

JEE MAIN 2020 · QUESTION PAPER

9 Jan 2020 **Shift 2**

66 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	20 Q1 to Q20	4 Q21 to Q24
● Chemistry	17 Q25 to Q41	2 Q42 to Q43
● Mathematics	18 Q44 to Q61	5 Q62 to Q66
In this PDF	66 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.

prepwisar.in/pyqs/paper/2020-01-09-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? prepwisar.in/feedback · Terms: prepwisar.in/terms

Q1 Alternating Current

[Step-by-step solution](#) · [prepwise.in/questions/YsT3gkSaZM](https://www.prepwise.in/questions/YsT3gkSaZM)

In LC circuit the inductance $L = 40 \text{ mH}$ and capacitance $C = 100 \mu\text{F}$. If a voltage $V(t) = 10\sin(314t)$ is applied to the circuit, the current in the circuit is given as:

- (A) $0.52 \cos 314 t$ (B) $5.2 \cos 314 t$ (C) $0.52 \sin 314 t$ (D) $10 \cos 314 t$

Q2 Atomic Physics

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

The energy required to ionise a hydrogen like ion in its ground state is 9 Rydbergs. What is the wavelength of the radiation emitted when the electron in this ion jumps from the second excited state to the ground state?

- (A) 35.8 nm (B) 11.4 nm (C) 8.6 nm (D) 24.2 nm

Q3 Collision

[Step-by-step solution](#) · [prepwise.in/questions/SRB90V5xCN](https://www.prepwise.in/questions/SRB90V5xCN)

A particle of mass m is projected with a speed u from the ground at an angle $\theta = \frac{\pi}{3}$ w.r.t. horizontal (x -axis). When it has reached its maximum height, it collides completely inelastically with another particle of the same mass and velocity $u\hat{i}$. The horizontal distance covered by the combined mass before reaching the ground is:

- (A) $2\sqrt{2} \frac{u^2}{g}$ (B) $\frac{3\sqrt{3}}{8} \frac{u^2}{g}$ (C) $\frac{3\sqrt{2}}{4} \frac{u^2}{g}$ (D) $\frac{5}{8} \frac{u^2}{g}$

Q4 Centre of Mass & Linear Momentum

[Step-by-step solution](#) · [prepwise.in/questions/X7cYKfYt7Z](https://www.prepwise.in/questions/X7cYKfYt7Z)

A rod of length L has non-uniform linear mass density given by $\rho(x) = a + b\left(\frac{x}{L}\right)^2$, where a and b are constants and $0 \leq x \leq L$. The value of x for the centre of mass of the rod is at:

- (A) $\frac{3}{2} \left(\frac{a+b}{2a+b} \right) L$ (B) $\frac{4}{3} \left(\frac{a+b}{2a+3b} \right) L$ (C) $\frac{3}{4} \left(\frac{2a+b}{3a+b} \right) L$ (D) $\frac{3}{2} \left(\frac{2a+b}{3a+b} \right) L$

Q5 Dual Nature of Radiation & Matter

[Step-by-step solution](#) · [prepwise.in/questions/CQpgba9_vD](https://www.prepwise.in/questions/CQpgba9_vD)

An electron of mass m and magnitude of charge $|e|$ initially at rest gets accelerated by a constant electric field E . The rate of change of de-Broglie wavelength of this electron at time t ignoring relativistic effects is:

- (A) $\frac{-h}{|e| Et}$ (B) $\frac{-h}{|e| E\sqrt{t}}$ (C) $\frac{-h}{|e| Et^2}$ (D) $\frac{|e| Et}{h}$

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Q6 Electromagnetic Waves[Step-by-step solution > prepwiser.in/questions/FbsWzI0ucQ](https://www.prepwiser.in/questions/FbsWzI0ucQ)

A plane electromagnetic wave is propagating along the direction $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$, with its polarization along the direction $\hat{k}$. The correct form of the magnetic field of the wave would be (here B_0 is an appropriate constant):

(A) $B_0 \frac{\hat{i} - \hat{j}}{\sqrt{2}} \cos \left(\omega t - k \frac{\hat{i} + \hat{j}}{\sqrt{2}} \right)$

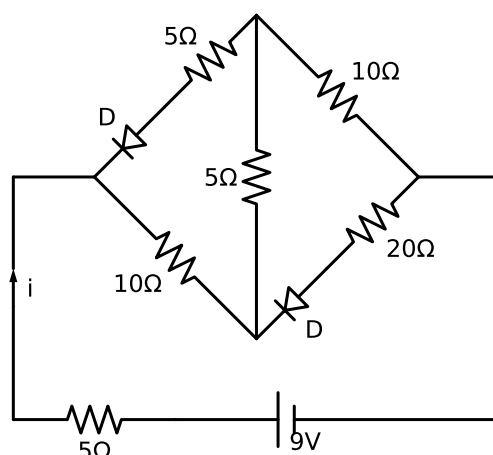
(B) $B_0 \frac{\hat{i} + \hat{j}}{\sqrt{2}} \cos \left(\omega t - k \frac{\hat{i} + \hat{j}}{\sqrt{2}} \right)$

(C) $B_0 \frac{\hat{j} - \hat{i}}{\sqrt{2}} \cos \left(\omega t + k \frac{\hat{i} + \hat{j}}{\sqrt{2}} \right)$

