

JEE MAIN 2022 · QUESTION PAPER

25 Jun 2022 Shift 2

84 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	9 Q47 to Q55
● Mathematics	19 Q56 to Q74	10 Q75 to Q84
In this PDF	84 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.

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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/9ACEFHgdeL](https://www.prepwisar.in/questions/9ACEFHgdeL)

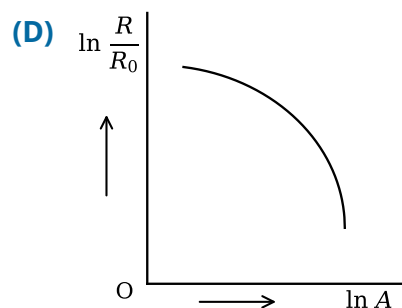
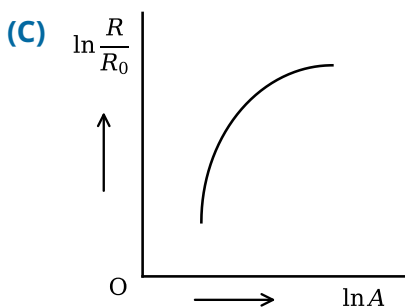
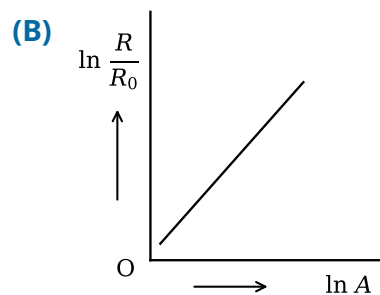
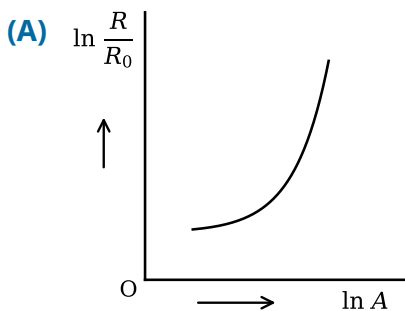
A sinusoidal voltage $V(t) = 210 \sin 3000 t$ volt is applied to a series LCR circuit in which $L = 10 \text{ mH}$, $C = 25 \mu\text{F}$ and $R = 100 \Omega$. The phase difference (Φ) between the applied voltage and resultant current will be:

- (A) $\tan^{-1}(0.17)$ (B) $\tan^{-1}(9.46)$ (C) $\tan^{-1}(0.30)$ (D) $\tan^{-1}(13.33)$

Q2 Nuclear Physics

[Step-by-step solution](#) › [prepwisar.in/questions/ZQ_is3hfpw](https://www.prepwisar.in/questions/ZQ_is3hfpw)

Which of the following figure represents the variation of $\ln \left(\frac{R}{R_0} \right)$ with $\ln A$ (if R = radius of a nucleus and A = its mass number)



Q3 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) › [prepwisar.in/questions/b4GNRRldXi](https://www.prepwisar.in/questions/b4GNRRldXi)

Two metallic plates form a parallel plate capacitor. The distance between the plates is 'd'. A metal sheet of thickness $\frac{d}{2}$ and of area equal to area of each plate is introduced between the plates. What will be the ratio of the new capacitance to the original capacitance of the capacitor?

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

Q4 Circular Motion

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

A disc with a flat small bottom beaker placed on it at a distance R from its center is revolving about an axis passing through the center and perpendicular to its plane with an angular velocity ω . The coefficient of static friction between the bottom of the beaker and the surface of the disc is μ . The beaker will revolve with the disc if:

- (A) $R \leq \frac{\mu g}{2\omega^2}$ (B) $R \leq \frac{\mu g}{\omega^2}$ (C) $R \geq \frac{\mu g}{2\omega^2}$ (D) $R \geq \frac{\mu g}{\omega^2}$

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Q5 Circular Motion[Step-by-step solution > prepwiser.in/questions/XK9eACLXc3](https://www.prepwiser.in/questions/XK9eACLXc3)

For a particle in uniform circular motion, the acceleration $\vec{a}$ at any point P(R, θ) on the circular path of radius R is (when θ is measured from the positive x-axis and v is uniform speed):

(A) $-\frac{v^2}{R} \sin \theta \hat{i} + \frac{v^2}{R} \cos \theta \hat{j}$

(B) $-\frac{v^2}{R} \cos \theta \hat{i} + \frac{v^2}{R} \sin \theta \hat{j}$

(C) $-\frac{v^2}{R} \cos \theta \hat{i} - \frac{v^2}{R} \sin \theta \hat{j}$

(D) $-\frac{v^2}{R} \hat{i} + \frac{v^2}{R} \hat{j}$

Q6 Current Electricity[Step-by-step solution > prepwiser.in/questions/QfTxbU19M2](https://www.prepwiser.in/questions/QfTxbU19M2)

Two cells of same emf but different internal resistances r_1 and r_2 are connected in series with a resistance R. The value of resistance R, for which the potential difference across second cell is zero, is:

(A) $r_2 - r_1$

(B) $r_1 - r_2$

(C) r_1

(D) r_2

Q7 Moving Charges & Magnetism[Step-by-step solution > prepwiser.in/questions/MqWpFZg9u5](https://www.prepwiser.in/questions/MqWpFZg9u5)

If n represents the actual number of deflections in a converted galvanometer of resistance G and shunt resistance S. Then the total current I when its figure of merit is K will be:

(A) $\frac{KS}{(S+G)}$

(B) $\frac{(G+S)}{nKS}$

(C) $\frac{nKS}{(G+S)}$

(D) $\frac{nK(G+S)}{S}$

Q8 Dual Nature of Radiation & Matter[Step-by-step solution > prepwiser.in/questions/HRF--uBs8j](https://www.prepwiser.in/questions/HRF--uBs8j)

A proton, a neutron, an electron and an α particle have same energy. If λ_p , λ_n , λ_e and λ_a are the de Broglie's wavelengths of proton, neutron, electron and α particle respectively, then choose the correct relation from the following:

(A) $\lambda_p = \lambda_n > \lambda_e > \lambda_a$

(B) $\lambda_a < \lambda_n < \lambda_p < \lambda_e$

(C) $\lambda_e < \lambda_p = \lambda_n > \lambda_a$

(D) $\lambda_e = \lambda_p = \lambda_n = \lambda_a$

Q9 Electromagnetic Waves[Step-by-step solution > prepwiser.in/questions/oFMEDNiu7r](https://www.prepwiser.in/questions/oFMEDNiu7r)

The electromagnetic waves travel in a medium at a speed of 2.0×10^8 m/s. The relative permeability of the medium is 1.0. The relative permittivity of the medium will be:

(A) 2.25

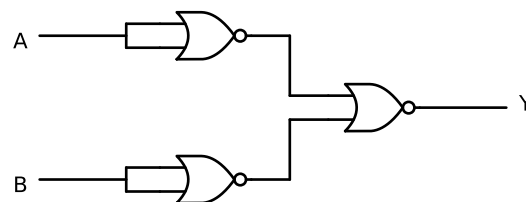
(B) 4.25

(C) 6.25

(D) 8.25

Q10 Semiconductors & Electronic Devices[Step-by-step solution > prepwiser.in/questions/VZsI95WBLZ](https://www.prepwiser.in/questions/VZsI95WBLZ)

Identify the logic operation performed by the given circuit:

(A) AND gate**(B)** OR gate**(C)** NOR gate**(D)** NAND gate**Q11** Thermometry & Calorimetry[Step-by-step solution > prepwiser.in/questions/fUsEkZImrh](https://www.prepwiser.in/questions/fUsEkZImrh)

A solid metallic cube having total surface area 24 m^2 is uniformly heated. If its temperature is increased by 10°C , calculate the increase in volume of the cube. (Given $\alpha = 5.0 \times 10^{-4} \text{ }^\circ\text{C}^{-1}$).

(A) $2.4 \times 10^6 \text{ cm}^3$

(B) $1.2 \times 10^5 \text{ cm}^3$

(C) $6.0 \times 10^4 \text{ cm}^3$

(D) $4.8 \times 10^5 \text{ cm}^3$

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Q12 Thermometry & Calorimetry[Step-by-step solution](https://www.prepwisar.in/questions/2hQCnib9je) > prepwisar.in/questions/2hQCnib9je

A copper block of mass 5.0 kg is heated to a temperature of 500°C and is placed on a large ice block. What is the maximum amount of ice that can melt? [Specific heat of copper : 0.39 J g⁻¹ °C⁻¹ and latent heat of fusion of water : 335 J g⁻¹]

- (A) 1.5 kg (B) 5.8 kg (C) 2.9 kg (D) 3.8 kg

Q13 Kinetic Theory of Gases[Step-by-step solution](https://www.prepwisar.in/questions/-8N2bCwkg_) > prepwisar.in/questions/-8N2bCwkg_

The ratio of specific heats ($\frac{C_p}{C_v}$) in terms of degree of freedom (f) is given by:

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

Q14 Magnetism & Matter[Step-by-step solution](https://www.prepwisar.in/questions/8Sq8QqsdT6) > prepwisar.in/questions/8Sq8QqsdT6

Given below are two statements:

Statement I : Susceptibilities of paramagnetic and ferromagnetic substances increase with decrease in temperature.

Statement II : Diamagnetism is a result of orbital motions of electrons developing magnetic moments opposite to the applied magnetic field.

Choose the correct answer from the options given below:

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

Q15 Moving Charges & Magnetism[Step-by-step solution](https://www.prepwisar.in/questions/nbW5L-LNlb) > prepwisar.in/questions/nbW5L-LNlb

A long solenoid carrying a current produces a magnetic field B along its axis. If the current is doubled and the number of turns per cm is halved, the new value of magnetic field will be equal to

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

Q16 Projectile Motion & Relative Motion[Step-by-step solution](https://www.prepwisar.in/questions/FcX_W0EM03) > prepwisar.in/questions/FcX_W0EM03

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

Assertion A : Two identical balls A and B thrown with same velocity 'u' at two different angles with horizontal attained the same range R. IF A and B reached the maximum height h_1 and h_2 respectively, then $R = 4\sqrt{h_1 h_2}$

Reason R : Product of said heights.

$$h_1 h_2 = \left(\frac{u^2 \sin^2 \theta}{2g} \right) \cdot \left(\frac{u^2 \cos^2 \theta}{2g} \right)$$

Choose the correct answer:

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

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Q17 Rectilinear Motion[Step-by-step solution > prepwiser.in/questions/yeSTqVLbVZ](https://www.prepwiser.in/questions/yeSTqVLbVZ)

Two buses P and Q start from a point at the same time and move in a straight line and their positions are represented by $X_P(t) = \alpha t + \beta t^2$ and $X_Q(t) = ft - t^2$. At what time, both the buses have same velocity?

