

JEE MAIN 2023 · QUESTION PAPER

15 Apr 2023 **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	10 Q46 to Q55
● Mathematics	19 Q56 to Q74	9 Q75 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.

prepwis.in/pyqs/paper/2023-04-15-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 Nuclear Physics

[Step-by-step solution](https://www.prepwisar.in/questions/y63SGOD7C8) > prepwisar.in/questions/y63SGOD7C8

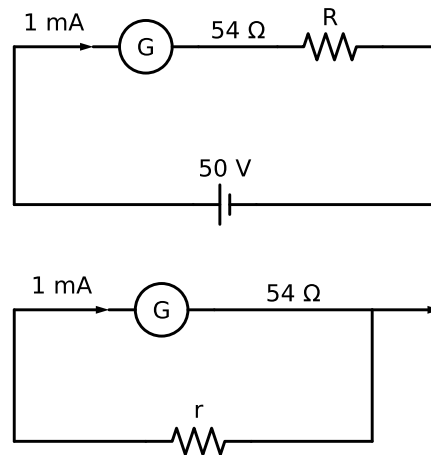
The half-life of a radioactive nucleus is 5 years. The fraction of the original sample that would decay in 15 years is:

- (A) $\frac{1}{8}$ (B) $\frac{3}{4}$ (C) $\frac{7}{8}$ (D) $\frac{1}{4}$

Q2 Moving Charges & Magnetism

[Step-by-step solution](https://www.prepwisar.in/questions/Nz7nXobEur) > prepwisar.in/questions/Nz7nXobEur

For designing a voltmeter of range 50V and an ammeter of range 10mA using a galvanometer which has a coil of resistance 54Ω showing a full scale deflection for 1mA as in figure.



- (A) for voltmeter $R \approx 50k\Omega$
 (B) for ammeter $r \approx 0.2\Omega$
 (C) for ammeter $r = 6\Omega$
 (D) for voltmeter $R \approx 5k\Omega$
 (E) for voltmeter $R \approx 500\Omega$

Choose the correct answer from the options given below:

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

Q3 Current Electricity

[Step-by-step solution](https://www.prepwisar.in/questions/8YW-u43-Xx) > prepwisar.in/questions/8YW-u43-Xx

Given below are two statements:

Statement I: The equivalent resistance of resistors in a series combination is smaller than least resistance used in the combination.

Statement II: The resistivity of the material is independent of temperature.

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

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

Q4 Dual Nature of Radiation & Matter

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

The de Broglie wavelength of an electron having kinetic energy E is λ . If the kinetic energy of electron becomes $\frac{E}{4}$, then its de-Broglie wavelength will be:

- (A) $\sqrt{2}\lambda$ (B) 2λ (C) $\frac{\lambda}{2}$ (D) $\frac{\lambda}{\sqrt{2}}$

Q5 Electromagnetic Induction[Step-by-step solution > prepwiser.in/questions/awPIAGHcJ1](https://www.prepwiser.in/questions/awPIAGHcJ1)

12V battery connected to a coil of resistance 6Ω through a switch, drives a constant current in the circuit. The switch is opened in 1ms. The emf induced across the coil is 20V. The inductance of the coil is:

- (A) 5mH (B) 8mH (C) 10mH (D) 12mH

Q6 Electromagnetic Waves[Step-by-step solution > prepwiser.in/questions/AJL4KNxwrh](https://www.prepwiser.in/questions/AJL4KNxwrh)

Match **List I** with **List II** of Electromagnetic waves with corresponding wavelength range:

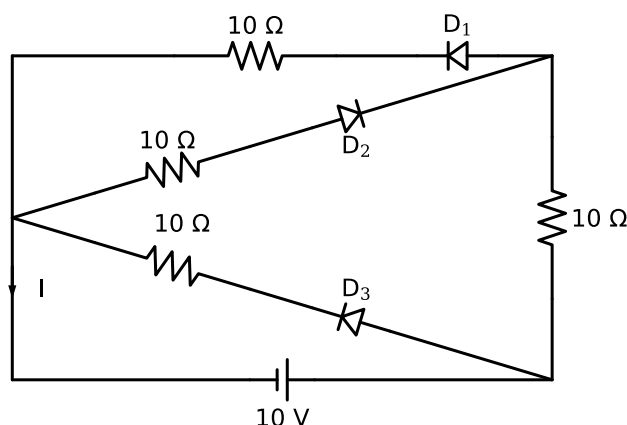
List I	List II
(A) Microwave	(I) 400nm to 1nm
(B) Ultraviolet	(II) 1nm to 10^{-3} nm
(C) X-Ray	(III) 1mm to 700nm
(D) Infra-red	(IV) 0.1m to 1mm

Choose the correct answer from the options given below:

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

Q7 Current Electricity[Step-by-step solution > prepwiser.in/questions/5aHAPUzeOP](https://www.prepwiser.in/questions/5aHAPUzeOP)

