

JEE MAIN 2020 · QUESTION PAPER

3 Sep 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	5 Q21 to Q25
● Chemistry	12 Q26 to Q37	5 Q38 to Q42
● Mathematics	19 Q43 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/2020-09-03-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 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) › [prepwiser.in/questions/ssgg6Vees-z](https://www.prepwiser.in/questions/ssgg6Vees-z)

Hydrogen ion and singly ionized helium atom are accelerated, from rest, through the same potential difference. The ratio of final speeds of hydrogen and helium ions is close to:

- (A) 2 : 1 (B) 1 : 2 (C) 5 : 7 (D) 10 : 7

Q2 Nuclear Physics

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

The radius R of a nucleus of mass number A can be estimated by the formula

$$R = (1.3 \times 10^{-15})A^{1/3} \text{ m.}$$

It follows that the mass density of a nucleus is of the order of:

$$(M_{\text{prot.}} \cong M_{\text{neut}} \cong 1.67 \times 10^{-27} \text{ kg})$$

- (A) $10^{24} \text{ kg m}^{-3}$ (B) $10^{10} \text{ kg m}^{-3}$ (C) $10^{17} \text{ kg m}^{-3}$ (D) 10^3 kg m^{-3}

Q3 Collision

[Step-by-step solution](#) › [prepwiser.in/questions/f9l9QagDQh](https://www.prepwiser.in/questions/f9l9QagDQh)

A block of mass 1.9 kg is at rest at the edge of a table, of height 1 m. A bullet of mass 0.1 kg collides with the block and sticks to it. If the velocity of the bullet is 20 m/s in the horizontal direction just before the collision then the kinetic energy just before the combined system strikes the floor, is [Take $g = 10 \text{ m/s}^2$. Assume there is no rotational motion and loss of energy after the collision is negligible.]

- (A) 23 J (B) 21 J (C) 20 J (D) 19 J

Q4 Current Electricity

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

Two resistors 400Ω and 800Ω are connected in series across a 6 V battery. The potential difference measured by a voltmeter of $10 \text{ k}\Omega$ across 400Ω resistor is close to:

- (A) 2.05 V (B) 1.95 V (C) 2 V (D) 1.8 V

Q5 Dual Nature of Radiation & Matter

[Step-by-step solution](#) › [prepwiser.in/questions/Fgl7ywGldk](https://www.prepwiser.in/questions/Fgl7ywGldk)

Two sources of light emit X-rays of wavelength 1 nm and visible light of wavelength 500 nm, respectively. Both the sources emit light of the same power 200 W. The ratio of the number density of photons of X-rays to the number density of photons of the visible light of the given wavelengths is:

- (A) $\frac{1}{500}$ (B) 500 (C) 250 (D) $\frac{1}{250}$

Q6 Electromagnetic Induction

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

A uniform magnetic field B exists in a direction perpendicular to the plane of a square loop made of a metal wire. The wire has a diameter of 4 mm and a total length of 30 cm. The magnetic field changes with time at a steady rate $\frac{dB}{dt} = 0.032 \text{ Ts}^{-1}$. The induced current in the loop is close to (Resistivity of the metal wire is $1.23 \times 10^{-8} \Omega\text{m}$)

- (A) 0.53 A (B) 0.43 A (C) 0.34 A (D) 0.61 A

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

The electric field of a plane electromagnetic wave propagating along the x direction in vacuum is

$$\vec{E} = E_0 \hat{j} \cos(\omega t - kx).$$

The magnetic field $\vec{B}$, at the moment $t = 0$ is:

(A) $\vec{B} = \frac{E_0}{\sqrt{\mu_0 \epsilon_0}} \cos(kx) \hat{j}$

(B) $\vec{B} = \frac{E_0}{\sqrt{\mu_0 \epsilon_0}} \cos(kx) \hat{k}$

(C) $\vec{B} = E_0 \sqrt{\mu_0 \epsilon_0} \cos(kx) \hat{k}$

(D) $\vec{B} = E_0 \sqrt{\mu_0 \epsilon_0} \cos(kx) \hat{j}$

Q8 Experimental Skills[Step-by-step solution](https://www.prepwiser.in/questions/wykEcbVQCq) › prepwiser.in/questions/wykEcbVQCq

Which of the following will NOT be observed when a multimeter (operating in resistance measuring mode) probes connected across a component, are just reversed?

- (A) Multimeter shows NO deflection in both cases i.e. before and after reversing the probes if the chosen component is metal wire.
- (B) Multimeter shows a deflection, accompanied by a splash of light out of connected component in one direction and NO deflection on reversing the probes if the chosen component is LED.
- (C) Multimeter shows an equal deflection in both cases i.e. before and after reversing the probes if the chosen component is resistor.
- (D) Multimeter shows NO deflection in both cases i.e. before and after reversing the probes if the chosen component is capacitor.

