

JEE MAIN 2021 · QUESTION PAPER

26 Aug 2021 **Shift 1**

82 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	20 Q1 to Q20	9 Q21 to Q29
● Chemistry	15 Q30 to Q44	10 Q45 to Q54
● Mathematics	18 Q55 to Q72	10 Q73 to Q82
In this PDF	82 questions · answer key at the end	

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

Attempt this paper online

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

prepwis.in/pyqs/paper/2021-08-26-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 Alternating Current

[Step-by-step solution](#) > [prepwiser.in/questions/Y7-aGNg9Ie](https://www.prepwiser.in/questions/Y7-aGNg9Ie)

A series LCR circuit driven by 300 V at a frequency of 50 Hz contains a resistance $R = 3 \text{ k}\Omega$, an inductor of inductive reactance $X_L = 250 \pi \Omega$ and an unknown capacitor. The value of capacitance to maximize the average power should be : (Take $\pi^2 = 10$)

- (A) $4 \mu\text{F}$ (B) $25 \mu\text{F}$ (C) $400 \mu\text{F}$ (D) $40 \mu\text{F}$

Q2 Atomic Physics

[Step-by-step solution](#) > [prepwiser.in/questions/Dbp2UqFaPo](https://www.prepwiser.in/questions/Dbp2UqFaPo)

A particular hydrogen like ion emits radiation of frequency $2.92 \times 10^{15} \text{ Hz}$ when it makes transition from $n = 3$ to $n = 1$. The frequency in Hz of radiation emitted in transition from $n = 2$ to $n = 1$ will be:

- (A) 0.44×10^{15} (B) 6.57×10^{15} (C) 4.38×10^{15} (D) 2.46×10^{15}

Q3 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) > [prepwiser.in/questions/JH8TeSgJGQ](https://www.prepwiser.in/questions/JH8TeSgJGQ)

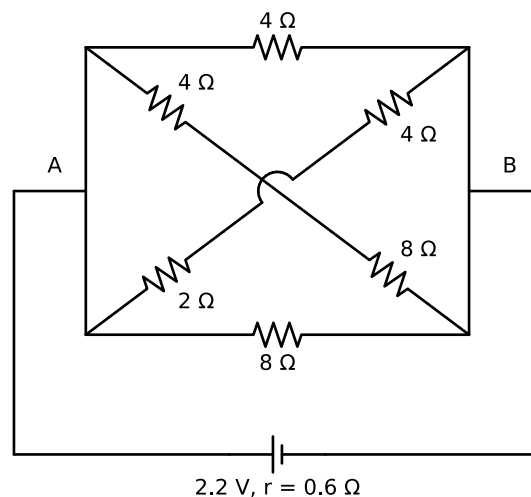
The material filled between the plates of a parallel plate capacitor has resistivity $200 \Omega\text{m}$. The value of capacitance of the capacitor is 2 pF. If a potential difference of 40 V is applied across the plates of the capacitor, then the value of leakage current flowing out of the capacitor is : (given the value of relative permittivity of material is 50)

- (A) $9.0 \mu\text{A}$ (B) 9.0 mA (C) 0.9 mA (D) $0.9 \mu\text{A}$

Q4 Current Electricity

[Step-by-step solution](#) > [prepwiser.in/questions/K_hothKd83](https://www.prepwiser.in/questions/K_hothKd83)

In the given figure, the emf of the cell is 2.2 V and if internal resistance is 0.6Ω . Calculate the power dissipated in the whole circuit:



- (A) 1.32 W (B) 0.65 W (C) 2.2 W (D) 4.4 W

Q5 Current Electricity

[Step-by-step solution](#) > [prepwiser.in/questions/_SiFsy_pO1](https://www.prepwiser.in/questions/_SiFsy_pO1)

What equal length of an iron wire and a copper-nickel alloy wire, each of 2 mm diameter connected parallel to give an equivalent resistance of 3Ω ?

(Given resistivities of iron and copper-nickel alloy wire are $12 \mu\Omega$ and $51 \mu\Omega \text{ cm}$ respectively)

- (A) 82 m (B) 97 m (C) 110 m (D) 90 m

Attempt this paper online with instant answer checking > [prepwiser.in/pyqs/paper/2021-08-26-morning](https://www.prepwiser.in/pyqs/paper/2021-08-26-morning)

Q6 Dual Nature of Radiation & Matter[Step-by-step solution](https://www.prepwiser.in/questions/Vx3PnUzAO) › prepwiser.in/questions/Vx3PnUzAO

In a photoelectric experiment ultraviolet light of wavelength 280 nm is used with lithium cathode having work function $\phi = 2.5$ eV. If the wavelength of incident light is switched to 400 nm, find out the change in the stopping potential. ($h = 6.63 \times 10^{-34}$ Js, $c = 3 \times 10^8$ ms $^{-1}$)

- (A) 1.3 V (B) 1.1 V (C) 1.9 V (D) 0.6 V

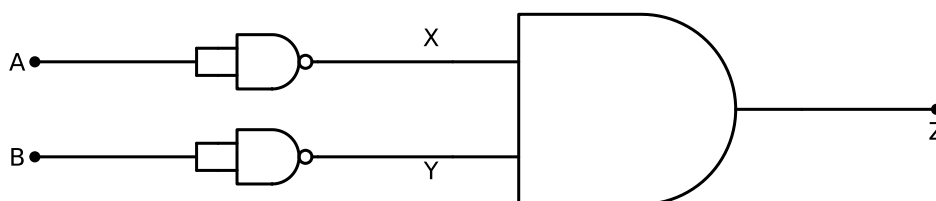
Q7 Electromagnetic Induction[Step-by-step solution](https://www.prepwiser.in/questions/ZRe2p7GIR7) › prepwiser.in/questions/ZRe2p7GIR7