(D) $B_0 \hat{k} \cos \left(\omega t - k \frac{\hat{i} + \hat{j}}{\sqrt{2}} \right)$

Q7 Current Electricity[Step-by-step solution > prepwiser.in/questions/v0YwSNPdXB](https://www.prepwiser.in/questions/v0YwSNPdXB)

The current i in the network is:



(A) 0.6 A

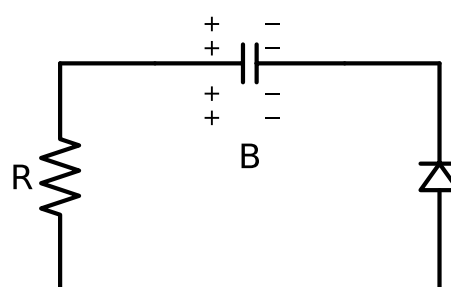
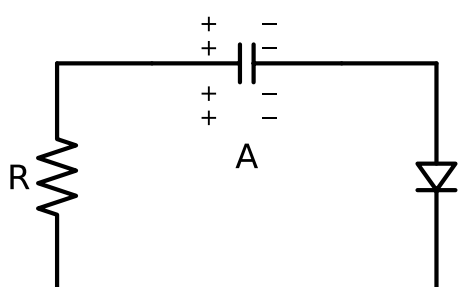
(B) 0.3 A

(C) 0 A

(D) 0.2 A

Q8 Electrostatics II: Potential & Capacitance[Step-by-step solution > prepwiser.in/questions/jrt-M417AM](https://www.prepwiser.in/questions/jrt-M417AM)

Two identical capacitors A and B, charged to the same potential 5V are connected in two different circuits as shown below at time $t = 0$. If the charge on capacitors A and B at time $t = CR$ is Q_A and Q_B respectively, then (Here e is the base of natural logarithm)



(A) $Q_A = \frac{CV}{e}, Q_B = \frac{VC}{2}$

(B) $Q_A = \frac{CV}{2}, Q_B = \frac{VC}{e}$

(C) $Q_A = VC, Q_B = \frac{VC}{e}$

(D) $Q_A = VC, Q_B = CV$

Q9 Ray Optics[Step-by-step solution > prepwiser.in/questions/IDSc1_rLZC](https://www.prepwiser.in/questions/IDSc1_rLZC)

There is a small source of light at some depth below the surface of water (refractive index $= \frac{4}{3}$) in a tank of large cross sectional surface area. Neglecting any reflection from the bottom and absorption by water, percentage of light that emerges out of surface is (nearly):

[Use the fact that surface area of a spherical cap of height h and radius of curvature r is $2\pi rh$]:

(A) 17%

(B) 34%

(C) 50%

(D) 21%

Q10 Gravitation[Step-by-step solution](#) > [prepwisar.in/questions/OiOJ3xLDME](https://www.prepwisar.in/questions/OiOJ3xLDME)

Planet A has mass M and radius R . Planet B has half the mass and half the radius of Planet A. If the escape velocities from the Planets A and B are v_A and v_B , respectively, then $\frac{v_A}{v_B} = \frac{n}{4}$. The value of n is:

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

Q11 Kinetic Theory of Gases[Step-by-step solution](#) > [prepwisar.in/questions/SRGOZNhX7m](https://www.prepwisar.in/questions/SRGOZNhX7m)

Two gases-argon (atomic radius 0.07 nm, atomic weight 40) and xenon (atomic radius 0.1 nm, atomic weight 140) have the same number density and are at the same temperature. The ratio of their respective mean free times is closest to:

- (A) 2.3 (B) 1.83 (C) 4.67 (D) 3.67

Q12 Magnetism & Matter[Step-by-step solution](#) > [prepwisar.in/questions/3M-5Z4xSd7](https://www.prepwisar.in/questions/3M-5Z4xSd7)

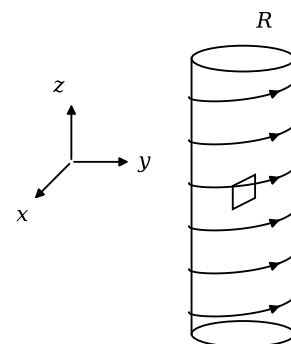
A small circular loop of conducting wire has radius a and carries current I . It is placed in a uniform magnetic field B perpendicular to its plane such that when rotated slightly about its diameter and released, it starts performing simple harmonic motion of time period T . If the mass of the loop is m then:

- (A) $T = \sqrt{\frac{2m}{IB}}$ (B) $T = \sqrt{\frac{\pi m}{IB}}$ (C) $T = \sqrt{\frac{\pi m}{2IB}}$ (D) $T = \sqrt{\frac{2\pi m}{IB}}$

Q13 Moving Charges & Magnetism[Step-by-step solution](#) > [prepwisar.in/questions/m7Y1jFixZq](https://www.prepwisar.in/questions/m7Y1jFixZq)

An electron gun is placed inside a long solenoid of radius R on its axis. The solenoid has n turns/length and carries a current I . The electron gun shoots an electron along the radius of the solenoid with speed v . If the electron does not hit the surface of the solenoid, maximum possible value of v is (all symbols have their standard meaning):