- (A) $\frac{\alpha - f}{1 + \beta}$ (B) $\frac{\alpha + f}{2(\beta - 1)}$ (C) $\frac{\alpha + f}{2(1 + \beta)}$ (D) $\frac{f - \alpha}{2(1 + \beta)}$

Q18 Wave Optics[Step-by-step solution > prepwiser.in/questions/WldMchhW71](https://www.prepwiser.in/questions/WldMchhW71)

The interference pattern is obtained with two coherent light sources of intensity ratio 4 : 1. And the ratio $\frac{I_{\max} + I_{\min}}{I_{\max} - I_{\min}}$ is $\frac{5}{x}$. Then, the value of x will be equal to:

- (A) 3 (B) 4 (C) 2 (D) 1

Q19 Wave Optics[Step-by-step solution > prepwiser.in/questions/FDJDW8Pkij](https://www.prepwiser.in/questions/FDJDW8Pkij)

A light whose electric field vectors are completely removed by using a good polaroid, allowed to incident on the surface of the prism at Brewster's angle. Choose the most suitable option for the phenomenon related to the prism.

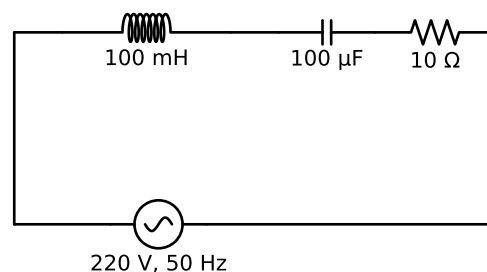
- (A) Reflected and refracted rays will be perpendicular to each other.
(B) Wave will propagate along the surface of prism.
(C) No refraction, and there will be total reflection of light.
(D) No reflection, and there will be total transmission of light.

Physics Section B · Numerical value

Q20 to Q29

Q20 Alternating Current **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/iy1zR5ksMi](https://www.prepwiser.in/questions/iy1zR5ksMi)

In a series LCR circuit, the inductance, capacitance and resistance are $L = 100 \text{ mH}$, $C = 100 \mu\text{F}$ and $R = 10 \Omega$ respectively. They are connected to an AC source of voltage 220 V and frequency of 50 Hz. The approximate value of current in the circuit will be _____ A.

**Q21** Circular Motion **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/0tUyI-URcM](https://www.prepwiser.in/questions/0tUyI-URcM)

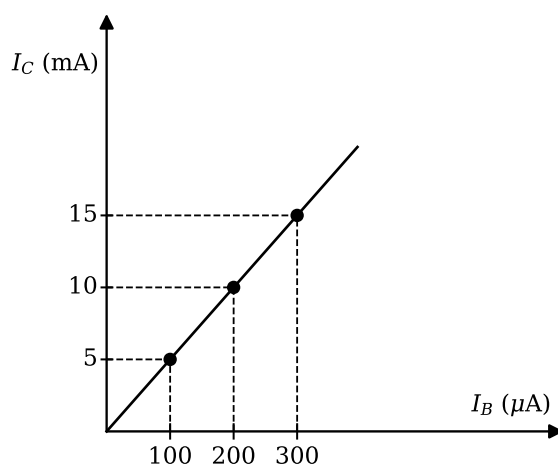
A curved in a level road has a radius 75 m. The maximum speed of a car turning this curved road can be 30 m/s without skidding. If radius of curved road is changed to 48 m and the coefficient of friction between the tyres and the road remains same, then maximum allowed speed would be _____ m/s.

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

The length of a given cylindrical wire is increased to double of its original length. The percentage increase in the resistance of the wire will be _____ %.

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In an experiment of CE configuration of n-p-n transistor, the transfer characteristics are observed as given in figure.



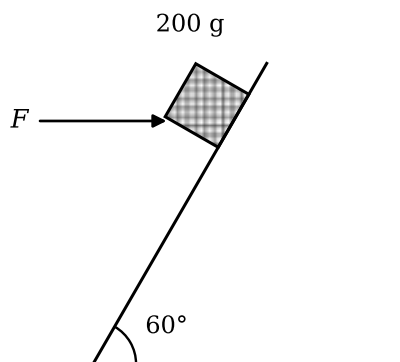
If the input resistance is $200\ \Omega$ and output resistance is $60\ \Omega$, the voltage gain in this experiment will be _____.

27 identical drops are charged at 22V each. They combine to form a bigger drop. The potential of the bigger drop will be _____ V.

Two satellites S_1 and S_2 are revolving in circular orbits around a planet with radius $R_1 = 3200\text{ km}$ and $R_2 = 800\text{ km}$ respectively. The ratio of speed of satellite S_1 to be speed of satellite S_2 in their respective orbits would be $\frac{1}{x}$ where $x =$ _____.

When a gas filled in a closed vessel is heated by raising the temperature by 1°C , its pressure increases by 0.4%. The initial temperature of the gas is _____ K.

A block of mass 200 g is kept stationary on a smooth inclined plane by applying a minimum horizontal force $F = \sqrt{x}\text{ N}$ as shown in figure.



The value of $x =$ _____.

