

JEE MAIN 2022 · QUESTION PAPER

28 Jun 2022 Shift 1

83 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	18 Q1 to Q18	9 Q19 to Q27
● Chemistry	18 Q28 to Q45	10 Q46 to Q55
● Mathematics	18 Q56 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.

prepwis.in/pyqs/paper/2022-06-28-morning · Free, no signup needed to start

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

Q1 Nuclear Physics

[Step-by-step solution](#) › [prepwisar.in/questions/sjNM2kegcI](https://www.prepwisar.in/questions/sjNM2kegcI)

The Q-value of a nuclear reaction and kinetic energy of the projectile particle, K_p are related as:

- (A) $Q = K_p$ (B) $(K_p + Q) < 0$ (C) $Q < K_p$ (D) $(K_p + Q) > 0$

Q2 Work, Energy & Power

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

A particle of mass m is moving in a circular path of constant radius r such that its centripetal acceleration (a) is varying with time t as $a = k^2 r t^2$, where k is a constant. The power delivered to the particle by the force acting on it is given as

- (A) zero (B) $mk^2 r^2 t^2$ (C) $mk^2 r^2 t$ (D) $mk^2 r t$

Q3 Dual Nature of Radiation & Matter

[Step-by-step solution](#) › [prepwisar.in/questions/_5GTOzUaem](https://www.prepwisar.in/questions/_5GTOzUaem)

The de Broglie wavelengths for an electron and a photon are λ_e and λ_p respectively. For the same kinetic energy of electron and photon, which of the following presents the correct relation between the de Broglie wavelengths of two?

- (A) $\lambda_p \propto \lambda_e^2$ (B) $\lambda_p \propto \lambda_e$ (C) $\lambda_p \propto \sqrt{\lambda_e}$ (D) $\lambda_p \propto \sqrt{\frac{1}{\lambda_e}}$

Q4 Electromagnetic Waves

[Step-by-step solution](#) › [prepwisar.in/questions/KDGWsd4yC5](https://www.prepwisar.in/questions/KDGWsd4yC5)

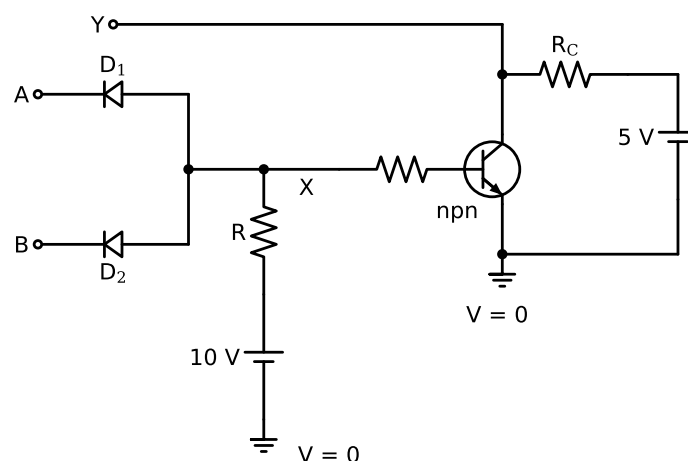
A radar sends an electromagnetic signal of electric field (E_0) = 2.25 V/m and magnetic field (B_0) = 1.5×10^{-8} T which strikes a target on line of sight at a distance of 3 km in a medium. After that, a part of signal (echo) reflects back towards the radar with same velocity and by same path. If the signal was transmitted at time $t = 0$ from radar, then after how much time echo will reach to the radar?

- (A) 2.0×10^{-5} s (B) 4.0×10^{-5} s (C) 1.0×10^{-5} s (D) 8.0×10^{-5} s

Q5 Semiconductors & Electronic Devices

[Step-by-step solution](#) › [prepwisar.in/questions/6ggIH2zUml](https://www.prepwisar.in/questions/6ggIH2zUml)

In the following circuit, the correct relation between output (Y) and inputs A and B will be:



- (A) $Y = AB$ (B) $Y = A + B$ (C) $Y = \overline{AB}$ (D) $Y = \overline{A + B}$

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For using a multimeter to identify diode from electrical components, choose the correct statement out of the following about the diode:

- (A) It is two terminal device which conducts current in both directions.
- (B) It is two terminal device which conducts current in one direction only.
- (C) It does not conduct current gives an initial deflection which decays to zero.
- (D) It is three terminal device which conducts current in one direction only between central terminal and either of the remaining two terminals

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

Assertion A : n-p-n transistor permits more current than a p-n-p transistor.

Reason R : Electrons have greater mobility as a charge carrier.

Choose the correct answer from the options given below:

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

Given below are two statements:

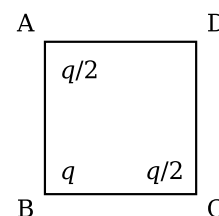
Statement I : A point charge is brought in an electric field. The value of electric field at a point near to the charge may increase if the charge is positive.

Statement II : An electric dipole is placed in a non-uniform electric field. The net electric force on the dipole will not be zero.

Choose the correct answer 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 true but Statement II is false.
- (D) Statement I is false but Statement II is true.

