

JEE MAIN 2023 · QUESTION PAPER

31 Jan 2023 **Shift 2**

87 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	10 Q49 to Q58
● Mathematics	19 Q59 to Q77	10 Q78 to Q87
In this PDF		
87 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.

prepwise.in/pyqs/paper/2023-01-31-evening · 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? prepwise.in/feedback · Terms: prepwise.in/terms

Q1 Alternating Current

[Step-by-step solution](#) › [prepwiser.in/questions/I9OPj_j1oR](https://www.prepwiser.in/questions/I9OPj_j1oR)

An alternating voltage source $V = 260 \sin(628t)$ is connected across a pure inductor of 5mH . Inductive reactance in the circuit is:

- (A) 6.28Ω (B) 0.318Ω (C) 0.5Ω (D) 3.14Ω

Q2 Atomic Physics

[Step-by-step solution](#) › [prepwiser.in/questions/IOrMoDy5Wu](https://www.prepwiser.in/questions/IOrMoDy5Wu)

The radius of electron's second stationary orbit in Bohr's atom is R . The radius of 3rd orbit will be

- (A) $2.25R$ (B) $3R$ (C) $\frac{R}{3}$ (D) $9R$

Q3 Circular Motion

[Step-by-step solution](#) › [prepwiser.in/questions/-4snGQ4IFX](https://www.prepwiser.in/questions/-4snGQ4IFX)

A stone of mass 1kg is tied to end of a massless string of length 1m . If the breaking tension of the string is 400N , then maximum linear velocity, the stone can have without breaking the string, while rotating in horizontal plane, is:

- (A) 20ms^{-1} (B) 40ms^{-1} (C) 400ms^{-1} (D) 10ms^{-1}

Q4 Circular Motion

[Step-by-step solution](#) › [prepwiser.in/questions/m5j6yNkMFS](https://www.prepwiser.in/questions/m5j6yNkMFS)

A body is moving with constant speed, in a circle of radius 10m . The body completes one revolution in 4s . At the end of 3rd second, the displacement of body (in m) from its starting point is:

- (A) 15π (B) 30 (C) $10\sqrt{2}$ (D) 5π

Q5 Moving Charges & Magnetism

[Step-by-step solution](#) › [prepwiser.in/questions/10jxoMvMJz](https://www.prepwiser.in/questions/10jxoMvMJz)

The number of turns of the coil of a moving coil galvanometer is increased in order to increase current sensitivity by 50% . The percentage change in voltage sensitivity of the galvanometer will be:

- (A) 0% (B) 75% (C) 100% (D) 50%

Q6 Current Electricity

[Step-by-step solution](#) › [prepwiser.in/questions/6PCg3baLme](https://www.prepwiser.in/questions/6PCg3baLme)

The amount of thermal energy is developed by a resistor in 10s when a current of 4A is passed through it. If the current is increased to 16A , the thermal energy developed by the resistor in 10s will be:

- (A) $\frac{H}{4}$ (B) $16H$ (C) H (D) $4H$

Q7 Dual Nature of Radiation & Matter

[Step-by-step solution](#) › [prepwiser.in/questions/izAJ7aT3yr](https://www.prepwiser.in/questions/izAJ7aT3yr)

If the two metals A and B are exposed to radiation of wavelength 350nm . The work functions of metals A and B are 4.8eV and 2.2eV . Then choose the correct option.

- (A) Metal B will not emit photo-electrons
(B) Both metals A and B will not emit photo-electrons
(C) Metal A will not emit photo-electrons
(D) Both metals A and B will emit photo-electrons

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Match List I with List II

LIST I		LIST II	
A.	Microwaves	I.	Physiotherapy
B.	UV rays	II.	Treatment of cancer
C.	Infra-red light	III.	Lasik eye surgery
D.	X-ray	IV.	Aircraft navigation

Choose the correct answer from the options given below:

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

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

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

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

Given below are two statements:

Statement I: In a typical transistor, all three regions emitter, base and collector have same doping level.**Statement II:** In a transistor, collector is the thickest and base is the thinnest segment.

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

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

Considering a group of positive charges, which of the following statements is correct?

(A) Net potential of the system cannot be zero at a point but net electric field can be zero at that point

(B) Net potential of the system at a point can be zero but net electric field can't be zero at that point.

(C) Both the net potential and the net electric field cannot be zero at a point.

(D) Both the net potential and the net field can be zero at a point.

