

JEE MAIN 2024 · QUESTION PAPER

5 Apr 2024 Shift 1

85 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	19 Q1 to Q19	10 Q20 to Q29
● Chemistry	19 Q30 to Q48	8 Q49 to Q56
● Mathematics	20 Q57 to Q76	9 Q77 to Q85

In this PDF

85 questions · answer key at the end

- 1 Set a 3 hour timer and attempt the paper in one sitting, like the real exam.
- 2 In the 2021 to 2024 papers, Section B asked you to answer any 5 numerical questions per subject. Try each one here.
- 3 Check yourself against the answer key at the end. Every question names its chapter, so you can see where marks went.
- 4 Got one wrong? Tap "Step-by-step solution" at the top right of it for the full working, where available.

Attempt this paper online

The same questions in the same order, with instant answer checking and step-by-step solutions where available.

prepwiser.in/pyqs/paper/2024-04-05-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? prepwiser.in/feedback · Terms: prepwiser.in/terms

Q1 Electromagnetic Waves

[Step-by-step solution](#) > [prepwiser.in/questions/1C4kxpgdD5](https://www.prepwiser.in/questions/1C4kxpgdD5)

An alternating voltage of amplitude 40V and frequency 4kHz is applied directly across the capacitor of $12\mu\text{F}$. The maximum displacement current between the plates of the capacitor is nearly:

- (A) 10 A (B) 8 A (C) 13 A (D) 12 A

Q2 Atomic Physics

[Step-by-step solution](#) > [prepwiser.in/questions/f0eMJLI1Zy](https://www.prepwiser.in/questions/f0eMJLI1Zy)

An electron rotates in a circle around a nucleus having positive charge Ze . Correct relation between total energy (E) of electron to its potential energy (U) is:

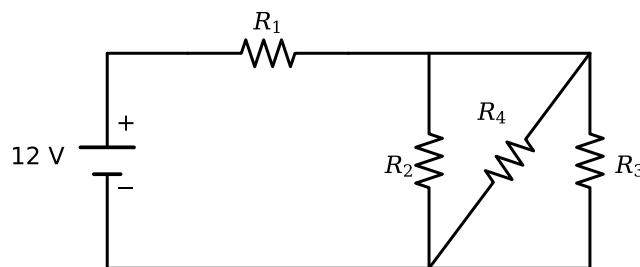
- (A) $2E = 3U$ (B) $E = U$ (C) $2E = U$ (D) $E = 2U$

Q3 Current Electricity

[Step-by-step solution](#) > [prepwiser.in/questions/8VPbg9czfE](https://www.prepwiser.in/questions/8VPbg9czfE)

In the given figure $R_1 = 10\Omega$, $R_2 = 8\Omega$, $R_3 = 4\Omega$ and $R_4 = 8\Omega$. Battery is ideal with emf 12V . Equivalent resistant of the circuit and current supplied by battery are respectively:

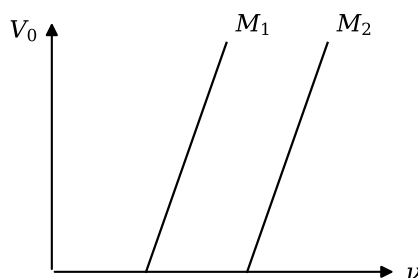
- (A) 12Ω and 11.4A (B) 10.5Ω and 1.14A
(C) 10.5Ω and 1A (D) 12Ω and 1A



Q4 Dual Nature of Radiation & Matter

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

Given below are two statements:



Statement I : Figure shows the variation of stopping potential with frequency (ν) for the two photosensitive materials M_1 and M_2 . The slope gives value of $\frac{h}{e}$, where h is Planck's constant, e is the charge of electron.

Statement II: M_2 will emit photoelectrons of greater kinetic energy for the incident radiation having same frequency.

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

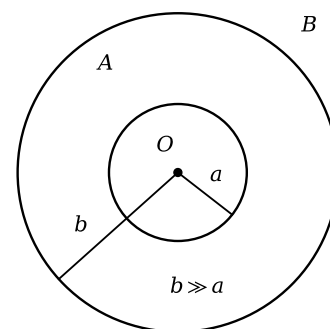
- (A) Statement I is correct and Statement II is incorrect
(B) Statement I is incorrect but Statement II is correct
(C) Both Statement I and Statement II are correct
(D) Both Statement I and Statement II are incorrect

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Q5 Electromagnetic Induction[Step-by-step solution](#) > [prepwisar.in/questions/SgMjzMV1QT](https://www.prepwisar.in/questions/SgMjzMV1QT)

Two conducting circular loops A and B are placed in the same plane with their centres coinciding as shown in figure. The mutual inductance between them is:

- (A) $\frac{\mu_0}{2\pi} \cdot \frac{b^2}{a}$ (B) $\frac{\mu_0 \pi a^2}{2b}$ (C) $\frac{\mu_0 \pi b^2}{2a}$ (D) $\frac{\mu_0}{2\pi} \cdot \frac{a^2}{b}$

**Q6** Electrostatics I: Charges, Field & Gauss's Law[Step-by-step solution](#) > [prepwisar.in/questions/MNOoZoQkYw](https://www.prepwisar.in/questions/MNOoZoQkYw)

In hydrogen like system the ratio of coulombian force and gravitational force between an electron and a proton is in the order of:

- (A) 10^{19} (B) 10^{39} (C) 10^{29} (D) 10^{36}

Q7 Units, Dimensions & Errors[Step-by-step solution](#) > [prepwisar.in/questions/jJz9pnGVq8](https://www.prepwisar.in/questions/jJz9pnGVq8)

If G be the gravitational constant and u be the energy density then which of the following quantity have the dimensions as that of the $\sqrt{uG}$:

- (A) Gravitational potential (B) pressure gradient per unit mass
(C) Energy per unit mass (D) Force per unit mass

Q8 Gravitation[Step-by-step solution](#) > [prepwisar.in/questions/ZZEDD7g124](https://www.prepwisar.in/questions/ZZEDD7g124)

Match List I with List II:

	LIST I		LIST II
A.	Kinetic energy of planet	I.	$-GMm/a$
B.	Gravitation Potential energy of sun-planet system	II.	$GMm/2a$
C.	Total mechanical energy of planet	III.	$\frac{Gm}{r}$
D.	Escape energy at the surface of planet for unit mass object	IV.	$-GMm/2a$

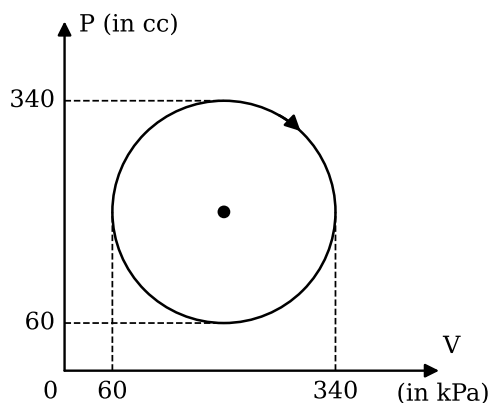
(Where a = radius of planet orbit, r = radius of planet, M = mass of Sun, m = mass of planet)

Choose the correct answer from the options given below:

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

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The heat absorbed by a system in going through the given cyclic process is:



- (A) 61.6 J (B) 431.2 J (C) 19.6 J (D) 616 J

If the collision frequency of hydrogen molecules in a closed chamber at 27°C is Z , then the collision frequency of the same system at 127°C is:

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

A wooden block of mass 5kg rests on a soft horizontal floor. When an iron cylinder of mass 25kg is placed on the top of the block, the floor yields and the block and the cylinder together go down with an acceleration of 0.1ms^{-2} . The action force of the system on the floor is equal to:

- (A) 297 N (B) 291 N (C) 196 N (D) 294 N

In a co-axial straight cable, the central conductor and the outer conductor carry equal currents in opposite directions. The magnetic field is zero:

- (A) inside the outer conductor (B) outside the cable
(C) in between the two conductors (D) inside the inner conductor

Given below are two statements:

Statement I : When a capillary tube is dipped into a liquid, the liquid neither rises nor falls in the capillary. The contact angle may be 0° .

Statement II : The contact angle between a solid and a liquid is a property of the material of the solid and liquid as well.

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

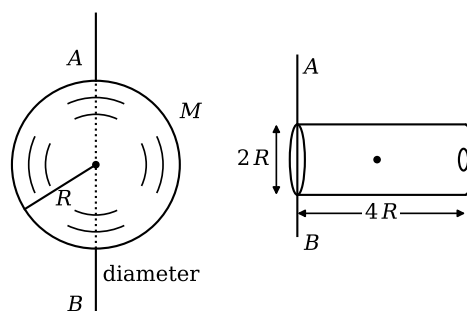
- (A) Statement I is true and Statement II is false (B) Statement I is false but Statement II is true
(C) Both Statement I and Statement II are true (D) Both Statement I and Statement II are false

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Q14 Rotational Motion[Step-by-step solution](https://www.prepwiser.in/questions/mvOVs4OWNk) > prepwiser.in/questions/mvOVs4OWNk

Ratio of radius of gyration of a hollow sphere to that of a solid cylinder of equal mass, for moment of Inertia about their diameter axis AB as shown in figure is $\sqrt{8/x}$. The value of x is:

- (A) 34 (B) 51 (C) 67 (D) 17

**Q15** Gravitation[Step-by-step solution](https://www.prepwiser.in/questions/Vk2SVS0Ici) > prepwiser.in/questions/Vk2SVS0Ici

A simple pendulum doing small oscillations at a place R height above earth surface has time period of $T_1 = 4s$. T_2 would be it's time period if it is brought to a point which is at a height $2R$ from earth surface. Choose the correct relation [R = radius of earth]:

- (A) $3T_1 = 2T_2$ (B) $T_1 = T_2$ (C) $2T_1 = 3T_2$ (D) $2T_1 = T_2$

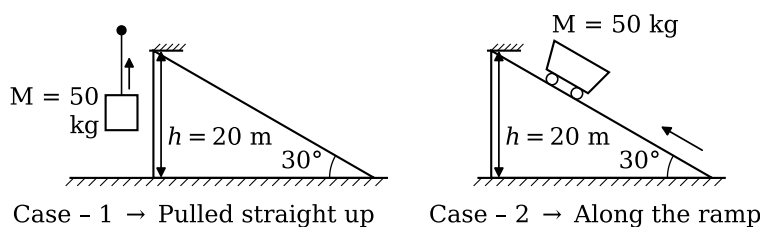
Q16 Wave Optics[Step-by-step solution](https://www.prepwiser.in/questions/J4A6RTdMtU) > prepwiser.in/questions/J4A6RTdMtU

