

JEE MAIN 2021 · QUESTION PAPER

18 Mar 2021 **Shift 1**

85 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	19 Q1 to Q19	10 Q20 to Q29
● Chemistry	17 Q30 to Q46	10 Q47 to Q56
● Mathematics	20 Q57 to Q76	9 Q77 to Q85
In this PDF	85 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/2021-03-18-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](#) › [prepwisar.in/questions/UKpW-z2jAW](https://www.prepwisar.in/questions/UKpW-z2jAW)

In a series LCR resonance circuit, if we change the resistance only, from a lower to higher value:

- (A) The bandwidth of resonance circuit will increase.
- (B) The resonance frequency will increase.
- (C) The quality factor will increase.
- (D) The quality factor and the resonance frequency will remain constant.

Q2 Alternating Current

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

An AC source rated 220 V, 50 Hz is connected to a resistor. The time taken by the current to change from its maximum to the rms value is:

- (A) 2.5 ms
- (B) 25 ms
- (C) 2.5 s
- (D) 0.25 ms

Q3 Atomic Physics

[Step-by-step solution](#) › [prepwisar.in/questions/iSJwQbPz9](https://www.prepwisar.in/questions/iSJwQbPz9)

Imagine that the electron in a hydrogen atom is replaced by a muon (μ). The mass of muon particle is 207 times that of an electron and charge is equal to the charge of an electron. The ionization potential of this hydrogen atom will be:

- (A) 13.6 eV
- (B) 2815.2 eV
- (C) 331.2 eV
- (D) 27.2 eV

Q4 Nuclear Physics

[Step-by-step solution](#) › [prepwisar.in/questions/FcRDN_8s0T](https://www.prepwisar.in/questions/FcRDN_8s0T)

A radioactive sample disintegrates via two independent decay processes having half lives $T_{1/2}^{(1)}$ and $T_{1/2}^{(2)}$ respectively. The effective half-life $T_{1/2}$ of the nuclei is:

- (A) None of the above
- (B) $T_{1/2} = T_{1/2}^{(1)} + T_{1/2}^{(2)}$
- (C) $T_{1/2} = \frac{T_{1/2}^{(1)} T_{1/2}^{(2)}}{T_{1/2}^{(1)} + T_{1/2}^{(2)}}$
- (D) $T_{1/2} = \frac{T_{1/2}^{(1)} + T_{1/2}^{(2)}}{T_{1/2}^{(1)} - T_{1/2}^{(2)}}$

Q5 Units, Dimensions & Errors

[Step-by-step solution](#) › [prepwisar.in/questions/wFx5kCWmbE](https://www.prepwisar.in/questions/wFx5kCWmbE)

In the experiment of Ohm's law, a potential difference of 5.0 V is applied across the end of a conductor of length 10.0 cm and diameter of 5.00 mm. The measured current in the conductor is 2.00 A. The maximum permissible percentage error in the resistivity of the conductor is:

- (A) 3.9
- (B) 8.4
- (C) 7.5
- (D) 3.0

Q6 Dual Nature of Radiation & Matter

[Step-by-step solution](#) › [prepwisar.in/questions/v_MeHB9ZmO](https://www.prepwisar.in/questions/v_MeHB9ZmO)

A particle is travelling 4 time as fast as an electron. Assuming the ratio of de-Broglie wavelength of a particle to that of electron is 2 : 1, the mass of the particle is:

- (A) $\frac{1}{16}$ times the mass of e^-
- (B) 8 times the mass of e^-
- (C) 16 times the mass of e^-
- (D) $\frac{1}{8}$ times the mass of e^-

Attempt this paper online with instant answer checking › [prepwisar.in/pyqs/paper/2021-03-18-morning](https://www.prepwisar.in/pyqs/paper/2021-03-18-morning)

Q7 Electromagnetic Waves[Step-by-step solution](https://www.prepwiser.in/questions/IYZ3QZ0-Yp)

A plane electromagnetic wave of frequency 100 MHz is travelling in vacuum along the x-direction. At a particular point in space and time, $\vec{B} = 2.0 \times 10^{-8} \hat{k} T$. (where, $\hat{k}$ is unit vector along z-direction) What is $\vec{E}$ at this point?

- (A) $0.6 \hat{j} \text{ V/m}$ (B) $6.0 \hat{k} \text{ V/m}$ (C) $6.0 \hat{j} \text{ V/m}$ (D) $0.6 \hat{k} \text{ V/m}$

Q8 Electrostatics I: Charges, Field & Gauss's Law[Step-by-step solution](https://www.prepwiser.in/questions/u6fduVzsRO)

An oil drop of radius 2 mm with a density 3 g cm^{-3} is held stationary under a constant electric field $3.55 \times 10^5 \text{ V m}^{-1}$ in the Millikan's oil drop experiment. What is the number of excess electrons that the oil drop will possess? (consider $g = 9.81 \text{ m/s}^2$)

- (A) 48.8×10^{11} (B) 1.73×10^{10} (C) 17.3×10^{10} (D) 1.73×10^{12}

Q9 Ray Optics[Step-by-step solution](https://www.prepwiser.in/questions/LBCuya_PDP)

Your friend is having eye sight problem. She is not able to see clearly a distant uniform window mesh and it appears to her as non-uniform and distorted. The doctor diagnosed the problem as:

- (A) Astigmatism (B) Myopia with Astigmatism
(C) Presbyopia with Astigmatism (D) Myopia and Hypermetropia

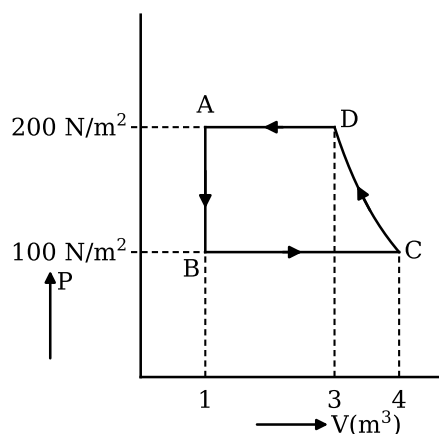
Q10 Gravitation[Step-by-step solution](https://www.prepwiser.in/questions/NbBlnAglOH)