Moment of Inertia (M.I.) of four bodies having same mass 'M' and radius '2R' are as follows:

I_1 = M.I. of solid sphere about its diameter

I_2 = M.I. of solid cylinder about its axis

I_3 = M.I. of solid circular disc about its diameter

I_4 = M.I. of thin circular ring about its diameter

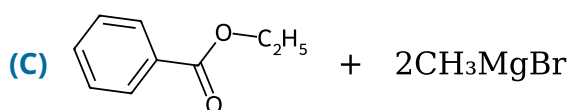
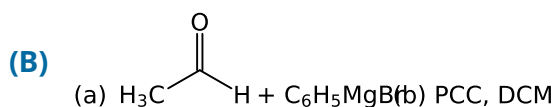
If $2(I_2 + I_3) + I_4 = x \cdot I_1$, then the value of x will be _____.

For $z = a^2 x^3 y^{\frac{1}{2}}$, where 'a' is a constant. If percentage error in measurement of 'x' and 'y' are 4% and 12% respectively, then the percentage error for 'z' will be _____%.

Chemistry Section A · Multiple choice

Q30 to Q46

Which of the following conditions or reaction sequence will NOT give acetophenone as the major product?



Match List I with List II

	List - I		List -II
A.	Zymase	I.	Stomach
B.	Diastase	II.	Yeast
C.	Urease	III.	Malt
D.	Pepsin	IV.	Soyabean

Choose the correct answer from the options given below:

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

An antiseptic dettol is a mixture of two compounds 'A' and 'B' where A has 6π electrons and B has 2π electrons. What is 'B'?

(A) Bithionol (B) Terpineol (C) Chloroxynol (D) Chloramphenicol

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The metal ion (in gaseous state) with lowest spin-only magnetic moment value is:

- (A) V^{2+} (B) Ni^{2+} (C) Cr^{2+} (D) Fe^{2+}

The correct order of reduction potentials of the following pairs is

- A. Cl_2/Cl^-
B. I_2/I^-
C. Ag^+/Ag
D. Na^+/Na
E. Li^+/Li

Choose the correct answer from the options given below.

- (A) $A > C > B > D > E$ (B) $A > B > C > D > E$ (C) $A > C > B > E > D$ (D) $A > B > C > E > D$

The K_{sp} for bismuth sulphide (Bi_2S_3) is 1.08×10^{-73} . The solubility of Bi_2S_3 in $mol\ L^{-1}$ at 298 K is:

- (A) 1.0×10^{-15} (B) 2.7×10^{-12} (C) 3.2×10^{-10} (D) 4.2×10^{-8}

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

Assertion A : The amphoteric nature of water is explained by using Lewis acid/base concept.

Reason R : Water acts as an acid with NH_3 and as a base with H_2S .

In the light of the above statements choose the correct answer from the options given below:

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

Given below are two statements.

Statement I : During electrolytic refining, blister copper deposits precious metals.

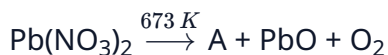
Statement II : In the process of obtaining pure copper by electrolysis method, copper blister is used to make the anode.

In the light of the above statements, choose the correct from the options given below.

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

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The number of bridged oxygen atoms present in compound B formed from the following reactions is



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

The correct order of electron gain enthalpies of Cl, F, Te and Po is

- (A) $\text{F} < \text{Cl} < \text{Te} < \text{Po}$ (B) $\text{Po} < \text{Te} < \text{F} < \text{Cl}$ (C) $\text{Te} < \text{Po} < \text{Cl} < \text{F}$ (D) $\text{Cl} < \text{F} < \text{Te} < \text{Po}$

Solute A associates in water. When 0.7 g of solute A is dissolved in 42.0 g of water, it depresses the freezing point by 0.2°C . The percentage association of solute A in water, is:

[Given : Molar mass of A = 93 g mol^{-1} . Molal depression constant of water is $1.86\text{ K kg mol}^{-1}$.]

- (A) 50% (B) 60% (C) 70% (D) 80%

The minimum energy that must be possessed by photons in order to produce the photoelectric effect with platinum metal is:

[Given : The threshold frequency of platinum is $1.3 \times 10^{15}\text{ s}^{-1}$ and $h = 6.6 \times 10^{-34}\text{ J s}$.]

- (A) $3.21 \times 10^{-14}\text{ J}$ (B) $6.24 \times 10^{-16}\text{ J}$ (C) $8.58 \times 10^{-19}\text{ J}$ (D) $9.76 \times 10^{-20}\text{ J}$

At 25°C and 1 atm pressure, the enthalpy of combustion of benzene (l) and acetylene (g) are -3268 kJ mol^{-1} and -1300 kJ mol^{-1} , respectively. The change in enthalpy for the reaction $3\text{ C}_2\text{H}_2(\text{g}) \rightarrow \text{C}_6\text{H}_6(\text{l})$, is:

- (A) $+324\text{ kJ mol}^{-1}$ (B) $+632\text{ kJ mol}^{-1}$ (C) -632 kJ mol^{-1} (D) -732 kJ mol^{-1}

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

Assertion A : A mixture contains benzoic acid and naphthalene. The pure benzoic acid can be separated out by the use of benzene.

