

JEE MAIN 2022 · QUESTION PAPER

29 Jun 2022 Shift 1

83 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	16 Q30 to Q45	9 Q46 to Q54
● Mathematics	19 Q55 to Q73	10 Q74 to Q83
In this PDF		
83 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.

prepwisar.in/pyqs/paper/2022-06-29-morning · Free, no signup needed to start

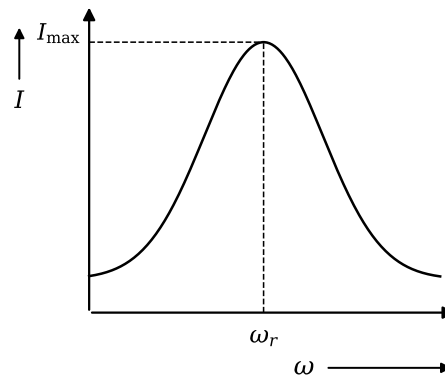
Answers follow NTA's final answer keys. Typing errors are possible, so check doubtful answers against the official key. Spotted a mistake? prepwisar.in/feedback · Terms: prepwisar.in/terms

Q1 Alternating Current

[Step-by-step solution](#) › [prepwisar.in/questions/UsiK3F9FJn](https://www.prepwisar.in/questions/UsiK3F9FJn)

For a series LCR circuit, I vs ω curve is shown:

- (a) To the left of ω_r , the circuit is mainly capacitive.
- (b) To the left of ω_r , the circuit is mainly inductive.
- (c) At ω_r , impedance of the circuit is equal to the resistance of the circuit.
- (d) At ω_r , impedance of the circuit is 0.



Choose the most appropriate answer from the options given below:

- (A) (a) and (d) only. (B) (b) and (d) only. (C) (a) and (c) only. (D) (b) and (c) only.

Q2 Nuclear Physics

[Step-by-step solution](#) › [prepwisar.in/questions/nbcr7jGGBP](https://www.prepwisar.in/questions/nbcr7jGGBP)

The activity of a radioactive material is 2.56×10^{-3} Ci. If the half life of the material is 5 days, after how many days the activity will become 2×10^{-5} Ci?

- (A) 30 days (B) 35 days (C) 40 days (D) 25 days

Q3 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) › [prepwisar.in/questions/ik_XWNTy4v](https://www.prepwisar.in/questions/ik_XWNTy4v)

A parallel plate capacitor filled with a medium of dielectric constant 10, is connected across a battery and is charged. The dielectric slab is replaced by another slab of dielectric constant 15. Then the energy of capacitor will:

- (A) increase by 50% (B) decrease by 15% (C) increase by 25% (D) increase by 33%

Q4 Centre of Mass & Linear Momentum

[Step-by-step solution](#) › [prepwisar.in/questions/ZU3IJ-pRXI](https://www.prepwisar.in/questions/ZU3IJ-pRXI)

A body of mass M at rest explodes into three pieces, in the ratio of masses 1 : 1 : 2. Two smaller pieces fly off perpendicular to each other with velocities of 30 ms^{-1} and 40 ms^{-1} respectively. The velocity of the third piece will be:

- (A) 15 ms^{-1} (B) 25 ms^{-1} (C) 35 ms^{-1} (D) 50 ms^{-1}

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

Assertion A : The photoelectric effect does not take place, if the energy of the incident radiation is less than the work function of a metal.

Reason R : Kinetic energy of the photoelectrons is zero, if the energy of the incident radiation is equal to the work function of a metal.

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

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

A positive charge particle of 100 mg is thrown in opposite direction to a uniform electric field of strength $1 \times 10^5 \text{ NC}^{-1}$. If the charge on the particle is $40 \mu\text{C}$ and the initial velocity is 200 ms^{-1} , how much distance it will travel before coming to the rest momentarily:

- (A) 1 m (B) 5 m (C) 10 m (D) 0.5 m

The escape velocity of a body on a planet 'A' is 12 kms^{-1} . The escape velocity of the body on another planet 'B', whose density is four times and radius is half of the planet 'A', is:

- (A) 12 kms^{-1} (B) 24 kms^{-1} (C) 36 kms^{-1} (D) 6 kms^{-1}

A cylinder of fixed capacity of 44.8 litres contains helium gas at standard temperature and pressure. The amount of heat needed to raise the temperature of gas in the cylinder by 20.0°C will be:
(Given gas constant $R = 8.3 \text{ JK}^{-1}\text{-mol}^{-1}$)

- (A) 249 J (B) 415 J (C) 498 J (D) 830 J

In van der Waal equation $\left[P + \frac{a}{V^2}\right] [V - b] = RT$; P is pressure, V is volume, R is universal gas constant and T is temperature. The ratio of constants $\frac{a}{b}$ is dimensionally equal to:

- (A) $\frac{P}{V}$ (B) $\frac{V}{P}$ (C) PV (D) PV^3

At a certain place the angle of dip is 30° and the horizontal component of earth's magnetic field is 0.5 G. The earth's total magnetic field (in G), at that certain place, is:

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

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Q11 Moving Charges & Magnetism[Step-by-step solution](https://www.prepwisar.in/questions/b5i4VtKtQY) > prepwisar.in/questions/b5i4VtKtQY