Q9 Semiconductors & Electronic Devices[Step-by-step solution](https://www.prepwiser.in/questions/Y3uf9hZMdo) › prepwiser.in/questions/Y3uf9hZMdo

If a semiconductor photodiode can detect a photon with a maximum wavelength of 400 nm, then its band gap energy is:

Planck's constant $h = 6.63 \times 10^{-34}$ J.s. Speed of light $c = 3 \times 10^8$ m/s

(A) 1.5 eV

(B) 2.0 eV

(C) 3.1 eV

(D) 1.1 eV

Q10 Electrostatics II: Potential & Capacitance[Step-by-step solution](https://www.prepwiser.in/questions/Of0H5ekeRy) › prepwiser.in/questions/Of0H5ekeRy

Concentric metallic hollow spheres of radii R and $4R$ hold charges Q_1 and Q_2 respectively. Given that surface charge densities of the concentric spheres are equal, the potential difference $V(R) - V(4R)$ is:

(A) $\frac{3Q_2}{4\pi\epsilon_0 R}$

(B) $\frac{3Q_1}{4\pi\epsilon_0 R}$

(C) $\frac{3Q_1}{16\pi\epsilon_0 R}$

(D) $\frac{Q_2}{4\pi\epsilon_0 R}$

Q11 Gravitation[Step-by-step solution](https://www.prepwiser.in/questions/4GAzDKHrFp) › prepwiser.in/questions/4GAzDKHrFp

The mass density of a planet of radius R varies with the distance r from its centre as

$$\rho(r) = \rho_0 \left(1 - \frac{r^2}{R^2}\right).$$

Then the gravitational field is maximum at:

(A) $r = \frac{1}{\sqrt{3}}R$

(B) $r = R$

(C) $r = \sqrt{\frac{3}{4}}R$

(D) $r = \sqrt{\frac{5}{9}}R$

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Q12 Kinetic Theory of Gases[Step-by-step solution](#) > [prepwisar.in/questions/D3Xf_N84in](https://www.prepwisar.in/questions/D3Xf_N84in)

To raise the temperature of a certain mass of gas by 50°C at a constant pressure, 160 calories of heat is required. When the same mass of gas is cooled by 100°C at constant volume, 240 calories of heat is released. How many degrees of freedom does each molecule of this gas have (assume gas to be ideal)?

- (A) 6 (B) 7 (C) 5 (D) 3

Q13 Thermometry & Calorimetry[Step-by-step solution](#) > [prepwisar.in/questions/5b00I62G5e](https://www.prepwisar.in/questions/5b00I62G5e)

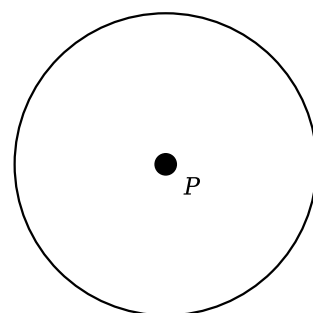
A calorimeter of water equivalent 20 g contains 180 g of water at 25°C . 'm' grams of steam at 100°C is mixed in it till the temperature of the mixture is 31°C . The value of 'm' is close to: (Latent heat of water = 540 cal g^{-1} , specific heat of water = $1 \text{ cal g}^{-1} \text{ }^{\circ}\text{C}^{-1}$)

- (A) 2.6 (B) 2 (C) 4 (D) 3.2

Q14 Magnetism & Matter[Step-by-step solution](#) > [prepwisar.in/questions/sdRGt4QwSj](https://www.prepwisar.in/questions/sdRGt4QwSj)

A perfectly diamagnetic sphere has a small spherical cavity at its centre, which is filled with a paramagnetic substance. The whole system is placed in a uniform magnetic field $\vec{B}$. Then the field inside the paramagnetic substance is:

- (A) $\vec{B}$
(B) zero
(C) much large than $|\vec{B}|$ and parallel to $\vec{B}$
(D) much large than $|\vec{B}|$ but opposite to $\vec{B}$

**Q15** Heat Transfer[Step-by-step solution](#) > [prepwisar.in/questions/dmS27qylRx](https://www.prepwisar.in/questions/dmS27qylRx)

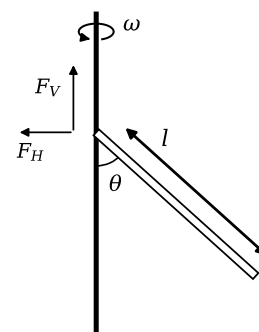
A metallic sphere cools from 50°C to 40° in 300 s. If atmospheric temperature around is 20°C , then the sphere's temperature after the next 5 minutes will be close to:

- (A) 35°C (B) 31°C (C) 33°C (D) 28°C

Q16 Rotational Motion[Step-by-step solution](#) > [prepwisar.in/questions/bt3lOuCU1f](https://www.prepwisar.in/questions/bt3lOuCU1f)