Light emerges out of a convex lens when a source of light kept at its focus. The shape of wavefront of the light is:

- (A) cylindrical (B) spherical
(C) plane (D) both spherical and cylindrical

Q17 Work, Energy & Power[Step-by-step solution](https://www.prepwiser.in/questions/iNXZSWuYrL) > prepwiser.in/questions/iNXZSWuYrL

A body of mass 50kg is lifted to a height of 20m from the ground in the two different ways as shown in the figures. The ratio of work done against the gravity in both the respective cases, will be:



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

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

Time periods of oscillation of the same simple pendulum measured using four different measuring clocks were recorded as $4.62s$, $4.632s$, $4.6s$ and $4.64s$. The arithmetic mean of these readings in correct significant figure is:

- (A) 5 s (B) 4.6 s (C) 4.62 s (D) 4.623 s

Q19 Vectors[Step-by-step solution](https://www.prepwiser.in/questions/Bijc1gtA3) > prepwiser.in/questions/Bijc1gtA3

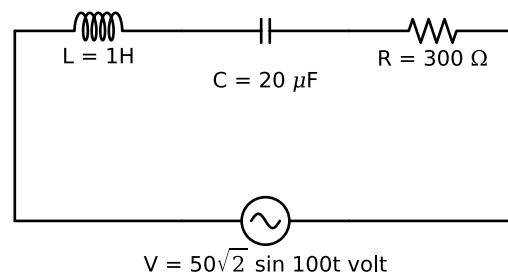
The angle between vector $\vec{Q}$ and the resultant of $(2\vec{Q} + 2\vec{P})$ and $(2\vec{Q} - 2\vec{P})$ is:

- (A) $\tan^{-1}(P/Q)$ (B) 0° (C) $\tan^{-1} \frac{(2\vec{Q} - 2\vec{P})}{2\vec{Q} + 2\vec{P}}$ (D) $\tan^{-1}(2Q/P)$

Q20 Alternating Current **NUMERICAL**

[Step-by-step solution](#) > [prepwiser.in/questions/B-5iSqTgtP](#)

An ac source is connected in given series LCR circuit. The rms potential difference across the capacitor of $20\mu\text{F}$ is _____ V.



Q21 Nuclear Physics **NUMERICAL**

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

If three helium nuclei combine to form a carbon nucleus then the energy released in this reaction is _____ $\times 10^{-2}\text{MeV}$. (Given $1\text{u} = 931\text{MeV}/c^2$, atomic mass of helium = 4.002603u)

Q22 Current Electricity **NUMERICAL**

[Step-by-step solution](#) > [prepwiser.in/questions/ZtDfD8TjH_](#)

The electric field between the two parallel plates of a capacitor of $1.5\mu\text{F}$ capacitance drops to one third of its initial value in $6.6\mu\text{s}$ when the plates are connected by a thin wire. The resistance of this wire is _____ Ω . (Given, $\log 3 = 1.1$)

Q23 Electrostatics II: Potential & Capacitance **NUMERICAL**

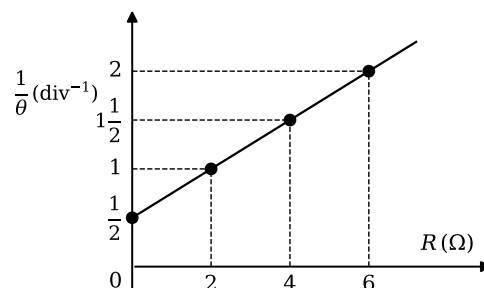
[Step-by-step solution](#) > [prepwiser.in/questions/9Haj9EggUd](#)

Three capacitors of capacitances $25\mu\text{F}$, $30\mu\text{F}$ and $45\mu\text{F}$ are connected in parallel to a supply of 100V . Energy stored in the above combination is E . When these capacitors are connected in series to the same supply, the stored energy is $\frac{9}{x}E$. The value of x is _____.

Q24 Experimental Skills **NUMERICAL**

[Step-by-step solution](#) > [prepwiser.in/questions/PHt2s5ktFo](#)

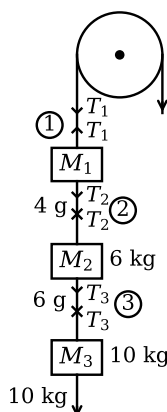
In the experiment to determine the galvanometer resistance by half-deflection method, the plot of $1/\theta$ vs the resistance (R) of the resistance box is shown in the figure. The figure of merit of the galvanometer is _____ $\times 10^{-1}\text{A}/\text{division}$. [The source has emf 2V]



Q25 Newton's Laws of Motion **NUMERICAL**

[Step-by-step solution](#) > [prepwiser.in/questions/2ykf_JEBD3](#)

Three blocks M_1 , M_2 , M_3 having masses 4kg , 6kg and 10kg respectively are hanging from a smooth pulley using rope 1, 2 and 3 as shown in figure. The tension in the rope 1, T_1 when they are moving upward with acceleration of 2ms^{-2} is _____ N (if $g = 10\text{m/s}^2$).



Q26 Moving Charges & Magnetism **NUMERICAL**

[Step-by-step solution](#) › [prepwiser.in/questions/5YMIUtyqh](https://www.prepwiser.in/questions/5YMIUtyqh)

A 2A current carrying straight metal wire of resistance 1Ω , resistivity $2 \times 10^{-6}\Omega\text{m}$, area of cross-section 10mm^2 and mass 500g is suspended horizontally in mid air by applying a uniform magnetic field $\vec{B}$. The magnitude of B is $\text{_____} \times 10^{-1}\text{T}$ (given, $g = 10\text{m/s}^2$).

