

JEE MAIN 2020 · QUESTION PAPER

7 Jan 2020 Shift 2

69 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	20 Q1 to Q20	4 Q21 to Q24
● Chemistry	16 Q25 to Q40	5 Q41 to Q45
● Mathematics	19 Q46 to Q64	5 Q65 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.

prepwise.in/pyqs/paper/2020-01-07-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? prepwise.in/feedback · Terms: prepwise.in/terms

Q1 Electromagnetic Induction

[Step-by-step solution](#) > [prepwiser.in/questions/cKzul3qgvc](https://www.prepwiser.in/questions/cKzul3qgvc)

An emf of 20 V is applied at time $t = 0$ to a circuit containing in series 10 mH inductor and $5\ \Omega$ resistor. The ratio of the currents at time $t = \infty$ and at $t = 40\text{ s}$ is close to : (Take $e^2 = 7.389$)

- (A) 1.06 (B) 0.84 (C) 1.15 (D) 1.46

Q2 Nuclear Physics

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

The activity of a radioactive sample falls from 700 s^{-1} to 500 s^{-1} in 30 minutes. Its half life is close to:

- (A) 62 min (B) 66 min (C) 72 min (D) 52 min

Q3 Current Electricity

[Step-by-step solution](#) > [prepwiser.in/questions/qKkt0bkPac](https://www.prepwiser.in/questions/qKkt0bkPac)

In a building there are 15 bulbs of 45 W, 15 bulbs of 100 W, 15 small fans of 10 W and 2 heaters of 1 kW. The voltage of electric main is 220 V. The minimum fuse capacity (rated value) of the building will be:

- (A) 15 A (B) 20 A (C) 25 A (D) 10 A

Q4 Dual Nature of Radiation & Matter

[Step-by-step solution](#) > [prepwiser.in/questions/gaM5hoSQah](https://www.prepwiser.in/questions/gaM5hoSQah)

An electron (of mass m) and a photon have the same energy E in the range of a few eV. The ratio of the de-Broglie wavelength associated with the electron and the wavelength of the photon is (c = speed of light in vacuum)

- (A) $\frac{1}{c} \left(\frac{2E}{m} \right)^{\frac{1}{2}}$ (B) $\frac{1}{c} \left(\frac{E}{2m} \right)^{\frac{1}{2}}$ (C) $\left(\frac{E}{2m} \right)^{\frac{1}{2}}$ (D) $c(2mE)^{\frac{1}{2}}$

Q5 Electromagnetic Induction

[Step-by-step solution](#) > [prepwiser.in/questions/ke3e1taIqp](https://www.prepwiser.in/questions/ke3e1taIqp)

A planar loop of wire rotates in a uniform magnetic field. Initially at $t = 0$, the plane of the loop is perpendicular to the magnetic field. If it rotates with a period of 10 s about an axis in its plane then the magnitude of induced emf will be maximum and minimum, respectively at:

- (A) 2.5 s and 7.5 s (B) 5.0 s and 10.0 s (C) 5.0 s and 7.5 s (D) 2.5 s and 5.0 s

Q6 Electromagnetic Waves

[Step-by-step solution](#) > [prepwiser.in/questions/K3IoEBENII](https://www.prepwiser.in/questions/K3IoEBENII)

The electric field of a plane electromagnetic wave is given by

$$\vec{E} = E_0 \frac{\hat{i} + \hat{j}}{\sqrt{2}} \cos(kz + \omega t)$$

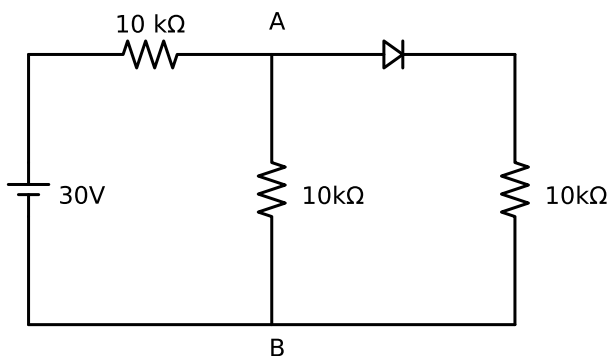
At $t = 0$, a positively charged particle is at the point $(x, y, z) = (0, 0, \frac{\pi}{k})$.