A uniform rod of length 'l' is pivoted at one of its ends on a vertical shaft of negligible radius. When the shaft rotates at angular speed ω the rod makes an angle θ with it (see figure). To find θ equate the rate of change of angular momentum (direction going into the paper) $\frac{ml^2}{12}\omega^2 \sin \theta \cos \theta$ about the centre of mass (CM) to the torque provided by the horizontal and vertical forces F_H and F_V about the CM. The value of θ is then such that:

- (A) $\cos \theta = \frac{2g}{3l\omega^2}$ (B) $\cos \theta = \frac{3g}{2l\omega^2}$ (C) $\cos \theta = \frac{g}{2l\omega^2}$ (D) $\cos \theta = \frac{g}{l\omega^2}$

**Q17** Simple Harmonic Motion[Step-by-step solution](#) > [prepwisar.in/questions/FAuUIjq6Mx](https://www.prepwisar.in/questions/FAuUIjq6Mx)

A block of mass m attached to a massless spring is performing oscillatory motion of amplitude 'A' on a frictionless horizontal plane. If half of the mass of the block breaks off when it is passing through its equilibrium point, the amplitude of oscillation for the remaining system become fA . The value of f is:

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

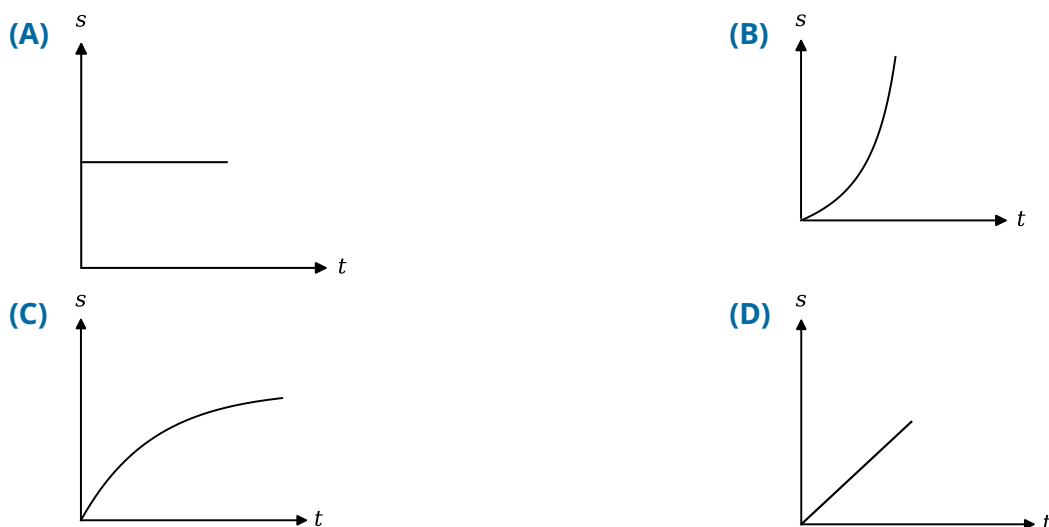
Q18 Wave Optics[Step-by-step solution](#) > prepwiser.in/questions/bRPrtUxCky

Two light waves having the same wavelength λ in vacuum are in phase initially. Then the first wave travels a path L_1 through a medium of refractive index n_1 while the second wave travels a path of length L_2 through a medium of refractive index n_2 . After this the phase difference between the two waves is:

- (A) $\frac{2\pi}{\lambda} (n_1 L_1 - n_2 L_2)$ (B) $\frac{2\pi}{\lambda} (n_2 L_1 - n_1 L_2)$ (C) $\frac{2\pi}{\lambda} \left(\frac{L_1}{n_1} - \frac{L_2}{n_2} \right)$ (D) $\frac{2\pi}{\lambda} \left(\frac{L_2}{n_1} - \frac{L_1}{n_2} \right)$

Q19 Work, Energy & Power[Step-by-step solution](#) > prepwiser.in/questions/0qVLsX1VCK

A particle is moving unidirectionally on a horizontal plane under the action of a constant power supplying energy source. The displacement (s) - time (t) graph that describes the motion of the particle is (graphs are drawn schematically and are not to scale):

**Q20** Units, Dimensions & Errors[Step-by-step solution](#) > prepwiser.in/questions/jFH4-068Bx

Amount of solar energy received on the earth's surface per unit area per unit time is defined a solar constant. Dimension of solar constant is:

- (A) MLT^{-2} (B) ML^0T^{-3} (C) $M^2L^0T^{-1}$ (D) ML^2T^{-2}

Physics Section B · Numerical value

Q21 to Q25

Q21 Ray Optics **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/d5pxBGpdSI

When an object is kept at a distance of 30 cm from a concave mirror, the image is formed at a distance of 10 cm from the mirror. If the object is moved with a speed of 9 cm s^{-1} , the speed (in cm s^{-1}) with which image moves at that instant is ____.

