

JEE MAIN 2022 · QUESTION PAPER

24 Jun 2022 **Shift 2**

83 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	20 Q1 to Q20	8 Q21 to Q28
● Chemistry	18 Q29 to Q46	8 Q47 to Q54
● Mathematics	19 Q55 to Q73	10 Q74 to Q83
In this PDF	83 questions · answer key at the end	

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

Attempt this paper online

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

prepwis.in/pyqs/paper/2022-06-24-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? prepwis.in/feedback · Terms: prepwis.in/terms

Q1 Alternating Current

[Step-by-step solution](https://www.prepwiser.in/questions/clC6QwWnaj) › prepwiser.in/questions/clC6QwWnaj

Given below are two statements:

Statement I : The reactance of an ac circuit is zero. It is possible that the circuit contains a capacitor and an inductor.

Statement II : In ac circuit, the average power delivered by the source never becomes zero.

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

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

Q2 Atomic Physics

[Step-by-step solution](https://www.prepwiser.in/questions/Bx_Ww6jITE) › prepwiser.in/questions/Bx_Ww6jITE

In Bohr's atomic model of hydrogen, let K, P and E are the kinetic energy, potential energy and total energy of the electron respectively. Choose the correct option when the electron undergoes transitions to a higher level:

- (A) All K, P and E increase. (B) K decreases, P and E increase.
(C) P decreases, K and E increase. (D) K increases, P and E decrease.

Q3 Electrostatics II: Potential & Capacitance

[Step-by-step solution](https://www.prepwiser.in/questions/s6mC2NHVd5) › prepwiser.in/questions/s6mC2NHVd5

If the charge on a capacitor is increased by 2 C, the energy stored in it increases by 44%. The original charge on the capacitor is (in C)

- (A) 10 (B) 20 (C) 30 (D) 40

Q4 Circular Motion

[Step-by-step solution](https://www.prepwiser.in/questions/KTP06tDgz0) › prepwiser.in/questions/KTP06tDgz0

A stone of mass m, tied to a string is being whirled in a vertical circle with a uniform speed. The tension in the string is

- (A) the same throughout the motion.
(B) minimum at the highest position of the circular path.
(C) minimum at the lowest position of the circular path.
(D) minimum when the rope is in the horizontal position.

Q5 Rotational Motion

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

A fly wheel is accelerated uniformly from rest and rotates through 5 rad in the first second. The angle rotated by the fly wheel in the next second, will be:

- (A) 7.5 rad (B) 15 rad (C) 20 rad (D) 30 rad

Q6 Current Electricity

[Step-by-step solution](https://www.prepwiser.in/questions/u1eGJ-M6r8) › prepwiser.in/questions/u1eGJ-M6r8

What will be the most suitable combination of three resistors $A = 2\Omega$, $B = 4\Omega$, $C = 6\Omega$ so that $\left(\frac{22}{3}\right)\Omega$ is equivalent resistance of combination?

- (A) Parallel combination of A and C connected in series with B.
(B) Parallel combination of A and B connected in series with C.
(C) Series combination of A and C connected in parallel with B.
(D) Series combination of B and C connected in parallel with A.

Q7 Dual Nature of Radiation & Matter[Step-by-step solution](https://www.prepwiser.in/questions/0ClkzkaHO3) › prepwiser.in/questions/0ClkzkaHO3

The light of two different frequencies whose photons have energies 3.8 eV and 1.4 eV respectively, illuminate a metallic surface whose work function is 0.6 eV successively. The ratio of maximum speeds of emitted electrons for the two frequencies respectively will be:

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

Q8 Electromagnetic Waves[Step-by-step solution](https://www.prepwiser.in/questions/_grwaFzRg1) › prepwiser.in/questions/_grwaFzRg1

An electric bulb is rated as 200 W. What will be the peak magnetic field at 4 m distance produced by the radiations coming from this bulb? Consider this bulb as a point source with 3.5% efficiency.