In the given circuit, the current (I) through the battery will be



- (A) 1A (B) 2.5A (C) 2A (D) 1.5A

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

The electric field due to a short electric dipole at a large distance (r) from center of dipole on the equatorial plane varies with distance as:

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

Q9 Gravitation[Step-by-step solution > prepwiser.in/questions/1hX6dJPLiI](https://www.prepwiser.in/questions/1hX6dJPLiI)

Two identical particles each of mass ' m ' go round a circle of radius a under the action of their mutual gravitational attraction. The angular speed of each particle will be:

- (A) $\sqrt{\frac{Gm}{2a^3}}$ (B) $\sqrt{\frac{Gm}{a^3}}$ (C) $\sqrt{\frac{Gm}{8a^3}}$ (D) $\sqrt{\frac{Gm}{4a^3}}$

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Q10 Gravitation[Step-by-step solution > prepwiser.in/questions/98bj8gl-Q0](https://www.prepwiser.in/questions/98bj8gl-Q0)

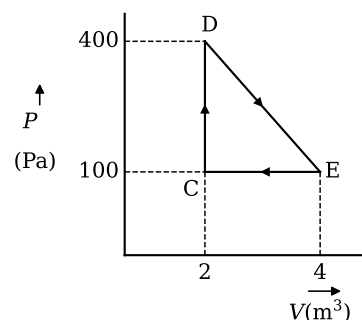
A body is released from a height equal to the radius (R) of the earth. The velocity of the body when it strikes the surface of the earth will be
(Given g = acceleration due to gravity on the earth.)

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

Q11 Thermodynamics[Step-by-step solution > prepwiser.in/questions/obznSAU9iy](https://www.prepwiser.in/questions/obznSAU9iy)

A thermodynamic system is taken through cyclic process. The total work done in the process is:

- (A) 100J (B) Zero (C) 300J (D) 200J

**Q12** Kinetic Theory of Gases[Step-by-step solution > prepwiser.in/questions/J-dZbI3ll-](https://www.prepwiser.in/questions/J-dZbI3ll-)

A flask contains Hydrogen and Argon in the ratio 2 : 1 by mass. The temperature of the mixture is 30°C . The ratio of average kinetic energy per molecule of the two gases ($K_{\text{argon}}/K_{\text{hydrogen}}$) is:
(Given: Atomic Weight of Ar = 39.9)

- (A) $\frac{39.9}{2}$ (B) 2 (C) 39.9 (D) 1

Q13 Newton's Laws of Motion[Step-by-step solution > prepwiser.in/questions/ud1v3ZdBfP](https://www.prepwiser.in/questions/ud1v3ZdBfP)

The position vector of a particle related to time t is given by

$$\vec{r} = (10t\hat{i} + 15t^2\hat{j} + 7t\hat{k}) \text{ m}$$

The direction of net force experienced by the particle is:

- (A) Positive x - axis (B) Positive y - axis (C) Positive z - axis (D) In x - y plane

Q14 Rectilinear Motion[Step-by-step solution > prepwiser.in/questions/wTWtky11sO](https://www.prepwiser.in/questions/wTWtky11sO)

The position of a particle related to time is given by $x = (5t^2 - 4t + 5) \text{ m}$. The magnitude of velocity of the particle at $t = 2\text{ s}$ will be:

- (A) 14ms^{-1} (B) 16ms^{-1} (C) 10ms^{-1} (D) 06ms^{-1}

Q15 Elasticity[Step-by-step solution > prepwiser.in/questions/nHWXg8qmxT](https://www.prepwiser.in/questions/nHWXg8qmxT)

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 ' l '. Another wire of same material of length ' $2L$ ' and radius ' $2r$ ' is pulled by a force ' $2f$ '. Then the increase in its length will be:

- (A) $2l$ (B) $4l$ (C) l (D) $l/2$

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Q16 Simple Harmonic Motion[Step-by-step solution](https://www.prepwiser.in/questions/GRT6t5upjV) › prepwiser.in/questions/GRT6t5upjV

In a linear Simple Harmonic Motion (SHM)

- (A) Restoring force is directly proportional to the displacement.
- (B) The acceleration and displacement are opposite in direction.
- (C) The velocity is maximum at mean position.
- (D) The acceleration is minimum at extreme points.

