

JEE MAIN 2022 · QUESTION PAPER

25 Jul 2022 Shift 1

82 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	19 Q1 to Q19	9 Q20 to Q28
● Chemistry	17 Q29 to Q45	9 Q46 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/2022-07-25-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/ijw9htkKCr](https://www.prepwisar.in/questions/ijw9htkKCr)

To increase the resonant frequency in series LCR circuit,

- (A) source frequency should be increased.
- (B) another resistance should be added in series with the first resistance.
- (C) another capacitor should be added in series with the first capacitor.
- (D) the source frequency should be decreased.

Q2 Atomic Physics

[Step-by-step solution](#) > [prepwisar.in/questions/-52ZU0b40s](https://www.prepwisar.in/questions/-52ZU0b40s)

The momentum of an electron revolving in n^{th} orbit is given by:

(Symbols have their usual meanings)

- (A) $\frac{nh}{2\pi r}$
- (B) $\frac{nh}{2r}$
- (C) $\frac{nh}{2\pi}$
- (D) $\frac{2\pi r}{nh}$

Q3 Atomic Physics

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

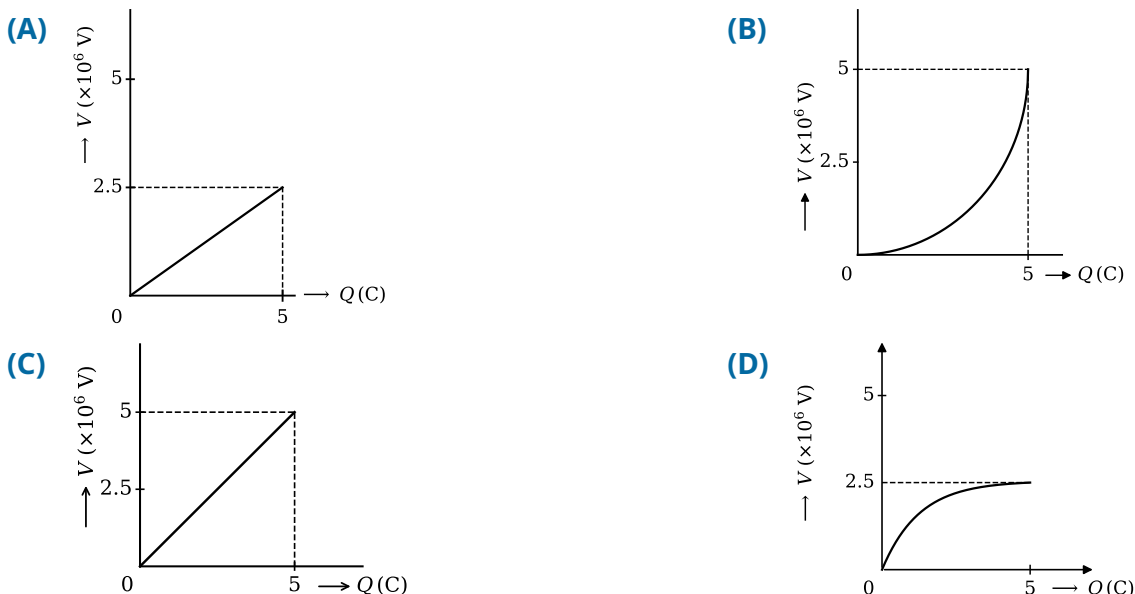
The magnetic moment of an electron (e) revolving in an orbit around nucleus with an orbital angular momentum is given by:

- (A) $\vec{\mu}_L = \frac{e\vec{L}}{2m}$
- (B) $\vec{\mu}_L = -\frac{e\vec{L}}{2m}$
- (C) $\vec{\mu}_L = -\frac{e\vec{L}}{m}$
- (D) $\vec{\mu}_L = \frac{2e\vec{L}}{m}$

Q4 Electrostatics II: Potential & Capacitance

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

A condenser of $2 \mu\text{F}$ capacitance is charged steadily from 0 to 5 C. Which of the following graph represents correctly the variation of potential difference (V) across it's plates with respect to the charge (Q) on the condenser?



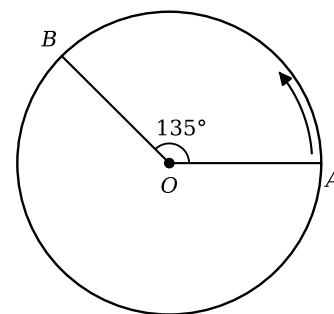
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Q5 Rectilinear Motion[Step-by-step solution](https://www.prepwise.in/questions/hhl5PeDD_k) > prepwise.in/questions/hhl5PeDD_k

A person moved from A to B on a circular path as shown in figure. If the distance travelled by him is 60m, then the magnitude of displacement would be:

(Given $\cos 135^\circ = -0.7$)

- (A) 42 m (B) 47 m (C) 19 m (D) 40 m

**Q6** Units, Dimensions & Errors[Step-by-step solution](https://www.prepwise.in/questions/0c5jxCqss7) > prepwise.in/questions/0c5jxCqss7

Which of the following physical quantities have the same dimensions?

