

JEE MAIN 2022 · QUESTION PAPER

24 Jun 2022 **Shift 1**

86 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	9 Q49 to Q57
● Mathematics	19 Q58 to Q76	10 Q77 to Q86
In this PDF	86 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/2022-06-24-morning · Free, no signup needed to start

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

Q1 Alternating Current

[Step-by-step solution](#) › [prepwise.in/questions/Cfq8XHudHZ](https://www.prepwise.in/questions/Cfq8XHudHZ)

A resistance of $40\ \Omega$ is connected to a source of alternating current rated 220 V, 50 Hz. Find the time taken by the current to change from its maximum value to the rms value:

- (A) 2.5 ms (B) 1.25 ms (C) 2.5 s (D) 0.25 s

Q2 Atomic Physics

[Step-by-step solution](#) › [prepwise.in/questions/zs99Lxgkhc](https://www.prepwise.in/questions/zs99Lxgkhc)

Choose the correct option from the following options given below:

- (A) In the ground state of Rutherford's model electrons are in stable equilibrium. While in Thomson's model electrons always experience a net-force.
- (B) An atom has a nearly continuous mass distribution in a Rutherford's model but has a highly non-uniform mass distribution in Thomson's model.
- (C) A classical atom based on Rutherford's model is doomed to collapse.
- (D) The positively charged part of the atom possesses most of the mass in Rutherford's model but not in Thomson's model.

Q3 Nuclear Physics

[Step-by-step solution](#) › [prepwise.in/questions/IL_knQnPh4](https://www.prepwise.in/questions/IL_knQnPh4)

Nucleus A is having mass number 220 and its binding energy per nucleon is 5.6 MeV. It splits in two fragments 'B' and 'C' of mass numbers 105 and 115. The binding energy of nucleons in 'B' and 'C' is 6.4 MeV per nucleon. The energy Q released per fission will be:

- (A) 0.8 MeV (B) 275 MeV (C) 220 MeV (D) 176 MeV

Q4 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) › [prepwise.in/questions/TNxO5m8Cvj](https://www.prepwise.in/questions/TNxO5m8Cvj)

A parallel plate capacitor is formed by two plates each of area $30\pi\text{ cm}^2$ separated by 1 mm. A material of dielectric strength $3.6 \times 10^7\text{ Vm}^{-1}$ is filled between the plates. If the maximum charge that can be stored on the capacitor without causing any dielectric breakdown is $7 \times 10^{-6}\text{ C}$, the value of dielectric constant of the material is:

[Use $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9\text{ Nm}^2\text{ C}^{-2}$]

- (A) 1.66 (B) 1.75 (C) 2.25 (D) 2.33

Q5 Circular Motion

[Step-by-step solution](#) › [prepwise.in/questions/KWNcXx3TVu](https://www.prepwise.in/questions/KWNcXx3TVu)

A boy ties a stone of mass 100 g to the end of a 2 m long string and whirls it around in a horizontal plane. The string can withstand the maximum tension of 80 N. If the maximum speed with which the stone can revolve is $\frac{K}{\pi}\text{ rev./min}$. The value of K is:

(Assume the string is massless and unstretchable)

- (A) 400 (B) 300 (C) 600 (D) 800

Q6 Current Electricity

[Step-by-step solution](#) › [prepwise.in/questions/dQ9Z8SXIId](https://www.prepwise.in/questions/dQ9Z8SXIId)

Two identical cells each of emf 1.5 V are connected in parallel across a parallel combination of two resistors each of resistance $20\ \Omega$. A voltmeter connected in the circuit measures 1.2 V. The internal resistance of each cell is:

- (A) $2.5\ \Omega$ (B) $4\ \Omega$ (C) $5\ \Omega$ (D) $10\ \Omega$

Q7 Electromagnetic Waves[Step-by-step solution](https://www.prepwiser.in/questions/IPc4IwfG0W)

A plane electromagnetic wave travels in a medium of relative permeability 1.61 and relative permittivity 6.44. If magnitude of magnetic intensity is $4.5 \times 10^{-2} \text{ Am}^{-1}$ at a point, what will be the approximate magnitude of electric field intensity at that point?

(Given : Permeability of free space $\mu_0 = 4\pi \times 10^{-7} \text{ NA}^{-2}$, speed of light in vacuum $c = 3 \times 10^8 \text{ ms}^{-1}$)

- (A) 16.96 Vm^{-1} (B) $2.25 \times 10^{-2} \text{ Vm}^{-1}$ (C) 8.48 Vm^{-1} (D) $6.75 \times 10^6 \text{ Vm}^{-1}$

Q8 Electrostatics I: Charges, Field & Gauss's Law[Step-by-step solution](https://www.prepwiser.in/questions/FW8rv6S0hP)

A vertical electric field of magnitude $4.9 \times 10^5 \text{ N/C}$ just prevents a water droplet of a mass 0.1 g from falling. The value of charge on the droplet will be:

(Given : $g = 9.8 \text{ m/s}^2$)

- (A) $1.6 \times 10^{-9} \text{ C}$ (B) $2.0 \times 10^{-9} \text{ C}$ (C) $3.2 \times 10^{-9} \text{ C}$ (D) $0.5 \times 10^{-9} \text{ C}$

Q9 Gravitation[Step-by-step solution](https://www.prepwiser.in/questions/MuLcQSbN45)

The approximate height from the surface of earth at which the weight of the body becomes $\frac{1}{3}$ of its weight on the surface of earth is:

[Radius of earth $R = 6400 \text{ km}$ and $\sqrt{3} = 1.732$]

- (A) 3840 km (B) 4685 km (C) 2133 km (D) 4267 km

Q10 Thermodynamics[Step-by-step solution](https://www.prepwiser.in/questions/X_2R1r_QJj)

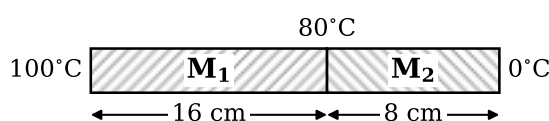
A Carnot engine whose heat sinks at 27°C , has an efficiency of 25%. By how many degrees should the temperature of the source be changed to increase the efficiency by 100% of the original efficiency?

- (A) Increases by 18°C (B) Increases by 200°C (C) Increases by 120°C (D) Increases by 73°C

Q11 Heat Transfer[Step-by-step solution](https://www.prepwiser.in/questions/FLnmAZ-bgM)

Two metallic blocks M_1 and M_2 of same area of cross-section are connected to each other (as shown in figure). If the thermal conductivity of M_2 is K then the thermal conductivity of M_1 will be:

[Assume steady state heat conduction]



- (A) 10 K (B) 8 K (C) 12.5 K (D) 2 K

Q12 Friction[Step-by-step solution](https://www.prepwiser.in/questions/TkaYKSTsZG)

A block of mass 10 kg starts sliding on a surface with an initial velocity of 9.8 ms^{-1} . The coefficient of friction between the surface and block is 0.5. The distance covered by the block before coming to rest is:

[use $g = 9.8 \text{ ms}^{-2}$]

- (A) 4.9 m (B) 9.8 m (C) 12.5 m (D) 19.6 m

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Q13 Moving Charges & Magnetism[Step-by-step solution](https://www.prepwise.in/questions/4pwrEeD0a_) > prepwise.in/questions/4pwrEeD0a_

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

Assertion (A) : In an uniform magnetic field, speed and energy remains the same for a moving charged particle.

Reason (R) : Moving charged particle experiences magnetic force perpendicular to its direction of motion.

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

Q14 Moving Charges & Magnetism[Step-by-step solution](https://www.prepwise.in/questions/iCLkPWqF6C) > prepwise.in/questions/iCLkPWqF6C

The magnetic field at the centre of a circular coil of radius r , due to current I flowing through it, is B . The magnetic field at a point along the axis at a distance $\frac{r}{2}$ from the centre is:

- (A) $B/2$ (B) $2B$ (C) $\left(\frac{2}{\sqrt{5}}\right)^3 B$ (D) $\left(\frac{2}{\sqrt{3}}\right)^3 B$

Q15 Projectile Motion & Relative Motion[Step-by-step solution](https://www.prepwise.in/questions/Vt0pryuFHy) > prepwise.in/questions/Vt0pryuFHy

A projectile is projected with velocity of 25 m/s at an angle θ with the horizontal. After t seconds its inclination with horizontal becomes zero. If R represents horizontal range of the projectile, the value of θ will be:

[use $g = 10 \text{ m/s}^2$]

- (A) $\frac{1}{2} \sin^{-1} \left(\frac{5t^2}{4R} \right)$ (B) $\frac{1}{2} \sin^{-1} \left(\frac{4R}{5t^2} \right)$ (C) $\tan^{-1} \left(\frac{4t^2}{5R} \right)$ (D) $\cot^{-1} \left(\frac{R}{20t^2} \right)$

Q16 Elasticity[Step-by-step solution](https://www.prepwise.in/questions/o0xB2_zAJl) > prepwise.in/questions/o0xB2_zAJl

The bulk modulus of a liquid is $3 \times 10^{10} \text{ Nm}^{-2}$. The pressure required to reduce the volume of liquid by 2% is:

- (A) $3 \times 10^8 \text{ Nm}^{-2}$ (B) $9 \times 10^8 \text{ Nm}^{-2}$ (C) $6 \times 10^8 \text{ Nm}^{-2}$ (D) $12 \times 10^8 \text{ Nm}^{-2}$

Q17 Mechanical Waves[Step-by-step solution](https://www.prepwise.in/questions/t5eZMNOG7x) > prepwise.in/questions/t5eZMNOG7x

The equations of two waves are given by:

$$y_1 = 5 \sin 2\pi(x - vt) \text{ cm}$$

$$y_2 = 3 \sin 2\pi(x - vt + 1.5) \text{ cm}$$

These waves are simultaneously passing through a string. The amplitude of the resulting wave is:

- (A) 2 cm (B) 4 cm (C) 5.8 cm (D) 8 cm

Q18 Work, Energy & Power[Step-by-step solution](https://www.prepwise.in/questions/zcoBXkjtgz) > prepwise.in/questions/zcoBXkjtgz

A particle experiences a variable force $\vec{F} = (4x\hat{i} + 3y^2\hat{j})$ in a horizontal x-y plane. Assume distance in meters and force is newton. If the particle moves from point (1, 2) to point (2, 3) in the x-y plane, then Kinetic Energy changes by:

- (A) 50.0 J (B) 12.5 J (C) 25.0 J (D) 0 J

Identify the pair of physical quantities which have different dimensions:

- (A) Wave number and Rydberg's constant
(B) Stress and Coefficient of elasticity
(C) Coercivity and Magnetisation
(D) Specific heat capacity and Latent heat

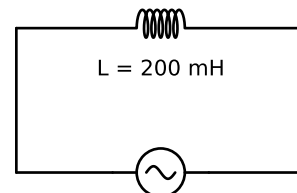
Physics Section B · Numerical value

Q20 to Q29

Q20 Alternating Current NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/jX8TBONgEY](https://www.prepwisar.in/questions/jX8TBONgEY)

As shown in the figure an inductor of inductance 200 mH is connected to an AC source of emf 220 V and frequency 50 Hz. The instantaneous voltage of the source is 0 V when the peak value of current is $\frac{\sqrt{a}}{\pi}$ A. The value of a is _____.



Q21 Current Electricity NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/VnTd_80Ii](https://www.prepwisar.in/questions/VnTd_80Ii)

In a potentiometer arrangement, a cell gives a balancing point at 75 cm length of wire. This cell is now replaced by another cell of unknown emf. If the ratio of the emf's of two cells respectively is 3 : 2, the difference in the balancing length of the potentiometer wire in above two cases will be _____ cm.

Q22 Dual Nature of Radiation & Matter NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/VrBpnl48Sr](https://www.prepwisar.in/questions/VrBpnl48Sr)

When light of frequency twice the threshold frequency is incident on the metal plate, the maximum velocity of emitted electron is v_1 . When the frequency of incident radiation is increased to five times the threshold value, the maximum velocity of emitted electron becomes v_2 . If $v_2 = x v_1$, the value of x will be _____.

Q23 Semiconductors & Electronic Devices NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/MPSMgT2f1L](https://www.prepwisar.in/questions/MPSMgT2f1L)

A transistor is used in common-emitter mode in an amplifier circuit. When a signal of 10 mV is added to the base-emitter voltage, the base current changes by $10 \mu\text{A}$ and the collector current changes by 1.5 mA. The load resistance is $5 \text{ k}\Omega$. The voltage gain of the transistor will be _____.

Q24 Ray Optics NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/Ok9njMnCzj](https://www.prepwisar.in/questions/Ok9njMnCzj)

Two identical thin biconvex lens of focal length 15 cm and refractive index 1.5 are in contact with each other. The space between the lenses is filled with a liquid of refractive index 1.25. The focal length of the combination is _____ cm.

Q25 Kinetic Theory of Gases NUMERICAL

[Step-by-step solution](#) > [prepwisar.in/questions/Xbyrkdook8](https://www.prepwisar.in/questions/Xbyrkdook8)

0.056 kg of Nitrogen is enclosed in a vessel at a temperature of 127°C . The amount of heat required to double the speed of its molecules is _____ k cal.

Take $R = 2 \text{ cal mole}^{-1} \text{ K}^{-1}$

Q26 Rectilinear Motion NUMERICAL

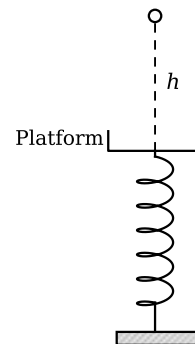
[Step-by-step solution](#) > [prepwisar.in/questions/knCOLIhptc](https://www.prepwisar.in/questions/knCOLIhptc)

From the top of a tower, a ball is thrown vertically upward which reaches the ground in 6 s. A second ball thrown vertically downward from the same position with the same speed reaches the ground in 1.5 s. A third ball released, from the rest from the same location, will reach the ground in _____ s.

A metre scale is balanced on a knife edge at its centre. When two coins, each of mass 10 g are put one on the top of the other at the 10.0 cm mark the scale is found to be balanced at 40.0 cm mark. The mass of the metre scale is found to be $x \times 10^{-2}$ kg. The value of x is _____.

Sodium light of wavelengths 650 nm and 655 nm is used to study diffraction at a single slit of aperture 0.5 mm. The distance between the slit and the screen is 2.0 m. The separation between the positions of the first maxima of diffraction pattern obtained in the two cases is _____ $\times 10^{-5}$ m.