- (A) $\frac{e\mu_0 nIR}{4m}$ (B) $\frac{e\mu_0 nIR}{m}$ (C) $\frac{e\mu_0 nIR}{2m}$ (D) $\frac{2e\mu_0 nIR}{m}$

**Q14** Projectile Motion & Relative Motion[Step-by-step solution](#) > [prepwisar.in/questions/PcnwFORfj8](https://www.prepwisar.in/questions/PcnwFORfj8)

A particle starts from the origin at $t = 0$ with an initial velocity of $3.0 \hat{i}$ m/s and moves in the x - y plane with a constant acceleration $(6\hat{i} + 4\hat{j})$ m/s². The x -coordinate of the particle at the instant when its y -coordinate is 32 m is D meters. The value of D is :-

- (A) 40 (B) 32 (C) 50 (D) 60

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

Two steel wires having same length are suspended from a ceiling under the same load. If the ratio of their energy stored per unit volume is 1 : 4, the ratio of their diameters is:

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

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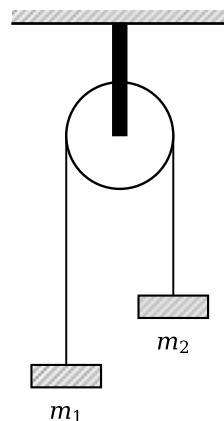
Q16 Surface Tension[Step-by-step solution](#) > [prepwiser.in/questions/-iqfMd_sZ](https://www.prepwiser.in/questions/-iqfMd_sZ)

A small spherical droplet of density d is floating exactly half immersed in a liquid of density ρ and surface tension T . The radius of the droplet is (take note that the surface tension applies an upward force on the droplet):

- (A) $r = \sqrt{\frac{T}{(d-\rho)g}}$ (B) $r = \sqrt{\frac{2T}{3(d+\rho)g}}$ (C) $r = \sqrt{\frac{T}{(d+\rho)g}}$ (D) $r = \sqrt{\frac{3T}{(2d-\rho)g}}$

Q17 Rotational Motion[Step-by-step solution](#) > [prepwiser.in/questions/jDFTANTrHV](https://www.prepwiser.in/questions/jDFTANTrHV)

A uniformly thick wheel with moment of inertia I and radius R is free to rotate about its centre of mass (see fig). A massless string is wrapped over its rim and two blocks of masses m_1 and m_2 ($m_1 > m_2$) are attached to the ends of the string. The system is released from rest. The angular speed of the wheel when m_1 descends by a distance h is:



- (A) $\left[\frac{2(m_1 + m_2)gh}{(m_1 + m_2)R^2 + I} \right]^{\frac{1}{2}}$ (B) $\left[\frac{m_1 + m_2}{(m_1 + m_2)R^2 + I} \right]^{\frac{1}{2}} gh$
 (C) $\left[\frac{(m_1 - m_2)}{(m_1 + m_2)R^2 + I} \right]^{\frac{1}{2}} gh$ (D) $\left[\frac{2(m_1 - m_2)gh}{(m_1 + m_2)R^2 + I} \right]^{\frac{1}{2}}$

Q18 Circular Motion[Step-by-step solution](#) > [prepwiser.in/questions/Qv8_81WWHD](https://www.prepwiser.in/questions/Qv8_81WWHD)

A spring mass system (mass m , spring constant k and natural length l) rest in equilibrium on a horizontal disc. The free end of the spring is fixed at the centre of the disc. If the disc together with spring mass system, rotates about its axis with an angular velocity ω , ($k \gg m\omega^2$) the relative change in the length of the spring is best given by the option:

- (A) $\frac{m\omega^2}{3k}$ (B) $\frac{m\omega^2}{k}$ (C) $\frac{2m\omega^2}{k}$ (D) $\sqrt{\frac{2}{3}} \left(\frac{m\omega^2}{k} \right)$

Q19 Mechanical Waves[Step-by-step solution](#) > [prepwiser.in/questions/17cG-Gs42E](https://www.prepwiser.in/questions/17cG-Gs42E)

A wire of length L and mass per unit length $6.0 \times 10^{-3} \text{ kgm}^{-1}$ is put under tension of 540 N. Two consecutive frequencies that it resonates at are : 420 Hz and 490 Hz. Then L in meters is:

- (A) 5.1 m (B) 2.1 m (C) 1.1 m (D) 8.1 m

Q20 Units, Dimensions & Errors[Step-by-step solution](#) > [prepwiser.in/questions/fiOx1v60aH](https://www.prepwiser.in/questions/fiOx1v60aH)

For the four sets of three measured physical quantities as given below. Which of the following options is correct?

