

JEE MAIN 2020 · QUESTION PAPER

7 Jan 2020 **Shift 1**

72 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	20 Q1 to Q20	5 Q21 to Q25
● Chemistry	18 Q26 to Q43	5 Q44 to Q48
● Mathematics	19 Q49 to Q67	5 Q68 to Q72
In this PDF	72 questions · answer key at the end	

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

Attempt this paper online

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

prepwise.in/pyqs/paper/2020-01-07-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](#) > [prepwisar.in/questions/jgtQ3tfPrT](https://www.prepwisar.in/questions/jgtQ3tfPrT)

A LCR circuit behaves like a damped harmonic oscillator. Comparing it with a physical spring-mass damped oscillator having damping constant 'b', the correct equivalence would be:

- (A) $L \leftrightarrow k, C \leftrightarrow b, R \leftrightarrow m$ (B) $L \leftrightarrow m, C \leftrightarrow k, R \leftrightarrow b$
 (C) $L \leftrightarrow m, C \leftrightarrow \frac{1}{k}, R \leftrightarrow b$ (D) $L \leftrightarrow \frac{1}{b}, C \leftrightarrow \frac{1}{m}, R \leftrightarrow \frac{1}{k}$

Q2 Atomic Physics

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

The time period of revolution of electron in its ground state orbit in a hydrogen atom is 1.6×10^{-16} s. The frequency of revolution of the electron in its first excited state (in s^{-1}) is:

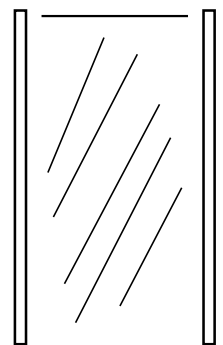
- (A) 5.6×10^{12} (B) 1.6×10^{14} (C) 7.8×10^{14} (D) 6.2×10^{15}

Q3 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) > [prepwisar.in/questions/W8IS_ZsX06](https://www.prepwisar.in/questions/W8IS_ZsX06)

A parallel plate capacitor has plates of area A separated by distance 'd' between them. It is filled with a dielectric which has a dielectric constant that varies as $k(x) = K(1 + \alpha x)$ where 'x' is the distance measured from one of the plates. If $(\alpha d) \ll 1$, the total capacitance of the system is best given by the expression:

- (A) $\frac{A\epsilon_0 K}{d} \left(1 + \left(\frac{\alpha d}{2} \right)^2 \right)$ (B) $\frac{A\epsilon_0 K}{d} \left(1 + \frac{\alpha d}{2} \right)$
 (C) $\frac{A\epsilon_0 K}{d} \left(1 + \frac{\alpha^2 d^2}{2} \right)$ (D) $\frac{A\epsilon_0 K}{d} (1 + \alpha d)$

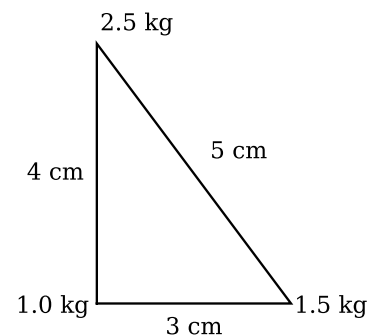


Q4 Centre of Mass & Linear Momentum

[Step-by-step solution](#) > [prepwisar.in/questions/qsWsL_icd9](https://www.prepwisar.in/questions/qsWsL_icd9)

Three point particles of masses 1.0 kg, 1.5 kg and 2.5 kg are placed at three corners of a right angle triangle of sides 4.0 cm, 3.0 cm and 5.0 cm as shown in the figure. The center of mass of the system is at a point:

- (A) 2.0 cm right and 0.9 cm above 1 kg mass
 (B) 0.9 cm right and 2.0 cm above 1 kg mass
 (C) 0.6 cm right and 2.0 cm above 1 kg mass
 (D) 1.5 cm right and 1.2 cm above 1 kg mass

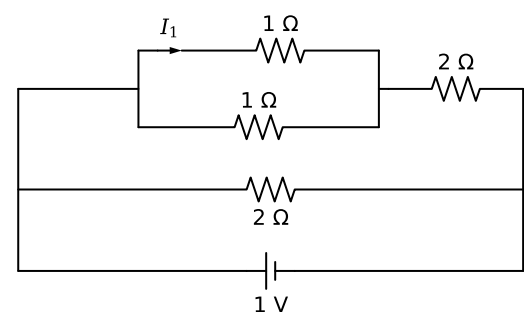


Q5 Current Electricity

[Step-by-step solution](#) > [prepwisar.in/questions/1U6p_aKGUj](https://www.prepwisar.in/questions/1U6p_aKGUj)

The current I_1 (in A) flowing through 1Ω resistor in the following circuit is:

- (A) 0.4 (B) 0.25 (C) 0.2 (D) 0.5



Attempt this paper online with instant answer checking > [prepwisar.in/pyqs/paper/2020-01-07-morning](https://www.prepwisar.in/pyqs/paper/2020-01-07-morning)

Consider a circular coil of wire carrying constant current I , forming a magnetic dipole. The magnetic flux through an infinite plane that contains the circular coil and excluding the circular coil area is given by ϕ_i . The magnetic flux through the area of the circular coil is given by ϕ_0 . Which of the following option is correct?

