

JEE MAIN 2020 · QUESTION PAPER

3 Sep 2020 **Shift 1**

70 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	16 Q26 to Q41	5 Q42 to Q46
● Mathematics	19 Q47 to Q65	5 Q66 to Q70
In this PDF	70 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/2020-09-03-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? prepwisar.in/feedback · Terms: prepwisar.in/terms

Q1 Alternating Current

[Step-by-step solution](#) > [prepwisar.in/questions/iomfw0o6V](https://www.prepwisar.in/questions/iomfw0o6V)

A 750 Hz, 20 V (rms) source is connected to a resistance of $100\ \Omega$, an inductance of 0.1803 H and a capacitance of $10\ \mu\text{F}$ all in series. The time in which the resistance (heat capacity $2\text{ J/}^\circ\text{C}$) will get heated by 10°C . (assume no loss of heat to the surroundings) is close to:

- (A) 348 s (B) 418 s (C) 245 s (D) 365 s

Q2 Nuclear Physics

[Step-by-step solution](#) > [prepwisar.in/questions/K9bmIpDymi](https://www.prepwisar.in/questions/K9bmIpDymi)

In a radioactive material, fraction of active material remaining after time t is $9/16$. The fraction that was remaining after $t/2$ is

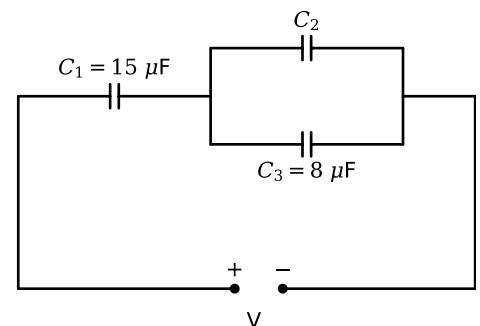
- (A) $\frac{3}{4}$ (B) $\frac{4}{5}$ (C) $\frac{3}{5}$ (D) $\frac{7}{8}$

Q3 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) > [prepwisar.in/questions/ESgc4-KXiO](https://www.prepwisar.in/questions/ESgc4-KXiO)

In the circuit shown in the figure, the total charge is $750\ \mu\text{C}$ and the voltage across capacitor C_2 is 20 V . Then the charge on capacitor C_2 is:

- (A) $160\ \mu\text{C}$ (B) $450\ \mu\text{C}$ (C) $590\ \mu\text{C}$ (D) $650\ \mu\text{C}$

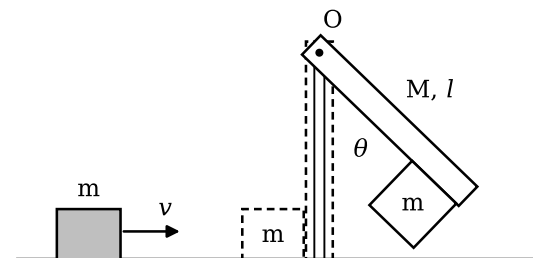


Q4 Rotational Motion

[Step-by-step solution](#) > [prepwisar.in/questions/aCuqxv0VLd](https://www.prepwisar.in/questions/aCuqxv0VLd)

A block of mass $m = 1\text{ kg}$ slides with velocity $v = 6\text{ m/s}$ on a frictionless horizontal surface and collides with a uniform vertical rod and sticks to it as shown. The rod is pivoted about O and swings as a result of the collision making angle θ before momentarily coming to rest. If the rod has mass $M = 2\text{ kg}$, and length $l = 1\text{ m}$, the value of θ is approximately: (take $g = 10\text{ m/s}^2$)

- (A) 63° (B) 69° (C) 55° (D) 49°

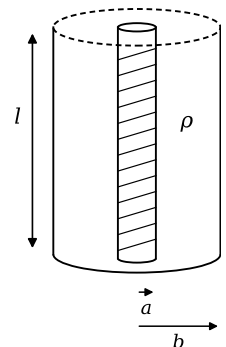


Q5 Current Electricity

[Step-by-step solution](#) > [prepwisar.in/questions/9_yis_1K5H](https://www.prepwisar.in/questions/9_yis_1K5H)

Model a torch battery of length l to be made up of a thin cylindrical bar of radius ' a ' and a concentric thin cylindrical shell of radius ' b ' filled in between with an electrolyte of resistivity ρ (see figure). If the battery is connected to a resistance of value R , the maximum Joule heating in R will take place for:

- (A) $R = \frac{2\rho}{\pi l} \ln\left(\frac{b}{a}\right)$ (B) $R = \frac{\rho}{\pi l} \ln\left(\frac{b}{a}\right)$ (C) $R = \frac{\rho}{2\pi l} \ln\left(\frac{b}{a}\right)$ (D) $R = \frac{\rho}{2\pi l} \left(\frac{b}{a}\right)$