The three charges $q/2$, q and $q/2$ are placed at the corners A, B and C of a square of side 'a' as shown in figure. The magnitude of electric field (E) at the corner D of the square, is:



- (A) $\frac{q}{4\pi\epsilon_0 a^2} \left(\frac{1}{\sqrt{2}} + \frac{1}{2} \right)$
- (B) $\frac{q}{4\pi\epsilon_0 a^2} \left(1 + \frac{1}{\sqrt{2}} \right)$
- (C) $\frac{q}{4\pi\epsilon_0 a^2} \left(1 - \frac{1}{\sqrt{2}} \right)$
- (D) $\frac{q}{4\pi\epsilon_0 a^2} \left(\frac{1}{\sqrt{2}} - \frac{1}{2} \right)$

The refracting angle of a prism is A and refractive index of the material of the prism is $\cot(A/2)$. Then the angle of minimum deviation will be -

- (A) $180 - 2A$
- (B) $90 - A$
- (C) $180 + 2A$
- (D) $180 - 3A$

Q11 Wave Optics[Step-by-step solution](https://www.prepwisar.in/questions/zQ716rSexP) > prepwisar.in/questions/zQ716rSexP

The aperture of the objective is 24.4 cm. The resolving power of this telescope, if a light of wavelength $2440 \text{ \AA}$ is used to see the object will be:

- (A) 8.1×10^6 (B) 10.0×10^7 (C) 8.2×10^5 (D) 1.0×10^{-8}

Q12 Gravitation[Step-by-step solution](https://www.prepwisar.in/questions/6CmoRDp8va) > prepwisar.in/questions/6CmoRDp8va

Two planets A and B of equal mass are having their period of revolutions T_A and T_B such that $T_A = 2T_B$. These planets are revolving in the circular orbits of radii r_A and r_B respectively. Which out of the following would be the correct relationship of their orbits?

- (A) $2r_A^2 = r_B^3$ (B) $r_A^3 = 2r_B^3$
(C) $r_A^3 = 4r_B^3$ (D) $T_A^2 - T_B^2 = \frac{\pi^2}{GM} (r_B^3 - 4r_A^3)$

Q13 Thermodynamics[Step-by-step solution](https://www.prepwisar.in/questions/pUwPqSM1zV) > prepwisar.in/questions/pUwPqSM1zV

Given below are two statements:

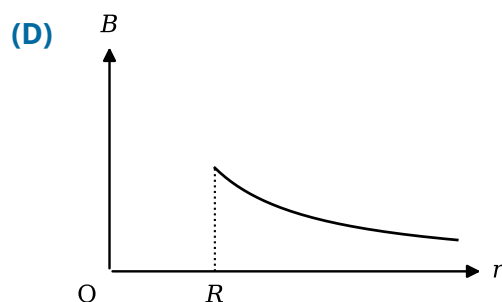
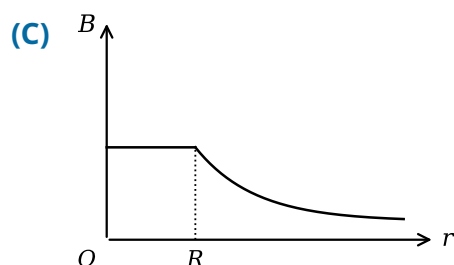
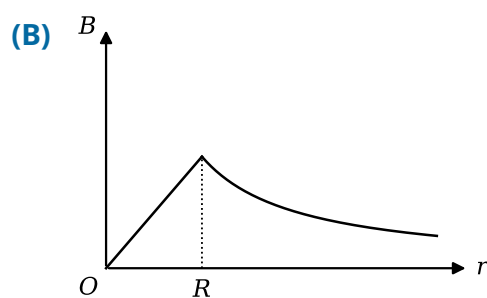
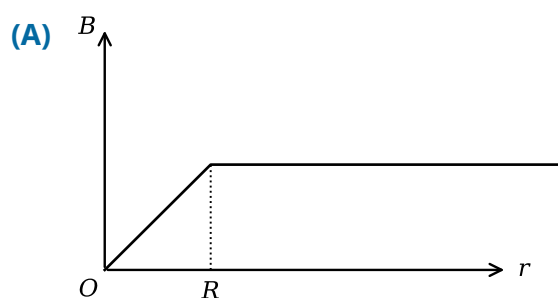
Statement I : When μ amount of an ideal gas undergoes adiabatic change from state (P_1, V_1, T_1) to state (P_2, V_2, T_2) , then work done is $W = \frac{\mu R(T_2 - T_1)}{1 - \gamma}$, where $\gamma = \frac{C_p}{C_v}$ and R = universal gas constant.

Statement II : In the above case, when work is done on the gas, the temperature of the gas would rise. Choose the correct answer 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 true but Statement II is false. (D) Statement I is false but Statement II is true.

Q14 Moving Charges & Magnetism[Step-by-step solution](https://www.prepwisar.in/questions/My4KeWx_JM) > prepwisar.in/questions/My4KeWx_JM

An infinitely long hollow conducting cylinder with radius R carries a uniform current along its surface. Choose the correct representation of magnetic field (B) as a function of radial distance (r) from the axis of cylinder.



