiser.in/questions/IIkSySF60L](https://www.prepwiser.in/questions/IIkSySF60L)

The number of electrons flowing per second in the filament of a 110W bulb operating at 220V is : (Given $e = 1.6 \times 10^{-19} \text{C}$)

- (A) 1.25×10^{19} (B) 31.25×10^{17} (C) 6.25×10^{18} (D) 6.25×10^{17}

Q4 Dual Nature of Radiation & Matter

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

When UV light of wavelength 300nm is incident on the metal surface having work function 2.13eV, electron emission takes place. The stopping potential is:

(Given $hc = 1240 \text{eVnm}$)

- (A) 4 V (B) 2 V (C) 4.1 V (D) 1.5 V

Q5 Electromagnetic Induction

[Step-by-step solution](#) › [prepwiser.in/questions/0EKDfsvC1q](https://www.prepwiser.in/questions/0EKDfsvC1q)

In a coil, the current changes from -2A to $+2\text{A}$ in 0.2s and induces an emf of 0.1V. The self inductance of the coil is:

- (A) 4 mH (B) 2.5 mH (C) 1 mH (D) 5 mH

Q6 Electromagnetic Waves

[Step-by-step solution](#) › [prepwiser.in/questions/w63x3Vfuxj](https://www.prepwiser.in/questions/w63x3Vfuxj)

In the given electromagnetic wave $E_y = 600 \sin(\omega t - kx) \text{Vm}^{-1}$, intensity of the associated light beam is (in W/m^2): (Given $\epsilon_0 = 9 \times 10^{-12} \text{C}^2 \text{N}^{-1} \text{m}^{-2}$)

- (A) 486 (B) 729 (C) 243 (D) 972

Q7 Semiconductors & Electronic Devices

[Step-by-step solution](#) › [prepwiser.in/questions/wDDiuaU52c](https://www.prepwiser.in/questions/wDDiuaU52c)

The acceptor level of a p-type semiconductor is 6eV. The maximum wavelength of light which can create a hole would be : Given $hc = 1242 \text{eVnm}$.

- (A) 407 nm (B) 103.5 nm (C) 414 nm (D) 207 nm

Q8 Electrostatics I: Charges, Field & Gauss's Law

[Step-by-step solution](#) › [prepwiser.in/questions/7YysOoYRXs](https://www.prepwiser.in/questions/7YysOoYRXs)

Two identical conducting spheres P and S with charge Q on each, repel each other with a force 16N. A third identical uncharged conducting sphere R is successively brought in contact with the two spheres. The new force of repulsion between P and S is:

- (A) 1 N (B) 6 N (C) 12 N (D) 4 N

Q9 Ray Optics

[Step-by-step solution](#) › [prepwiser.in/questions/llFWp7Lujh](https://www.prepwiser.in/questions/llFWp7Lujh)

For the thin convex lens, the radii of curvature are at 15cm and 30cm respectively. The focal length the lens is 20cm. The refractive index of the material is:

- (A) 1.2 (B) 1.5 (C) 1.4 (D) 1.8

Q10 Gravitation[Step-by-step solution](https://www.prepwiser.in/questions/6xvPzwCrSL) > prepwiser.in/questions/6xvPzwCrSL

Assuming the earth to be a sphere of uniform mass density, a body weighed 300N on the surface of earth. How much it would weigh at $R/4$ depth under surface of earth?

- (A) 75 N (B) 375 N (C) 300 N (D) 225 N

Q11 Units, Dimensions & Errors[Step-by-step solution](https://www.prepwiser.in/questions/_IRzNWJDnJ) > prepwiser.in/questions/_IRzNWJDnJ

Given below are two statements:

Statement (I) : Dimensions of specific heat is $[L^2T^{-2}K^{-1}]$.

Statement (II) : Dimensions of gas constant is $[ML^2T^{-1}K^{-1}]$.

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

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

Q12 Kinetic Theory of Gases[Step-by-step solution](https://www.prepwiser.in/questions/20H2QmujPH) > prepwiser.in/questions/20H2QmujPH

Energy of 10 non rigid diatomic molecules at temperature T is:

- (A) 35 RT (B) $\frac{7}{2}$ RT (C) 70 $K_B T$ (D) 35 $K_B T$

Q13 Thermodynamics[Step-by-step solution](https://www.prepwiser.in/questions/d2jZ5N5CmD) > prepwiser.in/questions/d2jZ5N5CmD

A total of 48J heat is given to one mole of helium kept in a cylinder. The temperature of helium increases by 2°C . The work done by the gas is: Given, $R = 8.3\text{JK}^{-1}\text{mol}^{-1}$.