A charge particle moves along circular path in a uniform magnetic field in a cyclotron. The kinetic energy of the charge particle increases to 4 times its initial value. What will be the ratio of new radius to the original radius of circular path of the charge particle:

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

Q12 Rectilinear Motion[Step-by-step solution](https://www.prepwisar.in/questions/rSAKK_x9zE) > prepwisar.in/questions/rSAKK_x9zE

Two balls A and B are placed at the top of 180 m tall tower. Ball A is released from the top at $t = 0$ s. Ball B is thrown vertically down with an initial velocity 'u' at $t = 2$ s. After a certain time, both balls meet 100 m above the ground. Find the value of 'u' in ms^{-1} . [use $g = 10 \text{ ms}^{-2}$]:

- (A) 10 (B) 15 (C) 20 (D) 30

Q13 Elasticity[Step-by-step solution](https://www.prepwisar.in/questions/TMzMv9JLX4) > prepwisar.in/questions/TMzMv9JLX4

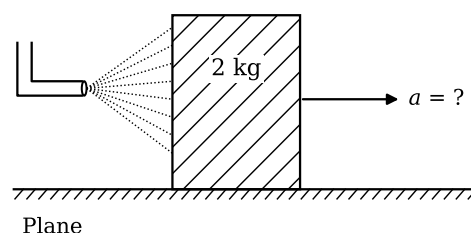
A wire of length L is hanging from a fixed support. The length changes to L_1 and L_2 when masses 1 kg and 2 kg are suspended respectively from its free end. Then the value of L is equal to:

- (A) $\sqrt{L_1 L_2}$ (B) $\frac{L_1 + L_2}{2}$ (C) $2L_1 - L_2$ (D) $3L_1 - 2L_2$

Q14 Newton's Laws of Motion[Step-by-step solution](https://www.prepwisar.in/questions/VecXweRy1p) > prepwisar.in/questions/VecXweRy1p

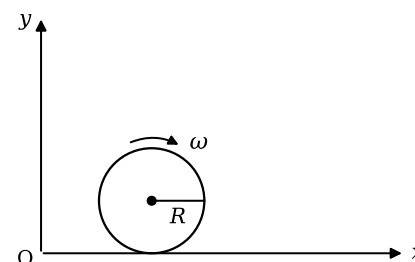
A block of metal weighing 2 kg is resting on a frictionless plane (as shown in figure). It is struck by a jet releasing water at a rate of 1 kgs^{-1} and at a speed of 10 ms^{-1} . Then, the initial acceleration of the block, in ms^{-2} , will be:

- (A) 3 (B) 6 (C) 5 (D) 4

**Q15** Rotational Motion[Step-by-step solution](https://www.prepwisar.in/questions/TrIAZf-0aZ) > prepwisar.in/questions/TrIAZf-0aZ

A spherical shell of 1 kg mass and radius R is rolling with angular speed ω on horizontal plane (as shown in figure). The magnitude of angular momentum of the shell about the origin O is $\frac{a}{3} R^2 \omega$. The value of a will be:

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

**Q16** Wave Optics[Step-by-step solution](https://www.prepwisar.in/questions/foOc0OUGoa) > prepwisar.in/questions/foOc0OUGoa

Using Young's double slit experiment, a monochromatic light of wavelength $5000 \text{ \AA}$ produces fringes of fringe width 0.5 mm. If another monochromatic light of wavelength $6000 \text{ \AA}$ is used and the separation between the slits is doubled, then the new fringe width will be:

- (A) 0.5 mm (B) 1.0 mm (C) 0.6 mm (D) 0.3 mm

Q17 Mechanical Waves[Step-by-step solution](https://www.prepwisar.in/questions/Uh_EIK2Bqz) > prepwisar.in/questions/Uh_EIK2Bqz

A longitudinal wave is represented by $x = 10 \sin 2\pi \left(nt - \frac{x}{\lambda} \right)$ cm. The maximum particle velocity will be four times the wave velocity if the determined value of wavelength is equal to:

- (A) 2π (B) 5π (C) π (D) $\frac{5\pi}{2}$

Q18 Work, Energy & Power[Step-by-step solution](#) > [prepwiser.in/questions/SV3mlas5cA](#)

A particle of mass 500 gm is moving in a straight line with velocity $v = b x^{5/2}$. The work done by the net force during its displacement from $x = 0$ to $x = 4$ m is : (Take $b = 0.25 \text{ m}^{-3/2} \text{ s}^{-1}$).

- (A) 2 J (B) 4 J (C) 8 J (D) 16 J

Q19 Vectors[Step-by-step solution](#) > [prepwiser.in/questions/W4ajotZPv](#)

Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. If magnitude of $\vec{A} + \vec{B}$ is equal to two times the magnitude of $\vec{A} - \vec{B}$, then the angle between $\vec{A}$ and $\vec{B}$ will be:

- (A) $\sin^{-1} \left(\frac{3}{5} \right)$ (B) $\sin^{-1} \left(\frac{1}{3} \right)$ (C) $\cos^{-1} \left(\frac{3}{5} \right)$ (D) $\cos^{-1} \left(\frac{1}{3} \right)$

