

JEE MAIN 2025 · QUESTION PAPER

24 Jan 2025 **Shift 1**

73 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	20 Q1 to Q20	5 Q21 to Q25
● Chemistry	18 Q26 to Q43	5 Q44 to Q48
● Mathematics	20 Q49 to Q68	5 Q69 to Q73
In this PDF	73 questions · answer key at the end	

- 1 Set a 3 hour timer and attempt the paper in one sitting, like the real exam.
- 2 Check yourself against the answer key at the end. Every question names its chapter, so you can see where marks went.
- 3 Got one wrong? Tap “Step-by-step solution” at the top right of it for the full working, where available.

Attempt this paper online

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

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

Q1 Alternating Current

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

An alternating current is given by $I = I_A \sin \omega t + I_B \cos \omega t$. The r.m.s current will be

- (A) $\frac{\sqrt{I_A^2 + I_B^2}}{2}$ (B) $\sqrt{\frac{I_A^2 + I_B^2}{2}}$ (C) $\frac{|I_A + I_B|}{\sqrt{2}}$ (D) $\sqrt{I_A^2 + I_B^2}$

Q2 Atomic Physics

[Step-by-step solution](#) · [prepwisar.in/questions/HiQWmK6Bnw](https://www.prepwisar.in/questions/HiQWmK6Bnw)

During the transition of electron from state A to state C of a Bohr atom, the wavelength of emitted radiation is $2000 \text{ \AA}$ and it becomes $6000 \text{ \AA}$ when the electron jumps from state B to state C. Then the wavelength of the radiation emitted during the transition of electrons from state A to state B is

- (A) $4000 \text{ \AA}$ (B) $6000 \text{ \AA}$ (C) $2000 \text{ \AA}$ (D) $3000 \text{ \AA}$

Q3 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) · [prepwisar.in/questions/XQRA5dC-Co](https://www.prepwisar.in/questions/XQRA5dC-Co)

A parallel plate capacitor was made with two rectangular plates, each with a length of $l = 3\text{cm}$ and breadth of $b = 1\text{cm}$. The distance between the plates is $3\mu\text{m}$. Out of the following, which are the ways to increase the capacitance by a factor of 10?

- A. $l = 30\text{cm}$, $b = 1\text{cm}$, $d = 1\mu\text{m}$
 B. $l = 3\text{cm}$, $b = 1\text{cm}$, $d = 30\mu\text{m}$
 C. $l = 6\text{cm}$, $b = 5\text{cm}$, $d = 3\mu\text{m}$
 D. $l = 1\text{cm}$, $b = 1\text{cm}$, $d = 10\mu\text{m}$
 E. $l = 5\text{cm}$, $b = 2\text{cm}$, $d = 1\mu\text{m}$

Choose the correct answer from the options given below:

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

Q4 Circular Motion

[Step-by-step solution](#) · [prepwisar.in/questions/Alm7cQEZGd](https://www.prepwisar.in/questions/Alm7cQEZGd)

A car of mass ' m ' moves on a banked road having radius ' r ' and banking angle θ . To avoid slipping from banked road, the maximum permissible speed of the car is v_0 . The coefficient of friction μ between the wheels of the car and the banked road is

- (A) $\mu = \frac{v_0^2 + rg \tan \theta}{rg + v_0^2 \tan \theta}$ (B) $\mu = \frac{v_0^2 - rg \tan \theta}{rg - v_0^2 \tan \theta}$ (C) $\mu = \frac{v_0^2 - rg \tan \theta}{rg + v_0^2 \tan \theta}$ (D) $\mu = \frac{v_0^2 + rg \tan \theta}{rg - v_0^2 \tan \theta}$

Q5 Dual Nature of Radiation & Matter

[Step-by-step solution](#) · [prepwisar.in/questions/Al2Nv3ex2L](https://www.prepwisar.in/questions/Al2Nv3ex2L)

An electron of mass ' m ' with an initial velocity $\vec{v} = v_0 \hat{i}$ ($v_0 > 0$) enters an electric field $\vec{E} = -E_0 \hat{k}$. If the initial de Broglie wavelength is λ_0 , the value after time t would be

- (A) $\frac{\lambda_0}{\sqrt{1 - \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$ (B) λ_0 (C) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$ (D) $\lambda_0 \sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}$

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Consider the following statements:

- A. The junction area of solar cell is made very narrow compared to a photo diode.
- B. Solar cells are not connected with any external bias.
- C. LED is made of lightly doped p-n junction.
- D. Increase of forward current results in continuous increase of LED light intensity.
- E. LEDs have to be connected in forward bias for emission of light.