A ball of mass 100 g is dropped from a height $h = 10$ cm on a platform fixed at the top of a vertical spring (as shown in figure). The ball stays on the platform and the platform is depressed by a distance $\frac{h}{2}$. The spring constant is _____ Nm^{-1} .
(Use $g = 10 \text{ ms}^{-2}$)



Chemistry Section A · Multiple choice

Q30 to Q48

Two statements are given below:

Statement I : The melting point of monocarboxylic acid with even number of carbon atoms is higher than that of with odd number of carbon atoms acid immediately below and above it in the series.

Statement II : The solubility of monocarboxylic acids in water decreases with increase in molar mass.

Choose the most appropriate option:

- (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.

A polysaccharide 'X' on boiling with dil H_2SO_4 at 393 K under 2-3 atm pressure yields 'Y'. 'Y' on treatment with bromine water gives gluconic acid. 'X' contains β -glycosidic linkages only. Compound 'X' is:

- (A) starch
- (B) cellulose
- (C) amylose
- (D) amylopectin

Which of the following is not a broad spectrum antibiotic?

- (A) Vancomycin
- (B) Ampicillin
- (C) Ofloxacin
- (D) Penicillin G

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Match List - I with List - II:

	List - I		List - II
(A)	$[PtCl_4]^{2-}$	(I)	sp^3d
(B)	BrF_5	(II)	d^2sp^3
(C)	PCl_5	(III)	dsp^2
(D)	$[Co(NH_3)_6]^{3+}$	(IV)	sp^3d^2

Choose the most appropriate answer from the options given below:

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

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

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

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

The highest industrial consumption of molecular hydrogen is to produce compounds of element:

(A) Carbon

(B) Nitrogen

(C) Oxygen

(D) Chlorine

Match List - I with List - II:

	List - I		List - II
(A)	Sphalerite	(I)	$FeCO_3$
(B)	Calamine	(II)	PbS
(C)	Galena	(III)	$ZnCO_3$
(D)	Siderite	(IV)	ZnS

Choose the most appropriate answer from the options given below:

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

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

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

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

Identify the correct statement for B_2H_6 from those given below:(A) In B_2H_6 , all B-H bonds are equivalent.(B) In B_2H_6 , there are four 3-centre-2-electron bonds.(C) B_2H_6 is a Lewis acid.(D) B_2H_6 can be synthesized from both BF_3 and $NaBH_4$.(E) B_2H_6 is a planar molecule.

Choose the most appropriate answer from the options given below:

(A) (A) and (E) only

(B) (B), (C) and (E) only

(C) (C) and (D) only

(D) (C) and (E) only

The most stable trihalide of nitrogen is:

(A) NF_3 (B) NCl_3 (C) NBr_3 (D) NI_3

Which one of the following elemental forms is not present in the enamel of the teeth?

(A) Ca^{2+} (B) P^{3+} (C) F^- (D) P^{5+}

Given below are the oxides:

Na_2O , As_2O_3 , N_2O , NO and Cl_2O_7

Number of amphoteric oxides is:

- (A) 0 (B) 1 (C) 2 (D) 3

Which of the following is an example of polyester?

- (A) Butadiene-styrene copolymer (B) Melamine polymer
(C) Neoprene (D) Poly- β -hydroxybutyrate-co- β -hydroxyvalerate

Which of the following statements are correct?

- (A) Both LiCl and MgCl_2 are soluble in ethanol.
(B) The oxides Li_2O and MgO combine with excess of oxygen to give superoxide.
(C) LiF is less soluble in water than other alkali metal fluorides.
(D) Li_2O is more soluble in water than other alkali metal oxides.

Choose the most appropriate answer from the options given below:

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

If a rocket runs on a fuel ($\text{C}_{15}\text{H}_{30}$) and liquid oxygen, the weight of oxygen required and CO_2 released for every litre of fuel respectively are:

(Given : density of the fuel is 0.756 g/mL)

- (A) 1188 g and 1296 g (B) 2376 g and 2592 g (C) 2592 g and 2376 g (D) 3429 g and 3142 g

Consider the following pairs of electrons

- (A) (a) $n = 3, l = 1, m_l = 1, m_s = +\frac{1}{2}$
(b) $n = 3, l = 2, m_l = 1, m_s = +\frac{1}{2}$
(B) (a) $n = 3, l = 2, m_l = -2, m_s = -\frac{1}{2}$
(b) $n = 3, l = 2, m_l = -1, m_s = -\frac{1}{2}$
(C) (a) $n = 4, l = 2, m_l = 2, m_s = +\frac{1}{2}$
(b) $n = 3, l = 2, m_l = 2, m_s = +\frac{1}{2}$

The pairs of electrons present in degenerate orbitals is/are:

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

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Given below are two statements:

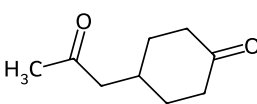
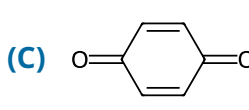
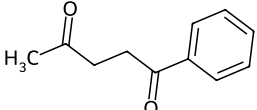
Statement I : Emulsions of oil in water are unstable and sometimes they separate into two layers on standing.

