

JEE MAIN 2020 · QUESTION PAPER

2 Sep 2020 **Shift 1**

67 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	18 Q1 to Q18	5 Q19 to Q23
● Chemistry	16 Q24 to Q39	5 Q40 to Q44
● Mathematics	19 Q45 to Q63	4 Q64 to Q67
In this PDF 67 questions · answer key at the end		

- 1 Set a 3 hour timer and attempt the paper in one sitting, like the real exam.
- 2 Check yourself against the answer key at the end. Every question names its chapter, so you can see where marks went.
- 3 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/2020-09-02-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?
prepwisar.in/feedback · Terms: prepwisar.in/terms

Q1 Nuclear Physics

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

In a reactor, 2 kg of ${}_{92}\text{U}^{235}$ fuel is fully used up in 30 days. The energy released per fission is 200 MeV. Given that the Avogadro number, $N = 6.023 \times 10^{26}$ per kilo mole and $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$. The power output of the reactor is close to

- (A) 125 MW (B) 60 MW (C) 54 MW (D) 35 MW

Q2 Collision

[Step-by-step solution](#) > [prepwisar.in/questions/lgoKjTl37h](https://www.prepwisar.in/questions/lgoKjTl37h)

A particle of mass m with an initial velocity $u\hat{i}$ collides perfectly elastically with a mass $3m$ at rest. It moves with a velocity $v\hat{j}$ after collision, then, v is given by:

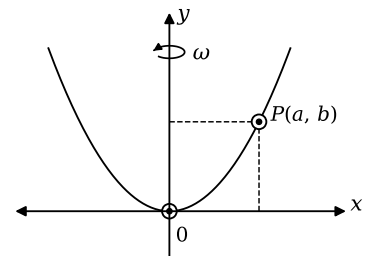
- (A) $v = \sqrt{\frac{2}{3}}u$ (B) $v = \frac{u}{\sqrt{3}}$ (C) $v = \frac{u}{\sqrt{2}}$ (D) $v = \frac{1}{\sqrt{6}}u$

Q3 Circular Motion

[Step-by-step solution](#) > [prepwisar.in/questions/qa-XEzP9fS](https://www.prepwisar.in/questions/qa-XEzP9fS)

A bead of mass m stays at point $P(a, b)$ on a wire bent in the shape of a parabola $y = 4Cx^2$ and rotating with angular speed ω (see figure). The value of ω is (neglect friction):

- (A) $2\sqrt{2gC}$ (B) $2\sqrt{gC}$ (C) $\sqrt{\frac{2gC}{ab}}$ (D) $\sqrt{\frac{2g}{C}}$



Q4 Current Electricity

[Step-by-step solution](#) > [prepwisar.in/questions/T7eDaSizAp](https://www.prepwisar.in/questions/T7eDaSizAp)

Consider four conducting materials copper, tungsten, mercury and aluminium with resistivity ρ_C , ρ_T , ρ_M and ρ_A respectively. Then:

- (A) $\rho_C > \rho_A > \rho_T$ (B) $\rho_M > \rho_A > \rho_C$ (C) $\rho_A > \rho_T > \rho_C$ (D) $\rho_A > \rho_M > \rho_C$

Q5 Electromagnetic Waves

[Step-by-step solution](#) > [prepwisar.in/questions/bH9MQSyfBm](https://www.prepwisar.in/questions/bH9MQSyfBm)

A plane electromagnetic wave, has frequency of $2.0 \times 10^{10} \text{ Hz}$ and its energy density is $1.02 \times 10^{-8} \text{ J/m}^3$ in vacuum. The amplitude of the magnetic field of the wave is close to $(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2})$ and speed of light $= 3 \times 10^8 \text{ ms}^{-1}$

- (A) 190 nT (B) 150 nT (C) 160 nT (D) 180 nT

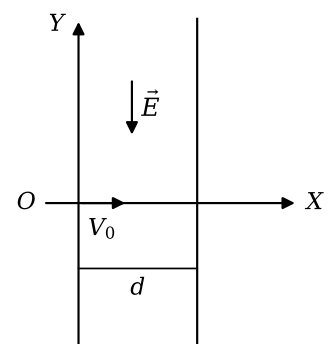
Q6 Projectile Motion & Relative Motion

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

A charged particle (mass m and charge q) moves along X-axis with velocity V_0 . When it passes through the origin it enters a region having uniform electric field $\vec{E} = -E\hat{j}$ which extends upto $x = d$.