The time period of a satellite in a circular orbit of radius R is T. The period of another satellite in a circular orbit of radius 9R is:

- (A) 9 T (B) 27 T (C) 12 T (D) 3 T

Q11 Thermodynamics[Step-by-step solution](https://www.prepwiser.in/questions/Rc8RH0C41q)

The P-V diagram of a diatomic ideal gas system going under cyclic process as shown in figure. The work done during an adiabatic process CD is (use $\gamma = 1.4$):



- (A) -500 J (B) -400 J (C) 400 J (D) 200 J

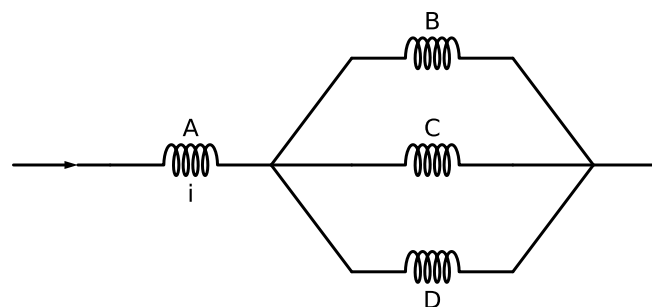
Q12 Kinetic Theory of Gases[Step-by-step solution](https://www.prepwiser.in/questions/iROUXEi6Fg)

What will be the average value of energy along one degree of freedom for an ideal gas in thermal equilibrium at a temperature T? (k_B is Boltzmann constant)

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

Q13 Moving Charges & Magnetism[Step-by-step solution > prepwiser.in/questions/Li2JV0E2Bn](https://www.prepwiser.in/questions/Li2JV0E2Bn)

Four identical long solenoids A, B, C and D are connected to each other as shown in the figure. If the magnetic field at the center of A is 3T, the field at the center of C would be : (Assume that the magnetic field is confined within the volume of respective solenoid).



- (A) 12T (B) 6T (C) 9T (D) 1T

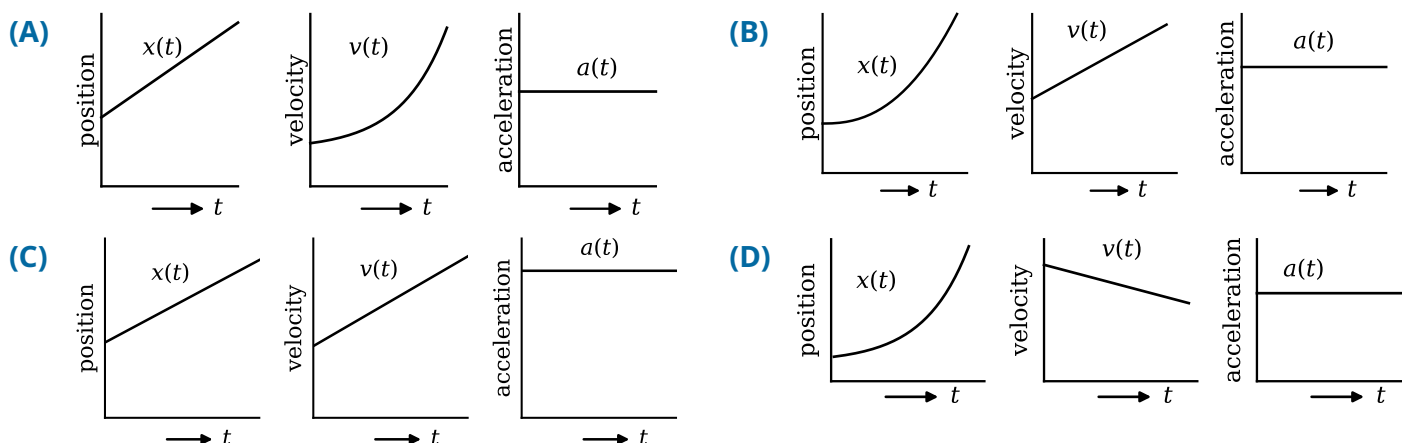
Q14 Moving Charges & Magnetism[Step-by-step solution > prepwiser.in/questions/FaP53LCQ6d](https://www.prepwiser.in/questions/FaP53LCQ6d)

A loop of flexible wire of irregular shape carrying current is placed in an external magnetic field. Identify the effect of the field on the wire.

- (A) Loop assumes circular shape with its plane normal to the field.
 (B) Loop assumes circular shape with its plane parallel to the field.
 (C) Wire gets stretched to become straight.
 (D) Shape of the loop remains unchanged.

Q15 Rectilinear Motion[Step-by-step solution > prepwiser.in/questions/GHKS2XOdOm](https://www.prepwiser.in/questions/GHKS2XOdOm)

The position, velocity and acceleration of a particle moving with a constant acceleration can be represented by:

**Q16** Rotational Motion[Step-by-step solution > prepwiser.in/questions/DJ3iAK1hdN](https://www.prepwiser.in/questions/DJ3iAK1hdN)

A thin circular ring of mass M and radius r is rotating about its axis with an angular speed ω . Two particles having mass m each are now attached at diametrically opposite points. The angular speed of the ring will become:

- (A) $\omega \frac{M}{M+m}$ (B) $\omega \frac{M+2m}{M}$ (C) $\omega \frac{M}{M+2m}$ (D) $\omega \frac{M-2m}{M+2m}$

Q17 Units, Dimensions & Errors[Step-by-step solution > prepwiser.in/questions/VeSC1DKdc8](https://www.prepwiser.in/questions/VeSC1DKdc8)