- (A) $1.19 \times 10^{-8} \text{ T}$ (B) $1.71 \times 10^{-8} \text{ T}$ (C) $0.84 \times 10^{-8} \text{ T}$ (D) $3.36 \times 10^{-8} \text{ T}$

Q9 Friction[Step-by-step solution](https://www.prepwiser.in/questions/rRnpnZsRI5) › prepwiser.in/questions/rRnpnZsRI5

Two identical charged particles each having a mass 10 g and charge $2.0 \times 10^{-7} \text{ C}$ are placed on a horizontal table with a separation of L between them such that they stay in limited equilibrium. If the coefficient of friction between each particle and the table is 0.25, find the value of L. [Use $g = 10 \text{ ms}^{-2}$]

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

Q10 Electrostatics I: Charges, Field & Gauss's Law[Step-by-step solution](https://www.prepwiser.in/questions/rQQCR5SJFI) › prepwiser.in/questions/rQQCR5SJFI

A long cylindrical volume contains a uniformly distributed charge of density ρ . The radius of cylindrical volume is R. A charge particle (q) revolves around the cylinder in a circular path. The kinetic energy of the particle is:

- (A) $\frac{\rho q R^2}{4\epsilon_0}$ (B) $\frac{\rho q R^2}{2\epsilon_0}$ (C) $\frac{q\rho}{4\epsilon_0 R^2}$ (D) $\frac{4\epsilon_0 R^2}{q\rho}$

Q11 Gravitation[Step-by-step solution](https://www.prepwiser.in/questions/osRE5RsFLX) › prepwiser.in/questions/osRE5RsFLX

The distance between Sun and Earth is R. The duration of year if the distance between Sun and Earth becomes 3R will be:

- (A) $\sqrt{3}$ years (B) 3 years (C) 9 years (D) $3\sqrt{3}$ years

Q12 Thermodynamics[Step-by-step solution](https://www.prepwiser.in/questions/1L8dTtM1oG) › prepwiser.in/questions/1L8dTtM1oG

A Carnot engine takes 5000 kcal of heat from a reservoir at 727°C and gives heat to a sink at 127°C . The work done by the engine is

- (A) $3 \times 10^6 \text{ J}$ (B) Zero (C) $12.6 \times 10^6 \text{ J}$ (D) $8.4 \times 10^6 \text{ J}$

Q13 Thermometry & Calorimetry[Step-by-step solution](https://www.prepwiser.in/questions/6PppFD7VpO) › prepwiser.in/questions/6PppFD7VpO

A 100 g of iron nail is hit by a 1.5 kg hammer striking at a velocity of 60 ms^{-1} . What will be the rise in the temperature of the nail if one fourth of energy of the hammer goes into heating the nail? [Specific heat capacity of iron = $0.42 \text{ Jg}^{-1} \text{ }^\circ \text{C}^{-1}$]

- (A) 675°C (B) 1600°C (C) 16.07°C (D) 6.75°C

Q14 Rectilinear Motion[Step-by-step solution](https://www.prepwiser.in/questions/EvxO3MLNq_) › prepwiser.in/questions/EvxO3MLNq_

An object of mass 5 kg is thrown vertically upwards from the ground. The air resistance produces a constant retarding force of 10 N throughout the motion. The ratio of time of ascent to the time of descent will be equal to : [Use $g = 10 \text{ ms}^{-2}$].

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

Q15 Magnetism & Matter[Step-by-step solution](#) > [prepwisar.in/questions/cEI5AGeujg](https://www.prepwisar.in/questions/cEI5AGeujg)

The soft-iron is a suitable material for making an electromagnet. This is because soft-iron has

- (A) low coercivity and high retentivity. (B) low coercivity and low permeability.
(C) high permeability and low retentivity. (D) high permeability and high retentivity.

Q16 Moving Charges & Magnetism[Step-by-step solution](#) > [prepwisar.in/questions/6rHsjct23d](https://www.prepwisar.in/questions/6rHsjct23d)

A proton, a deuteron and an α -particle with same kinetic energy enter into a uniform magnetic field at right angle to magnetic field. The ratio of the radii of their respective circular paths is:

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

Q17 Work, Energy & Power[Step-by-step solution](#) > [prepwisar.in/questions/ZvyraHNMf7](https://www.prepwisar.in/questions/ZvyraHNMf7)

Potential energy as a function of r is given by $U = \frac{A}{r^{10}} - \frac{B}{r^5}$, where r is the interatomic distance, A and B are positive constants. The equilibrium distance between the two atoms will be:

- (A) $\left(\frac{A}{B}\right)^{\frac{1}{5}}$ (B) $\left(\frac{B}{A}\right)^{\frac{1}{5}}$ (C) $\left(\frac{2A}{B}\right)^{\frac{1}{5}}$ (D) $\left(\frac{B}{2A}\right)^{\frac{1}{5}}$

Q18 Simple Harmonic Motion[Step-by-step solution](#) > [prepwisar.in/questions/JDIxPzfzV](https://www.prepwisar.in/questions/JDIxPzfzV)