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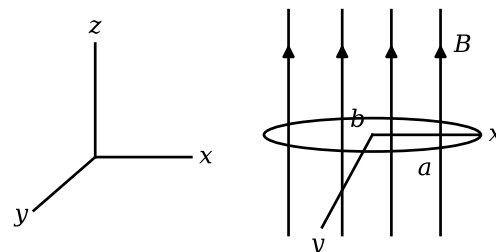
Q6 Dual Nature of Radiation & Matter[Step-by-step solution > prepwisar.in/questions/PeU1g8gW30](https://www.prepwisar.in/questions/PeU1g8gW30)

When the wavelength of radiation falling on a metal is changed from 500 nm to 200 nm, the maximum kinetic energy of the photoelectrons becomes three times larger. The work function of the metal is close to:

- (A) 1.02 eV (B) 0.81 eV (C) 0.61 eV (D) 0.52 eV

Q7 Electromagnetic Induction[Step-by-step solution > prepwisar.in/questions/oLooNU6-j2](https://www.prepwisar.in/questions/oLooNU6-j2)

An elliptical loop having resistance R , of semi major axis a , and semi minor axis b is placed in magnetic field as shown in the figure. If the loop is rotated about the x -axis with angular frequency ω , the average power loss in the loop due to Joule heating is:



- (A) $\frac{\pi abB\omega}{R}$ (B) $\frac{\pi^2 a^2 b^2 B^2 \omega^2}{R}$ (C) $\frac{\pi^2 a^2 b^2 B^2 \omega^2}{2R}$ (D) Zero

Q8 Electromagnetic Waves[Step-by-step solution > prepwisar.in/questions/ECZ9kLIc0A](https://www.prepwisar.in/questions/ECZ9kLIc0A)

The magnetic field of a plane electromagnetic wave is

$$\vec{B} = 3 \times 10^{-8} \sin [200\pi (y + ct)] \hat{i}$$

where $c = 3 \times 10^8 \text{ ms}^{-1}$ is the speed of light. The corresponding electric field is:

- (A) $\vec{E} = -10^{-6} \sin [200\pi (y + ct)] \hat{k}$ V/m (B) $\vec{E} = -9 \sin [200\pi (y + ct)] \hat{k}$ V/m
(C) $\vec{E} = 9 \sin [200\pi (y + ct)] \hat{k}$ V/m (D) $\vec{E} = 3 \times 10^{-8} \sin [200\pi (y + ct)] \hat{k}$ V/m

Q9 Semiconductors & Electronic Devices[Step-by-step solution > prepwisar.in/questions/ZBAGCBT-tI](https://www.prepwisar.in/questions/ZBAGCBT-tI)

When a diode is forward biased, it has a voltage drop of 0.5 V. The safe limit of current through the diode is 10 mA. If a battery of emf 1.5 V is used in the circuit, the value of minimum resistance to be connected in series with the diode so that the current does not exceed the safe limit is

- (A) 50 Ω (B) 200 Ω (C) 300 Ω (D) 100 Ω

Q10 Electrostatics II: Potential & Capacitance[Step-by-step solution > prepwisar.in/questions/pnO1-5ilks](https://www.prepwisar.in/questions/pnO1-5ilks)

Two isolated conducting spheres S_1 and S_2 of radius $\frac{2}{3}R$ and $\frac{1}{3}R$ have $12 \mu\text{C}$ and $-3 \mu\text{C}$ charges, respectively, and are at a large distance from each other. They are now connected by a conducting wire. A long time after this is done the charges on S_1 and S_2 are respectively:

- (A) $4.5 \mu\text{C}$ on both (B) $+4.5 \mu\text{C}$ and $-4.5 \mu\text{C}$
(C) $6 \mu\text{C}$ and $3 \mu\text{C}$ (D) $3 \mu\text{C}$ and $6 \mu\text{C}$

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Q11 Gravitation[Step-by-step solution](https://www.prepwiser.in/questions/m11GaPTAfI)

A satellite is moving in a low nearly circular orbit around the earth. Its radius is roughly equal to that of the earth's radius R_e . By firing rockets attached to it, its speed is instantaneously increased in the direction of its motion so that it become $\sqrt{\frac{3}{2}}$ times larger. Due to this the farthest distance from the centre of the earth that the satellite reaches is R . Value of R is:

- (A) $2R_e$ (B) $3R_e$ (C) $4R_e$ (D) $2.5R_e$

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

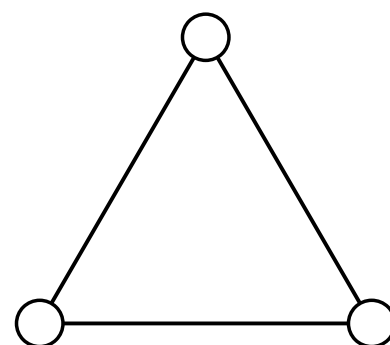
A balloon filled with helium (32°C and 1.7 atm.) bursts. Immediately afterwards the expansion of helium can be considered as