Q27 Rectilinear Motion **NUMERICAL**

[Step-by-step solution](#) › [prepwiser.in/questions/eDtUvYqPO9](https://www.prepwiser.in/questions/eDtUvYqPO9)

A body moves on a frictionless plane starting from rest. If S_n is distance moved between $t = n - 1$ and $t = n$ and S_{n-1} is distance moved between $t = n - 2$ and $t = n - 1$, then the ratio $\frac{S_{n-1}}{S_n}$ is $(1 - \frac{2}{x})$ for $n = 10$. The value of x is _____ .

Q28 Elasticity **NUMERICAL**

[Step-by-step solution](#) › [prepwiser.in/questions/46vp4XoFHZ](https://www.prepwiser.in/questions/46vp4XoFHZ)

The density and breaking stress of a wire are $6 \times 10^4\text{kg/m}^3$ and $1.2 \times 10^8\text{N/m}^2$ respectively. The wire is suspended from a rigid support on a planet where acceleration due to gravity is $\frac{1}{3}$ rd of the value on the surface of earth. The maximum length of the wire with breaking is _____ m (take, $g = 10\text{m/s}^2$).

Q29 Wave Optics **NUMERICAL**

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

In Young's double slit experiment, carried out with light of wavelength $5000\text{\AA}$, the distance between the slits is 0.3mm and the screen is at 200cm from the slits. The central maximum is at $x = 0\text{cm}$. The value of x for third maxima is _____ mm .

Chemistry Section A · Multiple choice

Q30 to Q48

Q30 Alcohols, Phenols & Ethers

[Step-by-step solution](#) › [prepwiser.in/questions/hrU3RK4_d6](https://www.prepwiser.in/questions/hrU3RK4_d6)

Given below are two statement:

Statements I : Bromination of phenol in solvent with low polarity such as CHCl_3 or CS_2 requires Lewis acid catalyst.

Statements II : The Lewis acid catalyst polarises the bromine to generate Br^+ .

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) Statement I is false but Statement II is true (D) Both Statement I and Statement II are false

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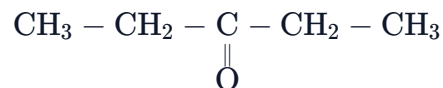
For the Compounds:

(A)

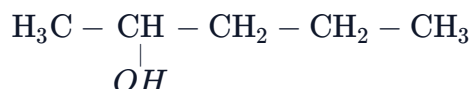


(B) $\text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$

(C)



(D)



The increasing order of boiling point is:

Choose the correct answer from the options given below:

(A) (D) < (C) < (A) < (B)

(B) (B) < (A) < (C) < (D)

(C) (A) < (B) < (C) < (D)

(D) (B) < (A) < (D) < (C)

Which of the following gives a positive test with ninhydrin?

(A) Polyvinyl chloride

(B) Cellulose

(C) Egg albumin

(D) Starch

Number of σ and π bonds present in ethylene molecule is respectively:

(A) 3 and 1

(B) 5 and 1

(C) 4 and 1

(D) 5 and 2

The correct order of ligands arranged in increasing field strength.

(A) $\text{F}^- < \text{Br}^- < \text{I}^- < \text{NH}_3$

(B) $\text{H}_2\text{O} < ^-\text{OH} < \text{CN}^- < \text{NH}_3$

(C) $\text{Br}^- < \text{F}^- < \text{H}_2\text{O} < \text{NH}_3$

(D) $\text{Cl}^- < ^-\text{OH} < \text{Br}^- < \text{CN}^-$

Which one of the following complexes will exhibit the least paramagnetic behaviour? [Atomic number, Cr = 24, Mn = 25, Fe = 26, Co = 27]

(A) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$

(B) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$

(C) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$

(D) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$

The metal that shows highest and maximum number of oxidation state is:

(A) Co

(B) Mn

(C) Fe

(D) Ti

Molar ionic conductivities of divalent cation and anion are $57\text{Scm}^2\text{mol}^{-1}$ and $73\text{Scm}^2\text{mol}^{-1}$ respectively. The molar conductivity of solution of an electrolyte with the above cation and anion will be:

(A) $187\text{Scm}^2\text{mol}^{-1}$

(B) $260\text{Scm}^2\text{mol}^{-1}$

(C) $65\text{Scm}^2\text{mol}^{-1}$

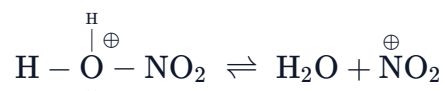
(D) $130\text{Scm}^2\text{mol}^{-1}$

The reaction at cathode in the cells commonly used in clocks involves.

- (A) oxidation of Mn from +2 to +7
(B) reduction of Mn from +4 to +3
(C) oxidation of Mn from +3 to +4
(D) reduction of Mn from +7 to +2

Given below are two statements:

Statement I : Nitration of benzene involves the following step -



Statement II : Use of Lewis base promotes the electrophilic substitution of benzene.

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) Statement I is incorrect but Statement II is correct
(D) Both Statement I and Statement II are correct

The number of neutrons present in the more abundant isotope of boron is ' x '. Amorphous boron upon heating with air forms a product, in which the oxidation state of boron is ' y '. The value of $x + y$ is _____.