Equation of path of electron in the region $x > d$ is

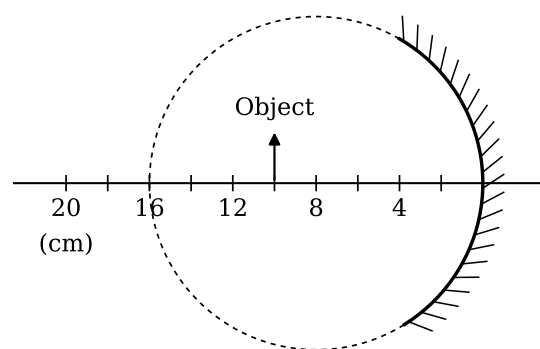
- (A) $y = \frac{qEd}{mV_0^2} (x - d)$ (B) $y = \frac{qEd}{mV_0^2} (\frac{d}{2} - x)$
(C) $y = \frac{qEd}{mV_0^2} x$ (D) $y = \frac{qEd^2}{mV_0^2} x$



Q7 Ray Optics[Step-by-step solution](https://www.prepwiser.in/questions/SyxTTYKT6t) > prepwiser.in/questions/SyxTTYKT6t

A spherical mirror is obtained as shown in the figure from a hollow glass sphere. If an object is positioned in front of the mirror, what will be the nature and magnification of the image of the object?

(Figure drawn as schematic and not to scale)



- (A) Inverted, real and unmagnified
- (B) Inverted, real and magnified
- (C) Erect, virtual and magnified
- (D) Erect, virtual and unmagnified

Q8 Kinetic Theory of Gases[Step-by-step solution](https://www.prepwiser.in/questions/W2xCX9IP-) > prepwiser.in/questions/W2xCX9IP-

A gas mixture consists of 3 moles of oxygen and 5 moles of argon at temperature T . Assuming the gases to be ideal and the oxygen bond to be rigid, the total internal energy (in units of RT) of the mixture is:

- (A) 11
- (B) 20
- (C) 15
- (D) 13

Q9 Magnetism & Matter[Step-by-step solution](https://www.prepwiser.in/questions/ifhnKui9DS) > prepwiser.in/questions/ifhnKui9DS

Magnetic materials used for making permanent magnets (P) and magnets in a transformer (T) have different properties of the following, which property best matches for the type of magnet required?

- (A) T : Large retentivity, small coercivity
- (B) P : Large retentivity, large coercivity
- (C) P : Small retentivity, large coercivity
- (D) T : Large retentivity, large coercivity

Q10 Moving Charges & Magnetism[Step-by-step solution](https://www.prepwiser.in/questions/uB2grrJMAJ) > prepwiser.in/questions/uB2grrJMAJ

A beam of protons with speed $4 \times 10^5 \text{ ms}^{-1}$ enters a uniform magnetic field of 0.3 T at an angle of 60° to the magnetic field. The pitch of the resulting helical path of protons is close to:

(Mass of the proton = $1.67 \times 10^{-27} \text{ kg}$, charge of the proton = $1.69 \times 10^{-19} \text{ C}$)

- (A) 2 cm
- (B) 12 cm
- (C) 5 cm
- (D) 4 cm

Q11 Projectile Motion & Relative Motion[Step-by-step solution](https://www.prepwiser.in/questions/DxpuaSThmw) > prepwiser.in/questions/DxpuaSThmw

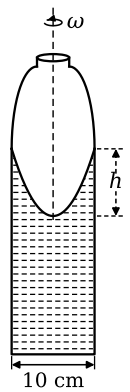
Train A and train B are running on parallel tracks in the opposite directions with speeds of 36 km/hour and 72 km/hour, respectively. A person is walking in train A in the direction opposite to its motion with a speed of 1.8 km/hour. Speed (in ms^{-1}) of this person as observed from train B will be close to: (take the distance between the tracks as negligible)

- (A) 30.5 ms^{-1}
- (B) 29.5 ms^{-1}
- (C) 31.5 ms^{-1}
- (D) 28.5 ms^{-1}

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Q12 Fluid Mechanics[Step-by-step solution > prepwisar.in/questions/xZA4jq4kH2](https://www.prepwisar.in/questions/xZA4jq4kH2)

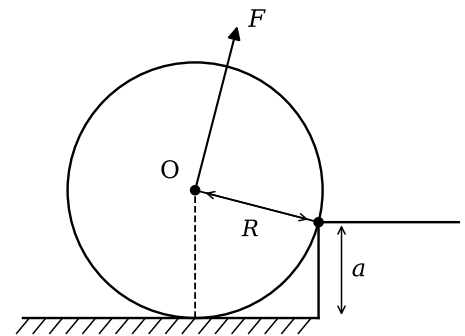
A cylindrical vessel containing a liquid is rotated about its axis so that the liquid rises at its sides as shown in the figure. The radius of vessel is 5 cm and the angular speed of rotation is $\omega \text{ rad s}^{-1}$. The difference in the height, h (in cm) of liquid at the centre of vessel and at the side will be:



- (A) $\frac{2\omega^2}{25g}$ (B) $\frac{5\omega^2}{2g}$ (C) $\frac{25\omega^2}{2g}$ (D) $\frac{2\omega^2}{5g}$

Q13 Rotational Motion[Step-by-step solution > prepwisar.in/questions/_CQzwCjinE](https://www.prepwisar.in/questions/_CQzwCjinE)