If its instantaneous velocity at ($t = 0$) is $v_0 \hat{k}$, the force acting on it due to the wave is:

- (A) parallel to $\hat{k}$ (B) parallel to $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$ (C) antiparallel to $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$ (D) zero

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In the figure, potential difference between A and B is:



- (A) 10 V (B) 5 V (C) zero (D) 15 V

A thin lens made of glass (refractive index = 1.5) of focal length $f = 16$ cm is immersed in a liquid of refractive index 1.42. If its focal length in liquid is f_1 , then the ratio $\frac{f_1}{f}$ is closest to the integer:

- (A) 17 (B) 1 (C) 9 (D) 5

A box weight 196 N on a spring balance at the north pole. Its weight recorded on the same balance if it is shifted to the equator is close to (Take $g = 10 \text{ ms}^{-2}$ at the north pole and the radius of the earth = 6400 km):

- (A) 194.32 N (B) 195.66 N (C) 195.32 N (D) 194.66 N

Two ideal Carnot engines operate in cascade (all heat given up by one engine is used by the other engine to produce work) between temperature, T_1 and T_2 . The temperature of the hot reservoir of the first engine is T_1 and the temperature of the cold reservoir of the second engine is T_2 . T is temperature of the sink of first engine which is also the source for the second which is also the source for the second engine. How is T related to T_1 and T_2 . If both engines perform equal amount of work?

- (A) $T = \frac{2T_1T_2}{T_1+T_2}$ (B) $T = \sqrt{T_1T_2}$ (C) $T = \frac{T_1+T_2}{2}$ (D) $T = 0$

Under an adiabatic process, the volume of an ideal gas gets doubled. Consequently the mean collision time between the gas molecule changes from τ_1 to τ_2 . If $\frac{C_p}{C_v} = \gamma$ for this gas then a good estimate for $\frac{\tau_2}{\tau_1}$ is given by:

- (A) $(2)^{\frac{1+\gamma}{2}}$ (B) 2 (C) $\left(\frac{1}{2}\right)^{\frac{1+\gamma}{2}}$ (D) $\left(\frac{1}{2}\right)^\gamma$

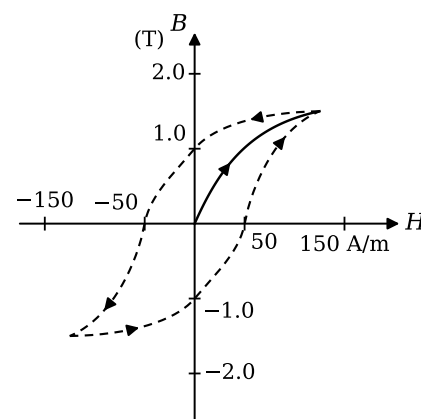
A mass of 10 kg is suspended by a rope of length 4 m, from the ceiling. A force F is applied horizontally at the mid point of the rope such that the top half of the rope makes an angle of 45° with the vertical. Then F equal : (Take $g = 10 \text{ ms}^{-2}$ and the rope to be massless)

- (A) 100 N (B) 75 N (C) 90 N (D) 70 N

Q13 Magnetism & Matter[Step-by-step solution > prepwiser.in/questions/GWCLpL3IbW](https://www.prepwiser.in/questions/GWCLpL3IbW)

The figure gives experimentally measured B vs H variation in a ferromagnetic material. The retentivity, coercivity and saturation, respectively, of the material are:

- (A) 1.0 T, 50 A/m and 1.5 T
 (B) 1.5 T, 50 A/m and 1.0 T
 (C) 1.5 T, 50 A/m and 2.0 T
 (D) 150 A/m, 1.0 T and 1.5 T

**Q14** Moving Charges & Magnetism[Step-by-step solution > prepwiser.in/questions/mTG1YQGHqc](https://www.prepwiser.in/questions/mTG1YQGHqc)

A particle of mass m and charge q has an initial velocity $\vec{v} = v_0 \hat{j}$. If an electric field $\vec{E} = E_0 \hat{i}$ and magnetic field $\vec{B} = B_0 \hat{i}$ act on the particle, its speed will double after a time:

- (A) $\frac{3mv_0}{qE_0}$
 (B) $\frac{\sqrt{2}mv_0}{qE_0}$
 (C) $\frac{\sqrt{3}mv_0}{qE_0}$
 (D) $\frac{2mv_0}{qE_0}$