- (A) 9 (B) 6 (C) 4 (D) 3

Given below are two statements:

Statement I: In group 13, the stability of +1 oxidation state increases down the group.

Statement II : The atomic size of gallium is greater than that of aluminium.

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

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

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The statement(s) that are correct about the species O^{2-} , F^{-} , Na^{+} and Mg^{2+} .

- (A) All are isoelectronic
- (B) All have the same nuclear charge
- (C) O^{2-} has the largest ionic radii
- (D) Mg^{2+} has the smallest ionic radii

Choose the most appropriate answer from the options given below:

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

An organic compound has 42.1% carbon, 6.4% hydrogen and remainder is oxygen. If its molecular weight is 342, then its molecular formula is:

- (A) $C_{14}H_{20}O_{10}$ (B) $C_{12}H_{22}O_{11}$ (C) $C_{12}H_{20}O_{12}$ (D) $C_{11}H_{18}O_{12}$

The incorrect postulates of the Dalton's atomic theory are:

- (A) Atoms of different elements differ in mass.
- (B) Matter consists of divisible atoms.
- (C) Compounds are formed when atoms of different element combine in a fixed ratio.
- (D) All the atoms of given element have different properties including mass.
- (E) Chemical reactions involve reorganisation of atoms.

Choose the correct answer from the options given below:

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

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

Assertion (A) : Enthalpy of neutralisation of strong monobasic acid with strong monoacidic base is always -57kJmol^{-1}

Reason (R) : Enthalpy of neutralisation is the amount of heat liberated when one mole of H^{+} ions furnished by acid combine with one mole of OH^{-} ions furnished by base to form one mole of water.

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

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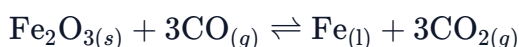
Assertion (A) : Cis form of alkene is found to be more polar than the trans form.

Reason (R) : Dipole moment of trans isomer of 2-butene is zero.

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

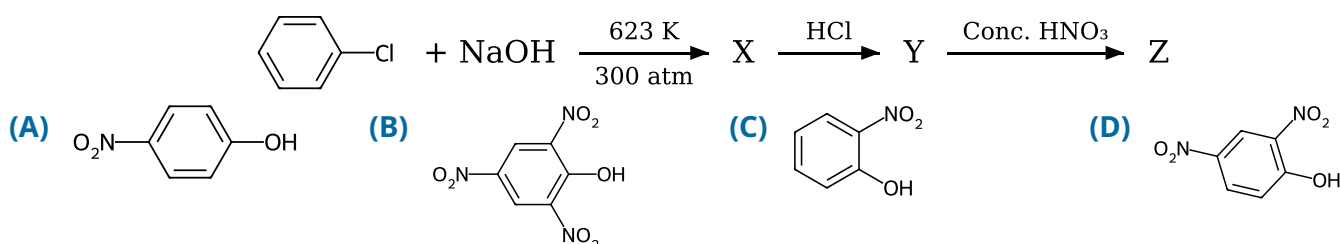
The following reaction occurs in the Blast furnace where iron ore is reduced to iron metal



Using the Le-chatelier's principle, predict which one of the following will not disturb the equilibrium.

- (A) Addition of CO_2 (B) Removal of CO (C) Addition of Fe_2O_3 (D) Removal of CO_2

Identify compound (Z) in the following reaction sequence.



Chemistry Section B · Numerical value

Q49 to Q56

In the lewis dot structure for NO_2^- , total number of valence electrons around nitrogen is _____.

During Kinetic study of reaction $2\text{A} + \text{B} \rightarrow \text{C} + \text{D}$, the following results were obtained:

	A[M]	B[M]	initial rate of formation of D
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

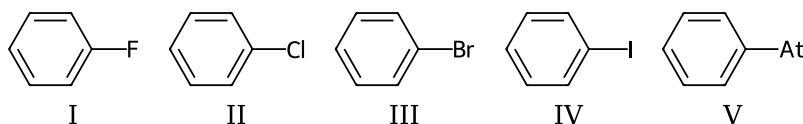
Based on above data, overall order of the reaction is _____.

The spin-only magnetic moment value of the ion among Ti^{2+} , V^{2+} , Co^{3+} and Cr^{2+} , that acts as strong oxidising agent in aqueous solution is _____ BM (Near integer).

(Given atomic numbers: Ti : 22, V : 23, Cr : 24, Co : 27)

Q52 Amines & Diazonium Salts **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/BXsAzJxOSz](https://www.prepwiser.in/questions/BXsAzJxOSz)

The number of halobenzenes from the following that can be prepared by Sandmeyer's reaction is _____

**Q53** Solutions & Colligative Properties **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/wuNTE98FeX](https://www.prepwiser.in/questions/wuNTE98FeX)

An artificial cell is made by encapsulating 0.2M glucose solution within a semipermeable membrane. The osmotic pressure developed when the artificial cell is placed within a 0.05M solution of NaCl at 300K is _____ $\times 10^{-1}$ bar. (nearest integer).

[Given: $R = 0.083 \text{ L bar mol}^{-1} \text{ K}^{-1}$]

Assume complete dissociation of NaCl

Q54 Atomic Structure **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/81Uf5ALgVh](https://www.prepwiser.in/questions/81Uf5ALgVh)

The value of Rydberg constant (R_H) is $2.18 \times 10^{-18} \text{ J}$. The velocity of electron having mass $9.1 \times 10^{-31} \text{ kg}$ in Bohr's first orbit of hydrogen atom = _____ $\times 10^5 \text{ ms}^{-1}$ (nearest integer).