Two massless springs with spring constants $2k$ and $9k$, carry 50 g and 100 g masses at their free ends. These two masses oscillate vertically such that their maximum velocities are equal. Then, the ratio of their respective amplitudes will be:

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

Q19 Wave Optics[Step-by-step solution](#) > [prepwisar.in/questions/1wvk0aTOLY](https://www.prepwisar.in/questions/1wvk0aTOLY)

Two light beams of intensities in the ratio of $9:4$ are allowed to interfere. The ratio of the intensity of maxima and minima will be:

- (A) $2:3$ (B) $16:81$ (C) $25:169$ (D) $25:1$

Q20 Units, Dimensions & Errors[Step-by-step solution](#) > [prepwisar.in/questions/SNaq1jCIWY](https://www.prepwisar.in/questions/SNaq1jCIWY)

Identify the pair of physical quantities that have same dimensions:

- (A) velocity gradient and decay constant (B) Wien's constant and Stefan constant
(C) angular frequency and angular momentum (D) wave number and Avogadro number

Physics Section B · Numerical value

Q21 to Q28

Q21 Nuclear Physics **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/hAlxozKOI3](https://www.prepwisar.in/questions/hAlxozKOI3)

A sample contains 10^{-2} kg each of two substances A and B with half lives 4 s and 8 s respectively. The ratio of their atomic weights is $1:2$. The ratio of the amounts of A and B after 16 s is $\frac{x}{100}$. The value of x is _____.

Q22 Current Electricity **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/af4HAqvUtV](https://www.prepwisar.in/questions/af4HAqvUtV)

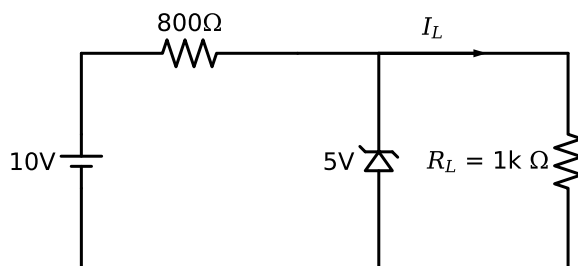
A potentiometer wire of length 10 m and resistance $20\ \Omega$ is connected in series with a 25 V battery and an external resistance $30\ \Omega$. A cell of emf E in secondary circuit is balanced by 250 cm long potentiometer wire. The value of E (in volt) is $\frac{x}{10}$. The value of x is _____.

Q23 Electromagnetic Induction **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/JkfOQRw9Rt

A circular coil of 1000 turns each with area 1m^2 is rotated about its vertical diameter at the rate of one revolution per second in a uniform horizontal magnetic field of 0.07T . The maximum voltage generation will be _____ V.

Q24 Semiconductors & Electronic Devices **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/v1BZXrMrp1

In the given circuit, the value of current I_L will be _____ mA. (When $R_L = 1\text{k}\Omega$)

**Q25** Ray Optics **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/G0LDLII_X2

A ray of light is incident at an angle of incidence 60° on the glass slab of refractive index $\sqrt{3}$. After refraction, the light ray emerges out from other parallel faces and lateral shift between incident ray and emergent ray is $4\sqrt{3}\text{ cm}$. The thickness of the glass slab is _____ cm.

Q26 Thermodynamics **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/WmapWpEXNx

A monoatomic gas performs a work of $\frac{Q}{4}$ where Q is the heat supplied to it. The molar heat capacity of the gas will be _____ R during this transformation. Where R is the gas constant.

Q27 Projectile Motion & Relative Motion **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/q9qdR4u_Ei

A body is projected from the ground at an angle of 45° with the horizontal. Its velocity after 2s is 20 ms^{-1} . The maximum height reached by the body during its motion is _____ m. (use $g = 10\text{ ms}^{-2}$)

Q28 Mechanical Waves **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/QXLRWEBNu2

Two travelling waves of equal amplitudes and equal frequencies move in opposite directions along a string. They interfere to produce a stationary wave whose equation is given by $y = (10 \cos \pi x \sin \frac{2\pi t}{T})$ cm

The amplitude of the particle at $x = \frac{4}{3}\text{ cm}$ will be _____ cm.