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Q15 Units, Dimensions & Errors[Step-by-step solution](#) > [prepwise.in/questions/-0rCleFNXn](https://www.prepwise.in/questions/-0rCleFNXn)

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

Assertion A : Product of Pressure (P) and time (t) has the same dimension as that of coefficient of viscosity.

Reason R : Coefficient of viscosity = $\frac{\text{Force}}{\text{Velocity gradient}}$

Choose the correct answer from the options given below:

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

Q16 Surface Tension[Step-by-step solution](#) > [prepwise.in/questions/HBE0kgBHlp](https://www.prepwise.in/questions/HBE0kgBHlp)

A water drop of diameter 2 cm is broken into 64 equal droplets. The surface tension of water is 0.075 N/m. In this process the gain in surface energy will be:

- (A) 2.8×10^{-4} J (B) 1.5×10^{-3} J (C) 1.9×10^{-4} J (D) 9.4×10^{-5} J

Q17 Simple Harmonic Motion[Step-by-step solution](#) > [prepwise.in/questions/C-7-UNYQtC](https://www.prepwise.in/questions/C-7-UNYQtC)

Motion of a particle in x-y plane is described by a set of following equations $x = 4 \sin\left(\frac{\pi}{2} - \omega t\right)$ m and $y = 4 \sin(\omega t)$ m. The path of the particle will be:

- (A) circular (B) helical (C) parabolic (D) elliptical

Q18 Sound Waves[Step-by-step solution](#) > [prepwise.in/questions/RgqSsoKmnv](https://www.prepwise.in/questions/RgqSsoKmnv)

The velocity of sound in a gas, in which two wavelengths 4.08 m and 4.16 m produce 40 beats in 12s, will be:

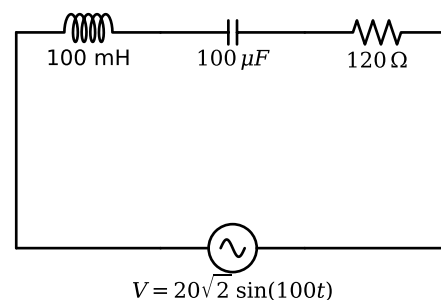
- (A) 282.8 ms^{-1} (B) 175.5 ms^{-1} (C) 353.6 ms^{-1} (D) 707.2 ms^{-1}

Physics Section B · Numerical value

Q19 to Q27

Q19 Alternating Current **NUMERICAL**[Step-by-step solution](#) > [prepwise.in/questions/D9cPSP2Qd6](https://www.prepwise.in/questions/D9cPSP2Qd6)

An AC source is connected to an inductance of 100 mH, a capacitance of $100 \mu\text{F}$ and a resistance of 120Ω as shown in figure. The time in which the resistance having a thermal capacity $2 \text{ J}^\circ\text{C}$ will get heated by 16°C is _____ s.

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

A telegraph line of length 100 km has a capacity of $0.01 \mu\text{F}/\text{km}$ and it carries an alternating current at 0.5 kilo cycle per second. If minimum impedance is required, then the value of the inductance that needs to be introduced in series is _____ mH. (if $\pi = \sqrt{10}$)

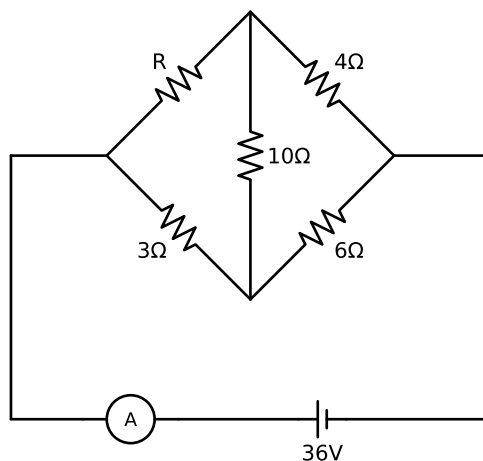
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Q21 Centre of Mass & Linear Momentum **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/yn9i583DG9](https://www.prepwiser.in/questions/yn9i583DG9)

A man of 60 kg is running on the road and suddenly jumps into a stationary trolley car of mass 120 kg. Then, the trolley car starts moving with velocity 2 ms^{-1} . The velocity of the running man was _____ ms^{-1} , when he jumps into the car.

Q22 Current Electricity **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/ez2WMPGoR7](https://www.prepwiser.in/questions/ez2WMPGoR7)

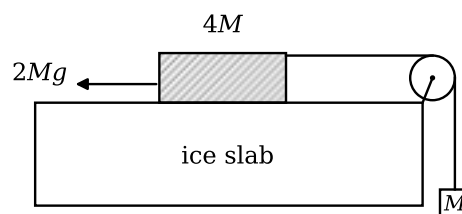
Current measured by the ammeter (A) in the reported circuit when no current flows through 10Ω resistance, will be _____ A.