A microscope is focused on an object at the bottom of a bucket. If liquid with refractive index $\frac{5}{3}$ is poured inside the bucket, then the microscope has to be raised by 30cm to focus the object again. The height of the liquid in the bucket is:

(A) 50cm

(B) 18cm

(C) 75cm

(D) 12cm

A body weight W , is projected vertically upwards from earth's surface to reach a height above the earth which is equal to nine times the radius of earth. The weight of the body at that height will be:(A) $\frac{W}{91}$ (B) $\frac{W}{3}$ (C) $\frac{W}{100}$ (D) $\frac{W}{9}$ Attempt this paper online with instant answer checking > [prepwise.in/pyqs/paper/2023-01-31-evening](https://www.prepwise.in/pyqs/paper/2023-01-31-evening)

Q13 Thermodynamics[Step-by-step solution](#) › prepwiser.in/questions/W09cDznaE9

Heat energy of 735J is given to a diatomic gas allowing the gas to expand at constant pressure. Each gas molecule rotates around an internal axis but do not oscillate. The increase in the internal energy of the gas will be:

- (A) 572J (B) 441J (C) 525J (D) 735J

Q14 Thermodynamics[Step-by-step solution](#) › prepwiser.in/questions/xLkAzq-AXp

A hypothetical gas expands adiabatically such that its volume changes from 08 litres to 27 litres. If the ratio of final pressure of the gas to initial pressure of the gas is $\frac{16}{81}$. Then the ratio of $\frac{C_p}{C_v}$ will be.

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

Q15 Friction[Step-by-step solution](#) › prepwiser.in/questions/408GAAONPQ

A body of mass 10kg is moving with an initial speed of 20m/s. The body stops after 5s due to friction between body and the floor. The value of the coefficient of friction is:
(Take acceleration due to gravity $g = 10\text{ms}^{-2}$)

- (A) 0.3 (B) 0.2 (C) 0.5 (D) 0.4

Q16 Moving Charges & Magnetism[Step-by-step solution](#) › prepwiser.in/questions/fZaDZsRhIN

A long conducting wire having a current I flowing through it, is bent into a circular coil of N turns. Then it is bent into a circular coil of n turns. The magnetic field is calculated at the centre of coils in both the cases. The ratio of the magnetic field in first case to that of second case is:

- (A) $N^2 : n^2$ (B) $N : n$ (C) $n : N$ (D) $n^2 : N^2$

Q17 Mechanical Waves[Step-by-step solution](#) › prepwiser.in/questions/UMsY5Y3XsF

For a solid rod, the Young's modulus of elasticity is $3.2 \times 10^{11}\text{Nm}^{-2}$ and density is $8 \times 10^3\text{kgm}^{-3}$. The velocity of longitudinal wave in the rod will be.

- (A) $3.65 \times 10^3\text{ms}^{-1}$ (B) $6.32 \times 10^3\text{ms}^{-1}$ (C) $18.96 \times 10^3\text{ms}^{-1}$ (D) $145.75 \times 10^3\text{ms}^{-1}$

Q18 Elasticity[Step-by-step solution](#) › prepwiser.in/questions/637AIXG_qi

Under the same load, wire A having length 5.0m and cross section $2.5 \times 10^{-5}\text{m}^2$ stretches uniformly by the same amount as another wire B of length 6.0m and a cross section of $3.0 \times 10^{-5}\text{m}^2$ stretches. The ratio of the Young's modulus of wire A to that of wire B will be:

- (A) 1 : 2 (B) 1 : 4 (C) 1 : 1 (D) 1 : 10

Q19 Units, Dimensions & Errors[Step-by-step solution](#) › prepwiser.in/questions/10K2NoDXKA

Match List I with List II

LIST I		LIST II	
A.	Angular momentum	I.	$[\text{ML}^2\text{T}^{-2}]$
B.	Torque	II.	$[\text{ML}^{-2}\text{T}^{-2}]$
C.	Stress	III.	$[\text{ML}^2\text{T}^{-1}]$
D.	Pressure gradient	IV.	$[\text{ML}^{-1}\text{T}^{-2}]$

Choose the correct answer from the options given below:

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

Q20 Alternating Current **NUMERICAL**

[Step-by-step solution](#) > [prepwisar.in/questions/O2oBG7adQP](https://www.prepwisar.in/questions/O2oBG7adQP)

A series LCR circuit consists of $R = 80\Omega$, $X_L = 100\Omega$, and $X_C = 40\Omega$. The input voltage is $2500 \cos(100\pi t) \text{ V}$. The amplitude of current, in the circuit, is _____ A.