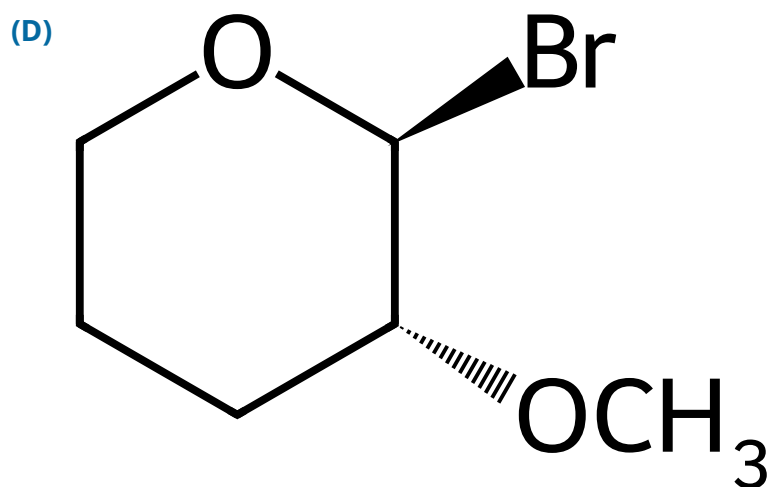
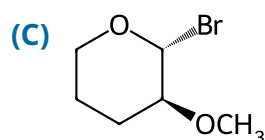
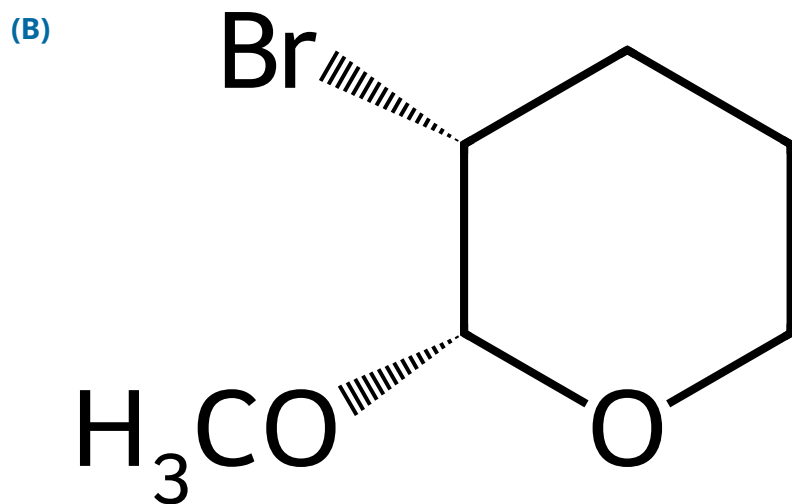
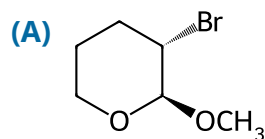
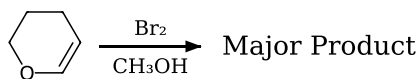
Reason R : Benzoic acid is soluble in hot water.

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

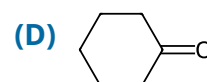
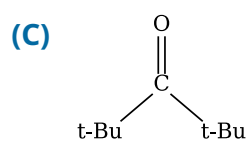
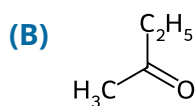
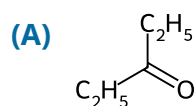
- (A) Both A and R are true and R is the correct explanation of A.
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Amongst the following, the major product of the given chemical reaction is



Which of the following ketone will NOT give enamine on treatment with secondary amines? [where t-Bu is $-\text{C}(\text{CH}_3)_3$]



During halogen test, sodium fusion extract is boiled with concentrated HNO_3 to

- (A) remove unreacted sodium (B) decompose cyanide or sulphide of sodium
(C) extract halogen from organic compound (D) maintain the pH of extract.

Chemistry Section B · Numerical value

Q47 to Q55

Q47 Carbohydrates & Biomolecules NUMERICAL

[Step-by-step solution](#) › [prepwisar.in/questions/9m853VcYko](https://www.prepwisar.in/questions/9m853VcYko)

How many of the given compounds will give a positive Biuret test _____?

Glycine, Glycylalanine, Tripeptide, Biuret

Q48 Chemical Bonding & Molecular Structure NUMERICAL

[Step-by-step solution](#) › [prepwisar.in/questions/T4PyB-08vA](https://www.prepwisar.in/questions/T4PyB-08vA)

Amongst BeF_2 , BF_3 , H_2O , NH_3 , CCl_4 and HCl , the number of molecules with non-zero net dipole moment is _____.

Q49 Chemical Kinetics NUMERICAL

[Step-by-step solution](#) › [prepwisar.in/questions/Z2TLjjsdED](https://www.prepwisar.in/questions/Z2TLjjsdED)

At 345 K, the half life for the decomposition of a sample of a gaseous compound initially at 55.5 kPa was 340 s. When the pressure was 27.8 kPa, the half life was found to be 170 s. The order of the reaction is _____. [integer answer]

Q50 Coordination Compounds NUMERICAL

[Step-by-step solution](#) › [prepwisar.in/questions/Z68VtAHv27](https://www.prepwisar.in/questions/Z68VtAHv27)

Amongst $\text{FeCl}_3 \cdot 3\text{H}_2\text{O}$, $\text{K}_3[\text{Fe}(\text{CN})_6]$ and $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$, the spin-only magnetic moment value of the inner-orbital complex that absorbs light at shortest wavelength is _____ B.M. [nearest integer]

Q51 Electrochemistry NUMERICAL

[Step-by-step solution](#) › [prepwisar.in/questions/H95Ja5p5Dv](https://www.prepwisar.in/questions/H95Ja5p5Dv)

A solution of $\text{Fe}_2(\text{SO}_4)_3$ is electrolyzed for 'x' min with a current of 1.5 A to deposit 0.3482 g of Fe. The value of x is _____. [nearest integer]

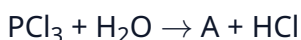
Given : $1 \text{ F} = 96500 \text{ C mol}^{-1}$

Atomic mass of Fe = 56 g mol^{-1}

Q52 p-Block Elements: Part II (Group 15-18) NUMERICAL

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

Consider the following reactions:



The number of ionisable protons present in the product B is _____.