- (A) Irreversible adiabatic (B) Reversible adiabatic
(C) Irreversible isothermal (D) Reversible isothermal

Q13 Kinetic Theory of Gases[Step-by-step solution](https://www.prepwiser.in/questions/td-VIqTyki)

Consider a gas of triatomic molecules. The molecules are assumed to be triangular and made of massless rigid rods whose vertices are occupied by atoms. The internal energy of a mole of the gas at temperature T is:

- (A) $\frac{3}{2}RT$ (B) $\frac{9}{2}RT$ (C) $\frac{5}{2}RT$ (D) $3RT$

**Q14** Moving Charges & Magnetism[Step-by-step solution](https://www.prepwiser.in/questions/TcNoX9Weqf)

A charged particle carrying charge $1\text{ }\mu\text{C}$ is moving with velocity $(2\hat{i} + 3\hat{j} + 4\hat{k})\text{ ms}^{-1}$. If an external magnetic field of $(5\hat{i} + 3\hat{j} - 6\hat{k}) \times 10^{-3}\text{ T}$ exists in the region where the particle is moving then the force on the particle is $\vec{F} \times 10^{-9}\text{ N}$. The vector $\vec{F}$ is:

- (A) $-0.30\hat{i} + 0.32\hat{j} - 0.09\hat{k}$ (B) $-300\hat{i} + 320\hat{j} - 90\hat{k}$
(C) $-30\hat{i} + 32\hat{j} - 9\hat{k}$ (D) $-3.0\hat{i} + 3.2\hat{j} - 0.9\hat{k}$

Q15 Moving Charges & Magnetism[Step-by-step solution](https://www.prepwiser.in/questions/T-zkZGU2b9)

Magnitude of magnetic field (in SI units) at the centre of a hexagonal shape coil of side 10 cm , 50 turns and carrying current I (Ampere) in units of $\frac{\mu_0 I}{\pi}$ is:

- (A) $250\sqrt{3}$ (B) $5\sqrt{3}$ (C) $500\sqrt{3}$ (D) $50\sqrt{3}$

Q16 Surface Tension[Step-by-step solution](https://www.prepwiser.in/questions/jWR_K8mE81)

Pressure inside two soap bubbles are 1.01 and 1.02 atmosphere, respectively. The ratio of their volumes is:

- (A) $4 : 1$ (B) $8 : 1$ (C) $2 : 1$ (D) $0.8 : 1$

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

Moment of inertia of a cylinder of mass M , length L and radius R about an axis passing through its centre and perpendicular to the axis of the cylinder is

$I = M \left(\frac{R^2}{4} + \frac{L^2}{12} \right)$. If such a cylinder is to be made for a given mass of a material, the ratio $\frac{L}{R}$ for it to have minimum possible I is

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

Q18 Wave Optics[Step-by-step solution](https://www.prepwisar.in/questions/iFEsj1_VOA) > prepwisar.in/questions/iFEsj1_VOA

In a Young's double slit experiment, light of 500 nm is used to produce an interference pattern. When the distance between the slits is 0.05 mm, the angular width (in degree) of the fringes formed on the distance screen is close to

- (A) 0.17° (B) 1.7° (C) 0.57° (D) 0.07°

Q19 Mechanical Waves[Step-by-step solution](https://www.prepwisar.in/questions/uWIEwxIMrN) > prepwisar.in/questions/uWIEwxIMrN

A uniform thin rope of length 12 m and mass 6 kg hangs vertically from a rigid support and a block of mass 2 kg is attached to its free end. A transverse short wavetrain of wavelength 6 cm is produced at the lower end of the rope. What is the wavelength of the wavetrain (in cm) when it reaches the top of the rope?

- (A) 12 (B) 3 (C) 9 (D) 6

Q20 Experimental Skills[Step-by-step solution](https://www.prepwisar.in/questions/C7MagbGjN) > prepwisar.in/questions/C7MagbGjN

Using screw gauge of pitch 0.1 cm and 50 divisions on its circular scale, the thickness of an object is measured. It should correctly be recorded as

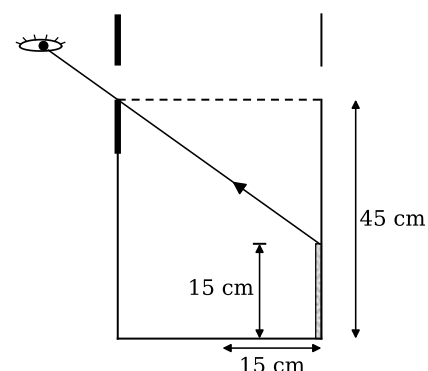
- (A) 2.123 cm (B) 2.124 cm (C) 2.125 cm (D) 2.121 cm