Q21 Atomic Physics **NUMERICAL**

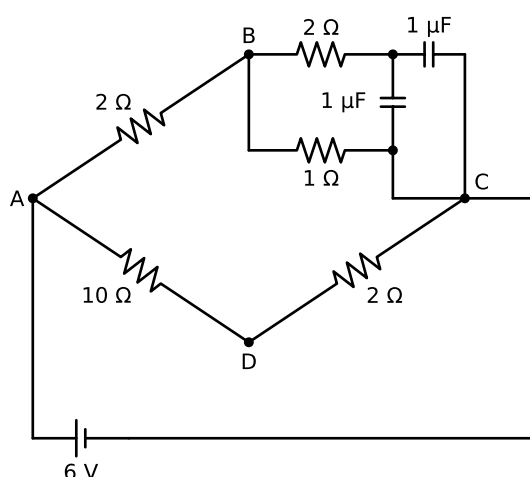
[Step-by-step solution](#) > [prepwisar.in/questions/D-CASC3LFI](https://www.prepwisar.in/questions/D-CASC3LFI)

If the binding energy of ground state electron in a hydrogen atom is 13.6 eV , then, the energy required to remove the electron from the second excited state of Li^{2+} will be: $x \times 10^{-1} \text{ eV}$. The value of x is _____.

Q22 Current Electricity **NUMERICAL**

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

For the given circuit, in the steady state, $|V_B - V_D| = \text{_____ V}$.



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

[Step-by-step solution](#) > [prepwisar.in/questions/sn8c2kZwFH](https://www.prepwisar.in/questions/sn8c2kZwFH)

Two parallel plate capacitors C_1 and C_2 each having capacitance of $10\mu\text{F}$ are individually charged by a 100 V D.C. source. Capacitor C_1 is kept connected to the source and a dielectric slab is inserted between its plates. Capacitor C_2 is disconnected from the source and then a dielectric slab is inserted in it. Afterwards the capacitor C_1 is also disconnected from the source and the two capacitors are finally connected in parallel combination. The common potential of the combination will be _____ V. (Assuming Dielectric constant = 10)

Q24 Collision **NUMERICAL**

[Step-by-step solution](#) > [prepwisar.in/questions/1J1cCsCJWI](https://www.prepwisar.in/questions/1J1cCsCJWI)

A ball is dropped from a height of 20m . If the coefficient of restitution for the collision between ball and floor is 0.5 , after hitting the floor, the ball rebounds to a height of _____ m.

Q25 Thermometry & Calorimetry **NUMERICAL**

[Step-by-step solution](#) > [prepwisar.in/questions/Xx_OfLEI7z](https://www.prepwisar.in/questions/Xx_OfLEI7z)

A water heater of power 2000W is used to heat water. The specific heat capacity of water is $4200 \text{ J kg}^{-1} \text{ K}^{-1}$. The efficiency of heater is 70% . Time required to heat 2kg of water from 10°C to 60°C is _____ s.

(Assume that the specific heat capacity of water remains constant over the temperature range of the water).

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Q26 Projectile Motion & Relative Motion **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/cd3s1QIA_g) > prepwisar.in/questions/cd3s1QIA_g

Two bodies are projected from ground with same speeds 40ms^{-1} at two different angles with respect to horizontal. The bodies were found to have same range. If one of the body was projected at an angle of 60° , with horizontal then sum of the maximum heights, attained by the two projectiles, is m . (Given $g = 10\text{ms}^{-2}$)

Q27 Rotational Motion **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/VwD93hA6Ut) > prepwisar.in/questions/VwD93hA6Ut

Two discs of same mass and different radii are made of different materials such that their thicknesses are 1cm and 0.5cm respectively. The densities of materials are in the ratio $3 : 5$. The moment of inertia of these discs respectively about their diameters will be in the ratio of $\frac{x}{6}$. The value of x is _____.

Q28 Wave Optics **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/OJ4Y4sS_Y9) > prepwisar.in/questions/OJ4Y4sS_Y9

Two light waves of wavelengths 800 and 600nm are used in Young's double slit experiment to obtain interference fringes on a screen placed 7m away from plane of slits. If the two slits are separated by 0.35mm , then shortest distance from the central bright maximum to the point where the bright fringes of the two wavelength coincide will be _____ mm .

Q29 Mechanical Waves **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/XzvhJTA4mz) > prepwisar.in/questions/XzvhJTA4mz

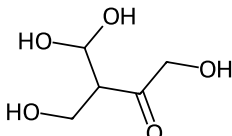
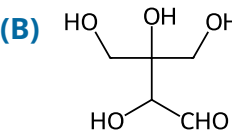
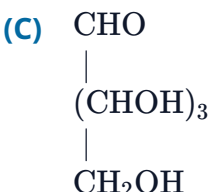
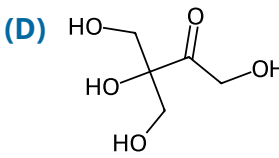
The displacement equations of two interfering waves are given by $y_1 = 10 \sin(\omega t + \frac{\pi}{3}) \text{ cm}$, $y_2 = 5[\sin \omega t + \sqrt{3} \cos \omega t] \text{ cm}$ respectively. The amplitude of the resultant wave is _____ cm .