Choose the correct answer from the options given below:

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

Q17 Wave Optics[Step-by-step solution](https://www.prepwiser.in/questions/sR3v3SVPK4) › prepwiser.in/questions/sR3v3SVPK4

A single slit of width a is illuminated by a monochromatic light of wavelength 600nm . The value of ' a ' for which first minimum appears at $\theta = 30^\circ$ on the screen will be:

- (A) $3\mu\text{m}$
- (B) $0.6\mu\text{m}$
- (C) $1.8\mu\text{m}$
- (D) $1.2\mu\text{m}$

Q18 Units, Dimensions & Errors[Step-by-step solution](https://www.prepwiser.in/questions/e_w5b0PKA-) › prepwiser.in/questions/e_w5b0PKA-

The speed of a wave produced in water is given by $v = \lambda^a g^b \rho^c$. Where λ , g and ρ are wavelength of wave, acceleration due to gravity and density of water respectively. The values of a , b and c respectively, are:

- (A) $\frac{1}{2}, 0, \frac{1}{2}$
- (B) $1, 1, 0$
- (C) $1, -1, 0$
- (D) $\frac{1}{2}, \frac{1}{2}, 0$

Q19 Vectors[Step-by-step solution](https://www.prepwiser.in/questions/sUX95PtSCs) › prepwiser.in/questions/sUX95PtSCs

A vector in $x - y$ plane makes an angle of 30° with y -axis. The magnitude of y -component of vector is $2\sqrt{3}$. The magnitude of x -component of the vector will be:

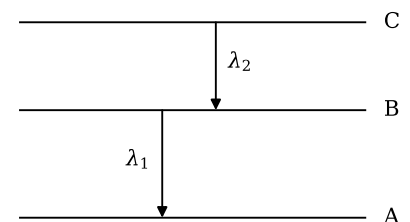
- (A) $\sqrt{3}$
- (B) 2
- (C) 6
- (D) $\frac{1}{\sqrt{3}}$

Physics Section B · Numerical value

Q20 to Q29

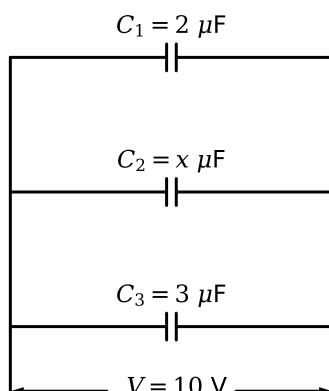
Q20 Atomic Physics **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/lsCkqw5bvT) › prepwiser.in/questions/lsCkqw5bvT

As per given figure A , B and C are the first, second and third excited energy levels of hydrogen atom respectively. If the ratio of the two wavelengths (i.e. $\frac{\lambda_1}{\lambda_2}$) is $\frac{7}{4n}$, then the value of n will be _____.

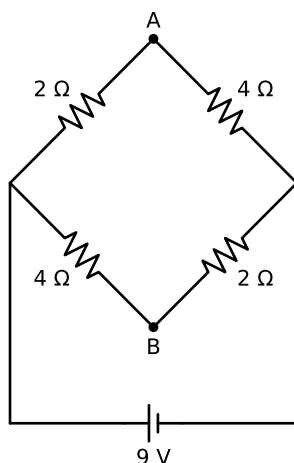


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In the given figure the total charge stored in the combination of capacitors is $100\mu\text{C}$. The value of 'x' is _____.



A network of four resistances is connected to 9V battery, as shown in figure. The magnitude of voltage difference between the points A and B is _____ V.



A 20cm long metallic rod is rotated with 210rpm about an axis normal to the rod passing through its one end. The other end of the rod is in contact with a circular metallic ring. A constant and uniform magnetic field 0.2T parallel to the axis exists everywhere. The emf developed between the centre and the ring is _____ mV.

Take $\pi = \frac{22}{7}$

The refractive index of a transparent liquid filled in an equilateral hollow prism is $\sqrt{2}$. The angle of minimum deviation for the liquid will be _____ $^\circ$.

An electron in a hydrogen atom revolves around its nucleus with a speed of $6.76 \times 10^6\text{ms}^{-1}$ in an orbit of radius $0.52\text{\AA}$. The magnetic field produced at the nucleus of the hydrogen atom is _____ T.

There is an air bubble of radius 1.0mm in a liquid of surface tension 0.075Nm^{-1} and density 1000kgm^{-3} at a depth of 10cm below the free surface. The amount by which the pressure inside the bubble is greater than the atmospheric pressure is _____ Pa ($g = 10\text{ms}^{-2}$)

Q27 Rotational Motion **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/C7arqPhsoK](https://www.prepwiser.in/questions/C7arqPhsoK)

A solid sphere and a solid cylinder of same mass and radius are rolling on a horizontal surface without slipping. The ratio of their radius of gyration respectively ($k_{\text{sph}} : k_{\text{cyl}}$) is $2 : \sqrt{x}$. The value of x is _____.

Q28 Mechanical Waves **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/UvrV8tl7tj](https://www.prepwiser.in/questions/UvrV8tl7tj)

The fundamental frequency of vibration of a string stretched between two rigid support is 50Hz . The mass of the string is 18g and its linear mass density is 20g/m . The speed of the transverse waves so produced in the string is _____ ms^{-1}

Q29 Work, Energy & Power **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/YkqBX2LYOz](https://www.prepwiser.in/questions/YkqBX2LYOz)

A block of mass 10kg is moving along x -axis under the action of force $F = 5x\text{N}$. The work done by the force in moving the block from $x = 2\text{m}$ to 4m will be _____ J.