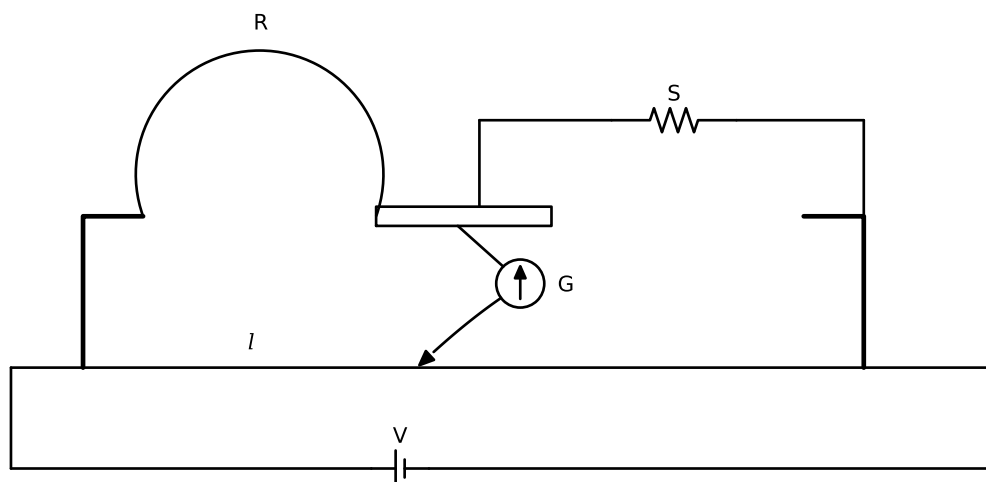
- (i) $A_1 = 24.36$, $B_1 = 0.0724$, $C_1 = 256.2$
 (ii) $A_2 = 24.44$, $B_2 = 16.082$, $C_2 = 240.2$
 (iii) $A_3 = 25.2$, $B_3 = 19.2812$, $C_3 = 236.183$
 (iv) $A_4 = 25$, $B_4 = 236.191$, $C_4 = 19.5$

- (A) $A_1 + B_1 + C_1 = A_2 + B_2 + C_2 = A_3 + B_3 + C_3 = A_4 + B_4 + C_4$
 (B) $A_4 + B_4 + C_4 < A_1 + B_1 + C_1 < A_3 + B_3 + C_3 < A_2 + B_2 + C_2$
 (C) $A_4 + B_4 + C_4 < A_1 + B_1 + C_1 = A_2 + B_2 + C_2 = A_3 + B_3 + C_3$
 (D) $A_4 + B_4 + C_4 > A_3 + B_3 + C_3 = A_2 + B_2 + C_2 > A_1 + B_1 + C_1$

Q21 Current Electricity **NUMERICAL**

[Step-by-step solution](#) > prepwiser.in/questions/q2kimzdhF3

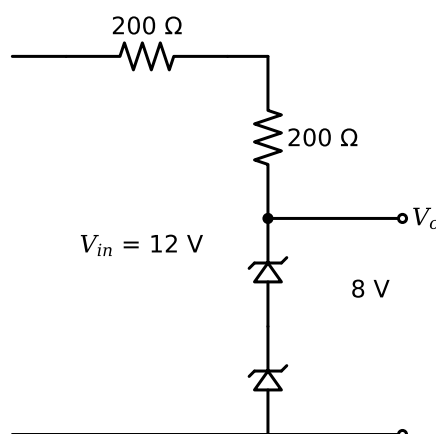
In a meter bridge experiment S is a standard resistance. R is a resistance wire. It is found that balancing length is $l = 25$ cm. If R is replaced by a wire of half length and half diameter that of R of same material, then the balancing distance l' (in cm) will now be_____.



Q22 Semiconductors & Electronic Devices **NUMERICAL**

[Step-by-step solution](#) > prepwiser.in/questions/ibnY5yUQqL

The circuit shown below is working as a 8 V dc regulated voltage source. When 12 V is used as input, the power dissipated (in mW) in each diode is; (considering both zener diodes are identical) _____.



Q23 Thermodynamics **NUMERICAL**

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

Starting at temperature 300 K, one mole of an ideal diatomic gas ($\gamma = 1.4$) is first compressed adiabatically from volume V_1 to $V_2 = \frac{V_1}{16}$. It is then allowed to expand isobarically to volume $2V_2$. If all the processes are the quasi-static then the final temperature of the gas (in $^{\circ}\text{K}$) is (to the nearest integer) _____.

Q24 Wave Optics **NUMERICAL**

[Step-by-step solution](#) > prepwiser.in/questions/YMzEob8UMp

In a Young's double slit experiment 15 fringes are observed on a small portion of the screen when light of wavelength 500 nm is used. Ten fringes are observed on the same section of the screen when another light source of wavelength λ is used. Then the value of λ is (in nm) _____.

Q25 Chemical Bonding & Molecular Structure[Step-by-step solution](#) › prepwiser.in/questions/j0gtqPFaPA

The number of sp^2 hybrid orbitals in a molecule of benzene is:

- (A) 24 (B) 12 (C) 6 (D) 18

Q26 Coordination Compounds[Step-by-step solution](#) › prepwiser.in/questions/u7L_mq1Waq

The isomer(s) of $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]$ that has/have a Cl-Co-Cl angle of 90° , is/are:

- (A) cis only (B) cis and trans
(C) meridional and trans (D) trans only

Q27 Coordination Compounds[Step-by-step solution](#) › prepwiser.in/questions/cB_PLjyA9K

The correct order of the spin-only magnetic moments of the following complexes is:

- (I) $[\text{Cr}(\text{H}_2\text{O})_6]\text{Br}_2$
(II) $\text{Na}_4[\text{Fe}(\text{CN})_6]$
(III) $\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$ ($\Delta_0 > P$)
(IV) $(\text{Et}_4\text{N})_2[\text{CoCl}_4]$

- (A) (III) > (I) > (II) > (IV) (B) (II) $\approx$ (I) > (IV) > (III) (C) (III) > (I) > (IV) > (II) (D) (I) > (IV) > (III) > (II)

Q28 d & f Block Elements[Step-by-step solution](#) › prepwiser.in/questions/EA7a522Hik

5 g of zinc is treated separately with an excess of

- (a) dilute hydrochloric acid and
(b) aqueous sodium hydroxide.