**Q23** Kinetic Theory of Gases **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/jHjX_N89nK](https://www.prepwiser.in/questions/jHjX_N89nK)

The total internal energy of two mole monoatomic ideal gas at temperature $T = 300 \text{ K}$ will be _____ J. (Given $R = 8.31 \text{ J/mol.K}$)

Q24 Newton's Laws of Motion **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/o5J88MKiIO](https://www.prepwiser.in/questions/o5J88MKiIO)

A hanging mass M is connected to a four times bigger mass by using a string-pulley arrangement, as shown in the figure. The bigger mass is placed on a horizontal ice-slab and being pulled by $2Mg$ force. In this situation, tension in the string is $\frac{x}{5} Mg$ for $x =$ _____. Neglect mass of the string and friction of the block (bigger mass) with ice slab.



(Given $g =$ acceleration due to gravity)

Q25 Moving Charges & Magnetism **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/-EbVeO_GC1](https://www.prepwiser.in/questions/-EbVeO_GC1)

A singly ionized magnesium atom ($A = 24$) ion is accelerated to kinetic energy 5 keV, and is projected perpendicularly into a magnetic field B of the magnitude 0.5 T. The radius of path formed will be _____ cm.

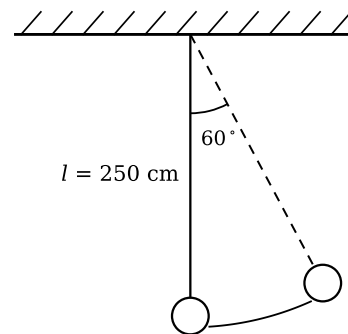
Q26 Rotational Motion **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/O7C2BZ5-p1](https://www.prepwiser.in/questions/O7C2BZ5-p1)

The position vector of 1 kg object is $\vec{r} = (3\hat{i} - \hat{j}) \text{ m}$ and its velocity $\vec{v} = (3\hat{j} + \hat{k}) \text{ ms}^{-1}$. The magnitude of its angular momentum is $\sqrt{x} \text{ Nm}$ where x is _____.

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Q27 Simple Harmonic Motion **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/7M34UybkF6)

A pendulum is suspended by a string of length 250 cm. The mass of the bob of the pendulum is 200 g. The bob is pulled aside until the string is at 60° with vertical as shown in the figure. After releasing the bob, the maximum velocity attained by the bob will be _____ ms^{-1} . (if $g = 10 \text{ m/s}^2$)

**Chemistry** Section A · Multiple choice

Q28 to Q45

Q28 Carbohydrates & Biomolecules[Step-by-step solution](https://www.prepwisar.in/questions/53Wkww8U_U)

Stability of α -Helix structure of proteins depends upon

- (A) dipolar interaction (B) H-bonding interaction
(C) van der Waals forces (D) π -stacking interaction

Q29 Environmental Chemistry[Step-by-step solution](https://www.prepwisar.in/questions/rdFK9HGpV8)

Which amongst the following is not a pesticide?

- (A) DDT (B) Organophosphates (C) Dieldrin (D) Sodium arsenite

Q30 Coordination Compounds[Step-by-step solution](https://www.prepwisar.in/questions/H2kZxrHRvt)

Given below are two statements:

Statement I : $[\text{Ni}(\text{CN})_4]^{2-}$ is square planar and diamagnetic complex, with dsp^2 hybridization for Ni but $[\text{Ni}(\text{CO})_4]$ is tetrahedral, paramagnetic and with sp^3 -hybridization for Ni.

Statement II : $[\text{NiCl}_4]^{2-}$ and $[\text{Ni}(\text{CO})_4]$ both have same d-electron configuration have same geometry and are paramagnetic.

In light the above statements, choose the correct answer 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 correct but Statement II is false.
(D) Statement I is false but Statement II is correct.

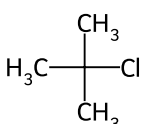
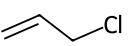
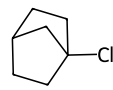
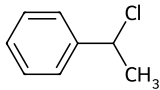
Q31 d & f Block Elements[Step-by-step solution](https://www.prepwisar.in/questions/HBTtNeRRad)

Which one of the lanthanoids given below is the most stable in divalent form?

- (A) Ce (Atomic Number 58) (B) Sm (Atomic number 62)
(C) Eu (Atomic Number 63) (D) Yb (Atomic Number 70)

Q32 Halogen Derivatives: Haloalkanes & Haloarenes[Step-by-step solution](https://www.prepwisar.in/questions/8sIe1wkQFU)

Which one of the following compounds is inactive towards $\text{S}_\text{N}1$ reaction?

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

Dihydrogen reacts with CuO to give:

- (A) CuH_2 (B) Cu (C) Cu_2O (D) Cu(OH)_2

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

Assertion A : Magnesium can reduce Al_2O_3 at a temperature below 1350°C , while above 1350°C , while above 1350°C aluminium can reduce MgO .

Reason R : The melting and boiling points of magnesium are lower than those of aluminium.

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

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

Nitrogen gas is obtained by thermal decomposition of:

- (A) $\text{Ba(NO}_3)_2$ (B) $\text{Ba(N}_3)_2$ (C) NaNO_2 (D) NaNO_3

Given below are two statements:

Statement I : The pentavalent oxide of group-15 element, E_2O_5 , is less acidic than trivalent oxide, E_2O_3 , of the same element.