Chemistry Section A · Multiple choice

Q30 to Q45

Q30 Carbohydrates & Biomolecules[Step-by-step solution > prepwiser.in/questions/nE7ZLguBCs](https://www.prepwiser.in/questions/nE7ZLguBCs)

Which is not true for arginine?

- (A) It has a fairly high melting point.
- (B) It is associated with more than one pK_a values.
- (C) It has high solubility in benzene.
- (D) It is a crystalline solid.

Q31 p-Block Elements: Part II (Group 15-18)[Step-by-step solution > prepwiser.in/questions/IPHMqmsnWq](https://www.prepwiser.in/questions/IPHMqmsnWq)

The number of $\text{P} - \text{O} - \text{P}$ bonds in $\text{H}_4\text{P}_2\text{O}_7$, $(\text{HPO}_3)_3$ and P_4O_{10} are respectively:

- (A) 1, 3, 6
- (B) 1, 2, 4
- (C) 0, 3, 4
- (D) 0, 3, 6

Q32 Chemical Bonding & Molecular Structure[Step-by-step solution > prepwiser.in/questions/gQs1j6kgAP](https://www.prepwiser.in/questions/gQs1j6kgAP)

Consider the following statements:

- (A) NF_3 molecule has a trigonal planar structure.
- (B) Bond length of N_2 is shorter than O_2 .
- (C) Isoelectronic molecules or ions have identical bond order.
- (D) Dipole moment of H_2S is higher than that of water molecule.

Choose the correct answer from the options given below:

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

Q33 Coordination Compounds[Step-by-step solution > prepwiser.in/questions/HanTBCDwUA](https://www.prepwiser.in/questions/HanTBCDwUA)

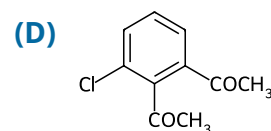
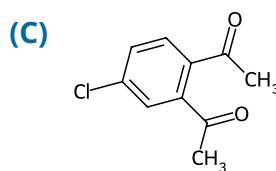
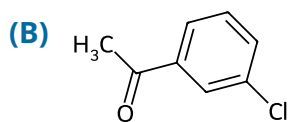
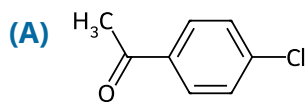
The complex with highest magnitude of crystal field splitting energy (Δ_0) is:

- (A) $[\text{Fe}(\text{OH}_2)_6]^{3+}$
- (B) $[\text{Mn}(\text{OH}_2)_6]^{3+}$
- (C) $[\text{Cr}(\text{OH}_2)_6]^{3+}$
- (D) $[\text{Ti}(\text{OH}_2)_6]^{3+}$

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Q34 Hydrocarbons: Aromatic (Arenes)[Step-by-step solution](https://www.prepwiser.in/questions/GZtntZT0Xb) › prepwiser.in/questions/GZtntZT0Xb

The major product formed in the Friedel-Craft acylation of chlorobenzene is

**Q35** Ionic Equilibrium[Step-by-step solution](https://www.prepwiser.in/questions/9YuPLTpQQT) › prepwiser.in/questions/9YuPLTpQQT

Which of the following statement(s) is/are correct?

(A) The pH of 1×10^{-8} M HCl solution is 8.

(B) The conjugate base of H_2PO_4^- is HPO_4^{2-} .

(C) K_w increases with increase in temperature.

(D) When a solution of a weak monoprotic acid is titrated against a strong base at half neutralisation point, $\text{pH} = \frac{1}{2}\text{pK}_a$

Choose the correct answer from the options given below:

(A) (A), (B), (C)

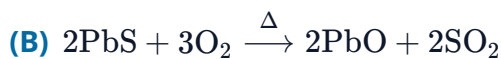
(B) (B), (C)

(C) (B), (C), (D)

(D) (A), (D)

Q36 Metallurgy[Step-by-step solution](https://www.prepwiser.in/questions/6aLFP3UaXK) › prepwiser.in/questions/6aLFP3UaXK

Which one of the following is not an example of calcination?

**Q37** Hydrogen & s-Block Elements[Step-by-step solution](https://www.prepwiser.in/questions/QZgt4SzHpn) › prepwiser.in/questions/QZgt4SzHpn

During water-gas shift reaction

(A) water is evaporated in presence of catalyst.

(B) carbon monoxide is oxidized to carbon dioxide.

(C) carbon is oxidized to carbon monoxide.

(D) carbon dioxide is reduced to carbon monoxide.

