

JEE MAIN 2020 · QUESTION PAPER

8 Jan 2020 **Shift 2**

68 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	18 Q1 to Q18	5 Q19 to Q23
● Chemistry	18 Q24 to Q41	4 Q42 to Q45
● Mathematics	19 Q46 to Q64	4 Q65 to Q68
In this PDF	68 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/2020-01-08-evening · Free, no signup needed to start

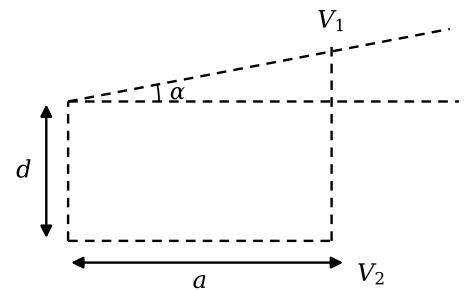
Answers follow NTA's final answer keys. Typing errors are possible, so check doubtful answers against the official key. Spotted a mistake?
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Q1 Electrostatics II: Potential & Capacitance

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

A capacitor is made of two square plates each of side 'a' making a very small angle α between them, as shown in figure. The capacitance will be close to:

- (A) $\frac{\epsilon_0 a^2}{d} \left(1 + \frac{\alpha a}{d}\right)$ (B) $\frac{\epsilon_0 a^2}{d} \left(1 - \frac{\alpha a}{4d}\right)$
 (C) $\frac{\epsilon_0 a^2}{d} \left(1 - \frac{\alpha a}{2d}\right)$ (D) $\frac{\epsilon_0 a^2}{d} \left(1 - \frac{3\alpha a}{2d}\right)$



Q2 Collision

[Step-by-step solution](https://www.prepwiser.in/questions/9OVb9xPFkI) > prepwiser.in/questions/9OVb9xPFkI

A particle of mass m is dropped from a height h above the ground. At the same time another particle of the same mass is thrown vertically upwards from the ground with a speed of $\sqrt{2gh}$. If they collide head-on completely inelastically, the time taken for the combined mass to reach the ground, in units of $\sqrt{\frac{h}{g}}$ is:

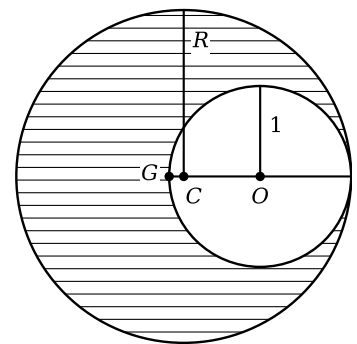
- (A) $\sqrt{\frac{1}{2}}$ (B) $\frac{1}{2}$ (C) $\sqrt{\frac{3}{2}}$ (D) $\sqrt{\frac{3}{4}}$

Q3 Centre of Mass & Linear Momentum

[Step-by-step solution](https://www.prepwiser.in/questions/I8jhDgR-iL) > prepwiser.in/questions/I8jhDgR-iL

As shown in figure, when a spherical cavity (centered at O) of radius 1 is cut out of a uniform sphere of radius R (centered at C), the centre of mass of remaining (shaded) part of sphere is at G, i.e., on the surface of the cavity. R can be determined by the equation:

- (A) $(R^2 + R - 1)(2 - R) = 1$ (B) $(R^2 - R - 1)(2 - R) = 1$
 (C) $(R^2 - R + 1)(2 - R) = 1$ (D) $(R^2 + R + 1)(2 - R) = 1$



Q4 Moving Charges & Magnetism

[Step-by-step solution](https://www.prepwiser.in/questions/nM6QoVvF_x) > prepwiser.in/questions/nM6QoVvF_x

A galvanometer having a coil resistance 100Ω gives a full scale deflection when a current of 1 mA is passed through it. What is the value of the resistance which can convert this galvanometer into a voltmeter giving full scale deflection for a potential difference of 10 V?

- (A) 8.9 k Ω (B) 10 k Ω (C) 9.9 k Ω (D) 7.9 k Ω

Q5 Dual Nature of Radiation & Matter

[Step-by-step solution](https://www.prepwiser.in/questions/IpNXnna6vo) > prepwiser.in/questions/IpNXnna6vo

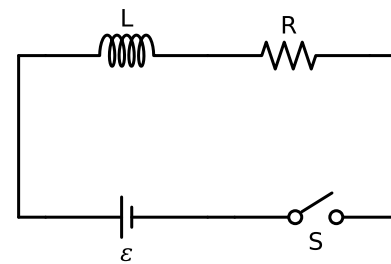
An electron (mass m) with initial velocity $\vec{v} = v_0 \hat{i} + v_0 \hat{j}$ is in an electric field $\vec{E} = -E_0 \hat{k}$. If λ_0 is initial de-Broglie wavelength of electron, its de-Broglie wave length at time t is given by:

- (A) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$ (B) $\frac{\lambda_0 \sqrt{2}}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$ (C) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{2m^2 v_0^2}}}$ (D) $\frac{\lambda_0}{\sqrt{2 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$

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Q6 Electromagnetic Induction[Step-by-step solution > prepwisar.in/questions/PJLQdCQAUI](https://www.prepwisar.in/questions/PJLQdCQAUI)

A shown in the figure, a battery of emf ε is connected to an inductor L and resistance R in series. The switch is closed at $t = 0$. The total charge that flows from the battery, between $t = 0$ and $t = t_c$ (t_c is the time constant of the circuit) is:



- (A) $\frac{\varepsilon L}{eR^2}$ (B) $\frac{\varepsilon L}{R^2}$
(C) $\frac{\varepsilon L}{R^2} \left(1 - \frac{1}{e}\right)$ (D) $\frac{\varepsilon R}{eL^2}$

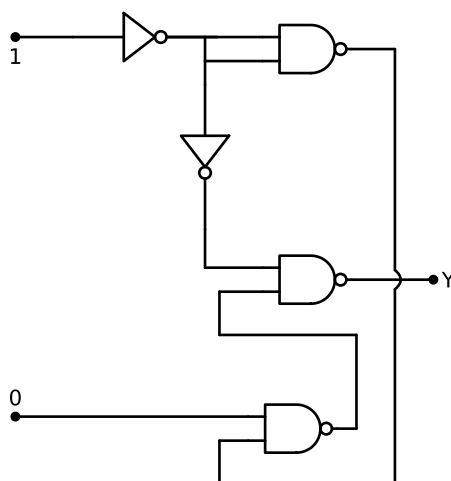
Q7 Electromagnetic Waves[Step-by-step solution > prepwisar.in/questions/BZnDiiNUax](https://www.prepwisar.in/questions/BZnDiiNUax)

A plane electromagnetic wave of frequency 25 GHz is propagating in vacuum along the z -direction. At a particular point in space and time, the magnetic field is given by $\vec{B} = 5 \times 10^{-8} \hat{j} T$. The corresponding electric field $\vec{E}$ is (speed of light $c = 3 \times 10^8 \text{ ms}^{-1}$)

- (A) $15 \hat{i} \text{ V/m}$ (B) $-15 \hat{i} \text{ V/m}$ (C) $1.66 \times 10^{-16} \hat{i} \text{ V/m}$ (D) $-1.66 \times 10^{-16} \hat{i} \text{ V/m}$

Q8 Semiconductors & Electronic Devices[Step-by-step solution > prepwisar.in/questions/eUJ93Xz8IT](https://www.prepwisar.in/questions/eUJ93Xz8IT)

In the given circuit, value of Y is:



- (A) toggles between 0 and 1 (B) 1
(C) will not execute (D) 0

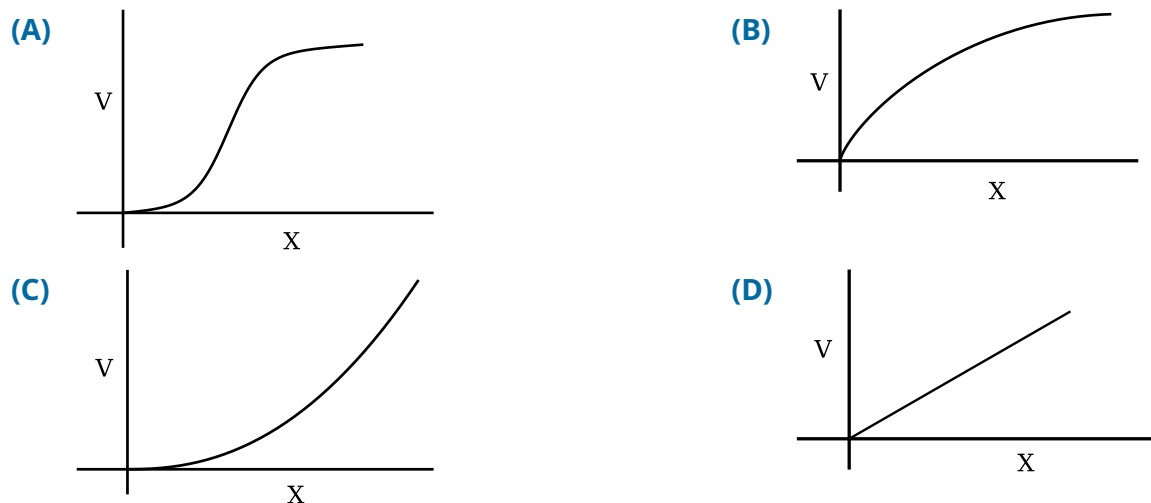
Q9 Electrostatics II: Potential & Capacitance[Step-by-step solution > prepwisar.in/questions/eVMbiYmPRE](https://www.prepwisar.in/questions/eVMbiYmPRE)

