

JEE MAIN 2020 · QUESTION PAPER

9 Jan 2020 **Shift 1**

69 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	19 Q1 to Q19	5 Q20 to Q24
● Chemistry	18 Q25 to Q42	4 Q43 to Q46
● Mathematics	19 Q47 to Q65	4 Q66 to Q69
In this PDF	69 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.

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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 Collision

[Step-by-step solution](#) > [prepwiser.in/questions/wGnxjY2N_i](https://www.prepwiser.in/questions/wGnxjY2N_i)

Two particles of equal mass m have respective initial velocities $u\hat{i}$ and $u\left(\frac{\hat{i}+\hat{j}}{2}\right)$.

They collide completely inelastically. The energy lost in the process is:

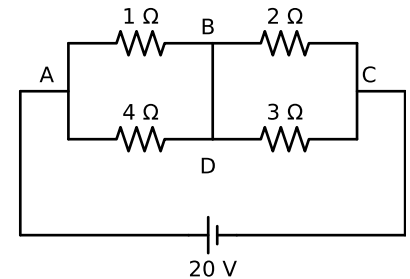
- (A) $\frac{1}{3}mu^2$ (B) $\frac{1}{8}mu^2$ (C) $\frac{3}{4}mu^2$ (D) $\sqrt{\frac{2}{3}}mu^2$

Q2 Current Electricity

[Step-by-step solution](#) > [prepwiser.in/questions/_oreok_c0I](https://www.prepwiser.in/questions/_oreok_c0I)

In the given circuit diagram, a wire is joining points B and D. The current in this wire is:

- (A) 4 A (B) 2 A (C) zero (D) 0.4 A



Q3 Dual Nature of Radiation & Matter

[Step-by-step solution](#) > [prepwiser.in/questions/RggoEC0poE](https://www.prepwiser.in/questions/RggoEC0poE)

A particle moving with kinetic energy E has de Broglie wavelength λ . If energy ΔE is added to its energy, the wavelength become $\lambda/2$. Value of ΔE , is:

- (A) E (B) $3E$ (C) $2E$ (D) $4E$

Q4 Dual Nature of Radiation & Matter

[Step-by-step solution](#) > [prepwiser.in/questions/ZxxR8i3Mlf](https://www.prepwiser.in/questions/ZxxR8i3Mlf)

Radiation, with wavelength $6561 \text{ \AA}$ falls on a metal surface to produce photoelectrons. The electrons are made to enter a uniform magnetic field of $3 \times 10^{-4} \text{ T}$. If the radius of the largest circular path followed by the electrons is 10 mm, the work function of the metal is close to:

- (A) 1.8eV (B) 0.8eV (C) 1.1eV (D) 1.6eV

Q5 Electromagnetic Waves

[Step-by-step solution](#) > [prepwiser.in/questions/EY4Ci1_APx](https://www.prepwiser.in/questions/EY4Ci1_APx)

The electric fields of two plane electromagnetic plane waves in vacuum are given by

$$\vec{E}_1 = E_0\hat{j} \cos(\omega t - kx) \text{ and}$$

$$\vec{E}_2 = E_0\hat{k} \cos(\omega t - ky)$$

At $t = 0$, a particle of charge q is at origin with

a velocity $\vec{v} = 0.8c\hat{j}$ (c is the speed of light in vacuum). The instantaneous force experienced by the particle is:

- (A) $E_0q(0.8\hat{i} - \hat{j} + 0.4\hat{k})$ (B) $E_0q(-0.8\hat{i} + \hat{j} + \hat{k})$
(C) $E_0q(0.8\hat{i} + \hat{j} + 0.2\hat{k})$ (D) $E_0q(0.4\hat{i} - 3\hat{j} + 0.8\hat{k})$

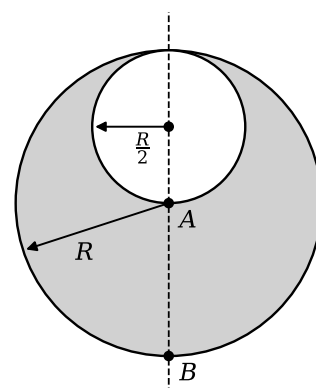
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Consider a sphere of radius R which carries a uniform charge density ρ . If a sphere of radius $\frac{R}{2}$ is carved out of it, as shown, the ratio

$$\frac{|\vec{E}_A|}{|\vec{E}_B|}$$

of magnitude of electric field $\vec{E}_A$ and $\vec{E}_B$, respectively, at points A and B due to the remaining portion is:

- (A) $\frac{17}{54}$ (B) $\frac{18}{54}$ (C) $\frac{18}{34}$ (D) $\frac{21}{34}$



An electric dipole of moment

$$\vec{p} = (-\hat{i} - 3\hat{j} + 2\hat{k}) \times 10^{-29}$$

C.m is

at the origin $(0, 0, 0)$. The electric field due to this dipole at

$\vec{r} = +\hat{i} + 3\hat{j} + 5\hat{k}$ (note that $\vec{r} \cdot \vec{p} = 0$) is parallel to:

- (A) $(+\hat{i} + 3\hat{j} - 2\hat{k})$ (B) $(+\hat{i} - 3\hat{j} - 2\hat{k})$ (C) $(-\hat{i} + 3\hat{j} - 2\hat{k})$ (D) $(-\hat{i} - 3\hat{j} + 2\hat{k})$

A vessel of depth $2h$ is half filled with a liquid of refractive index $2\sqrt{2}$ and the upper half with another liquid of refractive index $\sqrt{2}$. The liquids are immiscible. The apparent depth of the inner surface of the bottom of vessel will be:

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

The aperture diameter of a telescope is 5m. The separation between the moon and the earth is 4×10^5 km. With light of wavelength of $5500 \text{ \AA}$, the minimum separation between objects on the surface of moon, so that they are just resolved, is close to:

- (A) 20 m (B) 200 m (C) 600 m (D) 60 m

A body A of mass m is moving in a circular orbit of radius R about a planet. Another body B of mass $\frac{m}{2}$ collides with A with a velocity which is half $\left(\frac{\vec{v}}{2}\right)$ the instantaneous velocity $\vec{v}$ of A. The collision is completely inelastic. Then, the combined body:

- (A) starts moving in an elliptical orbit around the planet.
(B) Falls vertically downwards towards the planet
(C) Escapes from the Planet's Gravitational field.
(D) continues to move in a circular orbit

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Q11 Kinetic Theory of Gases[Step-by-step solution > prepwisar.in/questions/6VO_337CjE](https://www.prepwisar.in/questions/6VO_337CjE)

Consider two ideal diatomic gases A and B at some temperature T . Molecules of the gas A are rigid, and have a mass m . Molecules of the gas B have an additional vibrational mode, and have a mass $\frac{m}{4}$. The ratio of the specific heats (C_V^A and C_V^B) of gas A and B, respectively is:

- (A) 7 : 9 (B) 5 : 7 (C) 3 : 5 (D) 5 : 9

Q12 Moving Charges & Magnetism[Step-by-step solution > prepwisar.in/questions/ghGw98MGeF](https://www.prepwisar.in/questions/ghGw98MGeF)

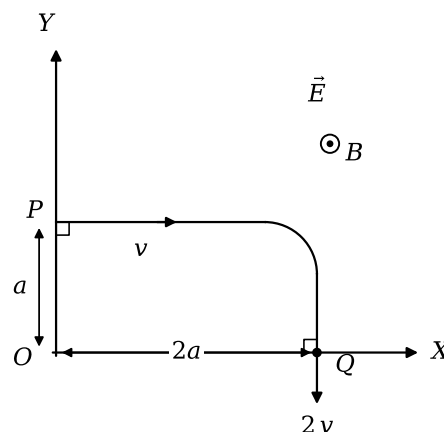
A long, straight wire of radius a carries a current distributed uniformly over its cross-section. The ratio of the magnetic fields due to the wire at distance $\frac{a}{3}$ and $2a$, respectively from the axis of the wire is:

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

Q13 Moving Charges & Magnetism[Step-by-step solution > prepwisar.in/questions/vY7SQsrXV9](https://www.prepwisar.in/questions/vY7SQsrXV9)

A charged particle of mass ' m ' and charge ' q ' moving under the influence of uniform electric field $\vec{E} \hat{i}$ and a uniform magnetic field $\vec{B} \hat{k}$ follows a trajectory from point P to Q as shown in figure. The velocities at P and Q are respectively, $v \hat{i}$ and $-2v \hat{j}$. Then which of the following statements (A, B, C, D) are the correct? (Trajectory shown is schematic and not to scale):

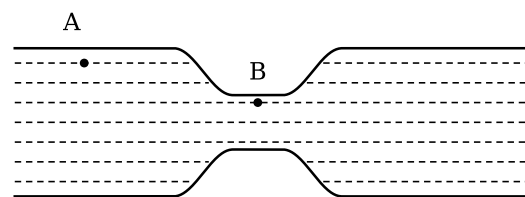
- (A) $E = \frac{3}{4} \left(\frac{mv^2}{qa} \right)$
 (B) Rate of work done by the electric field at P is $\frac{3}{4} \left(\frac{mv^3}{a} \right)$
 (C) Rate of work done by both the fields at Q is zero
 (D) The difference between the magnitude of angular momentum of the particle at P and Q is $2mav$.