Q22 Thermodynamics **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/GVf3kYC44J

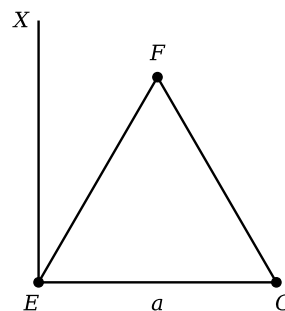
If minimum possible work is done by a refrigerator in converting 100 grams of water at 0°C to ice, how much heat (in calories) is released to the surroundings at temperature 27°C (Latent heat of ice = 80 Cal/gram) to the nearest integer?

Q23 Moving Charges & Magnetism **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/sb7MA3bXOa

A galvanometer coil has 500 turns and each turn has an average area of $3 \times 10^{-4} \text{ m}^2$. If a torque of 1.5 Nm is required to keep this coil parallel to a magnetic field when a current of 0.5 A is flowing through it, the strength of the field (in T) is ____.

Q24 Rotational Motion **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/oFo2cSjvHL) > prepwisar.in/questions/oFo2cSjvHL

An massless equilateral triangle EFG of side 'a' (As shown in figure) has three particles of mass m situated at its vertices. The moment of inertia of the system about the line EX perpendicular to EG in the plane of EFG is $\frac{N}{20} ma^2$ where N is an integer. The value of N is ____.

**Q25** Friction **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/18rRzI2Vbt) > prepwisar.in/questions/18rRzI2Vbt

A block starts moving up an inclined plane of inclination 30° with an initial velocity of v_0 . It comes back to its initial position with velocity $\frac{v_0}{2}$. The value of the coefficient of kinetic friction between the block and the inclined plane is close to $\frac{I}{1000}$. The nearest integer to I is ____.

Chemistry Section A · Multiple choice

Q26 to Q37

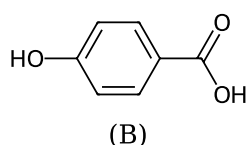
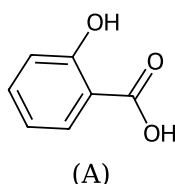
Q26 Aldehydes & Ketones[Step-by-step solution](https://www.prepwisar.in/questions/DIX-JRqpNj) > prepwisar.in/questions/DIX-JRqpNj

The increasing order of the reactivity of the following compound in nucleophilic addition reaction is: Propanal, Benzaldehyde, Propanone, Butanone

- (A) Butanone < Propanone < Benzaldehyde < Propanal
(B) Benzaldehyde < Butanone < Propanone < Propanal
(C) Propanal < Propanone < Butanone < Benzaldehyde
(D) Benzaldehyde < Propanal < Propanone < Butanone

Q27 Chemical Bonding & Molecular Structure[Step-by-step solution](https://www.prepwisar.in/questions/3UFlorz-18) > prepwisar.in/questions/3UFlorz-18

Consider the following molecules and statements related to them:



- (a) (B) is more likely to be crystalline than (A)
(b) (B) has higher boiling point than (A)
(c) (B) dissolves more readily than (A) in water

Identify the correct option from below:

- (A) only (a) is true
(B) (a), (b) and (c) are true
(C) (b) and (c) are true
(D) (a) and (b) are true

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Q28 Mole Concept & Stoichiometry[Step-by-step solution > prepwiser.in/questions/tTvQuWZY61](https://www.prepwiser.in/questions/tTvQuWZY61)

For the reaction

 $2A + 3B + \frac{3}{2}C \rightarrow 3P$, which statement is correct?

(A) $\frac{dn_A}{dt} = \frac{dn_B}{dt} = \frac{dn_C}{dt}$

(B) $\frac{dn_A}{dt} = \frac{2}{3} \frac{dn_B}{dt} = \frac{3}{4} \frac{dn_C}{dt}$

(C) $\frac{dn_A}{dt} = \frac{3}{2} \frac{dn_B}{dt} = \frac{3}{4} \frac{dn_C}{dt}$

(D) $\frac{dn_A}{dt} = \frac{2}{3} \frac{dn_B}{dt} = \frac{4}{3} \frac{dn_C}{dt}$

Q29 Chemistry in Everyday Life[Step-by-step solution > prepwiser.in/questions/RjPg-Yz_1N](https://www.prepwiser.in/questions/RjPg-Yz_1N)

Match the following drugs with their therapeutic actions:

(A) (i)-(a); (ii)-(c); (iii)-(b); (iv)-(e)**(B)** (i)-(e); (ii)-(a); (iii)-(c); (iv)-(d)**(C)** (i)-(d); (ii)-(a); (iii)-(b); (iv)-(c)**(D)** (i)-(d); (ii)-(c); (iii)-(a); (iv)-(e)

(i) Ranitidine	(a) Antidepressant
(ii) Nardil (Phenelzine)	(b) Antibiotic
(iii) Chloramphenicol	(c) Antihistamine
(iv) Dimetane (Brompheniramine)	(d) Antacid
	(e) Analgesic