Chemistry Section A · Multiple choice

Q29 to Q46

Q29 Aldehydes & Ketones[Step-by-step solution](#) > prepwiser.in/questions/B2ApA8wGm5

Hex-4-ene-2-ol on treatment with PCC gives 'A'. 'A' on reaction with sodium hypoiodite gives 'B', which on further heating with soda lime gives 'C'. The compound 'C' is:

- (A) 2-pentene (B) propanaldehyde (C) 2-butene (D) 4-methylpent-2-ene

Q30 Chemical Bonding & Molecular Structure[Step-by-step solution](#) > prepwiser.in/questions/K7SISxtj8

The correct order of bond orders of C_2^{2-} , N_2^{2-} and O_2^{2-} is, respectively

- (A) $\text{C}_2^{2-} < \text{N}_2^{2-} < \text{O}_2^{2-}$ (B) $\text{O}_2^{2-} < \text{N}_2^{2-} < \text{C}_2^{2-}$ (C) $\text{C}_2^{2-} < \text{O}_2^{2-} < \text{N}_2^{2-}$ (D) $\text{N}_2^{2-} < \text{C}_2^{2-} < \text{O}_2^{2-}$

Q31 Chemical Kinetics[Step-by-step solution](https://www.prepwisar.in/questions/6rkAFTPCFN) > prepwisar.in/questions/6rkAFTPCFN

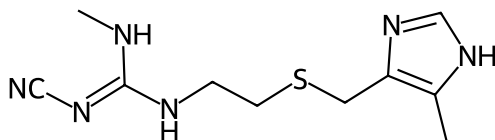
For a first order reaction, the time required for completion of 90% reaction is 'x' times the half life of the reaction. The value of 'x' is

(Given : $\ln 10 = 2.303$ and $\log 2 = 0.3010$)

- (A) 1.12 (B) 2.43 (C) 3.32 (D) 33.31

Q32 Chemistry in Everyday Life[Step-by-step solution](https://www.prepwisar.in/questions/nzSIXR-7Gy) > prepwisar.in/questions/nzSIXR-7Gy

The structure shown below is of which well-known drug molecule?



- (A) Ranitidine (B) Seldane (C) Cimetidine (D) Codeine

Q33 Coordination Compounds[Step-by-step solution](https://www.prepwisar.in/questions/WTwopf7-we) > prepwisar.in/questions/WTwopf7-we

Transition metal complex with highest value of crystal field splitting (Δ_0) will be:

- (A) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ (B) $[\text{Mo}(\text{H}_2\text{O})_6]^{3+}$ (C) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ (D) $[\text{Os}(\text{H}_2\text{O})_6]^{3+}$

Q34 d & f Block Elements[Step-by-step solution](https://www.prepwisar.in/questions/-PwF3vgpBh) > prepwisar.in/questions/-PwF3vgpBh

Metals generally melt at very high temperature. Amongst the following, the metal with the highest melting point will be:

- (A) Hg (B) Ag (C) Ga (D) Cs

Q35 Hydrocarbons: Alkenes & Alkynes[Step-by-step solution](https://www.prepwisar.in/questions/flj5jhFltj) > prepwisar.in/questions/flj5jhFltj

Given below are two statements:

Statement I : The presence of weaker π -bonds make alkenes less stable than alkanes.

Statement II : The strength of the double bond is greater than that of carbon-carbon single bond.

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

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

Q36 Metallurgy[Step-by-step solution](https://www.prepwisar.in/questions/IkHtUr0Bp7) > prepwisar.in/questions/IkHtUr0Bp7

Which of the following chemical reactions represents Hall-Heroult Process?

- (A) $\text{Cr}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Cr}$ (B) $2\text{Al}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Al} + 3\text{CO}_2$
(C) $\text{FeO} + \text{CO} \rightarrow \text{Fe} + \text{CO}_2$ (D) $2[\text{Au}(\text{CN})_2]_{(aq)}^- + \text{Zn(s)} \rightarrow 2\text{Au(s)} + [\text{Zn}(\text{CN})_4]^{2-}$

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PCl_5 is well known, but NCl_5 is not. because,

- (A) nitrogen is less reactive than phosphorus.
 (B) nitrogen doesn't have d-orbitals in its valence shell.
 (C) catenation tendency is weaker in nitrogen than phosphorus.
 (D) size of phosphorus is larger than nitrogen.

Which of the following is not an example of a condensation polymer?

- (A) Nylon 6,6 (B) Dacron (C) Buna-N (D) Silicone

In the industrial production of which of the following, molecular hydrogen is obtained as a byproduct?

- (A) NaOH (B) NaCl (C) Na metal (D) Na_2CO_3

Which one of the following compounds is used as a chemical in certain type of fire extinguishers?