Q53 Polymers NUMERICAL

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

The Novolac polymer has mass of 963 g. The number of monomer units present in it are

Q54 Mole Concept & Stoichiometry NUMERICAL

[Step-by-step solution](#) › [prepwisar.in/questions/uol9sLn6iS](https://www.prepwisar.in/questions/uol9sLn6iS)

The neutralization occurs when 10 mL of 0.1M acid 'A' is allowed to react with 30 mL of 0.05 M base $\text{M}(\text{OH})_2$. The basicity of the acid 'A' is _____.

[M is a metal]

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A protein 'A' contains 0.30% of glycine (molecular weight 75). The minimum molar mass of the protein 'A' is _____ $\times 10^3 \text{ g mol}^{-1}$ [nearest integer]

Mathematics Section A · Multiple choice

Q56 to Q74

Q56 Three Dimensional Geometry

Step-by-step solution > prepwiser.in/questions/P0ImEzT1xg

Let p be the plane passing through the intersection of the planes

$$\vec{r} \cdot (\hat{i} + 3\hat{j} - \hat{k}) = 5$$

and

$$\vec{r} \cdot (2\hat{i} - \hat{j} + \hat{k}) = 3$$

, and the point $(2, 1, -2)$. Let the position vectors of the points X and Y be $\hat{i} - 2\hat{j} + 4\hat{k}$ and $5\hat{i} - \hat{j} + 2\hat{k}$ respectively. Then the points:

- (A) X and $X + Y$ are on the same side of P (B) Y and $Y - X$ are on the opposite sides of P
 (C) X and Y are on the opposite sides of P (D) $X + Y$ and $X - Y$ are on the same side of P

Q57 Applications of Derivatives

Step-by-step solution > prepwiser.in/questions/5tRPcTkQEa

Water is being filled at the rate of $1 \text{ cm}^3 / \text{sec}$ in a right circular conical vessel (vertex downwards) of height 35 cm and diameter 14 cm. When the height of the water level is 10 cm, the rate (in cm^2 / sec) at which the wet conical surface area of the vessel increases is

- (A) 5 (B) $\frac{\sqrt{21}}{5}$ (C) $\frac{\sqrt{26}}{5}$ (D) $\frac{\sqrt{26}}{10}$

Q58 Differentiation

Step-by-step solution > prepwiser.in/questions/5vHM41DhXw

If the angle made by the tangent at the point (x_0, y_0) on the curve $x = 12(t + \sin t \cos t)$, $y = 12(1 + \sin t)^2$, $0 < t < \frac{\pi}{2}$, with the positive x -axis is $\frac{\pi}{3}$, then y_0 is equal to:

- (A) $6(3 + 2\sqrt{2})$ (B) $3(7 + 4\sqrt{3})$ (C) 27 (D) 48

Q59 Binomial Theorem

Step-by-step solution > prepwiser.in/questions/qyd2OVCRDU

The coefficient of x^{101} in the expression

$$(5 + x)^{500} + x(5 + x)^{499} + x^2(5 + x)^{498} + \dots + x^{500}$$

, $x > 0$, is

- (A) ${}^{501}C_{101} (5)^{399}$ (B) ${}^{501}C_{101} (5)^{400}$ (C) ${}^{501}C_{100} (5)^{400}$ (D) ${}^{500}C_{101} (5)^{399}$

Q60 Straight Lines

Step-by-step solution > prepwiser.in/questions/W0wGHYZWYw

A circle touches both the y -axis and the line $x + y = 0$. Then the locus of its center is:

- (A) $y = \sqrt{2}x$ (B) $x = \sqrt{2}y$ (C) $y^2 - x^2 = 2xy$ (D) $x^2 - y^2 = 2xy$

Q61 Complex Numbers

Step-by-step solution > prepwiser.in/questions/qK0sihemr5

Let z_1 and z_2 be two complex numbers such that $\bar{z}_1 = iz_2$ and $\arg\left(\frac{z_1}{z_2}\right) = \pi$. Then:

- (A) $\arg z_2 = \frac{\pi}{4}$ (B) $\arg z_2 = -\frac{3\pi}{4}$ (C) $\arg z_1 = \frac{\pi}{4}$ (D) $\arg z_1 = -\frac{3\pi}{4}$

Q62 Definite Integration[Step-by-step solution](https://www.prepwisar.in/questions/fHPuSCrqvE)

If $b_n = \int_0^{\frac{\pi}{2}} \frac{\cos^2 nx}{\sin x} dx$, $n \in N$, then

(A) $b_3 - b_2, b_4 - b_3, b_5 - b_4$ are in A.P. with common difference -2

(B) $\frac{1}{b_3 - b_2}, \frac{1}{b_4 - b_3}, \frac{1}{b_5 - b_4}$ are in an A.P. with common difference 2

(C) $b_3 - b_2, b_4 - b_3, b_5 - b_4$ are in a G.P.