An inductor coil stores 64 J of magnetic field energy and dissipates energy at the rate of 640 W when a current of 8A is passed through it. If this coil is joined across an ideal battery, find the time constant of the circuit in seconds:

- (A) 0.4 (B) 0.8 (C) 0.125 (D) 0.2

Q8 Semiconductors & Electronic Devices[Step-by-step solution](https://www.prepwiser.in/questions/0tD2nXnvyC) › prepwiser.in/questions/0tD2nXnvyC

Identify the logic operation carried out by the given circuit :-



- (A) OR (B) AND (C) NOR (D) NAND

Q9 Semiconductors & Electronic Devices[Step-by-step solution](https://www.prepwiser.in/questions/17dJjuptGq) › prepwiser.in/questions/17dJjuptGq

Statement I : By doping silicon semiconductor with pentavalent material, the electrons density increases.

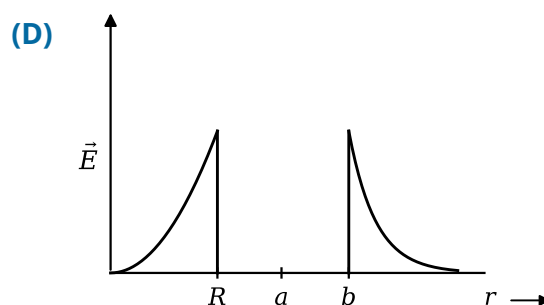
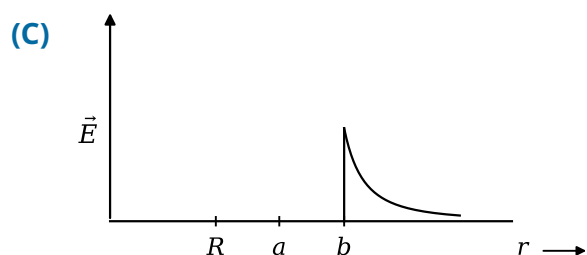
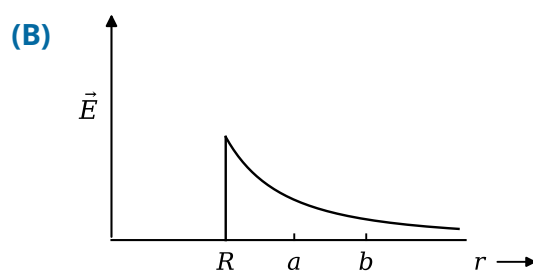
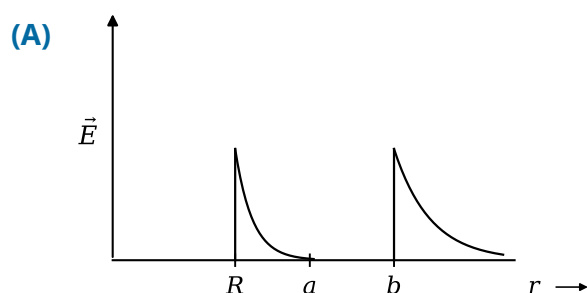
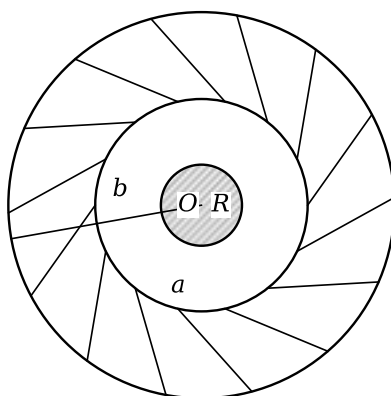
Statement II : The n-type semiconductor has net negative charge.

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

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

Attempt this paper online with instant answer checking › [prepwiser.in/pyqs/paper/2021-08-26-morning](https://www.prepwiser.in/pyqs/paper/2021-08-26-morning)

A solid metal sphere of radius R having charge q is enclosed inside the concentric spherical shell of inner radius a and outer radius b as shown in the figure. The approximate variation electric field $\vec{E}$ as a function of distance r from centre O is given by



Car B overtakes another car A at a relative speed of 40 ms^{-1} . How fast will the image of car B appear to move in the mirror of focal length 10 cm fitted in car A, when the car B is 1.9 m away from the car A?

- (A) 4 ms^{-1} (B) 0.2 ms^{-1} (C) 40 ms^{-1} (D) 0.1 ms^{-1}

Inside a uniform spherical shell:

- (1) the gravitational field is zero
- (2) the gravitational potential is zero
- (3) the gravitational field is same everywhere
- (4) the gravitational potential is same everywhere
- (5) all of the above

Choose the most appropriate answer from the options given below:

- (A) (1), (3) and (4) only (B) (5) only (C) (1), (2) and (3) only (D) (2), (3) and (4) only

Q13 Thermodynamics[Step-by-step solution](#) › [prepwiser.in/questions/jnNMK32Aiv](#)

An electric appliance supplies 6000 J/min heat to the system. If the system delivers a power of 90W. How long it would take to increase the internal energy by 2.5×10^3 J?