Consider two charged metallic spheres S_1 and S_2 of radii R_1 and R_2 , respectively. The electric fields E_1 (on S_1) and E_2 (on S_2) on their surfaces are such that $E_1/E_2 = R_1/R_2$. Then the ratio V_1 (on S_1) / V_2 (on S_2) of the electrostatic potentials on each sphere is:

- (A) $(R_1/R_2)^2$ (B) (R_2/R_1) (C) $(R_1/R_2)^3$ (D) R_1/R_2

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A particle of mass m and charge q is released from rest in a uniform electric field. If there is no other force on the particle, the dependence of its speed v on the distance x travelled by it is correctly given by (graphs are schematic and not drawn to scale)



Consider a mixture of n moles of helium gas and $2n$ moles of oxygen gas (molecules taken to be rigid) as an ideal gas. Its C_p/C_v value will be:

- (A) 23/15 (B) 67/45 (C) 40/27 (D) 19/13

A carnot engine having an efficiency of $\frac{1}{10}$ is being used as a refrigerator. If the work done on the refrigerator is 10 J, the amount of heat absorbed from the reservoir at lower temperature is:

- (A) 90 J (B) 99 J (C) 1 J (D) 100 J

A particle moves such that its position vector

$$\vec{r}(t) = \cos \omega t \hat{i} + \sin \omega t \hat{j}$$

where ω is a constant and t is time. Then which of the following statements is true for the velocity $\vec{v}(t)$ and acceleration $\vec{a}(t)$ of the particle:

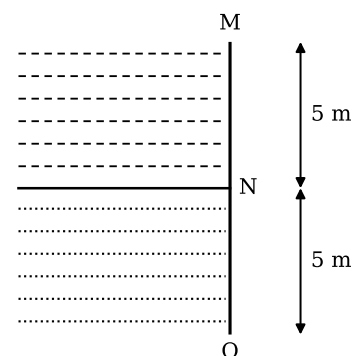
- (A) $\vec{v}$ and $\vec{a}$ both are perpendicular to $\vec{r}$
 (B) $\vec{v}$ and $\vec{a}$ both are parallel to $\vec{r}$
 (C) $\vec{v}$ is perpendicular to $\vec{r}$ and $\vec{a}$ is directed towards the origin
 (D) $\vec{v}$ is perpendicular to $\vec{r}$ and $\vec{a}$ is directed away from the origin

Attempt this paper online with instant answer checking > [prepwiser.in/pyqs/paper/2020-01-08-evening](https://www.prepwiser.in/pyqs/paper/2020-01-08-evening)

Q14 Fluid Mechanics[Step-by-step solution > prepwiser.in/questions/khaYBR4MMA](https://www.prepwiser.in/questions/khaYBR4MMA)

Two liquids of densities ρ_1 and ρ_2 ($\rho_2 = 2\rho_1$) are filled up behind a square wall of side 10 m as shown in figure. Each liquid has a height of 5 m. The ratio of the forces due to these liquids exerted on upper part MN to that at the lower part NO is (Assume that the liquids are not mixing)

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

**Q15** Rotational Motion[Step-by-step solution > prepwiser.in/questions/MKD6ely7Ue](https://www.prepwiser.in/questions/MKD6ely7Ue)

A uniform sphere of mass 500 g rolls without slipping on a plane horizontal surface with its centre moving at a speed of 5.00 cm/s. Its kinetic energy is:

- (A) 8.75×10^{-3} J (B) 1.13×10^{-3} J (C) 8.75×10^{-4} J (D) 6.25×10^{-4} J

Q16 Experimental Skills[Step-by-step solution > prepwiser.in/questions/oaotlemV6k](https://www.prepwiser.in/questions/oaotlemV6k)

A simple pendulum is being used to determine the value of gravitational acceleration g at a certain place. The length of the pendulum is 25.0 cm and a stop watch with 1 s resolution measures the time taken for 40 oscillations to be 50 s. The accuracy in g is:

- (A) 4.40% (B) 3.40% (C) 2.40% (D) 5.40%

Q17 Wave Optics[Step-by-step solution > prepwiser.in/questions/eij6fGX0sf](https://www.prepwiser.in/questions/eij6fGX0sf)

In a double slit experiment, at a certain point on the screen the path difference between the two interfering waves is $\frac{1}{8}$ th of a wavelength. The ratio of the intensity of light at that point to that at the centre of a bright fringe is:

- (A) 0.853 (B) 0.568 (C) 0.672 (D) 0.760

Q18 Mechanical Waves[Step-by-step solution > prepwiser.in/questions/HTZnFa2j-6](https://www.prepwiser.in/questions/HTZnFa2j-6)

A transverse wave travels on a taut steel wire with a velocity of v when tension in it is 2.06×10^4 N. When the tension is changed to T , the velocity changed to $v/2$. The value of T is close to:

- (A) 30.5×10^4 N (B) 2.50×10^4 N (C) 10.2×10^2 N (D) 5.15×10^3 N

Physics Section B · Numerical value

Q19 to Q23

Q19 Atomic Physics **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/BDRvfnz_ua](https://www.prepwiser.in/questions/BDRvfnz_ua)

The first member of the Balmer series of hydrogen atom has a wavelength of 6561 Å. The wavelength of the second member of the Balmer series (in nm) is:

Q20 Current Electricity **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/v5JISvhkuq](https://www.prepwiser.in/questions/v5JISvhkuq)

The series combination of two batteries, both of the same emf 10 V, but different internal resistance of 20Ω and 5Ω , is connected to the parallel combination of two resistors 30Ω and $R\Omega$. The voltage difference across the battery of internal resistance 20Ω is zero, the value of R (in Ω) is : _____

Attempt this paper online with instant answer checking > [prepwiser.in/pyqs/paper/2020-01-08-evening](https://www.prepwiser.in/pyqs/paper/2020-01-08-evening)

An asteroid is moving directly towards the centre of the earth. When at a distance of $10R$ (R is the radius of the earth) from the earth's centre, it has a speed of 12 km/s . Neglecting the effect of earth's atmosphere, what will be the speed of the asteroid when it hits the surface of the earth (escape velocity from the earth is 11.2 km/s)? Give your answer to the nearest integer in kilometer/s ____.

A ball is dropped from the top of a 100 m high tower on a planet. In the last $\frac{1}{2} \text{ s}$ before hitting the ground, it covers a distance of 19 m . Acceleration due to gravity (in ms^{-2}) near the surface on that planet is ____.

Three containers C_1 , C_2 and C_3 have water at different temperatures. The table below shows the final temperature T when different amounts of water (given in litres) are taken from each container and mixed (assume no loss of heat during the process)

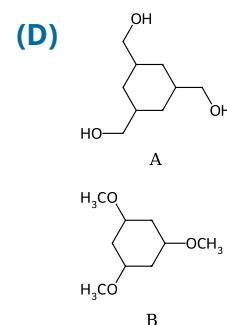
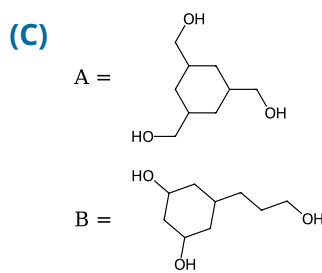
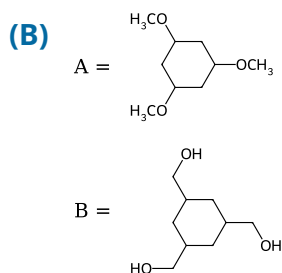
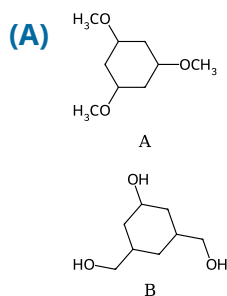
C_1	C_2	C_3	T
1 l	2 l	—	60°C
—	1 l	2 l	30°C
2 l	—	1 l	60°C
1 l	1 l	1 l	θ

The value of θ (in $^\circ\text{C}$ to the nearest integer) is

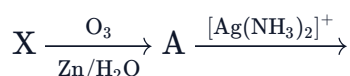
Chemistry Section A · Multiple choice

Q24 to Q41

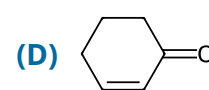
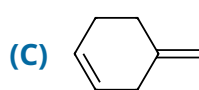
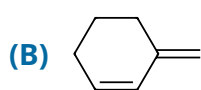
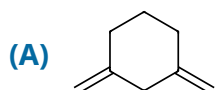
Among the compounds A and B with molecular formula $\text{C}_9\text{H}_{18}\text{O}_3$, A is having higher boiling point than B. The possible structures of A and B are:



An unsaturated hydrocarbon X absorbs two hydrogen molecules on catalytic hydrogenation and also gives following reaction:



B(3 - oxo - hexanedicarboxylic acid) X will be :-



Two monomers in maltose are:

- (A) α -D-glucose and α -D-galactose
 (B) α -D-glucose and α -D-fructose
 (C) α -D-glucose and α -D-glucose
 (D) α -D-glucose and β -D-glucose

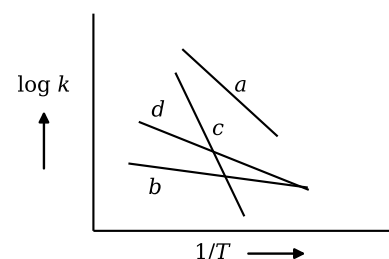
Arrange the following bonds according to their average bond energies in descending order:

C-Cl, C-Br, C-F, C-I

- (A) C-Br > C-I > C-Cl > C-F
 (B) C-Cl > C-Br > C-I > C-F
 (C) C-I > C-Br > C-Cl > C-F
 (D) C-F > C-Cl > C-Br > C-I

Consider the following plots of rate constant versus $\frac{1}{T}$ for four different reactions. Which of the following orders is correct for the activation energies of these reactions?