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

Q14 Fluid Mechanics[Step-by-step solution > prepwisar.in/questions/FahfC1jn_8](https://www.prepwisar.in/questions/FahfC1jn_8)

Water flows in a horizontal tube (see figure). The pressure of water changes by 700 Nm^{-2} between A and B where the area of cross section are 40 cm^2 and 20 cm^2 , respectively. Find the rate of flow of water through the tube. (density of water = 1000 kgm^{-3})

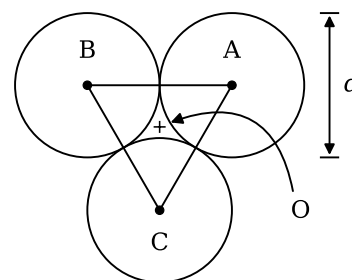


- (A) $1810 \text{ cm}^3/\text{s}$ (B) $2420 \text{ cm}^3/\text{s}$ (C) $3020 \text{ cm}^3/\text{s}$ (D) $2720 \text{ cm}^3/\text{s}$

Q15 Rotational Motion[Step-by-step solution > prepwisar.in/questions/oOq2wWdANI](https://www.prepwisar.in/questions/oOq2wWdANI)

Three solid spheres each of mass m and diameter d are stuck together such that the lines connecting the centres form an equilateral triangle of side of length d . The ratio I_O/I_A of moment of inertia I_O of the system about an axis passing the centroid and about center of any of the spheres I_A and perpendicular to the plane of the triangle is:

- (A) $\frac{13}{23}$ (B) $\frac{23}{13}$ (C) $\frac{15}{13}$ (D) $\frac{13}{15}$



Q16 Mechanical Waves[Step-by-step solution](#) > [prepwiser.in/questions/igeRyPt03t](https://www.prepwiser.in/questions/igeRyPt03t)

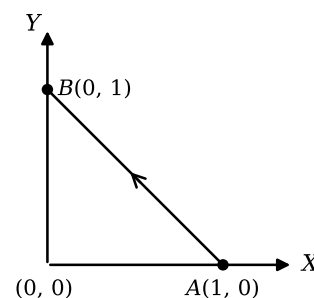
Three harmonic waves having equal frequency ν and same intensity I_0 , have phase angles 0 , $\frac{\pi}{4}$ and $-\frac{\pi}{4}$ respectively. When they are superimposed the intensity of the resultant wave is close to:

- (A) $5.8 I_0$ (B) $3 I_0$ (C) $0.2 I_0$ (D) I_0

Q17 Work, Energy & Power[Step-by-step solution](#) > [prepwiser.in/questions/-JGp15tk-1](https://www.prepwiser.in/questions/-JGp15tk-1)

Consider a force $\vec{F} = -x\hat{i} + y\hat{j}$. The work done by this force in moving a particle from point A(1, 0) to B(0, 1) along the line segment is : (all quantities are in SI units)

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

**Q18** Units, Dimensions & Errors[Step-by-step solution](#) > [prepwiser.in/questions/IMVhWWfQUY](https://www.prepwiser.in/questions/IMVhWWfQUY)

A quantity f is given by $f = \sqrt{\frac{hc^5}{G}}$ where c is speed of light, G universal gravitational constant and h is the Planck's constant. Dimension of f is that of:

- (A) Energy (B) Momentum (C) Area (D) Volume

Q19 Experimental Skills[Step-by-step solution](#) > [prepwiser.in/questions/M3h9Y9V-yP](https://www.prepwiser.in/questions/M3h9Y9V-yP)

If the screw on a screw-gauge is given six rotations, it moves by 3 mm on the main scale. If there are 50 divisions on the circular scale the least count of the screw gauge is:

- (A) 0.001 mm (B) 0.01 cm (C) 0.02 mm (D) 0.001 cm

Physics Section B · Numerical value

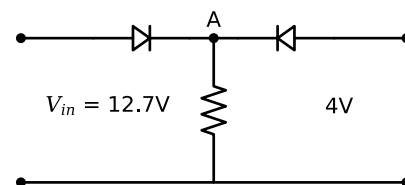
Q20 to Q24

Q20 Electromagnetic Induction **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/0TSvug4mx8](https://www.prepwiser.in/questions/0TSvug4mx8)

In a fluorescent lamp choke (a small transformer) 100 V of reverse voltage is produced when the choke current changes uniformly from 0.25 A to 0 in a duration of 0.025 ms. The self-inductance of the choke (in mH) is estimated to be _____.

Q21 Semiconductors & Electronic Devices **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/PqRuTmuitp](https://www.prepwiser.in/questions/PqRuTmuitp)

Both the diodes used in the circuit shown are assumed to be ideal and have negligible resistance when these are forward biased. Built in potential in each diode is 0.7 V. For the input voltages shown in the figure, the voltage (in Volts) at point A is _____.