- (A) 23.1 J (B) 48 J (C) 24.9 J (D) 72.9 J

Q14 Newton's Laws of Motion[Step-by-step solution](https://www.prepwiser.in/questions/eoFL_ZP_qF) > prepwiser.in/questions/eoFL_ZP_qF

A body of weight 200N is suspended from a tree branch through a chain of mass 10kg. The branch pulls the chain by a force equal to (if $g = 10\text{m/s}^2$):

- (A) 300 N (B) 100 N (C) 150 N (D) 200 N

Q15 Rectilinear Motion[Step-by-step solution](https://www.prepwiser.in/questions/oQPvdcvoY6) > prepwiser.in/questions/oQPvdcvoY6

A body projected vertically upwards with a certain speed from the top of a tower reaches the ground in t_1 . If it is projected vertically downwards from the same point with the same speed, it reaches the ground in t_2 . Time required to reach the ground, if it is dropped from the top of the tower, is:

- (A) $\sqrt{t_1 + t_2}$ (B) $\sqrt{t_1 t_2}$ (C) $\sqrt{\frac{t_1}{t_2}}$ (D) $\sqrt{t_1 - t_2}$

Q16 Surface Tension[Step-by-step solution](https://www.prepwiser.in/questions/jqCkQri98p) > prepwiser.in/questions/jqCkQri98p

Pressure inside a soap bubble is greater than the pressure outside by an amount : (given: R = Radius of bubble, S = Surface tension of bubble)

- (A) $\frac{S}{R}$ (B) $\frac{4S}{R}$ (C) $\frac{4R}{S}$ (D) $\frac{2S}{R}$

Q17 Work, Energy & Power[Step-by-step solution](https://www.prepwiser.in/questions/zekv2UJmy2) > prepwiser.in/questions/zekv2UJmy2

When kinetic energy of a body becomes 36 times of its original value, the percentage increase in the momentum of the body will be:

- (A) 60% (B) 500% (C) 6% (D) 600%

Q18 Experimental Skills[Step-by-step solution](#) > [prepwiser.in/questions/t7LX84cxOf](https://www.prepwiser.in/questions/t7LX84cxOf)

In a vernier calliper, when both jaws touch each other, zero of the vernier scale shifts towards left and its 4th division coincides exactly with a certain division on main scale. If 50 vernier scale divisions equal to 49 main scale divisions and zero error in the instrument is 0.04mm then how many main scale divisions are there in 1cm?

- (A) 5 (B) 40 (C) 10 (D) 20

Q19 Experimental Skills[Step-by-step solution](#) > [prepwiser.in/questions/8fOTYik77L](https://www.prepwiser.in/questions/8fOTYik77L)

In finding out refractive index of glass slab the following observations were made through travelling microscope
50 vernier scale division = 49MSD; 20 divisions on main scale in each cm

For mark on paper

$$\text{MSR} = 8.45\text{cm}, \text{VC} = 26$$

For mark on paper seen through slab

$$\text{MSR} = 7.12\text{cm}, \text{VC} = 41$$

For powder particle on the top surface of the glass slab

$$\text{MSR} = 4.05\text{cm}, \text{VC} = 1$$

(MSR = Main Scale Reading, VC = Vernier Coincidence)

Refractive index of the glass slab is:

- (A) 1.52 (B) 1.35 (C) 1.24 (D) 1.42

Physics Section B · Numerical value

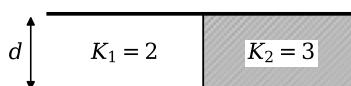
Q20 to Q29

Q20 Alternating Current **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/QFI0zBaX5r](https://www.prepwiser.in/questions/QFI0zBaX5r)

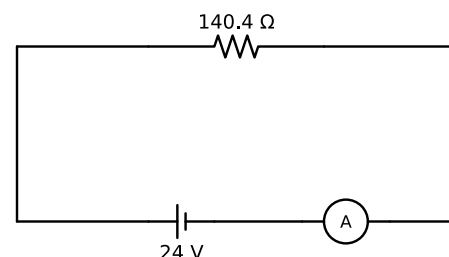
For a given series LCR circuit it is found that maximum current is drawn when value of variable capacitance is 2.5nF . If resistance of 200Ω and 100mH inductor is being used in the given circuit. The frequency of ac source is _____ $\times 10^3\text{Hz}$ (given $a^2 = 10$)

Q21 Electrostatics II: Potential & Capacitance **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/fo-6yVP5c6](https://www.prepwiser.in/questions/fo-6yVP5c6)

A capacitor of $10\mu\text{F}$ capacitance whose plates are separated by 10mm through air and each plate has area 4cm^2 is now filled equally with two dielectric media of $K_1 = 2$, $K_2 = 3$ respectively as shown in figure. If new force between the plates is 8N . The supply voltage is _____ V.

**Q22** Moving Charges & Magnetism **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/sl9J3sKou4](https://www.prepwiser.in/questions/sl9J3sKou4)

In the given figure an ammeter A consists of a 240Ω coil connected in parallel to a 10Ω shunt. The reading of the ammeter is _____ mA.