Q38 p-Block Elements: Part I (Group 13 & 14)[Step-by-step solution](https://www.prepwiser.in/questions/4tcv1pgj2i) › prepwiser.in/questions/4tcv1pgj2i

For a good quality cement, the ratio of silica to alumina is found to be:

(A) 1.5

(B) 2

(C) 3

(D) 4.5

Q39 Polymers[Step-by-step solution](https://www.prepwiser.in/questions/X1m7uHr43V) › prepwiser.in/questions/X1m7uHr43V

Match **List I** with **List II**:

List I - (Monomer)	List II - (Polymer)
(A) Tetrafluoroethene	(I) Orlon
(B) Acrylonitrile	(II) Natural rubber
(C) Caprolactam	(III) Teflon
(D) Isoprene	(IV) Nylon-6

Choose the correct answer from the options given below:

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

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

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

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

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

Assertion (A): BeCl_2 and MgCl_2 produce characteristic flame

Reason (R): The excitation energy is high in BeCl_2 and MgCl_2

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

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

Which of the following expressions is correct in case of a CsCl unit cell (edge length 'a')?

- (A) $r_{\text{Cs}^+} + r_{\text{Cl}^-} = \frac{\sqrt{3}}{2}a$
- (B) $r_{\text{Cs}^+} + r_{\text{Cl}^-} = \frac{a}{\sqrt{2}}$
- (C) $r_{\text{Cs}^+} + r_{\text{Cl}^-} = a$
- (D) $r_{\text{Cs}^+} + r_{\text{Cl}^-} = \frac{a}{2}$

Given below are two statements:

Statement I: According to Bohr's model of hydrogen atom, the angular momentum of an electron in a given stationary state is quantised.

Statement II: The concept of electron in Bohr's orbit, violates the Heisenberg uncertainty principle.

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

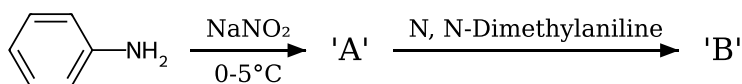
- (A) Both Statement I and Statement II are incorrect
- (B) Statement I is correct but Statement II is incorrect
- (C) Both Statement I and Statement II are correct
- (D) Statement I is incorrect but Statement II is correct

Which of the following statement is correct for paper chromatography?

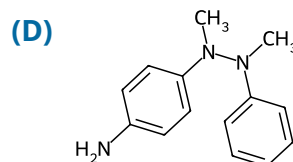
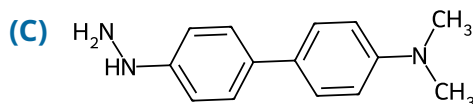
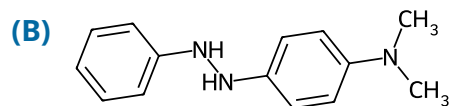
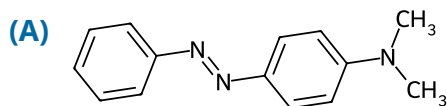
- (A) Water present in the mobile phase gets absorbed by the paper which then forms the stationary phase.
- (B) Water present in the pores of the paper forms the stationary phase.
- (C) Paper sheet forms the stationary phase.
- (D) Paper and water present in its pores together form the stationary phase.

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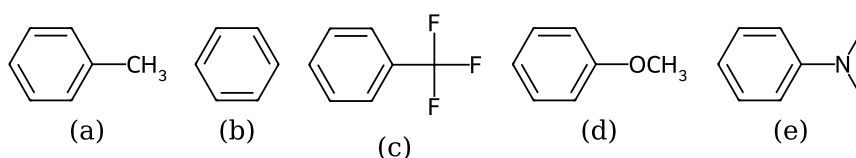
Consider the following sequence of reactions:



The product 'B' is



Decreasing order of reactivity towards electrophilic substitution for the following compounds is:



(A) $a > d > e > b > c$ (B) $d > a > e > c > b$ (C) $c > b > a > d > e$ (D) $e > d > a > b > c$

Chemistry Section B · Numerical value

Q46 to Q55

For a reversible reaction $A \rightleftharpoons B$, the $\Delta H_{\text{forward reaction}} = 20 \text{ kJ mol}^{-1}$. The activation energy of the uncatalysed forward reaction is 300 kJ mol^{-1} . When the reaction is catalysed keeping the reactant concentration same, the rate of the catalysed forward reaction at 27°C is found to be same as that of the uncatalysed reaction at 327°C .

The activation energy of the catalysed backward reaction is _____ kJ mol^{-1} .

The homoleptic and octahedral complex of Co^{2+} and H_2O has _____ unpaired electron(s) in the t_{2g} set of orbitals.

In Chromyl chloride, the oxidation state of chromium is (+) _____.

The total change in the oxidation state of manganese involved in the reaction of KMnO_4 and potassium iodide in the acidic medium is _____.

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The number of correct statements from the following is _____.

- (A) Conductivity always decreases with decrease in concentration for both strong and weak electrolytes.
- (B) The number of ions per unit volume that carry current in a solution increases on dilution.
- (C) Molar conductivity increases with decrease in concentration
- (D) The variation in molar conductivity is different for strong and weak electrolytes
- (E) For weak electrolytes, the change in molar conductivity with dilution is due to decrease in degree of dissociation.

The vapour pressure of 30% (w/v) aqueous solution of glucose is _____ mmHg at 25°C.

[Given : The density of 30% (w/v), aqueous solution of glucose is 1.2gcm^{-3} and vapour pressure of pure water is 24mmHg.]