Statement II : The acidic character of trivalent oxide of group 15 elements, E_2O_3 , decreases down the group.

In light of the above statements, choose most appropriate answer 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 true, but Statement II is false. (D) Statement I is false, but Statement II is true.

Element "E" belongs to the period 4 and group 16 of the periodic table. The valence shell electron configuration of the element, which is just above "E" in the group is

- (A) $3s^2, 3p^4$ (B) $3d^{10}, 4s^2, 4p^4$ (C) $4d^{10}, 5s^2, 5p^4$ (D) $2s^2, 2p^4$

Which one of the following is NOT a copolymer?

- (A) Buna-S (B) Neoprene (C) PHBV (D) Butadiene-styrene

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The incorrect statement about the imperfections in solids is:

- (A) Schottky defect decreases the density of the substance.
 (B) Interstitial defect increases the density of the substance.
 (C) Frenkel defect does not alter the density of the substance.
 (D) Vacancy defect increases the density of the substance.

The Zeta potential is related to which property of colloids?

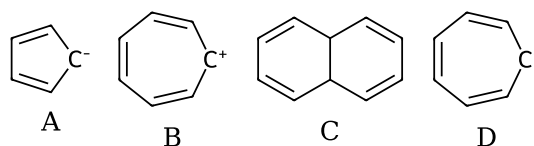
- (A) Colour (B) Tyndall effect
 (C) Charge on the surface of colloidal particles (D) Brownian movement

Which one of the following techniques is not used to spot components of a mixture separated on thin layer chromatographic plate?

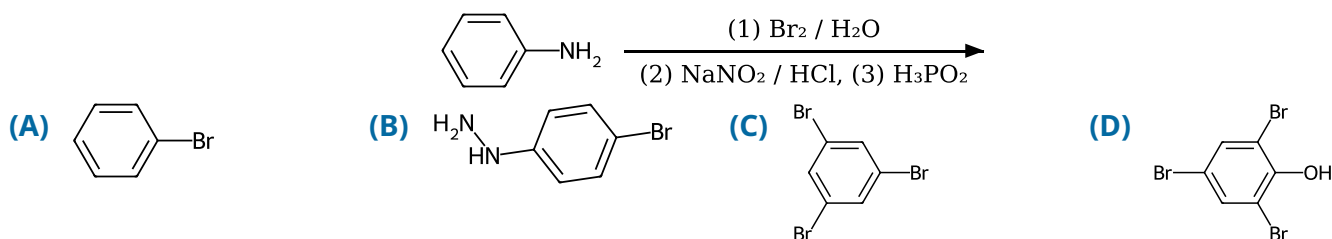
- (A) I_2 (Solid)
 (B) U.V. Light
 (C) Visualisation agent as a component of mobile phase
 (D) Spraying of an appropriate reagent

Which of the following structure are aromatic in nature?

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



Identify the major product formed in the following sequence of reactions:



A primary aliphatic amine on reaction with nitrous acid in cold (273 K) and there after raising temperature of reaction mixture to room temperature (298 K), gives a/an

- (A) nitrile (B) alcohol (C) diazonium salt (D) secondary amine

The formula of the purple colour formed in Laissaigne's test for sulphur using sodium nitroprusside is:

- (A) $NaFe[Fe(CN)_6]$ (B) $Na[Cr(NH_3)_2(NCS)_4]$ (C) $Na_2[Fe(CN)_5(NO)]$ (D) $Na_4[Fe(CN)_5(NOS)]$

Q46 Chemical Bonding & Molecular Structure **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/P-RfUoCU_p

The hybridization of P exhibited in PF_5 is sp^xd^y . The value of y is _____.

Q47 Chemical Kinetics **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/by546R1rKM

For a first order reaction $\text{A} \rightarrow \text{B}$, the rate constant, $k = 5.5 \times 10^{-14} \text{ s}^{-1}$. The time required for 67% completion of reaction is $x \times 10^{-1}$ times the half life of reaction. The value of x is _____ (Nearest integer)

(Given : $\log 3 = 0.4771$)

Q48 Coordination Compounds **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/2OkvHnhvlz

Number of complexes which will exhibit synergic bonding amongst, $[\text{Cr}(\text{CO})_6]$, $[\text{Mn}(\text{CO})_5]$ and $[\text{Mn}_2(\text{CO})_{10}]$ is _____.

Q49 Electrochemistry **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/5HbmdrxvT2

The quantity of electricity in Faraday needed to reduce 1 mol of $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} is _____.

Q50 Electrochemistry **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/5HnxYvFEXm

The solubility product of a sparingly soluble salt A_2X_3 is 1.1×10^{-23} . If specific conductance of the solution is $3 \times 10^{-5} \text{ S m}^{-1}$, the limiting molar conductivity of the solution is $x \times 10^{-3} \text{ S m}^2 \text{ mol}^{-1}$. The value of x is _____.