**Q23** Atomic Physics **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/3hE9Lj0InM](https://www.prepwiser.in/questions/3hE9Lj0InM)

In Franck-Hertz experiment, the first dip in the current-voltage graph for hydrogen is observed at 10.2V . The wavelength of light emitted by hydrogen atom when excited to the first excitation level is _____ nm. (Given $hc = 1245\text{eVnm}$, $e = 1.6 \times 10^{-19}\text{C}$).

Q24 Magnetism & Matter **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/8jNV4HhZYf](https://www.prepwiser.in/questions/8jNV4HhZYf)

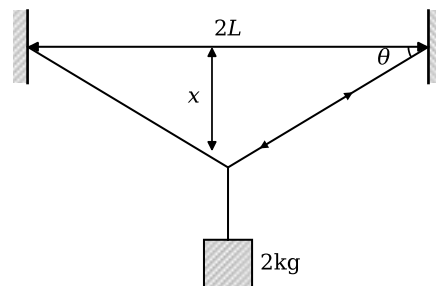
A coil having 100 turns, area of $5 \times 10^{-3} \text{m}^2$, carrying current of 1mA is placed in uniform magnetic field of 0.20T such a way that plane of coil is perpendicular to the magnetic field. The work done in turning the coil through 90° is _____ μJ .

Q25 Rectilinear Motion **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/rTqBILrzo3](https://www.prepwiser.in/questions/rTqBILrzo3)

A particle moves in a straight line so that its displacement x at any time t is given by $x^2 = 1 + t^2$. Its acceleration at any time t is x^{-n} where $n =$ _____.

Q26 Elasticity **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/rP_At-ACB3](https://www.prepwiser.in/questions/rP_At-ACB3)

A wire of cross sectional area A , modulus of elasticity $2 \times 10^{11} \text{Nm}^{-2}$ and length 2m is stretched between two vertical rigid supports. When a mass of 2kg is suspended at the middle it sags lower from its original position making angle $\theta = \frac{1}{100}$ radian on the points of support. The value of A is _____ $\times 10^{-4} \text{m}^2$ (consider $x \ll L$).
(given: $g = 10 \text{m/s}^2$)

**Q27** Rotational Motion **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/CkJIeJOSk4](https://www.prepwiser.in/questions/CkJIeJOSk4)

Three balls of masses 2kg , 4kg and 6kg respectively are arranged at centre of the edges of an equilateral triangle of side 2m . The moment of inertia of the system about an axis through the centroid and perpendicular to the plane of triangle, will be _____ kgm^2 .

Q28 Wave Optics **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/lJjY0kupjr](https://www.prepwiser.in/questions/lJjY0kupjr)

Two coherent monochromatic light beams of intensities I and $4I$ are superimposed. The difference between maximum and minimum possible intensities in the resulting beam is xI . The value of x is _____.

Q29 Mechanical Waves **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/onuBL8eHdN](https://www.prepwiser.in/questions/onuBL8eHdN)

Two open organ pipes of lengths 60cm and 90cm resonate at 6^{th} and 5^{th} harmonics respectively. The difference of frequencies for the given modes is _____ Hz . (Velocity of sound in air = 333m/s)

Chemistry Section A · Multiple choice

Q30 to Q46

Q30 Carbohydrates & Biomolecules[Step-by-step solution](#) > [prepwiser.in/questions/5kj3hMAj4r](https://www.prepwiser.in/questions/5kj3hMAj4r)

The incorrect statements regarding enzymes are:

- (A) Enzymes are biocatalysts.
- (B) Enzymes are non-specific and can catalyse different kinds of reactions.
- (C) Most Enzymes are globular proteins.
- (D) Enzyme - oxidase catalyses the hydrolysis of maltose into glucose.

Choose the correct answer from the option given below:

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

Q31 Chemical Bonding & Molecular Structure[Step-by-step solution](#) > [prepwiser.in/questions/kR0UUZNBtk](https://www.prepwiser.in/questions/kR0UUZNBtk)

Given below are two statements:

Statement I: PF_5 and BrF_5 both exhibit sp^3d hybridisation.

Statement II: Both SF_6 and $[\text{Co}(\text{NH}_3)_6]^{3+}$ exhibit sp^3d^2 hybridisation.

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

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

Match List I with List II.

	LIST I Tetrahedral Complex		LIST II Electronic configuration
A.	TiCl_4	I.	e^2, t_2^0
B.	$[\text{FeO}_4]^{2-}$	II.	e^4, t_2^3
C.	$[\text{FeCl}_4]^-$	III.	e^0, t_2^0
D.	$[\text{CoCl}_4]^{2-}$	IV.	e^2, t_2^3

Choose the correct answer from the options given below:

(A) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)**(B)** (A)-(III), (B)-(I), (C)-(IV), (D)-(II)**(C)** (A)-(I), (B)-(III), (C)-(IV), (D)-(II)**(D)** (A)-(III), (B)-(IV), (C)-(II), (D)-(I)The correct IUPAC name of $[\text{PtBr}_2(\text{PMe}_3)_2]$ is:**(A)** bis(trimethylphosphine)dibromoplatinum(II)**(B)** dibromodi(trimethylphosphine)platinum(II)**(C)** dibromobis(trimethylphosphine)platinum(II)**(D)** bis[bromo(trimethylphosphine)]platinum(II)

Arrange the following elements in the increasing order of number of unpaired electrons in it.