The ratio of the volumes of H_2 evolved in these two reactions is:

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

Q29 Electrochemistry[Step-by-step solution](#) › prepwiser.in/questions/VzZVpsogD9

Amongst the following, the form of water with the lowest ionic conductance at 298 K is:

- (A) saline water used for intravenous injection (B) sea water
(C) distilled water (D) water from a well

Q30 Ionic Equilibrium[Step-by-step solution](#) › prepwiser.in/questions/SRU5Gca_2F

The solubility product of $\text{Cr}(\text{OH})_3$ at 298 K is 6.0×10^{-31} . The concentration of hydroxide ions in a saturated solution of $\text{Cr}(\text{OH})_3$ will be:

- (A) $(2.22 \times 10^{-31})^{1/4}$ (B) $(4.86 \times 10^{-29})^{1/4}$ (C) $(18 \times 10^{-31})^{1/4}$ (D) $(18 \times 10^{-31})^{1/2}$

Q31 p-Block Elements: Part I (Group 13 & 14)[Step-by-step solution](#) › prepwiser.in/questions/Dvi2Gryk73

The reaction of $\text{H}_3\text{N}_3\text{B}_3\text{Cl}_3$ (A) with LiBH_4 in tetrahydrofuran gives inorganic benzene (B). Further, the reaction of (A) with (C) leads to $\text{H}_3\text{N}_3\text{B}_3(\text{Me})_3$. Compounds (B) and (C) respectively, are:

- (A) Borazine and MeBr (B) Diborane and MeMgBr
(C) Boron nitride and MeBr (D) Borazine and MeMgBr

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The first and second ionisation enthalpies of a metal are 496 and 4560 kJ mol⁻¹, respectively. How many moles of HCl and H₂SO₄, respectively, will be needed to react completely with 1 mole of the metal hydroxide?

- (A) 1 and 2 (B) 1 and 0.5 (C) 1 and 1 (D) 2 and 0.5

Which polymer has 'chiral' monomer(s)?

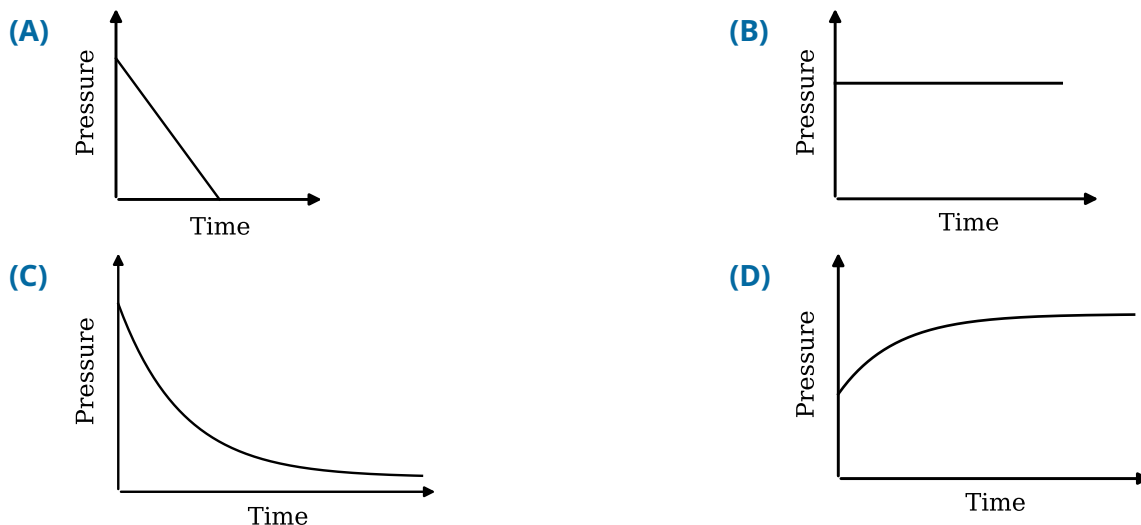
- (A) Nylon 6,6 (B) Buna-N (C) PHBV (D) Neoprene

Among the statements (a)-(d) the correct ones are:

- (a) Lithium has the highest hydration enthalpy among the alkali metals.
(b) Lithium chloride is insoluble in pyridine.
(c) Lithium cannot form ethynide upon its reaction with ethyne.
(d) Both lithium and magnesium react slowly with H₂O.

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

A mixture of gases O₂, H₂ and CO are taken in a closed vessel containing charcoal. The graph that represents the correct behaviour of pressure with time is:



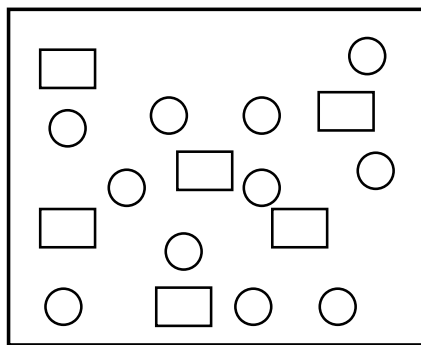
The true statement amongst the following is:

- (A) S is a function of temperature but ΔS is not a function of temperature.
(B) Both S and ΔS are not functions of temperature.
(C) Both ΔS and S are functions of temperature.
(D) S is not a function of temperature but ΔS is a function of temperature.