Q51 Solutions & Colligative Properties **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/xFMZxWcP_r

The vapour pressures of two volatile liquids A and B at 25°C are 50 Torr and 100 Torr, respectively. If the liquid mixture contains 0.3 mole fraction of A, then the mole fraction of liquid B in the vapour phase is $\frac{x}{17}$. The value of x is _____.

Q52 Atomic Structure **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/UroOhFrgVN

If the work function of a metal is $6.63 \times 10^{-19} \text{ J}$, the maximum wavelength of the photon required to remove a photoelectron from the metal is _____ nm. (Nearest integer)

[Given : $h = 6.63 \times 10^{-34} \text{ J s}$, and $c = 3 \times 10^8 \text{ m s}^{-1}$]

Q53 Chemical Thermodynamics **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/tbAp-T9KSu

4.0 L of an ideal gas is allowed to expand isothermally into vacuum until the total volume is 2.0 L. The amount of heat absorbed in this expansion is _____ L atm.

Q54 Redox Reactions **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/wIggNKft6

A 2.0 g sample containing MnO_2 is treated with HCl liberating Cl_2 . The Cl_2 gas is passed into a solution of KI and 60.0 mL of 0.1 M $\text{Na}_2\text{S}_2\text{O}_3$ is required to titrate the liberated iodine. The percentage of MnO_2 in the sample is _____. (Nearest integer)

[Atomic masses (in u) Mn = 55; Cl = 35.5; O = 16, I = 127, Na = 23, K = 39, S = 32]

Q55 Purification & Characterisation of Organic Compounds **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/c-bNfamvQY

In the estimation of bromine, 0.5 g of an organic compound gave 0.40 g of silver bromide. The percentage of bromine in the given compound is _____ % (nearest integer)

(Relative atomic masses of Ag and Br are 108u and 80u, respectively).

Q56 Three Dimensional Geometry

[Step-by-step solution](#) › [prepwisar.in/questions/kfeeDUv62L](https://www.prepwisar.in/questions/kfeeDUv62L)

If two distinct point Q, R lie on the line of intersection of the planes $-x + 2y - z = 0$ and $3x - 5y + 2z = 0$ and $PQ = PR = \sqrt{18}$ where the point P is $(1, -2, 3)$, then the area of the triangle PQR is equal to:

- (A) $\frac{2}{3}\sqrt{38}$ (B) $\frac{4}{3}\sqrt{38}$ (C) $\frac{8}{3}\sqrt{38}$ (D) $\sqrt{\frac{152}{3}}$

Q57 Three Dimensional Geometry

[Step-by-step solution](#) › [prepwisar.in/questions/xjGy7TzTMI](https://www.prepwisar.in/questions/xjGy7TzTMI)

The acute angle between the planes P_1 and P_2 , when P_1 and P_2 are the planes passing through the intersection of the planes $5x + 8y + 13z - 29 = 0$ and $8x - 7y + z - 20 = 0$ and the points $(2, 1, 3)$ and $(0, 1, 2)$, respectively, is:

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

Q58 Three Dimensional Geometry

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

Let the plane $P : \vec{r} \cdot \vec{a} = d$ contain the line of intersection of two planes

$$\vec{r} \cdot (\hat{i} + 3\hat{j} - \hat{k}) = 6$$

and

$$\vec{r} \cdot (-6\hat{i} + 5\hat{j} - \hat{k}) = 7$$

. If the plane P passes through the point $(2, 3, \frac{1}{2})$, then the value of $\frac{|13\vec{a}|^2}{d^2}$ is equal to:

- (A) 90 (B) 93 (C) 95 (D) 97

Q59 Applications of Derivatives

[Step-by-step solution](#) › [prepwisar.in/questions/U7BOaegzH_](https://www.prepwisar.in/questions/U7BOaegzH_)

The number of real solutions of $x^7 + 5x^3 + 3x + 1 = 0$ is equal to _____.

- (A) 0 (B) 1 (C) 3 (D) 5

Q60 Binomial Theorem

[Step-by-step solution](#) › [prepwisar.in/questions/e1HmTMAKUV](https://www.prepwisar.in/questions/e1HmTMAKUV)

If

$$\sum_{k=1}^{31} ({}^{31}C_k) ({}^{31}C_{k-1}) - \sum_{k=1}^{30} ({}^{30}C_k) ({}^{30}C_{k-1}) = \frac{\alpha(60!)}{(30!)(31!)}$$

, where $\alpha \in \mathbb{R}$, then the value of 16α is equal to

- (A) 1411 (B) 1320 (C) 1615 (D) 1855

Q61 Circles

[Step-by-step solution](#) › [prepwisar.in/questions/6Z9mFIaGn](https://www.prepwisar.in/questions/6Z9mFIaGn)

If the tangents drawn at the points $O(0, 0)$ and $P(1 + \sqrt{5}, 2)$ on the circle $x^2 + y^2 - 2x - 4y = 0$ intersect at the point Q, then the area of the triangle OPQ is equal to:

- (A) $\frac{3 + \sqrt{5}}{2}$ (B) $\frac{4 + 2\sqrt{5}}{2}$ (C) $\frac{5 + 3\sqrt{5}}{2}$ (D) $\frac{7 + 3\sqrt{5}}{2}$