- (A) $E_c > E_a > E_d > E_b$
 (B) $E_a > E_c > E_d > E_b$
 (C) $E_b > E_a > E_d > E_c$
 (D) $E_b > E_d > E_c > E_a$



The correct order of the calculated spin-only magnetic moments of complexes (A) to (D) is:

- (A) $\text{Ni}(\text{CO})_4$
 (B) $[\text{Ni}(\text{H}_2\text{O})_6]\text{Cl}_2$
 (C) $\text{Na}_2[\text{Ni}(\text{CN})_4]$
 (D) $\text{PdCl}_2(\text{PPh}_3)_2$

- (A) (C) < (D) < (B) < (A) (B) (C) $\approx$ (D) < (B) < (A) (C) (A) $\approx$ (C) $\approx$ (D) < (B) (D) (A) $\approx$ (C) < (B) $\approx$ (D)

Among (a) – (d) the complexes that can display geometrical isomerism are:

- (a) $[\text{Pt}(\text{NH}_3)_3\text{Cl}]^+$
 (b) $[\text{Pt}(\text{NH}_3)\text{Cl}_5]^-$
 (c) $[\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{NO}_2)]$
 (d) $[\text{Pt}(\text{NH}_3)_4\text{ClBr}]^{2+}$

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

For the following Assertion and Reason, the correct option is:

Assertion: The pH of water increases with increase in temperature.

Reason: The dissociation of water into H^+ and OH^- is an exothermic reaction.

- (A) Both assertion and reason are false.
 (B) Both assertion and reason are true, but the reason is not the correct explanation for the assertion.
 (C) Both assertion and reason are true, and the reason is the correct explanation for the assertion.
 (D) Assertion is not true, but reason is true.

Q32 Metallurgy[Step-by-step solution](https://www.prepwisar.in/questions/Sfq9-FcA-4) › prepwisar.in/questions/Sfq9-FcA-4

Among the reactions (a) - (d), the reaction(s) that does/do not occur in the blast furnace during the extraction of iron is/are:

- (a) $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$
(b) $3\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow 2\text{Fe}_3\text{O}_4 + \text{CO}_2$
(c) $\text{FeO} + \text{SiO}_2 \rightarrow \text{FeSiO}_3$
(d) $\text{FeO} \rightarrow \text{Fe} + \frac{1}{2}\text{O}_2$

- (A) (a) and (d) (B) (c) and (d) (C) (a) (D) (d)

Q33 Hydrogen & s-Block Elements[Step-by-step solution](https://www.prepwisar.in/questions/7XG4D4s_K2) › prepwisar.in/questions/7XG4D4s_K2

A metal (A) on heating in nitrogen gas gives compound B. B on treatment with H_2O gives a colourless gas which when passed through CuSO_4 solution gives a dark blue-violet coloured solution. A and B respectively, are:

- (A) Na and NaNO_3 (B) Na and Na_3N (C) Mg and Mg_3N_2 (D) Mg and $\text{Mg}(\text{NO}_3)_2$

Q34 p-Block Elements: Part II (Group 15-18)[Step-by-step solution](https://www.prepwisar.in/questions/Rsh3lopAe8) › prepwisar.in/questions/Rsh3lopAe8

White Phosphorus on reaction with concentrated NaOH solution in an inert atmosphere of CO_2 gives phosphine and compound (X). (X) on acidification with HCl gives compound (Y). The basicity of compound (Y) is:

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

Q35 Periodic Table & Periodicity[Step-by-step solution](https://www.prepwisar.in/questions/nYh_hW9h0V) › prepwisar.in/questions/nYh_hW9h0V

The increasing order of the atomic radii of the following elements is :-

- (a) C (b) O
(c) F (d) Cl
(e) Br

- (A) (a) < (b) < (c) < (d) < (e) (B) (c) < (b) < (a) < (d) < (e)
(C) (b) < (c) < (d) < (a) < (e) (D) (d) < (c) < (b) < (a) < (e)

Q36 Polymers[Step-by-step solution](https://www.prepwisar.in/questions/zgHmFTojJ8) › prepwisar.in/questions/zgHmFTojJ8

Preparation of Bakelite proceeds via reactions.

- (A) Electrophilic substitution and dehydration (B) Condensation and elimination
(C) Nucleophilic addition and dehydration (D) Electrophilic addition and dehydration

Q37 Solid State[Step-by-step solution](https://www.prepwisar.in/questions/gqDPij4yDQ) › prepwisar.in/questions/gqDPij4yDQ

Which of the following compounds is likely to show both Frenkel and Schottky defects in its crystalline form?