Chemistry Section A · Multiple choice

Q30 to Q48

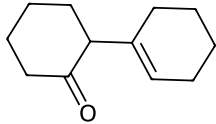
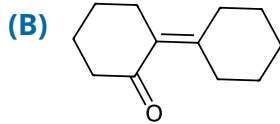
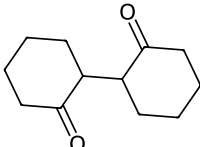
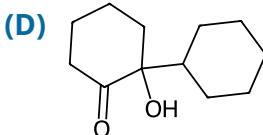
Q30 Carbohydrates & Biomolecules[Step-by-step solution](https://www.prepwisar.in/questions/umbBd3kG-t) > prepwisar.in/questions/umbBd3kG-t

Compound A, $\text{C}_5\text{H}_{10}\text{O}_5$, given a tetraacetate with Ac_2O and oxidation of A with $\text{Br}_2 - \text{H}_2\text{O}$ gives an acid, $\text{C}_5\text{H}_{10}\text{O}_6$. Reduction of A with HI gives isopentane. The possible structure of A is

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

Q31 Aldehydes & Ketones[Step-by-step solution](https://www.prepwisar.in/questions/ACJC-0n_wt) > prepwisar.in/questions/ACJC-0n_wt

Cyclohexylamine when treated with nitrous acid yields (P). On treating (P) with PCC results in (Q). When (Q) is heated with dil. NaOH we get (R). The final product (R) is:

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

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Which of the following compounds are not used as disinfectants?

- A. Chloroxylenol
- B. Bithional
- C. Veronal
- D. Prontosil
- E. Terpeneol

Choose the correct answer from the options given below:

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

In the following halogenated organic compounds, the one with the maximum number of chlorine atoms in its structure is:

- (A) Gammaxene (B) Chloropicrin (C) Chloral (D) Freon-12

A hydrocarbon 'X' with formula C_6H_8 uses two moles of H_2 on catalytic hydrogenation of its one mole. On ozonolysis, 'X' yields two moles of methane dicarbaldehyde. The hydrocarbon 'X' is:

- (A) hexa-1, 3, 5-triene (B) cyclohexa-1, 4-diene
(C) cyclohexa - 1,3 - diene (D) 1-methylcyclopenta-1, 4-diene

The normal rain water is slightly acidic and its pH value is 5.6 because of which one of the following?

- (A) $N_2O_5 + H_2O \rightarrow 2HNO_3$ (B) $2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$
(C) $4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$ (D) $CO_2 + H_2O \rightarrow H_2CO_3$

Given below are two statements:

Statement I: H_2O_2 is used in the synthesis of Cephalosporin

Statement II: H_2O_2 is used for the restoration of aerobic conditions to sewage wastes.

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

The incorrect statement for the use of indicators in acid-base titration is:

- (A) Phenolphthalein is a suitable indicator for a weak acid vs strong base titration.
(B) Methyl orange may be used for a weak acid vs weak base titration.
(C) Methyl orange is a suitable indicator for a strong acid vs weak base titration.
(D) Phenolphthalein may be used for a strong acid vs strong base titration.

Which one of the following statements is incorrect?

- (A) Cast iron is obtained by melting pig iron with scrap iron and coke using hot air blast.
- (B) The malleable iron is prepared from cast iron by oxidising impurities in a reverberatory furnace.
- (C) van Arkel method is used to purify tungsten.
- (D) Boron and Indium can be purified by zone refining method.

The Lewis acid character of boron tri halides follows the order:

- (A) $\text{BI}_3 > \text{BBr}_3 > \text{BCl}_3 > \text{BF}_3$
- (B) $\text{BCl}_3 > \text{BF}_3 > \text{BBr}_3 > \text{BI}_3$
- (C) $\text{BF}_3 > \text{BCl}_3 > \text{BBr}_3 > \text{BI}_3$
- (D) $\text{BBr}_3 > \text{BI}_3 > \text{BCl}_3 > \text{BF}_3$

Given below are two statements:

Statement I: Upon heating a borax bead dipped in cupric sulphate in a luminous flame, the colour of the bead becomes green

Statement II: The green colour observed is due to the formation of copper(I) metaborate

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

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

Which of the following elements have half-filled f-orbitals in their ground state?

(Given : atomic number Sm = 62; Eu = 63; Tb = 65; Gd = 64, Pm = 61)

- A. Sm
- B. Eu
- C. Tb
- D. Gd
- E. Pm

Choose the correct answer from the options given below:

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

The element playing significant role in neuromuscular function and interneuronal transmission is:

- (A) Be
- (B) Ca
- (C) Mg
- (D) Li

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Evaluate the following statements for their correctness.