Which of the following has the shortest C-Cl bond?

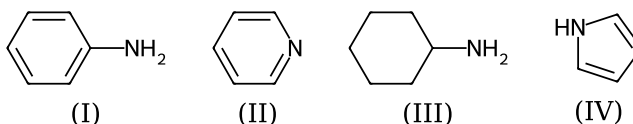
- (A) Cl-CH=CH-CH₃ (B) Cl-CH=CH-NO₂ (C) Cl-CH=CH-OCH₃ (D) Cl-CH=CH₂

In the figure shown below reactant A (represented by square) is in equilibrium with product B (represented by circle). The equilibrium constant is:



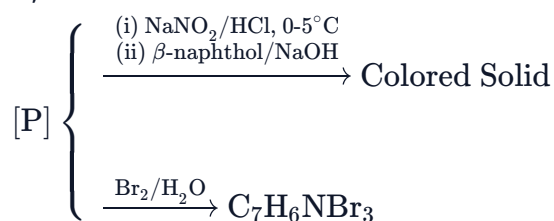
- (A) 1 (B) 2 (C) 8 (D) 4

The decreasing order of basicity of the following amines is:



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

Consider the following reactions,



The compound [P] is:



A, B and C are three biomolecules. The results of the tests performed on them are given below:

	Molisch's Test	Barfoed Test	Biuret Test
A	Positive	Negative	Negative
B	Positive	Positive	Negative
C	Negative	Negative	Positive

A, B and C are respectively:

- (A) A = Lactose, B = Glucose, C = Albumin (B) A = Lactose, B = Fructose, C = Alanine
 (C) A = Lactose, B = Glucose, C = Alanine (D) A = Glucose, B = Fructose, C = Albumin

Q42 Chemical Kinetics **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/knMFIBXitz](https://www.prepwiser.in/questions/knMFIBXitz)

A sample of milk splits after 60 min. at 300 K and after 40 min. at 400 K when the population of lactobacillus acidophilus in it doubles. The activation energy (in kJ/mol) for this process is closest to _____.

(Given, $R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$, $\ln\left(\frac{3}{2}\right) = 0.4$, $e^{-3} = 4.0$)

Q43 Solutions & Colligative Properties **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/90GwfFXaV1](https://www.prepwiser.in/questions/90GwfFXaV1)

10.30 mg of O_2 is dissolved into a liter of sea water of density 1.03 g/mL. The concentration of O_2 in ppm is _____.

Mathematics Section A · Multiple choice

Q44 Binomial Theorem[Step-by-step solution](#) > [prepwiser.in/questions/YmCwZSGs0J](https://www.prepwiser.in/questions/YmCwZSGs0J)

In the expansion of $\left(\frac{x}{\cos\theta} + \frac{1}{x\sin\theta}\right)^{16}$, if ℓ_1 is the least value of the term independent of x when $\frac{\pi}{8} \leq \theta \leq \frac{\pi}{4}$ and ℓ_2 is the least value of the term independent of x when $\frac{\pi}{16} \leq \theta \leq \frac{\pi}{8}$, then the ratio $\ell_2 : \ell_1$ is equal to:

- (A) 8 : 1 (B) 16 : 1 (C) 1 : 8 (D) 1 : 16

Q45 Complex Numbers[Step-by-step solution](#) > [prepwiser.in/questions/rW2W7bqSOR](https://www.prepwiser.in/questions/rW2W7bqSOR)

If z be a complex number satisfying $|\text{Re}(z)| + |\text{Im}(z)| = 4$, then $|z|$ cannot be:

- (A) $\sqrt{10}$ (B) $\sqrt{7}$ (C) $\sqrt{\frac{17}{2}}$ (D) $\sqrt{8}$

Q46 Applications of Derivatives[Step-by-step solution](#) > [prepwiser.in/questions/OETZjIZOly](https://www.prepwiser.in/questions/OETZjIZOly)

Let a function $f : [0, 5] \rightarrow \mathbb{R}$ be continuous, $f(1) = 3$ and F be defined as:

$$F(x) = \int_1^x t^2 g(t) dt, \text{ where } g(t) = \int_1^t f(u) du$$

Then for the function F , the point $x = 1$ is:

- (A) a point of inflection. (B) a point of local maxima.
(C) a point of local minima. (D) not a critical point.