Physics Section B · Numerical value

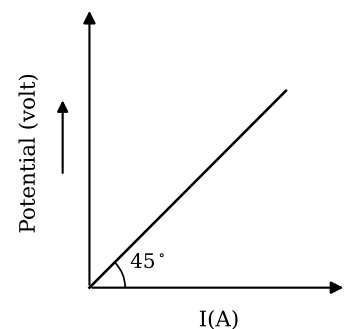
Q20 to Q29

Q20 Atomic Physics **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/oy3UrX5VD](#)

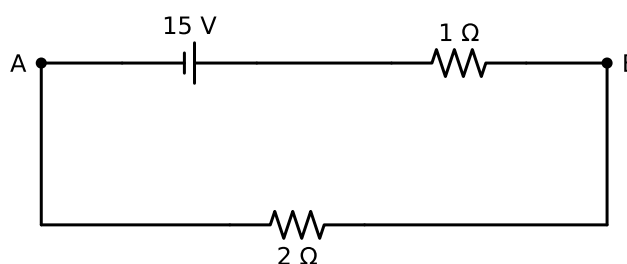
$\sqrt{d_1}$ and $\sqrt{d_2}$ are the impact parameters corresponding to scattering angles 60° and 90° respectively, when an α particle is approaching a gold nucleus. For $d_1 = x d_2$, the value of x will be _____.

Q21 Current Electricity **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/kIGDsCKOQF](#)

The variation of applied potential and current flowing through a given wire is shown in figure. The length of wire is 31.4 cm. The diameter of wire is measured as 2.4 cm. The resistivity of the given wire is measured as $x \times 10^{-3} \Omega \text{ cm}$. The value of x is _____. [Take $\pi = 3.14$]

**Q22** Current Electricity **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/extD6L_0op](#)

For the network shown below, the value of $V_B - V_A$ is _____ V.

**Q23** Electromagnetic Waves **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/qFOs1xZVT](#)

The intensity of the light from a bulb incident on a surface is 0.22 W/m^2 . The amplitude of the magnetic field in this light-wave is _____ $\times 10^{-9} \text{ T}$.

(Given : Permittivity of vacuum $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$, speed of light in vacuum $c = 3 \times 10^8 \text{ ms}^{-1}$)

Q24 Semiconductors & Electronic Devices **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/JfrIRJRztR](#)

A transistor is used in an amplifier circuit in common emitter mode. If the base current changes by $100 \mu\text{A}$, it brings a change of 10 mA in collector current. If the load resistance is $2 \text{ k}\Omega$ and input resistance is $1 \text{ k}\Omega$, the value of power gain is $x \times 10^4$. The value of x is _____.

Q25 Ray Optics **NUMERICAL**[Step-by-step solution](#) › [prepwise.in/questions/-iKt0wlbys](#)

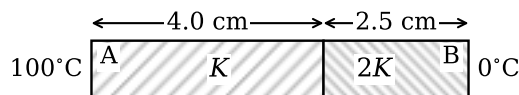
A parallel beam of light is allowed to fall on a transparent spherical globe of diameter 30 cm and refractive index 1.5. The distance from the centre of the globe at which the beam of light can converge is _____ mm.

Q26 Current Electricity **NUMERICAL**[Step-by-step solution](#) › [prepwise.in/questions/1c3U2pbHEU](#)

Two coils require 20 minutes and 60 minutes respectively to produce same amount of heat energy when connected separately to the same source. If they are connected in parallel arrangement to the same source; the time required to produce same amount of heat by the combination of coils, will be _____ min.

Q27 Heat Transfer **NUMERICAL**[Step-by-step solution](#) › [prepwise.in/questions/6vIRpfXZOH](#)

As per the given figure, two plates A and B of thermal conductivity K and $2K$ are joined together to form a compound plate. The thickness of plates are 4.0 cm and 2.5 cm respectively and the area of cross-section is 120 cm^2 for each plate. The equivalent thermal conductivity of the compound plate is $(1 + \frac{5}{\alpha}) K$, then the value of α will be _____.

**Q28** Thermodynamics **NUMERICAL**[Step-by-step solution](#) › [prepwise.in/questions/Z_6Maf6R9X](#)

300 cal. of heat is given to a heat engine and it rejects 225 cal. If source temperature is 227°C , then the temperature of sink will be _____ $^\circ\text{C}$.

Q29 Simple Harmonic Motion **NUMERICAL**[Step-by-step solution](#) › [prepwise.in/questions/hhflU16z-i](#)

A body is performing simple harmonic with an amplitude of 10 cm. The velocity of the body was tripled by air jet when it is at 5 cm from its mean position. The new amplitude of vibration is $\sqrt{x}$ cm. The value of x is _____.

Chemistry Section A · Multiple choice

Q30 to Q45

Q30 Alcohols, Phenols & Ethers[Step-by-step solution](#) › [prepwise.in/questions/NgLbHhkbU_](#)

Given below are two statements:

Statement I : Phenols are weakly acidic.

Statement II : Therefore they are freely soluble in NaOH solution and are weaker acids than alcohols and water.

Choose the most appropriate 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.

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Q31 Carboxylic Acids & Their Derivatives[Step-by-step solution](https://www.prepwise.in/questions/qp4r-E3Gk6) › prepwise.in/questions/qp4r-E3Gk6

Given below are two statements:

Statement I : The esterification of carboxylic acid with an alcohol is a nucleophilic acyl substitution.