(Molar mass of glucose is 180gmol^{-1} .)

The volume (in mL) of 0.1M AgNO_3 required for complete precipitation of chloride ions present in 20mL of 0.01M solution of $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2$ as silver chloride is _____.

The total number of isoelectronic species from the given set is _____.

O^{2-} , F^- , Al, Mg^{2+} , Na^+ , O^+ , Mg, Al^{3+} , F

20mL of 0.5M NaCl is required to coagulate 200mL of As_2S_3 solution in 2 hours. The coagulating value of NaCl is _____.

30.4kJ of heat is required to melt one mole of sodium chloride and the entropy change at the melting point is $28.4\text{JK}^{-1}\text{mol}^{-1}$ at 1 atm. The melting point of sodium chloride is _____ K (Nearest Integer)

Mathematics Section A · Multiple choice

Q56 to Q74

Let the foot of perpendicular of the point $P(3, -2, -9)$ on the plane passing through the points $(-1, -2, -3)$, $(9, 3, 4)$, $(9, -2, 1)$ be $Q(\alpha, \beta, \gamma)$. Then the distance of Q from the origin is:

(A) $\sqrt{38}$

(B) $\sqrt{29}$

(C) $\sqrt{42}$

(D) $\sqrt{35}$

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Q57 Determinants[Step-by-step solution](https://www.prepwisar.in/questions/KEB5FOJQzu) › prepwisar.in/questions/KEB5FOJQzu

Let the system of linear equations

$$-x + 2y - 9z = 7$$

$$-x + 3y + 7z = 9$$

$$-2x + y + 5z = 8$$

$$-3x + y + 13z = \lambda$$

has a unique solution $x = \alpha, y = \beta, z = \gamma$. Then the distance of the point (α, β, γ) from the plane $2x - 2y + z = \lambda$ is:

- (A) 11 (B) 7 (C) 13 (D) 9

Q58 Three Dimensional Geometry[Step-by-step solution](https://www.prepwisar.in/questions/wBi9Pu-8q7) › prepwisar.in/questions/wBi9Pu-8q7

Let S be the set of all values of λ , for which the shortest distance between

the lines $\frac{x-\lambda}{0} = \frac{y-3}{4} = \frac{z+6}{1}$ and $\frac{x+\lambda}{3} = \frac{y}{-4} = \frac{z-6}{0}$ is 13. Then $8 \left| \sum_{\lambda \in S} \lambda \right|$ is equal to:

- (A) 306 (B) 304 (C) 308 (D) 302

Q59 Binomial Theorem[Step-by-step solution](https://www.prepwisar.in/questions/2cBCIGbnWK) › prepwisar.in/questions/2cBCIGbnWK

Let $(a + bx + cx^2)^{10} = \sum_{i=0}^{20} p_i x^i, a, b, c \in \mathbb{N}$.

If $p_1 = 20$ and $p_2 = 210$, then $2(a + b + c)$ is equal to:

- (A) 15 (B) 8 (C) 6 (D) 12

Q60 Circles[Step-by-step solution](https://www.prepwisar.in/questions/lrnejCXylx) › prepwisar.in/questions/lrnejCXylx

The number of common tangents, to the circles

$$x^2 + y^2 - 18x - 15y + 131 = 0$$

$$\text{and } x^2 + y^2 - 6x - 6y - 7 = 0, \text{ is:}$$

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

Q61 Complex Numbers[Step-by-step solution](https://www.prepwisar.in/questions/-5w9MejIXy) › prepwisar.in/questions/-5w9MejIXy

If the set $\left\{ \operatorname{Re} \left(\frac{z-\bar{z}+z\bar{z}}{2-3z+5\bar{z}} \right) : z \in \mathbb{C}, \operatorname{Re}(z) = 3 \right\}$ is equal to the interval $(\alpha, \beta]$, then $24(\beta - \alpha)$ is equal to:

- (A) 36 (B) 27 (C) 42 (D) 30

Q62 Definite Integration[Step-by-step solution](https://www.prepwisar.in/questions/ZYFUL2NPYA) › prepwisar.in/questions/ZYFUL2NPYA

If $\int_0^1 \frac{1}{(5+2x-2x^2)(1+e^{(2-4x)})} dx = \frac{1}{\alpha} \log_e \left(\frac{\alpha+1}{\beta} \right), \alpha, \beta > 0$, then $\alpha^4 - \beta^4$ is equal to:

- (A) -21 (B) 21 (C) 19 (D) 0

Q63 Differential Equations[Step-by-step solution](https://www.prepwisar.in/questions/Goh1CCsAE0) › prepwisar.in/questions/Goh1CCsAE0

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

$$2(y+2) \log_e(y+2) dx + (x+4-2 \log_e(y+2)) dy = 0, y > -1$$

with $x(e^4 - 2) = 1$. Then $x(e^9 - 2)$ is equal to:

- (A) $\frac{4}{9}$ (B) $\frac{32}{9}$ (C) $\frac{10}{3}$ (D) 3

Q64 Functions (Advanced)[Step-by-step solution](#) > [prepwiser.in/questions/6w6V5aX9jR](https://www.prepwiser.in/questions/6w6V5aX9jR)

If the domain of the function

$f(x) = \log_e(4x^2 + 11x + 6) + \sin^{-1}(4x + 3) + \cos^{-1}\left(\frac{10x+6}{3}\right)$ is $(\alpha, \beta]$, then

$36|\alpha + \beta|$ is equal to:

(A) 72**(B)** 54**(C)** 45**(D)** 63**Q65** Continuity & Differentiability[Step-by-step solution](#) > [prepwiser.in/questions/iVQuddxNRM](https://www.prepwiser.in/questions/iVQuddxNRM)

Let $[x]$ denote the greatest integer function and

$f(x) = \max\{1 + x + [x], 2 + x, x + 2[x]\}$, $0 \leq x \leq 2$. Let m be the number of points in $[0, 2]$, where f is not continuous and n be the number of points in $(0, 2)$, where f is not differentiable. Then $(m + n)^2 + 2$ is equal to:

(A) 3**(B)** 6**(C)** 2**(D)** 11**Q66** Determinants[Step-by-step solution](#) > [prepwiser.in/questions/myoB8jMimQ](https://www.prepwiser.in/questions/myoB8jMimQ)

Let the determinant of a square matrix A of order m be $m - n$, where m and n satisfy $4m + n = 22$ and $17m + 4n = 93$.

If $\det(n \operatorname{adj}(\operatorname{adj}(mA))) = 3^a 5^b 6^c$ then $a + b + c$ is equal to:

(A) 96**(B)** 84**(C)** 109**(D)** 101**Q67** Permutations & Combinations[Step-by-step solution](#) > [prepwiser.in/questions/KylMK2newu](https://www.prepwiser.in/questions/KylMK2newu)

The total number of three-digit numbers, divisible by 3, which can be formed using the digits 1, 3, 5, 8, if repetition of digits is allowed, is:

(A) 21**(B)** 22**(C)** 18**(D)** 20**Q68** Probability: Advanced[Step-by-step solution](#) > [prepwiser.in/questions/L36IUeabk6](https://www.prepwiser.in/questions/L36IUeabk6)

A bag contains 6 white and 4 black balls. A die is rolled once and the number of balls equal to the number obtained on the die are drawn from the bag at random. The probability that all the balls drawn are white is:

(A) $\frac{1}{4}$ **(B)** $\frac{9}{50}$ **(C)** $\frac{1}{5}$ **(D)** $\frac{11}{50}$ **Q69** Quadratic Equations & Polynomial Inequalities[Step-by-step solution](#) > [prepwiser.in/questions/xM7uXeMcHX](https://www.prepwiser.in/questions/xM7uXeMcHX)

The number of real roots of the equation $x|x| - 5|x + 2| + 6 = 0$, is:

(A) 4**(B)** 3**(C)** 5**(D)** 6**Q70** Sequences & Series[Step-by-step solution](#) > [prepwiser.in/questions/VrPT7bxw9S](https://www.prepwiser.in/questions/VrPT7bxw9S)

Let A_1 and A_2 be two arithmetic means and G_1, G_2, G_3 be three geometric means of two distinct positive numbers. Then $G_1^4 + G_2^4 + G_3^4 + G_1^2 G_3^2$ is equal to:

(A) $(A_1 + A_2)^2 G_1 G_3$ **(B)** $(A_1 + A_2) G_1^2 G_3^2$ **(C)** $2(A_1 + A_2) G_1^2 G_3^2$ **(D)** $2(A_1 + A_2) G_1 G_3$ **Q71** Statistics[Step-by-step solution](#) > [prepwiser.in/questions/T2QNKm8daa](https://www.prepwiser.in/questions/T2QNKm8daa)

The mean and standard deviation of 10 observations are 20 and 8 respectively. Later on, it was observed that one observation was recorded as 50 instead of 40. Then the correct variance is:

(A) 11**(B)** 12**(C)** 13**(D)** 14

Q72 Vectors[Step-by-step solution](#) › prepwiser.in/questions/83lrNi7f6C

Let S be the set of all (λ, μ) for which the vectors $\lambda\hat{i} - \hat{j} + \hat{k}$, $\hat{i} + 2\hat{j} + \mu\hat{k}$ and $3\hat{i} - 4\hat{j} + 5\hat{k}$, where $\lambda - \mu = 5$, are coplanar, then $\sum_{(\lambda, \mu) \in S} 80(\lambda^2 + \mu^2)$ is equal to:

(A) 2370**(B)** 2130**(C)** 2210**(D)** 2290**Q73** Vectors[Step-by-step solution](#) › prepwiser.in/questions/eZcoq8601H