Q30 Coordination Compounds[Step-by-step solution > prepwiser.in/questions/6JADOrOZT](https://www.prepwiser.in/questions/6JADOrOZT)The d-electron configuration of $[\text{Ru}(\text{en})_3]\text{Cl}_2$ and $[\text{Fe}(\text{H}_2\text{O})_6]\text{Cl}_2$, respectively are:

(A) $t_{2g}^4 e_g^2$ and $t_{2g}^6 e_g^0$

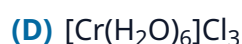
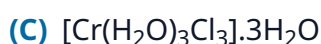
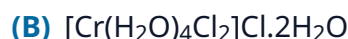
(B) $t_{2g}^6 e_g^0$ and $t_{2g}^6 e_g^0$

(C) $t_{2g}^6 e_g^0$ and $t_{2g}^4 e_g^2$

(D) $t_{2g}^4 e_g^2$ and $t_{2g}^4 e_g^2$

Q31 Coordination Compounds[Step-by-step solution > prepwiser.in/questions/ubbqw7MHVZ](https://www.prepwiser.in/questions/ubbqw7MHVZ)Complex A has a composition of $\text{H}_{12}\text{O}_6\text{Cl}_3\text{Cr}$. If the complex on treatment with conc. H_2SO_4 loses 13.5% of its original mass, the correct molecular formula of A is:

[Given: atomic mass of Cr = 52 amu and Cl = 35 amu]

**Q32** Periodic Table & Periodicity[Step-by-step solution > prepwiser.in/questions/8qwXIfITUj](https://www.prepwiser.in/questions/8qwXIfITUj)

Among the statements (I – IV), the correct ones are:

(I) Be has smaller atomic radius compared to Mg.

(II) Be has higher ionization enthalpy than Al.

(III) Charge/radius ratio of Be is greater than that of Al.

(IV) Both Be and Al form mainly covalent compounds.

(A) (I), (II) and (IV)**(B)** (II), (III) and (IV)**(C)** (I), (III) and (IV)**(D)** (I), (II) and (III)**Q33** Periodic Table & Periodicity[Step-by-step solution > prepwiser.in/questions/qLpzE0bhVG](https://www.prepwiser.in/questions/qLpzE0bhVG)The five successive ionization enthalpies of an element are 800, 2427, 3658, 25024 and 32824 kJ mol⁻¹. The number of valence electrons in the element is:**(A)** 2**(B)** 3**(C)** 4**(D)** 5**Q34** Mole Concept & Stoichiometry[Step-by-step solution > prepwiser.in/questions/SoBs4jF9GM](https://www.prepwiser.in/questions/SoBs4jF9GM)

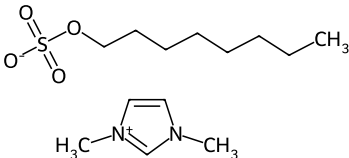
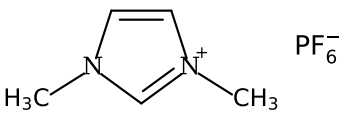
The strengths of 5.6 volume hydrogen peroxide (of density 1 g/mL) in terms of mass percentage and molarity (M), respectively, are: (Take molar mass of hydrogen peroxide as 34 g/mol)

(A) 0.85 and 0.5**(B)** 0.85 and 0.25**(C)** 1.7 and 0.25**(D)** 1.7 and 0.5

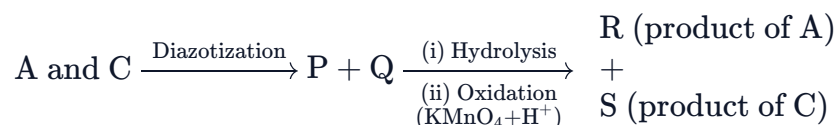
Consider the hypothetical situation where the azimuthal quantum number, l , takes values 0, 1, 2, ..., $n + 1$, where n is the principal quantum number. Then, the element with atomic number:

- (A) 13 has a half-filled valence subshell
 (B) 9 is the first alkali metal
 (C) 8 is the first noble gas
 (D) 6 has a 2p-valence subshell

An ionic micelle is formed on the addition of:

- (A) excess water to liquid 
- (B) excess water to liquid 
- (C) liquid diethyl ether to aqueous NaCl solution
- (D) sodium stearate to pure toluene