Physics Section B · Numerical value

Q21 to Q25

Q21 Ray Optics **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/QaIK0oAkT1) > prepwisar.in/questions/QaIK0oAkT1

An observer can see through a small hole on the side of a jar (radius 15 cm) at a point at height of 15 cm from the bottom (see figure). The hole is at a height of 45 cm. When the jar is filled with a liquid up to a height of 30 cm the same observer can see the edge at the bottom of the jar. If the refractive index of the liquid is $N/100$, where N is an integer, the value of N is ____.

**Q22** Thermometry & Calorimetry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/sl5ei6iyBm) > prepwisar.in/questions/sl5ei6iyBm

A bakelite beaker has volume capacity of 500 cc at 30°C . When it is partially filled with V_m volume (at 30°C) of mercury, it is found that the unfilled volume of the beaker remains constant as temperature is varied. If $\gamma_{(\text{beaker})} = 6 \times 10^{-6} \text{ }^\circ\text{C}^{-1}$ and $\gamma_{(\text{mercury})} = 1.5 \times 10^{-4} \text{ }^\circ\text{C}^{-1}$, where γ is the coefficient of volume expansion, then V_m (in cc) is close to ____.

Q23 Surface Tension **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/Mwz4TGFrl) > prepwiser.in/questions/Mwz4TGFrl

When a long glass capillary tube of radius 0.015 cm is dipped in a liquid, the liquid rises to a height of 15 cm within it. If the contact angle between the liquid and glass is close to 0° , the surface tension of the liquid, in milliNewton m^{-1} , is $[\rho_{\text{(liquid)}} = 900 \text{ kgm}^{-3}, g = 10 \text{ ms}^{-2}]$
(Give answer in closest integer) ____.

Q24 Rotational Motion **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/yVoxg0Vq1H) > prepwiser.in/questions/yVoxg0Vq1H

A person of 80 kg mass is standing on the rim of a circular platform of mass 200 kg rotating about its axis at 5 revolutions per minute (rpm). The person now starts moving towards the centre of the platform. What will be the rotational speed (in rpm) of the platform when the person reaches its centre _____.

Q25 Work, Energy & Power **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/-7e1ozEFbq) > prepwiser.in/questions/-7e1ozEFbq

A cricket ball of mass 0.15 kg is thrown vertically up by a bowling machine so that it rises to a maximum height of 20 m after leaving the machine. If the part pushing the ball applies a constant force F on the ball and moves horizontally a distance of 0.2 m while launching the ball, the value of F (in N) is ($g = 10 \text{ ms}^{-2}$) ____.

Chemistry Section A · Multiple choice

Q26 to Q41

Q26 Chemical Bonding & Molecular Structure[Step-by-step solution](https://www.prepwiser.in/questions/mxIsAUgEvf) > prepwiser.in/questions/mxIsAUgEvf

Of the species, NO , NO^+ , NO^{2+} and NO^- , the one with minimum bond strength is:

- (A) NO^- (B) NO (C) NO^+ (D) NO^{2+}

Q27 Chemical Kinetics[Step-by-step solution](https://www.prepwiser.in/questions/swnrTtKIMv) > prepwiser.in/questions/swnrTtKIMv

It is true that:

- (A) A first order reaction is always a single step reaction
(B) A zero order reaction is a multistep reaction
(C) A zero order reaction is a single step reaction
(D) A second order reaction is always a multistep reaction

Q28 Chemistry in Everyday Life[Step-by-step solution](https://www.prepwiser.in/questions/2DUtKbWL4v) > prepwiser.in/questions/2DUtKbWL4v

The antifertility drug "Novestrol" can react with:

- (A) Br_2 /water; ZnCl_2 /HCl; FeCl_3 (B) Br_2 /water; ZnCl_2 /HCl; NaOCl
(C) Alcoholic HCN ; NaOCl ; ZnCl_2 /HCl (D) ZnCl_2 /HCl; FeCl_3 ; Alcoholic HCN

Q29 Coordination Compounds[Step-by-step solution](https://www.prepwiser.in/questions/ioRh2i2_4i) > prepwiser.in/questions/ioRh2i2_4i

The complex that can show optical activity is:

- (A) $\text{cis-}[\text{Fe}(\text{NH}_3)_2(\text{CN})_4]^-$ (B) $\text{trans-}[\text{Cr}(\text{Cl}_2)(\text{ox})_2]^{3-}$
(C) $\text{trans-}[\text{Fe}(\text{NH}_3)_2(\text{CN})_4]^-$ (D) $\text{cis-}[\text{CrCl}_2(\text{ox})_2]^{3-}$ (ox = oxalate)