- A. The elevation in boiling point temperature of water will be same for 0.1M NaCl and 0.1M urea.
 B. Azeotropic mixtures boil without change in their composition.
 C. Osmosis always takes place from hypertonic to hypotonic solution.
 D. The density of 32% H_2SO_4 solution having molarity 4.09M is approximately 1.26g mL^{-1}
 E. A negatively charged sol is obtained when KI solution is added to silver nitrate solution.
 Choose the correct answer from the options given below:

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

When a hydrocarbon A undergoes complete combustion it requires 11 equivalents of oxygen and produces 4 equivalents of water. What is the molecular formula of A?

- (A) C_9H_8 (B) C_5H_8 (C) C_{11}H_4 (D) C_{11}H_8

Arrange the following orbitals in decreasing order of energy.

- A. $n = 3, l = 0, m = 0$
 B. $n = 4, l = 0, m = 0$
 C. $n = 3, l = 1, m = 0$
 D. $n = 3, l = 2, m = 1$

The correct option for the order is:

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

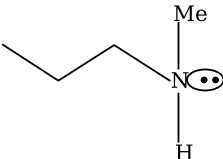
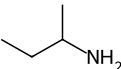
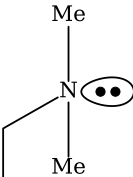
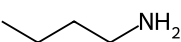
Match List I with List II

LIST I		LIST II	
A.	Physisorption	I.	Single Layer Adsorption
B.	Chemisorption	II.	$20 - 40\text{kJmol}^{-1}$
C.	$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \xrightarrow{\text{Fe(s)}} 2\text{NH}_3(\text{g})$	III.	Chromatography
D.	Analytical Application or Adsorption	IV.	Heterogeneous catalysis

Choose the **correct** answer from the options given below:

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

An organic compound [A] ($\text{C}_4\text{H}_{11}\text{N}$), shows optical activity and gives N_2 gas on treatment with HNO_2 . The compound [A] reacts with PhSO_2Cl producing a compound which is soluble in KOH. The structure of A is:

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

In Dumas method for the estimation of N_2 , the sample is heated with copper oxide and the gas evolved is passed over:

- (A) Copper oxide (B) Copper gauze (C) Pd (D) Ni

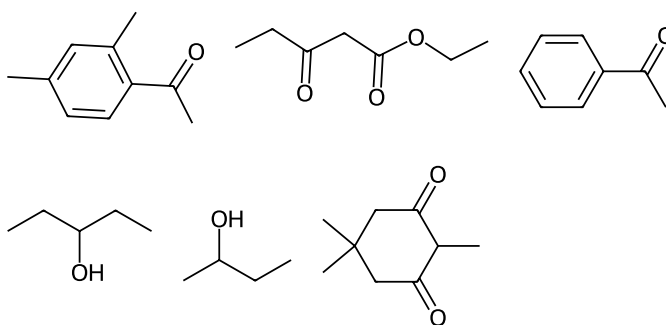
Chemistry Section B · Numerical value

Q49 to Q58

Q49 Aldehydes & Ketones NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/9rE7Sww_i_](https://www.prepwisar.in/questions/9rE7Sww_i_)

The number of molecules which gives the haloform test among the following molecules is _____.



Q50 Chemical Bonding & Molecular Structure NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/IuQw4eoDUi](https://www.prepwisar.in/questions/IuQw4eoDUi)

Amongst the following, the number of species having the linear shape is _____.

XeF_2 , I_3^+ , C_3O_2 , I_3^- , CO_2 , SO_2 , $BeCl_2$ and BCl_2^-

Q51 Chemical Kinetics NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/HmZpcZ4wp_](https://www.prepwisar.in/questions/HmZpcZ4wp_)

The rate constant for a first order reaction is 20 min^{-1} . The time required for the initial concentration of the reactant to reduce to its $\frac{1}{32}$ level is _____ $\times 10^{-2} \text{ min}$. (Nearest integer)
(Given: $\ln 10 = 2.303$ and $\log 2 = 0.3010$)

Q52 Coordination Compounds NUMERICAL

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

If the CFSE of $[Ti(H_2O)_6]^{3+}$ is -96.0 kJ/mol , this complex will absorb maximum at wavelength _____ nm. (nearest integer)

Assume Planck's constant (h) = $6.4 \times 10^{-34} \text{ Js}$, Speed of light (c) = $3.0 \times 10^8 \text{ m/s}$ and Avogadro's Constant (N_A) = $6 \times 10^{23} \text{ /mol}$

Q53 Electrochemistry NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/Pj_eyHIgQ7](https://www.prepwisar.in/questions/Pj_eyHIgQ7)

The resistivity of a 0.8M solution of an electrolyte is $5 \times 10^{-3} \Omega \text{ cm}$.