- (A) CsCl (B) AgBr (C) ZnS (D) KBr

Q38 Atomic Structure[Step-by-step solution](https://www.prepwisar.in/questions/cINTT-FXtP) › prepwisar.in/questions/cINTT-FXtP

The radius of the second Bohr orbit, in terms of the Bohr radius, a_0 , in Li^{2+} is:

- (A) $\frac{2a_0}{9}$ (B) $\frac{2a_0}{3}$ (C) $\frac{4a_0}{9}$ (D) $\frac{4a_0}{3}$

Hydrogen has three isotopes (A), (B) and (C). If the number of neutron(s) in (A), (B) and (C) respectively, are (x), (y) and (z), the sum of (x), (y) and (z) is:

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

For the following Assertion and Reason, the correct option is

Assertion : For hydrogenation reactions, the catalytic activity increases from Group 5 to Group 11 metals with maximum activity shown by Group 7-9 elements.

Reason: The reactants are most strongly adsorbed on group 7-9 elements.

- (A) Both assertion and reason are true and the reason is the correct explanation for the assertion.
 (B) The assertion is true, but the reason is false.
 (C) Both assertion and reason are true but the reason is not the correct explanation for the assertion.
 (D) Both assertion and reason are false.

Kjeldahl's method cannot be used to estimate nitrogen for which of the following compounds?

- (A) $C_6H_5NH_2$ (B) $NH_2 - \overset{O}{\parallel} C - NH_2$ (C) $C_6H_5NO_2$ (D) $CH_3CH_2-C \equiv N$

Chemistry Section B · Numerical value

Q42 to Q45

Complexes (ML_5) of metals Ni and Fe have ideal square pyramidal and trigonal bipyramidal geometries, respectively. The sum of the 90° , 120° and 180° L-M-L angles in the two complexes is _____.

For an electrochemical cell

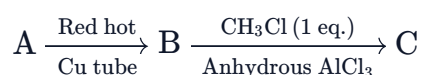


the ratio $\frac{[Sn^{2+}]}{[Pb^{2+}]}$ when this cell attains equilibrium is _____. (Round off to the nearest integer)

(Given $E_{Sn^{2+}|Sn}^0 = -0.14V$,

$E_{Pb^{2+}|Pb}^0 = -0.13V$, $\frac{2.303RT}{F} = 0.06$)

In the following sequence of reactions the maximum number of atoms present in molecule 'C' in one plane is _____.



(A is a lowest molecular weight alkyne)

At constant volume, 4 mol of an ideal gas when heated from 300 K to 500 K changes its internal energy by 5000 J. The molar heat capacity at constant volume is _____. (Round off to the nearest integer)

Q46 Three Dimensional Geometry

[Step-by-step solution](#) › [prepwisar.in/questions/a94tF0Wnz8](https://www.prepwisar.in/questions/a94tF0Wnz8)

The mirror image of the point $(1, 2, 3)$ in a plane is $(-\frac{7}{3}, -\frac{4}{3}, -\frac{1}{3})$. Which of the following points lies on this plane?

- (A) $(1, -1, 1)$ (B) $(-1, -1, -1)$ (C) $(-1, -1, 1)$ (D) $(1, 1, 1)$

Q47 Straight Lines

[Step-by-step solution](#) › [prepwisar.in/questions/x6MUbN4oJT](https://www.prepwisar.in/questions/x6MUbN4oJT)

The length of the perpendicular from the origin, on the normal to the curve, $x^2 + 2xy - 3y^2 = 0$ at the point $(2, 2)$ is

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

Q48 Binomial Theorem

[Step-by-step solution](#) › [prepwisar.in/questions/MUFtPQDMc4](https://www.prepwisar.in/questions/MUFtPQDMc4)

If α and β be the coefficients of x^4 and x^2 respectively in the expansion of

$$\left(x + \sqrt{x^2 - 1}\right)^6 + \left(x - \sqrt{x^2 - 1}\right)^6$$

, then

- (A) $\alpha + \beta = 60$ (B) $\alpha - \beta = 60$ (C) $\alpha + \beta = -30$ (D) $\alpha - \beta = -132$

Q49 Circles

[Step-by-step solution](#) › [prepwisar.in/questions/_W1oD7k73a](https://www.prepwisar.in/questions/_W1oD7k73a)

If a line, $y = mx + c$ is a tangent to the circle, $(x - 3)^2 + y^2 = 1$ and it is perpendicular to a line L_1 , where L_1 is the tangent to the circle, $x^2 + y^2 = 1$ at the point $(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}})$, then:

- (A) $c^2 + 6c + 7 = 0$ (B) $c^2 - 7c + 6 = 0$ (C) $c^2 - 6c + 7 = 0$ (D) $c^2 + 7c + 6 = 0$