- (A) Electric displacement ($\vec{D}$) and surface charge density
(B) Displacement current and electric field
(C) Current density and surface charge density
(D) Electric potential and energy

Q7 Dual Nature of Radiation & Matter[Step-by-step solution](https://www.prepwise.in/questions/T05m6bCg7C) > prepwise.in/questions/T05m6bCg7C

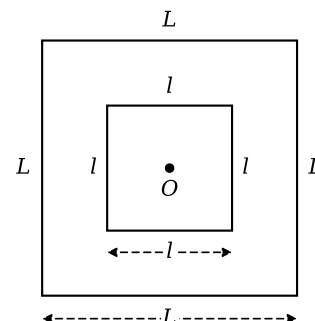
A metal exposed to light of wavelength 800nm and emits photoelectrons with a certain kinetic energy. The maximum kinetic energy of photo-electron doubles when light of wavelength 500nm is used. The workfunction of the metal is : (Take $hc = 1230 \text{ eV} - \text{nm}$).

- (A) 1.537 eV (B) 2.46 eV (C) 0.615 eV (D) 1.23 eV

Q8 Electromagnetic Induction[Step-by-step solution](https://www.prepwise.in/questions/QnK0lnAos1) > prepwise.in/questions/QnK0lnAos1

A small square loop of wire of side l is placed inside a large square loop of wire L ($L \gg l$). Both loops are coplanar and their centres coincide at point O as shown in figure. The mutual inductance of the system is:

- (A) $\frac{2\sqrt{2}\mu_0 L^2}{\pi l}$ (B) $\frac{\mu_0 l^2}{2\sqrt{2}\pi L}$ (C) $\frac{2\sqrt{2}\mu_0 l^2}{\pi L}$ (D) $\frac{\mu_0 L^2}{2\sqrt{2}\pi l}$

**Q9** Alternating Current[Step-by-step solution](https://www.prepwise.in/questions/LxOgNSgecA) > prepwise.in/questions/LxOgNSgecA

The rms value of conduction current in a parallel plate capacitor is $6.9 \mu\text{A}$. The capacity of this capacitor, if it is connected to 230V ac supply with an angular frequency of 600 rad/s, will be:

- (A) 5 pF (B) 50 pF (C) 100 pF (D) 200 pF

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Q10 Semiconductors & Electronic Devices[Step-by-step solution > prepwiser.in/questions/G9JHHb0UWk](https://www.prepwiser.in/questions/G9JHHb0UWk)

In the circuit, the logical value of $A = 1$ or $B = 1$ when potential at A or B is $5V$ and the logical value of $A = 0$ or $B = 0$ when potential at A or B is $0V$.

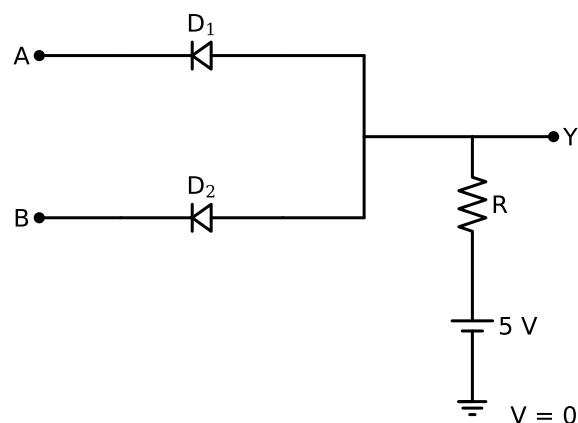
The truth table of the given circuit will be:

A	B	Y
0	0	0
(A) 1	0	0
0	1	0
1	1	1

A	B	Y
0	0	0
(B) 1	0	1
0	1	1
1	1	1

A	B	Y
0	0	0
(C) 1	0	0
0	1	0
1	1	0

A	B	Y
0	0	1
(D) 1	0	1
0	1	1
1	1	0

**Q11** Ray Optics[Step-by-step solution > prepwiser.in/questions/QKa4WYCsnh](https://www.prepwiser.in/questions/QKa4WYCsnh)

Which of the following statement is correct?

- (A) In primary rainbow, observer sees red colour on the top and violet on the bottom
- (B) In primary rainbow, observer sees violet colour on the top and red on the bottom
- (C) In primary rainbow, light wave suffers total internal reflection twice before coming out of water drops.
- (D) Primary rainbow is less bright than secondary rainbow.

Q12 Ray Optics[Step-by-step solution > prepwiser.in/questions/mlq3_3DD2O](https://www.prepwiser.in/questions/mlq3_3DD2O)

Time taken by light to travel in two different materials A and B of refractive indices μ_A and μ_B of same thickness is t_1 and t_2 respectively. If $t_2 - t_1 = 5 \times 10^{-10}$ s and the ratio of μ_A to μ_B is $1 : 2$. Then, the thickness of material, in meter is: (Given v_A and v_B are velocities of light in A and B materials respectively.)

- (A) $5 \times 10^{-10} v_A$ m (B) 5×10^{-10} m (C) 1.5×10^{-10} m (D) $5 \times 10^{-10} v_B$ m

Q13 Gravitation[Step-by-step solution > prepwiser.in/questions/-7MatcW8O-](https://www.prepwiser.in/questions/-7MatcW8O-)

Three identical particles A , B and C of mass 100kg each are placed in a straight line with $AB = BC = 13\text{m}$. The gravitational force on a fourth particle P of the same mass is F , when placed at a distance 13m from the particle B on the perpendicular bisector of the line AC . The value of F will be approximately:

- (A) 21 G (B) 100 G (C) 59 G (D) 42 G

Q14 Thermodynamics[Step-by-step solution > prepwiser.in/questions/O2axjMpDQM](https://www.prepwiser.in/questions/O2axjMpDQM)

A certain amount of gas of volume V at 27°C temperature and pressure $2 \times 10^7 \text{Nm}^{-2}$ expands isothermally until its volume gets doubled. Later it expands adiabatically until its volume gets redoubled. The final pressure of the gas will be (Use $\gamma = 1.5$):