- (A) $\phi_i = \phi_0$ (B) $\phi_i < \phi_0$ (C) $\phi_i > \phi_0$ (D) $\phi_i = -\phi_0$

Q7 Electromagnetic Induction

[Step-by-step solution](https://www.prepwisar.in/questions/7V4Z2Ari0D)

A long solenoid of radius R carries a time (t) - dependent current $I(t) = I_0 t(1 - t)$. A ring of radius $2R$ is placed coaxially near its middle. During the time interval $0 \leq t \leq 1$, the induced current (I_R) and the induced EMF (V_R) in the ring change as:

- (A) Direction of I_R remains unchanged and V_R is zero at $t = 0.25$
 (B) Direction of I_R remains unchanged and V_R is maximum at $t = 0.5$
 (C) At $t = 0.25$ direction of I_R reverses and V_R is maximum
 (D) At $t = 0.5$ direction of I_R reverses and V_R is zero

Q8 Electromagnetic Waves

[Step-by-step solution](https://www.prepwisar.in/questions/44PTLZKOYG)

If the magnetic field in a plane electromagnetic wave is given by

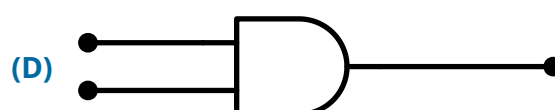
$\vec{B} = 3 \times 10^{-8} \sin(1.6 \times 10^3 x + 48 \times 10^{10} t) \hat{j}$ T, then what will be expression for electric field?

- (A) $\vec{E} = (9 \sin(1.6 \times 10^3 x + 48 \times 10^{10} t) \hat{k})$ V/m
 (B) $\vec{E} = (60 \sin(1.6 \times 10^3 x + 48 \times 10^{10} t) \hat{k})$ V/m
 (C) $\vec{E} = (3 \times 10^{-8} \sin(1.6 \times 10^3 x + 48 \times 10^{10} t) \hat{i})$ V/m
 (D) $\vec{E} = (3 \times 10^{-8} \sin(1.6 \times 10^3 x + 48 \times 10^{10} t) \hat{j})$ V/m

Q9 Thermodynamics

[Step-by-step solution](https://www.prepwisar.in/questions/yi_1oa5bok)

Which of the following gives a reversible operation?

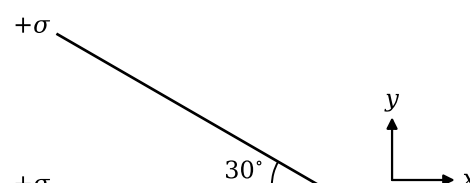


Q10 Electrostatics I: Charges, Field & Gauss's Law

[Step-by-step solution](https://www.prepwisar.in/questions/h1WOXmIOxb)

Two infinite planes each with uniform surface charge density σ are kept in such a way that the angle between them is 30° . The electric field in the region shown between them is given by:

- (A) $\frac{\sigma}{\epsilon_0} \left[\left(1 + \frac{\sqrt{3}}{2}\right) \hat{y} + \frac{\hat{x}}{2} \right]$ (B) $\frac{\sigma}{2\epsilon_0} \left[\left(1 + \sqrt{3}\right) \hat{y} + \frac{\hat{x}}{2} \right]$
 (C) $\frac{\sigma}{2\epsilon_0} \left[\left(1 + \sqrt{3}\right) \hat{y} - \frac{\hat{x}}{2} \right]$ (D) $\frac{\sigma}{2\epsilon_0} \left[\left(1 - \frac{\sqrt{3}}{2}\right) \hat{y} - \frac{\hat{x}}{2} \right]$



Q11 Ray Optics[Step-by-step solution](#) > [prepwisar.in/questions/M7VKN3YVWW](https://www.prepwisar.in/questions/M7VKN3YVWW)

If we need a magnification of 375 from a compound microscope of tube length 150 mm and an objective of focal length 5 mm, the focal length of the eye-piece, should be close to:

- (A) 22 mm (B) 12 mm (C) 33 mm (D) 2 mm

Q12 Gravitation[Step-by-step solution](#) > [prepwisar.in/questions/k-PhV06uzq](https://www.prepwisar.in/questions/k-PhV06uzq)

A satellite of mass m is launched vertically upwards with an initial speed u from the surface of the earth. After it reaches height R (R = radius of the earth), it ejects a rocket of mass $\frac{m}{10}$ so that subsequently the satellite moves in a circular orbit. The kinetic energy of the rocket is (G is the gravitational constant; M is the mass of the earth):