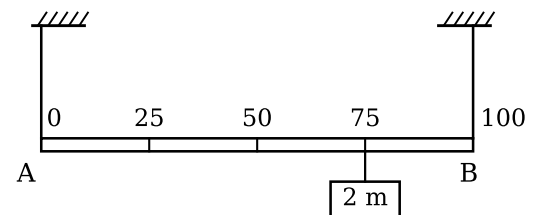
A uniform cylinder of mass M and radius R is to be pulled over a step of height a ($a < R$) by applying a force F at its centre 'O' perpendicular to the plane through the axes of the cylinder on the edge of the step (see figure). The minimum value of F required is:



- (A) $Mg\sqrt{1 - \left(\frac{R-a}{R}\right)^2}$ (B) $Mg\sqrt{1 - \frac{a^2}{R^2}}$
 (C) $Mg\frac{a}{R}$ (D) $Mg\sqrt{\left(\frac{R}{R-a}\right)^2 - 1}$

Q14 Rotational Motion[Step-by-step solution > prepwisar.in/questions/djG4f-cXjm](https://www.prepwisar.in/questions/djG4f-cXjm)

Shown in the figure is rigid and uniform one meter long rod AB held in horizontal position by two strings tied to its ends and attached to the ceiling. The rod is of mass ' m ' and has another weight of mass $2m$ hung at a distance of 75 cm from A. The tension in the string at A is:



- (A) $0.5 mg$ (B) $2 mg$ (C) $0.75 mg$ (D) $1 mg$

Q15 Wave Optics[Step-by-step solution > prepwisar.in/questions/0BVmqW1azU](https://www.prepwisar.in/questions/0BVmqW1azU)

Interference fringes are observed on a screen by illuminating two thin slits 1 mm apart with a light source ($\lambda = 632.8 \text{ nm}$). The distance between the screen and the slits is 100 cm. If a bright fringe is observed on a screen at a distance of 1.27 mm from the central bright fringe, then the path difference between the waves, which are reaching this point from the slits is close is

- (A) $1.27 \mu\text{m}$ (B) $2.05 \mu\text{m}$ (C) 2.87 nm (D) 2 nm

Q16 Mechanical Waves[Step-by-step solution > prepwisar.in/questions/B2BVn-nZvQ](https://www.prepwisar.in/questions/B2BVn-nZvQ)

Two identical strings X and Z made of same material have tension T_X and T_Z in them. If their fundamental frequencies are 450 Hz and 300 Hz, respectively, then the ratio T_X/T_Z is

- (A) 2.25 (B) 0.44 (C) 1.25 (D) 1.5

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If speed V , area A and force F are chosen as fundamental units, then the dimension of Young's modulus will be

- (A) $FA^{-1}V^0$ (B) FA^2V^{-1} (C) FA^2V^{-2} (D) FA^2V^{-3}

The least count of the main scale of a vernier callipers is 1 mm. Its vernier scale is divided into 10 divisions and coincide with 9 divisions of the main scale. When jaws are touching each other, the 7th division of vernier scale coincides with a division of main scale and the zero of vernier scale is lying right side of the zero of main scale. When this vernier is used to measure length of a cylinder the zero of the vernier scale between 3.1 cm and 3.2 cm and 4th VSD coincides with a main scale division. The length of the cylinder is : (VSD is vernier scale division)

- (A) 3.21 cm (B) 2.99 cm (C) 3.07 cm (D) 3.2 cm

Physics Section B · Numerical value

Q19 to Q23

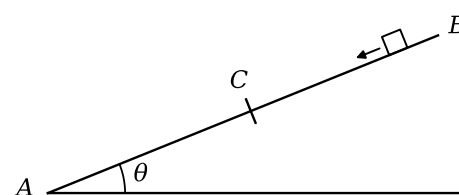
A $5\ \mu\text{F}$ capacitor is charged fully by a 220 V supply. It is then disconnected from the supply and is connected in series to another uncharged $2.5\ \mu\text{F}$ capacitor. If the energy change during the charge redistribution is $\frac{X}{100}\text{ J}$ then value of X to the nearest integer is ____.

When radiation of wavelength λ is used to illuminate a metallic surface, the stopping potential is V . When the same surface is illuminated with radiation of wavelength 3λ , the stopping potential is $\frac{V}{4}$. If the threshold wavelength for the metallic surface is $n\lambda$ then value of n will be ____.

A circular coil of radius 10 cm is placed in a uniform magnetic field of $3.0 \times 10^{-5}\text{ T}$ with its plane perpendicular to the field initially. It is rotated at constant angular speed about an axis along the diameter of coil and perpendicular to magnetic field so that it undergoes half of rotation in 0.2 s. The maximum value of EMF induced (in μV) in the coil will be close to the integer ____.