- (A) 2.5×10^2 s (B) 4.1×10^1 s (C) 2.4×10^3 s (D) 2.5×10^1 s

Q14 Kinetic Theory of Gases[Step-by-step solution](#) › [prepwiser.in/questions/ZmB5c0f1NC](#)

The rms speeds of the molecules of Hydrogen, Oxygen and Carbon dioxide at the same temperature are V_H , V_O and V_C respectively then:

- (A) $V_H > V_O > V_C$ (B) $V_C > V_O > V_H$ (C) $V_H = V_O > V_C$ (D) $V_H = V_O = V_C$

Q15 Centre of Mass & Linear Momentum[Step-by-step solution](#) › [prepwiser.in/questions/fx1pkHZ_tj](#)

The initial mass of a rocket is 1000 kg. Calculate at what rate the fuel should be burnt so that the rocket is given an acceleration of 20 ms^{-2} . The gases come out at a relative speed of 500 ms^{-1} with respect to the rocket : [Use $g = 10 \text{ m/s}^2$]

- (A) $6.0 \times 10^2 \text{ kg s}^{-1}$ (B) 500 kg s^{-1} (C) 10 kg s^{-1} (D) 60 kg s^{-1}

Q16 Moving Charges & Magnetism[Step-by-step solution](#) › [prepwiser.in/questions/4J579R2qd2](#)

The fractional change in the magnetic field intensity at a distance 'r' from centre on the axis of current carrying coil of radius 'a' to the magnetic field intensity at the centre of the same coil is : (Take $r < a$)

- (A) $\frac{3}{2} \frac{a^2}{r^2}$ (B) $\frac{2}{3} \frac{a^2}{r^2}$ (C) $\frac{2}{3} \frac{r^2}{a^2}$ (D) $\frac{3}{2} \frac{r^2}{a^2}$

Q17 Surface Tension[Step-by-step solution](#) › [prepwiser.in/questions/tKJR80n8FK](#)

Two narrow bores of diameter 5.0 mm and 8.0 mm are joined together to form a U-shaped tube open at both ends. If this U-tube contains water, what is the difference in the level of two limbs of the tube. [Take surface tension of water $T = 7.3 \times 10^{-2} \text{ Nm}^{-1}$, angle of contact = 0, $g = 10 \text{ ms}^2$ and density of water = $1.0 \times 10^3 \text{ kg m}^{-3}$]

- (A) 3.62 mm (B) 2.19 mm (C) 5.34 mm (D) 4.97 mm

Q18 Experimental Skills[Step-by-step solution](#) › [prepwiser.in/questions/vqCSE_vEKt](#)

In a Screw Gauge, fifth division of the circular scale coincides with the reference line when the ratchet is closed. There are 50 divisions on the circular scale, and the main scale moves by 0.5 mm on a complete rotation. For a particular observation the reading on the main scale is 5 mm and the 20th division of the circular scale coincides with reference line. Calculate the true reading.

- (A) 5.00 mm (B) 5.25 mm (C) 5.15 mm (D) 5.20 mm

Q19 Units, Dimensions & Errors[Step-by-step solution](#) › [prepwiser.in/questions/cvUqYdJnmj](#)

If E, L, M and G denote the quantities as energy, angular momentum, mass and constant of gravitation respectively, then the dimensions of P in the formula $P = EL^2M^{-5}G^{-2}$ are:

- (A) $[M^0 L^1 T^0]$ (B) $[M^{-1} L^{-1} T^2]$ (C) $[M^1 L^1 T^{-2}]$ (D) $[M^0 L^0 T^0]$

Attempt this paper online with instant answer checking › [prepwiser.in/pyqs/paper/2021-08-26-morning](#)

Q20 Vectors[Step-by-step solution](https://www.prepwise.in/questions/YKGRlvdy2w) > prepwise.in/questions/YKGRlvdy2w

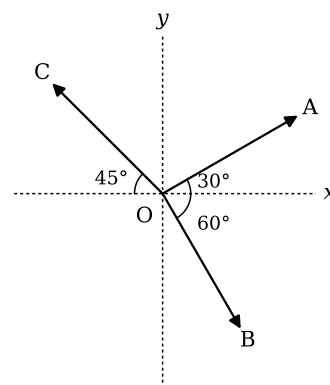
The magnitude of vectors $\vec{OA}$, $\vec{OB}$ and $\vec{OC}$ in the given figure are equal.
The direction of $\vec{OA} + \vec{OB} - \vec{OC}$ with x-axis will be:

(A) $\tan^{-1} \frac{(1 - \sqrt{3} - \sqrt{2})}{(1 + \sqrt{3} + \sqrt{2})}$

(B) $\tan^{-1} \frac{(\sqrt{3} - 1 + \sqrt{2})}{(1 + \sqrt{3} - \sqrt{2})}$

(C) $\tan^{-1} \frac{(\sqrt{3} - 1 + \sqrt{2})}{(1 - \sqrt{3} + \sqrt{2})}$

(D) $\tan^{-1} \frac{(1 + \sqrt{3} - \sqrt{2})}{(1 - \sqrt{3} - \sqrt{2})}$

**Physics Section B · Numerical value**

Q21 to Q29

Q21 Electromagnetic Waves **NUMERICAL**[Step-by-step solution](https://www.prepwise.in/questions/8TQIUCNnWC) > prepwise.in/questions/8TQIUCNnWC

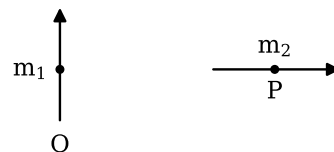
The electric field in a plane electromagnetic wave is given by

$$\vec{E} = 200 \cos \left[\left(\frac{0.5 \times 10^3}{m} \right) x - \left(1.5 \times 10^{11} \frac{rad}{s} \times t \right) \right] \frac{V}{m} \hat{j}$$

If this wave falls normally on a perfectly reflecting surface having an area of 100 cm^2 . If the radiation pressure exerted by the E.M. wave on the surface during a 10 minute exposure is $\frac{x}{10^9} \frac{N}{m^2}$. Find the value of x.