Statement II : For stabilisation of an emulsion, excess of electrolyte is added.

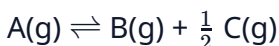
In the light of the above statements, choose the most appropriate answer from the options given below:

- (A) Both Statement I and Statement II are 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.

Which of the following is an example of conjugated diketone?

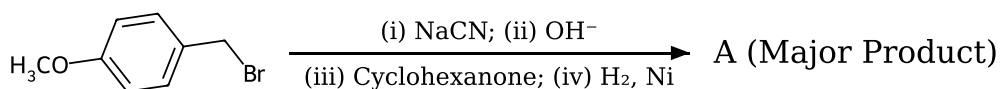
- (A) $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3$
 (B) 
 (C) 
 (D) 

For a reaction at equilibrium

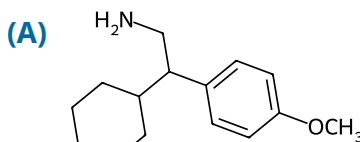
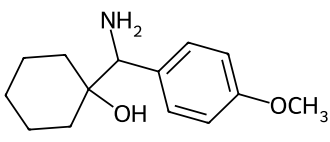
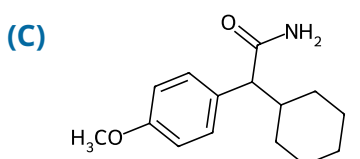
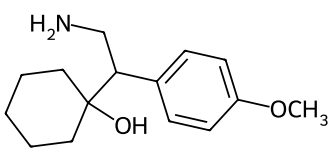


the relation between dissociation constant (K), degree of dissociation (α) and equilibrium pressure (p) is given by:

- (A) $K = \frac{\alpha^{\frac{1}{2}} p^{\frac{3}{2}}}{(1 + \frac{3}{2}\alpha)^{\frac{1}{2}} (1 - \alpha)}$ (B) $K = \frac{\alpha^{\frac{3}{2}} p^{\frac{1}{2}}}{(2 + \alpha)^{\frac{1}{2}} (1 - \alpha)}$ (C) $K = \frac{(\alpha p)^{\frac{3}{2}}}{(1 + \frac{3}{2}\alpha)^{\frac{1}{2}} (1 - \alpha)}$ (D) $K = \frac{(\alpha p)^{\frac{3}{2}}}{(1 + \alpha)(1 - \alpha)^{\frac{1}{2}}}$



The major product of the above reactions is:

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

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During the qualitative analysis of salt with cation y^{2+} , addition of a reagent (X) to alkaline solution of the salt gives a bright red precipitate. The reagent (X) and the cation (y^{2+}) present respectively are:

- (A) Dimethylglyoxime and Ni^{2+} (B) Dimethylglyoxime and Co^{2+}
 (C) Nessler's reagent and Hg^{2+} (D) Nessler's reagent and Ni^{2+}

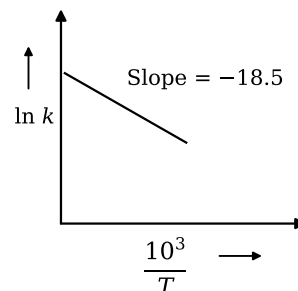
Chemistry Section B · Numerical value

Q49 to Q57

Q49 Chemical Kinetics NUMERICAL

[Step-by-step solution](#) > [prepwise.in/questions/rmC29twFB4](https://www.prepwise.in/questions/rmC29twFB4)

The rate constants for decomposition of acetaldehyde have been measured over the temperature range 700 - 1000 K. The data has been analysed by plotting $\ln k$ vs $\frac{10^3}{T}$ graph. The value of activation energy for the reaction is _____ kJ mol^{-1} . (Nearest integer)
 (Given : $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$)



Q50 Coordination Compounds NUMERICAL

[Step-by-step solution](#) > [prepwise.in/questions/NIXoBS5H-k](https://www.prepwise.in/questions/NIXoBS5H-k)

In the cobalt-carbonyl complex : $[Co_2(CO)_8]$, number of Co-Co bonds is "X" and terminal CO ligands is "Y". $X + Y =$ _____.

Q51 d & f Block Elements NUMERICAL

[Step-by-step solution](#) > [prepwise.in/questions/gF7qQDmCwE](https://www.prepwise.in/questions/gF7qQDmCwE)

The difference in oxidation state of chromium in chromate and dichromate salts is _____.