Choose the correct answer from the options given below:

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

Consider a parallel plate capacitor of area A (of each plate) and separation ' d ' between the plates. If E is the electric field and ϵ_0 is the permittivity of free space between the plates, then potential energy stored in the capacitor is

- (A) $\epsilon_0 E^2 A d$ (B) $\frac{3}{4} \epsilon_0 E^2 A d$ (C) $\frac{1}{4} \epsilon_0 E^2 A d$ (D) $\frac{1}{2} \epsilon_0 E^2 A d$

What is the relative decrease in focal length of a lens for an increase in optical power by 0.1 D from 2.5D? ['D' stands for dioptre]

- (A) 0.04 (B) 0.1 (C) 0.40 (D) 0.01

A thin plano convex lens made of glass of refractive index 1.5 is immersed in a liquid of refractive index 1.2. When the plane side of the lens is silver coated for complete reflection, the lens immersed in the liquid behaves like a concave mirror of focal length 0.2 m. The radius of curvature of the curved surface of the lens is

- (A) 0.15 m (B) 0.10 m (C) 0.25 m (D) 0.20 m

A plano-convex lens having radius of curvature of first surface 2 cm exhibits focal length of f_1 in air. Another plano-convex lens with first surface radius of curvature 3 cm has focal length of f_2 when it is immersed in a liquid of refractive index 1.2. If both the lenses are made of same glass of refractive index 1.5, the ratio of f_1 and f_2 will be

- (A) 2 : 3 (B) 1 : 3 (C) 1 : 2 (D) 3 : 5

A satellite is launched into a circular orbit of radius ' R ' around the earth. A second satellite is launched into an orbit of radius 1.03 R . The time period of revolution of the second satellite is larger than the first one approximately by

- (A) 3% (B) 2.5% (C) 4.5% (D) 9%

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Q12 Thermodynamics[Step-by-step solution > prepwise.in/questions/5uo6USQISZ](https://www.prepwise.in/questions/5uo6USQISZ)

An ideal gas goes from an initial state to final state. During the process, the pressure of gas increases linearly with temperature.

- A. The work done by gas during the process is zero.
- B. The heat added to gas is different from change in its internal energy.
- C. The volume of the gas is increased.
- D. The internal energy of the gas is increased.
- E. The process is isochoric (constant volume process)

Choose the correct answer from the options given below:

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

Q13 Rotational Motion[Step-by-step solution > prepwise.in/questions/z1slflq6VJ](https://www.prepwise.in/questions/z1slflq6VJ)

An object of mass 'm' is projected from origin in a vertical xy plane at an angle 45° with the x-axis with an initial velocity v_0 . The magnitude and direction of the angular momentum of the object with respect to origin, when it reaches at the maximum height, will be [g is acceleration due to gravity]

- (A) $\frac{mv_0^3}{2\sqrt{2}g}$ along negative z-axis (B) $\frac{mv_0^3}{2\sqrt{2}g}$ along positive z-axis
(C) $\frac{mv_0^3}{4\sqrt{2}g}$ along positive z-axis (D) $\frac{mv_0^3}{4\sqrt{2}g}$ along negative z-axis

Q14 Surface Tension[Step-by-step solution > prepwise.in/questions/_oxpxPA5yv](https://www.prepwise.in/questions/_oxpxPA5yv)

An air bubble of radius 0.1 cm lies at a depth of 20 cm below the free surface of a liquid of density 1000kg/m^3 . If the pressure inside the bubble is 2100N/m^2 greater than the atmospheric pressure, then the surface tension of the liquid in SI unit is (use $g = 10\text{m/s}^2$)

- (A) 0.02 (B) 0.05 (C) 0.25 (D) 0.1

Q15 Surface Tension[Step-by-step solution > prepwise.in/questions/xx6e5KQmdP](https://www.prepwise.in/questions/xx6e5KQmdP)

The amount of work done to break a big water drop of radius 'R' into 27 small drops of equal radius is 10 J. The work done required to break the same big drop into 64 small drops of equal radius will be

- (A) 20 J (B) 10 J (C) 5 J (D) 15 J

Q16 Rotational Motion[Step-by-step solution > prepwise.in/questions/ZGbNk5Mfyr](https://www.prepwise.in/questions/ZGbNk5Mfyr)

A uniform solid cylinder of mass 'm' and radius 'r' rolls along an inclined rough plane of inclination 45° . If it starts to roll from rest from the top of the plane then the linear acceleration of the cylinder's axis will be

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

Q17 Simple Harmonic Motion[Step-by-step solution > prepwise.in/questions/-I4KfTMrAq](https://www.prepwise.in/questions/-I4KfTMrAq)

A particle is executing simple harmonic motion with time period 2 s and amplitude 1 cm. If D and d are the total distance and displacement covered by the particle in 12.5 s, then $\frac{D}{d}$ is

- (A) 10 (B) $\frac{16}{5}$ (C) 25 (D) $\frac{15}{4}$

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Q18 Wave Optics[Step-by-step solution](https://www.prepwiser.in/questions/94pZn4RKuI) › prepwiser.in/questions/94pZn4RKuI