- (A) $\frac{3m}{8} \left(u + \sqrt{\frac{5GM}{6R}} \right)^2$ (B) $\frac{m}{20} \left(u^2 + \frac{113}{100} \frac{GM}{R} \right)$
(C) $5m \left(u^2 - \frac{119}{200} \frac{GM}{R} \right)$ (D) $\frac{m}{20} \left(u - \sqrt{\frac{2GM}{3R}} \right)^2$

Q13 Kinetic Theory of Gases[Step-by-step solution](#) > [prepwisar.in/questions/3i7g9zKhSM](https://www.prepwisar.in/questions/3i7g9zKhSM)

Two moles of an ideal gas with $\frac{C_p}{C_v} = \frac{5}{3}$ are mixed with 3 moles of another ideal gas with $\frac{C_p}{C_v} = \frac{4}{3}$. The value of $\frac{C_p}{C_v}$ for the mixture is:

- (A) 1.50 (B) 1.45 (C) 1.47 (D) 1.42

Q14 Thermodynamics[Step-by-step solution](#) > [prepwisar.in/questions/WYQ_dBcZ-H](https://www.prepwisar.in/questions/WYQ_dBcZ-H)

A litre of dry air at STP expands adiabatically to a volume of 3 litres. If $\gamma = 1.40$, the work done by air is : ($3^{1.4} = 4.6555$) [Take air to be an ideal gas]

- (A) 60.7 J (B) 100.8 J (C) 90.5 J (D) 48 J

Q15 Rotational Motion[Step-by-step solution](#) > [prepwisar.in/questions/XVnfFaTk9W](https://www.prepwisar.in/questions/XVnfFaTk9W)

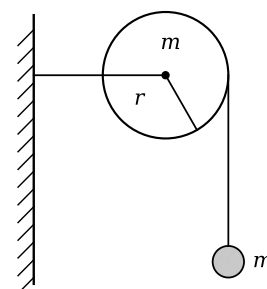
The radius of gyration of a uniform rod of length l , about an axis passing through a point $\frac{l}{4}$ away from the centre of the rod, and perpendicular to it, is:

- (A) $\frac{1}{8}l$ (B) $\frac{1}{4}l$ (C) $\sqrt{\frac{7}{48}}l$ (D) $\sqrt{\frac{3}{8}}l$

Q16 Rotational Motion[Step-by-step solution](#) > [prepwisar.in/questions/sZQqTAV4xF](https://www.prepwisar.in/questions/sZQqTAV4xF)

As shown in the figure, a bob of mass m is tied by a massless string whose other end portion is wound on a fly wheel (disc) of radius r and mass m . When released from rest the bob starts falling vertically. When it has covered a distance of h , the angular speed of the wheel will be:

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



Attempt this paper online with instant answer checking > [prepwisar.in/pyqs/paper/2020-01-07-morning](https://www.prepwisar.in/pyqs/paper/2020-01-07-morning)

Q17 Wave Optics[Step-by-step solution](#) > [prepwiser.in/questions/IRsbcRxp49](https://www.prepwiser.in/questions/IRsbcRxp49)

A polarizer - analyser set is adjusted such that the intensity of light coming out of the analyser is just 10% of the original intensity. Assuming that the polarizer - analyser set does not absorb any light, the angle by which the analyser need to be rotated further to reduce the output intensity to be zero, is:

- (A) 71.6° (B) 90° (C) 18.4° (D) 45°

Q18 Wave Optics[Step-by-step solution](#) > [prepwiser.in/questions/6Dc_UFVla9](https://www.prepwiser.in/questions/6Dc_UFVla9)

Visible light of wavelength 6000×10^{-8} cm falls normally on a single slit and produces a diffraction pattern. It is found that the second diffraction minimum is at 60° from the central maximum. If the first minimum is produced at θ_1 , then θ_1 , is close to:

- (A) 45° (B) 30° (C) 25° (D) 20°

Q19 Elasticity[Step-by-step solution](#) > [prepwiser.in/questions/ts4G12-04q](https://www.prepwiser.in/questions/ts4G12-04q)

Speed of a transverse wave on a straight wire (mass 6.0 g, length 60 cm and area of cross-section 1.0 mm^2) is 90 ms^{-1} . If the Young's modulus of wire is $16 \times 10^{11} \text{ Nm}^{-2}$, the extension of wire over its natural length is:

- (A) 0.03 mm (B) 0.04 mm (C) 0.02 mm (D) 0.01 mm

Q20 Work, Energy & Power[Step-by-step solution](#) > [prepwiser.in/questions/rQyRjOVq3s](https://www.prepwiser.in/questions/rQyRjOVq3s)