- (A) Baking soda (B) Soda ash (C) Washing soda (D) Caustic soda

120 g of an organic compound that contains only carbon and hydrogen gives 330 g of CO_2 and 270 g of water on complete combustion. The percentage of carbon and hydrogen, respectively are

- (A) 25 and 75 (B) 40 and 60 (C) 60 and 40 (D) 75 and 25

The energy of one mole of photons of radiation of wavelength 300 nm is

(Given : $h = 6.63 \times 10^{-34} \text{ J s}$, $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$, $c = 3 \times 10^8 \text{ m s}^{-1}$)

- (A) 235 kJ mol^{-1} (B) 325 kJ mol^{-1} (C) 399 kJ mol^{-1} (D) 435 kJ mol^{-1}

At 25°C and 1 atm pressure, the enthalpies of combustion are as given below:

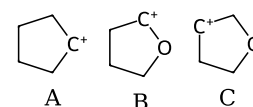
Substance	H_2	C (graphite)	$\text{C}_2\text{H}_6(\text{g})$
$\frac{\Delta_c H^\ominus}{\text{kJ mol}^{-1}}$	-286.0	-394.0	-1560.0

The enthalpy of formation of ethane is

- (A) +54.0 kJ mol^{-1} (B) -68.0 kJ mol^{-1} (C) -86.0 kJ mol^{-1} (D) +97.0 kJ mol^{-1}

Arrange the following carbocations in decreasing order of stability.

- (A) $\text{B} > \text{A} > \text{C}$ (B) $\text{A} > \text{B} > \text{C}$ (C) $\text{C} > \text{B} > \text{A}$ (D) $\text{C} > \text{A} > \text{B}$



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Q45 Amines & Diazonium Salts[Step-by-step solution](https://www.prepwisar.in/questions/o2C22c9OxO)

The conversion of propan-1-ol to n-butylamine involves the sequential addition of reagents. The correct sequential order of reagents is

- (A) (i) SOCl_2 (ii) KCN (iii) H_2/Ni , $\text{Na(Hg)}/\text{C}_2\text{H}_5\text{OH}$ (B) (i) HCl (ii) H_2/Ni , $\text{Na(Hg)}/\text{C}_2\text{H}_5\text{OH}$
(C) (i) SOCl_2 (ii) KCN (iii) CH_3NH_2 (D) (i) HCl (ii) CH_3NH_2

Q46 Qualitative Analysis: Salt Analysis[Step-by-step solution](https://www.prepwisar.in/questions/Pvyxm-9HcR)

In the flame test of a mixture of salts, a green flame with blue centre was observed. Which one of the following cations may be present?

- (A) Cu^{2+} (B) Sr^{2+} (C) Ba^{2+} (D) Ca^{2+}

Chemistry Section B · Numerical value

Q47 to Q54

Q47 Carbohydrates & Biomolecules

NUMERICAL

[Step-by-step solution](https://www.prepwisar.in/questions/hkp9u2t9DA)

In alanyl glycyl leucyl alanyl valine, the number of peptide linkages is _____.

Q48 Redox Reactions

NUMERICAL

[Step-by-step solution](https://www.prepwisar.in/questions/A3ZNwI7rcD)

Manganese (VI) has ability to disproportionate in acidic solution. The difference in oxidation states of two ions it forms in acidic solution is _____.

Q49 Electrochemistry

NUMERICAL

[Step-by-step solution](https://www.prepwisar.in/questions/cYUXGoG-C7)

The resistance of a conductivity cell containing 0.01 M KCl solution at 298 K is $1750\ \Omega$. If the conductivity of 0.01 M KCl solution at 298 K is $0.152 \times 10^{-3}\ \text{S cm}^{-1}$, then the cell constant of the conductivity cell is _____ $\times 10^{-3}\ \text{cm}^{-1}$.

Q50 Metallurgy

NUMERICAL

[Step-by-step solution](https://www.prepwisar.in/questions/FLh2wJajni)

(a) Baryte, (b) Galena, (c) Zinc blende and (d) Copper pyrites. How many of these minerals are sulphide based?

Q51 Solutions & Colligative Properties

NUMERICAL

[Step-by-step solution](https://www.prepwisar.in/questions/BETJU7ipdl)

A company dissolves 'x' amount of CO_2 at 298 K in 1 litre of water to prepare soda water. $X = \text{_____} \times 10^{-3}\ \text{g}$. (nearest integer)

(Given : partial pressure of CO_2 at 298 K = 0.835 bar.