- (A) $3.536 \times 10^5 \text{Pa}$ (B) $3.536 \times 10^6 \text{Pa}$ (C) $1.25 \times 10^6 \text{Pa}$ (D) $1.25 \times 10^5 \text{Pa}$

Q15 Moving Charges & Magnetism[Step-by-step solution](https://www.prepwisar.in/questions/0fAi0iySro) › prepwisar.in/questions/0fAi0iySro

Two charged particles, having same kinetic energy, are allowed to pass through a uniform magnetic field perpendicular to the direction of motion. If the ratio of radii of their circular paths is 6 : 5 and their respective masses ratio is 9 : 4. Then, the ratio of their charges will be:

- (A) 8 : 5 (B) 5 : 4 (C) 5 : 3 (D) 8 : 7

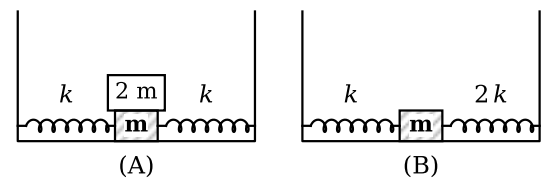
Q16 Rotational Motion[Step-by-step solution](https://www.prepwisar.in/questions/en2Yw3FFzc) › prepwisar.in/questions/en2Yw3FFzc

A solid cylinder and a solid sphere, having same mass M and radius R , roll down the same inclined plane from top without slipping. They start from rest. The ratio of velocity of the solid cylinder to that of the solid sphere, with which they reach the ground, will be:

- (A) $\sqrt{\frac{5}{3}}$ (B) $\sqrt{\frac{4}{5}}$ (C) $\sqrt{\frac{3}{5}}$ (D) $\sqrt{\frac{14}{15}}$

Q17 Simple Harmonic Motion[Step-by-step solution](https://www.prepwisar.in/questions/QzxfMck8pR) › prepwisar.in/questions/QzxfMck8pR

In figure (A), mass ' $2m$ ' is fixed on mass ' m ' which is attached to two springs of spring constant k . In figure (B), mass ' m ' is attached to two springs of spring constant ' k ' and ' $2k$ '. If mass ' m ' in (A) and in (B) are displaced by distance ' x ' horizontally and then released, then time period T_1 and T_2 corresponding to (A) and (B) respectively follow the relation.



- (A) $\frac{T_1}{T_2} = \frac{3}{\sqrt{2}}$ (B) $\frac{T_1}{T_2} = \sqrt{\frac{3}{2}}$ (C) $\frac{T_1}{T_2} = \sqrt{\frac{2}{3}}$ (D) $\frac{T_1}{T_2} = \frac{\sqrt{2}}{3}$

Q18 Work, Energy & Power[Step-by-step solution](https://www.prepwisar.in/questions/U8IT-g1Iiz) › prepwisar.in/questions/U8IT-g1Iiz

A body of mass 0.5kg travels on straight line path with velocity $v = (3x^2 + 4)$ m/s. The net workdone by the force during its displacement from $x = 0$ to $x = 2$ m is:

- (A) 64 J (B) 60 J (C) 120 J (D) 128 J

Q19 Units, Dimensions & Errors[Step-by-step solution](https://www.prepwisar.in/questions/boP2_Ty9OT) › prepwisar.in/questions/boP2_Ty9OT

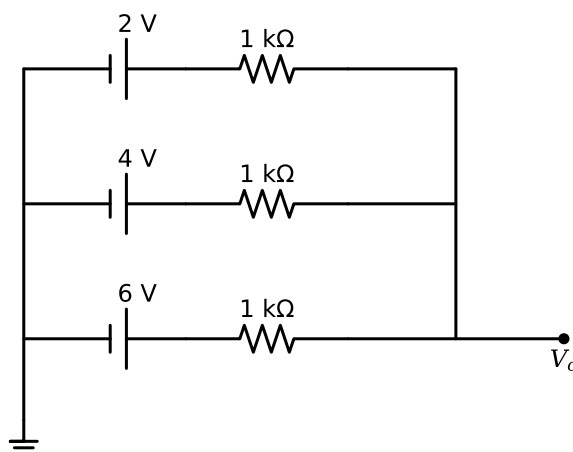
If momentum $[P]$, area $[A]$ and time $[T]$ are taken as fundamental quantities, then the dimensional formula for coefficient of viscosity is:

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

Q20 Semiconductors & Electronic Devices **NUMERICAL**

[Step-by-step solution](https://prepwiser.in/questions/rIjN3nLRdW) > prepwiser.in/questions/rIjN3nLRdW

In the given figure, the value of V_o will be _____ V.



Q21 Current Electricity **NUMERICAL**

[Step-by-step solution](https://prepwiser.in/questions/8RaN3BXIHB) > prepwiser.in/questions/8RaN3BXIHB

Eight copper wire of length l and diameter d are joined in parallel to form a single composite conductor of resistance R . If a single copper wire of length $2l$ have the same resistance (R) then its diameter will be _____ d .

Q22 Semiconductors & Electronic Devices **NUMERICAL**

[Step-by-step solution](https://prepwiser.in/questions/7NMqg7w88R) > prepwiser.in/questions/7NMqg7w88R

The energy band gap of semiconducting material to produce violet (wavelength = $4000 \text{ \AA}$) LED is _____ eV. (Round off to the nearest integer).