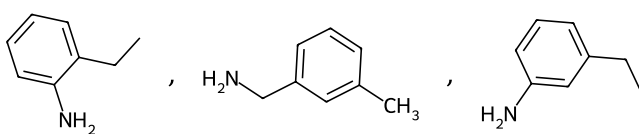
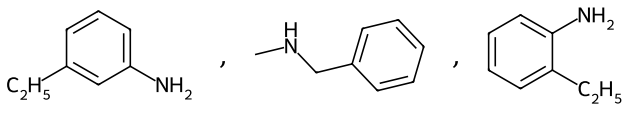
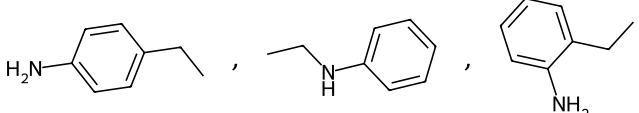
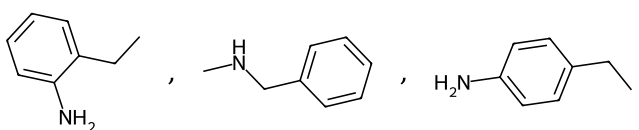
Three isomers A, B and C (mol. formula $C_8H_{11}N$) give the following results:



R has lower boiling point than S

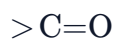


A, B and C, respectively are:

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

Q38 Carbohydrates & Biomolecules **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/uU1MC7FIrm) › prepwisar.in/questions/uU1MC7FIrm

The number of



groups present in a tripeptide Asp–Glu–Lys is ____.

Q39 Electrochemistry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/T-CtiMBkPS) › prepwisar.in/questions/T-CtiMBkPS

An acidic solution of dichromate is electrolyzed for 8 minutes using 2A current. As per the following equation

The amount of Cr^{3+} obtained was 0.104 g. The efficiency of the process(in%) is (Take : F = 96000 C, At. mass of chromium = 52) ____.**Q40** Solutions & Colligative Properties **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/gJDD2rIMeq) › prepwisar.in/questions/gJDD2rIMeqIf 250 cm^3 of an aqueous solution containing 0.73 g of a protein A is isotonic with one litre of another aqueous solution containing 1.65 g of a protein B, at 298 K, the ratio of the molecular masses of A and B is ____ $\times 10^{-2}$ (to the nearest integer).**Q41** Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/u5bBjFdxve) › prepwisar.in/questions/u5bBjFdxve 6.023×10^{22} molecules are present in 10 g of a substance 'x'. The molarity of a solution containing 5 g of substance 'x' in 2 L solution is ____ $\times 10^{-3}$ **Q42** Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/f5dmVAaxWE) › prepwisar.in/questions/f5dmVAaxWE

The volume (in mL) of 0.1 N NaOH required to neutralise 10 mL of 0.1 N phosphinic acid is ____.

Mathematics Section A · Multiple choice

Q43 to Q61

Q43 Three Dimensional Geometry[Step-by-step solution](https://www.prepwisar.in/questions/CB95wM-jnd) › prepwisar.in/questions/CB95wM-jnd

The plane which bisects the line joining, the points (4, -2, 3) and (2, 4, -1) at right angles also passes through the point:

- (A) (4, 0, 1) (B) (0, -1, 1) (C) (0, 1, -1) (D) (4, 0, -1)

Q44 Applications of Derivatives[Step-by-step solution](https://www.prepwisar.in/questions/pQNr2M8Kd5) › prepwisar.in/questions/pQNr2M8Kd5If the surface area of a cube is increasing at a rate of $3.6 \text{ cm}^2/\text{sec}$, retaining its shape; then the rate of change of its volume (in cm^3/sec), when the length of a side of the cube is 10 cm, is:

- (A) 9 (B) 10 (C) 18 (D) 20

Q45 Binomial Theorem[Step-by-step solution](https://www.prepwisar.in/questions/2M92itbdAh) › prepwisar.in/questions/2M92itbdAhIf the term independent of x in the expansion of $\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^9$ is k, then 18 k is equal to:

- (A) 5 (B) 9 (C) 7 (D) 11

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Q46 Complex Numbers[Step-by-step solution](https://www.prepwisar.in/questions/oigXp75Hh3) > prepwisar.in/questions/oigXp75Hh3

If z_1, z_2 are complex numbers such that $\operatorname{Re}(z_1) = |z_1 - 1|$, $\operatorname{Re}(z_2) = |z_2 - 1|$, and $\arg(z_1 - z_2) = \frac{\pi}{6}$, then $\operatorname{Im}(z_1 + z_2)$ is equal to:

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

Q47 Definite Integration[Step-by-step solution](https://www.prepwisar.in/questions/MZnsBmyOYD) > prepwisar.in/questions/MZnsBmyOYD

If the value of the integral

$$\int_0^{\frac{1}{2}} \frac{x^2}{(1-x^2)^{\frac{3}{2}}} dx$$

is $\frac{k}{6}$, then k is equal to:

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

Q48 Applications of Derivatives[Step-by-step solution](https://www.prepwisar.in/questions/EOq4nAZUjk) > prepwisar.in/questions/EOq4nAZUjk

Suppose $f(x)$ is a polynomial of degree four, having critical points at $-1, 0, 1$. If $T = \{x \in \mathbb{R} \mid f(x) = f(0)\}$, then the sum of squares of all the elements of T is:

- (A) 6 (B) 2 (C) 8 (D) 4

Q49 Differential Equations[Step-by-step solution](https://www.prepwisar.in/questions/PMT-YCCni4) > prepwisar.in/questions/PMT-YCCni4

If $x^3 dy + xy dx = x^2 dy + 2y dx$; $y(2) = e$ and $x > 1$, then $y(4)$ is equal to:

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

Q50 Ellipse[Step-by-step solution](https://www.prepwisar.in/questions/J2EQ9OQgtN) > prepwisar.in/questions/J2EQ9OQgtN

Let e_1 and e_2 be the eccentricities of the ellipse, $\frac{x^2}{25} + \frac{y^2}{b^2} = 1$ ($b < 5$) and the hyperbola, $\frac{x^2}{16} - \frac{y^2}{b^2} = 1$ respectively satisfying $e_1 e_2 = 1$. If α and β are the distances between the foci of the ellipse and the foci of the hyperbola respectively, then the ordered pair (α, β) is equal to:

- (A) (8, 10) (B) (8, 12) (C) $\left(\frac{24}{5}, 10\right)$ (D) $\left(\frac{20}{3}, 12\right)$

Q51 Limits[Step-by-step solution](https://www.prepwisar.in/questions/SMY6JeiWz0) > prepwisar.in/questions/SMY6JeiWz0

$$\lim_{x \rightarrow a} \frac{(a+2x)^{\frac{1}{3}} - (3x)^{\frac{1}{3}}}{(3a+x)^{\frac{1}{3}} - (4x)^{\frac{1}{3}}}$$

($a \neq 0$) is equal to:

- (A) $\left(\frac{2}{9}\right) \left(\frac{2}{3}\right)^{\frac{1}{3}}$ (B) $\left(\frac{2}{3}\right) \left(\frac{2}{9}\right)^{\frac{1}{3}}$ (C) $\left(\frac{2}{3}\right)^{\frac{4}{3}}$ (D) $\left(\frac{2}{9}\right)^{\frac{4}{3}}$

Q52 Determinants[Step-by-step solution](https://www.prepwiser.in/questions/HAz6xQjLDH) › prepwiser.in/questions/HAz6xQjLDH

Let A be a 3×3 matrix such that
 $\text{adj } A =$

$$\begin{bmatrix} 2 & -1 & 1 \\ -1 & 0 & 2 \\ 1 & -2 & -1 \end{bmatrix}$$

and $B = \text{adj}(\text{adj } A)$.

If $|A| = \lambda$ and $|(B^{-1})^T| = \mu$, then the ordered pair,
 $(|\lambda|, \mu)$ is equal to:

- (A) (3, 81) (B) $\left(9, \frac{1}{9}\right)$ (C) $\left(3, \frac{1}{81}\right)$ (D) $\left(9, \frac{1}{81}\right)$

Q53 Circles[Step-by-step solution](https://www.prepwiser.in/questions/36ST2-XtZV) › prepwiser.in/questions/36ST2-XtZV

Let the latus rectum of the parabola $y^2 = 4x$ be the common chord to the circles C_1 and C_2 each of them having radius $2\sqrt{5}$. Then, the distance between the centres of the circles C_1 and C_2 is:

- (A) 8 (B) 12 (C) $8\sqrt{5}$ (D) $4\sqrt{5}$

Q54 Probability: Basic[Step-by-step solution](https://www.prepwiser.in/questions/kMLNVciWNh) › prepwiser.in/questions/kMLNVciWNh

The probability that a randomly chosen 5-digit number is made from exactly two digits is:

- (A) $\frac{150}{10^4}$ (B) $\frac{134}{10^4}$ (C) $\frac{121}{10^4}$ (D) $\frac{135}{10^4}$

Q55 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](https://www.prepwiser.in/questions/dTjtxWsgGo) › prepwiser.in/questions/dTjtxWsgGo

The set of all real values of λ for which the quadratic equations,
 $(\lambda^2 + 1)x^2 - 4\lambda x + 2 = 0$ always have exactly one root in the interval $(0, 1)$ is:

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

Q56 Sequences & Series[Step-by-step solution](https://www.prepwiser.in/questions/wl3-3RvPVb) › prepwiser.in/questions/wl3-3RvPVb

If the sum of the series

$$20 + 19\frac{3}{5} + 19\frac{1}{5} + 18\frac{4}{5} + \dots$$

upto n th term is 488 and the n th term is negative, then:

- (A) $n = 41$ (B) $n = 60$ (C) n th term is -4 (D) n th term is $-4\frac{2}{5}$

Q57 Relations & Functions (Basic)[Step-by-step solution](https://www.prepwiser.in/questions/GrbKUVkem7) › prepwiser.in/questions/GrbKUVkem7

Let R_1 and R_2 be two relation defined as follows:

$$R_1 = \{(a, b) \in \mathbb{R}^2 : a^2 + b^2 \in \mathbb{Q}\} \text{ and}$$

$$R_2 = \{(a, b) \in \mathbb{R}^2 : a^2 + b^2 \notin \mathbb{Q}\},$$

where $\mathbb{Q}$ is the set of all rational numbers. Then:

- (A) Neither R_1 nor R_2 is transitive. (B) R_2 is transitive but R_1 is not transitive.
(C) R_1 and R_2 are both transitive. (D) R_1 is transitive but R_2 is not transitive.