Q47 Differential Equations[Step-by-step solution](#) > [prepwiser.in/questions/PbsVRREvzY](https://www.prepwiser.in/questions/PbsVRREvzY)

If $\frac{dy}{dx} = \frac{xy}{x^2 + y^2}$; $y(1) = 1$; then a value of x satisfying $y(x) = e$ is:

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

Q48 Differentiation[Step-by-step solution](#) > [prepwiser.in/questions/5m8tjpU1kD](https://www.prepwiser.in/questions/5m8tjpU1kD)

Let f and g be differentiable functions on $\mathbb{R}$ such that $f \circ g$ is the identity function. If for some $a, b \in \mathbb{R}$, $g'(a) = 5$ and $g(a) = b$, then $f'(b)$ is equal to:

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

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Q49 Differentiation[Step-by-step solution > prepwise.in/questions/Kypjkmjt7](https://www.prepwise.in/questions/Kypjkmjt7)

If $x = 2 \sin \theta - \sin 2\theta$ and $y = 2 \cos \theta - \cos 2\theta$,
 $\theta \in [0, 2\pi]$, then $\frac{d^2y}{dx^2}$ at $\theta = \pi$ is:

- (A) $\frac{3}{8}$ (B) $\frac{3}{2}$ (C) $\frac{3}{4}$ (D) $-\frac{3}{4}$

Q50 Ellipse[Step-by-step solution > prepwise.in/questions/nINtMUWQxo](https://www.prepwise.in/questions/nINtMUWQxo)

The length of the minor axis (along y-axis) of an ellipse in the standard form is $\frac{4}{\sqrt{3}}$. If this ellipse touches the line, $x + 6y = 8$; then its eccentricity is:

- (A) $\frac{1}{3} \sqrt{\frac{11}{3}}$ (B) $\frac{1}{2} \sqrt{\frac{5}{3}}$ (C) $\sqrt{\frac{5}{6}}$ (D) $\frac{1}{2} \sqrt{\frac{11}{3}}$

Q51 Determinants[Step-by-step solution > prepwise.in/questions/lkQrMy2Dfg](https://www.prepwise.in/questions/lkQrMy2Dfg)

Let $a - 2b + c = 1$.

If

$$f(x) = \begin{vmatrix} x+a & x+2 & x+1 \\ x+b & x+3 & x+2 \\ x+c & x+4 & x+3 \end{vmatrix}$$

, then:

- (A) $f(50) = 1$ (B) $f(-50) = -1$ (C) $f(50) = -501$ (D) $f(-50) = 501$

Q52 Continuity & Differentiability[Step-by-step solution > prepwise.in/questions/aqbeFI0v](https://www.prepwise.in/questions/aqbeFI0v)

Let $[t]$ denote the greatest integer $\leq t$ and $\lim_{x \rightarrow 0} x \left[\frac{4}{x} \right] = A$.

Then the function, $f(x) = [x^2] \sin(\pi x)$ is discontinuous, when x is equal to:

- (A) $\sqrt{A+1}$ (B) $\sqrt{A+5}$ (C) $\sqrt{A+21}$ (D) $\sqrt{A}$

Q53 Determinants[Step-by-step solution > prepwise.in/questions/bfTTY8Ikzo](https://www.prepwise.in/questions/bfTTY8Ikzo)

The following system of linear equations

$$7x + 6y - 2z = 0$$

$$3x + 4y + 2z = 0$$

$$x - 2y - 6z = 0, \text{ has}$$

- (A) no solution
(B) infinitely many solutions, (x, y, z) satisfying $y = 2z$
(C) infinitely many solutions, (x, y, z) satisfying $x = 2z$
(D) only the trivial solution

Q54 Parabola[Step-by-step solution > prepwise.in/questions/5p2gGCaIOX](https://www.prepwise.in/questions/5p2gGCaIOX)

If one end of a focal chord AB of the parabola $y^2 = 8x$ is at $A\left(\frac{1}{2}, -2\right)$, then the equation of the tangent to it at B is:

- (A) $2x - y - 24 = 0$ (B) $x - 2y + 8 = 0$ (C) $x + 2y + 8 = 0$ (D) $2x + y - 24 = 0$

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Q55 Probability: Advanced[Step-by-step solution](#) > [prepwiser.in/questions/dtOrWPkUGd](https://www.prepwiser.in/questions/dtOrWPkUGd)

A random variable X has the following probability distribution: Then $P(X > 2)$ is equal to:

X:	1	2	3	4	5
P(X):	K^2	$2K$	K	$2K$	$5K^2$

- (A) $\frac{1}{6}$ (B) $\frac{7}{12}$ (C) $\frac{1}{36}$ (D) $\frac{23}{36}$

Q56 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](#) > [prepwiser.in/questions/EeQ77tUASg](https://www.prepwiser.in/questions/EeQ77tUASg)

Let $a, b \in \mathbb{R}$, $a \neq 0$ be such that the equation, $ax^2 - 2bx + 5 = 0$ has a repeated root α , which is also a root of the equation, $x^2 - 2bx - 10 = 0$. If β is the other root of this equation, then $\alpha^2 + \beta^2$ is equal to:

- (A) 28 (B) 24 (C) 26 (D) 25

Q57 Sequences & Series[Step-by-step solution](#) > [prepwiser.in/questions/dy6sMYic6m](https://www.prepwiser.in/questions/dy6sMYic6m)

Let a_n be the n^{th} term of a G.P. of positive terms.

$$\sum_{n=1}^{100} a_{2n+1} = 200 \text{ and } \sum_{n=1}^{100} a_{2n} = 100,$$

then $\sum_{n=1}^{200} a_n$ is equal to:

- (A) 150 (B) 175 (C) 225 (D) 300

Q58 Sets[Step-by-step solution](#) > [prepwiser.in/questions/I1LImGvbTI](https://www.prepwiser.in/questions/I1LImGvbTI)