The Young's double slit interference experiment is performed using light consisting of 480 nm and 600 nm wavelengths to form interference patterns. The least number of the bright fringes of 480 nm light that are required for the first coincidence with the bright fringes formed by 600 nm light is

- (A) 8 (B) 4 (C) 5 (D) 6

Q19 Work, Energy & Power[Step-by-step solution](https://www.prepwiser.in/questions/zUN59QaQtp) › prepwiser.in/questions/zUN59QaQtp

A force $F = \alpha + \beta x^2$ acts on an object in the x-direction. The work done by the force is 5 J when the object is displaced by 1 m. If the constant $\alpha = 1\text{ N}$ then β will be

- (A) 15 N/m^2 (B) 10 N/m^2 (C) 12 N/m^2 (D) 8 N/m^2

Q20 Units, Dimensions & Errors[Step-by-step solution](https://www.prepwiser.in/questions/C0t4bC6jPv) › prepwiser.in/questions/C0t4bC6jPv

For an experimental expression $y = \frac{32.3 \times 1125}{27.4}$, where all the digits are significant. Then to report the value of y we should write

- (A) $y = 1326.186$ (B) $y = 1326.2$ (C) $y = 1326.19$ (D) $y = 1330$

Physics Section B · Numerical value

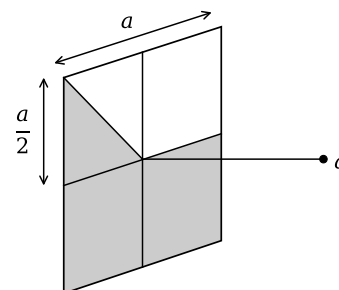
Q21 to Q25

Q21 Current Electricity **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/naAp226T6N) › prepwiser.in/questions/naAp226T6N

A wire of resistance 9Ω is bent to form an equilateral triangle. Then the equivalent resistance across any two vertices will be _____ ohm.

Q22 Electrostatics I: Charges, Field & Gauss's Law **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/F3l-Mp1SYp) › prepwiser.in/questions/F3l-Mp1SYp

A square loop of sides $a = 1\text{ m}$ is held normally in front of a point charge $q = 1\text{ C}$ at a distance $\frac{a}{2}$. The flux of the electric field through the shaded region is $\frac{5}{p} \times \frac{1}{\epsilon_0} \frac{\text{Nm}^2}{\text{C}}$, where the value of p is _____.

**Q23** Thermodynamics **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/D1u6pviEUU) › prepwiser.in/questions/D1u6pviEUU

The temperature of 1 mole of an ideal monoatomic gas is increased by 50°C at constant pressure. The total heat added and change in internal energy are E_1 and E_2 , respectively. If $\frac{E_1}{E_2} = \frac{x}{9}$ then the value of x is _____.

Q24 Moving Charges & Magnetism **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/2wKqov0yWj) › prepwiser.in/questions/2wKqov0yWj

A current of 5 A exists in a square loop of side $\frac{1}{\sqrt{2}}\text{ m}$. Then the magnitude of the magnetic field B at the centre of the square loop will be $p \times 10^{-6}\text{ T}$. where, value of p is _____ [Take $\mu_0 = 4\pi \times 10^{-7}\text{ TmA}^{-1}$].

Q25 Experimental Skills **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/JhNPQX8byy) › prepwiser.in/questions/JhNPQX8byy

The least count of a screw gauge is 0.01 mm. If the pitch is increased by 75% and number of divisions on the circular scale is reduced by 50%, the new least count will be _____ $\times 10^{-3}\text{ mm}$

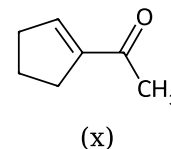
Q26 Aldehydes & Ketones[Step-by-step solution](https://www.prepwisar.in/questions/b96Pe2MuLi) > prepwisar.in/questions/b96Pe2MuLi

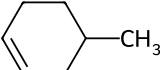
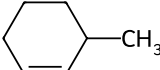
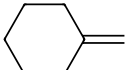
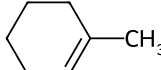
Which of the following arrangements with respect to their reactivity in nucleophilic addition reaction is correct?

- (A) acetophenone < benzaldehyde < p-tolualdehyde < p- nitrobenzaldehyde
(B) acetophenone < p-tolualdehyde < benzaldehyde < p- nitrobenzaldehyde
(C) p- nitrobenzaldehyde < benzaldehyde < p-tolualdehyde < acetophenone
(D) benzaldehyde < acetophenone < p- nitrobenzaldehyde < p-tolualdehyde

Q27 Aldehydes & Ketones[Step-by-step solution](https://www.prepwisar.in/questions/fN5x_3nXI9) > prepwisar.in/questions/fN5x_3nXI9

Aman has been asked to synthesise the molecule He thought of preparing the molecule using an aldol condensation reaction. He found a few cyclic alkenes in his laboratory. He thought of performing ozonolysis reaction on alkene to produce a dicarbonyl compound followed by aldol reaction to prepare "x". Predict the suitable alkene that can lead to the formation of "x".