Q52 Electrochemistry NUMERICAL

[Step-by-step solution](#) > [prepwise.in/questions/cxxHaqp27A](https://www.prepwise.in/questions/cxxHaqp27A)

The cell potential for the following cell



is 0.576 V at 298 K. The pH of the solution is _____. (Nearest integer)

(Given: $E_{Cu^{2+}/Cu}^o = 0.34 \text{ V}$ and $\frac{2.303 RT}{F} = 0.06 \text{ V}$)

Q53 Solid State NUMERICAL

[Step-by-step solution](#) > [prepwise.in/questions/iIXjSx_7QC](https://www.prepwise.in/questions/iIXjSx_7QC)

Atoms of element X form hcp lattice and those of element Y occupy $\frac{2}{3}$ of its tetrahedral voids. The percentage of element X in the lattice is _____. (Nearest integer)

Q54 Solutions & Colligative Properties NUMERICAL

[Step-by-step solution](#) > [prepwise.in/questions/hFc5ua5Vps](https://www.prepwise.in/questions/hFc5ua5Vps)

The osmotic pressure of blood is 7.47 bar at 300 K. To inject glucose to a patient intravenously, it has to be isotonic with blood. The concentration of glucose solution in g L^{-1} is _____.

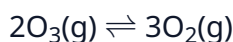
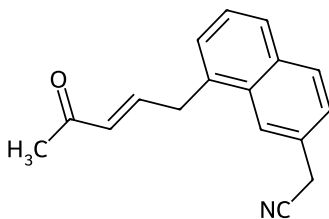
(Molar mass of glucose = 180 g mol^{-1} , $R = 0.083 \text{ L bar K}^{-1} \text{ mol}^{-1}$) (Nearest integer)

Q55 Purification & Characterisation of Organic Compounds NUMERICAL

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

A 0.166 g sample of an organic compound was digested with conc. H_2SO_4 and then distilled with NaOH. The ammonia gas evolved was passed through 50.0 mL of 0.5 N H_2SO_4 . The used acid required 30.0 mL of 0.25 N NaOH for complete neutralization. The mass percentage of nitrogen in the organic compound is _____.

Number of electrophilic centres in the given compound is _____.



At 300 K, ozone is fifty percent dissociated. The standard free energy change at this temperature and 1 atm pressure is (–) _____ J mol^{–1}. (Nearest integer)

[Given : $\ln 1.35 = 0.3$ and $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$]

Mathematics Section A · Multiple choice

Q58 to Q76

The surface area of a balloon of spherical shape being inflated, increases at a constant rate. If initially, the radius of balloon is 3 units and after 5 seconds, it becomes 7 units, then its radius after 9 seconds is:

- (A) 9 (B) 10 (C) 11 (D) 12

For the function

$f(x) = 4\log_e(x - 1) - 2x^2 + 4x + 5$, $x > 1$, which one of the following is NOT correct?

- (A) f is increasing in $(1, 2)$ and decreasing in $(2, \infty)$
 (B) $f(x) = -1$ has exactly two solutions
 (C) $f'(e) - f''(2) < 0$
 (D) $f(x) = 0$ has a root in the interval $(e, e + 1)$

If the tangent at the point (x_1, y_1) on the curve $y = x^3 + 3x^2 + 5$ passes through the origin, then (x_1, y_1) does NOT lie on the curve:

- (A) $x^2 + \frac{y^2}{81} = 2$ (B) $\frac{y^2}{9} - x^2 = 8$ (C) $y = 4x^2 + 5$ (D) $\frac{x}{3} - y^2 = 2$

The sum of absolute maximum and absolute minimum values of the function $f(x) = |2x^2 + 3x - 2| + \sin x \cos x$ in the interval $[0, 1]$ is:

- (A) $3 + \frac{\sin(1)\cos^2\left(\frac{1}{2}\right)}{2}$ (B) $3 + \frac{1}{2}(1 + 2\cos(1))\sin(1)$
 (C) $5 + \frac{1}{2}(\sin(1) + \sin(2))$ (D) $2 + \sin\left(\frac{1}{2}\right)\cos\left(\frac{1}{2}\right)$

Q62 Hyperbola[Step-by-step solution](#) > [prepwisar.in/questions/ANY_ALmC4w](https://www.prepwisar.in/questions/ANY_ALmC4w)

Let $\lambda x - 2y = \mu$ be a tangent to the hyperbola $a^2x^2 - y^2 = b^2$. Then $\left(\frac{\lambda}{a}\right)^2 - \left(\frac{\mu}{b}\right)^2$ is equal to:

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

Q63 Binomial Theorem[Step-by-step solution](#) > [prepwisar.in/questions/hQAqDTJlyu](https://www.prepwisar.in/questions/hQAqDTJlyu)

The remainder when 3^{2022} is divided by 5 is:

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

Q64 Complex Numbers[Step-by-step solution](#) > [prepwisar.in/questions/PILa28LHJ_](https://www.prepwisar.in/questions/PILa28LHJ_)

Let $A = \{z \in \mathbb{C} : 1 \leq |z - (1 + i)| \leq 2\}$

and $B = \{z \in A : |z - (1 - i)| = 1\}$. Then, B:

- (A) is an empty set (B) contains exactly two elements
(C) contains exactly three elements (D) is an infinite set