(A) Sc

(B) Cr

(C) V

(D) Ti

(E) Mn

Choose the correct answer from the options given below:

(A) (A) < (D) < (C) < (B) < (E)**(B)** (A) < (D) < (C) < (E) < (B)**(C)** (B) < (C) < (D) < (E) < (A)**(D)** (C) < (E) < (B) < (A) < (D)

How can an electrochemical cell be converted into an electrolytic cell?

(A) Applying an external opposite potential greater than E_{cell}^0 **(B)** Exchanging the electrodes at anode and cathode.**(C)** Applying an external opposite potential lower than E_{cell}^0 **(D)** Reversing the flow of ions in salt bridge.

Evaluate the following statements related to group 14 elements for their correctness.

(A) Covalent radius decreases down the group from C to Pb in a regular manner.

(B) Electronegativity decreases from C to Pb down the group gradually.

(C) Maximum covalance of C is 4 whereas other elements can expand their covalance due to presence of d orbitals.

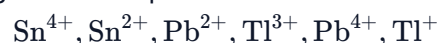
(D) Heavier elements do not form $p\pi - p\pi$ bonds.

(E) Carbon can exhibit negative oxidation states.

Choose the correct answer from the options given below:

(A) (A), (B) and (C) Only**(B)** (A) and (B) Only**(C)** (C), (D) and (E) Only**(D)** (C) and (D) Only

The number of ions from the following that are expected to behave as oxidising agent is:



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

Match List I with List II.

	LIST I Reaction		LIST II Type of redox reaction
A.	$\text{N}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{NO}_{(g)}$	I.	Decomposition
B.	$2\text{Pb}(\text{NO}_3)_{2(s)} \rightarrow 2\text{PbO}_{(s)} + 4\text{NO}_{2(g)} + \text{O}_{2(g)}$	II.	Displacement
C.	$2\text{Na}_{(s)} + 2\text{H}_2\text{O}_{(l)} \rightarrow 2\text{NaOH}_{(aq.)} + \text{H}_{2(g)}$	III.	Disproportionation
D.	$2\text{NO}_{2(g)} + 2^-\text{OH}(\text{aq.}) \rightarrow \text{NO}_{2(aq.)}^- + \text{NO}_{3(aq.)}^- + \text{H}_2\text{O}_{(l)}$	IV.	Combination

Choose the correct answer from the options given below:

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

Match List I with List II.

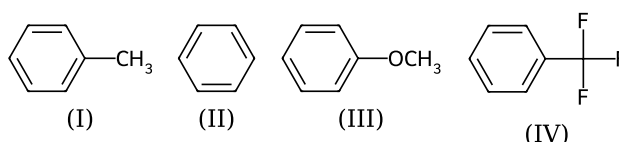
	LIST I Alkali Metal		LIST II Emission Wavelength in nm
A.	Li	I.	589.2
B.	Na	II.	455.5
C.	Rb	III.	670.8
D.	Cs	IV.	780.0

Choose the correct answer from the options given below:

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

Molality (m) of 3M aqueous solution of NaCl is : (Given : Density of solution = 1.25g mL^{-1} , Molar mass in g mol^{-1} : Na – 23, Cl – 35.5)

- (A) 2.90 m (B) 3.85 m (C) 1.90 m (D) 2.79 m



The correct arrangement for decreasing order of electrophilic substitution for above compounds is:

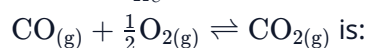
- (A) (III) > (IV) > (II) > (I) (B) (III) > (I) > (II) > (IV)
(C) (II) > (IV) > (III) > (I) (D) (IV) > (I) > (II) > (III)

Attempt this paper online with instant answer checking > [prepwiser.in/pyqs/paper/2024-04-06-evening](#)

The incorrect statement regarding the geometrical isomers of 2-butene is:

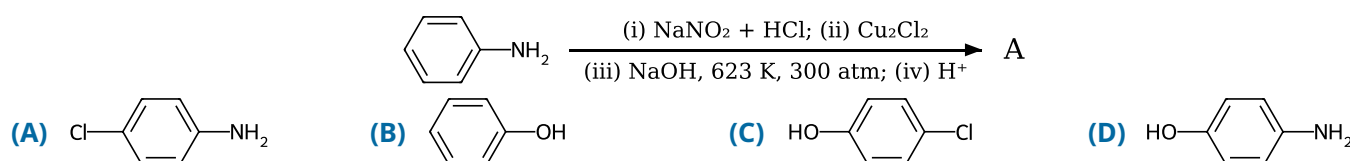
- (A) cis-2-butene and trans-2-butene are not interconvertible at room temperature.
 (B) trans-2-butene is more stable than cis-2-butene.
 (C) cis-2-butene has less dipole moment than trans-2-butene.
 (D) cis-2-butene and trans-2-butene are stereoisomers.