Henry's law constant for CO_2 at 298 K = 1.67 kbar.

Atomic mass of H, C and O is 1, 12, and $6\ \text{g mol}^{-1}$, respectively)

Q52 Surface Chemistry

NUMERICAL

[Step-by-step solution](https://www.prepwisar.in/questions/gSM0eLobFr)

When 200 mL of 0.2 M acetic acid is shaken with 0.6 g of wood charcoal, the final concentration of acetic acid after adsorption is 0.1 M. The mass of acetic acid adsorbed per gram of carbon is _____ g.

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PCl_5 dissociates as



5 moles of PCl_5 are placed in a 200 litre vessel which contains 2 moles of N_2 and is maintained at 600 K. The equilibrium pressure is 2.46 atm. The equilibrium constant K_p for the dissociation of PCl_5 is _____ $\times 10^{-3}$. (nearest integer)

(Given : $R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$; Assume ideal gas behaviour)

0.2 g of an organic compound was subjected to estimation of nitrogen by Dumas method in which volume of N_2 evolved (at STP) was found to be 22.400 mL. The percentage of nitrogen in the compound is _____. [nearest integer]

(Given : Molar mass of N_2 is 28 g mol^{-1} . Molar volume of N_2 at STP : 22.4 L)

Mathematics Section A · Multiple choice

Q55 to Q73

If the shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{\lambda}$ and $\frac{x-2}{1} = \frac{y-4}{4} = \frac{z-5}{5}$ is $\frac{1}{\sqrt{3}}$, then the sum of all possible value of λ is:

- (A) 16 (B) 6 (C) 12 (D) 15

Let the points on the plane P be equidistant from the points $(-4, 2, 1)$ and $(2, -2, 3)$. Then the acute angle between the plane P and the plane $2x + y + 3z = 1$ is:

- (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{5\pi}{12}$

The slope of normal at any point (x, y) , $x > 0$, $y > 0$ on the curve $y = y(x)$ is given by $\frac{x^2}{xy - x^2y^2 - 1}$. If the curve passes through the point $(1, 1)$, then $e \cdot y(e)$ is equal to

- (A) $\frac{1 - \tan(1)}{1 + \tan(1)}$ (B) $\tan(1)$ (C) 1 (D) $\frac{1 + \tan(1)}{1 - \tan(1)}$

Let λ^* be the largest value of λ for which the function $f_\lambda(x) = 4\lambda x^3 - 36\lambda x^2 + 36x + 48$ is increasing for all $x \in \mathbb{R}$. Then $f_{\lambda^*}(1) + f_{\lambda^*}(-1)$ is equal to:

- (A) 36 (B) 48 (C) 64 (D) 72

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The value of the integral

$$\int_{-\pi/2}^{\pi/2} \frac{dx}{(1+e^x)(\sin^6 x + \cos^6 x)}$$

is equal to

- (A) 2π (B) 0 (C) π (D) $\frac{\pi}{2}$

$$\lim_{n \rightarrow \infty} \left(\frac{n^2}{(n^2+1)(n+1)} + \frac{n^2}{(n^2+4)(n+2)} + \frac{n^2}{(n^2+9)(n+3)} + \dots + \frac{n^2}{(n^2+n^2)(n+n)} \right)$$

is equal to:

- (A) $\frac{\pi}{8} + \frac{1}{4} \log_e 2$ (B) $\frac{\pi}{4} + \frac{1}{8} \log_e 2$ (C) $\frac{\pi}{4} - \frac{1}{8} \log_e 2$ (D) $\frac{\pi}{8} + \log_e \sqrt{2}$

If

$$y = \tan^{-1}(\sec x^3 - \tan x^3), \frac{\pi}{2} < x^3 < \frac{3\pi}{2}$$

, then

- (A) $xy'' + 2y' = 0$ (B) $x^2y'' - 6y + \frac{3\pi}{2} = 0$
(C) $x^2y'' - 6y + 3\pi = 0$ (D) $xy'' - 4y' = 0$

Let the maximum area of the triangle that can be inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{4} = 1$, $a > 2$, having one of its vertices at one end of the major axis of the ellipse and one of its sides parallel to the y-axis, be $6\sqrt{3}$. Then the eccentricity of the ellipse is:

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

Let $x * y = x^2 + y^3$ and $(x * 1) * 1 = x * (1 * 1)$.