The time period of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$. The measured value of the length of pendulum is 10 cm known to a 1 mm accuracy. The time for 200 oscillations of the pendulum is found to be 100 second using a clock of 1s resolution. The percentage accuracy in the determination of 'g' using this pendulum is 'x'. The value of 'x' to be nearest integer is :-

- (A) 2% (B) 3% (C) 5% (D) 4%

Q18 Wave Optics[Step-by-step solution > prepwiser.in/questions/UZEAT8EUZv](https://www.prepwiser.in/questions/UZEAT8EUZv)

In Young's double slit arrangement, slits are separated by a gap of 0.5 mm, and the screen is placed at a distance of 0.5 m from them. The distance between the first and the third bright fringe formed when the slits are illuminated by a monochromatic light of $5890 \text{ \AA}$ is :-

- (A) $1178 \times 10^{-9} \text{ m}$ (B) $1178 \times 10^{-6} \text{ m}$ (C) $1178 \times 10^{-12} \text{ m}$ (D) $5890 \times 10^{-7} \text{ m}$

Q19 Work, Energy & Power[Step-by-step solution > prepwiser.in/questions/76LpSBdARE](https://www.prepwiser.in/questions/76LpSBdARE)

A constant power delivering machine has towed a box, which was initially at rest, along a horizontal straight line. The distance moved by the box in time 't' is proportional to :-

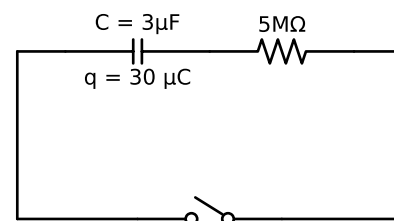
- (A) $t^{2/3}$ (B) $t^{3/2}$ (C) t (D) $t^{1/2}$

Physics Section B · Numerical value

Q20 to Q29

Q20 Electrostatics II: Potential & Capacitance **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/W1q73jfluU](https://www.prepwiser.in/questions/W1q73jfluU)

The circuit shown in the figure consists of a charged capacitor of capacity $3 \mu\text{F}$ and a charge of μC . At time $t = 0$, when the key is closed, the value of current flowing through the $5 \text{ M}\Omega$ resistor is ' x ' μA . The value of ' x ' to the nearest integer is _____.

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

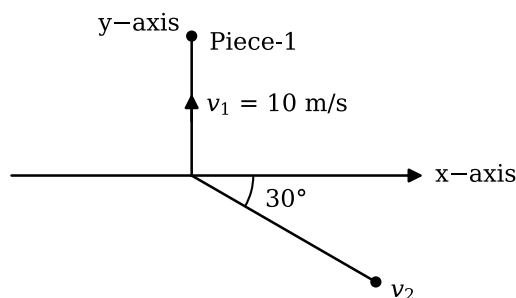
A parallel plate capacitor has plate area 100 m^2 and plate separation of 10 m. The space between the plates is filled up to a thickness 5 m with a material of dielectric constant of 10. The resultant capacitance of the system is ' x ' pF.

The value of $\epsilon_0 = 8.85 \times 10^{-12} \text{ F.m}^{-1}$.

The value of ' x ' to the nearest integer is _____.

Q22 Collision **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/J8gzqUfC-8](https://www.prepwiser.in/questions/J8gzqUfC-8)

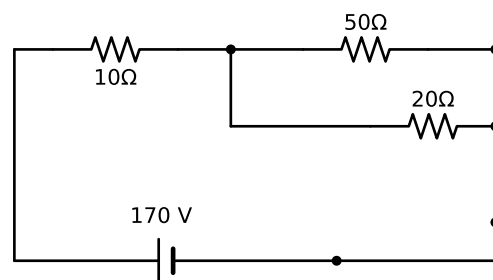
A ball of mass 10 kg moving with a velocity $10\sqrt{3} \text{ m/s}$ along the x-axis, hits another ball of mass 20 kg which is at rest. After the collision, first ball comes to rest while the second ball disintegrates into two equal pieces. One piece starts moving along y-axis with a speed of 10 m/s. The second piece starts moving at an angle of 30° with respect to the x-axis. The velocity of the ball moving at 30° with x-axis is $x \text{ m/s}$. The configuration of pieces after collision is shown in the figure below. The value of x to the nearest integer is _____.



Attempt this paper online with instant answer checking > [prepwiser.in/pyqs/paper/2021-03-18-morning](https://www.prepwiser.in/pyqs/paper/2021-03-18-morning)

Q23 Current Electricity **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/1r9hJRgZg0) > prepwiser.in/questions/1r9hJRgZg0

The voltage across the 10Ω resistor in the given circuit is x volt.
The value of ' x ' to the nearest integer is _____.

**Q24** Semiconductors & Electronic Devices **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/c2lgOjNp45) > prepwiser.in/questions/c2lgOjNp45

An npn transistor operates as a common emitter amplifier with a power gain of 10^6 . The input circuit resistance is 100Ω and the output load resistance is $10\text{ K}\Omega$. The common emitter current gain ' β ' will be _____. (Round off to the Nearest Integer).

Q25 Work, Energy & Power **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/G9YDWFFisc) > prepwiser.in/questions/G9YDWFFisc

A bullet of mass 0.1 kg is fired on a wooden block to pierce through it, but it stops after moving a distance of 50 cm into it. If the velocity of bullet before hitting the wood is 10 m/s and it slows down with uniform deceleration, then the magnitude of effective retarding force on the bullet is ' x ' N. The value of ' x ' to the nearest integer is _____.

Q26 Projectile Motion & Relative Motion **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/dKFtMUHnge) > prepwiser.in/questions/dKFtMUHnge

A person is swimming with a speed of 10 m/s at an angle of 120° with the flow and reaches to a point directly opposite on the other side of the river. The speed of the flow is ' x ' m/s. The value of ' x ' to the nearest integer is _____.