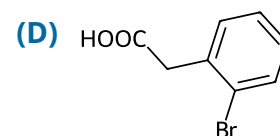
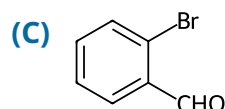
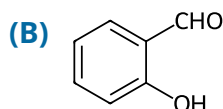
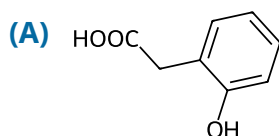
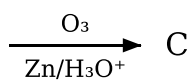
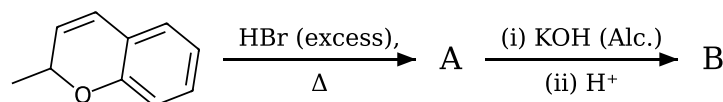
An engine takes in 5 moles of air at 20°C and 1 atm, and compresses it adiabatically to $1/10^{\text{th}}$ of the original volume. Assuming air to be a diatomic ideal gas made up of rigid molecules, the change in its internal energy during this process comes out to be $X\text{ kJ}$. The value of X to the nearest integer is ____.

A small block starts slipping down from a point B on an inclined plane AB, which is making an angle θ with the horizontal. Section BC is smooth and the remaining section CA is rough with a coefficient of friction μ . It is found that the block comes to rest as it reaches the bottom (point A) of the inclined plane. If $BC = 2AC$, the coefficient of friction is given by $\mu = k \tan \theta$. The value of k is ____.



Q24 Hydrocarbons: Aromatic (Arenes)[Step-by-step solution > prepwisar.in/questions/UPXmYcvhmw](https://www.prepwisar.in/questions/UPXmYcvhmw)

The major aromatic product C in the following reaction sequence will be:

**Q25** Aldehydes & Ketones[Step-by-step solution > prepwisar.in/questions/LBc7dswypc](https://www.prepwisar.in/questions/LBc7dswypc)

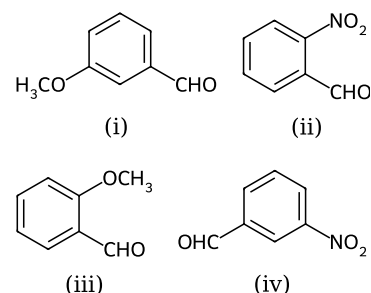
The increasing order of the following compounds towards HCN addition is:

(A) (iii) < (iv) < (ii) < (i)

(B) (i) < (iii) < (iv) < (ii)

(C) (iii) < (i) < (iv) < (ii)

(D) (iii) < (iv) < (i) < (ii)

**Q26** Chemical Bonding & Molecular Structure[Step-by-step solution > prepwisar.in/questions/4guF62NT9B](https://www.prepwisar.in/questions/4guF62NT9B)

If AB_4 molecule is a polar molecule, a possible geometry of AB_4 is

(A) Tetrahedral

(B) see-saw

(C) Square pyramidal

(D) Square planar

Q27 Coordination Compounds[Step-by-step solution > prepwisar.in/questions/chHirKPvLw](https://www.prepwisar.in/questions/chHirKPvLw)

Consider that a d^6 metal ion (M^{2+}) forms a complex with aqua ligands, and the spin only magnetic moment of the complex is 4.90 BM. The geometry and the crystal field stabilization energy of the complex is

(A) tetrahedral and $-1.6 \Delta_t + 1P$ (B) octahedral and $-2.4 \Delta_0 + 2P$ (C) tetrahedral and $-0.6 \Delta_t$ (D) octahedral and $-1.6 \Delta_0$ **Q28** Coordination Compounds[Step-by-step solution > prepwisar.in/questions/Jgt0BdFahW](https://www.prepwisar.in/questions/Jgt0BdFahW)

For octahedral $Mn(II)$ and tetrahedral $Ni(II)$ complexes, consider the following statements:

(I) both the complexes can be high spin.

(II) $Ni(II)$ complex can very rarely be low spin.(III) with strong field ligands, $Mn(II)$ complexes can be low spin.(IV) aqueous solution of $Mn(II)$ ions is yellow in colour.

The **correct** statements are:

(A) (I), (III) and (IV) only

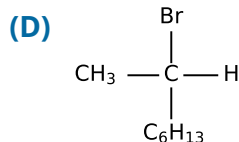
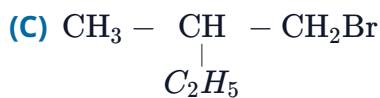
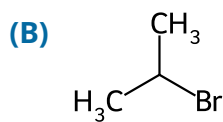
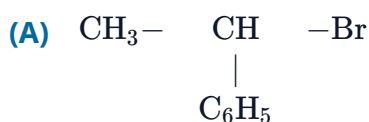
(B) (I) and (II) only

(C) (II), (III) and (IV) only

(D) (I), (II) and (III) only

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Which of the following compounds will show retention in configuration on nucleophilic substitution by OH^- ion?



For the following **Assertion** and **Reason**, the correct option is

Assertion (A): When Cu (II) and sulphide ions are mixed, they react together extremely quickly to give a solid.