Q55 Chemical Thermodynamics **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/xOlgo807g3](https://www.prepwiser.in/questions/xOlgo807g3)

The heat of combustion of solid benzoic acid at constant volume is -321.30 kJ at 27°C . The heat of combustion at constant pressure is $(-321.30 - xR) \text{ kJ}$, the value of x is _____.

Q56 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/pQiuUY4vH2](https://www.prepwiser.in/questions/pQiuUY4vH2)

9.3g of pure aniline is treated with bromine water at room temperature to give a white precipitate of the product 'P'. The mass of product 'P' obtained is 26.4g. The percentage yield is _____ %.

Mathematics Section A · Multiple choice

Q57 to Q76

Q57 Three Dimensional Geometry[Step-by-step solution](#) > [prepwiser.in/questions/UVqC3mgIpN](https://www.prepwiser.in/questions/UVqC3mgIpN)

If the line $\frac{2-x}{3} = \frac{3y-2}{4\lambda+1} = 4-z$ makes a right angle with the line $\frac{x+3}{3\mu} = \frac{1-2y}{6} = \frac{5-z}{7}$, then $4\lambda + 9\mu$ is equal to:

- (A) 4 (B) 13 (C) 5 (D) 6

Q58 Three Dimensional Geometry[Step-by-step solution](#) > [prepwiser.in/questions/6LTSM65ejV](https://www.prepwiser.in/questions/6LTSM65ejV)

Let d be the distance of the point of intersection of the lines $\frac{x+6}{3} = \frac{y}{2} = \frac{z+1}{1}$ and $\frac{x-7}{4} = \frac{y-9}{3} = \frac{z-4}{2}$ from the point $(7, 8, 9)$. Then $d^2 + 6$ is equal to:

- (A) 75 (B) 78 (C) 72 (D) 69

Q59 Applications of Derivatives[Step-by-step solution](#) > [prepwiser.in/questions/ynOEvQiT00](https://www.prepwiser.in/questions/ynOEvQiT00)

Let a rectangle ABCD of sides 2 and 4 be inscribed in another rectangle PQRS such that the vertices of the rectangle ABCD lie on the sides of the rectangle PQRS. Let a and b be the sides of the rectangle PQRS when its area is maximum. Then $(a+b)^2$ is equal to:

- (A) 64 (B) 80 (C) 60 (D) 72

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Q60 Functions (Advanced)[Step-by-step solution > prepwiser.in/questions/aDqBFFYEyu](https://www.prepwiser.in/questions/aDqBFFYEyu)

Let $f(x) = x^5 + 2x^3 + 3x + 1, x \in \mathbf{R}$, and $g(x)$ be a function such that $g(f(x)) = x$ for all $x \in \mathbf{R}$. Then $\frac{g(7)}{g'(7)}$ is equal to:

- (A) 42 (B) 7 (C) 1 (D) 14

Q61 Applications of Derivatives[Step-by-step solution > prepwiser.in/questions/3YVtpv9Lwi](https://www.prepwiser.in/questions/3YVtpv9Lwi)

For the function

$$f(x) = \sin x + 3x - \frac{2}{\pi}(x^2 + x), \text{ where } x \in \left[0, \frac{\pi}{2}\right],$$

consider the following two statements:

(I) f is increasing in $(0, \frac{\pi}{2})$.

(II) f' is decreasing in $(0, \frac{\pi}{2})$.

Between the above two statements,

- (A) only (I) is true. (B) both (I) and (II) are true.
(C) only (II) is true. (D) neither (I) nor (II) is true.

Q62 Circles[Step-by-step solution > prepwiser.in/questions/exF9GPwyef](https://www.prepwiser.in/questions/exF9GPwyef)

Let a circle C of radius 1 and closer to the origin be such that the lines passing through the point $(3, 2)$ and parallel to the coordinate axes touch it. Then the shortest distance of the circle C from the point $(5, 5)$ is:

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

Q63 Complex Numbers[Step-by-step solution > prepwiser.in/questions/KPuS-_pnKK](https://www.prepwiser.in/questions/KPuS-_pnKK)

Consider the following two statements:

Statement I: For any two non-zero complex numbers

$$z_1, z_2, (|z_1| + |z_2|) \left| \frac{z_1}{|z_1|} + \frac{z_2}{|z_2|} \right| \leq 2(|z_1| + |z_2|), \text{ and}$$

Statement II: If x, y, z are three distinct complex numbers and a, b, c are three positive real numbers such that $\frac{a}{|y-z|} = \frac{b}{|z-x|} = \frac{c}{|x-y|}$, then $\frac{a^2}{y-z} + \frac{b^2}{z-x} + \frac{c^2}{x-y} = 1$.