Q62 Definite Integration[Step-by-step solution](#) > [prepwiser.in/questions/CO4ndtnjie](https://www.prepwiser.in/questions/CO4ndtnjie)

Let $[t]$ denote the greatest integer less than or equal to t . Then, the value of the integral

$$\int_0^1 [-8x^2 + 6x - 1] dx \text{ is equal to:}$$

- (A) -1 (B) $-\frac{5}{4}$ (C) $\frac{\sqrt{17}-13}{8}$ (D) $\frac{\sqrt{17}-16}{8}$

Q63 Differential Equations[Step-by-step solution](#) > [prepwiser.in/questions/bVdLKWUUG](https://www.prepwiser.in/questions/bVdLKWUUG)

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

$$\left[\frac{x}{\sqrt{x^2 - y^2}} + e^{\frac{y}{x}} \right] x \frac{dy}{dx} = x + \left[\frac{x}{\sqrt{x^2 - y^2}} + e^{\frac{y}{x}} \right] y$$

pass through the points $(1, 0)$ and $(2\alpha, \alpha)$, $\alpha > 0$. Then α is equal to

- (A) $\frac{1}{2} \exp\left(\frac{\pi}{6} + \sqrt{e} - 1\right)$ (B) $\frac{1}{2} \exp\left(\frac{\pi}{6} + e - 1\right)$
(C) $\exp\left(\frac{\pi}{6} + \sqrt{e} + 1\right)$ (D) $2 \exp\left(\frac{\pi}{3} + \sqrt{e} - 1\right)$

Q64 Differential Equations[Step-by-step solution](#) > [prepwiser.in/questions/zRpVOEyaHV](https://www.prepwiser.in/questions/zRpVOEyaHV)

Let $y = y(x)$ be the solution of the differential equation $x(1 - x^2)\frac{dy}{dx} + (3x^2y - y - 4x^3) = 0$, $x > 1$, with $y(2) = -2$. Then $y(3)$ is equal to:

- (A) -18 (B) -12 (C) -6 (D) -3

Q65 Relations & Functions (Basic)[Step-by-step solution](#) > [prepwiser.in/questions/RLEEski07j](https://www.prepwiser.in/questions/RLEEski07j)

Let a function $f: \mathbb{N} \rightarrow \mathbb{N}$ be defined by

$$f(n) = \begin{cases} 2n, & n = 2, 4, 6, 8, \dots \\ n-1, & n = 3, 7, 11, 15, \dots \\ \frac{n+1}{2}, & n = 1, 5, 9, 13, \dots \end{cases}$$

then, f is

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

Q66 Hyperbola[Step-by-step solution](#) > [prepwiser.in/questions/8dUQM0LuX6](https://www.prepwiser.in/questions/8dUQM0LuX6)

Let the eccentricity of the hyperbola $H: \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ be $\sqrt{\frac{5}{2}}$ and length of its latus rectum be $6\sqrt{2}$. If $y = 2x + c$ is a tangent to the hyperbola H , then the value of c^2 is equal to:

- (A) 18 (B) 20 (C) 24 (D) 32

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Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined as

$$f(x) = \begin{cases} [e^x], & x < 0 \\ ae^x + [x - 1], & 0 \leq x < 1 \\ b + [\sin(\pi x)], & 1 \leq x < 2 \\ [e^{-x}] - c, & x \geq 2 \end{cases}$$

where $a, b, c \in \mathbb{R}$ and $[t]$ denotes greatest integer less than or equal to t . Then, which of the following statements is true?

- (A) There exists $a, b, c \in \mathbb{R}$ such that f is continuous on $\mathbb{R}$.
 (B) If f is discontinuous at exactly one point, then $a + b + c = 1$
 (C) If f is discontinuous at exactly one point, then $a + b + c \neq 1$
 (D) f is discontinuous at at least two points, for any values of a, b and c

If the system of linear equations

$$2x + 3y - z = -2$$

$$x + y + z = 4$$

$$x - y + |\lambda|z = 4\lambda - 4$$

where, $\lambda \in \mathbb{R}$, has no solution, then

- (A) $\lambda = 7$ (B) $\lambda = -7$ (C) $\lambda = 8$ (D) $\lambda^2 = 1$

Let A be a matrix of order 3×3 and $\det(A) = 2$. Then $\det(\det(A) \operatorname{adj}(5 \operatorname{adj}(A^3)))$ is equal to _____.