A 60 HP electric motor lifts an elevator having a maximum total load capacity of 2000 kg. If the frictional force on the elevator is 4000 N, the speed of the elevator at full load is close to: (1 HP = 746 W, $g = 10 \text{ ms}^{-2}$)

- (A) 1.5 ms^{-1} (B) 1.7 ms^{-1} (C) 2.0 ms^{-1} (D) 1.9 ms^{-1}

Physics Section B · Numerical value

Q21 to Q25

Q21 Dual Nature of Radiation & Matter**NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/CU40uwH_oZ](https://www.prepwiser.in/questions/CU40uwH_oZ)

A beam of electromagnetic radiation of intensity $6.4 \times 10^{-5} \text{ W/cm}^2$ is comprised of wavelength, $\lambda = 310 \text{ nm}$. It falls normally on a metal (work function $\phi = 2 \text{ eV}$) of surface area of 1 cm^2 . If one in 10^3 photons ejects an electron, total number of electrons ejected in 1 s is 10^x . ($hc = 1240 \text{ eVnm}$, $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$), then x is ____.

Q22 Electromagnetic Induction**NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/es33NwHe8c](https://www.prepwiser.in/questions/es33NwHe8c)

A loop ABCDEFA of straight edges has six corner points A(0, 0, 0), B(5, 0, 0), C(5, 5, 0), D(0, 5, 0), E(0, 5, 5) and F(0, 0, 5). The magnetic field in this region is $\vec{B} = (3\hat{i} + 4\hat{k}) T$. The quantity of flux through the loop ABCDEFA (in Wb) is ____.

Q23 Thermometry & Calorimetry**NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/vq2S1FixaC](https://www.prepwiser.in/questions/vq2S1FixaC)

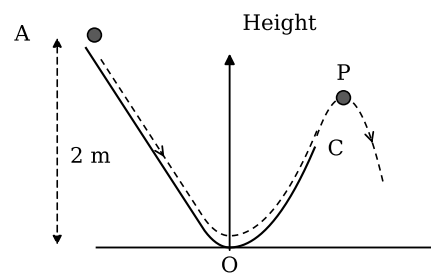
A non-isotropic solid metal cube has coefficients of linear expansion as: $5 \times 10^{-5}/^\circ\text{C}$ along the x-axis and $5 \times 10^{-6}/^\circ\text{C}$ along the y and the z-axis. If the coefficient of volume expansion of the solid is $C \times 10^{-6}/^\circ\text{C}$ then the value of C is

Q24 Thermodynamics**NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/dXQ7hfZbCC](https://www.prepwiser.in/questions/dXQ7hfZbCC)

A Carnot engine operates between two reservoirs of temperatures 900 K and 300 K. The engine performs 1200 J of work per cycle. The heat energy (in J) delivered by the engine to the low temperature reservoir, in a cycle, is ____.

A particle ($m = 1 \text{ kg}$) slides down a frictionless track (AOC) starting from rest at a point A (height 2 m). After reaching C, the particle continues to move freely in air as a projectile. When it reaches its highest point P (height 1 m), the kinetic energy of the particle (in J) is:

(Figure drawn is schematic and not to scale; take $g = 10 \text{ ms}^{-2}$)



Chemistry Section A · Multiple choice

Q26 to Q43

Match the following:

- (i) Riboflavin (a) Beriberi
 (ii) Thiamine (b) Scurvy
 (iii) Pyridoxine (c) Cheliosis
 (iv) Ascorbic acid (d) Convulsions

(A) (i)-(c), (ii)-(d), (iii)-(a), (iv)-(b)

(B) (i)-(d), (ii)-(b), (iii)-(a), (iv)-(c)

(C) (i)-c, (ii)-(a), (iii)-(d), (iv)-(b)

(D) (i)-(a), (ii)-(d), (iii)-(c), (iv)-(b)

The dipole of CCl_4 , CHCl_3 and CH_4 are in the order:

- (A) $\text{CCl}_4 < \text{CH}_4 < \text{CHCl}_3$ (B) $\text{CH}_4 = \text{CCl}_4 < \text{CHCl}_3$ (C) $\text{CH}_4 < \text{CCl}_4 < \text{CHCl}_3$ (D) $\text{CHCl}_3 < \text{CH}_4 = \text{CCl}_4$

The relative strength of interionic/intermolecular forces in decreasing order is:

- (A) dipole-dipole > ion-dipole > ion-ion (B) ion-dipole > dipole-dipole > ion-ion
 (C) ion-dipole > ion-ion > dipole-dipole (D) ion-ion > ion-dipole > dipole-dipole

The IUPAC name of complex $[\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{NH}_2\text{CH}_3)]\text{Cl}$ is:

- (A) Diamminechlorido (methanamine) platinum(II)chloride.
 (B) Biasmmine (methanamine)chlorido platinum(II)chloride.
 (C) Diamminechlorido (amminomethane) platinum(II) chloride.
 (D) Diammine (methanamine) chlorido platinum(II)Chloride.