Statement II : Electron withdrawing groups in the carboxylic acid will increase the rate of esterification reaction.

Choose the most appropriate 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.

Q32 Carbohydrates & Biomolecules[Step-by-step solution](https://www.prepwise.in/questions/HZvplzQFqT) › prepwise.in/questions/HZvplzQFqT

Sugar moiety in DNA and RNA molecules respectively are

- (A) β -D-2-deoxyribose, β -D-deoxyribose. (B) β -D-2-deoxyribose, β -D-ribose
(C) β -D-ribose, β -D-2-deoxyribose. (D) β -D-deoxyribose, β -D-2-deoxyribose.

Q33 Atomic Structure[Step-by-step solution](https://www.prepwise.in/questions/rHHWEg0f5e) › prepwise.in/questions/rHHWEg0f5e

The electronic configuration of Pt (atomic number 78) is:

- (A) $[\text{Xe}] 4f^{14} 5d^9 6s^1$ (B) $[\text{Kr}] 4f^{14} 5d^{10}$ (C) $[\text{Xe}] 4f^{14} 5d^{10}$ (D) $[\text{Xe}] 4f^{14} 5d^8 6s^2$

Q34 Hydrocarbons: Alkenes & Alkynes[Step-by-step solution](https://www.prepwise.in/questions/sMa_92-Fxh) › prepwise.in/questions/sMa_92-Fxh

Two isomers 'A' and 'B' with molecular formula C_4H_8 give different products on oxidation with KMnO_4 in acidic medium. Isomer 'A' on reaction with KMnO_4/H^+ results in effervescence of a gas and gives ketone. The compound 'A' is

- (A) But-1-ene. (B) cis-But-2-ene. (C) trans-But-2-ene. (D) 2-methyl propene.

Q35 Hydrogen & s-Block Elements[Step-by-step solution](https://www.prepwise.in/questions/UoOMTwegV9) › prepwise.in/questions/UoOMTwegV9

Which one of the following reactions indicates the reducing ability of hydrogen peroxide in basic medium?

- (A) $\text{HOCl} + \text{H}_2\text{O}_2 \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^- + \text{O}_2$
(B) $\text{PbS} + 4\text{H}_2\text{O}_2 \rightarrow \text{PbSO}_4 + 4\text{H}_2\text{O}$
(C) $2\text{MnO}_4^- + 3\text{H}_2\text{O}_2 \rightarrow 2\text{MnO}_2 + 3\text{O}_2 + 2\text{H}_2\text{O} + 2\text{OH}^-$
(D) $\text{Mn}^{2+} + \text{H}_2\text{O}_2 \rightarrow \text{Mn}^{4+} + 2\text{OH}^-$

Q36 Ionic Equilibrium[Step-by-step solution](https://www.prepwise.in/questions/VgPEkzNPuX) › prepwise.in/questions/VgPEkzNPuX

The solubility of AgCl will be maximum in which of the following?

- (A) 0.01 M KCl (B) 0.01 M HCl (C) 0.01 M AgNO_3 (D) Deionised water

Q37 Metallurgy[Step-by-step solution](https://www.prepwise.in/questions/bjjh6JjdKd) › prepwise.in/questions/bjjh6JjdKd

In isolation of which one of the following metals from their ores, the use of cyanide salt is not commonly involved?

- (A) Zinc (B) Gold (C) Silver (D) Copper

Match List-I with List-II.

	List-I (Metal)		List-II (Application)
(A)	Cs	(I)	High temperature thermometer
(B)	Ga	(II)	Water repellent sprays
(C)	B	(III)	Photoelectric cells
(D)	Si	(IV)	Bullet proof vest

Choose the most appropriate answer from the options given below:

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

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

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

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

The oxoacid of phosphorus that is easily obtained from a reaction of alkali and white phosphorus and has two P-H bonds, is:

(A) Phosphonic acid

(B) Phosphinic acid

(C) Pyrophosphorus acid

(D) Hypophosphoric acid

The polymer, which can be stretched and remains its original status on releasing the force is

(A) Bakelite.

(B) Nylon 6, 6.

(C) Buna-N.

(D) Terylene.

Arrange the following in the decreasing order of their covalent character:

(A) LiCl

(B) NaCl

(C) KCl

(D) CsCl

Choose the most appropriate answer from the options given below:

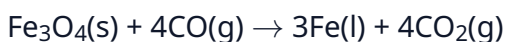
(A) (A) > (C) > (B) > (D)

(B) (B) > (A) > (C) > (D)

(C) (A) > (B) > (C) > (D)

(D) (A) > (B) > (D) > (C)

Production of iron in blast furnace follows the following equation



when 4.640 kg of Fe_3O_4 and 2.520 kg of CO are allowed to react then the amount of iron (in g) produced is:

[Given : Molar Atomic mass (g mol^{-1}) : Fe = 56, Molar Atomic mass (g mol^{-1}) : O = 16, Molar Atomic mass (g mol^{-1}) : C = 12]

(A) 1400

(B) 2200

(C) 3360

(D) 4200

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Which of the following statements are correct?