The ratio $\frac{K_P}{K_C}$ for the reaction:



- (A) 1 (B) $(RT)^{1/2}$ (C) RT (D) $\frac{1}{\sqrt{RT}}$

Identify the product A in the following reaction.



The correct statement among the following, for a "chromatography" purification method is:

- (A) R_f of a polar compound is smaller than that of a non-polar compound.
 (B) Non-polar compounds are retained at top and polar compounds come down in column chromatography.
 (C) Organic compounds run faster than solvent in the thin layer chromatographic plate.
 (D) R_f is an integral value.

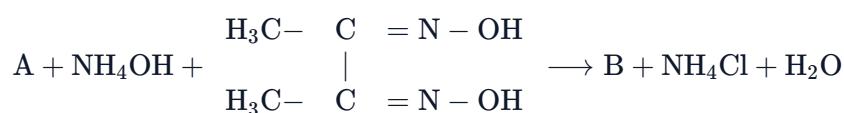
During the detection of acidic radical present in a salt, a student gets a pale yellow precipitate soluble with difficulty in NH_4OH solution when sodium carbonate extract was first acidified with dil. HNO_3 and then AgNO_3 solution was added. This indicates presence of:

- (A) I^- (B) CO_3^{2-} (C) Cl^- (D) Br^-

Chemistry Section B · Numerical value

Q47 to Q54

Consider the following reactions

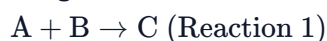


The number of protons that do not involve in hydrogen bonding in the product B is _____.

Total number of species from the following with central atom utilising sp^2 hybrid orbitals for bonding is _____.



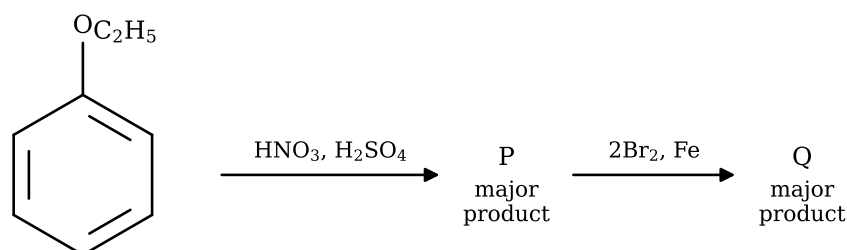
Consider the two different first order reactions given below



The ratio of the half life of Reaction 1 : Reaction 2 is 5 : 2. If t_1 and t_2 represent the time taken to complete $2/3^{\text{rd}}$ and $4/5^{\text{th}}$ of Reaction 1 and Reaction 2, respectively, then the value of the ratio $t_1 : t_2$ is _____ $\times 10^{-1}$ (nearest integer). [Given: $\log_{10}(3) = 0.477$ and $\log_{10}(5) = 0.699$]

Among VO_2^+ , MnO_4^- and $\text{Cr}_2\text{O}_7^{2-}$, the spin-only magnetic moment value of the species with least oxidising ability is _____ BM (Nearest integer).

(Given atomic member V = 23, Mn = 25, Cr = 24)

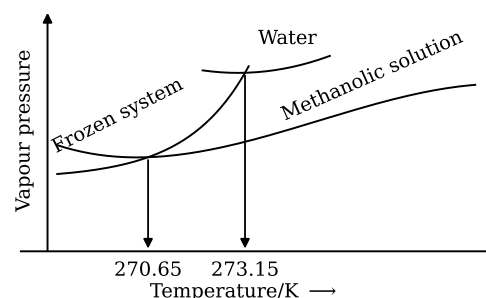


The ratio of number of oxygen atoms to bromine atoms in the product Q is _____ $\times 10^{-1}$.

When ' x ' $\times 10^{-2}$ mL methanol (molar mass = 32g, density = 0.792g/cm³) is added to 100mL. water (density = 1g/cm³), the following diagram is obtained.

$x =$ _____ (nearest integer).

[Given : Molal freezing point depression constant of water at 273.15K is 1.86Kkgmol⁻¹]



For hydrogen atom, energy of an electron in first excited state is -3.4eV , K.E. of the same electron of hydrogen atom is $x\text{eV}$. Value of x is _____ $\times 10^{-1}\text{eV}$. (Nearest integer)

For the reaction at



and $\Delta S = 0.2\text{kJmol}^{-1}\text{K}^{-1}$. The reaction will become spontaneous above _____ K.