The theory that can completely/properly explain the nature of bonding in $[\text{Ni}(\text{CO})_4]$ is:

- (A) Wemer's theory (B) Valence bond theory
 (C) Crystal field theory (D) Molecular orbital theory

The atomic radius of Ag is closed to:

- (A) Au (B) Cu (C) Hg (D) Ni

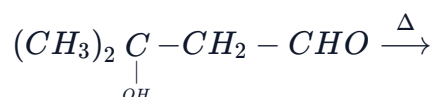
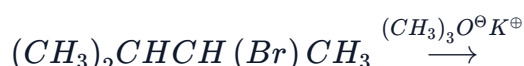
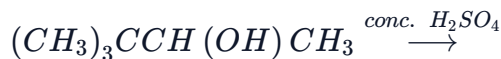
Q32 Electrochemistry[Step-by-step solution > prepwiser.in/questions/_tCDTXOSH](https://www.prepwiser.in/questions/_tCDTXOSH)

Given that the standard potentials (E°) of Cu^{2+}/Cu and Cu^+/Cu are 0.34 V and 0.522 V respectively, the E° of $\text{Cu}^{2+}/\text{Cu}^+$:

- (A) - 0.182 V (B) - 0.158 V (C) 0.182 V (D) +0.158 V

Q33 Halogen Derivatives: Haloalkanes & Haloarenes[Step-by-step solution > prepwiser.in/questions/2HgsS28H_0](https://www.prepwiser.in/questions/2HgsS28H_0)

Consider the following reaction:



Which of these reaction(s) will not produce Saytzeff product?

- (A) (d) only (B) (b) and (d) (C) (a), (c) and (d) (D) (c) only

Q34 Environmental Chemistry[Step-by-step solution > prepwiser.in/questions/D5s-GFAwOX](https://www.prepwiser.in/questions/D5s-GFAwOX)

In comparison to the zeolite process for the removal of permanent hardness, the synthetic resins method is:

- (A) less efficient as the resins cannot be regenerated.
(B) more efficient as it can exchange only cations.
(C) more efficient as it can exchange both cations as well as anions.
(D) less efficient as it exchanges only anions.

Q35 Metallurgy[Step-by-step solution > prepwiser.in/questions/VZ5Wb0OmxE](https://www.prepwiser.in/questions/VZ5Wb0OmxE)

The purest form of commercial iron is:

- (A) pig iron (B) wrought iron
(C) cast iron (D) scrap iron and pig iron

Q36 Periodic Table & Periodicity[Step-by-step solution > prepwiser.in/questions/B8PpgPJHEA](https://www.prepwiser.in/questions/B8PpgPJHEA)

The electron gain enthalpy (in KJ/mol) of fluorine, chlorine, bromine and iodine, respectively are:

- (A) -296, -325, -333 and -349 (B) 349, -333, -325 and -296
(C) -333, -349, -325 and -296 (D) -333, -325, -349 and -296

Q37 Redox Reactions[Step-by-step solution > prepwiser.in/questions/LirEcM1b97](https://www.prepwiser.in/questions/LirEcM1b97)

Oxidation number of potassium in K_2O , K_2O_2 and KO_2 respectively is:

- (A) +1, +2 and +4 (B) +1, +1 and +1 (C) +2, +1 and $+\frac{1}{2}$ (D) +1, +4, and +2

At 35°C, the vapour pressure of CS₂ is 512 mm. Hg and that of acetone is 344 mm Hg. A solution of CS₂ in acetone has a total vapour pressure of 600 mm Hg. The false statement amongst the following is:

- (A) CS₂ and acetone are less attracted to each other than to themselves.
- (B) a mixture of 100 ml. CS₂ and 100 ml. acetone has a volume < 200 ml.
- (C) Heat must be absorbed in order to produce the solution 35°C
- (D) Raoult's law is not obeyed by this system.

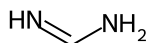
Amongst the following statements, that which was not proposed by Dalton was:

- (A) Matter consists of indivisible atoms all the atoms of a given element have.
- (B) Chemical reactions involve reorganization of atoms. These are neither created nor destroyed in a chemical reaction.
- (C) When gases combine or reproduced in a chemical reaction they do so in a simple ratio by volume provided all gases are the same T & P.
- (D) Identical properties including identical mass. Atoms of different element differ in mass.