Between the above two statements,

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

Q64 Definite Integration[Step-by-step solution > prepwiser.in/questions/73f23v_Nx2](https://www.prepwiser.in/questions/73f23v_Nx2)

The integral $\int_0^{\pi/4} \frac{136 \sin x}{3 \sin x + 5 \cos x} dx$ is equal to:

- (A) $3\pi - 50 \log_e 2 + 20 \log_e 5$ (B) $3\pi - 25 \log_e 2 + 10 \log_e 5$
(C) $3\pi - 10 \log_e(2\sqrt{2}) + 10 \log_e 5$ (D) $3\pi - 30 \log_e 2 + 20 \log_e 5$

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Q65 Definite Integration[Step-by-step solution](https://www.prepwiser.in/questions/d5T04XIEAr) › prepwiser.in/questions/d5T04XIEAr

The value of $\int_{-\pi}^{\pi} \frac{2y(1+\sin y)}{1+\cos^2 y} dy$ is:

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

Q66 Differential Equations[Step-by-step solution](https://www.prepwiser.in/questions/3QH0cBLe4T) › prepwiser.in/questions/3QH0cBLe4T

If $y = y(x)$ is the solution of the differential equation $\frac{dy}{dx} + 2y = \sin(2x)$, $y(0) = \frac{3}{4}$, then $y\left(\frac{\pi}{8}\right)$ is equal to:

- (A) $e^{-\pi/8}$ (B) $e^{\pi/4}$ (C) $e^{-\pi/4}$ (D) $e^{\pi/8}$

Q67 Ellipse[Step-by-step solution](https://www.prepwiser.in/questions/2KL1po-DJ) › prepwiser.in/questions/2KL1po-DJ

Let the line $2x + 3y - k = 0$, $k > 0$, intersect the x -axis and y -axis at the points A and B, respectively. If the equation of the circle having the line segment AB as a diameter is $x^2 + y^2 - 3x - 2y = 0$ and the length of the latus rectum of the ellipse $x^2 + 9y^2 = k^2$ is $\frac{m}{n}$, where m and n are coprime, then $2m + n$ is equal to

- (A) 12 (B) 13 (C) 11 (D) 10

Q68 Permutations & Combinations[Step-by-step solution](https://www.prepwiser.in/questions/fZRH5yVcC-) › prepwiser.in/questions/fZRH5yVcC-

Let $A = \{1, 3, 7, 9, 11\}$ and $B = \{2, 4, 5, 7, 8, 10, 12\}$. Then the total number of one-one maps $f: A \rightarrow B$, such that $f(1) + f(3) = 14$, is:

- (A) 120 (B) 180 (C) 240 (D) 480

Q69 Limits[Step-by-step solution](https://www.prepwiser.in/questions/IgNM1S27L1) › prepwiser.in/questions/IgNM1S27L1

If the function $f(x) = \frac{\sin 3x + \alpha \sin x - \beta \cos 3x}{x^3}$, $x \in \mathbf{R}$, is continuous at $x = 0$, then $f(0)$ is equal to:

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

Q70 Determinants[Step-by-step solution](https://www.prepwiser.in/questions/oq3xTSES2W) › prepwiser.in/questions/oq3xTSES2W

Let A and B be two square matrices of order 3 such that $|A| = 3$ and $|B| = 2$. Then

$$|A^T A (\text{adj}(2A))^{-1} (\text{adj}(4B)) (\text{adj}(AB))^{-1} A A^T|$$

is equal to:

- (A) 32 (B) 81 (C) 64 (D) 108

Q71 Determinants[Step-by-step solution](https://www.prepwiser.in/questions/iE7yCGhFNh) › prepwiser.in/questions/iE7yCGhFNh

If the system of equations

$$\begin{aligned} 11x + y + \lambda z &= -5 \\ 2x + 3y + 5z &= 3 \\ 8x - 19y - 39z &= \mu \end{aligned}$$

has infinitely many solutions, then $\lambda^4 - \mu$ is equal to:

- (A) 51 (B) 45 (C) 47 (D) 49

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Q72 Probability: Basic[Step-by-step solution](#) › [prepwiser.in/questions/4eISFhGSoS](https://www.prepwiser.in/questions/4eISFhGSoS)

The coefficients a, b, c in the quadratic equation $ax^2 + bx + c = 0$ are chosen from the set $\{1, 2, 3, 4, 5, 6, 7, 8\}$. The probability of this equation having repeated roots is:

- (A) $\frac{1}{128}$ (B) $\frac{1}{64}$ (C) $\frac{3}{256}$ (D) $\frac{3}{128}$

Q73 Sequences & Series[Step-by-step solution](#) › [prepwiser.in/questions/EhrDD7Gny0](https://www.prepwiser.in/questions/EhrDD7Gny0)

If

$$\frac{1}{\sqrt{1} + \sqrt{2}} + \frac{1}{\sqrt{2} + \sqrt{3}} + \dots + \frac{1}{\sqrt{99} + \sqrt{100}} = m$$

and $\frac{1}{1.2} + \frac{1}{2.3} + \dots + \frac{1}{99.100} = n$, then the point (m, n) lies on the line

- (A) $11(x - 1) - 100y = 0$ (B) $11x - 100y = 0$
(C) $11(x - 1) - 100(y - 2) = 0$ (D) $11(x - 2) - 100(y - 1) = 0$

Q74 Vectors[Step-by-step solution](#) › [prepwiser.in/questions/GhG9m-gokQ](https://www.prepwiser.in/questions/GhG9m-gokQ)

If $A(1, -1, 2)$, $B(5, 7, -6)$, $C(3, 4, -10)$ and $D(-1, -4, -2)$ are the vertices of a quadrilateral ABCD, then its area is:

- (A) $24\sqrt{7}$ (B) $48\sqrt{7}$ (C) $24\sqrt{29}$ (D) $12\sqrt{29}$

Q75 Straight Lines[Step-by-step solution](#) › [prepwiser.in/questions/vSWjl6v5z](https://www.prepwiser.in/questions/vSWjl6v5z)