Let ABCD be a quadrilateral. If E and F are the mid points of the diagonals AC and BD respectively and $(\overrightarrow{AB} - \overrightarrow{BC}) + (\overrightarrow{AD} - \overrightarrow{DC}) = k\overrightarrow{FE}$, then k is equal to:

(A) -2**(B)** 4**(C)** -4**(D)** 2**Q74** Straight Lines[Step-by-step solution](#) › prepwiser.in/questions/Wto-XeeRub

If (α, β) is the orthocenter of the triangle ABC with vertices $A(3, -7)$, $B(-1, 2)$ and $C(4, 5)$, then $9\alpha - 6\beta + 60$ is equal to:

(A) 30**(B)** 40**(C)** 25**(D)** 35**Mathematics Section B · Numerical value**

Q75 to Q83

Q75 Three Dimensional Geometry**NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/NB5_DuoEUO

Let the plane P contain the line $2x + y - z - 3 = 0 = 5x - 3y + 4z + 9$ and be parallel to the line $\frac{x+2}{2} = \frac{3-y}{-4} = \frac{z-7}{5}$. Then the distance of the point $A(8, -1, -19)$ from the plane P measured parallel to the line $\frac{x}{-3} = \frac{y-5}{4} = \frac{z-2}{-12}$ is equal to _____.

Q76 Applications of Derivatives**NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/Vo9u4PIWon

Consider the triangles with vertices $A(2, 1)$, $B(0, 0)$ and $C(t, 4)$, $t \in [0, 4]$.

If the maximum and the minimum perimeters of such triangles are obtained at $t = \alpha$ and $t = \beta$ respectively, then $6\alpha + 21\beta$ is equal to _____.

Q77 Ellipse**NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/wZQf5AfC9o

Let an ellipse with centre $(1, 0)$ and latus rectum of length $\frac{1}{2}$ have its major axis along x-axis. If its minor axis subtends an angle 60° at the foci, then the square of the sum of the lengths of its minor and major axes is equal to _____.

Q78 Permutations & Combinations**NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/qw4LXhTNif

A person forgets his 4-digit ATM pin code. But he remembers that in the code all the digits are different, the greatest digit is 7 and the sum of the first two digits is equal to the sum of the last two digits. Then the maximum number of trials necessary to obtain the correct code is _____.

Q79 Binomial Theorem**NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/SFTkm_Q-Pv

If the sum of the series

$$\left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{2^2} - \frac{1}{2 \cdot 3} + \frac{1}{3^2}\right) + \left(\frac{1}{2^3} - \frac{1}{2^2 \cdot 3} + \frac{1}{2 \cdot 3^2} - \frac{1}{3^3}\right) + \left(\frac{1}{2^4} - \frac{1}{2^3 \cdot 3} + \frac{1}{2^2 \cdot 3^2} - \frac{1}{2 \cdot 3^3} + \frac{1}{3^4}\right) + \dots$$

is $\frac{\alpha}{\beta}$, where α and β are co-prime, then $\alpha + 3\beta$ is equal to _____.

The number of elements in the set

$\{n \in \mathbb{N} : 10 \leq n \leq 100 \text{ and } 3^n - 3 \text{ is a multiple of } 7\}$ is _____.

Let $A = \{1, 2, 3, 4\}$ and R be a relation on the set $A \times A$ defined by

$R = \{(a, b), (c, d) : 2a + 3b = 4c + 5d\}$. Then the number of elements in R is _____.

If the area bounded by the curve $2y^2 = 3x$, lines $x + y = 3$, $y = 0$ and outside the circle $(x - 3)^2 + y^2 = 2$ is A , then $4(\pi + 4A)$ is equal to _____.

Let $f(x) = \int \frac{dx}{(3+4x^2)\sqrt{4-3x^2}}$, $|x| < \frac{2}{\sqrt{3}}$. If $f(0) = 0$

and $f(1) = \frac{1}{\alpha\beta} \tan^{-1}\left(\frac{\alpha}{\beta}\right)$, $\alpha, \beta > 0$, then $\alpha^2 + \beta^2$ is equal to _____.

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Physics

1. C	2. A	3. C	4. B	5. C	6. B	7. D	8. D
9. D	10. D	11. C	12. D	13. B	14. B	15. C	16. C
17. D	18. D	19. B	20. 5	21. 5	22. 3	23. 88	24. 30
25. 40	26. 1150	27. 5	28. 90	29. 30			

Chemistry

30. C	31. A	32. C	33. C	34. A	35. B	36. B	37. B
38. C	39. A	40. C	41. A	42. C	43. B	44. A	45. D
46. 130	47. 1	48. 6	49. 5	50. 3	51. 23	52. 4	53. 5
54. 50	55. 1070						

Mathematics

56. C	57. B	58. A	59. D	60. C	61. D	62. B	63. B
64. C	65. A	66. A	67. B	68. C	69. B	70. A	71. C
72. D	73. C	74. C	75. 26	76. 48	77. 9	78. 72	79. 7
80. 15	81. 6	82. 42	83. 28				

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