Q22 Magnetism & Matter **NUMERICAL**[Step-by-step solution](https://www.prepwise.in/questions/EeUW7zc_UT) > prepwise.in/questions/EeUW7zc_UT

Two short magnetic dipoles m_1 and m_2 each having magnetic moment of 1 Am^2 are placed at point O and P respectively. The distance between OP is 1 meter. The torque experienced by the magnetic dipole m_2 due to the presence of m_1 is $\times 10^{-7} \text{ Nm}$.

**Q23** Rectilinear Motion **NUMERICAL**[Step-by-step solution](https://www.prepwise.in/questions/jO8QFFtKGGo) > prepwise.in/questions/jO8QFFtKGGo

Two spherical balls having equal masses with radius of 5 cm each are thrown upwards along the same vertical direction at an interval of 3s with the same initial velocity of 35 m/s, then these balls collide at a height of m. (Take $g = 10 \text{ m/s}^2$)

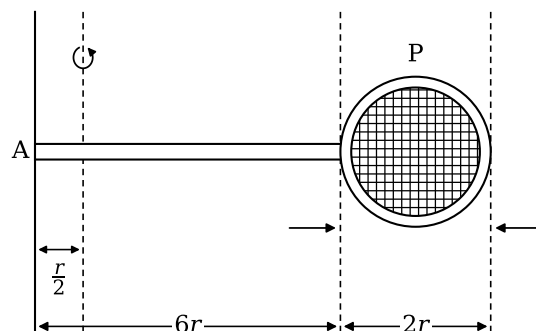
Q24 Surface Tension **NUMERICAL**[Step-by-step solution](https://www.prepwise.in/questions/_KR1irdlDi) > prepwise.in/questions/_KR1irdlDi

A soap bubble of radius 3 cm is formed inside the another soap bubble of radius 6 cm. The radius of an equivalent soap bubble which has the same excess pressure as inside the smaller bubble with respect to the atmospheric pressure is cm.

Q25 Rotational Motion **NUMERICAL**[Step-by-step solution](https://www.prepwise.in/questions/YFnQOcWYzR) > prepwise.in/questions/YFnQOcWYzR

Consider a badminton racket with length scales as shown in the figure.

If the mass of the linear and circular portions of the badminton racket are same (M) and the mass of the threads are negligible, the moment of inertia of the racket about an axis perpendicular to the handle and in the plane of the ring at, $\frac{r}{2}$ distance from the end A of the handle will be Mr^2 .



Q26 Wave Optics **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/0d_58-K-7P](https://www.prepwiser.in/questions/0d_58-K-7P)

White light is passed through a double slit and interference is observed on a screen 1.5 m away. The separation between the slits is 0.3 mm. The first violet and red fringes are formed 2.0 mm and 3.5 mm away from the central white fringes. the difference in wavelengths of red and violet light is nm.

Q27 Sound Waves **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/u05f1N8G1_](https://www.prepwiser.in/questions/u05f1N8G1_)

A source and a detector move away from each other in absence of wind with a speed of 20 m/s with respect to the ground. If the detector detects a frequency of 1800 Hz of the sound coming from the source, then the original frequency of source considering speed of sound in air 340 m/s will be Hz.

Q28 Mechanical Waves **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/ZXZU85zPBm](https://www.prepwiser.in/questions/ZXZU85zPBm)

Two travelling waves produces a standing wave represented by equation,

$$y = 1.0 \text{ mm} \cos(1.57 \text{ cm}^{-1}) \times \sin(78.5 \text{ s}^{-1})t.$$

The node closest to the origin in the region $x > 0$ will be at $x = \dots\dots\dots$ cm.

Q29 Work, Energy & Power **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/KTf7LrjH03](https://www.prepwiser.in/questions/KTf7LrjH03)

A uniform chain of length 3 meter and mass 3 kg overhangs a smooth table with 2 meter lying on the table. If k is the kinetic energy of the chain in joule as it completely slips off the table, then the value of k is (Take $g = 10 \text{ m/s}^2$)

Chemistry Section A · Multiple choice

Q30 to Q44

Q30 d & f Block Elements[Step-by-step solution](#) > [prepwiser.in/questions/F82fIA2Cij](https://www.prepwiser.in/questions/F82fIA2Cij)

Which one of the following when dissolved in water gives coloured solution in nitrogen atmosphere?

- (A) CuCl_2 (B) AgCl (C) ZnCl_2 (D) Cu_2Cl_2

Q31 Electrochemistry[Step-by-step solution](#) > [prepwiser.in/questions/dGbIg0kRdO](https://www.prepwiser.in/questions/dGbIg0kRdO)

Given below are two statements:

Statement I : The limiting molar conductivity of KCl (strong electrolyte) is higher compared to that of CH_3COOH (weak electrolyte).

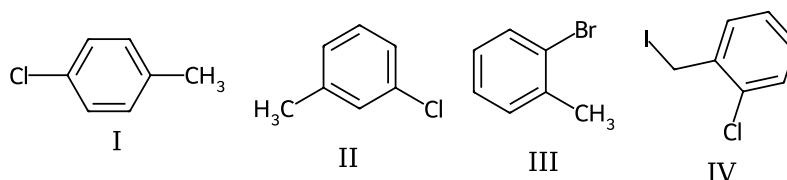
Statement II : Molar conductivity decreases with decrease in concentration of electrolyte.

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

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

Q32 Qualitative Analysis: Salt Analysis[Step-by-step solution](#) > [prepwiser.in/questions/ZVVVE0-ARX](https://www.prepwiser.in/questions/ZVVVE0-ARX)

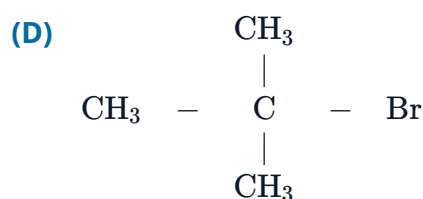
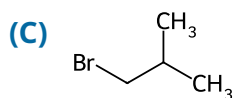
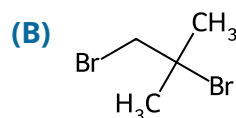
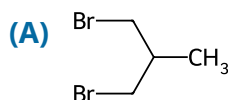
Among the following compounds I-IV, which one forms a yellow precipitate on reacting sequentially with (i) NaOH (ii) dil. HNO_3 (iii) AgNO_3 ?