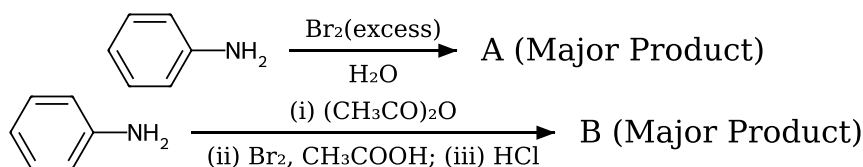
- (A) The electronic configuration of Cr is $[\text{Ar}] 3d^5 4s^1$.
 (B) The magnetic quantum number may have a negative value.
 (C) In the ground state of an atom, the orbitals are filled in order of their increasing energies.
 (D) The total number of nodes are given by $n - 2$.

Choose the most appropriate answer from the options given below:

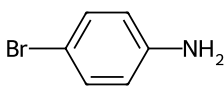
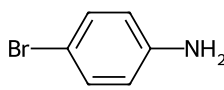
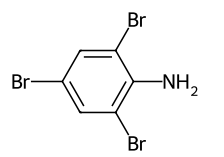
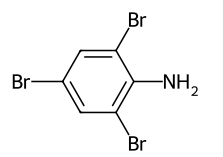
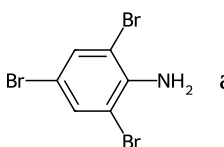
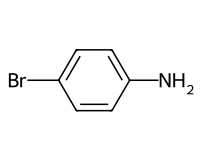
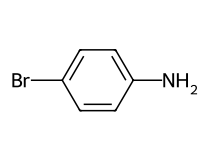
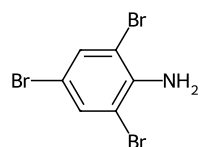
- (A) (A), (C) and (D) only (B) (A) and (B) only (C) (A) and (C) only (D) (A), (B) and (C) only

Which of the following is a correct statement?

- (A) Brownian motion destabilises sols.
 (B) Any amount of dispersed phase can added to emulsion without destabilising it.
 (C) Mixing two oppositely charged sols in equal amount neutralises charges and stabilises colloids.
 (D) Presence of equal and similar charges on colloidal particles provides stability to the colloidal solution.

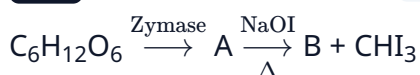


Consider the above reactions, the product A and product B respectively are

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

Chemistry Section B · Numerical value

Q46 to Q54



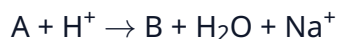
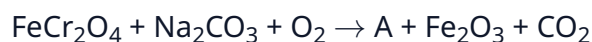
The number of carbon atoms present in the product B is _____.

The activation energy of one of the reactions in a biochemical process is $532611 \text{ J mol}^{-1}$. When the temperature falls from 310 K to 300 K, the change in rate constant observed is $k_{300} = x \times 10^{-3} k_{310}$. The value of x is _____.

[Given: $\ln 10 = 2.3$, $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$]

Q48 d & f Block Elements **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/sQIxWjUYjc) > prepwisar.in/questions/sQIxWjUYjc

The number of terminal oxygen atoms present in the product B obtained from the following reaction is _____.

**Q49** d & f Block Elements **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/Tmyh3Eq-OD) > prepwisar.in/questions/Tmyh3Eq-OD

An acidified manganate solution undergoes disproportionation reaction. The spin-only magnetic moment value of the product having manganese in higher oxidation state is _____ B.M. (Nearest integer)

Q50 Electrochemistry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/cyVNoMSSI1) > prepwisar.in/questions/cyVNoMSSI1

A dilute solution of sulphuric acid is electrolysed using a current of 0.10 A for 2 hours to produce hydrogen and oxygen gas. The total volume of gases produced at STP is _____ cm^3 . (Nearest integer)

[Given : Faraday constant $F = 96500 \text{ C mol}^{-1}$ at STP, molar volume of an ideal gas is 22.7 L mol^{-1}]

Q51 Solutions & Colligative Properties **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/wCXrNXy2HM) > prepwisar.in/questions/wCXrNXy2HM

1.2 mL of acetic acid is dissolved in water to make 2.0 L of solution. The depression in freezing point observed for this strength of acid is 0.0198°C . The percentage of dissociation of the acid is _____. (Nearest integer)

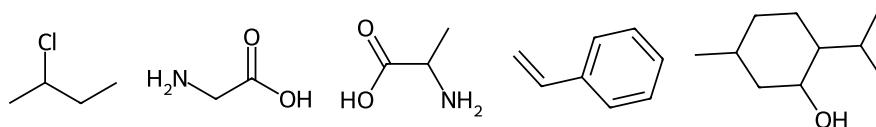
[Given : Density of acetic acid is 1.02 g mL^{-1} , Molar mass of acetic acid is 60 g mol^{-1} , $K_f(\text{H}_2\text{O}) = 1.85 \text{ K kg mol}^{-1}$]

Q52 Chemical Thermodynamics **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/XZVZFS7Wum) > prepwisar.in/questions/XZVZFS7Wum

17.0 g of NH_3 completely vapourises at -33.42°C and 1 bar pressure and the enthalpy change in the process is 23.4 kJ mol^{-1} . The enthalpy change for the vapourisation of 85 g of NH_3 under the same conditions is _____ kJ.