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

Q28 Carbohydrates & Biomolecules[Step-by-step solution](https://www.prepwisar.in/questions/irJoL7czKd) > prepwisar.in/questions/irJoL7czKd

The carbohydrate "Ribose" present in DNA, is

- A. A pentose sugar
B. present in pyranose form
C. in "D" configuration
D. a reducing sugar, when free
E. in α -anomeric form

Choose the correct answer from the options given below:

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

Q29 Chemical Bonding & Molecular Structure[Step-by-step solution](https://www.prepwisar.in/questions/rdSERFN9qT) > prepwisar.in/questions/rdSERFN9qT

Which of the following linear combination of atomic orbitals will lead to formation of molecular orbitals in homonuclear diatomic molecules [internuclear axis in z -direction]?

- A. $2p_z$ and $2p_x$
B. $2s$ and $2p_x$
C. $3d_{xy}$ and $3d_{x^2-y^2}$
D. $2s$ and $2p_z$
E. $2p_z$ and $3d_{x^2-y^2}$

Choose the correct answer from the options given below:

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

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Which of the following statement is true with respect to H_2O , NH_3 and CH_4 ?

- A. The central atoms of all the molecules are sp^3 hybridized.
 B. The $\text{H} - \text{O} - \text{H}$, $\text{H} - \text{N} - \text{H}$ and $\text{H} - \text{C} - \text{H}$ angles in the above molecules are 104.5° , 107.5° and 109.5° , respectively.
 C. The increasing order of dipole moment is $\text{CH}_4 < \text{NH}_3 < \text{H}_2\text{O}$.
 D. Both H_2O and NH_3 are Lewis acids and CH_4 is a Lewis base.
 E. A solution of NH_3 in H_2O is basic. In this solution NH_3 and H_2O act as Lowry-Bronsted acid and base respectively.

Choose the correct answer from the options given below:

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

For a reaction, $\text{N}_2\text{O}_{5(g)} \rightarrow 2\text{NO}_{2(g)} + \frac{1}{2}\text{O}_{2(g)}$ in a constant volume container, no products were present initially. The final pressure of the system when 50% of reaction gets completed is

- (A) $5/2$ times of initial pressure (B) $7/2$ times of initial pressure
 (C) $7/4$ times of initial pressure (D) 5 times of initial pressure

One mole of the octahedral complex compound $\text{Co}(\text{NH}_3)_5\text{Cl}_3$ gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with excess of AgNO_3 solution to yield two moles of $\text{AgCl}_{(s)}$. The structure of the complex is:

- (A) $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ (B) $[\text{Co}(\text{NH}_3)_4\text{Cl}] \cdot \text{Cl}_2 \cdot \text{NH}_3$
 (C) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3] \cdot 2\text{NH}_3$ (D) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2] \cdot \text{Cl} \cdot \text{NH}_3$

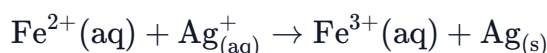
Preparation of potassium permanganate from MnO_2 involves two step process in which the 1st step is a reaction with KOH and KNO_3 to produce

- (A) K_3MnO_4 (B) $\text{K}_4[\text{Mn}(\text{OH})_6]$ (C) K_2MnO_4 (D) KMnO_4

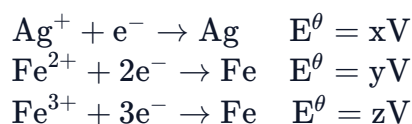
Which of the following ions is the strongest oxidizing agent? (Atomic Number of $\text{Ce} = 58$, $\text{Eu} = 63$, $\text{Tb} = 65$, $\text{Lu} = 71$)

- (A) Lu^{3+} (B) Eu^{2+} (C) Tb^{4+} (D) Ce^{3+}

For the given cell



The standard cell potential of the above reaction is Given:



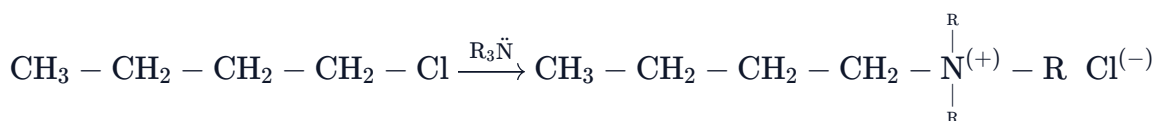
- (A) $x + 2y - 3z$ (B) $x + 2y$ (C) $y - 2x$ (D) $x + y - z$

Given below are two statements:

Statement I: The conversion proceeds well in the less polar medium.



Statement II: The conversion proceeds well in the more polar medium.



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

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

Q37 Ionic Equilibrium

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

K_{sp} for $\text{Cr}(\text{OH})_3$ is 1.6×10^{-30} . What is the molar solubility of this salt in water?