Q27 Elasticity **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/jzY67aP4tk) > prepwiser.in/questions/jzY67aP4tk

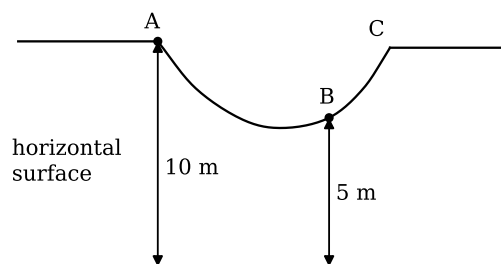
Two separate wires A and B are stretched by 2 mm and 4 mm respectively, when they are subjected to a force of 2 N . Assume that both the wires are made up of same material and the radius of wire B is 4 times that of the radius of wire A. The length of the wires A and B are in the ratio of $a : b$. Then a/b can be expressed as $1/x$ where x is _____.

Q28 Simple Harmonic Motion **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/TSbvPPBC5L) > prepwiser.in/questions/TSbvPPBC5L

A particle performs simple harmonic motion with a period of 2 second . The time taken by the particle to cover a displacement equal to half of its amplitude from the mean position is $\frac{1}{a}\text{ s}$. The value of ' a ' to the nearest integer is _____.

Q29 Work, Energy & Power **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/xGa2vnqjcx) > prepwiser.in/questions/xGa2vnqjcx

As shown in the figure, a particle of mass 10 kg is placed at a point A. When the particle is slightly displaced to its right, it starts moving and reaches the point B. The speed of the particle at B is $x\text{ m/s}$. (Take $g = 10\text{ m/s}^2$)
The value of ' x ' to the nearest integer is _____.



Q30 Carbohydrates & Biomolecules[Step-by-step solution](https://www.prepwisar.in/questions/4-HqnRPsHB) · prepwisar.in/questions/4-HqnRPsHB

A non-reducing sugar "A" hydrolyses to give two reducing mono saccharides. Sugar A is

- (A) Fructose (B) Galactose (C) Glucose (D) Sucrose

Q31 Chemistry in Everyday Life[Step-by-step solution](https://www.prepwisar.in/questions/9CQwp3RTHk) · prepwisar.in/questions/9CQwp3RTHk

Match the list - I with list - II

(A) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)

(B) (a) - (iv), (b) - (i), (c) - (ii), (d) - (iii)

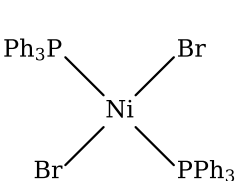
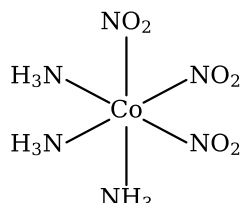
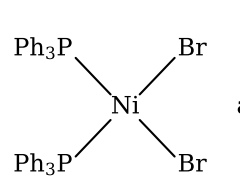
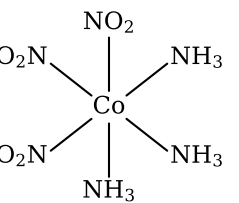
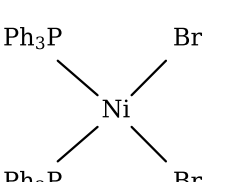
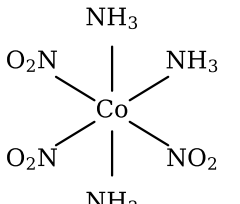
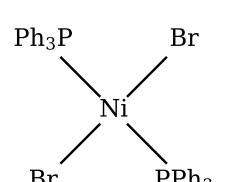
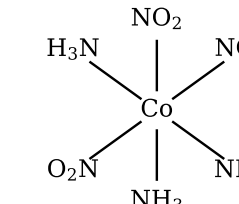
(C) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)

(D) (a) - (ii), (b) - (iv), (c) - (iii), (d) - (i)

	List - I (Class of Drug)		List - II (Example)
(a)	Antacid	(i)	Novestrol
(b)	Artificial sweetener	(ii)	Cimetidine
(c)	Antifertility	(iii)	Valium
(d)	Tranquilizers	(iv)	Alitame

Q32 Coordination Compounds[Step-by-step solution](https://www.prepwisar.in/questions/ubIkyJc2V) · prepwisar.in/questions/ubIkyJc2V

The correct structures of trans-[NiBr₂(PPh₃)₂] and meridional-[Co(NH₃)₃(NO₂)₃], respectively, are

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

Q33 Coordination Compounds[Step-by-step solution](https://www.prepwisar.in/questions/WSWe44sL_n) · prepwisar.in/questions/WSWe44sL_n

Match List - I with List - II

	List - I		List - II
(a)	Chlorophyll	(i)	Ruthenium
(b)	Vitamin-B ₁₂	(ii)	Platinum
(c)	Anticancer drug	(iii)	Cobalt
(d)	Grubbs catalyst	(iv)	Magnesium

Choose the most appropriate answer from the options given below:

(A) (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i)

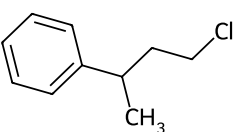
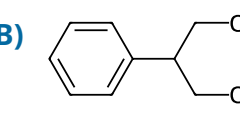
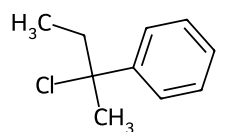
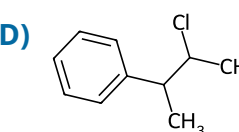
(B) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)

(C) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)

(D) (a) - (iv), (b) - (ii), (c) - (iii), (d) - (i)

Q34 Alcohols, Phenols & Ethers[Step-by-step solution](https://www.prepwisar.in/questions/uXk8IBgsxp) · prepwisar.in/questions/uXk8IBgsxp

Reaction of Grignard reagent, C₂H₅MgBr with C₈H₈O followed by hydrolysis gives compound "A" which reacts instantly with Lucas reagent to give compound B, C₁₀H₁₃Cl. The Compound B is:

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

Attempt this paper online with instant answer checking · [prepwisar.in/pyqs/paper/2021-03-18-morning](https://www.prepwisar.in/pyqs/paper/2021-03-18-morning)

Match List - I with List - II:

List - I (Chemicals)

- (a) Alcoholic potassium hydroxide
- (b) Pd/BaSO₄
- (c) BHC (Benzene hexachloride)
- (d) Polyacetylene

List - II (Use / Preparation / Constituent)

- (i) Electrodes in batteries
- (ii) Obtained by addition reaction
- (iii) Used for β - elimination reaction
- (iv) Lindlar's catalyst

Choose the most appropriate match:

(A) (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)

(B) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)

(C) (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)

(D) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)

Given below are two statements : One is labelled as Assertion A and the other labelled as reason R
 Assertion A : During the boiling of water having temporary hardness, $\text{Mg}(\text{HCO}_3)_2$ is converted to MgCO_3 .