Q23 Electrostatics I: Charges, Field & Gauss's Law **NUMERICAL**

[Step-by-step solution](https://prepwiser.in/questions/uQV5zhE6dk) > prepwiser.in/questions/uQV5zhE6dk

The volume charge density of a sphere of radius 6m is $2 \mu\text{C cm}^{-3}$. The number of lines of force per unit surface area coming out from the surface of the sphere is _____ $\times 10^{10} \text{ NC}^{-1}$.

[Given : Permittivity of vacuum

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$$

)

Q24 Thermometry & Calorimetry **NUMERICAL**

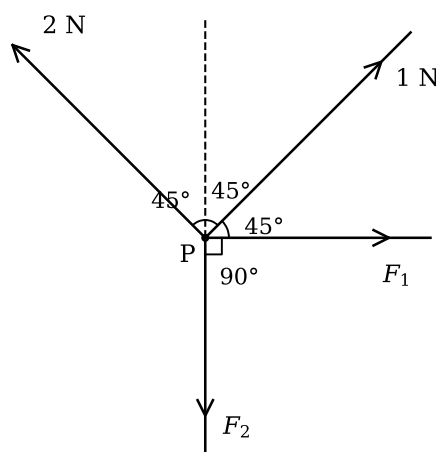
[Step-by-step solution](https://prepwiser.in/questions/HWPZrNE4Zz) > prepwiser.in/questions/HWPZrNE4Zz

A unit scale is to be prepared whose length does not change with temperature and remains 20cm , using a bimetallic strip made of brass and iron each of different length. The length of both components would change in such a way that difference between their lengths remains constant. If length of brass is 40cm and length of iron will be _____ cm. ($\alpha_{\text{iron}} = 1.2 \times 10^{-5} \text{ K}^{-1}$ and $\alpha_{\text{brass}} = 1.8 \times 10^{-5} \text{ K}^{-1}$).

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Q25 Vectors **NUMERICAL**[Step-by-step solution](https://prepwiser.in/questions/NywzWpXaio)

Four forces are acting at a point P in equilibrium as shown in figure. The ratio of force F_1 to F_2 is $1 : x$ where $x =$ _____.

**Q26** Rectilinear Motion **NUMERICAL**[Step-by-step solution](https://prepwiser.in/questions/Q7JFg1UZ6o)

A car is moving with speed of 150 km/h and after applying the break it will move 27 m before it stops. If the same car is moving with a speed of one third the reported speed then it will stop after travelling _____ m distance.

Q27 Elasticity **NUMERICAL**[Step-by-step solution](https://prepwiser.in/questions/PQgVnu7cUv)

A wire of length L and radius r is clamped rigidly at one end. When the other end of the wire is pulled by a force F , its length increases by 5 cm. Another wire of the same material of length $4L$ and radius $4r$ is pulled by a force $4F$ under same conditions. The increase in length of this wire is _____ cm.

Q28 Sound Waves **NUMERICAL**[Step-by-step solution](https://prepwiser.in/questions/DDwVufk5SZ)

An observer is riding on a bicycle and moving towards a hill at 18 kmh^{-1} . He hears a sound from a source at some distance behind him directly as well as after its reflection from the hill. If the original frequency of the sound as emitted by source is 640 Hz and velocity of the sound in air is 320 m/s, the beat frequency between the two sounds heard by observer will be _____ Hz.

Chemistry Section A · Multiple choice

Q29 to Q45

Q29 Alcohols, Phenols & Ethers[Step-by-step solution](https://prepwiser.in/questions/Hb944cHcP8)

Given below are two statements:

Statement I : On heating with KHSO_4 , glycerol is dehydrated and acrolein is formed.

Statement II : Acrolein has fruity odour and can be used to test glycerol's presence.

Choose the correct option.

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

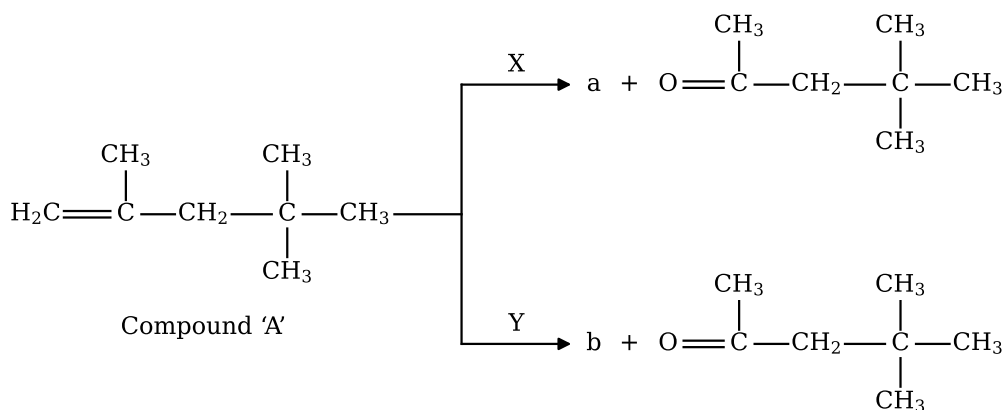
During the denaturation of proteins, which of these structures will remain intact?

- (A) Primary (B) Secondary (C) Tertiary (D) Quaternary

Drugs used to bind to receptors, inhibiting its natural function and blocking a message are called:

- (A) Agonists (B) Antagonists (C) Allosterists (D) Anti histaminists

A compound 'A' on reaction with 'X' and 'Y' produces the same major product but different by product 'a' and 'b'. Oxidation of 'a' gives a substance produced by ants.