- (A) $\sqrt[5]{1.8 \times 10^{-30}}$ (B) $\frac{1.8 \times 10^{-30}}{27}$ (C) $\sqrt[4]{\frac{1.6 \times 10^{-30}}{27}}$ (D) $\sqrt[2]{1.6 \times 10^{-30}}$

Q38 p-Block Elements: Part II (Group 15-18)

Step-by-step solution > [prepwisar.in/questions/eC9a0dLzyC](https://www.prepwisar.in/questions/eC9a0dLzyC)

The large difference between the melting and boiling points of oxygen and sulphur may be explained on the basis of

- (A) Atomicity (B) Electron gain enthalpy
(C) Atomic size (D) Electronegativity

Q39 Periodic Table & Periodicity

Step-by-step solution > [prepwisar.in/questions/XpvVI53IYg](https://www.prepwisar.in/questions/XpvVI53IYg)

Which of the following statements are NOT true about the periodic table?

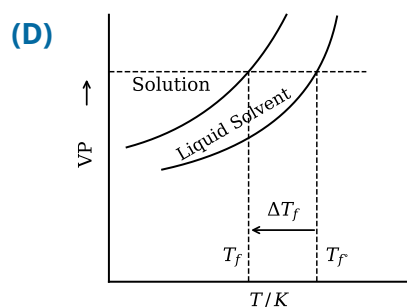
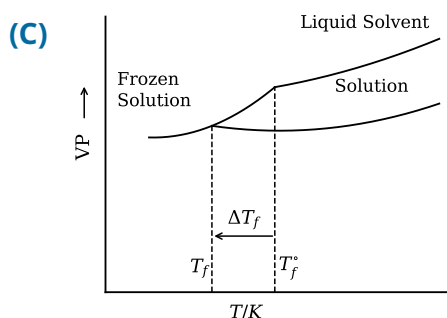
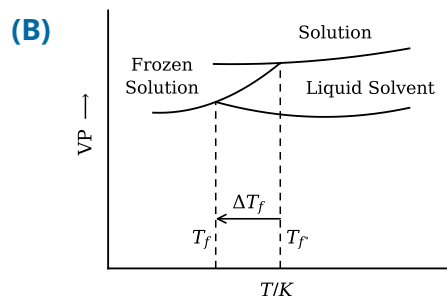
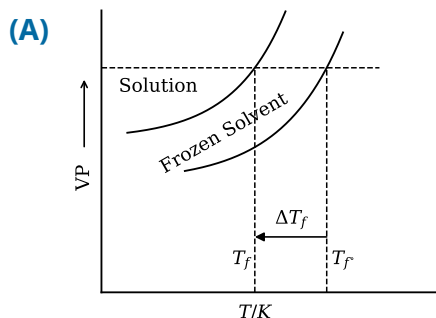
- A. The properties of elements are function of atomic weights.
B. The properties of elements are function of atomic numbers.
C. Elements having similar outer electronic configurations are arranged in same period.
D. An element's location reflects the quantum numbers of the last filled orbital.
E. The number of elements in a period is same as the number of atomic orbitals available in energy level that is being filled.

Choose the correct answer from the options given below:

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

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Consider the given plots of vapour pressure (VP) vs temperature (T/K). Which amongst the following options is correct graphical representation showing ΔT_f , depression in the freezing point of a solvent in a solution?



Let us consider an endothermic reaction which is non-spontaneous at the freezing point of water. However, the reaction is spontaneous at boiling point of water. Choose the correct option.

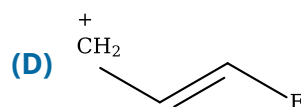
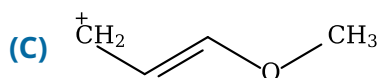
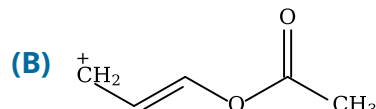
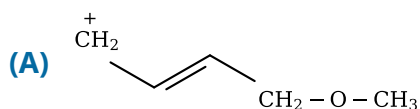
(A) Both ΔH and ΔS are (-ve)

(B) ΔH is (+ve) but ΔS is (-ve)

(C) ΔH is (-ve) but ΔS is (+ve)

(D) Both ΔH and ΔS are (+ve)

Which one of the carbocations from the following is most stable?



Given below are two statements I and II.

Statement I : Dumas method is used for estimation of "Nitrogen" in an organic compound.

Statement II : Dumas method involves the formation of ammonium sulphate by heating the organic compound with conc H_2SO_4 .