Let two straight lines drawn from the origin O intersect the line $3x + 4y = 12$ at the points P and Q such that $\triangle OPQ$ is an isosceles triangle and $\angle POQ = 90^\circ$. If $l = OP^2 + PQ^2 + QO^2$, then the greatest integer less than or equal to l is:

- (A) 42 (B) 46 (C) 48 (D) 44

Q76 Trigonometric Ratios & Identities[Step-by-step solution](#) › [prepwiser.in/questions/GUyKnm-493](https://www.prepwiser.in/questions/GUyKnm-493)

Suppose $\theta \in [0, \frac{\pi}{4}]$ is a solution of $4 \cos \theta - 3 \sin \theta = 1$. Then $\cos \theta$ is equal to:

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

Mathematics Section B · Numerical value

Q77 to Q85

Q77 Binomial Theorem **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/g7JYLNjrgO](https://www.prepwiser.in/questions/g7JYLNjrgO)

If the constant term in the expansion of $(1 + 2x - 3x^3) (\frac{3}{2}x^2 - \frac{1}{3x})^9$ is p , then $108p$ is equal to _____.

Q78 Relations & Functions (Basic) **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/kIEtSADOIM](https://www.prepwiser.in/questions/kIEtSADOIM)

If $S = \{a \in \mathbf{R} : |2a - 1| = 3[a] + 2\{a\}\}$, where $[t]$ denotes the greatest integer less than or equal to t and $\{t\}$ represents the fractional part of t , then $72 \sum_{a \in S} a$ is equal to _____.

Q79 Differential Equations **NUMERICAL**[Step-by-step solution](#) › [prepwiser.in/questions/UCLi7ow4qq](https://www.prepwiser.in/questions/UCLi7ow4qq)

Let f be a differentiable function in the interval $(0, \infty)$ such that $f(1) = 1$ and $\lim_{t \rightarrow x} \frac{t^2 f(x) - x^2 f(t)}{t - x} = 1$ for each $x > 0$. Then $2f(2) + 3f(3)$ is equal to _____.

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Q80 Parabola **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/V9BDFud_IB) › prepwiser.in/questions/V9BDFud_IB

Suppose AB is a focal chord of the parabola $y^2 = 12x$ of length l and slope $m < \sqrt{3}$. If the distance of the chord AB from the origin is d , then ld^2 is equal to _____.

Q81 Permutations & Combinations **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/2_gEf3z547) › prepwiser.in/questions/2_gEf3z547

The number of ways of getting a sum 16 on throwing a dice four times is _____.

Q82 Probability: Advanced **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/mb1Ik7T35I) › prepwiser.in/questions/mb1Ik7T35I

From a lot of 10 items, which include 3 defective items, a sample of 5 items is drawn at random. Let the random variable X denote the number of defective items in the sample. If the variance of X is σ^2 , then $96\sigma^2$ is equal to _____.

Q83 Sequences & Series **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/rrR76GDCZ0) › prepwiser.in/questions/rrR76GDCZ0

Let $a_1, a_2, a_3, \dots$ be in an arithmetic progression of positive terms.

Let $A_k = a_1^2 - a_2^2 + a_3^2 - a_4^2 + \dots + a_{2k-1}^2 - a_{2k}^2$.

If $A_3 = -153$, $A_5 = -435$ and $a_1^2 + a_2^2 + a_3^2 = 66$, then $a_{17} - A_7$ is equal to _____.

Q84 Vectors **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/IQSYdTxFx) › prepwiser.in/questions/IQSYdTxFx

Let

$$\vec{a} = \hat{i} - 3\hat{j} + 7\hat{k}, \vec{b} = 2\hat{i} - \hat{j} + \hat{k}$$

and $\vec{c}$ be a vector such that

$$(\vec{a} + 2\vec{b}) \times \vec{c} = 3(\vec{c} \times \vec{a})$$

. If $\vec{a} \cdot \vec{c} = 130$, then $\vec{b} \cdot \vec{c}$ is equal to _____.

Q85 Area Under Curves **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/xps2mQeEH8) › prepwiser.in/questions/xps2mQeEH8

The area of the region enclosed by the parabolas $y = x^2 - 5x$ and $y = 7x - x^2$ is _____.

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Physics

1.	D	2.	C	3.	D	4.	A	5.	B	6.	B	7.	D	8.	A	9.	A	10.	B
11.	B	12.	B	13.	B	14.	C	15.	A	16.	C	17.	C	18.	B	19.	B	20.	50
21.	727	22.	4	23.	86	24.	5	25.	240	26.	5	27.	19	28.	600	29.	10		

Chemistry

30.	C	31.	B	32.	C	33.	B	34.	C	35.	C	36.	B	37.	D	38.	B	39.	B
40.	A	41.	B	42.	B	43.	B	44.	A	45.	B	46.	C	47.	C	48.	B	49.	8
50.	3	51.	5	52.	2	53.	25	54.	22	55.	150	56.	80						

Mathematics

57.	D	58.	A	59.	D	60.	D	61.	B	62.	B	63.	B	64.	A	65.	B	66.	C
67.	C	68.	C	69.	C	70.	C	71.	C	72.	B	73.	B	74.	D	75.	B	76.	D
77.	54	78.	18	79.	24	80.	108	81.	125	82.	56	83.	910	84.	30	85.	72		

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