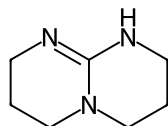
The number of orbitals associated with quantum number $n = 5$, $m_s = +\frac{1}{2}$ is:

- (A) 11
- (B) 25
- (C) 15
- (D) 50

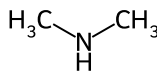
The increasing order to P_{kb} for the following compounds will be:



(A)



(B)



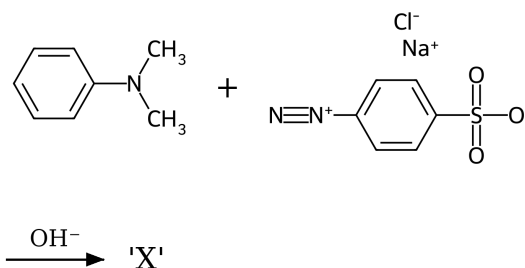
(C)

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

Consider the following reaction:

The product 'X' is used:

- (A) as food grade colourant
- (B) in acid base titration as an indicator.
- (C) in laboratory test for phenols
- (D) in protein estimation as an alternative to ninhydrin.



A solution of m-chloronailimne, m-chlorophenol and m-chlorobenzoic acid in ethyal acetate was extracted initially with a saturated solution of NaHCO_3 to give fraction A. The left over organic phase was extracted with dilute NaOH solution tio give fraction B. The final organiic layer was labelled as fraction C. Fractions A,B and C, contain respectively:

- (A) m-chlorobenzoic acid, m-chloroaniline and m-chlorophenol.
- (B) m-chlorobenzoic acid, m-chlorophenol and m-chloroaniline.
- (C) m-chlorophenol, m-chlorobenzoic acid and m-chloronailine.
- (D) m-chloroaniline m-chlorobenzoic acid and m-chlorophenol.

Chemistry Section B · Numerical value

Q44 to Q48

Q44 p-Block Elements: Part II (Group 15-18)

NUMERICAL

[Step-by-step solution](https://www.prepwiser.in/questions/3dtNxnGdL1) › prepwiser.in/questions/3dtNxnGdL1

Chlorine reacts with hot and concentrated NaOH and produces compounds (X) and (Y). Compound (X) gives white precipitate with silver nitrate solution. The average bond order between Cl and O atoms in (Y) is _____. (Round off to the nearest integer)

Q45 Nuclear & Radiochemistry

NUMERICAL

[Step-by-step solution](https://www.prepwiser.in/questions/0q-5qnOxzP) › prepwiser.in/questions/0q-5qnOxzP

During the nuclear explosion, one of the products is ^{90}Sr with half life of 6.93 years. If $1\ \mu\text{g}$ of ^{90}Sr was absorbed in the bones of newly born baby in placed of Ca, how much time, in years, is required to reduce it by 90% if it is not lost metabolically? (Round off to the nearest integer)

Q46 General Organic Chemistry (GOC)

NUMERICAL

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

The number of chiral carbons in chloramphenicol is

Q47 Ionic Equilibrium

NUMERICAL

[Step-by-step solution](https://www.prepwiser.in/questions/V5yCNBdt2k) › prepwiser.in/questions/V5yCNBdt2k

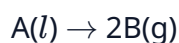
Two solutions, A and B, each of 100L was made by dissolving 4g of NaOH and 9.8 g of H_2SO_4 in water, respectively. The pH of the resultant solution obtained from mixing 40L of solution A and 10L of solution B is _____. (Round off to the nearest integer)

Q48 Chemical Thermodynamics

NUMERICAL

[Step-by-step solution](https://www.prepwiser.in/questions/NNue5V_xjj) › prepwiser.in/questions/NNue5V_xjj

For the reaction:



$$\Delta U = 2.1\text{ kcal}, \Delta S = 20\text{ cal K}^{-1} \text{ at } 300\text{ K}$$

Hence ΔG in kcal is _____. (Round off to the nearest integer)

Q49 Three Dimensional Geometry

[Step-by-step solution](#) › [prepwisar.in/questions/KG7RCbumo7](https://www.prepwisar.in/questions/KG7RCbumo7)

Let P be a plane passing through the points (2, 1, 0), (4, 1, 1) and (5, 0, 1) and R be any point (2, 1, 6). Then the image of R in the plane P is:

- (A) (4, 3, 2) (B) (6, 5, -2) (C) (3, 4, -2) (D) (6, 5, 2)

Q50 Applications of Derivatives

[Step-by-step solution](#) › [prepwisar.in/questions/NOOnL5XMBwP](https://www.prepwisar.in/questions/NOOnL5XMBwP)

Let the function, $f: [-7, 0] \rightarrow \mathbb{R}$ be continuous on $[-7, 0]$ and differentiable on $(-7, 0)$. If $f(-7) = -3$ and $f'(x) \leq 2$, for all $x \in (-7, 0)$, then for all such functions f , $f(-1) + f(0)$ lies in the interval:

- (A) $[-6, 20]$ (B) $(-\infty, 20]$ (C) $[-3, 11]$ (D) $(-\infty, 11]$

Q51 Sequences & Series

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

The greatest positive integer k , for which $49^k + 1$ is a factor of the sum $49^{125} + 49^{124} + \dots + 49^2 + 49 + 1$, is:

- (A) 32 (B) 60 (C) 63 (D) 65

Q52 Complex Numbers

[Step-by-step solution](#) › [prepwisar.in/questions/FyRo8pcCbW](https://www.prepwisar.in/questions/FyRo8pcCbW)

If $\operatorname{Re}\left(\frac{z-1}{2z+i}\right) = 1$, where $z = x + iy$, then the point (x, y) lies on a:

- (A) straight line whose slope is $\frac{3}{2}$ (B) straight line whose slope is $-\frac{2}{3}$
(C) circle whose diameter is $\frac{\sqrt{5}}{2}$ (D) circle whose centre is at $(-\frac{1}{2}, -\frac{3}{2})$

Q53 Definite Integration

[Step-by-step solution](#) › [prepwisar.in/questions/Vb8FgYjp_K](https://www.prepwisar.in/questions/Vb8FgYjp_K)

If $f(a + b + 1 - x) = f(x)$, for all x , where a and b are fixed positive real numbers, then

$\frac{1}{a+b} \int_a^b x (f(x) + f(x+1)) dx$ is equal to:

- (A) $\int_{a-1}^{b-1} f(x+1) dx$ (B) $\int_{a+1}^{b+1} f(x+1) dx$ (C) $\int_{a-1}^{b-1} f(x) dx$ (D) $\int_{a+1}^{b+1} f(x) dx$

Q54 Differential Equations

[Step-by-step solution](#) › [prepwisar.in/questions/_iy2nj7HZt](https://www.prepwisar.in/questions/_iy2nj7HZt)

If $y = y(x)$ is the solution of the differential equation, $e^y \left(\frac{dy}{dx} - 1 \right) = e^x$ such that $y(0) = 0$, then $y(1)$ is equal to:

- (A) $2 + \log_e 2$ (B) $\log_e 2$ (C) $1 + \log_e 2$ (D) $2e$

Q55 Differentiation

[Step-by-step solution](#) › [prepwisar.in/questions/Ch61x_mwrv](https://www.prepwisar.in/questions/Ch61x_mwrv)

Let $x^k + y^k = a^k$, ($a, k > 0$) and $\frac{dy}{dx} + \left(\frac{y}{x}\right)^{\frac{1}{3}} = 0$, then k is:

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

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Q56 Differentiation[Step-by-step solution](https://www.prepwiser.in/questions/kBouHP1p9K) › prepwiser.in/questions/kBouHP1p9K

If

$$y(\alpha) = \sqrt{2 \left(\frac{\tan \alpha + \cot \alpha}{1 + \tan^2 \alpha} \right) + \frac{1}{\sin^2 \alpha}}, \alpha \in \left(\frac{3\pi}{4}, \pi \right)$$

 $\frac{dy}{d\alpha}$ at $\alpha = \frac{5\pi}{6}$ is:**(A)** 4**(B)** -4**(C)** $\frac{4}{3}$ **(D)** $-\frac{1}{4}$ **Q57** Ellipse[Step-by-step solution](https://www.prepwiser.in/questions/iwWE8sfYEX) › prepwiser.in/questions/iwWE8sfYEX

If the distance between the foci of an ellipse is 6 and the distance between its directrices is 12, then the length of its latus rectum is:

(A) $\sqrt{3}$ **(B)** $3\sqrt{2}$ **(C)** $\frac{3}{\sqrt{2}}$ **(D)** $2\sqrt{3}$ **Q58** Relations & Functions (Basic)[Step-by-step solution](https://www.prepwiser.in/questions/JgupcoY8dA) › prepwiser.in/questions/JgupcoY8dAIf $g(x) = x^2 + x - 1$ and $(g \circ f)(x) = 4x^2 - 10x + 5$, then $f\left(\frac{5}{4}\right)$ is equal to:**(A)** $\frac{1}{2}$ **(B)** $\frac{3}{2}$ **(C)** $-\frac{1}{2}$ **(D)** $-\frac{3}{2}$ **Q59** Matrices[Step-by-step solution](https://www.prepwiser.in/questions/RCUPGjvXeR) › prepwiser.in/questions/RCUPGjvXeR

Let α be a root of the equation $x^2 + x + 1 = 0$ and the matrix $A =$

$$\frac{1}{\sqrt{3}} \begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha & \alpha^2 \\ 1 & \alpha^2 & \alpha^4 \end{bmatrix}$$

then the matrix A^{31} is equal to**(A)** A^2 **(B)** A **(C)** I_3 **(D)** A^3 **Q60** Determinants[Step-by-step solution](https://www.prepwiser.in/questions/hAgDZnGAdL) › prepwiser.in/questions/hAgDZnGAdL