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

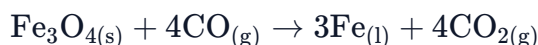
(B) Statement I is false but Statement II is true

(C) Both Statement I and Statement II are true

(D) Both Statement I and Statement II are false

Q44 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](#) · [prepwise.in/questions/u3gldRyFcE](#)

Consider the following reaction occurring in the blast furnace:



' x ' kg of iron is produced when $2.32 \times 10^3 \text{ kg Fe}_3\text{O}_4$ and $2.8 \times 10^2 \text{ kg CO}$ are brought together in the furnace. The value of ' x ' is _____. (nearest integer)

{Given: molar mass of $\text{Fe}_3\text{O}_4 = 232 \text{ g mol}^{-1}$

molar mass of $\text{CO} = 28 \text{ g mol}^{-1}$

molar mass of $\text{Fe} = 56 \text{ g mol}^{-1}$ }

Q45 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](#) · [prepwise.in/questions/9ZM-XQ-mc1](#)

Xg of benzoic acid on reaction with aq NaHCO_3 released CO_2 that occupied 11.2 L volume at STP.

X is _____ g.

Q46 Chemical Thermodynamics **NUMERICAL**[Step-by-step solution](#) · [prepwise.in/questions/fH0wxG7RNI](#)

Standard entropies of X_2 , Y_2 and XY_5 are 70, 50 and $110 \text{ J K}^{-1} \text{ mol}^{-1}$ respectively. The temperature in Kelvin at which the reaction



will be at equilibrium is _____ (Nearest integer)

Q47 Chemical Equilibrium **NUMERICAL**[Step-by-step solution](#) · [prepwise.in/questions/LGaUh9C03Y](#)

37.8g N_2O_5 was taken in a 1 L reaction vessel and allowed to undergo the following reaction at 500 K



The total pressure at equilibrium was found to be 18.65 bar.

Then, $K_p = \text{_____} \times 10^{-2}$ [nearest integer]

Assume N_2O_5 to behave ideally under these conditions.

Given: $R = 0.082 \text{ bar L mol}^{-1} \text{ K}^{-1}$

Q48 Qualitative Analysis: Salt Analysis **NUMERICAL**[Step-by-step solution](#) · [prepwise.in/questions/1HLtskbOG-](#)

Among the following cations, the number of cations which will give characteristic precipitate in their identification tests with $\text{K}_4[\text{Fe}(\text{CN})_6]$ is _____.

Cu^{2+} , Fe^{3+} , Ba^{2+} , Ca^{2+} , NH_4^+ , Mg^{2+} , Zn^{2+}

Q49 Three Dimensional Geometry

[Step-by-step solution](#) › [prepwisar.in/questions/mVwHpM0PA5](https://www.prepwisar.in/questions/mVwHpM0PA5)

Let in a $\triangle ABC$, the length of the side AC be 6, the vertex B be $(1, 2, 3)$ and the vertices A, C lie on the line $\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$. Then the area (in sq. units) of $\triangle ABC$ is:

- (A) 42 (B) 17 (C) 56 (D) 21

Q50 Three Dimensional Geometry

[Step-by-step solution](#) › [prepwisar.in/questions/RXRKYr0DyV](https://www.prepwisar.in/questions/RXRKYr0DyV)

Let the line passing through the points $(-1, 2, 1)$ and parallel to the line $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z}{4}$ intersect the line $\frac{x+2}{3} = \frac{y-3}{2} = \frac{z-4}{1}$ at the point P . Then the distance of P from the point $Q(4, -5, 1)$ is

- (A) $5\sqrt{6}$ (B) 5 (C) $5\sqrt{5}$ (D) 10

Q51 Applications of Derivatives

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

Consider the region $R = \{(x, y) : x \leq y \leq 9 - \frac{11}{3}x^2, x \geq 0\}$. The area, of the largest rectangle of sides parallel to the coordinate axes and inscribed in R , is:

- (A) $\frac{821}{123}$ (B) $\frac{567}{121}$ (C) $\frac{730}{119}$ (D) $\frac{625}{111}$

Q52 Binomial Theorem

[Step-by-step solution](#) › [prepwisar.in/questions/jFnMs5wvhn](https://www.prepwisar.in/questions/jFnMs5wvhn)

For some $n \neq 10$, let the coefficients of the 5th, 6th and 7th terms in the binomial expansion of $(1 + x)^{n+4}$ be in A.P. Then the largest coefficient in the expansion of $(1 + x)^{n+4}$ is:

- (A) 10 (B) 35 (C) 70 (D) 20

Q53 Circles

[Step-by-step solution](#) › [prepwisar.in/questions/Uyb8h4ec0j](https://www.prepwisar.in/questions/Uyb8h4ec0j)

Let circle C be the image of $x^2 + y^2 - 2x + 4y - 4 = 0$ in the line $2x - 3y + 5 = 0$ and A be the point on C such that OA is parallel to x -axis and A lies on the right hand side of the centre O of C . If $B(\alpha, \beta)$, with $\beta < 4$, lies on C such that the length of the arc AB is $(1/6)^{\text{th}}$ of the perimeter of C , then $\beta - \sqrt{3}\alpha$ is equal to