**Q22** Rectilinear Motion **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/ODOeIDIEiP](https://www.prepwiser.in/questions/ODOeIDIEiP)

The distance x covered by a particle in one dimensional motion varies with time t as $x^2 = at^2 + 2bt + c$. If the acceleration of the particle depends on x as x^{-n} , where n is an integer, the value of n is _____

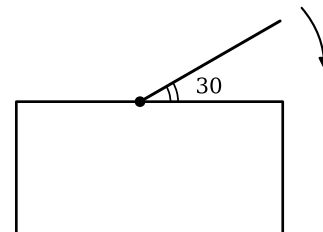
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Q23 Circular Motion **NUMERICAL**[Step-by-step solution](#) › [prepwisar.in/questions/08PpU8XDxP](https://www.prepwisar.in/questions/08PpU8XDxP)

A body of mass $m = 10 \text{ kg}$ is attached to one end of a wire of length 0.3 m . The maximum angular speed (in rad s^{-1}) with which it can be rotated about its other end in space station is:
(Breaking stress of wire = $4.8 \times 10^7 \text{ Nm}^{-2}$ and
area of cross-section of the wire = 10^{-2} cm^2) is:

Q24 Rotational Motion **NUMERICAL**[Step-by-step solution](#) › [prepwisar.in/questions/-4offe84Uk](https://www.prepwisar.in/questions/-4offe84Uk)

One end of a straight uniform 1 m long bar is pivoted on horizontal table. It is released from rest when it makes an angle 30° from the horizontal (see figure). Its angular speed when it hits the table is given as $\sqrt{n} \text{ s}^{-1}$, where n is an integer. The value of n is _____.

**Chemistry** Section A · Multiple choice

Q25 to Q42

Q25 Chemical Bonding & Molecular Structure[Step-by-step solution](#) › [prepwisar.in/questions/nkIc4SkGqR](https://www.prepwisar.in/questions/nkIc4SkGqR)

If the magnetic moment of a dioxygen species is 1.73 B.M. , it may be:

- (A) O_2^- or O_2^+ (B) O_2 , O_2^- or O_2^+ (C) O_2 or O_2^+ (D) O_2 or O_2^-

Q26 Chemical Kinetics[Step-by-step solution](#) › [prepwisar.in/questions/M4iKtBCVFe](https://www.prepwisar.in/questions/M4iKtBCVFe)

For the following reactions



it was found that E_a is decreased by 30 kJ/mol in the presence of catalyst.

If the rate remains unchanged, the activation energy for catalysed reaction is (Assume pre exponential factor is same):

- (A) 198 kJ/mol (B) 135 kJ/mol (C) 105 kJ/mol (D) 75 kJ/mol

Q27 Chemistry in Everyday Life[Step-by-step solution](#) › [prepwisar.in/questions/heIDgPP9TJ](https://www.prepwisar.in/questions/heIDgPP9TJ)

A chemist has 4 samples of artificial sweetener A, B, C and D. To identify these samples, he performed certain experiments and noted the following observations:

- (i) A and D both form blue-violet colour with ninhydrin.
(ii) Lassaigne extract of C gives positive AgNO_3 test and negative $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ test.
(iii) Lassaigne extract of B and D gives positive sodium nitroprusside test
Based on these observations which option is correct?

- (A) A : Aspartame; B : Alitame; C : Saccharin; D; Sucralose
(B) A : Alitame; B : Saccharin; C : Aspartame; D; Sucralose
(C) A : Aspartame; B : Saccharin; C : Sucralose; D; Alitame
(D) A : Saccharin; B : Alitame; C : Sucralose; D; Aspartame

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Q28 Coordination Compounds[Step-by-step solution](https://www.prepwisar.in/questions/DMNsej9GIA) › prepwisar.in/questions/DMNsej9GIA

Complex X of composition $\text{Cr}(\text{H}_2\text{O})_6\text{Cl}_n$ has a spin only magnetic moment of 3.83 BM. It reacts with AgNO_3 and shows geometrical isomerism. The IUPAC nomenclature of X is:

- (A) Hexaaqua chromium (III) chloride
(B) Tetraaquadichlorido chromium(IV) chloride dihydrate
(C) Tetraaquadichlorido chromium (III) chloride dihydrate
(D) Dichloridotetraqua chromium (IV) chloride dihydrate

Q29 Coordination Compounds[Step-by-step solution](https://www.prepwisar.in/questions/QFgeCaGyb6) › prepwisar.in/questions/QFgeCaGyb6

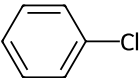
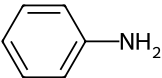
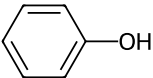
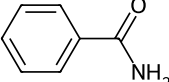
$[\text{Pd}(\text{F})(\text{Cl})(\text{Br})(\text{I})]^{2-}$ has n number of geometrical isomers. Then, the spin-only magnetic moment and crystal field stabilisation energy [CFSE] of $[\text{Fe}(\text{CN})_6]^{n-6}$, respectively, are:

[Note : Ignore the pairing energy]

- (A) 1.73 BM and $-2.0 \Delta_0$
(B) 5.92 BM and 0
(C) 2.84 BM and $-1.6 \Delta_0$
(D) 0 BM and $-2.4 \Delta_0$

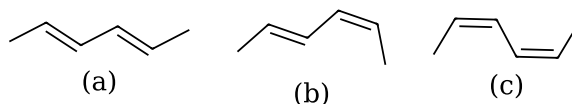
Q30 Hydrocarbons: Aromatic (Arenes)[Step-by-step solution](https://www.prepwisar.in/questions/w8De0mk0X-) › prepwisar.in/questions/w8De0mk0X-

Which of these will produce the highest yield in Friedel Crafts reaction?