Reason (R): The equilibrium constant of $\text{Cu}^{2+}(\text{aq}) + \text{S}^{2-}(\text{aq}) \rightleftharpoons \text{CuS}(\text{s})$ is high because the solubility product is low.

- (A) (A) is false and (R) is true.
 (B) Both (A) and (R) are true but (R) is not the explanation for (A).
 (C) Both (A) and (R) are true and (R) is the explanation for (A).
 (D) Both (A) and (R) are false.

On heating compound (A) gives a gas (B) which is a constituent of air. This gas when treated with H_2 in the presence of a catalyst gives another gas (C) which is basic in nature. (A) should **not** be:

- (A) $\text{Pb}(\text{NO}_3)_2$ (B) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ (C) NH_4NO_2 (D) NaN_3

In general the property (magnitudes only) that show an opposite trend in comparison to other properties across a period is

- (A) Electron gain enthalpy (B) Electronegativity
 (C) Ionization enthalpy (D) Atomic radius

While titrating dilute HCl solution with aqueous NaOH, which of the following will not be required?

- (A) Pipette and distilled water (B) Clamp and phenolphthalein
 (C) Burette and porcelain tile (D) Bunsen burner and measuring cylinder

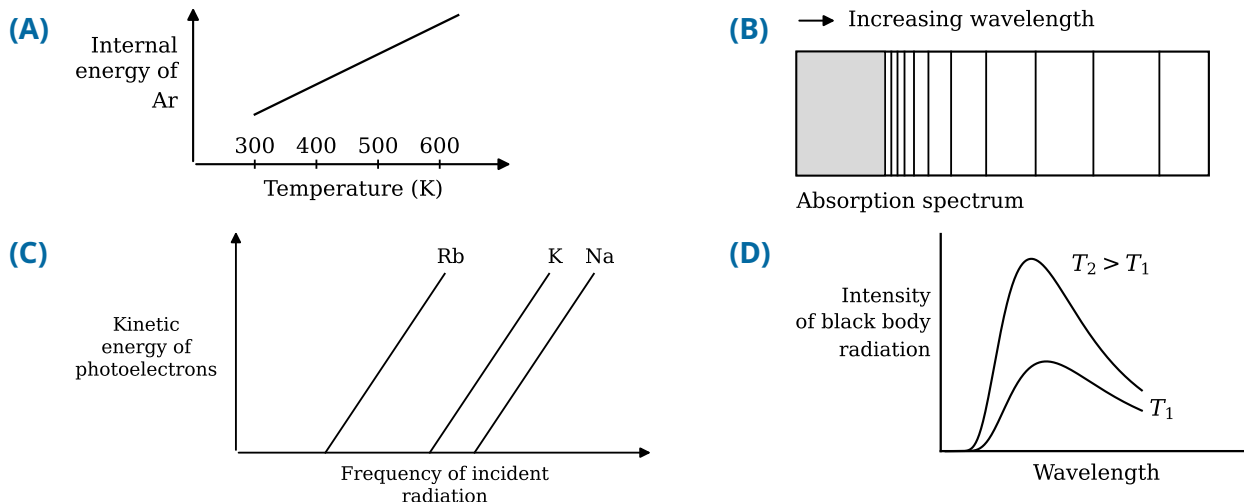
The metal mainly used in devising photoelectric cells is:

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

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Q35 Atomic Structure[Step-by-step solution](https://www.prepwiser.in/questions/fBxrNAJbCc) › prepwiser.in/questions/fBxrNAJbCc

The figure that is not a direct manifestation of the quantum nature of atoms is:

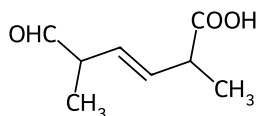
**Q36** Surface Chemistry[Step-by-step solution](https://www.prepwiser.in/questions/-Y2waM09X7) › prepwiser.in/questions/-Y2waM09X7

Which of the following is used for the preparation of colloids?

- (A) Van Arkel Method (B) Bredig's Arc Method
(C) Mond Process (D) Ostwald Process

Q37 General Organic Chemistry (GOC)[Step-by-step solution](https://www.prepwiser.in/questions/-XGLgDTQdi) › prepwiser.in/questions/-XGLgDTQdi

The IUPAC name for the following compound is



- (A) 2, 5-dimethyl-6-carboxy-hex-3-enal (B) 6-formyl-2-methyl-hex-3-enoic acid
(C) 2, 5-dimethyl-5-carboxy-hex-3-enal (D) 2, 5-dimethyl-6-oxo-hex-3-enoic acid

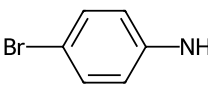
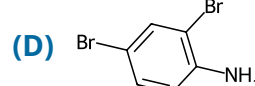
Q38 Solutions & Colligative Properties[Step-by-step solution](https://www.prepwiser.in/questions/uFu5_t3qSZ) › prepwiser.in/questions/uFu5_t3qSZ

An open beaker of water in equilibrium with water vapour is in a sealed container. When a few grams of glucose are added to the beaker of water, the rate at which water molecules:

- (A) leaves the solution increases (B) leaves the vapour increases
(C) leaves the vapour decreases (D) leaves the solution decreases

Q39 Purification & Characterisation of Organic Compounds[Step-by-step solution](https://www.prepwiser.in/questions/wcNDh3mCRI) › prepwiser.in/questions/wcNDh3mCRI

In Carius method of estimation of halogen, 0.172 g of an organic compound showed presence of 0.08 g of bromine. Which of these is the correct structure of the compound?