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

Q54 Complex Numbers

[Step-by-step solution](#) › [prepwisar.in/questions/a2N0sucdV2](https://www.prepwisar.in/questions/a2N0sucdV2)

If α and β are the roots of the equation $2z^2 - 3z - 2i = 0$, where $i = \sqrt{-1}$, then $16 \cdot$

$\text{Re} \left(\frac{\alpha^{19} + \beta^{19} + \alpha^{11} + \beta^{11}}{\alpha^{15} + \beta^{15}} \right) \cdot \text{Im} \left(\frac{\alpha^{19} + \beta^{19} + \alpha^{11} + \beta^{11}}{\alpha^{15} + \beta^{15}} \right)$ is equal to

- (A) 441 (B) 312 (C) 409 (D) 398

Q55 Definite Integration

[Step-by-step solution](#) › [prepwisar.in/questions/s7ORZycnyY](https://www.prepwisar.in/questions/s7ORZycnyY)

If $I(m, n) = \int_0^1 x^{m-1}(1-x)^{n-1}dx$, $m, n > 0$, then $I(9, 14) + I(10, 13)$ is

- (A) $I(9, 1)$ (B) $I(1, 13)$ (C) $I(19, 27)$ (D) $I(9, 13)$

Q56 Differential Equations

[Step-by-step solution](#) › [prepwisar.in/questions/U4FSwNd3jO](https://www.prepwisar.in/questions/U4FSwNd3jO)

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

$(xy - 5x^2\sqrt{1+x^2})dx + (1+x^2)dy = 0$, $y(0) = 0$. Then $y(\sqrt{3})$ is equal to

- (A) $\frac{5\sqrt{3}}{2}$ (B) $\sqrt{\frac{15}{2}}$ (C) $\sqrt{\frac{14}{3}}$ (D) $2\sqrt{2}$

Q57 Ellipse[Step-by-step solution](https://www.prepwiser.in/questions/JHOc35Zf-Q)

Let the product of the focal distances of the point $(\sqrt{3}, \frac{1}{2})$ on the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, ($a > b$), be $\frac{7}{4}$. Then the absolute difference of the eccentricities of two such ellipses is

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

Q58 Sequences & Series[Step-by-step solution](https://www.prepwiser.in/questions/s5S2OxD0m4)

Let $f(x) = \frac{2^{x+2} + 16}{2^{2x+1} + 2^{x+4} + 32}$. Then the value of $8 \left(f\left(\frac{1}{15}\right) + f\left(\frac{2}{15}\right) + \dots + f\left(\frac{59}{15}\right) \right)$ is equal to

- (A) 108 (B) 92 (C) 118 (D) 102

Q59 Limits[Step-by-step solution](https://www.prepwiser.in/questions/qEuCIID60A)

$\lim_{x \rightarrow 0} \operatorname{cosec} x \left(\sqrt{2 \cos^2 x + 3 \cos x} - \sqrt{\cos^2 x + \sin x + 4} \right)$ is:

- (A) $\frac{1}{\sqrt{15}}$ (B) $\frac{1}{2\sqrt{5}}$ (C) 0 (D) $-\frac{1}{2\sqrt{5}}$

Q60 Functions (Advanced)[Step-by-step solution](https://www.prepwiser.in/questions/HuO757hUdd)

Let $f: \mathbb{R} - \{0\} \rightarrow \mathbb{R}$ be a function such that $f(x) - 6f\left(\frac{1}{x}\right) = \frac{35}{3x} - \frac{5}{2}$. If the

$\lim_{x \rightarrow 0} \left(\frac{1}{\alpha x} + f(x) \right) = \beta$; $\alpha, \beta \in \mathbb{R}$, then $\alpha + 2\beta$ is equal to

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

Q61 Determinants[Step-by-step solution](https://www.prepwiser.in/questions/8XHGVtXPUO)

If the system of equations

$$2x - y + z = 4$$

$$5x + \lambda y + 3z = 12$$

$$100x - 47y + \mu z = 212$$

has infinitely many solutions, then $\mu - 2\lambda$ is equal to

- (A) 56 (B) 59 (C) 57 (D) 55

Q62 Probability: Basic[Step-by-step solution](https://www.prepwiser.in/questions/wPbZqImGYR)

A and B alternately throw a pair of dice. A wins if he throws a sum of 5 before B throws a sum of 8, and B wins if he throws a sum of 8 before A throws a sum of 5. The probability, that A wins if A makes the first throw, is

- (A) $\frac{8}{19}$ (B) $\frac{9}{19}$ (C) $\frac{8}{17}$ (D) $\frac{9}{17}$

Q63 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](https://www.prepwiser.in/questions/bz4VV9Czab)

The product of all the rational roots of the equation $(x^2 - 9x + 11)^2 - (x - 4)(x - 5) = 3$, is equal to

- (A) 7 (B) 21 (C) 28 (D) 14

Q64 Sequences & Series[Step-by-step solution](https://www.prepwiser.in/questions/gfPJ8mIpiM)