(D) $\frac{1}{b_3 - b_2}, \frac{1}{b_4 - b_3}, \frac{1}{b_5 - b_4}$ are in an A.P. with common difference -2

Q63 Differential Equations[Step-by-step solution](https://www.prepwisar.in/questions/EBW8icgmEd)

If $y = y(x)$ is the solution of the differential equation

$2x^2 \frac{dy}{dx} - 2xy + 3y^2 = 0$ such that $y(e) = \frac{e}{3}$, then $y(1)$ is equal to:

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

(B) $\frac{2}{3}$

(C) $\frac{3}{2}$

(D) 3

Q64 Ellipse[Step-by-step solution](https://www.prepwisar.in/questions/VRK13gsf9s)

The line $y = x + 1$ meets the ellipse $\frac{x^2}{4} + \frac{y^2}{2} = 1$ at two points P and Q. If r is the radius of the circle with PQ as diameter then $(3r)^2$ is equal to:

(A) 20

(B) 12

(C) 11

(D) 8

Q65 Inverse Trigonometric Functions[Step-by-step solution](https://www.prepwisar.in/questions/FPpTXaxGdG)

The value of

$$\tan^{-1} \left(\frac{\cos \left(\frac{15\pi}{4} \right) - 1}{\sin \left(\frac{\pi}{4} \right)} \right)$$

is equal to:

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

(B) $-\frac{\pi}{8}$

(C) $-\frac{5\pi}{12}$

(D) $-\frac{4\pi}{9}$

Q66 Limits[Step-by-step solution](https://www.prepwisar.in/questions/j1HvLZZEqn)

$$\lim_{x \rightarrow \frac{\pi}{2}} \left(\tan^2 x \left((2\sin^2 x + 3\sin x + 4)^{\frac{1}{2}} - (\sin^2 x + 6\sin x + 2)^{\frac{1}{2}} \right) \right)$$

is equal to

(A) $\frac{1}{12}$

(B) $-\frac{1}{18}$

(C) $-\frac{1}{12}$

(D) $\frac{1}{6}$

Q67 Determinants[Step-by-step solution](https://www.prepwisar.in/questions/vJaV8SGm2N)

The system of equations

$$-kx + 3y - 14z = 25$$

$$-15x + 4y - kz = 3$$

$$-4x + y + 3z = 4$$

is consistent for all k in the set

(A) R

(B) $R - \{-11, 13\}$

(C) $R - \{13\}$

(D) $R - \{-11, 11\}$

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Q68 Parabola[Step-by-step solution](#) > [prepwisar.in/questions/ogqxcd_6Cw](https://www.prepwisar.in/questions/ogqxcd_6Cw)

If the line $y = 4 + kx$, $k > 0$, is the tangent to the parabola $y = x - x^2$ at the point P and V is the vertex of the parabola, then the slope of the line through P and V is:

- (A) $\frac{3}{2}$ (B) $\frac{26}{9}$ (C) $\frac{5}{2}$ (D) $\frac{23}{6}$

Q69 Probability: Basic[Step-by-step solution](#) > [prepwisar.in/questions/sQwI8K9y0K](https://www.prepwisar.in/questions/sQwI8K9y0K)

A biased die is marked with numbers 2, 4, 8, 16, 32, 32 on its faces and the probability of getting a face with mark n is $\frac{1}{n}$. If the die is thrown thrice, then the probability, that the sum of the numbers obtained is 48, is:

- (A) $\frac{7}{2^{11}}$ (B) $\frac{7}{2^{12}}$ (C) $\frac{3}{2^{10}}$ (D) $\frac{13}{2^{12}}$

Q70 Sets[Step-by-step solution](#) > [prepwisar.in/questions/jZhZjbp3oF](https://www.prepwisar.in/questions/jZhZjbp3oF)

Let $A = \{x \in R : |x + 1| < 2\}$ and $B = \{x \in R : |x - 1| \geq 2\}$. Then which one of the following statements is NOT true?

- (A) $A - B = (-1, 1)$ (B) $B - A = R - (-3, 1)$
(C) $A \cap B = (-3, -1]$ (D) $A \cup B = R - [1, 3)$

Q71 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](#) > [prepwisar.in/questions/cFMLkwZ-A2](https://www.prepwisar.in/questions/cFMLkwZ-A2)

Let $a, b \in R$ be such that the equation $ax^2 - 2bx + 15 = 0$ has a repeated root α . If α and β are the roots of the equation $x^2 - 2bx + 21 = 0$, then $\alpha^2 + \beta^2$ is equal to:

- (A) 37 (B) 58 (C) 68 (D) 92

Q72 Sequences & Series[Step-by-step solution](#) > [prepwisar.in/questions/PhvP0phuJA](https://www.prepwisar.in/questions/PhvP0phuJA)

The sum $1 + 2 \cdot 3 + 3 \cdot 3^2 + \dots + 10 \cdot 3^9$ is equal to:

- (A) $\frac{2 \cdot 3^{12} + 10}{4}$ (B) $\frac{19 \cdot 3^{10} + 1}{4}$ (C) $5 \cdot 3^{10} - 2$ (D) $\frac{9 \cdot 3^{10} + 1}{2}$

Q73 Area Under Curves[Step-by-step solution](#) > [prepwisar.in/questions/iVag5_wTa-](https://www.prepwisar.in/questions/iVag5_wTa-)

The area of the region enclosed between the parabolas $y^2 = 2x - 1$ and $y^2 = 4x - 3$ is