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

Q33 Hydrocarbons: Alkanes[Step-by-step solution](https://www.prepwiser.in/questions/r_o0mFe53M) · prepwiser.in/questions/r_o0mFe53M

Excess of isobutane on reaction with Br_2 in presence of light at 125°C gives which one of the following, as the major product?

**Q34** Environmental Chemistry[Step-by-step solution](https://www.prepwiser.in/questions/X6wkEoEuRV) · prepwiser.in/questions/X6wkEoEuRV

Which one of the following methods is most suitable for preparing deionized water?

(A) Synthetic resin method

(B) Clark's method

(C) Calgon's method

(D) Permutit method

Q35 Ionic Equilibrium[Step-by-step solution](https://www.prepwiser.in/questions/cXQrg0ood6) · prepwiser.in/questions/cXQrg0ood6

Given below are two statements.

Statement I : In the titration between strong acid and weak base methyl orange is suitable as an indicator.

Statement II : For titration of acetic acid with NaOH phenolphthalein is not a suitable indicator.

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

(A) Statement I is false but Statement II is true

(B) Statement I is true but Statement II is false

(C) Both Statement I and Statement II are true

(D) Both Statement I and Statement II are false

Q36 Metallurgy[Step-by-step solution](https://www.prepwiser.in/questions/cTF3xCSYIk) · prepwiser.in/questions/cTF3xCSYIk

Given below are two statements:

Statement I : The choice of reducing agents for metals extraction can be made by using Ellingham diagram, a plot of ΔG vs temperature.

Statement II : The value of ΔS increases from left to right in Ellingham diagram.

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

(A) Both Statement I and Statement II are true

(B) Statement I is false but Statement II is true

(C) Both Statement I and Statement II are false

(D) Statement I is true but Statement II is false

Q37 p-Block Elements: Part II (Group 15-18)[Step-by-step solution](https://www.prepwiser.in/questions/GBgF9lYhBf) · prepwiser.in/questions/GBgF9lYhBf

The incorrect statement is:

(A) Cl_2 is more reactive than ClF .

(B) F_2 is more reactive than ClF .

(C) On hydrolysis ClF forms HOCl and HF .

(D) F_2 is a stronger oxidizing agent than Cl_2 in aqueous solution.

The polymer formed on heating Novolac with formaldehyde is:

- (A) Bakelite (B) Polyester (C) Melamine (D) Nylon 6, 6

What are the products formed in sequence when excess of CO_2 is passed in slaked lime?

- (A) $\text{Ca}(\text{HCO}_3)_2$, CaCO_3 (B) CaCO_3 , $\text{Ca}(\text{HCO}_3)_2$ (C) CaO , $\text{Ca}(\text{HCO}_3)_2$ (D) CaO , CaCO_3

Given below are two statements.

Statement I : Frenkel defects are vacancy as well as interstitial defects.

Statement II : Frenkel defect leads to colour in ionic solids due to presence of F-centres.

Choose the most appropriate answer for the statements from the options given below:

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

Given below are two statements.

Statement I : According to Bohr's model of an atom, qualitatively the magnitude of velocity of electron increases with decrease in positive charges on the nucleus as there is no strong hold on the electron by the nucleus.

Statement II : According to Bohr's model of an atom, qualitatively the magnitude of velocity of electron increases with decrease in principal quantum number.

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

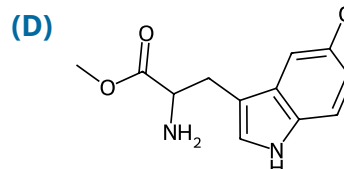
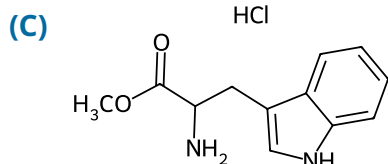
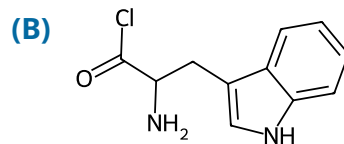
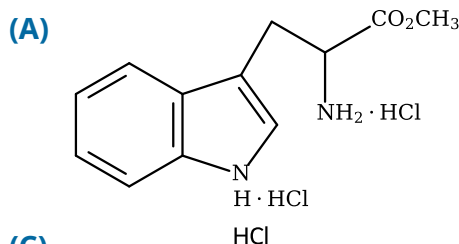
- (A) Both Statement I and Statement II are false (B) Both Statement I and Statement II are true
(C) Statement I is false but Statement II is true (D) Statement I is true but Statement II is false

Which one of the following is correct for the adsorption of a gas at a given temperature on a solid surface?

- (A) $\Delta H > 0$, $\Delta S > 0$ (B) $\Delta H > 0$, $\Delta S < 0$ (C) $\Delta H < 0$, $\Delta S < 0$ (D) $\Delta H < 0$, $\Delta S > 0$

Attempt this paper online with instant answer checking › [prepwisar.in/pyqs/paper/2021-08-26-morning](https://www.prepwisar.in/pyqs/paper/2021-08-26-morning)

The major product formed in the following reaction is:



Which one of the following complexes is violet in colour?