Mathematics Section A · Multiple choice

Q55 to Q73

Let $P(\alpha, \beta, \gamma)$ be the image of the point $Q(3, -3, 1)$ in the line $\frac{x-0}{1} = \frac{y-3}{1} = \frac{z-1}{-1}$ and R be the point $(2, 5, -1)$. If the area of the triangle PQR is λ and $\lambda^2 = 14K$, then K is equal to:

(A) 18

(B) 81

(C) 72

(D) 36

Q56 Complex Numbers[Step-by-step solution](#) › [prepwiser.in/questions/kJfQ6SiEoM](#)

If z_1, z_2 are two distinct complex number such that $\left| \frac{z_1 - 2z_2}{\frac{1}{2} - z_1 z_2} \right| = 2$, then

- (A) either z_1 lies on a circle of radius $\frac{1}{2}$ or z_2 lies on a circle of radius 1.
 (B) z_1 lies on a circle of radius $\frac{1}{2}$ and z_2 lies on a circle of radius 1.
 (C) either z_1 lies on a circle of radius 1 or z_2 lies on a circle of radius $\frac{1}{2}$.
 (D) both z_1 and z_2 lie on the same circle.

Q57 Differential Equations[Step-by-step solution](#) › [prepwiser.in/questions/PIHPlvvyQx](#)

Suppose the solution of the differential equation

$$\frac{dy}{dx} = \frac{(2 + \alpha)x - \beta y + 2}{\beta x - 2\alpha y - (\beta\gamma - 4\alpha)}$$

represents a circle passing through origin. Then the radius of this circle is:

- (A) $\sqrt{17}$ (B) 2 (C) $\frac{\sqrt{17}}{2}$ (D) $\frac{1}{2}$

Q58 Differentiation[Step-by-step solution](#) › [prepwiser.in/questions/rvhYKr4Gor](#)

Suppose for a differentiable function $h, h(0) = 0, h(1) = 1$ and $h'(0) = h'(1) = 2$. If $g(x) = h(e^x)e^{h(x)}$, then $g'(0)$ is equal to:

- (A) 4 (B) 5 (C) 3 (D) 8

Q59 Applications of Derivatives[Step-by-step solution](#) › [prepwiser.in/questions/9EoYKDHf7D](#)

If the function $f(x) = \left(\frac{1}{x}\right)^{2x}; x > 0$ attains the maximum value at $x = \frac{1}{e}$ then:

- (A) $e^\pi < \pi^e$ (B) $e^{2\pi} < (2\pi)^e$ (C) $(2e)^\pi > \pi^{(2e)}$ (D) $e^\pi > \pi^e$

Q60 Functions (Advanced)[Step-by-step solution](#) › [prepwiser.in/questions/gBxaocoxwt](#)

Let $f(x) = \frac{1}{7 - \sin 5x}$ be a function defined on $\mathbf{R}$. Then the range of the function $f(x)$ is equal to:

- (A) $\left[\frac{1}{8}, \frac{1}{5}\right]$ (B) $\left[\frac{1}{7}, \frac{1}{6}\right]$ (C) $\left[\frac{1}{7}, \frac{1}{5}\right]$ (D) $\left[\frac{1}{8}, \frac{1}{6}\right]$

Q61 Limits[Step-by-step solution](#) › [prepwiser.in/questions/TdTOPFDBos](#)

$$\lim_{n \rightarrow \infty} \frac{(1^2 - 1)(n - 1) + (2^2 - 2)(n - 2) + \dots + ((n - 1)^2 - (n - 1)) \cdot 1}{(1^3 + 2^3 + \dots + n^3) - (1^2 + 2^2 + \dots + n^2)}$$

is equal to:

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

Q62 Determinants[Step-by-step solution](#) › [prepwiser.in/questions/Egsh13SO1w](#)

If A is a square matrix of order 3 such that $\det(A) = 3$ and

$$\det(\text{adj}(-4 \text{adj}(-3 \text{adj}(3 \text{adj}((2A)^{-1})))))) = 2^m 3^n$$

, then $m + 2n$ is equal to:

- (A) 2 (B) 4 (C) 3 (D) 6

Q63 Permutations & Combinations[Step-by-step solution](#) › [prepwiser.in/questions/WHp86zZV_E](#)

If all the words with or without meaning made using all the letters of the word "NAGPUR" are arranged as in a dictionary, then the word at 315th position in this arrangement is:

- (A) NRAPUG (B) NRAGUP (C) NRAPGU (D) NRAGPU

Q64 Binomial Theorem[Step-by-step solution](#) > [prepwisar.in/questions/U_QeaIHYJ](https://www.prepwisar.in/questions/U_QeaIHYJ)

Let $0 \leq r \leq n$. If ${}^{n+1}C_{r+1} : {}^nC_r : {}^{n-1}C_{r-1} = 55 : 35 : 21$, then $2n + 5r$ is equal to:

- (A) 62 (B) 60 (C) 55 (D) 50

Q65 Probability: Basic[Step-by-step solution](#) > [prepwisar.in/questions/MDID7yriXR](https://www.prepwisar.in/questions/MDID7yriXR)

If three letters can be posted to any one of the 5 different addresses, then the probability that the three letters are posted to exactly two addresses is:

- (A) $\frac{18}{25}$ (B) $\frac{12}{25}$ (C) $\frac{6}{25}$ (D) $\frac{4}{25}$

Q66 Sequences & Series[Step-by-step solution](#) > [prepwisar.in/questions/w7_wdkibnY](https://www.prepwisar.in/questions/w7_wdkibnY)

Let ABC be an equilateral triangle. A new triangle is formed by joining the middle points of all sides of the triangle ABC and the same process is repeated infinitely many times. If P is the sum of perimeters and Q is the sum of areas of all the triangles formed in this process, then:

- (A) $P^2 = 72\sqrt{3}Q$ (B) $P^2 = 36\sqrt{3}Q$ (C) $P = 36\sqrt{3}Q^2$ (D) $P^2 = 6\sqrt{3}Q$

Q67 Sequences & Series[Step-by-step solution](#) > [prepwisar.in/questions/QhHop1rAD-](https://www.prepwisar.in/questions/QhHop1rAD-)

A software company sets up m number of computer systems to finish an assignment in 17 days. If 4 computer systems crashed on the start of the second day, 4 more computer systems crashed on the start of the third day and so on, then it took 8 more days to finish the assignment. The value of m is equal to:

- (A) 125 (B) 160 (C) 150 (D) 180

Q68 Relations & Functions (Basic)[Step-by-step solution](#) > [prepwisar.in/questions/S14SD_yBio](https://www.prepwisar.in/questions/S14SD_yBio)

Let $A = \{1, 2, 3, 4, 5\}$. Let R be a relation on A defined by xRy if and only if $4x \leq 5y$. Let m be the number of elements in R and n be the minimum number of elements from $A \times A$ that are required to be added to R to make it a symmetric relation. Then $m + n$ is equal to:

- (A) 23 (B) 26 (C) 25 (D) 24

Q69 Vectors[Step-by-step solution](#) > [prepwisar.in/questions/ndQdrjzqQc](https://www.prepwisar.in/questions/ndQdrjzqQc)

Let

$$\vec{a} = 2\hat{i} + \hat{j} - \hat{k}, \vec{b} = ((\vec{a} \times (\hat{i} + \hat{j})) \times \hat{i}) \times \hat{i}$$

. Then the square of the projection of $\vec{a}$ on $\vec{b}$ is:

- (A) $\frac{1}{3}$ (B) $\frac{1}{5}$ (C) 2 (D) $\frac{2}{3}$

Q70 Vectors[Step-by-step solution](#) > [prepwisar.in/questions/wjQVVTfydo](https://www.prepwisar.in/questions/wjQVVTfydo)

Let $\vec{a} = 6\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. If $\vec{c}$ is a vector such that

$$|\vec{c}| \geq 6, \vec{a} \cdot \vec{c} = 6|\vec{c}|, |\vec{c} - \vec{a}| = 2\sqrt{2}$$

and the angle between $\vec{a} \times \vec{b}$ and $\vec{c}$ is 60° , then $|(\vec{a} \times \vec{b}) \times \vec{c}|$ is equal to:

- (A) $\frac{3}{2}\sqrt{6}$ (B) $\frac{9}{2}(6 - \sqrt{6})$ (C) $\frac{9}{2}(6 + \sqrt{6})$ (D) $\frac{3}{2}\sqrt{3}$

Q71 Area Under Curves[Step-by-step solution](#) > [prepwisar.in/questions/TQVPDILm3Q](https://www.prepwisar.in/questions/TQVPDILm3Q)

If the area of the region $\{(x, y) : \frac{a}{x^2} \leq y \leq \frac{1}{x}, 1 \leq x \leq 2, 0 < a < 1\}$ is $(\log_e 2) - \frac{1}{7}$ then the value of $7a - 3$ is equal to:

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

Attempt this paper online with instant answer checking > [prepwisar.in/pyqs/paper/2024-04-06-evening](https://www.prepwisar.in/pyqs/paper/2024-04-06-evening)

Q72 Straight Lines[Step-by-step solution](#) › prepwiser.in/questions/ZpYQzKklwH

If the locus of the point, whose distances from the point (2, 1) and (1, 3) are in the ratio 5 : 4, is $ax^2 + by^2 + cxy + dx + ey + 170 = 0$, then the value of $a^2 + 2b + 3c + 4d + e$ is equal to:

- (A) 37 (B) -27 (C) 437 (D) 5

Q73 Indefinite Integration[Step-by-step solution](#) › prepwiser.in/questions/XO-Ea38KgS

If $\int \frac{1}{a^2 \sin^2 x + b^2 \cos^2 x} dx = \frac{1}{12} \tan^{-1}(3 \tan x) + \text{constant}$, then the maximum value of $a \sin x + b \cos x$, is:

- (A) $\sqrt{41}$ (B) $\sqrt{39}$ (C) $\sqrt{40}$ (D) $\sqrt{42}$

Mathematics Section B · Numerical value

Q74 to Q83

Q74 Three Dimensional Geometry **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/HZEYntjMLW

If the shortest distance between the lines $\frac{x-\lambda}{3} = \frac{y-2}{-1} = \frac{z-1}{1}$ and $\frac{x+2}{-3} = \frac{y+5}{2} = \frac{z-4}{4}$ is $\frac{44}{\sqrt{30}}$, then the largest possible value of $|\lambda|$ is equal to _____.