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Q30 Coordination Compounds[Step-by-step solution](#) > prepwiser.in/questions/LAxIKf1qfT

The electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ shows a single broad peak with a maximum at $20,300\text{ cm}^{-1}$. The crystal field stabilization energy (CFSE) of the complex ion, in kJ mol^{-1} , is:

- (A) 83.7 (B) 242.5 (C) 145.5 (D) 97

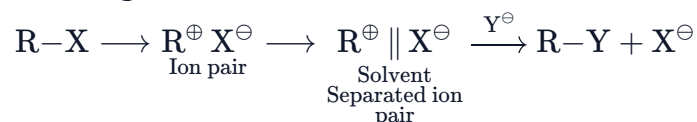
Q31 Electrochemistry[Step-by-step solution](#) > prepwiser.in/questions/qjU3XyjuvGU

Let C_{NaCl} and C_{BaSO_4} be the conductances (in S) measured for saturated aqueous solutions of NaCl and BaSO_4 , respectively, at a temperature T. Which of the following is false?

- (A) Ionic mobilities of ions from both salts increase with T.
(B) $C_{\text{NaCl}}(T_2) > C_{\text{NaCl}}(T_1)$ for $T_2 > T_1$
(C) $C_{\text{BaSO}_4}(T_2) > C_{\text{BaSO}_4}(T_1)$ for $T_2 > T_1$
(D) $C_{\text{NaCl}} \gg C_{\text{BaSO}_4}$ at a given T

Q32 Halogen Derivatives: Haloalkanes & Haloarenes[Step-by-step solution](#) > prepwiser.in/questions/dMu1liqXMa

The mechanism of $\text{S}_{\text{N}}1$ reaction is given as:



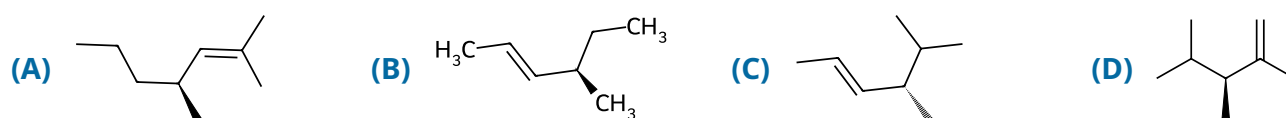
A student writes general characteristics based on the given mechanism as:

- (a) The reaction is favoured by weak nucleophiles.
(b) R^+ would be easily formed if the substituents are bulky.
(c) The reaction is accompanied by racemization.
(d) The reaction is favoured by non-polar solvents.

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

Q33 General Organic Chemistry (GOC)[Step-by-step solution](#) > prepwiser.in/questions/NHBy5DsojZ

Which of the following compounds produces an optically inactive compound on hydrogenation?

**Q34** Chemical Bonding & Molecular Structure[Step-by-step solution](#) > prepwiser.in/questions/TYAEIdGkl

If the boiling point of H_2O is 373 K, the boiling point of H_2S will be:

- (A) greater than 300 K but less than 373 K (B) equal to 373 K
(C) more than 373 K (D) less than 300 K

Q35 Ionic Equilibrium[Step-by-step solution](#) > prepwiser.in/questions/5R0U47itsf

An acidic buffer is obtained on mixing:

- (A) 100 mL of 0.1 M HCl and 200 mL of 0.1 M CH_3COONa
(B) 100 mL of 0.1 M HCl and 200 mL of 0.1 M NaCl
(C) 100 mL of 0.1 M CH_3COOH and 100 mL of 0.1 M NaOH
(D) 100 mL of 0.1 M CH_3COOH and 200 mL of 0.1 M NaOH

Q36 p-Block Elements: Part II (Group 15-18)

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

Aqua regia is used for dissolving noble metals (Au, Pt, etc.). The gas evolved in this process is:

- (A) N_2O_3 (B) N_2 (C) N_2O_5 (D) NO

Q37 p-Block Elements: Part II (Group 15-18)

[Step-by-step solution](#) > [prepwiser.in/questions/I-UU-xT1um](https://www.prepwiser.in/questions/I-UU-xT1um)

In a molecule of pyrophosphoric acid, the number of P - OH, P = O and P - O - P bonds/moiety(ies) respectively are:

- (A) 4, 2 and 0 (B) 4, 2 and 1 (C) 3, 3 and 3 (D) 2, 4 and 1

Q38 Periodic Table & Periodicity

[Step-by-step solution](#) > [prepwiser.in/questions/we8653TuEW](https://www.prepwiser.in/questions/we8653TuEW)

The atomic number of the element unnilennium is:

- (A) 109 (B) 102 (C) 119 (D) 108

Q39 Surface Chemistry

[Step-by-step solution](#) > [prepwiser.in/questions/rMZmc5XNgC](https://www.prepwiser.in/questions/rMZmc5XNgC)

Tyndall effect is observed when:

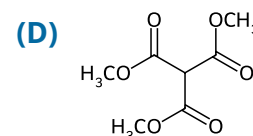
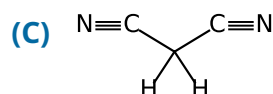
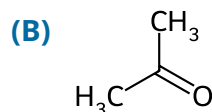
- (A) The diameter of dispersed particles is similar to the wavelength of light used.
(B) The diameter of dispersed particles is much smaller than the wavelength of light used.
(C) The diameter of dispersed particles is much larger than the wavelength of light used.
(D) The refractive index of dispersed phase is greater than that of the dispersion medium.

Q40 General Organic Chemistry (GOC)

[Step-by-step solution](#) > [prepwiser.in/questions/IfEIwz3-9F](https://www.prepwiser.in/questions/IfEIwz3-9F)

Which one of the following compounds possesses the most acidic hydrogen?

(A) $\text{H}_3\text{C} - \text{C} \equiv \text{C} - \text{H}$



Q41 Purification & Characterisation of Organic Compounds

[Step-by-step solution](#) > [prepwiser.in/questions/EWJaNDuFD8](https://www.prepwiser.in/questions/EWJaNDuFD8)

Glycerol is separated in soap industries by:

- (A) Fractional distillation (B) Distillation under reduced pressure
(C) Differential extraction (D) Steam distillation

Chemistry Section B · Numerical value

Q42 to Q46

Q42 Electrochemistry **NUMERICAL**

[Step-by-step solution](#) > [prepwiser.in/questions/84CLOmiqJD](https://www.prepwiser.in/questions/84CLOmiqJD)

The photoelectric current from Na (Work function, $w_0 = 2.3 \text{ eV}$) is stopped by the output voltage of the cell

$\text{Pt(s)} \mid \text{H}_2(\text{g}, 1 \text{ Bar}) \mid \text{HCl(aq., pH} = 1) \mid \text{AgCl(s)} \mid \text{Ag(s)}$.

The pH of aq. HCl required to stop the photoelectric current from K($w_0 = 2.25 \text{ eV}$), all other conditions remaining the same, is $\times 10^{-2}$ (to the nearest integer).

Given, $2.303 \frac{RT}{F} = 0.06 \text{ V}$;

$E_{\text{AgCl} \mid \text{Ag} \mid \text{Cl}^-}^0 = 0.22 \text{ V}$

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The total number of monohalogenated organic products in the following (including stereoisomers) reaction is ____.



An element with molar mass $2.7 \times 10^{-2} \text{ kg mol}^{-1}$ forms a cubic unit cell with edge length 405 pm. If its density is $2.7 \times 10^3 \text{ kg m}^{-3}$, the radius of the element is approximately ____ $\times 10^{-12} \text{ m}$ (to the nearest integer).

The mole fraction of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) in an aqueous binary solution is 0.1. The mass percentage of water in it, to the nearest integer, is ____.

The volume strength of 8.9 M H_2O_2 solution calculated at 273 K and 1 atm is _____. ($R = 0.0821 \text{ L atm K}^{-1} \text{ mol}^{-1}$) (rounded off to the nearest integer)

Mathematics Section A · Multiple choice

Q47 to Q65

The foot of the perpendicular drawn from the point (4, 2, 3) to the line joining the points (1, -2, 3) and (1, 1, 0) lies on the plane:

- (A) $x - 2y + z = 1$ (B) $x + 2y - z = 1$ (C) $x - y - 2z = 1$ (D) $2x + y - z = 1$

The function, $f(x) = (3x - 7)x^{2/3}$, $x \in \mathbb{R}$, is increasing for all x lying in:

- (A) $(-\infty, 0) \cup \left(\frac{3}{7}, \infty\right)$ (B) $(-\infty, 0) \cup \left(\frac{14}{15}, \infty\right)$
 (C) $\left(-\infty, \frac{14}{15}\right)$ (D) $\left(-\infty, \frac{14}{15}\right) \cup (0, \infty)$

If the number of integral terms in the expansion of $(3^{1/2} + 5^{1/8})^n$ is exactly 33, then the least value of n is:

- (A) 264 (B) 256 (C) 128 (D) 248

$\int_{-\pi}^{\pi} |\pi - |x|| dx$ is equal to:

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

Q51 Differential Equations[Step-by-step solution](https://www.prepwiser.in/questions/J7uHIJ5t9z) › prepwiser.in/questions/J7uHIJ5t9z

The solution curve of the differential equation,

$$(1 + e^{-x})(1 + y^2) \frac{dy}{dx} = y^2,$$

which passes through the point (0, 1), is:

(A) $y^2 + 1 = y \left(\log_e \left(\frac{1+e^{-x}}{2} \right) + 2 \right)$

(B) $y^2 + 1 = y \left(\log_e \left(\frac{1+e^x}{2} \right) + 2 \right)$

(C) $y^2 = 1 + y \log_e \left(\frac{1+e^{-x}}{2} \right)$

(D) $y^2 = 1 + y \log_e \left(\frac{1+e^x}{2} \right)$

Q52 Differentiation[Step-by-step solution](https://www.prepwiser.in/questions/5M8VxdoczC) › prepwiser.in/questions/5M8VxdoczC

If $y^2 + \log_e (\cos^2 x) = y$,

$x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, then:

(A) $|y''(0)| = 2$

(B) $|y'(0)| + |y''(0)| = 3$

(C) $y''(0) = 0$

(D) $|y'(0)| + |y''(0)| = 1$

Q53 Hyperbola[Step-by-step solution](https://www.prepwiser.in/questions/MDLzYw3HS9) › prepwiser.in/questions/MDLzYw3HS9

A hyperbola having the transverse axis of length $\sqrt{2}$ has the same foci as that of the ellipse $3x^2 + 4y^2 = 12$, then this hyperbola does not pass through which of the following points?

(A) $\left(1, -\frac{1}{\sqrt{2}}\right)$

(B) $\left(\sqrt{\frac{3}{2}}, \frac{1}{\sqrt{2}}\right)$

(C) $\left(-\sqrt{\frac{3}{2}}, 1\right)$

(D) $\left(\frac{1}{\sqrt{2}}, 0\right)$

Q54 Inverse Trigonometric Functions[Step-by-step solution](https://www.prepwiser.in/questions/rG8xcn01NJ) › prepwiser.in/questions/rG8xcn01NJ

$2\pi -$

$$\left(\sin^{-1} \frac{4}{5} + \sin^{-1} \frac{5}{13} + \sin^{-1} \frac{16}{65} \right)$$

is equal to:

(A) $\frac{7\pi}{4}$

(B) $\frac{5\pi}{4}$

(C) $\frac{3\pi}{2}$

(D) $\frac{\pi}{2}$

Q55 Limits[Step-by-step solution](https://www.prepwiser.in/questions/oNhGChhXGc) › prepwiser.in/questions/oNhGChhXGc

Let $[t]$ denote the greatest integer $\leq t$. If for some

$\lambda \in \mathbb{R} - \{1, 0\}$,

$$\lim_{x \rightarrow 0} \left| \frac{1 - x + |x|}{\lambda - x + [x]} \right|$$

= L, then L is equal to:

(A) 1

(B) 2

(C) 0

(D) $\frac{1}{2}$

Q56 Determinants[Step-by-step solution](https://www.prepwiser.in/questions/N4zCqlq1wz) › prepwiser.in/questions/N4zCqlq1wz

If $\Delta =$

$$\begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ 2x-3 & 3x-4 & 4x-5 \\ 3x-5 & 5x-8 & 10x-17 \end{vmatrix}$$

=

$Ax^3 + Bx^2 + Cx + D$, then B + C is equal to:

(A) -1

(B) -3

(C) 9

(D) 1

Q57 Parabola[Step-by-step solution](https://www.prepwisar.in/questions/Sk6-VbPwXY)

Let P be a point on the parabola, $y^2 = 12x$ and N be the foot of the perpendicular drawn from P on the axis of the parabola. A line is now drawn through the mid-point M of PN, parallel to its axis which meets the parabola at Q. If the y-intercept of the line NQ is $\frac{4}{3}$, then:

- (A) $MQ = \frac{1}{3}$ (B) $PN = 4$ (C) $PN = 3$ (D) $MQ = \frac{1}{4}$

Q58 Sequences & Series[Step-by-step solution](https://www.prepwisar.in/questions/AN6_eopTAI)

The value of $(2.^1P_0 - 3.^2P_1 + 4.^3P_2 \dots \text{up to } 51^{\text{th}} \text{ term}) + (1! - 2! + 3! - \dots \text{up to } 51^{\text{th}} \text{ term})$ is equal to:

- (A) 1 (B) $1 + (51)!$ (C) $1 - 51(51)!$ (D) $1 + (52)!$

Q59 Probability: Advanced[Step-by-step solution](https://www.prepwisar.in/questions/Gx71_6ysSZ)

A dice is thrown two times and the sum of the scores appearing on the die is observed to be a multiple of 4. Then the conditional probability that the score 4 has appeared atleast once is:

- (A) $\frac{1}{8}$ (B) $\frac{1}{9}$ (C) $\frac{1}{4}$ (D) $\frac{1}{3}$

Q60 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](https://www.prepwisar.in/questions/o7fvvwhbQC)