- (A) $[\text{Fe}(\text{CN})_6]^{4-}$ (B) $[\text{Fe}(\text{SCN})_6]^{4-}$ (C) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3 \cdot \text{H}_2\text{O}$ (D) $[\text{Fe}(\text{CN})_5\text{NOS}]^{4-}$

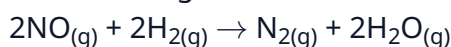
Chemistry Section B · Numerical value

Q45 to Q54

The total number of negative charge in the tetrapeptide, Gly-Glu-Asp-Tyr, at pH 12.5 will be _____. (Integer answer)

AB_3 is an interhalogen T-shaped molecule. The number of lone pairs of electrons on A is _____. (Integer answer)

The following data was obtained for chemical reaction given below at 975 K.



[NO]	[H ₂]	Rate
mol L ⁻¹	mol L ⁻¹	mol L ⁻¹ s ⁻¹
(A) 8×10^{-5}	8×10^{-5}	7×10^{-9}
(B) 24×10^{-5}	8×10^{-5}	2.1×10^{-8}
(C) 24×10^{-5}	32×10^{-5}	8.4×10^{-8}

The order of the reaction with respect to NO is _____. [Integer answer]

The ratio of number of water molecules in Mohr's salt and potash alum is _____ $\times 10^{-1}$. (Integer answer)

The number of 4f electrons in the ground state electronic configuration of Gd^{2+} is _____.
[Atomic number of Gd = 64]

These are physical properties of an element

- (A) Sublimation enthalpy
- (B) Ionisation enthalpy
- (C) Hydration enthalpy
- (D) Electron gain enthalpy

The total number of above properties that affect the reduction potential is _____ (Integer answer)

Of the following four aqueous solutions, total number of those solutions whose freezing point is lower than that of 0.10 M $\text{C}_2\text{H}_5\text{OH}$ is _____ (Integer answer)

- (i) 0.10 M $\text{Ba}_3(\text{PO}_4)_2$
- (ii) 0.10 M Na_2SO_4
- (iii) 0.10 M KCl
- (iv) 0.10 M Li_3PO_4

An aqueous KCl solution of density 1.20 g mL^{-1} has a molality of 3.30 mol kg^{-1} . The molarity of the solution in mol L^{-1} is _____ (Nearest integer) [Molar mass of KCl = 74.5]

The Born-Haber cycle for KCl is evaluated with the following data:

$$\Delta_f H^\ominus \text{ for KCl} = -436.7 \text{ kJ mol}^{-1};$$

$$\Delta_{\text{sub}} H^\ominus \text{ for K} = 89.2 \text{ kJ mol}^{-1};$$

$$\Delta_{\text{ionization}} H^\ominus \text{ for K} = 419.0 \text{ kJ mol}^{-1};$$

$$\Delta_{\text{electron gain}} H^\ominus \text{ for Cl}_{(\text{g})} = -348.6 \text{ kJ mol}^{-1};$$

$$\Delta_{\text{bond}} H^\ominus \text{ for Cl}_2 = 243.0 \text{ kJ mol}^{-1}$$

The magnitude of lattice enthalpy of KCl in kJ mol^{-1} is _____ (Nearest integer)

The OH^- concentration in a mixture of 5.0 mL of 0.0504 M NH_4Cl and 2 mL of 0.0210 M NH_3 solution is $x \times 10^{-6} \text{ M}$. The value of x is _____. (Nearest integer)
[Given $K_w = 1 \times 10^{-14}$ and $K_b = 1.8 \times 10^{-5}$]

Q55 Three Dimensional Geometry

[Step-by-step solution](#) › [prepwisar.in/questions/tIUXR2w4zg](https://www.prepwisar.in/questions/tIUXR2w4zg)

A plane P contains the line $x + 2y + 3z + 1 = 0 = x - y - z - 6$, and is perpendicular to the plane $-2x + y + z + 8 = 0$. Then which of the following points lies on P?

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

Q56 Binomial Theorem

[Step-by-step solution](#) › [prepwisar.in/questions/NAMz92DdX5](https://www.prepwisar.in/questions/NAMz92DdX5)

If ${}^{20}C_r$ is the co-efficient of x^r in the expansion of $(1 + x)^{20}$, then the value of $\sum_{r=0}^{20} r^2 \cdot {}^{20}C_r$ is equal to:

- (A) 420×2^{19} (B) 380×2^{19} (C) 380×2^{18} (D) 420×2^{18}

Q57 Parabola

[Step-by-step solution](#) › [prepwisar.in/questions/SMGosW4LK6](https://www.prepwisar.in/questions/SMGosW4LK6)

If a line along a chord of the circle $4x^2 + 4y^2 + 120x + 675 = 0$, passes through the point $(-30, 0)$ and is tangent to the parabola $y^2 = 30x$, then the length of this chord is:

- (A) 5 (B) 7 (C) $5\sqrt{3}$ (D) $3\sqrt{5}$

Q58 Complex Numbers

[Step-by-step solution](#) › [prepwisar.in/questions/RHA4A8eS92](https://www.prepwisar.in/questions/RHA4A8eS92)

The equation $\arg\left(\frac{z-1}{z+1}\right) = \frac{\pi}{4}$ represents a circle with:

- (A) centre at $(0, -1)$ and radius $\sqrt{2}$ (B) centre at $(0, 1)$ and radius $\sqrt{2}$
(C) centre $(0, 0)$ and radius $\sqrt{2}$ (D) centre at $(0, 1)$ and radius 2

Q59 Definite Integration

[Step-by-step solution](#) › [prepwisar.in/questions/1cqN3AYvHF](https://www.prepwisar.in/questions/1cqN3AYvHF)