- (A) $\text{H}_3\text{C} - \text{CH}_2 - \text{Br}$ (B) $\text{H}_3\text{C} - \text{Br}$ (C)  (D) 

Q40 Redox Reactions **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/pI5m40dFtv) › prepwiser.in/questions/pI5m40dFtv

The oxidation states of iron atoms in compounds (A), (B) and (C), respectively, are x, y and z. The sum of x, y and z is _____.



(A)



(B)



(C)

Q41 Electrochemistry **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/L-IvLaVWmL) › prepwiser.in/questions/L-IvLaVWmL

The Gibbs change (in J) for the given reaction at

$[\text{Cu}^{2+}] = [\text{Sn}^{2+}] = 1 \text{ M}$ and 298 K is:



$$E_{\text{Sn}^{2+}|\text{Sn}}^0 = -0.16 \text{ V},$$

$$E_{\text{Cu}^{2+}|\text{Cu}}^0 = 0.34 \text{ V}$$

Take $F = 96500 \text{ C mol}^{-1}$

Q42 Surface Chemistry **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/AiSCsf9KW2) › prepwiser.in/questions/AiSCsf9KW2

The mass of gas adsorbed, x, per unit mass of adsorbate, m, was measured at various pressures, p. A graph between $\log \frac{x}{m}$ and $\log p$ gives a straight line with slope equal to 2 and the intercept equal to 0.4771. The value of $\frac{x}{m}$ at a pressure of 4 atm is:

(Given $\log 3 = 0.4771$)

Q43 Chemical Thermodynamics **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/3J6RN8f1dL) › prepwiser.in/questions/3J6RN8f1dL

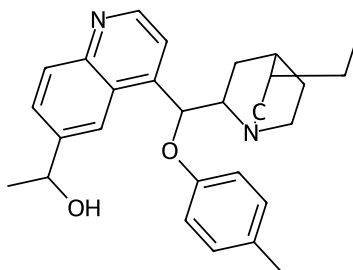
The internal energy change (in J) When 90 g of water undergoes complete evaporation at 100°C is _____. (Round off to the nearest integer)

(Given: ΔH_{vap} for water at $373 \text{ K} = 41 \text{ kJ/mol}$,

$R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)

Q44 General Organic Chemistry (GOC) **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/ZDrXXb7qYY) › prepwiser.in/questions/ZDrXXb7qYY

The number of chiral carbons present in the molecule given below is ____.



Q45 Three Dimensional Geometry

[Step-by-step solution](#) > [prepwisar.in/questions/u4FHnuXte_](https://www.prepwisar.in/questions/u4FHnuXte_)

The plane passing through the points (1, 2, 1), (2, 1, 2) and parallel to the line, $2x = 3y, z = 1$ also passes through the point:

- (A) (0, 6, -2) (B) (-2, 0, 1) (C) (0, -6, 2) (D) (2, 0, -1)

Q46 Applications of Derivatives

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

If $p(x)$ be a polynomial of degree three that has a local maximum value 8 at $x = 1$ and a local minimum value 4 at $x = 2$; then $p(0)$ is equal to:

- (A) 6 (B) 12 (C) -12 (D) -24

Q47 Applications of Derivatives

[Step-by-step solution](#) > [prepwisar.in/questions/OZ78sjuIFv](https://www.prepwisar.in/questions/OZ78sjuIFv)

Let $P(h, k)$ be a point on the curve $y = x^2 + 7x + 2$, nearest to the line, $y = 3x - 3$. Then the equation of the normal to the curve at P is:

- (A) $x - 3y - 11 = 0$ (B) $x - 3y + 22 = 0$ (C) $x + 3y - 62 = 0$ (D) $x + 3y + 26 = 0$

Q48 Applications of Derivatives

[Step-by-step solution](#) > [prepwisar.in/questions/sChoqf42Ty](https://www.prepwisar.in/questions/sChoqf42Ty)

If the tangent to the curve $y = x + \sin y$ at a point (a, b) is parallel to the line joining $(0, \frac{3}{2})$ and $(\frac{1}{2}, 2)$, then:

- (A) $b = a$ (B) $|b - a| = 1$ (C) $b = \frac{\pi}{2} + a$ (D) $|a + b| = 1$

Q49 Binomial Theorem

[Step-by-step solution](#) > [prepwisar.in/questions/31n2hxyUk](https://www.prepwisar.in/questions/31n2hxyUk)