Q53 General Organic Chemistry (GOC) **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/BRD501UwL6) > prepwisar.in/questions/BRD501UwL6

Observe structures of the following compounds



The total number of structures/compounds which possess asymmetric carbon atoms is _____.

Q54 Purification & Characterisation of Organic Compounds **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/qfjkfeIMfz) > prepwisar.in/questions/qfjkfeIMfz

Kjeldahl's method was used for the estimation of nitrogen in an organic compound. The ammonia evolved from 0.55 g of the compound neutralised 12.5 mL of 1 M H_2SO_4 solution. The percentage of nitrogen in the compound is _____. (Nearest integer)

Q55 Three Dimensional Geometry

[Step-by-step solution](#) › [prepwisar.in/questions/Wj85y7IVcs](https://www.prepwisar.in/questions/Wj85y7IVcs)

If the mirror image of the point $(2, 4, 7)$ in the plane $3x - y + 4z = 2$ is (a, b, c) , then $2a + b + 2c$ is equal to:

- (A) 54 (B) 50 (C) -6 (D) -42

Q56 Applications of Derivatives

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

A wire of length 22 m is to be cut into two pieces. One of the pieces is to be made into a square and the other into an equilateral triangle. Then, the length of the side of the equilateral triangle, so that the combined area of the square and the equilateral triangle is minimum, is:

- (A) $\frac{22}{9 + 4\sqrt{3}}$ (B) $\frac{66}{9 + 4\sqrt{3}}$ (C) $\frac{22}{4 + 9\sqrt{3}}$ (D) $\frac{66}{4 + 9\sqrt{3}}$

Q57 Binomial Theorem

[Step-by-step solution](#) › [prepwisar.in/questions/wHttU00vEM](https://www.prepwisar.in/questions/wHttU00vEM)

If the constant term in the expansion of

$(3x^3 - 2x^2 + \frac{5}{x^5})^{10}$ is $2^k \cdot l$, where l is an odd integer, then the value of k is equal to:

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

Q58 Circles

[Step-by-step solution](#) › [prepwisar.in/questions/_LyGj7msbT](https://www.prepwisar.in/questions/_LyGj7msbT)

Let the tangent to the circle $C_1: x^2 + y^2 = 2$ at the point $M(-1, 1)$ intersect the circle $C_2: (x - 3)^2 + (y - 2)^2 = 5$, at two distinct points A and B . If the tangents to C_2 at the points A and B intersect at N , then the area of the triangle ANB is equal to:

- (A) $\frac{1}{2}$ (B) $\frac{2}{3}$ (C) $\frac{1}{6}$ (D) $\frac{5}{3}$

Q59 Complex Numbers

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

Let α and β be the roots of the equation $x^2 + (2i - 1) = 0$. Then, the value of $|\alpha^8 + \beta^8|$ is equal to:

- (A) 50 (B) 250 (C) 1250 (D) 1500

Q60 Continuity & Differentiability

[Step-by-step solution](#) › [prepwisar.in/questions/6yZE39f6TS](https://www.prepwisar.in/questions/6yZE39f6TS)

Let $f: R \rightarrow R$ be a function defined by:

$$f(x) = \begin{cases} \max\{t^3 - 3t\} t \leq x & ; & x \leq 2 \\ x^2 + 2x - 6 & ; & 2 < x < 3 \\ [x - 3] + 9 & ; & 3 \leq x \leq 5 \\ 2x + 1 & ; & x > 5 \end{cases}$$

where $[t]$ is the greatest integer less than or equal to t . Let m be the number of points where f is not

differentiable and $I = \int_{-2}^2 f(x) dx$. Then the ordered pair (m, I) is equal to:

- (A) $(3, \frac{27}{4})$ (B) $(3, \frac{23}{4})$ (C) $(4, \frac{27}{4})$ (D) $(4, \frac{23}{4})$

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$$\int_0^5 \cos \left(\pi \left(x - \left[\frac{x}{2} \right] \right) \right) dx$$

where $[t]$ denotes greatest integer less than or equal to t , is equal to:

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

Let the solution curve of the differential equation

$$x \frac{dy}{dx} - y = \sqrt{y^2 + 16x^2}, y(1) = 3 \text{ be } y = y(x). \text{ Then } y(2) \text{ is equal to:}$$

- (A) 15 (B) 11 (C) 13 (D) 17

The domain of the function

$$\cos^{-1} \left(\frac{2 \sin^{-1} \left(\frac{1}{4x^2 - 1} \right)}{\pi} \right)$$

is:

- (A) $R - \left\{ -\frac{1}{2}, \frac{1}{2} \right\}$ (B) $(-\infty, -1] \cup [1, \infty) \cup \{0\}$
 (C) $\left(-\infty, \frac{-1}{2} \right) \cup \left(\frac{1}{2}, \infty \right) \cup \{0\}$ (D) $\left(-\infty, \frac{-1}{\sqrt{2}} \right] \cup \left[\frac{1}{\sqrt{2}}, \infty \right) \cup \{0\}$

If the system of linear equations

$$2x + y - z = 7$$

$$x - 3y + 2z = 1$$

$x + 4y + \delta z = k$, where $\delta, k \in \mathbb{R}$ has infinitely many solutions, then $\delta + k$ is equal to:

- (A) -3 (B) 3 (C) 6 (D) 9

Let $A = [a_{ij}]$ be a square matrix of order 3 such that $a_{ij} = 2^{j-i}$, for all $i, j = 1, 2, 3$. Then, the matrix $A^2 + A^3 + \dots + A^{10}$ is equal to:

- (A) $\left(\frac{3^{10} - 3}{2} \right) A$ (B) $\left(\frac{3^{10} - 1}{2} \right) A$ (C) $\left(\frac{3^{10} + 1}{2} \right) A$ (D) $\left(\frac{3^{10} + 3}{2} \right) A$

Let PQ be a focal chord of the parabola $y^2 = 4x$ such that it subtends an angle of $\frac{\pi}{2}$ at the point $(3, 0)$.