Q65 Differential Equations[Step-by-step solution](#) > [prepwisar.in/questions/GNBzW6ftf6](https://www.prepwisar.in/questions/GNBzW6ftf6)

If $x = x(y)$ is the solution of the differential equation

$y \frac{dx}{dy} = 2x + y^3(y + 1)e^y$, $x(1) = 0$; then $x(e)$ is equal to:

- (A) $e^3(e^e - 1)$ (B) $e^e(e^3 - 1)$ (C) $e^2(e^e + 1)$ (D) $e^e(e^2 - 1)$

Q66 Inverse Trigonometric Functions[Step-by-step solution](#) > [prepwisar.in/questions/ngFtc5RZEI](https://www.prepwisar.in/questions/ngFtc5RZEI)

The set of all values of k for which

$(\tan^{-1}x)^3 + (\cot^{-1}x)^3 = k\pi^3$, $x \in \mathbb{R}$, is the interval:

- (A) $\left[\frac{1}{32}, \frac{7}{8}\right)$ (B) $\left(\frac{1}{24}, \frac{13}{16}\right)$ (C) $\left[\frac{1}{48}, \frac{13}{16}\right]$ (D) $\left[\frac{1}{32}, \frac{9}{8}\right)$

Q67 Inverse Trigonometric Functions[Step-by-step solution](#) > [prepwisar.in/questions/4jsuB5jIRe](https://www.prepwisar.in/questions/4jsuB5jIRe)

The domain of the function

$$f(x) = \frac{\cos^{-1}\left(\frac{x^2 - 5x + 6}{x^2 - 9}\right)}{\log_e(x^2 - 3x + 2)}$$

is:

- (A) $(-\infty, 1) \cup (2, \infty)$ (B) $(2, \infty)$
(C) $\left[-\frac{1}{2}, 1\right) \cup (2, \infty)$ (D) $\left[-\frac{1}{2}, 1\right) \cup (2, \infty) - \left\{3, \frac{3 + \sqrt{5}}{2}, \frac{3 - \sqrt{5}}{2}\right\}$

Q68 Determinants[Step-by-step solution](#) > [prepwisar.in/questions/6tA7-Lnmk4](https://www.prepwisar.in/questions/6tA7-Lnmk4)

The number of values of α for which the system of equations:

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

$$\alpha x + 2\alpha y + 3z = -1$$

$$x + 3\alpha y + 5z = 4$$

is inconsistent, is

- (A) 0 (B) 1 (C) 2 (D) 3

Let $S = \{\sqrt{n}: 1 \leq n \leq 50 \text{ and } n \text{ is odd}\}$.

Let $a \in S$ and

$$A = \begin{bmatrix} 1 & 0 & a \\ -1 & 1 & 0 \\ -a & 0 & 1 \end{bmatrix}$$

If $\sum_{a \in S} \det(\text{adj } A) = 100\lambda$, then λ is equal to:

- (A) 218 (B) 221 (C) 663 (D) 1717

Let $x^2 + y^2 + Ax + By + C = 0$ be a circle passing through $(0, 6)$ and touching the parabola $y = x^2$ at $(2, 4)$. Then $A + C$ is equal to _____.

- (A) 16 (B) 88/5 (C) 72 (D) -8

Bag A contains 2 white, 1 black and 3 red balls and bag B contains 3 black, 2 red and n white balls. One bag is chosen at random and 2 balls drawn from it at random, are found to be 1 red and 1 black. If the probability that both balls come from Bag A is $\frac{6}{11}$, then n is equal to _____.

- (A) 13 (B) 6 (C) 4 (D) 3

If a random variable X follows the Binomial distribution $B(33, p)$ such that $3P(X = 0) = P(X = 1)$, then the value of $\frac{P(X=15)}{P(X=18)} - \frac{P(X=16)}{P(X=17)}$ is equal to:

- (A) 1320 (B) 1088 (C) $\frac{120}{1331}$ (D) $\frac{1088}{1089}$

If the sum of the squares of the reciprocals of the roots α and β of the equation $3x^2 + \lambda x - 1 = 0$ is 15, then $6(\alpha^3 + \beta^3)^2$ is equal to:

- (A) 18 (B) 24 (C) 36 (D) 96

If $\{a_i\}_{i=1}^n$, where n is an even integer, is an arithmetic progression with common difference 1, and

$$\sum_{i=1}^n a_i = 192, \sum_{i=1}^{n/2} a_{2i} = 120$$

, then n is equal to:

- (A) 48 (B) 96 (C) 92 (D) 104

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Let

$$S = \left\{ \theta \in [-\pi, \pi] - \left\{ \pm \frac{\pi}{2} \right\} : \sin \theta \tan \theta + \tan \theta = \sin 2\theta \right\}$$

If $T = \sum_{\theta \in S} \cos 2\theta$, then $T + n(S)$ is equal to:

(A) $7 + \sqrt{3}$

(B) 9

(C) $8 + \sqrt{3}$

(D) 10

Let $\hat{a}, \hat{b}$ be unit vectors. If $\vec{c}$ be a vector such that the angle between $\hat{a}$ and $\vec{c}$ is $\frac{\pi}{12}$, and

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

, then $|6\vec{c}|^2$ is equal to:

(A) $6(3 - \sqrt{3})$

(B) $3 + \sqrt{3}$

(C) $6(3 + \sqrt{3})$

(D) $6(\sqrt{3} + 1)$

Mathematics Section B · Numerical value

Q77 to Q86

Let a line having direction ratios, 1, -4, 2 intersect the lines $\frac{x-7}{3} = \frac{y-1}{-1} = \frac{z+2}{1}$ and $\frac{x}{2} = \frac{y-7}{3} = \frac{z}{1}$ at the points A and B. Then $(AB)^2$ is equal to _____.

If the shortest distance between the lines

$$\vec{r} = (-\hat{i} + 3\hat{k}) + \lambda(\hat{i} - a\hat{j})$$

and

$$\vec{r} = (-\hat{j} + 2\hat{k}) + \mu(\hat{i} - \hat{j} + \hat{k})$$

is $\sqrt{\frac{2}{3}}$, then the integral value of a is equal to _____.

Let

$$f(\theta) = \sin \theta + \int_{-\pi/2}^{\pi/2} (\sin \theta + t \cos \theta) f(t) dt$$

. Then the value of $\left| \int_0^{\pi/2} f(\theta) d\theta \right|$ is _____.

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Let

$$\text{Max}_{0 \leq x \leq 2} \left\{ \frac{9 - x^2}{5 - x} \right\} = \alpha$$

and

$$\text{Min}_{0 \leq x \leq 2} \left\{ \frac{9 - x^2}{5 - x} \right\} = \beta$$

If

$$\int_{\beta - \frac{8}{3}}^{2\alpha - 1} \text{Max} \left\{ \frac{9 - x^2}{5 - x}, x \right\} dx = \alpha_1 + \alpha_2 \log_e \left(\frac{8}{15} \right)$$

then $\alpha_1 + \alpha_2$ is equal to _____.

If two tangents drawn from a point (α, β) lying on the ellipse $25x^2 + 4y^2 = 1$ to the parabola $y^2 = 4x$ are such that the slope of one tangent is four times the other, then the value of $(10\alpha + 5)^2 + (16\beta^2 + 50)^2$ equals _____.

The number of one-one functions $f : \{a, b, c, d\} \rightarrow \{0, 1, 2, \dots, 10\}$ such that $2f(a) - f(b) + 3f(c) + f(d) = 0$ is _____.

The number of points where the function

$$f(x) = \begin{cases} |2x^2 - 3x - 7| & \text{if } x \leq -1 \\ [4x^2 - 1] & \text{if } -1 < x < 1 \\ |x + 1| + |x - 2| & \text{if } x \geq 1 \end{cases}$$

[t] denotes the greatest integer $\leq t$, is discontinuous is _____.

In an examination, there are 5 multiple choice questions with 3 choices, out of which exactly one is correct. There are 3 marks for each correct answer, -2 marks for each wrong answer and 0 mark if the question is not attempted. Then, the number of ways a student appearing in the examination gets 5 marks is _____.

Let S be the region bounded by the curves $y = x^3$ and $y^2 = x$. The curve $y = 2|x|$ divides S into two regions of areas R_1, R_2 . If $\max \{R_1, R_2\} = R_2$, then $\frac{R_2}{R_1}$ is equal to _____.

Let $A \left(\frac{3}{\sqrt{a}}, \sqrt{a} \right)$, $a > 0$, be a fixed point in the xy-plane. The image of A in y-axis be B and the image of B in x-axis be C. If $D(3 \cos \theta, a \sin \theta)$ is a point in the fourth quadrant such that the maximum area of $\triangle ACD$ is 12 square units, then a is equal to _____.

Answer key: JEE Main 2022 · 24 Jun · Shift 1

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Physics

1. A	2. C	3. D	4. D	5. C	6. C	7. C	8. B
9. B	10. B	11. B	12. B	13. A	14. C	15. D	16. C
17. A	18. C	19. D	20. 242	21. 25	22. 2	23. 750	24. 10
25. 12	26. 3	27. 6	28. 3	29. 120			

Chemistry

30. A	31. B	32. D	33. B	34. B	35. A	36. C	37. A
38. B	39. B	40. D	41. A	42. C	43. B	44. C	45. C
46. B	47. D	48. A	49. 154	50. 7	51. 0	52. 5	53. 43
54. 54	55. 63	56. 3	57. 747				

Mathematics

58. A	59. C	60. D	61. B	62. D	63. D	64. D	65. A
66. A	67. D	68. B	69. B	70. A	71. C	72. A	73. B
74. B	75. B	76. C	77. 84	78. 2	79. 1	80. 34	81. 2929
82. 31	83. 7	84. 40	85. 19	86. 8			

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