Then a value of $2\sin^{-1}\left(\frac{x^4+x^2-2}{x^4+x^2+2}\right)$ is:

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

Let

$$f(x) = \begin{cases} \frac{\sin(x-[x])}{x-[x]}, & x \in (-2, -1) \\ \max\{2x, 3[|x|]\} & , |x| < 1 \\ 1 & , \text{otherwise} \end{cases}$$

where $[t]$ denotes greatest integer $\leq t$. If m is the number of points where f is not continuous and n is the number of points where f is not differentiable, then the ordered pair (m, n) is:

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

Q65 Determinants[Step-by-step solution](#) › [prepwisar.in/questions/vYyT8_zulk](https://www.prepwisar.in/questions/vYyT8_zulk)

Let the system of linear equations

$$x + y + \alpha z = 2$$

$$3x + y + z = 4$$

$$x + 2z = 1$$

have a unique solution (x^*, y^*, z^*) . If $(\alpha, x^*), (y^*, \alpha)$ and $(x^*, -y^*)$ are collinear points, then the sum of absolute values of all possible values of α is

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

Q66 Parabola[Step-by-step solution](#) › [prepwisar.in/questions/kuQULrwI_T](https://www.prepwisar.in/questions/kuQULrwI_T)

A particle is moving in the xy-plane along a curve C passing through the point (3, 3). The tangent to the curve C at the point P meets the x-axis at Q. If the y-axis bisects the segment PQ, then C is a parabola with:

- (A) length of latus rectum 3 (B) length of latus rectum 6
(C) focus $(\frac{4}{3}, 0)$ (D) focus $(0, \frac{3}{4})$

Q67 Probability: Advanced[Step-by-step solution](#) › [prepwisar.in/questions/wk_hv6zmg3](https://www.prepwisar.in/questions/wk_hv6zmg3)

A random variable X has the following probability distribution:

X	0	1	2	3	4
P(X)	k	2k	4k	6k	8k

The value of $P(1 < X < 4 \mid X \leq 2)$ is equal to:

- (A) $\frac{4}{7}$ (B) $\frac{2}{3}$ (C) $\frac{3}{7}$ (D) $\frac{4}{5}$

Q68 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](#) › [prepwisar.in/questions/qcFtX7lvKH](https://www.prepwisar.in/questions/qcFtX7lvKH)

The sum of all the real roots of the equation

$$(e^{2x} - 4)(6e^{2x} - 5e^x + 1) = 0$$

- (A) $\log_e 3$ (B) $-\log_e 3$ (C) $\log_e 6$ (D) $-\log_e 6$

Q69 Applications of Derivatives[Step-by-step solution](#) › [prepwisar.in/questions/nyFKIInFHc](https://www.prepwisar.in/questions/nyFKIInFHc)

The number of distinct real roots of the equation

$$x^7 - 7x - 2 = 0$$

- (A) 5 (B) 7 (C) 1 (D) 3

Q70 Applications of Derivatives[Step-by-step solution](#) › [prepwisar.in/questions/b0FKCrRZWY](https://www.prepwisar.in/questions/b0FKCrRZWY)

Let $x, y > 0$. If $x^3 y^2 = 2^{15}$, then the least value of $3x + 2y$ is

- (A) 30 (B) 32 (C) 36 (D) 40

Q71 Trigonometric Equations[Step-by-step solution](#) › [prepwisar.in/questions/ro4vgAXI9W](https://www.prepwisar.in/questions/ro4vgAXI9W)

The number of solutions of the equation

$$\cos\left(x + \frac{\pi}{3}\right) \cos\left(\frac{\pi}{3} - x\right) = \frac{1}{4} \cos^2 2x$$

, $x \in [-3\pi, 3\pi]$ is:

- (A) 8 (B) 5 (C) 6 (D) 7

Q72 Vectors[Step-by-step solution](#) › prepwiser.in/questions/6QOpj58ZUw

Let $\hat{a}$ and $\hat{b}$ be two unit vectors such that $|(\hat{a} + \hat{b}) + 2(\hat{a} \times \hat{b})| = 2$. If $\theta \in (0, \pi)$ is the angle between $\hat{a}$ and $\hat{b}$, then among the statements:

(S1): $2|\hat{a} \times \hat{b}| = |\hat{a} - \hat{b}|$

(S2): The projection of $\hat{a}$ on $(\hat{a} + \hat{b})$ is $\frac{1}{2}$

(A) Only (S1) is true.

(B) Only (S2) is true.

(C) Both (S1) and (S2) are true.