The value of

$$\int_{\frac{-1}{\sqrt{2}}}^{\frac{1}{\sqrt{2}}} \left(\left(\frac{x+1}{x-1} \right)^2 + \left(\frac{x-1}{x+1} \right)^2 - 2 \right)^{\frac{1}{2}} dx$$

is:

- (A) $\log_e 4$ (B) $\log_e 16$ (C) $2\log_e 16$ (D) $4\log_e (3 + 2\sqrt{2})$

Q60 Definite Integration

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

The value of

$$\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{r=0}^{2n-1} \frac{n^2}{n^2 + 4r^2}$$

is:

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

Q61 Differential Equations

[Step-by-step solution](#) › [prepwisar.in/questions/KKeczz620x](https://www.prepwisar.in/questions/KKeczz620x)

Let $y = y(x)$ be a solution curve of the differential equation $(y + 1)\tan^2 x dx + \tan x dy + y dx = 0$, $x \in (0, \frac{\pi}{2})$. If $\lim_{x \rightarrow 0+} xy(x) = 1$, then the value of $y\left(\frac{\pi}{4}\right)$ is:

- (A) $-\frac{\pi}{4}$ (B) $\frac{\pi}{4} - 1$ (C) $\frac{\pi}{4} + 1$ (D) $\frac{\pi}{4}$

Let

$$f(x) = \cos \left(2 \tan^{-1} \sin \left(\cot^{-1} \sqrt{\frac{1-x}{x}} \right) \right)$$

, $0 < x < 1$. Then:

(A) $(1-x)^2 f'(x) - 2(f(x))^2 = 0$

(B) $(1+x)^2 f'(x) + 2(f(x))^2 = 0$

(C) $(1-x)^2 f'(x) + 2(f(x))^2 = 0$

(D) $(1+x)^2 f'(x) - 2(f(x))^2 = 0$

Q63 Ellipse

Step-by-step solution › [prepwisar.in/questions/9wMUWXVZIQ](https://www.prepwisar.in/questions/9wMUWXVZIQ)

On the ellipse $\frac{x^2}{8} + \frac{y^2}{4} = 1$ let P be a point in the second quadrant such that the tangent at P to the ellipse is perpendicular to the line $x + 2y = 0$. Let S and S' be the foci of the ellipse and e be its eccentricity. If A is the area of the triangle SPS' then, the value of $(5 - e^2) \cdot A$ is:

(A) 6

(B) 12

(C) 14

(D) 24

Q64 Determinants

Step-by-step solution › [prepwisar.in/questions/EEdTnmz6sz](https://www.prepwisar.in/questions/EEdTnmz6sz)Let $\theta \in (0, \frac{\pi}{2})$. If the system of linear equations

$$(1 + \cos^2 \theta)x + \sin^2 \theta y + 4 \sin 3\theta z = 0$$

$$\cos^2 \theta x + (1 + \sin^2 \theta)y + 4 \sin 3\theta z = 0$$

$$\cos^2 \theta x + \sin^2 \theta y + (1 + 4 \sin 3\theta)z = 0$$

has a non-trivial solution, then the value of θ is:

(A) $\frac{4\pi}{9}$

(B) $\frac{7\pi}{18}$

(C) $\frac{\pi}{18}$

(D) $\frac{5\pi}{18}$

Q65 Matrices

Step-by-step solution › [prepwisar.in/questions/eC0_fc3ZBI](https://www.prepwisar.in/questions/eC0_fc3ZBI)

If

$$A = \begin{pmatrix} \frac{1}{\sqrt{5}} & \frac{2}{\sqrt{5}} \\ \frac{-2}{\sqrt{5}} & \frac{1}{\sqrt{5}} \end{pmatrix}$$

, $B = \begin{pmatrix} 1 & 0 \\ i & 1 \end{pmatrix}$, $i = \sqrt{-1}$, and $Q = A^T B A$, then the inverse of the matrix $A Q^{2021} A^T$ is equal to:

(A) $\begin{pmatrix} \frac{1}{\sqrt{5}} & -2021 \\ 2021 & \frac{1}{\sqrt{5}} \end{pmatrix}$

(B) $\begin{pmatrix} 1 & 0 \\ -2021i & 1 \end{pmatrix}$

(C) $\begin{pmatrix} 1 & 0 \\ 2021i & 1 \end{pmatrix}$

(D) $\begin{pmatrix} 1 & -2021i \\ 0 & 1 \end{pmatrix}$

Q66 Probability: Advanced

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

Let A and B be independent events such that $P(A) = p$, $P(B) = 2p$. The largest value of p, for which P (exactly one of A, B occurs) = $\frac{5}{9}$, is:

(A) $\frac{1}{3}$

(B) $\frac{2}{9}$

(C) $\frac{4}{9}$

(D) $\frac{5}{12}$

Attempt this paper online with instant answer checking › [prepwisar.in/pyqs/paper/2021-08-26-morning](https://www.prepwisar.in/pyqs/paper/2021-08-26-morning)

The sum of the series

$$\frac{1}{x+1} + \frac{2}{x^2+1} + \frac{2^2}{x^4+1} + \dots + \frac{2^{100}}{x^{2^{100}}+1}$$

when $x = 2$ is:

- (A) $1 + \frac{2^{101}}{4^{101} - 1}$ (B) $1 + \frac{2^{100}}{4^{101} - 1}$ (C) $1 - \frac{2^{100}}{4^{100} - 1}$ (D) $1 - \frac{2^{101}}{2^{400} - 1}$

If the sum of an infinite GP $a, ar, ar^2, ar^3, \dots$ is 15 and the sum of the squares of its each term is 150, then the sum of $ar^2, ar^4, ar^6, \dots$ is:

- (A) $\frac{5}{2}$ (B) $\frac{1}{2}$ (C) $\frac{25}{2}$ (D) $\frac{9}{2}$

Out of all the patients in a hospital 89% are found to be suffering from heart ailment and 98% are suffering from lungs infection. If K% of them are suffering from both ailments, then K can not belong to the set:

- (A) {80, 83, 86, 89} (B) {84, 86, 88, 90} (C) {79, 81, 83, 85} (D) {84, 87, 90, 93}

The mean and standard deviation of 20 observations were calculated as 10 and 2.5 respectively. It was found that by mistake one data value was taken as 25 instead of 35. if α and $\sqrt{\beta}$ are the mean and standard deviation respectively for correct data, then (α, β) is:

- (A) (11, 26) (B) (10.5, 25) (C) (11, 25) (D) (10.5, 26)

The sum of solutions of the equation

$$\frac{\cos x}{1 + \sin x} = |\tan 2x|,$$

$$x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) - \left\{\frac{\pi}{4}, -\frac{\pi}{4}\right\}$$

is:

- (A) $-\frac{11\pi}{30}$ (B) $\frac{\pi}{10}$ (C) $-\frac{7\pi}{30}$ (D) $-\frac{\pi}{15}$

Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{j} - \hat{k}$. If $\vec{c}$ is a vector such that $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a} \cdot \vec{c} = 3$, then $\vec{a} \cdot (\vec{b} \times \vec{c})$ is equal to:

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

Q73 Three Dimensional Geometry **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/HdT9If_jQx

Let the line L be the projection of the line $\frac{x-1}{2} = \frac{y-3}{1} = \frac{z-4}{2}$ in the plane $x - 2y - z = 3$. If d is the distance of the point $(0, 0, 6)$ from L , then d^2 is equal to _____.

Q74 Applications of Derivatives **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/8jgg3dbZS_

A wire of length 36 m is cut into two pieces, one of the pieces is bent to form a square and the other is bent to form a circle. If the sum of the areas of the two figures is minimum, and the circumference of the circle is k (meter), then $\left(\frac{4}{\pi} + 1\right)k$ is equal to _____.

Q75 Straight Lines **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/sTLOCaG3NJ

The locus of a point, which moves such that the sum of squares of its distances from the points $(0, 0)$, $(1, 0)$, $(0, 1)$, $(1, 1)$ is 18 units, is a circle of diameter d . Then d^2 is equal to _____.

Q76 Complex Numbers **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/IXavMAZSM4

Let $z = \frac{1-i\sqrt{3}}{2}$, $i = \sqrt{-1}$. Then the value of

$$21 + \left(z + \frac{1}{z}\right)^3 + \left(z^2 + \frac{1}{z^2}\right)^3 + \left(z^3 + \frac{1}{z^3}\right)^3 + \dots + \left(z^{21} + \frac{1}{z^{21}}\right)^3$$

is _____.

Q77 Differentiation **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/gD9VEf2Oe7

If $y = y(x)$ is an implicit function of x such that $\log_e(x + y) = 4xy$, then $\frac{d^2y}{dx^2}$ at $x = 0$ is equal to _____.

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

Let $a, b \in \mathbb{R}$, $b \neq 0$. Define a function

$$f(x) = \begin{cases} a \sin \frac{\pi}{2}(x - 1), & \text{for } x \leq 0 \\ \frac{\tan 2x - \sin 2x}{bx^3}, & \text{for } x > 0 \end{cases}$$

If f is continuous at $x = 0$, then $10 - ab$ is equal to _____.

Q79 Permutations & Combinations **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/62GMFI4kn

If

$${}^1P_1 + 2 \cdot {}^2P_2 + 3 \cdot {}^3P_3 + \dots + 15 \cdot {}^{15}P_{15} = {}^qP_r - s, 0 \leq s \leq 1$$

, then ${}^{q+s}C_{r-s}$ is equal to _____.

Q80 Permutations & Combinations **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/57TvrdsGQ_

The number of three-digit even numbers, formed by the digits 0, 1, 3, 4, 6, 7 if the repetition of digits is not allowed, is _____.

Q81 Quadratic Equations & Polynomial Inequalities **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/GTNvutSwPU

The sum of all integral values of k ($k \neq 0$) for which the equation $\frac{2}{x-1} - \frac{1}{x-2} = \frac{2}{k}$ in x has no real roots, is _____.

Q82 Area Under Curves **NUMERICAL** [Step-by-step solution](#) › prepwiser.in/questions/sqDDxXpIfu

The area of the region $S = \{(x, y) : 3x^2 \leq 4y \leq 6x + 24\}$ is _____.

Answer key: JEE Main 2021 · 26 Aug · Shift 1

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/2021-08-26-morning

Physics

1. A	2. D	3. C	4. C	5. B	6. A	7. D	8. C
9. A	10. A	11. D	12. A	13. A	14. A	15. D	16. D
17. B	18. C	19. D	20. A	21. 354	22. 1	23. 50	24. 2
25. 52	26. 300	27. 2025	28. 1	29. 40			

Chemistry

30. A	31. D	32. B	33. D	34. A	35. B	36. D	37. A
38. A	39. B	40. C	41. C	42. C	43. C	44. D	45. 4
46. 2	47. 1	48. 5	49. 7	50. 3	51. 4	52. 3	53. 718
54. 3							

Mathematics

55. B	56. D	57. D	58. B	59. B	60. B	61. D	62. C
63. A	64. B	65. B	66. D	67. D	68. B	69. C	70. D
71. A	72. A	73. 26	74. 36	75. 16	76. 13	77. 40	78. 14
79. 136	80. 52	81. 66	82. 27				

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/2021-08-26-morning.
- 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 2021 papers

Every shift of 2021 as a PDF, and the year's questions chapter-wise: prepwisser.in/pyq-pdfs/jee-main/2021/

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.