Reason R : The solubility product of $\text{Mg}(\text{OH})_2$ is greater than that of MgCO_3 .

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

(A) Both A and R are true but R is not the correct explanation of A

(B) A is true but R is false

(C) Both A and R are true and R is the correct explanation of A

(D) A is false but R is true

The chemical that is added to reduce the melting point of the reaction mixture during the extraction of aluminium is:

(A) Cryolite

(B) Bauxite

(C) Calamine

(D) Kaolite

Match List - I with List - II

	List - I (process)		List - II (catalyst)
(a)	Deacron's process	(i)	ZSM-5
(b)	Contact process	(ii)	CuCl_2
(c)	Cracking of hydrocarbons	(iii)	Particles 'Ni'
(d)	Hydrogenation of vegetable oils	(iv)	V_2O_5

Choose the most appropriate answer from the options given below:

(A) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

(B) (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)

(C) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

(D) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

The number of ionisable hydrogens present in the product obtained from a reaction of phosphorus trichloride and phosphonic acid is:

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

The ionic radius of Na^+ ions is $1.02 \text{ \AA}$. The ionic radii (in $\text{\AA}$) of Mg^{2+} and Al^{3+} , respectively, are

- (A) 1.05 and 0.99 (B) 0.72 and 0.54 (C) 0.85 and 0.99 (D) 0.68 and 0.72

Match List - I with List - II

	List - I		List - II
(a)	$\text{Ca}(\text{OCl})_2$	(i)	Antacid
(b)	$\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$	(ii)	Cement
(c)	CaO	(iii)	Bleach
(d)	CaCO_3	(iv)	Plaster of paris

Choose the most appropriate answer from the options given below:

- (A) (a) - (i), (b) - (iv), (c) - (iii), (d) - (ii) (B) (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i)
 (C) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i) (D) (a) - (iii), (b) - (ii), (c) - (i), (d) - (iv)

In a binary compound, atoms of element A form a hcp structure and those of element M occupy $\frac{2}{3}$ of the tetrahedral voids of the hcp structure. The formula of the binary compound is:

- (A) M_2A_3 (B) M_4A_3 (C) M_4A (D) MA_3

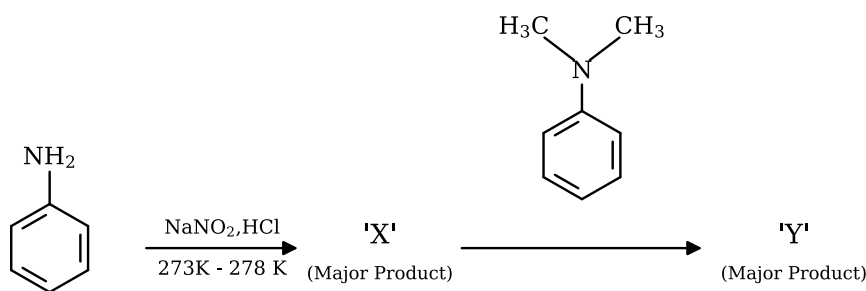
A certain orbital has no angular nodes and two radial nodes. The orbital is:

- (A) 2s (B) 3s (C) 3p (D) 2p

Compound with molecular formula $\text{C}_3\text{H}_6\text{O}$ can show:

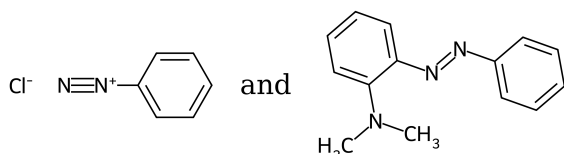
- (A) Positional isomerism (B) Both positional isomerism and metamerism
 (C) Metamerism (D) Functional group isomerism

Attempt this paper online with instant answer checking > [prepwiser.in/pyqs/paper/2021-03-18-morning](#)

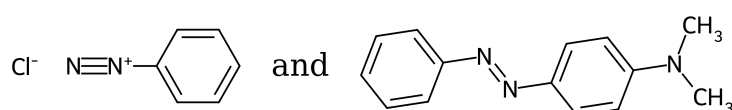


Considering the above reaction, X and Y respectively are:

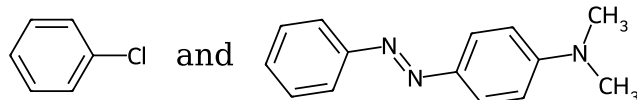
(A)



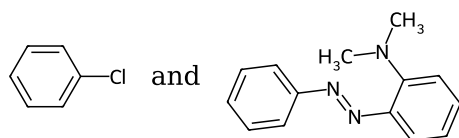
(B)



(C)



(D)



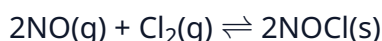
Reagent, 1-naphthylamine and sulphanilic acid in acetic acid is used for the detection of

(A) N_2O (B) NO_3^- (C) NO (D) NO_2^-

Chemistry Section B · Numerical value

Q47 to Q56

AX is a covalent diatomic molecule where A and X are second row elements of periodic table. Based on Molecular orbital theory, the bond order of AX is 2.5. The total number of electrons in AX is _____. (Round off to the Nearest Integer).