(D) Both (S1) and (S2) are false.

Q73 Straight Lines[Step-by-step solution](#) › prepwiser.in/questions/33uaHwWw7L

Let the area of the triangle with vertices $A(1, \alpha)$, $B(\alpha, 0)$ and $C(0, \alpha)$ be 4 sq. units. If the points $(\alpha, -\alpha)$, $(-\alpha, \alpha)$ and (α^2, β) are collinear, then β is equal to:

(A) 64

(B) -8

(C) -64

(D) 512

Mathematics Section B · Numerical value

Q74 to Q83

Q74 Sequences & Series **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/6OPAsZP_5P

The remainder on dividing $1 + 3 + 3^2 + 3^3 + \dots + 3^{2021}$ by 50 is _____.

Q75 Circles **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/NB6IuMIP9I

Let a circle $C : (x - h)^2 + (y - k)^2 = r^2$, $k > 0$, touch the x-axis at $(1, 0)$. If the line $x + y = 0$ intersects the circle C at P and Q such that the length of the chord PQ is 2, then the value of $h + k + r$ is equal to _____.

Q76 Complex Numbers **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/TacddgMA6f

Let $S = \{z \in \mathbb{C} : |z - 3| \leq 1 \text{ and } z(4 + 3i) + \bar{z}(4 - 3i) \leq 24\}$. If $\alpha + i\beta$ is the point in S which is closest to $4i$, then $25(\alpha + \beta)$ is equal to _____.

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

Let the hyperbola $H : \frac{x^2}{a^2} - y^2 = 1$ and the ellipse $E : 3x^2 + 4y^2 = 12$ be such that the length of latus rectum of H is equal to the length of latus rectum of E . If e_H and e_E are the eccentricities of H and E respectively, then the value of $12(e_H^2 + e_E^2)$ is equal to _____.

Q78 Matrices **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/sr38hCK9Uo

Let

$$S = \left\{ \begin{pmatrix} -1 & a \\ 0 & b \end{pmatrix} ; a, b \in \{1, 2, 3, \dots, 100\} \right\}$$

and let $T_n = \{A \in S : A^{n(n+1)} = I\}$. Then the number of elements in $\bigcap_{n=1}^{100} T_n$ is _____.

Q79 Parabola **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/0G2pnAqS8g

Let P_1 be a parabola with vertex $(3, 2)$ and focus $(4, 4)$ and P_2 be its mirror image with respect to the line $x + 2y = 6$. Then the directrix of P_2 is $x + 2y =$ _____.

Q80 Permutations & Combinations **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/vNuAs0MKbl

The number of 7-digit numbers which are multiples of 11 and are formed using all the digits 1, 2, 3, 4, 5, 7 and 9 is _____.

In an examination, there are 10 true-false type questions. Out of 10, a student can guess the answer of 4 questions correctly with probability $\frac{3}{4}$ and the remaining 6 questions correctly with probability $\frac{1}{4}$. If the probability that the student guesses the answers of exactly 8 questions correctly out of 10 is $\frac{27k}{4^{10}}$, then k is equal to _____.

The sum of all the elements of the set $\{\alpha \in \{1, 2, \dots, 100\} : HCF(\alpha, 24) = 1\}$ is _____.

The area (in sq. units) of the region enclosed between the parabola $y^2 = 2x$ and the line $x + y = 4$ is _____.

Answer key: JEE Main 2022 · 24 Jun · Shift 2

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Numbers match the question numbers above. For full working, open the solution link at the top right of each question.

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Physics

1. C	2. B	3. A	4. B	5. B	6. B	7. B	8. B
9. A	10. A	11. D	12. C	13. C	14. B	15. C	16. D
17. C	18. B	19. D	20. A	21. 25	22. 25	23. 440	24. 5
25. 12	26. 2	27. 20	28. 5				

Chemistry

29. C	30. B	31. C	32. C	33. D	34. B	35. A	36. B
37. B	38. C	39. A	40. A	41. D	42. C	43. C	44. A
45. A	46. A	47. 4	48. 3	49. 266	50. 3	51. 1221	52. 2
53. 1107	54. 14						

Mathematics

55. A	56. C	57. D	58. D	59. C	60. A	61. B	62. A
63. B	64. C	65. C	66. A	67. A	68. B	69. D	70. D
71. D	72. C	73. C	74. 4	75. 7	76. 80	77. 42	78. 100
79. 10	80. 576	81. 479	82. 1633	83. 18			

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