'X' and 'Y' respectively are

- (A) KMnO_4/H^+ and dil. KMnO_4 , 273K (B) KMnO_4 (dilute), 273K and KMnO_4/H^+
 (C) KMnO_4/H^+ and $\text{O}_3, \text{H}_2\text{O}/\text{Zn}$ (D) $\text{O}_3, \text{H}_2\text{O}/\text{Zn}$ and KMnO_4/H^+

The reaction of H_2O_2 with potassium permanganate in acidic medium leads to the formation of mainly:

- (A) Mn^{2+} (B) Mn^{4+} (C) Mn^{3+} (D) Mn^{6+}

20mL of 0.1 M NH_4OH is mixed with 40mL of 0.05M HCl . The pH of the mixture is nearest to:

(Given:

$$K_b(\text{NH}_4\text{OH}) = 1 \times 10^{-5}, \log 2 = 0.30, \log 3 = 0.48, \log 5 = 0.69, \log 7 = 0.84, \log 11 = 1.04)$$

- (A) 3.2 (B) 4.2 (C) 5.2 (D) 6.2

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The compound(s) that is (are) removed as slag during the extraction of copper is:

- (A) CaO
(B) FeO
(C) Al₂O₃
(D) ZnO
(E) NiO

Choose the correct answer from the options given below:

- (A) (C), (D) only (B) (A), (B), (E) only (C) (A), (B) only (D) (B) only

Match List I with List II

	List I		List II
(A)	$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$	(I)	Cu
(B)	$\text{CO}(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g})$	(II)	$\text{Cu/ZnO} - \text{Cr}_2\text{O}_3$
(C)	$\text{CO}(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{HCHO}(\text{g})$	(III)	$\text{Fe}_x\text{O}_y + \text{K}_2\text{O} + \text{Al}_2\text{O}_3$
(D)	$\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_3\text{OH}(\text{g})$	(IV)	Ni

Choose the correct answer from the options given below:

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

The geometry around boron in the product 'B' formed from the following reaction is



- (A) trigonal planar (B) tetrahedral (C) pyramidal (D) square planar

The interhalogen compound formed from the reaction of bromine with excess of fluorine is a:

- (A) hypohalite (B) halate (C) perhalate (D) halite

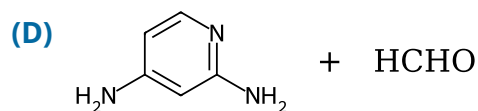
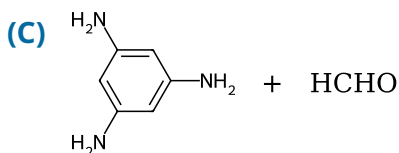
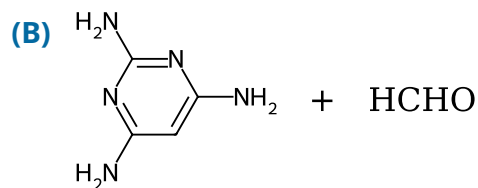
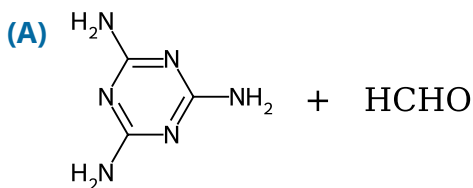
The IUPAC nomenclature of an element with electronic configuration $[\text{Rn}] 5f^{14}6d^17s^2$ is:

- (A) Unnilbium (B) Unnilunium (C) Unnilquadium (D) Unniltrium

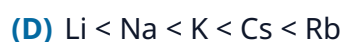
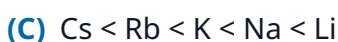
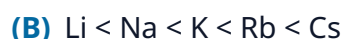
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Q40 Polymers[Step-by-step solution > prepwiser.in/questions/16lsmtm7T5](https://www.prepwiser.in/questions/16lsmtm7T5)

Melamine polymer is formed by the condensation of:

**Q41** Hydrogen & s-Block Elements[Step-by-step solution > prepwiser.in/questions/eCo_52gt5x](https://www.prepwiser.in/questions/eCo_52gt5x)

Choose the correct order of density of the alkali metals:

**Q42** Solutions & Colligative Properties[Step-by-step solution > prepwiser.in/questions/wq8br131uh](https://www.prepwiser.in/questions/wq8br131uh)

The depression in freezing point observed for a formic acid solution of concentration 0.5 mL^{-1} is 0.0405°C . Density of formic acid is 1.05 g mL^{-1} . The Van't Hoff factor of the formic acid solution is nearly : (Given for water $k_f = 1.86 \text{ k kg mol}^{-1}$)

**Q43** Mole Concept & Stoichiometry[Step-by-step solution > prepwiser.in/questions/-8SDt9Oe7Y](https://www.prepwiser.in/questions/-8SDt9Oe7Y)

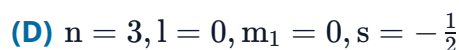
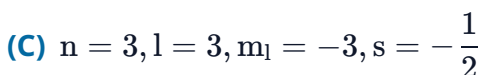
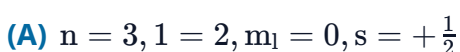
SO_2Cl_2 on reaction with excess of water results into acidic mixture



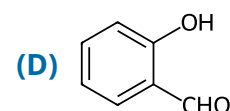
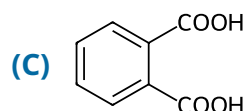
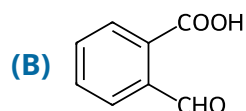
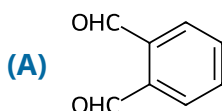
16 moles of NaOH is required for the complete neutralisation of the resultant acidic mixture. The number of moles of SO_2Cl_2 used is:

**Q44** Atomic Structure[Step-by-step solution > prepwiser.in/questions/ppWYGHZVow](https://www.prepwiser.in/questions/ppWYGHZVow)

Which of the following sets of quantum numbers is not allowed?