If the system of linear equations

$$2x + 2ay + az = 0$$

$$2x + 3by + bz = 0$$

$$2x + 4cy + cz = 0,$$

where $a, b, c \in \mathbb{R}$ are non-zero distinct; has a non-zero solution, then:**(A)** $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P.**(B)** $a + b + c = 0$ **(C)** a, b, c are in G.P.**(D)** a, b, c are in A.P.**Q61** Parabola[Step-by-step solution](https://www.prepwiser.in/questions/stsaqIUGcx) › prepwiser.in/questions/stsaqIUGcxIf $y = mx + 4$ is a tangent to both the parabolas, $y^2 = 4x$ and $x^2 = 2by$, then b is equal to:**(A)** -128**(B)** 128**(C)** -64**(D)** -32

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Total number of 6-digit numbers in which only and all the five digits 1, 3, 5, 7 and 9 appear, is:

- (A) $\frac{5}{2} (6!)$ (B) $6!$ (C) 5^6 (D) $\frac{1}{2} (6!)$

An unbiased coin is tossed 5 times. Suppose that a variable X is assigned the value of k when k consecutive heads are obtained for $k = 3, 4, 5$, otherwise X takes the value -1. Then the expected value of X, is:

- (A) $-\frac{3}{16}$ (B) $-\frac{1}{8}$ (C) $\frac{1}{8}$ (D) $\frac{3}{16}$

Let α and β be two real roots of the equation

$(k+1)\tan^2 x - \sqrt{2} \cdot \lambda \tan x = (1-k)$, where $k(\neq -1)$ and λ are real numbers. If $\tan^2(\alpha + \beta) = 50$, then a value of λ is:

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

Five numbers are in A.P. whose sum is 25 and product is 2520. If one of these five numbers is $-\frac{1}{2}$, then the greatest number amongst them is:

- (A) $\frac{21}{2}$ (B) 27 (C) 7 (D) 16

A vector

$$\vec{a} = \alpha \hat{i} + 2\hat{j} + \beta \hat{k} \quad (\alpha, \beta \in R)$$

lies in the plane of the vectors, $\vec{b} = \hat{i} + \hat{j}$ and $\vec{c} = \hat{i} - \hat{j} + 4\hat{k}$. If $\vec{a}$ bisects the angle between $\vec{b}$ and $\vec{c}$, then:

- (A) $\vec{a} \cdot \hat{i} + 3 = 0$ (B) $\vec{a} \cdot \hat{k} - 4 = 0$ (C) $\vec{a} \cdot \hat{i} + 1 = 0$ (D) $\vec{a} \cdot \hat{k} + 2 = 0$

The area of the region, enclosed by the circle $x^2 + y^2 = 2$ which is not common to the region bounded by the parabola $y^2 = x$ and the straight line $y = x$, is:

- (A) $\frac{1}{6} (24\pi - 1)$ (B) $\frac{1}{3} (12\pi - 1)$ (C) $\frac{1}{3} (6\pi - 1)$ (D) $\frac{1}{6} (12\pi - 1)$

Mathematics Section B · Numerical value

Q68 to Q72

If the sum of the coefficients of all even powers of x in the product

$(1 + x + x^2 + \dots + x^{2n})(1 - x + x^2 - x^3 + \dots + x^{2n})$ is 61, then n is equal to _____.

$$\lim_{x \rightarrow 2} \frac{3^x + 3^{3-x} - 12}{3^{-x/2} - 3^{1-x}}$$

is equal to _____.

Let S be the set of points where the function, $f(x) = |2 - |x-3||$, $x \in \mathbb{R}$ is not differentiable. Then $\sum_{x \in S} f(f(x))$ is equal to ____.

If the variance of the first n natural numbers is 10 and the variance of the first m even natural numbers is 16, then $m + n$ is equal to ____.

Let $A(1, 0)$, $B(6, 2)$ and $C\left(\frac{3}{2}, 6\right)$ be the vertices of a triangle ABC . If P is a Point inside the triangle ABC such that the triangles APC , APB and BPC have equal areas, then the length of the line segment PQ , where Q is the point $\left(-\frac{7}{6}, -\frac{1}{3}\right)$, is ____.

Answer key: JEE Main 2020 · 7 Jan · Shift 1

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Physics

1. C	2. C	3. B	4. B	5. C	6. D	7. D	8. A	9. B	10. D
11. A	12. C	13. D	14. C	15. C	16. C	17. C	18. C	19. A	20. D
21. 11	22. 175	23. 60	24. 600	25. 10					

Chemistry

26. C	27. B	28. D	29. A	30. D	31. A	32. D	33. D	34. C	35. B
36. C	37. B	38. B	39. C	40. B	41. C	42. B	43. B	44. 2	45. 23
46. 2	47. 11	48. -3							

Mathematics

49. B	50. B	51. C	52. C	53. A	54. C	55. B	56. A	57. B	58. C
59. D	60. A	61. A	62. A	63. C	64. B	65. D	66. B	67. D	68. 30
69. 36	70. 3	71. 18	72. 5						

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