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

Q31 General Organic Chemistry (GOC)[Step-by-step solution](https://www.prepwisar.in/questions/UbPfx7GBpH) › prepwisar.in/questions/UbPfx7GBpH

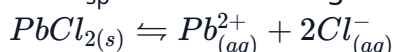
The correct order of heat of combustion for following alkadienes is:



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

Q32 Ionic Equilibrium[Step-by-step solution](https://www.prepwisar.in/questions/8xJz3VkcN5) › prepwisar.in/questions/8xJz3VkcN5

The K_{sp} for the following dissociation is 1.6×10^{-5}

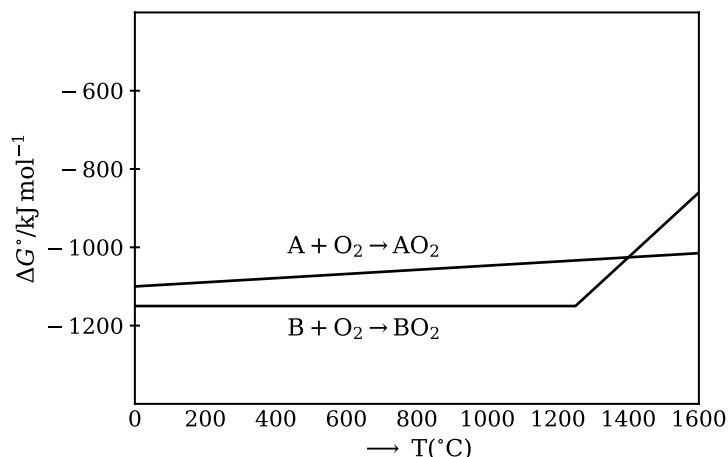


Which of the following choices is correct for a mixture of 300 mL 0.134 M $\text{Pb}(\text{NO}_3)_2$ and 100 mL 0.4 M NaCl?

- (A) $Q > K_{sp}$ (B) Not enough data provided
(C) $Q < K_{sp}$ (D) $Q = K_{sp}$

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According to the following diagram, A reduces BO_2 when the temperature is:



(A) $> 1400\text{ }^{\circ}\text{C}$

(B) $> 1200\text{ }^{\circ}\text{C}$ but $< 1400\text{ }^{\circ}\text{C}$

(C) $< 1400\text{ }^{\circ}\text{C}$

(D) $< 1200\text{ }^{\circ}\text{C}$

'X' melts at low temperature and is a bad conductor of electricity in both liquid and solid state. X is:

(A) Mercury

(B) Carbon tetrachloride

(C) Zinc sulphide

(D) Silicon carbide

The acidic, basic and amphoteric oxides, respectively, are:

(A) Cl_2O , CaO , P_4O_{10}

(B) N_2O_3 , Li_2O , Al_2O_3

(C) MgO , Cl_2O , Al_2O_3

(D) Na_2O , SO_3 , Al_2O_3

B has a smaller first ionization enthalpy than Be. Consider the following statements:

(I) It is easier to remove 2p electron than 2s electron

(II) 2p electron of B is more shielded from the nucleus by the inner core of electrons than the 2s electrons of Be.

(III) 2s electron has more penetration power than 2p electron.

(IV) atomic radius of B is more than Be (Atomic number B = 5, Be = 4)

The correct statements are:

(A) (I), (III) and (IV)

(B) (II), (III) and (IV)

(C) (I), (II) and (IV)

(D) (I), (II) and (III)

The electronic configurations of bivalent europium and trivalent cerium are (atomic number : Xe = 54, Ce = 58, Eu = 63)

(A) $[\text{Xe}] 4f^7 6s^2$ and $[\text{Xe}] 4f^2 6s^2$

(B) $[\text{Xe}] 4f^2$ and $[\text{Xe}] 4f^7$

(C) $[\text{Xe}] 4f^4$ and $[\text{Xe}] 4f^9$

(D) $[\text{Xe}] 4f^7$ and $[\text{Xe}] 4f^1$

The compound that cannot act both as oxidising and reducing agent is:

(A) H_3PO_4

(B) H_2SO_3

(C) H_2O_2

(D) HNO_2

The de Broglie wavelength of an electron in the 4th Bohr orbit is:

- (A) $2\pi a_0$ (B) $6\pi a_0$ (C) $8\pi a_0$ (D) $4\pi a_0$

If enthalpy of atomisation for $\text{Br}_{2(1)}$ is x kJ/mol and bond enthalpy for Br_2 is y kJ/mol, the relation between them:

- (A) does not exist (B) is $x < y$ (C) is $x > y$ (D) is $x = y$

The increasing order of basicity for the following intermediates is (from weak to strong)



(ii)



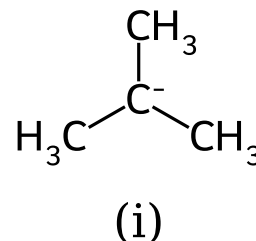
(iii)



(iv)

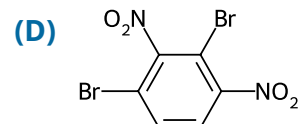
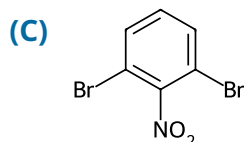
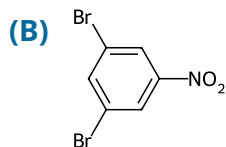
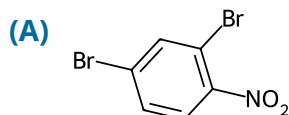
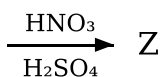
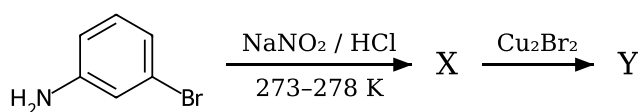


(v)



- (A) (iii) < (i) < (ii) < (iv) < (v) (B) (iii) < (iv) < (ii) < (i) < (v)
(C) (v) < (i) < (iv) < (ii) < (iii) (D) (v) < (iii) < (ii) < (iv) < (i)

The major product Z obtained in the following reaction scheme is:



Q43 Electrochemistry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/CLiS1Zjsjx) › prepwisar.in/questions/CLiS1Zjsjx

108 g of silver (molar mass 108 g mol^{-1}) is deposited at cathode from $\text{AgNO}_3(\text{aq})$ solution by a certain quantity of electricity. The volume (in L) of oxygen gas produced at 273 K and 1 bar pressure from water by the same quantity of electricity is _____. (Round off to the nearest integer)

Q44 Solutions & Colligative Properties **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/x1L_pvDTkW) › prepwisar.in/questions/x1L_pvDTkW

How much amount of NaCl should be added to 600 g of water ($\rho = 1.00 \text{ g/mL}$) to decrease the freezing point of water to -0.2°C ? _____. (Round off to the nearest integer)
(The freezing point depression constant for water = 2 K kg mol^{-1})

Q45 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/CzjpGJIY7t) › prepwisar.in/questions/CzjpGJIY7t

The molarity of HNO_3 in a sample which has density 1.4 g/mL and mass percentage of 63% is _____.
(Molecular Weight of $\text{HNO}_3 = 63$)

Q46 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/cuve0yP2eq) › prepwisar.in/questions/cuve0yP2eq

The hardness of a water sample containing 10^{-3} M MgSO_4 expressed as CaCO_3 equivalents (in ppm) is _____.
(molar mass of MgSO_4 is 120.37 g/mol)

Mathematics Section A · Multiple choice

Q47 Applications of Derivatives[Step-by-step solution](https://www.prepwisar.in/questions/feZr46OUTb) › prepwisar.in/questions/feZr46OUTb

A spherical iron ball of 10 cm radius is coated with a layer of ice of uniform thickness the melts at a rate of $50 \text{ cm}^3/\text{min}$. When the thickness of ice is 5 cm, then the rate (in cm/min.) at which of the thickness of ice decreases, is:

(A) $\frac{1}{18\pi}$

(B) $\frac{1}{36\pi}$

(C) $\frac{1}{54\pi}$

(D) $\frac{5}{6\pi}$

Q48 Circles[Step-by-step solution](https://www.prepwisar.in/questions/VNMCD1VjmG) › prepwisar.in/questions/VNMCD1VjmG

A circle touches the y-axis at the point (0, 4) and passes through the point (2, 0). Which of the following lines is not a tangent to this circle?

(A) $3x - 4y - 24 = 0$

(B) $4x + 3y - 8 = 0$

(C) $3x + 4y - 6 = 0$

(D) $4x - 3y + 17 = 0$

Q49 Complex Numbers[Step-by-step solution](https://www.prepwisar.in/questions/Vjo3emo2-C) › prepwisar.in/questions/Vjo3emo2-C

Let z be complex number such that

$$\left| \frac{z-i}{z+2i} \right| = 1 \text{ and } |z| = \frac{5}{2}.$$

Then the value of $|z + 3i|$ is:

(A) $2\sqrt{3}$

(B) $\sqrt{10}$

(C) $\frac{15}{4}$

(D) $\frac{7}{2}$

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Q50 Definite Integration[Step-by-step solution](https://www.prepwiser.in/questions/07hYffNly8) > prepwiser.in/questions/07hYffNly8

If for all real triplets (a, b, c), $f(x) = a + bx + cx^2$; then $\int_0^1 f(x)dx$ is equal to:

- (A) $\frac{1}{6} \left\{ f(0) + f(1) + 4f\left(\frac{1}{2}\right) \right\}$ (B) $2 \left\{ 3f(1) + 2f\left(\frac{1}{2}\right) \right\}$
 (C) $\frac{1}{3} \left\{ f(0) + f\left(\frac{1}{2}\right) \right\}$ (D) $\frac{1}{2} \left\{ f(1) + 3f\left(\frac{1}{2}\right) \right\}$

Q51 Definite Integration[Step-by-step solution](https://www.prepwiser.in/questions/EPdsylEbbR) > prepwiser.in/questions/EPdsylEbbR

The value of

$\int_0^{2\pi} \frac{x \sin^8 x}{\sin^8 x + \cos^8 x} dx$ is equal to:

- (A) 4π (B) 2π (C) π^2 (D) $2\pi^2$

Q52 Ellipse[Step-by-step solution](https://www.prepwiser.in/questions/r2NAf1rYHA) > prepwiser.in/questions/r2NAf1rYHA

If e_1 and e_2 are the eccentricities of the ellipse, $\frac{x^2}{18} + \frac{y^2}{4} = 1$ and the hyperbola, $\frac{x^2}{9} - \frac{y^2}{4} = 1$ respectively and (e_1, e_2) is a point on the ellipse, $15x^2 + 3y^2 = k$, then k is equal to:

- (A) 17 (B) 16 (C) 15 (D) 14

Q53 Continuity & Differentiability[Step-by-step solution](https://www.prepwiser.in/questions/iZDO-AfOXf) > prepwiser.in/questions/iZDO-AfOXf

If

$$f(x) = \begin{cases} \frac{\sin(a+2)x + \sin x}{x}; & x < 0 \\ b & x = 0 \\ \frac{(x+3x^2)^{\frac{1}{3}} - x^{\frac{1}{3}}}{x^{\frac{4}{3}}}; & x > 0 \end{cases}$$

is continuous at $x = 0$, then $a + 2b$ is equal to:

- (A) 0 (B) -1 (C) -2 (D) 1

Q54 Applications of Derivatives[Step-by-step solution](https://www.prepwiser.in/questions/tkhPJGqVyR) > prepwiser.in/questions/tkhPJGqVyR

Let f be any function continuous on $[a, b]$ and twice differentiable on (a, b) . If for all $x \in (a, b)$, $f'(x) > 0$ and $f''(x) < 0$, then for any $c \in (a, b)$, $\frac{f(c)-f(a)}{f(b)-f(c)}$ is greater than:

- (A) 1 (B) $\frac{b-c}{c-a}$ (C) $\frac{b+a}{b-a}$ (D) $\frac{c-a}{b-c}$

Q55 Determinants[Step-by-step solution](https://www.prepwiser.in/questions/xUkddGnDiC) > prepwiser.in/questions/xUkddGnDiC

If the matrices $A =$

$$\begin{bmatrix} 1 & 1 & 2 \\ 1 & 3 & 4 \\ 1 & -1 & 3 \end{bmatrix}$$

,

$B = \text{adj}A$ and $C = 3A$, then $\frac{|\text{adj}B|}{|C|}$ is equal to:

- (A) 8 (B) 2 (C) 72 (D) 16

Q56 Three Dimensional Geometry[Step-by-step solution](#) › prepwiser.in/questions/Vd3m2fEr3U

If for some α and β in $\mathbb{R}$, the intersection of the following three planes

$$x + 4y - 2z = 1$$

$$x + 7y - 5z = b$$

$$x + 5y + \alpha z = 5$$

is a line in $\mathbb{R}^3$, then $\alpha + \beta$ is equal to:

- (A) -10 (B) 0 (C) 10 (D) 2

Q57 Permutations & Combinations[Step-by-step solution](#) › prepwiser.in/questions/3d0d1uKom5

If the number of five digit numbers with distinct digits and 2 at the 10^{th} place is $336k$, then k is equal to:

- (A) 6 (B) 8 (C) 4 (D) 7

Q58 Probability: Advanced[Step-by-step solution](#) › prepwiser.in/questions/F-XU0O8OzC

In a box, there are 20 cards, out of which 10 are labelled as A and the remaining 10 are labelled as B. Cards are drawn at random, one after the other and with replacement, till a second A-card is obtained. The probability that the second A-card appears before the third B-card is:

- (A) $\frac{13}{16}$ (B) $\frac{11}{16}$ (C) $\frac{15}{16}$ (D) $\frac{9}{16}$

Q59 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](#) › prepwiser.in/questions/9hgpmfMIub

The number of real roots of the equation,
 $e^{4x} + e^{3x} - 4e^{2x} + e^x + 1 = 0$ is:

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

Q60 Sequences & Series[Step-by-step solution](#) › prepwiser.in/questions/C5AY91Ycsm

The product

$$2^{\frac{1}{4}} \cdot 4^{\frac{1}{16}} \cdot 8^{\frac{1}{48}} \cdot 16^{\frac{1}{128}}$$

... to ∞ is equal to:

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

Q61 Statistics[Step-by-step solution](#) › prepwiser.in/questions/IK9_XF6TwO

Let the observations x_i ($1 \leq i \leq 10$) satisfy the equations, $\sum_{i=1}^{10} (x_i - 5) = 10$ and $\sum_{i=1}^{10} (x_i - 5)^2 = 40$.