If $A = \{x \in \mathbb{R} : |x| < 2\}$ and $B = \{x \in \mathbb{R} : |x - 2| \geq 3\}$; then:

- (A) $A - B = [-1, 2)$ (B) $A \cup B = \mathbb{R} - (2, 5)$ (C) $A \cap B = (-2, -1)$ (D) $B - A = \mathbb{R} - (-2, 5)$

Q59 Area Under Curves[Step-by-step solution](#) > [prepwiser.in/questions/9JCj5FNrHr](https://www.prepwiser.in/questions/9JCj5FNrHr)

$$\text{Given: } f(x) = \begin{cases} x, & 0 \leq x < \frac{1}{2} \\ \frac{1}{2}, & x = \frac{1}{2} \\ 1 - x, & \frac{1}{2} < x \leq 1 \end{cases}$$

$$\text{and } g(x) = \left(x - \frac{1}{2}\right)^2, x \in \mathbb{R}$$

Then the area (in sq. units) of the region bounded by the curves, $y = f(x)$ and $y = g(x)$ between the lines, $2x = 1$ and $2x = \sqrt{3}$, is:

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

Q60 Indefinite Integration[Step-by-step solution](#) > [prepwiser.in/questions/d2LqX1yjmW](https://www.prepwiser.in/questions/d2LqX1yjmW)

$$\text{If } \int \frac{d\theta}{\cos^2 \theta (\tan 2\theta + \sec 2\theta)} = \lambda \tan \theta + 2 \log_e |f(\theta)| + C$$

where C is a constant of integration, then the ordered pair $(\lambda, f(\theta))$ is equal to:

- (A) $(-1, 1 - \tan \theta)$ (B) $(1, 1 + \tan \theta)$ (C) $(-1, 1 + \tan \theta)$ (D) $(1, 1 - \tan \theta)$

Q61 Trigonometric Ratios & Identities[Step-by-step solution](#) > [prepwiser.in/questions/n3-rgVxpHP](https://www.prepwiser.in/questions/n3-rgVxpHP)

$$\text{If } x = \sum_{n=0}^{\infty} (-1)^n \tan^{2n} \theta \text{ and } y = \sum_{n=0}^{\infty} \cos^{2n} \theta$$

for $0 < \theta < \frac{\pi}{4}$, then:

- (A) $x(1 + y) = 1$ (B) $y(1 - x) = 1$ (C) $y(1 + x) = 1$ (D) $x(1 - y) = 1$

Q62 Three Dimensional Geometry **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/D5GvY_DFe2](https://www.prepwisar.in/questions/D5GvY_DFe2)

If the distance between the plane, $23x - 10y - 2z + 48 = 0$ and the plane containing the lines $\frac{x+1}{2} = \frac{y-3}{4} = \frac{z+1}{3}$ and

$$\frac{x+3}{2} = \frac{y+2}{6} = \frac{z-1}{\lambda} (\lambda \in R)$$

is equal to $\frac{k}{\sqrt{633}}$, then k is equal to ____.

Q63 Binomial Theorem **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/juPzmI4UU3](https://www.prepwisar.in/questions/juPzmI4UU3)

If $C_r \equiv {}^{25}C_r$ and $C_0 + 5.C_1 + 9.C_2 + \dots + (101).C_{25} = 2^{25}.k$, then k is equal to ____.

Q64 Circles **NUMERICAL**

[Step-by-step solution](#) › [prepwisar.in/questions/mEjAfGa7yI](https://www.prepwisar.in/questions/mEjAfGa7yI)

If the curves, $x^2 - 6x + y^2 + 8 = 0$ and $x^2 - 8y + y^2 + 16 - k = 0$, ($k > 0$) touch each other at a point, then the largest value of k is ____.

Q65 Sequences & Series **NUMERICAL**

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

The number of terms common to the two A.P.'s 3, 7, 11, ..., 407 and 2, 9, 16, ..., 709 is ____.

Q66 Vectors **NUMERICAL**

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

Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three vectors such that $|\vec{a}| = \sqrt{3}$,

$$|\vec{b}| = 5, \vec{b} \cdot \vec{c} = 10$$

and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$. If $\vec{a}$ is perpendicular to the vector $\vec{b} \times \vec{c}$, then

$$|\vec{a} \times (\vec{b} \times \vec{c})|$$

is equal to ____.

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Physics

1.	A	2.	B	3.	B	4.	C	5.	C	6.	A	7.	B	8.	C
9.	A	10.	C	11.	B	12.	D	13.	C	14.	D	15.	D	16.	D
17.	D	18.	B	19.	B	20.	D	21.	40	22.	40	23.	1819	24.	750

Chemistry

25.	D	26.	A	27.	D	28.	B	29.	C	30.	C	31.	D	32.	B
33.	C	34.	D	35.	C	36.	C	37.	B	38.	B	39.	A	40.	B
41.	A	42.	4	43.	10										

Mathematics

44.	B	45.	B	46.	C	47.	D	48.	D	49.	A	50.	D	51.	A
52.	A	53.	C	54.	B	55.	D	56.	D	57.	A	58.	D	59.	D
60.	C	61.	B	62.	3	63.	51	64.	36	65.	14	66.	30		

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