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Q58 Statistics[Step-by-step solution](https://www.prepwisar.in/questions/yX3Yqh3ZkM)

Let x_i ($1 \leq i \leq 10$) be ten observations of a random variable X . If

$$\sum_{i=1}^{10} (x_i - p) = 3 \text{ and } \sum_{i=1}^{10} (x_i - p)^2 = 9$$

where $0 \neq p \in \mathbb{R}$, then the standard deviation of these observations is:

- (A) $\frac{7}{10}$ (B) $\frac{9}{10}$ (C) $\frac{4}{5}$ (D) $\sqrt{\frac{3}{5}}$

Q59 Vectors[Step-by-step solution](https://www.prepwisar.in/questions/TddpybZwei)

Let $a, b, c \in \mathbb{R}$ be such that $a^2 + b^2 + c^2 = 1$. If

$$a \cos \theta = b \cos \left(\theta + \frac{2\pi}{3} \right) = c \cos \left(\theta + \frac{4\pi}{3} \right)$$

where $\theta = \frac{\pi}{9}$, then the angle between the vectors $a\hat{i} + b\hat{j} + c\hat{k}$ and $b\hat{i} + c\hat{j} + a\hat{k}$ is:

- (A) 0 (B) $\frac{\pi}{9}$ (C) $\frac{2\pi}{3}$ (D) $\frac{\pi}{2}$

Q60 Straight Lines[Step-by-step solution](https://www.prepwisar.in/questions/wrDw2a0VLI)

If a $\triangle ABC$ has vertices $A(-1, 7)$, $B(-7, 1)$ and $C(5, -5)$, then its orthocentre has coordinates:

- (A) $(-3, 3)$ (B) $(3, -3)$ (C) $\left(\frac{3}{5}, -\frac{3}{5}\right)$ (D) $\left(-\frac{3}{5}, \frac{3}{5}\right)$

Q61 Indefinite Integration[Step-by-step solution](https://www.prepwisar.in/questions/8YeyEuraj4)

If $\int \sin^{-1} \left(\sqrt{\frac{x}{1+x}} \right) dx = A(x) \tan^{-1}(\sqrt{x}) + B(x) + C$,

where C is a constant of integration, then the ordered pair $(A(x), B(x))$ can be:

- (A) $(x+1, -\sqrt{x})$ (B) $(x+1, \sqrt{x})$ (C) $(x-1, -\sqrt{x})$ (D) $(x-1, \sqrt{x})$

Mathematics Section B · Numerical value

Q62 to Q66

Q62 Three Dimensional Geometry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/kdXbLsdnCU)

Let a plane P contain two lines

$$\vec{r} = \hat{i} + \lambda(\hat{i} + \hat{j})$$

, $\lambda \in \mathbb{R}$ and

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

, $\mu \in \mathbb{R}$

If $Q(\alpha, \beta, \gamma)$ is the foot of the perpendicular drawn from the point $M(1, 0, 1)$ to P , then $3(\alpha + \beta + \gamma)$ equals ____.

Q63 Determinants **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/8B_cFVfjDz)

Let S be the set of all integer solutions, (x, y, z) , of the system of equations

$$x - 2y + 5z = 0$$

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

$$-7x + 14y + 9z = 0$$

such that $15 \leq x^2 + y^2 + z^2 \leq 150$. Then, the number of elements in the set S is equal to ____.

If the tangent to the curve, $y = e^x$ at a point (c, e^c) and the normal to the parabola, $y^2 = 4x$ at the point $(1, 2)$ intersect at the same point on the x-axis, then the value of c is _____.

The total number of 3-digit numbers, whose sum of digits is 10, is _____.

If m arithmetic means (A.Ms) and three geometric means (G.Ms) are inserted between 3 and 243 such that 4th A.M. is equal to 2nd G.M., then m is equal to _____.

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Physics

1. A	2. C	3. B	4. B	5. A	6. D	7. C	8. D
9. C	10. C	11. D	12. A	13. B	14. B	15. C	16. B
17. D	18. A	19. B	20. B	21. 1	22. 8791	23. 20	24. 25
25. 346							

Chemistry

26. A	27. B	28. D	29. C	30. C	31. B	32. A	33. B
34. D	35. A	36. A	37. D	38. 5	39. 60	40. 177	41. 25
42. 10							

Mathematics

43. D	44. A	45. C	46. D	47. D	48. D	49. D	50. A
51. B	52. C	53. A	54. D	55. D	56. C	57. A	58. B
59. D	60. A	61. A	62. 5	63. 8	64. 4	65. 54	66. 39

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