If μ and λ are the mean and the variance of the observations, $x_1 - 3, x_2 - 3, \dots, x_{10} - 3$, then the ordered pair (μ, λ) is equal to:

- (A) (6, 6) (B) (3, 3) (C) (3, 6) (D) (6, 3)

Q62 Straight Lines[Step-by-step solution](#) › prepwiser.in/questions/Yzhs4tScYM

Let C be the centroid of the triangle with vertices (3, -1), (1, 3) and (2, 4). Let P be the point of intersection of the lines $x + 3y - 1 = 0$ and $3x - y + 1 = 0$. Then the line passing through the points C and P also passes through the point:

- (A) (-9, -7) (B) (9, 7) (C) (7, 6) (D) (-9, -6)

Q63 Indefinite Integration[Step-by-step solution](#) › prepwiser.in/questions/isKx4idu0n

The integral $\int \frac{dx}{(x+4)^{\frac{8}{7}}(x-3)^{\frac{6}{7}}}$ is equal to:
(where C is a constant of integration)

(A) $\frac{1}{2} \left(\frac{x-3}{x+4} \right)^{\frac{3}{7}} + C$

(B) $\left(\frac{x-3}{x+4} \right)^{\frac{1}{7}} + C$

(C) $-\frac{1}{13} \left(\frac{x-3}{x+4} \right)^{\frac{13}{7}} + C$

(D) $-\left(\frac{x-3}{x+4} \right)^{-\frac{1}{7}} + C$

Q64 Indefinite Integration[Step-by-step solution](#) › prepwiser.in/questions/fnoEjq8j4x

If $f'(x) = \tan^{-1}(\sec x + \tan x)$, $-\frac{\pi}{2} < x < \frac{\pi}{2}$,
and $f(0) = 0$, then $f(1)$ is equal to:

(A) $\frac{1}{4}$

(B) $\frac{\pi-1}{4}$

(C) $\frac{\pi+1}{4}$

(D) $\frac{\pi+2}{4}$

Q65 Trigonometric Ratios & Identities[Step-by-step solution](#) › prepwiser.in/questions/nEDzjeFUFm

The value of
 $\cos^3\left(\frac{\pi}{8}\right)\cos\left(\frac{3\pi}{8}\right) + \sin^3\left(\frac{\pi}{8}\right)\sin\left(\frac{3\pi}{8}\right)$
is:

(A) $\frac{1}{\sqrt{2}}$

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

(C) $\frac{1}{4}$

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

Mathematics Section B · Numerical value

Q66 to Q69

Q66 Three Dimensional Geometry **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/EiTmgcyNYf

The projection of the line segment joining the points $(1, -1, 3)$ and $(2, -4, 11)$ on the line joining the points $(-1, 2, 3)$ and $(3, -2, 10)$ is _____.

Q67 Binomial Theorem **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/NgaOml0pst

The coefficient of x^4 in the expansion of $(1 + x + x^2)^{10}$ is _____.

Q68 Differential Equations **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/9Cf55ml7Bf

If for $x \geq 0$, $y = y(x)$ is the solution of the differential equation
 $(x+1)dy = ((x+1)^2 + y - 3)dx$, $y(2) = 0$, then $y(3)$ is equal to _____.

If the vectors,

$$\vec{p} = (a + 1)\hat{i} + a\hat{j} + a\hat{k}$$

,

$$\vec{q} = a\hat{i} + (a + 1)\hat{j} + a\hat{k}$$

and

$$\vec{r} = a\hat{i} + a\hat{j} + (a + 1)\hat{k} \quad (a \in R)$$

are coplanar and

$$3(\vec{p} \cdot \vec{q})^2 - \lambda |\vec{r} \times \vec{q}|^2 = 0$$

, then the value of λ is ____.

Answer key: JEE Main 2020 · 9 Jan · Shift 1

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Physics

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

Chemistry

25.	A	26.	D	27.	C	28.	C	29.	A	30.	A	31.	C	32.	A	33.	A	34.	B
35.	B	36.	D	37.	D	38.	A	39.	C	40.	C	41.	D	42.	A	43.	6	44.	2
45.	14	46.	100																

Mathematics

47.	A	48.	B	49.	D	50.	A	51.	C	52.	B	53.	A	54.	D	55.	A	56.	C
57.	B	58.	B	59.	A	60.	B	61.	B	62.	D	63.	B	64.	C	65.	D	66.	8
67.	615	68.	3	69.	1														

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