Q15 Fluid Mechanics[Step-by-step solution > prepwiser.in/questions/7yyaBxpISc](https://www.prepwiser.in/questions/7yyaBxpISc)

An ideal fluid flows (laminar flow) through a pipe of non-uniform diameter. The maximum and minimum diameters of the pipes are 6.4 cm and 4.8 cm, respectively. The ratio of the minimum and the maximum velocities of fluid in this pipe is:

- (A) $\frac{3}{4}$
 (B) $\frac{9}{16}$
 (C) $\frac{\sqrt{3}}{2}$
 (D) $\frac{81}{256}$

Q16 Rotational Motion[Step-by-step solution > prepwiser.in/questions/6EoZ71bGVz](https://www.prepwiser.in/questions/6EoZ71bGVz)

Mass per unit area of a circular disc of radius a depends on the distance r from its centre as $\sigma(r) = A + Br$. The moment of inertia of the disc about the axis, perpendicular to the plane and passing through its centre is:

- (A) $2\pi a^4 \left(\frac{A}{4} + \frac{aB}{5} \right)$
 (B) $\pi a^4 \left(\frac{A}{4} + \frac{aB}{5} \right)$
 (C) $2\pi a^4 \left(\frac{aA}{4} + \frac{B}{5} \right)$
 (D) $2\pi a^4 \left(\frac{A}{4} + \frac{B}{5} \right)$

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

In a Young's double slit experiment, the separation between the slits is 0.15 mm. In the experiment, a source of light of wavelength 589 nm is used and the interference pattern is observed on a screen kept 1.5 m away. The separation between the successive bright fringes on the screen is:

- (A) 4.9 mm
 (B) 5.9 mm
 (C) 6.9 mm
 (D) 3.9 mm

Q18 Sound Waves[Step-by-step solution > prepwiser.in/questions/1zAy_7a7nm](https://www.prepwiser.in/questions/1zAy_7a7nm)

A stationary observer receives sound from two identical tuning forks, one of which approaches and the other one recedes with the same speed (much less than the speed of sound). The observer hears 2 beats/sec. The oscillation frequency of each tuning fork is $\nu_0 = 1400$ Hz and the velocity of sound in air is 350 m/s. The speed of each tuning fork is close to:

- (A) 1 m/s
 (B) $\frac{1}{8}$ m/s
 (C) $\frac{1}{4}$ m/s
 (D) $\frac{1}{2}$ m/s

Q19 Work, Energy & Power[Step-by-step solution](#) > [prepwisar.in/questions/kyB81oOOGC](https://www.prepwisar.in/questions/kyB81oOOGC)

An elevator in a building can carry a maximum of 10 persons, with the average mass of each person being 68 kg, The mass of the elevator itself is 920 kg and it moves with a constant speed of 3 m/s. The frictional force opposing the motion is 6000 N. If the elevator is moving up with its full capacity, the power delivered by the motor to the elevator ($g = 10 \text{ m/s}^2$) must be at least:

- (A) 48000 W (B) 62360 W (C) 56300 W (D) 66000 W

Q20 Units, Dimensions & Errors[Step-by-step solution](#) > [prepwisar.in/questions/4WsAsxhvtq](https://www.prepwisar.in/questions/4WsAsxhvtq)

The dimension of $\frac{B^2}{2\mu_0}$, where B is magnetic field and μ_0 is the magnetic permeability of vacuum, is:

- (A) ML^2T^{-2} (B) MLT^{-2} (C) $\text{ML}^{-1}\text{T}^{-2}$ (D) ML^2T^{-1}

Physics Section B · Numerical value

Q21 to Q24

Q21 Electrostatics II: Potential & Capacitance **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/zf9h737Too](https://www.prepwisar.in/questions/zf9h737Too)

A 60 pF capacitor is fully charged by a 20 V supply. It is then disconnected from the supply and is connected to another uncharged 60 pF capacitor in parallel. The electrostatic energy that is lost in this process by the time the charge is redistributed between them is (in nJ) ____

Q22 Current Electricity **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/K9Vwg9MJ-K](https://www.prepwisar.in/questions/K9Vwg9MJ-K)

The balancing length for a cell is 560 cm in a potentiometer experiment. When an external resistance of 10Ω is connected in parallel to the cell, the balancing length changes by 60 cm. If the internal resistance of the cell is $\frac{N}{10} \Omega$, where N is an integer then value of N is