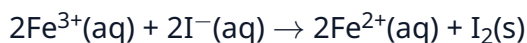
This reaction was studied at -10° and the following data was obtained
 $[\text{NO}]_0$ and $[\text{Cl}_2]_0$ are the initial concentrations and r_0 is the initial reaction rate.

The overall order of the reaction is _____. (Round off to the Nearest Integer).

Run	$[\text{NO}]_0$	$[\text{Cl}_2]_0$	r_0
1	0.10	0.10	0.18
2	0.10	0.20	0.35
3	0.20	0.20	1.40

The total number of unpaired electrons present in the complex $\text{K}_3[\text{Cr}(\text{oxalate})_3]$ is _____.

For the reaction



the magnitude of the standard molar Gibbs free energy change, $\Delta_r G_m^{\circ} = -$ _____ kJ (Round off to the Nearest Integer).

$$\left[\begin{array}{l} E_{\text{Fe}^{2+}/\text{Fe(s)}}^{\circ} = -0.440\text{V}; \quad E_{\text{Fe}^{3+}/\text{Fe(s)}}^{\circ} = -0.036\text{V} \\ E_{\text{I}_2/2\text{I}^{-}}^{\circ} = 0.539\text{V}; \quad F = 96500\text{C} \end{array} \right]$$

In order to prepare a buffer solution of pH 5.74, sodium acetate is added to acetic acid. If the concentration of acetic acid in the buffer is 1.0 M, the concentration of sodium acetate in the buffer is _____ M. (Round off to the Nearest Integer). [Given : pKa (acetic acid) = 4.74]

2 molal solution of a weak acid HA has a freezing point of 3.885°C . The degree of dissociation of this acid is _____ $\times 10^{-3}$. (Round off to the Nearest Integer).

[Given : Molal depression constant of water = $1.85 \text{ K kg mol}^{-1}$ Freezing point of pure water = 0°C]

_____ grams of 3-Hydroxy propanal (MW = 74) must be dehydrated to produce 7.8 g of acrolein (MW = 56) ($\text{C}_3\text{H}_4\text{O}$) if the percentage yield is 64. (Round off to the Nearest Integer).

[Given : Atomic masses : C : 12.0 u, H : 1.0 u, O : 16.0 u]

A reaction of 0.1 mole of Benzylamine with bromomethane gave 23 g of Benzyl trimethyl ammonium bromide. The number of moles of bromomethane consumed in this reaction are $n \times 10^{-1}$, when $n =$ _____. (Round off to the Nearest Integer).

(Given : Atomic masses : C : 12.0 u, H : 1.0 u, N : 14.0 u, Br : 80.0 u)

Complete combustion of 3g of ethane gives $x \times 10^{22}$ molecules of water. The value of x is _____. (Round off to the Nearest Integer). [Use : $N_A = 6.023 \times 10^{23}$; Atomic masses in u : C : 12.0; O : 16.0; H : 1.0]



the reaction enthalpy $\Delta_r H =$ _____ kJ mol^{-1} . (Round off to the Nearest Integer).

[Given : Bond enthalpies in kJ mol^{-1} : C-C : 347, C = C : 611; C-H : 414, H-H : 436]

Mathematics Section A · Multiple choice

Q57 to Q76

Let $(1 + x + 2x^2)^{20} = a_0 + a_1x + a_2x^2 + \dots + a_{40}x^{40}$. Then $a_1 + a_3 + a_5 + \dots + a_{37}$ is equal to

- (A) $2^{20}(2^{20} - 21)$ (B) $2^{19}(2^{20} - 21)$ (C) $2^{19}(2^{20} + 21)$ (D) $2^{20}(2^{20} + 21)$

Attempt this paper online with instant answer checking > prepwiser.in/pyqs/paper/2021-03-18-morning

Q58 Circles[Step-by-step solution](https://www.prepwiser.in/questions/H4vKfKfNVxK) > prepwiser.in/questions/H4vKfKfNVxK

Choose the correct statement about two circles whose equations are given below:

$$x^2 + y^2 - 10x - 10y + 41 = 0$$

$$x^2 + y^2 - 22x - 10y + 137 = 0$$

- (A) circles have same centre
(B) circles have no meeting point
(C) circles have only one meeting point
(D) circles have two meeting points

Q59 Circles[Step-by-step solution](https://www.prepwiser.in/questions/qY6OQrFxm5) > prepwiser.in/questions/qY6OQrFxm5

For the four circles M, N, O and P, following four equations are given:

Circle M : $x^2 + y^2 = 1$

Circle N : $x^2 + y^2 - 2x = 0$

Circle O : $x^2 + y^2 - 2x - 2y + 1 = 0$

Circle P : $x^2 + y^2 - 2y = 0$

If the centre of circle M is joined with centre of the circle N, further center of circle N is joined with centre of the circle O, centre of circle O is joined with the centre of circle P and lastly, centre of circle P is joined with centre of circle M, then these lines form the sides of a:

- (A) Rhombus
(B) Square
(C) Rectangle
(D) Parallelogram

Q60 Complex Numbers[Step-by-step solution](https://www.prepwiser.in/questions/zeqIKFzVEU) > prepwiser.in/questions/zeqIKFzVEU

If the equation $a|z|^2 + \overline{\alpha}z + \alpha\overline{z} + d = 0$ represents a circle where a, d are real constants then which of the following condition is correct?