Let the line segment PQ be also a focal chord of the ellipse $E : \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, a^2 > b^2$. If e is the eccentricity of the ellipse E, then the value of $\frac{1}{e^2}$ is equal to:

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

Q67 Probability: Basic[Step-by-step solution](https://www.prepwisar.in/questions/5NW3FEMu4W) › prepwisar.in/questions/5NW3FEMu4W

The probability that a randomly chosen 2×2 matrix with all the entries from the set of first 10 primes, is singular, is equal to:

- (A) $\frac{133}{10^4}$ (B) $\frac{18}{10^3}$ (C) $\frac{19}{10^3}$ (D) $\frac{271}{10^4}$

Q68 Sequences & Series[Step-by-step solution](https://www.prepwisar.in/questions/vKDyXEqud1) › prepwisar.in/questions/vKDyXEqud1

Let $\{a_n\}_{n=0}^{\infty}$ be a sequence such that $a_0 = a_1 = 0$ and $a_{n+2} = 2a_{n+1} - a_n + 1$ for all $n \geq 0$. Then, $\sum_{n=2}^{\infty} \frac{a_n}{7^n}$ is equal to:

- (A) $\frac{6}{343}$ (B) $\frac{7}{216}$ (C) $\frac{8}{343}$ (D) $\frac{49}{216}$

Q69 Relations & Functions (Basic)[Step-by-step solution](https://www.prepwisar.in/questions/iAaGWdJb0f) › prepwisar.in/questions/iAaGWdJb0f

Let a set $A = A_1 \cup A_2 \cup \dots \cup A_k$, where $A_i \cap A_j = \phi$ for $i \neq j$, $1 \leq j, j \leq k$. Define the relation R from A to A by $R = \{(x, y) : y \in A_i \text{ if and only if } x \in A_i, 1 \leq i \leq k\}$. Then, R is:

- (A) reflexive, symmetric but not transitive. (B) reflexive, transitive but not symmetric.
(C) reflexive but not symmetric and transitive. (D) an equivalence relation.

Q70 Statistics[Step-by-step solution](https://www.prepwisar.in/questions/fOQuOLZ0s8) › prepwisar.in/questions/fOQuOLZ0s8

Let the mean and the variance of 5 observations x_1, x_2, x_3, x_4, x_5 be $\frac{24}{5}$ and $\frac{194}{25}$ respectively. If the mean and variance of the first 4 observation are $\frac{7}{2}$ and a respectively, then $(4a + x_5)$ is equal to:

- (A) 13 (B) 15 (C) 17 (D) 18

Q71 Vectors[Step-by-step solution](https://www.prepwisar.in/questions/ZYPpkVG56p) › prepwisar.in/questions/ZYPpkVG56p

Let $\vec{a} = \alpha\hat{i} + 3\hat{j} - \hat{k}$, $\vec{b} = 3\hat{i} - \beta\hat{j} + 4\hat{k}$ and $\vec{c} = \hat{i} + 2\hat{j} - 2\hat{k}$ where $\alpha, \beta \in R$, be three vectors. If the projection of $\vec{a}$ on $\vec{c}$ is $\frac{10}{3}$ and

$$\vec{b} \times \vec{c} = -6\hat{i} + 10\hat{j} + 7\hat{k}$$

, then the value of $\alpha + \beta$ is equal to:

- (A) 3 (B) 4 (C) 5 (D) 6

Q72 Area Under Curves[Step-by-step solution](https://www.prepwisar.in/questions/cBTZDfu8Ye) › prepwisar.in/questions/cBTZDfu8Ye

The area enclosed by $y^2 = 8x$ and $y = \sqrt{2}x$ that lies outside the triangle formed by $y = \sqrt{2}x$, $x = 1$, $y = 2\sqrt{2}$, is equal to:

- (A) $\frac{16\sqrt{2}}{6}$ (B) $\frac{11\sqrt{2}}{6}$ (C) $\frac{13\sqrt{2}}{6}$ (D) $\frac{5\sqrt{2}}{6}$

Q73 Straight Lines[Step-by-step solution](https://www.prepwisar.in/questions/IFcyJo-z6Z) › prepwisar.in/questions/IFcyJo-z6Z

The distance between the two points A and A' which lie on $y = 2$ such that both the line segments AB and $A'B$ (where B is the point $(2, 3)$) subtend angle $\frac{\pi}{4}$ at the origin, is equal to:

- (A) 10 (B) $\frac{48}{5}$ (C) $\frac{52}{5}$ (D) 3

Q74 Three Dimensional Geometry **NUMERICAL**

[Step-by-step solution](#) › prepwiser.in/questions/MRHtYb7zfr

Let d be the distance between the foot of perpendiculars of the points $P(1, 2, -1)$ and $Q(2, -1, 3)$ on the plane $-x + y + z = 1$. Then d^2 is equal to _____.