Its molar conductivity is _____ $\times 10^4 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$. (Nearest integer)

Q54 Ionic Equilibrium NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/dViVT77oPu](https://www.prepwisar.in/questions/dViVT77oPu)

At 298K, the solubility of silver chloride in water is $1.434 \times 10^{-3} \text{ g L}^{-1}$. The value of $-\log K_{sp}$ for silver chloride is _____.

(Given mass of Ag is 107.9 g mol^{-1} and mass of Cl is 35.5 g mol^{-1})

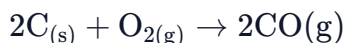
Q55 Hydrogen & s-Block Elements NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/MrQ202pPJd](https://www.prepwisar.in/questions/MrQ202pPJd)

The number of alkali metal(s), from Li, K, Cs, Rb having ionization enthalpy greater than 400 kJ mol^{-1} and forming stable super oxide is _____.

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Assume carbon burns according to the following equation:



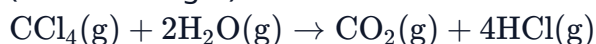
when 12g carbon is burnt in 48g of oxygen, the volume of carbon monoxide produced is _____ $\times 10^{-1}\text{L}$ at STP [nearest integer]

[Given: Assume CO as ideal gas, Mass of C is 12g mol^{-1} , Mass of O is 16g mol^{-1} and molar volume of an ideal gas at STP is 22.7L mol^{-1}]

A sample of a metal oxide has formula $\text{M}_{0.83}\text{O}_{1.00}$. The metal M can exist in two oxidation states +2 and +3.

In the sample of $\text{M}_{0.83}\text{O}_{1.00}$, the percentage of metal ions existing in +2 oxidation state is _____ %. (nearest integer)

Enthalpies of formation of $\text{CCl}_4(\text{g})$, $\text{H}_2\text{O}(\text{g})$, $\text{CO}_2(\text{g})$ and $\text{HCl}(\text{g})$ are -105 , -242 , -394 and -92kJ mol^{-1} respectively. The magnitude of enthalpy of the reaction given below is _____ kJ mol^{-1} . (nearest integer)



Mathematics Section A · Multiple choice

Q59 to Q77

Let the plane $P : 8x + \alpha_1 y + \alpha_2 z + 12 = 0$ be parallel to the line $L : \frac{x+2}{2} = \frac{y-3}{3} = \frac{z+4}{5}$. If the intercept of P on the y-axis is 1, then the distance between P and L is:

(A) $\frac{6}{\sqrt{14}}$

(B) $\sqrt{14}$

(C) $\sqrt{\frac{2}{7}}$

(D) $\sqrt{\frac{7}{2}}$

The foot of perpendicular from the origin O to a plane P which meets the co-ordinate axes at the points A, B, C is $(2, a, 4)$, $a \in \mathbb{N}$. If the volume of the tetrahedron OABC is 144 unit^3 , then which of the following points is **NOT** on P?

(A) $(3, 0, 4)$

(B) $(0, 6, 3)$

(C) $(0, 4, 4)$

(D) $(2, 2, 4)$

Let P be the plane, passing through the point $(1, -1, -5)$ and perpendicular to the line joining the points $(4, 1, -3)$ and $(2, 4, 3)$. Then the distance of P from the point $(3, -2, 2)$ is:

(A) 5

(B) 4

(C) 6

(D) 7

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If a point $P(\alpha, \beta, \gamma)$ satisfying

$$\begin{pmatrix} \alpha & \beta & \gamma \end{pmatrix} \begin{pmatrix} 2 & 10 & 8 \\ 9 & 3 & 8 \\ 8 & 4 & 8 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 \end{pmatrix}$$

lies on the plane $2x + 4y + 3z = 5$, then $6\alpha + 9\beta + 7\gamma$ is equal to:

- (A) $\frac{11}{5}$ (B) 11 (C) -1 (D) $\frac{5}{4}$

The set of all values of a^2 for which the line $x + y = 0$ bisects two distinct chords drawn from a point $P\left(\frac{1+a}{2}, \frac{1-a}{2}\right)$ on the circle $2x^2 + 2y^2 - (1+a)x - (1-a)y = 0$, is equal to:

- (A) $(0, 4]$ (B) $(4, \infty)$ (C) $(2, 12]$ (D) $(8, \infty)$

The complex number $z = \frac{i-1}{\cos \frac{\pi}{3} + i \sin \frac{\pi}{3}}$ is equal to:

- (A) $\cos \frac{\pi}{12} - i \sin \frac{\pi}{12}$ (B) $\sqrt{2} \left(\cos \frac{\pi}{12} + i \sin \frac{\pi}{12} \right)$
(C) $\sqrt{2}i \left(\cos \frac{5\pi}{12} - i \sin \frac{5\pi}{12} \right)$ (D) $\sqrt{2} \left(\cos \frac{5\pi}{12} + i \sin \frac{5\pi}{12} \right)$