- (A) $\frac{1}{3}$ (B) $\frac{1}{6}$ (C) $\frac{2}{3}$ (D) $\frac{3}{4}$

Q74 Trigonometric Ratios & Identities[Step-by-step solution](#) > [prepwisar.in/questions/dKCIC4eT5-](https://www.prepwisar.in/questions/dKCIC4eT5-)

The value of $2\sin(12^\circ) - \sin(72^\circ)$ is:

- (A) $\frac{\sqrt{5}(1 - \sqrt{3})}{4}$ (B) $\frac{1 - \sqrt{5}}{8}$ (C) $\frac{\sqrt{3}(1 - \sqrt{5})}{2}$ (D) $\frac{\sqrt{3}(1 - \sqrt{5})}{4}$

Q75 Three Dimensional Geometry **NUMERICAL**

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

Let l_1 be the line in xy -plane with x and y intercepts $\frac{1}{8}$ and $\frac{1}{4\sqrt{2}}$ respectively, and l_2 be the line in zx -plane with x and z intercepts $-\frac{1}{8}$ and $-\frac{1}{6\sqrt{3}}$ respectively. If d is the shortest distance between the line l_1 and l_2 , then d^{-2} is equal to _____.

Q76 Applications of Derivatives **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/mwU14PcBvr](https://www.prepwisar.in/questions/mwU14PcBvr)

Let $f(x) = |(x-1)(x^2-2x-3)| + x - 3$, $x \in R$. If m and M are respectively the number of points of local minimum and local maximum of f in the interval $(0, 4)$, then $m + M$ is equal to _____.

Q77 Binomial Theorem **NUMERICAL**

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

If the sum of the co-efficient of all the positive even powers of x in the binomial expansion of $(2x^3 + \frac{3}{x})^{10}$ is $5^{10} - \beta \cdot 3^9$, then β is equal to _____.

Q78 Definite Integration **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/ePI9f1zoOP](https://www.prepwisar.in/questions/ePI9f1zoOP)

The value of $b > 3$ for which

$$12 \int_3^b \frac{1}{(x^2-1)(x^2-4)} dx = \log_e \left(\frac{49}{40} \right)$$

, is equal to _____.

Q79 Hyperbola **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/8s1Yp2HAMy](https://www.prepwisar.in/questions/8s1Yp2HAMy)

Let the eccentricity of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ be $\frac{5}{4}$. If the equation of the normal at the point $(\frac{8}{\sqrt{5}}, \frac{12}{5})$ on the hyperbola is $8\sqrt{5}x + \beta y = \lambda$, then $\lambda - \beta$ is equal to _____.

Q80 Continuity & Differentiability **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/wIxI5m_b89](https://www.prepwisar.in/questions/wIxI5m_b89)

Let $f(x) = [2x^2 + 1]$ and

$$g(x) = \begin{cases} 2x - 3, & x < 0 \\ 2x + 3, & x \geq 0 \end{cases}$$

, where $[t]$ is the greatest integer $\leq t$. Then, in the open interval $(-1, 1)$, the number of points where $f \circ g$ is discontinuous is equal to _____.

Q81 Matrices **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/3Dy6KuXRmG](https://www.prepwisar.in/questions/3Dy6KuXRmG)

Let $A = \begin{pmatrix} 2 & -2 \\ 1 & -1 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 2 \\ -1 & 2 \end{pmatrix}$. Then the number of elements in the set $\{(n, m) : n, m \in \{1, 2, \dots, 10\} \text{ and } nA^n + mB^m = I\}$ is _____.

Q82 Permutations & Combinations **NUMERICAL**

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

The total number of three-digit numbers, with one digit repeated exactly two times, is _____.

Q83 Statistics **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/L8ASNIsqiI](https://www.prepwisar.in/questions/L8ASNIsqiI)

If the mean deviation about the mean of the numbers $1, 2, 3, \dots, n$, where n is odd, is $\frac{5(n+1)}{n}$, then n is equal to _____.

Let $\vec{b} = \hat{i} + \hat{j} + \lambda\hat{k}$, $\lambda \in \mathbb{R}$. If $\vec{a}$ is a vector such that

$$\vec{a} \times \vec{b} = 13\hat{i} - \hat{j} - 4\hat{k}$$

and $\vec{a} \cdot \vec{b} + 21 = 0$, then

$$(\vec{b} - \vec{a}) \cdot (\hat{k} - \hat{j}) + (\vec{b} + \vec{a}) \cdot (\hat{i} - \hat{k})$$

is equal to _____.

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Physics

1. A	2. B	3. A	4. B	5. C	6. A	7. D	8. B	9. A	10. A
11. B	12. C	13. B	14. A	15. A	16. A	17. D	18. B	19. D	20. 22
21. 24	22. 300	23. 15	24. 198	25. 2	26. 250	27. 12	28. 5	29. 18	

Chemistry

30. C	31. B	32. B	33. B	34. A	35. A	36. D	37. A	38. A	39. B
40. D	41. C	42. C	43. D	44. A	45. C	46. B	47. 2	48. 3	49. 0
50. 2	51. 20	52. 2	53. 9	54. 3	55. 25				

Mathematics

56. C	57. C	58. C	59. A	60. D	61. C	62. D	63. B	64. A	65. B
66. A	67. D	68. C	69. D	70. B	71. B	72. B	73. A	74. D	75. 51
76. 3	77. 83	78. 6	79. 85	80. 62	81. 1	82. 243	83. 21	84. 14	

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