Q75 Definite Integration **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/X60ui1zXDY

Let $[t]$ denote the largest integer less than or equal to t . If

$$\int_0^3 \left([x^2] + \left[\frac{x^2}{2} \right] \right) dx = a + b\sqrt{2} - \sqrt{3} - \sqrt{5} + c\sqrt{6} - \sqrt{7}$$

, where $a, b, c \in \mathbf{Z}$, then $a + b + c$ is equal to _____.

Q76 Differential Equations **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/HH89hd1L2T

If the solution $y(x)$ of the given differential equation $(e^y + 1) \cos x dx + e^y \sin x dy = 0$ passes through the point $(\frac{\pi}{2}, 0)$, then the value of $e^{y(\frac{\pi}{6})}$ is equal to _____.

Q77 Hyperbola **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/IRnnIMriP5

The length of the latus rectum and directrices of hyperbola with eccentricity e are 9 and $x = \pm \frac{4}{\sqrt{3}}$, respectively. Let the line $y - \sqrt{3}x + \sqrt{3} = 0$ touch this hyperbola at (x_0, y_0) . If m is the product of the focal distances of the point (x_0, y_0) , then $4e^2 + m$ is equal to _____.

Q78 Continuity & Differentiability **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/FQ2R5XYAIi

Let $[t]$ denote the greatest integer less than or equal to t . Let $f : [0, \infty) \rightarrow \mathbf{R}$ be a function defined by $f(x) = \left[\frac{x}{2} + 3 \right] - [\sqrt{x}]$. Let S be the set of all points in the interval $[0, 8]$ at which f is not continuous. Then $\sum_{a \in S} a$ is equal to _____.

Q79 Determinants **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/gP6cesQ2ik

If the system of equations

$$\begin{aligned} 2x + 7y + \lambda z &= 3 \\ 3x + 2y + 5z &= 4 \\ x + \mu y + 32z &= -1 \end{aligned}$$

has infinitely many solutions, then $(\lambda - \mu)$ is equal to _____:

Q80 Probability: Advanced **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/p5uinw3U--

From a lot of 12 items containing 3 defectives, a sample of 5 items is drawn at random. Let the random variable X denote the number of defective items in the sample. Let items in the sample be drawn one by one without replacement. If variance of X is $\frac{m}{n}$, where $\gcd(m, n) = 1$, then $n - m$ is equal to _____.

Q81 Sequences & Series **NUMERICAL**

[Step-by-step solution](#) > prepwiser.in/questions/75C2GhbdCF

Let α, β be roots of $x^2 + \sqrt{2}x - 8 = 0$. If $U_n = \alpha^n + \beta^n$, then $\frac{U_{10} + \sqrt{2}U_9}{2U_8}$ is equal to _____.

Q82 Sequences & Series **NUMERICAL**

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

If $S(x) = (1+x) + 2(1+x)^2 + 3(1+x)^3 + \dots + 60(1+x)^{60}$, $x \neq 0$, and $(60)^2 S(60) = a(b)^b + b$, where $a, b \in \mathbb{N}$, then $(a+b)$ equal to _____.

Q83 Properties of Triangles **NUMERICAL**

[Step-by-step solution](#) > prepwiser.in/questions/5iIp5SnIOq

In a triangle ABC, $BC = 7$, $AC = 8$, $AB = \alpha \in \mathbb{N}$ and $\cos A = \frac{2}{3}$. If $49 \cos(3C) + 42 = \frac{m}{n}$, where $\gcd(m, n) = 1$, then $m+n$ is equal to _____.

Answer key: JEE Main 2024 · 6 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/2024-04-06-evening

Physics

1. B	2. A	3. B	4. B	5. D	6. A	7. D	8. B
9. B	10. D	11. D	12. D	13. A	14. A	15. B	16. B
17. B	18. D	19. D	20. 10	21. 80	22. 160	23. 122	24. 100
25. 3	26. 1	27. 4	28. 8	29. 740			

Chemistry

30. A	31. A	32. B	33. C	34. B	35. A	36. C	37. C
38. A	39. B	40. D	41. B	42. C	43. D	44. B	45. A
46. D	47. 12	48. 6	49. 17	50. 0	51. 15	52. 543	53. 34
54. 2000							

Mathematics

55. B	56. C	57. C	58. A	59. D	60. D	61. D	62. B
63. C	64. D	65. B	66. B	67. C	68. C	69. C	70. C
71. D	72. A	73. C	74. 43	75. 23	76. 3	77. 61	78. 17
79. 38	80. 71	81. 4	82. 3660	83. 39			

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/2024-04-06-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.