Q23 Thermometry & Calorimetry **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/bFKPodNMO2](https://www.prepwisar.in/questions/bFKPodNMO2)

M grams of steam at 100°C is mixed with 200 g of ice at its melting point in a thermally insulated container. If it produced liquid water at 40°C [heat of vaporization of water is 540 cal/g and heat of fusion of ice is 80 cal/g] the value of M is ____

Q24 Vectors **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/mGKXXMPS1d](https://www.prepwisar.in/questions/mGKXXMPS1d)

The sum of two forces $\vec{P}$ and $\vec{Q}$ is $\vec{R}$ such that $|\vec{R}| = |\vec{P}|$. The angle θ (in degrees) that the resultant of $2\vec{P}$ and $\vec{Q}$ will make with $\vec{Q}$ is, ...

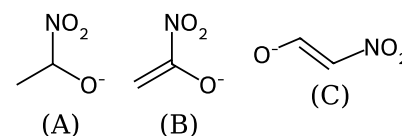
Chemistry Section A · Multiple choice

Q25 to Q40

Q25 General Organic Chemistry (GOC)[Step-by-step solution](#) > [prepwisar.in/questions/_Jzd7URHaV](https://www.prepwisar.in/questions/_Jzd7URHaV)

The correct order of stability for the following alkoxides is:

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

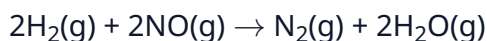
**Q26** Chemical Bonding & Molecular Structure[Step-by-step solution](#) > [prepwisar.in/questions/aB4qhpUUEV](https://www.prepwisar.in/questions/aB4qhpUUEV)

The bond order and the magnetic characteristics of CN^- are:

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

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For the reaction



the observed rate expression is, $\text{rate} = k_f[\text{NO}]^2[\text{H}_2]$. The rate expression for the reverse reaction is:

- (A) $k_b[\text{N}_2][\text{H}_2\text{O}]$ (B) $k_b[\text{N}_2][\text{H}_2\text{O}]^2/[\text{H}_2]$ (C) $k_b[\text{N}_2][\text{H}_2\text{O}]^2/[\text{NO}]$ (D) $k_b[\text{N}_2][\text{H}_2\text{O}]^2$

The number of possible optical isomers for the complexes MA_2B_2 with sp^3 and dsp^2 hybridized metal atom, respectively, is:

Note : A and B are unidentate neutral and unidentate monoanionic ligands, respectively.

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

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

(a) Octahedral $\text{CO}(\text{III})$ complexes with strong field ligands have very high magnetic moments.

(b) When $\Delta_0 < P$, the d-electron configuration of $\text{Co}(\text{III})$ in an octahedral complex is $t_{eg}^4 e_g^2$

(c) Wavelength of light absorbed by $[\text{Co}(\text{en})_3]^{3+}$ is lower than that of $[\text{CoF}_6]^{3-}$

(d) If the Δ_0 for an octahedral complex of $\text{CO}(\text{III})$ is $18,000 \text{ cm}^{-1}$, the Δ_t for its tetrahedral complex with the same ligand be $16,000 \text{ cm}^{-1}$

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

The equation that is incorrect is:

(A) $(\Lambda_m^0)_{\text{KCl}} - (\Lambda_m^0)_{\text{NaCl}} = (\Lambda_m^0)_{\text{KBr}} - (\Lambda_m^0)_{\text{NaBr}}$

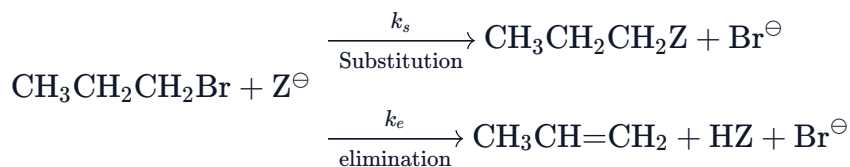
(B) $(\Lambda_m^0)_{\text{NaBr}} - (\Lambda_m^0)_{\text{NaI}} = (\Lambda_m^0)_{\text{KBr}} - (\Lambda_m^0)_{\text{NaBr}}$

(C) $(\Lambda_m^0)_{\text{NaBr}} - (\Lambda_m^0)_{\text{NaCl}} = (\Lambda_m^0)_{\text{KBr}} - (\Lambda_m^0)_{\text{KCl}}$