If α and β are the roots of the equation $x^2 + px + 2 = 0$ and $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ are the roots of the equation $2x^2 + 2qx + 1 = 0$, then

$$\left(\alpha - \frac{1}{\alpha}\right) \left(\beta - \frac{1}{\beta}\right) \left(\alpha + \frac{1}{\beta}\right) \left(\beta + \frac{1}{\alpha}\right)$$

is equal to:

- (A) $\frac{9}{4} (9 - q^2)$ (B) $\frac{9}{4} (9 + q^2)$ (C) $\frac{9}{4} (9 - p^2)$ (D) $\frac{9}{4} (9 + p^2)$

Q61 Sequences & Series[Step-by-step solution](https://www.prepwisar.in/questions/Xa0JrSmTow)

If the first term of an A.P. is 3 and the sum of its first 25 terms is equal to the sum of its next 15 terms, then the common difference of this A.P. is:

- (A) $\frac{1}{4}$ (B) $\frac{1}{5}$ (C) $\frac{1}{7}$ (D) $\frac{1}{6}$

Q62 Sets[Step-by-step solution](https://www.prepwisar.in/questions/vrcqUNvPm7)

Consider the two sets:

$A = \{m \in \mathbb{R} : \text{both the roots of } x^2 - (m+1)x + m+4 = 0 \text{ are real}\}$

and $B = [-3, 5)$.

Which of the following is not true?

- (A) $A \cap B = \{-3\}$ (B) $B - A = (-3, 5)$
(C) $A \cup B = \mathbb{R}$ (D) $A - B = (-\infty, -3) \cup (5, \infty)$

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For the frequency distribution:

Variate (x): $x_1, x_2, x_3, \dots, x_{15}$

Frequency (f): $f_1, f_2, f_3, \dots, f_{15}$

where $0 < x_1 < x_2 < x_3 < \dots < x_{15} = 10$ and

$\sum_{i=1}^{15} f_i > 0$, the standard deviation cannot be:

- (A) 6 (B) 1 (C) 4 (D) 2

The lines

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

and

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

- (A) do not intersect for any values of l and m (B) intersect for all values of l and m
 (C) intersect when $l = 2$ and $m = \frac{1}{2}$ (D) intersect when $l = 1$ and $m = 2$

The area (in sq. units) of the region

$\{(x, y) : 0 \leq y \leq x^2 + 1, 0 \leq y \leq x + 1, \frac{1}{2} \leq x \leq 2\}$ is:

- (A) $\frac{79}{16}$ (B) $\frac{79}{24}$ (C) $\frac{23}{6}$ (D) $\frac{23}{16}$

Mathematics Section B · Numerical value

Q66 to Q70

The diameter of the circle, whose centre lies on the line $x + y = 2$ in the first quadrant and which touches both the lines $x = 3$ and $y = 2$, is _____.

If

$$\left(\frac{1+i}{1-i}\right)^{\frac{m}{2}} = \left(\frac{1+i}{1-i}\right)^{\frac{n}{3}} = 1$$

, ($m, n \in \mathbb{N}$) then the greatest common divisor of the least values of m and n is _____.

If

$$\lim_{x \rightarrow 0} \left\{ \frac{1}{x^8} \left(1 - \cos \frac{x^2}{2} - \cos \frac{x^2}{4} + \cos \frac{x^2}{2} \cos \frac{x^2}{4} \right) \right\}$$

$= 2^{-k}$

then the value of k is _____.

Let $A = \begin{bmatrix} x & 1 \\ 1 & 0 \end{bmatrix}$, $x \in \mathbb{R}$ and $A^4 = [a_{ij}]$.

If $a_{11} = 109$, then a_{22} is equal to _____.

The value of

$$(0.16)^{\log_{2.5}\left(\frac{1}{3} + \frac{1}{3^2} + \dots \text{to } \infty\right)}$$

is equal to _____.

Answer key: JEE Main 2020 · 3 Sep · Shift 1

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Physics

1. A	2. A	3. C	4. A	5. C	6. C	7. C	8. B	9. D	10. C
11. B	12. A	13. D	14. C	15. C	16. B	17. B	18. C	19. A	20. B
21. 158	22. 20	23. 101	24. 9	25. 150					

Chemistry

26. A	27. B	28. A	29. D	30. D	31. D	32. B	33. D	34. D	35. A
36. D	37. B	38. A	39. A	40. D	41. B	42. 142	43. 8	44. 143	45. 47
46. 100									

Mathematics

47. D	48. B	49. B	50. A	51. D	52. A	53. B	54. C	55. B	56. B
57. D	58. D	59. B	60. C	61. D	62. D	63. A	64. A	65. B	66. 3
67. 4	68. 8	69. 10	70. 4						

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