- (A) $|\alpha|^2 - ad \neq 0$
(B) $|\alpha|^2 - ad > 0$ and $a \in \mathbb{R} - \{0\}$
(C) $|\alpha|^2 - ad \geq 0$ and $a \in \mathbb{R}$
(D) $\alpha = 0, a, d \in \mathbb{R}^+$

Q61 Differential Equations[Step-by-step solution](https://www.prepwiser.in/questions/8TW_-sZspM) > prepwiser.in/questions/8TW_-sZspM

The differential equation satisfied by the system of parabolas

$$y^2 = 4a(x + a) \text{ is:}$$

- (A) $y \left(\frac{dy}{dx} \right)^2 - 2x \left(\frac{dy}{dx} \right) - y = 0$
(B) $y \left(\frac{dy}{dx} \right)^2 - 2x \left(\frac{dy}{dx} \right) + y = 0$
(C) $y \left(\frac{dy}{dx} \right)^2 + 2x \left(\frac{dy}{dx} \right) - y = 0$
(D) $y \left(\frac{dy}{dx} \right)^2 + 2x \left(\frac{dy}{dx} \right) + y = 0$

Q62 Relations & Functions (Basic)[Step-by-step solution](https://www.prepwiser.in/questions/rPxBpkFHMI) > prepwiser.in/questions/rPxBpkFHMI

The real valued function

$$f(x) = \frac{\cos e c^{-1} x}{\sqrt{x - [x]}}, \text{ where } [x] \text{ denotes the greatest integer less than or equal to } x, \text{ is defined for all } x$$

belonging to:

- (A) all real except integers
(B) all non-integers except the interval $[-1, 1]$
(C) all integers except 0, -1, 1
(D) all real except the interval $[-1, 1]$

Attempt this paper online with instant answer checking > [prepwiser.in/pyqs/paper/2021-03-18-morning](https://www.prepwiser.in/pyqs/paper/2021-03-18-morning)

Q63 Functions (Advanced)[Step-by-step solution > prepwise.in/questions/9-iywGN156](https://www.prepwise.in/questions/9-iywGN156)

If the functions are defined as $f(x) = \sqrt{x}$ and $g(x) = \sqrt{1-x}$, then what is the common domain of the following functions:

$f+g, f-g, f/g, g/f, g-f$ where $(f \pm g)(x) = f(x) \pm g(x), (f/g)x = \frac{f(x)}{g(x)}$

- (A) $0 \leq x \leq 1$ (B) $0 \leq x < 1$ (C) $0 < x < 1$ (D) $0 < x \leq 1$

Q64 Limits[Step-by-step solution > prepwise.in/questions/5XCKGyadBW](https://www.prepwise.in/questions/5XCKGyadBW)

If

$$\lim_{x \rightarrow 0} \frac{\sin^{-1}x - \tan^{-1}x}{3x^3}$$

is equal to L, then the value of $(6L + 1)$ is

- (A) $\frac{1}{6}$ (B) $\frac{1}{2}$ (C) 6 (D) 2

Q65 Continuity & Differentiability[Step-by-step solution > prepwise.in/questions/-vqdi0yVXh](https://www.prepwise.in/questions/-vqdi0yVXh)

If

$$f(x) = \begin{cases} \frac{1}{x^2} & ; |x| \geq 1 \\ ax^2 + b & ; |x| < 1 \end{cases}$$

is differentiable at every point of the domain, then the values of a and b are respectively:

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

Q66 Determinants[Step-by-step solution > prepwise.in/questions/LBTJKnRFFw](https://www.prepwise.in/questions/LBTJKnRFFw)

The solutions of the equation

$$\begin{vmatrix} 1 + \sin^2 x & \sin^2 x & \sin^2 x \\ \cos^2 x & 1 + \cos^2 x & \cos^2 x \\ 4 \sin 2x & 4 \sin 2x & 1 + 4 \sin 2x \end{vmatrix} = 0, (0 < x < \pi)$$

, are

- (A) $\frac{\pi}{12}, \frac{\pi}{6}$ (B) $\frac{\pi}{6}, \frac{5\pi}{6}$ (C) $\frac{5\pi}{12}, \frac{7\pi}{12}$ (D) $\frac{7\pi}{12}, \frac{11\pi}{12}$

Q67 Determinants[Step-by-step solution > prepwise.in/questions/h3USk-8Iso](https://www.prepwise.in/questions/h3USk-8Iso)

Let α, β, γ be the real roots of the equation, $x^3 + ax^2 + bx + c = 0$, ($a, b, c \in \mathbb{R}$ and $a, b \neq 0$). If the system of equations (in u, v, w) given by $\alpha u + \beta v + \gamma w = 0, \beta u + \gamma v + \alpha w = 0; \gamma u + \alpha v + \beta w = 0$ has non-trivial solution, then the value of $\frac{a^2}{b}$ is

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

Attempt this paper online with instant answer checking > [prepwise.in/pyqs/paper/2021-03-18-morning](https://www.prepwise.in/pyqs/paper/2021-03-18-morning)

Let

$$A + 2B = \begin{bmatrix} 1 & 2 & 0 \\ 6 & -3 & 3 \\ -5 & 3 & 1 \end{bmatrix}$$

and

$$2A - B = \begin{bmatrix} 2 & -1 & 5 \\ 2 & -1 & 6 \\ 0 & 1 & 2 \end{bmatrix}$$

. If $\text{Tr}(A)$ denotes the sum of all diagonal elements of the matrix A , then $\text{Tr}(A) - \text{Tr}(B)$ has value equal to

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

The sum of all the 4-digit distinct numbers that can be formed with the digits 1, 2, 2 and 3 is:

- (A) 26664 (B) 122664 (C) 122234 (D) 22264

The value of $3 + \frac{1}{4 + \frac{1}{3 + \frac{1}{4 + \frac{1}{3 + \dots \infty}}}}$ is equal to

- (A) $1.5 + \sqrt{3}$ (B) $2 + \sqrt{3}$ (C) $3 + 2\sqrt{3}$ (D) $4 + \sqrt{3}$

If α, β are natural numbers such that
 $100^\alpha - 199^\beta = (100)(100) + (99)(101) + (98)(102) + \dots + (1)(199)$, then the slope of the line passing through (α, β) and origin is:

- (A) 540 (B) 550 (C) 530 (D) 510

$$\frac{1}{3^2 - 1} + \frac{1}{5^2 - 1} + \frac{1}{7^2 - 1} + \dots + \frac{1}{(201)^2 - 1}$$

is equal to

- (A) $\frac{101}{404}$ (B) $\frac{25}{101}$ (C) $\frac{101}{408}$ (D) $\frac{99}{400}$

A vector $\vec{a}$ has components $3p$ and 1 with respect to a rectangular cartesian system. This system is rotated through a certain angle about the origin in the counter clockwise sense. If, with respect to new system, $\vec{a}$ has components $p + 1$ and $\sqrt{10}$, then the value of p is equal to:

- (A) 1 (B) $-\frac{5}{4}$ (C) $\frac{4}{5}$ (D) -1

The number of integral values of m so that the abscissa of point of intersection of lines $3x + 4y = 9$ and $y = mx + 1$ is also an integer, is:

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

Q75 Straight Lines[Step-by-step solution](#) › prepwiser.in/questions/EBWyxGH_4n

The equation of one of the straight lines which passes through the point $(1, 3)$ and makes an angle $\tan^{-1}(\sqrt{2})$ with the straight line, $y + 1 = 3\sqrt{2}x$ is:

(A) $4\sqrt{2}x + 5y - (15 + 4\sqrt{2}) = 0$

(B) $5\sqrt{2}x + 4y - (15 + 4\sqrt{2}) = 0$

(C) $4\sqrt{2}x + 5y - 4\sqrt{2} = 0$

(D) $4\sqrt{2}x - 5y - (5 + 4\sqrt{2}) = 0$

Q76 Indefinite Integration[Step-by-step solution](#) › prepwiser.in/questions/U2b1vjGIYm

The integral $\int \frac{(2x-1) \cos \sqrt{(2x-1)^2+5}}{\sqrt{4x^2-4x+6}} dx$ is equal to (where c is a constant of integration)

(A) $\frac{1}{2} \sin \sqrt{(2x-1)^2+5} + c$

(B) $\frac{1}{2} \cos \sqrt{(2x+1)^2+5} + c$

(C) $\frac{1}{2} \cos \sqrt{(2x-1)^2+5} + c$

(D) $\frac{1}{2} \sin \sqrt{(2x+1)^2+5} + c$

Mathematics Section B · Numerical value

Q77 to Q85

Q77 Three Dimensional Geometry **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/HiVYukESmz

Let the plane $ax + by + cz + d = 0$ bisect the line joining the points $(4, -3, 1)$ and $(2, 3, -5)$ at the right angles. If a, b, c, d are integers, then the minimum value of $(a^2 + b^2 + c^2 + d^2)$ is _____.

Q78 Three Dimensional Geometry **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/AKIYaIotbc

The equation of the planes parallel to the plane $x - 2y + 2z - 3 = 0$ which are at unit distance from the point $(1, 2, 3)$ is $ax + by + cz + d = 0$. If $(b - d) = k(c - a)$, then the positive value of k is:

Q79 Complex Numbers **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/Z0wajCTm_p

Let z_1, z_2 be the roots of the equation $z^2 + az + 12 = 0$ and z_1, z_2 form an equilateral triangle with origin. Then, the value of $|a|$ is:

Q80 Definite Integration **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/Us4J_4eIEi

Let $f(x)$ and $g(x)$ be two functions satisfying $f(x^2) + g(4 - x) = 4x^3$ and $g(4 - x) + g(x) = 0$, then the value of $\int_{-4}^4 f(x)^2 dx$ is

Q81 Permutations & Combinations **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/el488CIp27

The number of times the digit 3 will be written when listing the integers from 1 to 1000 is:

Q82 Statistics **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/yxwom2gjql

The mean age of 25 teachers in a school is 40 years. A teacher retires at the age of 60 years and a new teacher is appointed in his place. If the mean age of the teachers in this school now is 39 years, then the age (in years) of the newly appointed teacher is _____.

Q83 Trigonometric Equations **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/yDppOqKQz5

The number of solutions of the equation $|\cot x| = \cot x + \frac{1}{\sin x}$ in the interval $[0, 2\pi]$ is

A square ABCD has all its vertices on the curve $x^2y^2 = 1$. The midpoints of its sides also lie on the same curve. Then, the square of area of ABCD is _____.

If $f(x) = \int \frac{5x^8 + 7x^6}{(x^2 + 1 + 2x^7)^2} dx$, ($x \geq 0$), $f(0) = 0$ and $f(1) = \frac{1}{K}$, then the value of K is

Answer key: JEE Main 2021 · 18 Mar · 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/2021-03-18-morning

Physics

1. A	2. A	3. B	4. C	5. A	6. D	7. C	8. B	9. B	10. B
11. A	12. A	13. D	14. A	15. B	16. C	17. B	18. B	19. B	20. 2
21. 161	22. 20	23. 70	24. 100	25. 10	26. 5	27. 32	28. 6	29. 10	

Chemistry

30. D	31. A	32. D	33. B	34. C	35. B	36. D	37. A	38. A	39. C
40. B	41. C	42. B	43. B	44. D	45. B	46. D	47. 15	48. 3	49. 3
50. 45	51. 10	52. 50	53. 16	54. 3	55. 18	56. 128			

Mathematics

57. B	58. C	59. B	60. B	61. C	62. B	63. C	64. D	65. D	66. D
67. B	68. B	69. A	70. A	71. B	72. B	73. D	74. B	75. A	76. A
77. 28	78. 4	79. 6	80. 512	81. 300	82. 35	83. 1	84. 80	85. 4	

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 prepwisar.in/pyqs/paper/2021-03-18-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 prepwisar.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: prepwisar.in/pyq-pdfs/jee-main/2021/

Chapter-wise PYQ PDFs

Every chapter with answer keys, 2020 to 2026: prepwisar.in/pyq-pdfs/

Daily Arena

10 questions from one chapter, every day: prepwisar.in/arena

Spotted a mistake in this PDF? Tell us at prepwisar.in/feedback.