Q50 Limits

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

$$\lim_{x \rightarrow 0} \frac{\int_0^x t \sin(10t) dt}{x}$$

is equal to

- (A) $-\frac{1}{5}$ (B) $-\frac{1}{10}$ (C) 0 (D) $\frac{1}{10}$

Q51 Definite Integration

[Step-by-step solution](#) › [prepwisar.in/questions/S51ETzqISb](https://www.prepwisar.in/questions/S51ETzqISb)

If $I = \int_1^2 \frac{dx}{\sqrt{2x^3 - 9x^2 + 12x + 4}}$, then:

- (A) $\frac{1}{16} < I^2 < \frac{1}{9}$ (B) $\frac{1}{8} < I^2 < \frac{1}{4}$ (C) $\frac{1}{9} < I^2 < \frac{1}{8}$ (D) $\frac{1}{6} < I^2 < \frac{1}{2}$

Q52 Differential Equations

[Step-by-step solution](#) › [prepwisar.in/questions/Ad3b962-E1](https://www.prepwisar.in/questions/Ad3b962-E1)

The differential equation of the family of curves, $x^2 = 4b(y + b)$, $b \in \mathbb{R}$, is:

- (A) $x(y')^2 = x - 2yy'$ (B) $x(y')^2 = 2yy' - x$ (C) $xy'' = y'$ (D) $x(y')^2 = x + 2yy'$

Q53 Relations & Functions (Basic)

[Step-by-step solution](#) › [prepwisar.in/questions/oqQ9mR_The](https://www.prepwisar.in/questions/oqQ9mR_The)

Let $f: (1, 3) \rightarrow \mathbb{R}$ be a function defined by

$f(x) = \frac{x[x]}{1+x^2}$, where $[x]$ denotes the greatest integer $\leq x$. Then the range of f is

- (A) $\left(\frac{2}{5}, \frac{1}{2}\right) \cup \left(\frac{3}{5}, \frac{4}{5}\right]$ (B) $\left(\frac{3}{5}, \frac{4}{5}\right)$ (C) $\left(\frac{2}{5}, \frac{4}{5}\right]$ (D) $\left(\frac{2}{5}, \frac{3}{5}\right] \cup \left(\frac{3}{4}, \frac{4}{5}\right)$

Q54 Hyperbola[Step-by-step solution](#) › [prepwisar.in/questions/DQTMcoR9-G](https://www.prepwisar.in/questions/DQTMcoR9-G)

If a hyperbola passes through the point $P(10, 16)$ and it has vertices at $(\pm 6, 0)$, then the equation of the normal to it at P is:

- (A) $2x + 5y = 100$ (B) $x + 3y = 58$ (C) $x + 2y = 42$ (D) $3x + 4y = 94$

Q55 Applications of Derivatives[Step-by-step solution](#) › [prepwisar.in/questions/w-tTlrYadT](https://www.prepwisar.in/questions/w-tTlrYadT)

Let S be the set of all functions $f : [0, 1] \rightarrow \mathbb{R}$, which are continuous on $[0, 1]$ and differentiable on $(0, 1)$. Then for every f in S , there exists a $c \in (0, 1)$, depending on f , such that

- (A) $|f(c) - f(1)| < |f'(c)|$ (B) $|f(c) + f(1)| < (1 + c) |f'(c)|$
 (C) $|f(c) - f(1)| < (1 - c) |f'(c)|$ (D) None

Q56 Determinants[Step-by-step solution](#) › [prepwisar.in/questions/NAuCKuce5t](https://www.prepwisar.in/questions/NAuCKuce5t)

The system of linear equations

$$\lambda x + 2y + 2z = 5$$

$$2\lambda x + 3y + 5z = 8$$

$$4x + \lambda y + 6z = 10$$
 has

- (A) a unique solution when $\lambda = -8$ (B) no solution when $\lambda = 2$
 (C) infinitely many solutions when $\lambda = 2$ (D) no solution when $\lambda = 8$

Q57 Matrices[Step-by-step solution](#) › [prepwisar.in/questions/wZQWn1kjcj](https://www.prepwisar.in/questions/wZQWn1kjcj)

If $A = \begin{pmatrix} 2 & 2 \\ 9 & 4 \end{pmatrix}$ and $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ then $10A^{-1}$ is equal to:

- (A) $6I - A$ (B) $4I - A$ (C) $A - 6I$ (D) $A - 4I$

Q58 Probability: Basic[Step-by-step solution](#) › [prepwisar.in/questions/srG-1UX7Zt](https://www.prepwisar.in/questions/srG-1UX7Zt)

Let A and B be two events such that the probability that exactly one of them occurs is $\frac{2}{5}$ and the probability that A or B occurs is $\frac{1}{2}$, then the probability of both of them occur together is:

- (A) 0.20 (B) 0.02 (C) 0.01 (D) 0.10

Q59 Complex Numbers[Step-by-step solution](#) › [prepwisar.in/questions/nmY5pn6Ako](https://www.prepwisar.in/questions/nmY5pn6Ako)

Let $\alpha = \frac{-1+i\sqrt{3}}{2}$.