Let $S_n = \frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \dots$ upto n terms. If the sum of the first six terms of an A.P. with first term $-p$ and common difference p is $\sqrt{2026S_{2025}}$, then the absolute difference between 20th and 15th terms of the A.P. is

- (A) 20 (B) 45 (C) 90 (D) 25

Q65 Statistics[Step-by-step solution](#) > prepwiser.in/questions/RXkTE6EvXw

For a statistical data $x_1, x_2, \dots, x_{10}$ of 10 values, a student obtained the mean as 5.5 and $\sum_{i=1}^{10} x_i^2 = 371$. He later found that he had noted two values in the data incorrectly as 4 and 5, instead of the correct values 6 and 8, respectively. The variance of the corrected data is

- (A) 5 (B) 7 (C) 9 (D) 4

Q66 Vectors[Step-by-step solution](#) > prepwiser.in/questions/UvAjUY-ZsU

Let $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = 3\hat{i} + \hat{j} - \hat{k}$ and $\vec{c}$ be three vectors such that $\vec{c}$ is coplanar with $\vec{a}$ and $\vec{b}$. If the vector $\vec{c}$ is perpendicular to $\vec{b}$ and $\vec{a} \cdot \vec{c} = 5$, then $|\vec{c}|$ is equal to

- (A) $\sqrt{\frac{11}{6}}$ (B) $\frac{1}{3\sqrt{2}}$ (C) 18 (D) 16

Q67 Area Under Curves[Step-by-step solution](#) > prepwiser.in/questions/JrH7frpQH0

The area of the region $\{(x, y) : x^2 + 4x + 2 \leq y \leq |x + 2|\}$ is equal to

- (A) 7 (B) 24/5 (C) 20/3 (D) 5

Q68 Straight Lines[Step-by-step solution](#) > prepwiser.in/questions/4yF4xnSDAu

Let the lines $3x - 4y - \alpha = 0$, $8x - 11y - 33 = 0$, and $2x - 3y + \lambda = 0$ be concurrent. If the image of the point $(1, 2)$ in the line $2x - 3y + \lambda = 0$ is $(\frac{57}{13}, \frac{-40}{13})$, then $|\alpha\lambda|$ is equal to

- (A) 91 (B) 113 (C) 101 (D) 84

Mathematics Section B · Numerical value

Q69 to Q73

Q69 Differential Equations **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/003OgvIRpn

Let f be a differentiable function such that $2(x+2)^2 f(x) - 3(x+2)^2 = 10 \int_0^x (t+2)f(t)dt$, $x \geq 0$. Then $f(2)$ is equal to _____.

Q70 Inverse Trigonometric Functions **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/4navOGZdqf

If for some α, β ; $\alpha \leq \beta$, $\alpha + \beta = 8$ and $\sec^2(\tan^{-1} \alpha) + \operatorname{cosec}^2(\cot^{-1} \beta) = 36$, then $\alpha^2 + \beta$ is _____

Q71 Determinants **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/C63LHtaeeS

Let A be a 3×3 matrix such that $X^T A X = O$ for all nonzero 3×1 matrices $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$. If

$A \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 4 \\ -5 \end{bmatrix}$, $A \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ 4 \\ -8 \end{bmatrix}$, and $\det(\operatorname{adj}(2(A+I))) = 2^\alpha 3^\beta 5^\gamma$, $\alpha, \beta, \gamma \in N$, then $\alpha^2 + \beta^2 + \gamma^2$ is

Q72 Permutations & Combinations **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/G-PudAw7Kz

The number of 3-digit numbers, that are divisible by 2 and 3, but not divisible by 4 and 9, is _____.

Let $S = \{p_1, p_2, \dots, p_{10}\}$ be the set of first ten prime numbers. Let $A = S \cup P$, where P is the set of all possible products of distinct elements of S . Then the number of all ordered pairs (x, y) , $x \in S$, $y \in A$, such that x divides y , is _____.

Answer key: JEE Main 2025 · 24 Jan · Shift 1

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Physics

1. B	2. D	3. D	4. C	5. C	6. B	7. D	8. A
9. B	10. B	11. C	12. B	13. D	14. B	15. D	16. D
17. C	18. C	19. C	20. D	21. 2	22. 48	23. 15	24. 8
25. 35							

Chemistry

26. B	27. D	28. C	29. A	30. C	31. C	32. A	33. C
34. C	35. A	36. D	37. C	38. A	39. A	40. C	41. D
42. C	43. A	44. 420	45. 61	46. 700	47. 962	48. 4	

Mathematics

49. D	50. C	51. B	52. B	53. C	54. A	55. D	56. A
57. C	58. C	59. D	60. D	61. C	62. B	63. D	64. D
65. B	66. A	67. C	68. A	69. 19	70. 14	71. 44	72. 125
73. 5120							

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