Let $\alpha > 0, \beta > 0$ be such that $\alpha^3 + \beta^2 = 4$. If the maximum value of the term independent of x in the binomial expansion of $(\alpha x^{\frac{1}{9}} + \beta x^{-\frac{1}{6}})^{10}$ is $10k$, then k is equal to:

- (A) 176 (B) 336 (C) 352 (D) 84

Q50 Complex Numbers

[Step-by-step solution](#) > [prepwisar.in/questions/OeYf8wwlyk](https://www.prepwisar.in/questions/OeYf8wwlyk)

The value of

$$\left(\frac{1 + \sin \frac{2\pi}{9} + i \cos \frac{2\pi}{9}}{1 + \sin \frac{2\pi}{9} - i \cos \frac{2\pi}{9}} \right)^3$$

is:

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

Q51 Differential Equations

[Step-by-step solution](#) > [prepwisar.in/questions/8xcRsk3mev](https://www.prepwisar.in/questions/8xcRsk3mev)

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

$$\frac{2 + \sin x}{y + 1} \cdot \frac{dy}{dx} = -\cos x, y > 0, y(0) = 1.$$

If $y(\pi) = a$ and $\frac{dy}{dx}$ at $x = \pi$ is b , then the ordered pair (a, b) is equal to:

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

Q52 Hyperbola[Step-by-step solution](#) › [prepwise.in/questions/GTrSMOlcWH](https://www.prepwise.in/questions/GTrSMOlcWH)

A line parallel to the straight line $2x - y = 0$ is tangent to the hyperbola

$\frac{x^2}{4} - \frac{y^2}{2} = 1$ at the point (x_1, y_1) . Then $x_1^2 + 5y_1^2$ is equal to:

- (A) 5 (B) 6 (C) 10 (D) 8

Q53 Inverse Trigonometric Functions[Step-by-step solution](#) › [prepwise.in/questions/U7RFPE690r](https://www.prepwise.in/questions/U7RFPE690r)

The domain of the function

$f(x) = \sin^{-1} \left(\frac{|x|+5}{x^2+1} \right)$ is $(-\infty, -a] \cup [a, \infty)$. Then a is equal to:

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

Q54 Continuity & Differentiability[Step-by-step solution](#) › [prepwise.in/questions/nh9QICPqdN](https://www.prepwise.in/questions/nh9QICPqdN)

If a function $f(x)$ defined by

$$f(x) = \begin{cases} ae^x + be^{-x}, & -1 \leq x < 1 \\ cx^2, & 1 \leq x \leq 3 \\ ax^2 + 2cx, & 3 < x \leq 4 \end{cases}$$

be continuous for some $a, b, c \in \mathbb{R}$ and $f'(0) + f'(2) = e$, then the value of a is:

- (A) $\frac{e}{e^2 - 3e - 13}$ (B) $\frac{1}{e^2 - 3e + 13}$ (C) $\frac{e}{e^2 - 3e + 13}$ (D) $\frac{e}{e^2 + 3e + 13}$

Q55 Matrices[Step-by-step solution](#) › [prepwise.in/questions/6CvybWaNUs](https://www.prepwise.in/questions/6CvybWaNUs)

Let A be a 2×2 real matrix with entries from $\{0, 1\}$ and $|A| \neq 0$. Consider the following two statements:

(P) If $A \neq I_2$, then $|A| = -1$

(Q) If $|A| = 1$, then $\text{tr}(A) = 2$,

where I_2 denotes 2×2 identity matrix and $\text{tr}(A)$ denotes the sum of the diagonal entries of A . Then:

- (A) (P) is true and (Q) is false (B) Both (P) and (Q) are false
(C) Both (P) and (Q) are true (D) (P) is false and (Q) is true

Q56 Determinants[Step-by-step solution](#) › [prepwise.in/questions/9ha08T2Dyl](https://www.prepwise.in/questions/9ha08T2Dyl)

Let S be the set of all $\lambda \in \mathbb{R}$ for which the system of linear equations

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

$$x - 2y + \lambda z = -4$$

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

has no solution. Then the set S :

- (A) contains more than two elements. (B) contains exactly two elements.
(C) is a singleton. (D) is an empty set.

Q57 Probability: Advanced[Step-by-step solution](#) › [prepwise.in/questions/-rrlmyetIz](https://www.prepwise.in/questions/-rrlmyetIz)

Box I contains 30 cards numbered 1 to 30 and Box II contains 20 cards numbered 31 to 50. A box is selected at random and a card is drawn from it. The number on the card is found to be a non-prime number. The probability that the card was drawn from Box I is:

- (A) $\frac{8}{17}$ (B) $\frac{2}{3}$ (C) $\frac{2}{5}$ (D) $\frac{4}{17}$

Q58 Sequences & Series[Step-by-step solution](#) › [prepwiser.in/questions/7zJHOMY6tE](https://www.prepwiser.in/questions/7zJHOMY6tE)