If $a = (1 + \alpha) \sum_{k=0}^{100} \alpha^{2k}$ and

$b = \sum_{k=0}^{100} \alpha^{3k}$, then a and b are the roots of the quadratic equation:

- (A) $x^2 + 101x + 100 = 0$ (B) $x^2 + 102x + 101 = 0$ (C) $x^2 - 102x + 101 = 0$ (D) $x^2 - 101x + 100 = 0$

Q60 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](#) › [prepwisar.in/questions/CCMCY7w4bB](https://www.prepwisar.in/questions/CCMCY7w4bB)

Let S be the set of all real roots of the equation, $3^x(3^x - 1) + 2 = |3^x - 1| + |3^x - 2|$. Then S :

- (A) contains exactly two elements. (B) is an empty set.
 (C) is a singleton. (D) contains at least four elements.

Q61 Sequences & Series[Step-by-step solution](#) › prepwiser.in/questions/DKxIhdvtGT

If the 10th term of an A.P. is $\frac{1}{20}$ and its 20th term is $\frac{1}{10}$, then the sum of its first 200 terms is

- (A) 100 (B) $100\frac{1}{2}$ (C) $50\frac{1}{4}$ (D) 50

Q62 Statistics[Step-by-step solution](#) › prepwiser.in/questions/0lx6khuZpR

The mean and variance of 20 observations are found to be 10 and 4, respectively. On rechecking, it was found that an observation 9 was incorrect and the correct observation was 11. Then the correct variance is

- (A) 3.98 (B) 3.99 (C) 4.01 (D) 4.02

Q63 Vectors[Step-by-step solution](#) › prepwiser.in/questions/H4b1M6eRnk

Let $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ be two vectors. If $\vec{c}$ is a vector such that $\vec{b} \times \vec{c} = \vec{b} \times \vec{a}$

and $\vec{c} \cdot \vec{a} = 0$, then $\vec{c} \cdot \vec{b}$ is equal to

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

Q64 Area Under Curves[Step-by-step solution](#) › prepwiser.in/questions/G0cp9igIpt

The area (in sq. units) of the region $\{(x,y) \in \mathbb{R}^2: x^2 \leq y \leq 3 - 2x\}$, is:

- (A) $\frac{34}{3}$ (B) $\frac{29}{3}$ (C) $\frac{31}{3}$ (D) $\frac{32}{3}$

Mathematics Section B · Numerical value

Q65 to Q68

Q65 Applications of Derivatives **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/LpmFXo-HN5

Let $f(x)$ be a polynomial of degree 3 such that $f(-1) = 10$, $f(1) = -6$, $f(x)$ has a critical point at $x = -1$ and $f'(x)$ has a critical point at $x = 1$. Then $f(x)$ has a local minima at $x = \underline{\hspace{2cm}}$.

Q66 Permutations & Combinations **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/34VtwvXFKh

The number of 4 letter words (with or without meaning) that can be formed from the eleven letters of the word 'EXAMINATION' is $\underline{\hspace{2cm}}$.

Q67 Sequences & Series **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/p9EgkJGIm

The sum,

$$\sum_{n=1}^7 \frac{n(n+1)(2n+1)}{4}$$

is equal to $\underline{\hspace{2cm}}$.

Q68 Trigonometric Ratios & Identities **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/IplwBkt_Ha

If $\frac{\sqrt{2}\sin\alpha}{\sqrt{1+\cos 2\alpha}} = \frac{1}{7}$ and $\sqrt{\frac{1-\cos 2\beta}{2}} = \frac{1}{\sqrt{10}}$
 $\alpha, \beta \in (0, \frac{\pi}{2})$ then $\tan(\alpha + 2\beta)$ is equal to $\underline{\hspace{2cm}}$.

Answer key: JEE Main 2020 · 8 Jan · Shift 2

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Physics

1. C	2. C	3. D	4. C	5. C	6. A	7. A	8. D
9. A	10. B	11. D	12. A	13. C	14. C	15. C	16. A
17. A	18. D	19. 486	20. 30	21. 16	22. 8	23. 50	

Chemistry

24. D	25. C	26. C	27. D	28. A	29. C	30. B	31. A
32. B	33. C	34. C	35. B	36. A	37. B	38. D	39. A
40. B	41. C	42. 20	43. 2	44. 13	45. 6		

Mathematics

46. A	47. D	48. D	49. A	50. C	51. C	52. D	53. A
54. A	55. D	56. B	57. C	58. D	59. C	60. C	61. B
62. B	63. A	64. D	65. 3	66. 2454	67. 504	68. 1	

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