Q75 Three Dimensional Geometry **NUMERICAL**

[Step-by-step solution](#) › prepwiser.in/questions/4KPArKIfNB

Let

$$P_1 : \vec{r} \cdot (2\hat{i} + \hat{j} - 3\hat{k}) = 4$$

be a plane. Let P_2 be another plane which passes through the points $(2, -3, 2)$, $(2, -2, -3)$ and $(1, -4, 2)$. If the direction ratios of the line of intersection of P_1 and P_2 be $16, \alpha, \beta$, then the value of $\alpha + \beta$ is equal to _____.

Q76 Complex Numbers **NUMERICAL**

[Step-by-step solution](#) › prepwiser.in/questions/kX9gmbTA_X

Let $S = \{z \in \mathbb{C} : |z - 2| \leq 1, z(1 + i) + \bar{z}(1 - i) \leq 2\}$. Let $|z - 4i|$ attains minimum and maximum values, respectively, at $z_1 \in S$ and $z_2 \in S$. If $5(|z_1|^2 + |z_2|^2) = \alpha + \beta\sqrt{5}$, where α and β are integers, then the value of $\alpha + \beta$ is equal to _____.

Q77 Differential Equations **NUMERICAL**

[Step-by-step solution](#) › prepwiser.in/questions/u_7qGwppiY

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

$$\frac{dy}{dx} + \frac{\sqrt{2}y}{2\cos^4 x - \cos^2 x} = xe^{\tan^{-1}(\sqrt{2}\cot 2x)}, \quad 0 < x < \frac{\pi}{2}$$

with $y\left(\frac{\pi}{4}\right) = \frac{\pi^2}{32}$. If

$$y\left(\frac{\pi}{3}\right) = \frac{\pi^2}{18}e^{-\tan^{-1}(\alpha)}$$

, then the value of $3\alpha^2$ is equal to _____.

Q78 Functions (Advanced) **NUMERICAL**

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

Let $c, k \in \mathbb{R}$. If $f(x) = (c + 1)x^2 + (1 - c^2)x + 2k$ and $f(x + y) = f(x) + f(y) - xy$, for all $x, y \in \mathbb{R}$, then the value of $|2(f(1) + f(2) + f(3) + \dots + f(20))|$ is equal to _____.

Q79 Hyperbola **NUMERICAL**

[Step-by-step solution](#) › prepwiser.in/questions/V2gq0PbiX7

Let $H : \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, $a > 0$, $b > 0$, be a hyperbola such that the sum of lengths of the transverse and the conjugate axes is $4(2\sqrt{2} + \sqrt{14})$. If the eccentricity H is $\frac{\sqrt{11}}{2}$, then the value of $a^2 + b^2$ is equal to _____.

Q80 Inverse Trigonometric Functions **NUMERICAL**

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

$$50 \tan \left(3 \tan^{-1} \left(\frac{1}{2} \right) + 2 \cos^{-1} \left(\frac{1}{\sqrt{5}} \right) \right) + 4\sqrt{2} \tan \left(\frac{1}{2} \tan^{-1}(2\sqrt{2}) \right)$$

is equal to _____.

Q81 Permutations & Combinations **NUMERICAL**

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

Let $b_1 b_2 b_3 b_4$ be a 4-element permutation with $b_i \in \{1, 2, 3, \dots, 100\}$ for $1 \leq i \leq 4$ and $b_i \neq b_j$ for $i \neq j$, such that either b_1, b_2, b_3 are consecutive integers or b_2, b_3, b_4 are consecutive integers. Then the number of such permutations $b_1 b_2 b_3 b_4$ is equal to _____.

The number of elements in the set

$$S = \{\theta \in [-4\pi, 4\pi] : 3\cos^2 2\theta + 6 \cos 2\theta - 10\cos^2 \theta + 5 = 0\}$$

is _____.

The number of solutions of the equation

$$2\theta - \cos^2 \theta + \sqrt{2} = 0 \text{ in } \mathbb{R} \text{ is equal to } \underline{\hspace{2cm}}.$$

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Physics

1. C	2. B	3. A	4. B	5. B	6. D	7. A	8. C
9. C	10. A	11. C	12. D	13. C	14. C	15. C	16. D
17. B	18. D	19. C	20. 3	21. 144	22. 10	23. 43	24. 2
25. 225	26. 15	27. 21	28. 102	29. 700			

Chemistry

30. C	31. A	32. B	33. A	34. D	35. C	36. D	37. D
38. A	39. B	40. C	41. C	42. C	43. D	44. D	45. C
46. 1	47. 1	48. 6	49. 0	50. 127	51. 5	52. 117	53. 3
54. 64							

Mathematics

55. C	56. B	57. D	58. C	59. A	60. C	61. D	62. A
63. D	64. B	65. A	66. B	67. C	68. B	69. D	70. B
71. A	72. C	73. C	74. 26	75. 28	76. 26	77. 2	78. 3395
79. 88	80. 29	81. 18915	82. 32	83. 1			

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