Let α and β be the roots of the equation $5x^2 + 6x - 2 = 0$. If $S_n = \alpha^n + \beta^n$, $n = 1, 2, 3, \dots$, then:

- (A) $5S_6 + 6S_5 = 2S_4$ (B) $5S_6 + 6S_5 + 2S_4 = 0$ (C) $6S_6 + 5S_5 + 2S_4 = 0$ (D) $6S_6 + 5S_5 = 2S_4$

Q59 Sequences & Series[Step-by-step solution](#) › [prepwiser.in/questions/GDrOS9nF_r](https://www.prepwiser.in/questions/GDrOS9nF_r)

The sum of the first three terms of a G.P. is S and their product is 27. Then all such S lie in:

- (A) $[-3, \infty)$ (B) $(-\infty, 9]$ (C) $(-\infty, -9] \cup [-3, \infty)$ (D) $(-\infty, -3] \cup [9, \infty)$

Q60 Sequences & Series[Step-by-step solution](#) › [prepwiser.in/questions/_LoELuLL9V](https://www.prepwiser.in/questions/_LoELuLL9V)

If $|x| < 1$, $|y| < 1$ and $x \neq y$, then the sum to infinity of the following series $(x + y) + (x^2 + xy + y^2) + (x^3 + x^2y + xy^2 + y^3) + \dots$

- (A) $\frac{x + y - xy}{(1 + x)(1 + y)}$ (B) $\frac{x + y - xy}{(1 - x)(1 - y)}$ (C) $\frac{x + y + xy}{(1 + x)(1 + y)}$ (D) $\frac{x + y + xy}{(1 - x)(1 - y)}$

Q61 Relations & Functions (Basic)[Step-by-step solution](#) › [prepwiser.in/questions/CH-AP_mweF](https://www.prepwiser.in/questions/CH-AP_mweF)

If $R = \{(x, y) : x, y \in \mathbb{Z}, x^2 + 3y^2 \leq 8\}$ is a relation on the set of integers $\mathbb{Z}$, then the domain of R^{-1} is:

- (A) $\{0, 1\}$ (B) $\{-2, -1, 1, 2\}$ (C) $\{-1, 0, 1\}$ (D) $\{-2, -1, 0, 1, 2\}$

Q62 Statistics[Step-by-step solution](#) › [prepwiser.in/questions/izjZB1PJzY](https://www.prepwiser.in/questions/izjZB1PJzY)

Let $X = \{x \in \mathbb{N} : 1 \leq x \leq 17\}$ and $Y = \{ax + b : x \in X \text{ and } a, b \in \mathbb{R}, a > 0\}$. If mean and variance of elements of Y are 17 and 216 respectively then $a + b$ is equal to:

- (A) 7 (B) 9 (C) -7 (D) -27

Q63 Area Under Curves[Step-by-step solution](#) › [prepwiser.in/questions/iqTDAJQODD](https://www.prepwiser.in/questions/iqTDAJQODD)

Area (in sq. units) of the region outside $\frac{|x|}{2} + \frac{|y|}{3} = 1$ and inside the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$ is:

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

Mathematics Section B · Numerical value

Q64 to Q67

Q64 Circles **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/E6UeuMstuW](https://www.prepwiser.in/questions/E6UeuMstuW)

The number of integral values of k for which the line, $3x + 4y = k$ intersects the circle, $x^2 + y^2 - 2x - 4y + 4 = 0$ at two distinct points is ____.

Q65 Limits **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/714Htjq3-G](https://www.prepwiser.in/questions/714Htjq3-G)

If

$$\lim_{x \rightarrow 1} \frac{x + x^2 + x^3 + \dots + x^n - n}{x - 1}$$

= 820,

($n \in \mathbb{N}$) then the value of n is equal to ____.

If the letters of the word 'MOTHER' be permuted and all the words so formed (with or without meaning) be listed as in a dictionary, then the position of the word 'MOTHER' is ____.

Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three unit vectors such that

$$|\vec{a} - \vec{b}|^2 + |\vec{a} - \vec{c}|^2 = 8.$$

Then $|\vec{a} + 2\vec{b}|^2 + |\vec{a} + 2\vec{c}|^2$ is equal to ____.

Answer key: JEE Main 2020 · 2 Sep · Shift 1

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1. B	2. C	3. A	4. B	5. C	6. B	7. A	8. C
9. B	10. D	11. B	12. C	13. A	14. D	15. A	16. A
17. A	18. C	19. 4	20. 9	21. 15	22. 46	23. 3	

Chemistry

24. B	25. C	26. B	27. C	28. D	29. C	30. C	31. A
32. D	33. D	34. D	35. A	36. B	37. D	38. D	39. C
40. 6	41. 96500	42. 48	43. 189494	44. 5			

Mathematics

45. B	46. C	47. D	48. B	49. B	50. B	51. D	52. B
53. B	54. C	55. D	56. B	57. A	58. A	59. D	60. B
61. C	62. C	63. C	64. 9	65. 40	66. 309	67. 2	

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