Let $\alpha > 0$. If $\int_0^\alpha \frac{x}{\sqrt{x+\alpha}-\sqrt{x}} dx = \frac{16+20\sqrt{2}}{15}$, then α is equal to:

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

If $\phi(x) = \frac{1}{\sqrt{x}} \int_{\frac{\pi}{4}}^x (4\sqrt{2} \sin t - 3\phi'(t)) dt$, $x > 0$,

then $\phi'\left(\frac{\pi}{4}\right)$ is equal to:

- (A) $\frac{4}{6 + \sqrt{\pi}}$ (B) $\frac{4}{6 - \sqrt{\pi}}$ (C) $\frac{8}{\sqrt{\pi}}$ (D) $\frac{8}{6 + \sqrt{\pi}}$

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

$$(3y^2 - 5x^2) y dx + 2x (x^2 - y^2) dy = 0$$

such that $y(1) = 1$. Then $|(y(2))^3 - 12y(2)|$ is equal to:

- (A) 64 (B) $16\sqrt{2}$ (C) 32 (D) $32\sqrt{2}$

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Q68 Functions (Advanced)[Step-by-step solution](https://www.prepwisar.in/questions/wget0GLEjm)

Let $f : \mathbb{R} - \{2, 6\} \rightarrow \mathbb{R}$ be real valued function defined as $f(x) = \frac{x^2+2x+1}{x^2-8x+12}$. Then range of f is

- (A) $(-\infty, -\frac{21}{4}] \cup [1, \infty)$ (B) $(-\infty, -\frac{21}{4}) \cup (0, \infty)$
 (C) $(-\infty, -\frac{21}{4}] \cup [0, \infty)$ (D) $(-\infty, -\frac{21}{4}) \cup [\frac{21}{4}, \infty)$

Q69 Relations & Functions (Basic)[Step-by-step solution](https://www.prepwisar.in/questions/hTAHHhH9yW)

The absolute minimum value, of the function $f(x) = |x^2 - x + 1| + [x^2 - x + 1]$, where $[t]$ denotes the greatest integer function, in the interval $[-1, 2]$, is:

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

Q70 Hyperbola[Step-by-step solution](https://www.prepwisar.in/questions/ZcgT_YqYh-)

Let H be the hyperbola, whose foci are $(1 \pm \sqrt{2}, 0)$ and eccentricity is $\sqrt{2}$. Then the length of its latus rectum is:

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

Q71 Inverse Trigonometric Functions[Step-by-step solution](https://www.prepwisar.in/questions/nGVqXymABY)

Let $(a, b) \subset (0, 2\pi)$ be the largest interval for which $\sin^{-1}(\sin \theta) - \cos^{-1}(\sin \theta) > 0, \theta \in (0, 2\pi)$, holds. If $\alpha x^2 + \beta x + \sin^{-1}(x^2 - 6x + 10) + \cos^{-1}(x^2 - 6x + 10) = 0$ and $\alpha - \beta = b - a$, then α is equal to:

- (A) $\frac{\pi}{16}$ (B) $\frac{\pi}{48}$ (C) $\frac{\pi}{8}$ (D) $\frac{\pi}{12}$

Q72 Limits[Step-by-step solution](https://www.prepwisar.in/questions/uBrYfHMCfZ)

$$\lim_{x \rightarrow \infty} \frac{(\sqrt{3x+1} + \sqrt{3x-1})^6 + (\sqrt{3x+1} - \sqrt{3x-1})^6}{(x + \sqrt{x^2-1})^6 + (x - \sqrt{x^2-1})^6} x^3$$

- (A) is equal to 9 (B) is equal to $\frac{27}{2}$ (C) does not exist (D) is equal to 27

Q73 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](https://www.prepwisar.in/questions/uFE4W01iVh)

The equation $e^{4x} + 8e^{3x} + 13e^{2x} - 8e^x + 1 = 0, x \in \mathbb{R}$ has:

- (A) two solutions and both are negative
 (B) two solutions and only one of them is negative
 (C) four solutions two of which are negative
 (D) no solution

Q74 Sequences & Series[Step-by-step solution](https://www.prepwisar.in/questions/nAC0AeDc1a)

Let $a_1, a_2, a_3, \dots$ be an A.P. If $a_7 = 3$, the product $a_1 a_4$ is minimum and the sum of its first n terms is zero, then $n! - 4a_{n(n+2)}$ is equal to:

- (A) 24 (B) $\frac{381}{4}$ (C) 9 (D) $\frac{33}{4}$

Among the relations

$$S = \{(a, b) : a, b \in \mathbb{R} - \{0\}, 2 + \frac{a}{b} > 0\}$$

$$\text{and } T = \{(a, b) : a, b \in \mathbb{R}, a^2 - b^2 \in \mathbb{Z}\},$$

(A) S is transitive but T is not

(B) both S and T are symmetric

(C) neither S nor T is transitive

(D) T is symmetric but S is not

Let the mean and standard deviation of marks of class A of 100 students be respectively 40 and $\alpha (> 0)$, and the mean and standard deviation of marks of class B of n students be respectively 55 and $30 - \alpha$. If the mean and variance of the marks of the combined class of $100 + n$ students are respectively 50 and 350, then the sum of variances of classes A and B is:

(A) 450

(B) 900

(C) 650

(D) 500

Let $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = \hat{i} - \hat{j} + 2\hat{k}$ and $\vec{c} = 5\hat{i} - 3\hat{j} + 3\hat{k}$ be three vectors. If $\vec{r}$ is a vector such that, $\vec{r} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{r} \cdot \vec{a} = 0$, then $25|\vec{r}|^2$ is equal to:

(A) 336

(B) 449

(C) 339

(D) 560

Mathematics Section B · Numerical value

Q78 to Q87

The coefficient of x^{-6} , in the expansion of $\left(\frac{4x}{5} + \frac{5}{2x^2}\right)^9$, is

If the constant term in the binomial expansion of $\left(\frac{x^{\frac{5}{2}}}{2} - \frac{4}{x^l}\right)^9$ is -84 and the coefficient of x^{-3l} is $2^\alpha \beta$, where $\beta < 0$ is an odd number, then $|\alpha l - \beta|$ is equal to _____.

Let A be a $n \times n$ matrix such that $|A| = 2$. If the determinant of the matrix $\text{Adj}(2 \cdot \text{Adj}(2A^{-1}))$ is 2^{84} , then n is equal to:

Let S be the set of all $a \in \mathbb{N}$ such that the area of the triangle formed by the tangent at the point $P(b, c)$, $b, c \in \mathbb{N}$, on the parabola $y^2 = 2ax$ and the lines $x = b, y = 0$ is 16 unit^2 , then $\sum_{a \in S} a$ is equal to:

Let $A = [a_{ij}]$, $a_{ij} \in \mathbb{Z} \cap [0, 4]$, $1 \leq i, j \leq 2$.

The number of matrices A such that the sum of all entries is a prime number $p \in (2, 13)$ is _____.

If ${}^{2n+1}P_{n-1} : {}^{2n-1}P_n = 11 : 21$, then $n^2 + n + 15$ is equal to:

Let A be the event that the absolute difference between two randomly chosen real numbers in the sample space $[0, 60]$ is less than or equal to a. If $P(A) = \frac{11}{36}$, then a is equal to _____.

The sum $1^2 - 2 \cdot 3^2 + 3 \cdot 5^2 - 4 \cdot 7^2 + 5 \cdot 9^2 - \dots + 15 \cdot 29^2$ is _____.

Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $|\vec{a}| = \sqrt{31}, 4|\vec{b}| = |\vec{c}| = 2$ and $2(\vec{a} \times \vec{b}) = 3(\vec{c} \times \vec{a})$.

If the angle between $\vec{b}$ and $\vec{c}$ is $\frac{2\pi}{3}$, then $\left(\frac{\vec{a} \times \vec{c}}{\vec{a} \cdot \vec{b}}\right)^2$ is equal to _____.

Let the area of the region

$\{(x, y) : |2x - 1| \leq y \leq |x^2 - x|, 0 \leq x \leq 1\}$ be A.

Then $(6A + 11)^2$ is equal to _____.

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Physics

1. D	2. A	3. A	4. C	5. A	6. B	7. C	8. A
9. C	10. A	11. C	12. C	13. C	14. B	15. D	16. A
17. B	18. C	19. B	20. 25	21. 136	22. 1	23. 55	24. 5
25. 300	26. 80	27. 5	28. 48	29. 20			

Chemistry

30. B	31. B	32. B	33. A	34. B	35. D	36. D	37. B
38. C	39. A	40. A	41. A	42. B	43. C	44. A	45. D
46. C	47. B	48. B	49. 3	50. 5	51. 17	52. 480	53. 25
54. 10	55. 2	56. 227	57. 59	58. 173			

Mathematics

59. B	60. A	61. A	62. B	63. D	64. D	65. B	66. D
67. D	68. C	69. A	70. C	71. D	72. D	73. A	74. A
75. D	76. D	77. C	78. 5040	79. 98	80. 5	81. 146	82. 204
83. 45	84. 10	85. 6952	86. 3	87. 125			

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