**Q45** Amines & Diazonium Salts[Step-by-step solution > prepwiser.in/questions/g2tmiUE2b6](https://www.prepwiser.in/questions/g2tmiUE2b6)

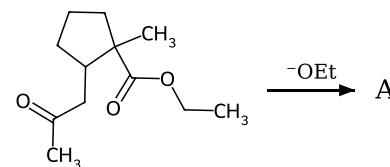
An organic compound 'A' on reaction with NH_3 followed by heating gives compound B. Which on further strong heating gives compound C ($\text{C}_8\text{H}_5\text{NO}_2$). Compound C on sequential reaction with ethanolic KOH , alkyl chloride and hydrolysis with alkali gives a primary amine. The compound A is:



Q46 General Organic Chemistry (GOC) **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/7karxPTL8S) › prepwiser.in/questions/7karxPTL8S

In the given reaction

The number of chiral carbon/s in product A is _____.



(Where Et is $-\text{C}_2\text{H}_5$)

Q47 Chemical Bonding & Molecular Structure **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/v_Emh7NPz) › prepwiser.in/questions/v_Emh7NPz

Among the following species



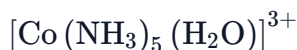
the number of species showing diamagnetism is _____.

Q48 Chemical Kinetics **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/gPGCHuL3V3) › prepwiser.in/questions/gPGCHuL3V3

The half life for the decomposition of gaseous compound A is 240s when the gaseous pressure was 500 Torr initially. When the pressure was 250 Torr, the half life was found to be 4.0 min. The order of the reaction is _____. (Nearest integer)

Q49 Coordination Compounds **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/2YE8Ozftoh) › prepwiser.in/questions/2YE8Ozftoh

Consider the following metal complexes:



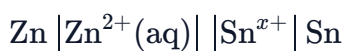
The spin-only magnetic moment value of the complex that absorbs light with shortest wavelength is _____ B. M. (Nearest integer)

Q50 d & f Block Elements **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/pMzxkVFCQB) › prepwiser.in/questions/pMzxkVFCQB

Among Co^{3+} , Ti^{2+} , V^{2+} and Cr^{2+} ions, one if used as a reagent cannot liberate H_2 from dilute mineral acid solution, its spin-only magnetic moment in gaseous state is _____ B.M. (Nearest integer)

Q51 Electrochemistry **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/wvqmH-sk8o) › prepwiser.in/questions/wvqmH-sk8o

The cell potential for



is 0.801V at 298K . The reaction quotient for the above reaction is 10^{-2} . The number of electrons involved in the given electrochemical cell reaction is _____.

(Given

$$: E_{\text{Zn}^{2+}|\text{Zn}}^{\circ} = -0.763\text{V}, E_{\text{Sn}^{x+}|\text{Sn}}^{\circ} = +0.008\text{V}$$

and $\frac{2.303RT}{F} = 0.06\text{V}$)

Q52 Chemical Thermodynamics **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/aoKQae8Co) › prepwiser.in/questions/aoKQae8Co

The enthalpy of combustion of propane, graphite and dihydrogen at 298K are

-2220.0kJmol^{-1} , -393.5kJmol^{-1} and -285.8kJmol^{-1} respectively. The magnitude of enthalpy of formation of propane (C_3H_8) is _____ kJ mol^{-1} . (Nearest integer)

The number of sp^3 hybridised carbons in an acyclic neutral compound with molecular formula C_4H_5N is _____.

While estimating the nitrogen present in an organic compound by Kjeldahl's method, the ammonia evolved from 0.25g of the compound neutralized 2.5mL of 2 M H_2SO_4 . The percentage of nitrogen present in organic compound is _____.

Mathematics Section A · Multiple choice

Q55 to Q72

Let P be the plane containing the straight line $\frac{x-3}{9} = \frac{y+4}{-1} = \frac{z-7}{-5}$ and perpendicular to the plane containing the straight lines $\frac{x}{2} = \frac{y}{3} = \frac{z}{5}$ and $\frac{x}{3} = \frac{y}{7} = \frac{z}{8}$. If d is the distance of P from the point (2, -5, 11), then d^2 is equal to:

- (A) $\frac{147}{2}$ (B) 96 (C) $\frac{32}{3}$ (D) 54

If the absolute maximum value of the function

$$f(x) = (x^2 - 2x + 7) e^{(4x^3 - 12x^2 - 180x + 31)}$$

in the interval $[-3, 0]$ is $f(\alpha)$, then:

- (A) $\alpha = 0$ (B) $\alpha = -3$ (C) $\alpha \in (-1, 0)$ (D) $\alpha \in (-3, -1]$

The curve $y(x) = ax^3 + bx^2 + cx + 5$ touches the x -axis at the point P(-2, 0) and cuts the y -axis at the point Q, where y' is equal to 3. Then the local maximum value of $y(x)$ is:

- (A) $\frac{27}{4}$ (B) $\frac{29}{4}$ (C) $\frac{37}{4}$ (D) $\frac{9}{2}$

For $n \in \mathbf{N}$, let

$$S_n = \left\{ z \in \mathbf{C} : |z - 3 + 2i| = \frac{n}{4} \right\}$$

and

$$T_n = \left\{ z \in \mathbf{C} : |z - 2 + 3i| = \frac{1}{n} \right\}$$

. Then the number of elements in the set $\{n \in \mathbf{N} : S_n \cap T_n = \phi\}$ is:

- (A) 0 (B) 2 (C) 3 (D) 4

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Q59 Definite Integration[Step-by-step solution](https://www.prepwiser.in/questions/pWdnzVPVuy)

For any real number x , let $[x]$ denote the largest integer less than equal to x . Let f be a real valued function defined on the interval $[-10, 10]$ by

$$f(x) = \begin{cases} x - [x], & \text{if } [x] \text{ is odd} \\ 1 + [x] - x, & \text{if } [x] \text{ is even} \end{cases}$$

Then the value of $\frac{\pi^2}{10} \int_{-10}^{10} f(x) \cos \pi x \, dx$ is:

- (A) 4 (B) 2 (C) 1 (D) 0

Q60 Indefinite Integration[Step-by-step solution](https://www.prepwiser.in/questions/2w0sZjYypw)

The slope of the tangent to a curve $C : y = y(x)$ at any point (x, y) on it is $\frac{2e^{2x} - 6e^{-x} + 9}{2 + 9e^{-2x}}$. If C passes through the points $(0, \frac{1}{2} + \frac{\pi}{2\sqrt{2}})$ and $(\alpha, \frac{1}{2}e^{2\alpha})$, then e^α is equal to:

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

Q61 Differential Equations[Step-by-step solution](https://www.prepwiser.in/questions/x0w35h9Fax)

The general solution of the differential equation $(x - y^2) \, dx + y(5x + y^2) \, dy = 0$ is:

- (A) $(y^2 + x)^4 = C \left| (y^2 + 2x)^3 \right|$ (B) $(y^2 + 2x)^4 = C \left| (y^2 + x)^3 \right|$
 (C) $\left| (y^2 + x)^3 \right| = C(2y^2 + x)^4$ (D) $\left| (y^2 + 2x)^3 \right| = C(2y^2 + x)^4$

Q62 Permutations & Combinations[Step-by-step solution](https://www.prepwiser.in/questions/8qrrQFR1-Q)

The total number of functions,

$f : \{1, 2, 3, 4\} \rightarrow \{1, 2, 3, 4, 5, 6\}$ such that $f(1) + f(2) = f(3)$, is equal to:

- (A) 60 (B) 90 (C) 108 (D) 126

Q63 Limits[Step-by-step solution](https://www.prepwiser.in/questions/CqXznONKeB)

If

$$\lim_{n \rightarrow \infty} \left(\sqrt{n^2 - n - 1} + n\alpha + \beta \right) = 0$$

, then $8(\alpha + \beta)$ is equal to:

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

Q64 Determinants[Step-by-step solution](https://www.prepwiser.in/questions/qZDFEA60eF)

The number of $\theta \in (0, 4\pi)$ for which the system of linear equations

$$3(\sin 3\theta)x - y + z = 2$$

$$3(\cos 2\theta)x + 4y + 3z = 3$$

$$6x + 7y + 7z = 9$$

has no solution, is:

- (A) 6 (B) 7 (C) 8 (D) 9

If the sum and the product of mean and variance of a binomial distribution are 24 and 128 respectively, then the probability of one or two successes is:

- (A) $\frac{33}{2^{32}}$ (B) $\frac{33}{2^{29}}$ (C) $\frac{33}{2^{28}}$ (D) $\frac{33}{2^{27}}$

If the numbers appeared on the two throws of a fair six faced die are α and β , then the probability that $x^2 + \alpha x + \beta > 0$, for all $x \in \mathbf{R}$, is:

- (A) $\frac{17}{36}$ (B) $\frac{4}{9}$ (C) $\frac{1}{2}$ (D) $\frac{19}{36}$

If $\alpha, \beta, \gamma, \delta$ are the roots of the equation $x^4 + x^3 + x^2 + x + 1 = 0$, then $\alpha^{2021} + \beta^{2021} + \gamma^{2021} + \delta^{2021}$ is equal to:

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

The number of solutions of $|\cos x| = \sin x$, such that $-4\pi \leq x \leq 4\pi$ is:

- (A) 4 (B) 6 (C) 8 (D) 12

Let ABC be a triangle such that

$$\overrightarrow{BC} = \vec{a}, \overrightarrow{CA} = \vec{b}, \overrightarrow{AB} = \vec{c}, |\vec{a}| = 6\sqrt{2}, |\vec{b}| = 2\sqrt{3}$$

and $\vec{b} \cdot \vec{c} = 12$. Consider the statements:

$$(S1) : |(\vec{a} \times \vec{b}) + (\vec{c} \times \vec{b})| - |\vec{c}| = 6(2\sqrt{2} - 1)$$

$$(S2) : \angle ACB = \cos^{-1} \left(\sqrt{\frac{2}{3}} \right)$$

Then

- (A) both (S1) and (S2) are true (B) only (S1) is true
(C) only (S2) is true (D) both (S1) and (S2) are false

The area of the region given by

$$A = \{(x, y) : x^2 \leq y \leq \min\{x + 2, 4 - 3x\}\} \text{ is:}$$

- (A) $\frac{31}{8}$ (B) $\frac{17}{6}$ (C) $\frac{19}{6}$ (D) $\frac{27}{8}$

Let the locus of the centre (α, β) , $\beta > 0$, of the circle which touches the circle $x^2 + (y - 1)^2 = 1$ externally and also touches the x -axis be L. Then the area bounded by L and the line $y = 4$ is:

- (A) $\frac{32\sqrt{2}}{3}$ (B) $\frac{40\sqrt{2}}{3}$ (C) $\frac{64}{3}$ (D) $\frac{32}{3}$

A line, with the slope greater than one, passes through the point $A(4, 3)$ and intersects the line $x - y - 2 = 0$ at the point B . If the length of the line segment AB is $\frac{\sqrt{29}}{3}$, then B also lies on the line:

- (A) $2x + y = 9$ (B) $3x - 2y = 7$ (C) $x + 2y = 6$ (D) $2x - 3y = 3$

Mathematics Section B · Numerical value

Q73 to Q82

The line of shortest distance between the lines $\frac{x-2}{0} = \frac{y-1}{1} = \frac{z}{1}$ and $\frac{x-3}{2} = \frac{y-5}{2} = \frac{z-1}{1}$ makes an angle of $\cos^{-1}\left(\sqrt{\frac{2}{27}}\right)$ with the plane $P : ax - y - z = 0, (a > 0)$. If the image of the point $(1, 1, -5)$ in the plane P is (α, β, γ) , then $\alpha + \beta - \gamma$ is equal to _____.

If the maximum value of the term independent of t in the expansion of

$$\left(t^2 x^{\frac{1}{5}} + \frac{(1-x)^{\frac{1}{10}}}{t}\right)^{15}, x \geq 0$$

, is K , then $8K$ is equal to _____.

$$\begin{aligned} \text{If } \lim_{n \rightarrow \infty} \frac{(n+1)^{k-1}}{n^{k+1}} [(nk+1) + (nk+2) + \dots + (nk+n)] \\ = 33 \cdot \lim_{n \rightarrow \infty} \frac{1}{n^{k+1}} \cdot [1^k + 2^k + 3^k + \dots + n^k] \end{aligned}$$

, then the integral value of k is equal to _____.

Let the equation of two diameters of a circle $x^2 + y^2 - 2x + 2fy + 1 = 0$ be $2px - y = 1$ and $2x + py = 4p$. Then the slope $m \in (0, \infty)$ of the tangent to the hyperbola $3x^2 - y^2 = 3$ passing through the centre of the circle is equal to _____.

Let

$$f(x) = \begin{cases} |4x^2 - 8x + 5|, & \text{if } 8x^2 - 6x + 1 \geq 0 \\ [4x^2 - 8x + 5], & \text{if } 8x^2 - 6x + 1 < 0, \end{cases}$$

where $[\alpha]$ denotes the greatest integer less than or equal to α . Then the number of points in $\mathbf{R}$ where f is not differentiable is _____.

Let

$$A = \begin{pmatrix} 2 & -1 & -1 \\ 1 & 0 & -1 \\ 1 & -1 & 0 \end{pmatrix}$$

and $B = A - I$. If $\omega = \frac{\sqrt{3}i-1}{2}$, then the number of elements in the

$$\text{set } \{n \in \{1, 2, \dots, 100\} : A^n + (\omega B)^n = A + B\}$$

is equal to _____.

Q79 Parabola **NUMERICAL**

[Step-by-step solution](#) › prepwisar.in/questions/_SP0p8ddeB

The sum of diameters of the circles that touch (i) the parabola $75x^2 = 64(5y - 3)$ at the point $(\frac{8}{5}, \frac{6}{5})$ and (ii) the y -axis, is equal to _____.

Q80 Permutations & Combinations **NUMERICAL**

[Step-by-step solution](#) › prepwisar.in/questions/qu3FWpY_I_

The letters of the word 'MANKIND' are written in all possible orders and arranged in serial order as in an English dictionary. Then the serial number of the word 'MANKIND' is _____.

Q81 Sequences & Series **NUMERICAL**

[Step-by-step solution](#) › prepwisar.in/questions/kDvTMKGgoZ

Let a, b be two non-zero real numbers. If p and r are the roots of the equation $x^2 - 8ax + 2a = 0$ and q and s are the roots of the equation $x^2 + 12bx + 6b = 0$, such that

$$\frac{1}{p}, \frac{1}{q}, \frac{1}{r}, \frac{1}{s}$$

are in A.P., then $a^{-1} - b^{-1}$ is equal to _____.

Q82 Sequences & Series **NUMERICAL**

[Step-by-step solution](#) › prepwisar.in/questions/WiaCROqaF7

Let $a_1 = b_1 = 1$, $a_n = a_{n-1} + 2$ and $b_n = a_n + b_{n-1}$ for every natural number $n \geq 2$. Then $\sum_{n=1}^{15} a_n \cdot b_n$ is equal to _____.

Answer key: JEE Main 2022 · 25 Jul · Shift 1

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Physics

1. C	2. A	3. B	4. A	5. B	6. A	7. C	8. C
9. B	10. A	11. A	12. A	13. B	14. B	15. B	16. D
17. A	18. B	19. A	20. 4	21. 4	22. 3	23. 45	24. 60
25. 3	26. 3	27. 5	28. 20				

Chemistry

29. C	30. A	31. B	32. D	33. A	34. C	35. D	36. C
37. B	38. B	39. D	40. A	41. A	42. C	43. C	44. C
45. C	46. 2	47. 2	48. 1	49. 0	50. 5	51. 4	52. 104
53. 1	54. 56						

Mathematics

55. C	56. B	57. A	58. D	59. A	60. B	61. A	62. B
63. C	64. B	65. C	66. A	67. B	68. C	69. C	70. B
71. C	72. C	73. 3	74. 6006	75. 5	76. 2	77. 3	78. 17
79. 10	80. 1492	81. 38	82. 27560				

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