- (A) 512×10^6 (B) 256×10^6 (C) 1024×10^6 (D) 256×10^{11}

The total number of 5-digit numbers, formed by using the digits 1, 2, 3, 5, 6, 7 without repetition, which are multiple of 6, is:

- (A) 36 (B) 48 (C) 60 (D) 72

The probability, that in a randomly selected 3-digit number at least two digits are odd, is:

- (A) $\frac{19}{36}$ (B) $\frac{15}{36}$ (C) $\frac{13}{36}$ (D) $\frac{23}{36}$

Let $A_1, A_2, A_3, \dots$ be an increasing geometric progression of positive real numbers. If $A_1 A_3 A_5 A_7 = \frac{1}{1296}$ and $A_2 + A_4 = \frac{7}{36}$, then the value of $A_6 + A_8 + A_{10}$ is equal to

- (A) 33 (B) 37 (C) 43 (D) 47

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Q73 Area Under Curves[Step-by-step solution](#) › prepwiser.in/questions/7VikXC3tSj

The area of the region $S = \{(x, y) : y^2 \leq 8x, y \geq \sqrt{2}x, x \geq 1\}$ is

(A) $\frac{13\sqrt{2}}{6}$

(B) $\frac{11\sqrt{2}}{6}$

(C) $\frac{5\sqrt{2}}{6}$

(D) $\frac{19\sqrt{2}}{6}$

Mathematics Section B · Numerical value

Q74 to Q83

Q74 Applications of Derivatives **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/i1ZE-H6MJo

Let l be a line which is normal to the curve $y = 2x^2 + x + 2$ at a point P on the curve. If the point $Q(6, 4)$ lies on the line l and O is origin, then the area of the triangle OPQ is equal to _____.

Q75 Binomial Theorem **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/GSvJgujt00

The number of positive integers k such that the constant term in the binomial expansion of $(2x^3 + \frac{3}{x^k})^{12}$, $x \neq 0$ is $2^8 \cdot l$, where l is an odd integer, is _____.

Q76 Circles **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/ixU-wuhyyb

Let the lines $y + 2x = \sqrt{11} + 7\sqrt{7}$ and $2y + x = 2\sqrt{11} + 6\sqrt{7}$ be normal to a circle $C : (x - h)^2 + (y - k)^2 = r^2$. If the line $\sqrt{11}y - 3x = \frac{5\sqrt{77}}{3} + 11$ is tangent to the circle C , then the value of $(5h - 8k)^2 + 5r^2$ is equal to _____.

Q77 Complex Numbers **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/irt1jYmmW-

The number of elements in the set $\{z = a + ib \in \mathbb{C} : a, b \in \mathbb{Z} \text{ and } 1 < |z - 3 + 2i| < 4\}$ is _____.

Q78 Quadratic Equations & Polynomial Inequalities **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/c4HJzD-NsA

The number of real solutions of the equation $e^{4x} + 4e^{3x} - 58e^{2x} + 4e^x + 1 = 0$ is _____.

Q79 Sets **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/tUVPDH5SDe

Let $A = \{1, a_1, a_2, \dots, a_{18}, 77\}$ be a set of integers with $1 < a_1 < a_2 < \dots < a_{18} < 77$. Let the set $A + A = \{x + y : x, y \in A\}$ contain exactly 39 elements. Then, the value of $a_1 + a_2 + \dots + a_{18}$ is equal to _____.

Q80 Relations & Functions (Basic) **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/CRPkYYB82P

Let R_1 and R_2 be relations on the set $\{1, 2, \dots, 50\}$ such that

$$R_1 = \{(p, p^n) : p \text{ is a prime and } n \geq 0 \text{ is an integer}\} \text{ and}$$

$$R_2 = \{(p, p^n) : p \text{ is a prime and } n = 0 \text{ or } 1\}.$$

Then, the number of elements in $R_1 - R_2$ is _____.

Q81 Statistics **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/BOVhpKo3gk

The mean and standard deviation of 15 observations are found to be 8 and 3 respectively. On rechecking it was found that, in the observations, 20 was misread as 5. Then, the correct variance is equal to _____.

Q82 Vectors **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/S-cDDGXfB8

If $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$, $\vec{b} = 3\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$ are coplanar vectors and $\vec{a} \cdot \vec{c} = 5$, $\vec{b} \perp \vec{c}$, then $122(c_1 + c_2 + c_3)$ is equal to _____.

A ray of light passing through the point $P(2, 3)$ reflects on the x -axis at point A and the reflected ray passes through the point $Q(5, 4)$. Let R be the point that divides the line segment AQ internally into the ratio $2 : 1$. Let the co-ordinates of the foot of the perpendicular M from R on the bisector of the angle PAQ be (α, β) . Then, the value of $7\alpha + 3\beta$ is equal to _____.

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Physics

1. D	2. C	3. A	4. B	5. C	6. B	7. A	8. A
9. A	10. A	11. C	12. C	13. A	14. D	15. C	16. A
17. A	18. D	19. 15	20. 100	21. 6	22. 10	23. 7479	24. 6
25. 10	26. 91	27. 5					

Chemistry

28. B	29. D	30. B	31. C	32. C	33. B	34. B	35. B
36. D	37. A	38. B	39. D	40. C	41. C	42. B	43. C
44. B	45. D	46. 1	47. 16	48. 3	49. 6	50. 3	51. 14
52. 300	53. 0	54. 13	55. 34				

Mathematics

56. B	57. A	58. B	59. B	60. A	61. C	62. C	63. A
64. A	65. D	66. B	67. C	68. B	69. A	70. D	71. A
72. C	73. B	74. 13	75. 2	76. 816	77. 40	78. 2	79. 702
80. 8	81. 17	82. 150	83. 31				

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