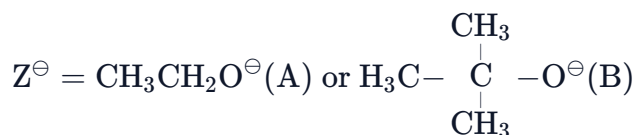
(D) $(\Lambda_m^0)_{\text{H}_2\text{O}} = (\Lambda_m^0)_{\text{HCl}} + (\Lambda_m^0)_{\text{NaOH}} - (\Lambda_m^0)_{\text{NaCl}}$

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For the following reactions



where,



K_s and K_e , are respectively, the rate constants for substitution and elimination and $\mu = \frac{k_s}{k_e}$ the correct options is

- (A) $\mu_B > \mu_A$ and $K_e(\text{A}) > K_e(\text{B})$ (B) $\mu_A > \mu_B$ and $K_e(\text{B}) > K_e(\text{A})$
 (C) $\mu_B > \mu_A$ and $K_e(\text{B}) > K_e(\text{A})$ (D) $\mu_A > \mu_B$ and $K_e(\text{A}) > K_e(\text{B})$

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

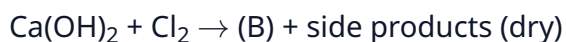
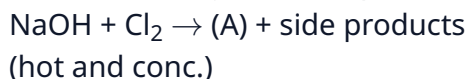
- (a) Decomposition of hydrogen peroxide gives dioxygen.
 (b) Like hydrogen peroxide, compounds, such as KClO_3 , $\text{Pb}(\text{NO}_3)_2$ and NaNO_3 when heated liberate dioxygen.
 (c) 2-Ethylanthraquinone is useful for the industrial preparation of hydrogen peroxide.
 (d) Hydrogen peroxide is used for the manufacture of sodium perborate.

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

The refining method used when the metal and the impurities have low and high melting temperatures, respectively, is:

- (A) liquation (B) vapour phase refining
 (C) distillation (D) zone refining

In the following reaction, products (A) and (B) respectively, are:



- (A) NaOCl and $\text{Ca}(\text{OCl})_2$ (B) NaClO_3 and $\text{Ca}(\text{ClO}_3)_2$
 (C) NaOCl and $\text{Ca}(\text{ClO}_3)_2$ (D) NaClO_3 and $\text{Ca}(\text{OCl})_2$

Within each pair of elements F & Cl, S & Se, and Li & Na, respectively, the elements that release more energy upon and electron gain are:

- (A) F, S and Li (B) Cl, Se and Na (C) Cl, S and Li (D) F, Se and Na

The redox reaction among the following is:

- (A) reaction of H_2SO_4 with NaOH .
- (B) formation of ozone from atmospheric oxygen in the presence of sunlight.
- (C) combination of dinitrogen with dioxygen at 2000 K
- (D) reaction of $[\text{Co}(\text{H}_2\text{O})_6]\text{Cl}_3$ with AgNO_3

Two open beakers one containing a solvent and the other containing a mixture of that solvent with a non-volatile solute are together sealed in a container. Over time:

- (A) The volume of the solution increases and the volume of the solvent decreases.
- (B) The volume of solution does not change and the volume of the solvent decreases.
- (C) The volume of the solution and the solvent does not change.
- (D) The volume of the solution decreases and the volume of the solvent increases.

The ammonia (NH_3) released on quantitative reaction of 0.6 g urea (NH_2CONH_2) with sodium hydroxide (NaOH) can be neutralized by:

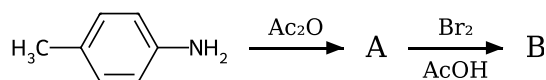
- (A) 200 ml of 0.02 N HCl
- (B) 100 ml of 0.2 N HCl
- (C) 100 ml of 0.1 HCl
- (D) 200 ml of 0.4 N HCl

A chromatography column, packed with silica gel as stationary phase, was used to separate a mixture of compounds consisting of (A) benzanilide (B) aniline and (C) acetophenone. When the column is eluted with a mixture of solvents, hexane : ethylacetate (20:80), the sequence of obtained compounds is:

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

In the following reaction sequence,
The major product B is:

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

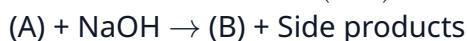


Chemistry Section B · Numerical value

Q41 to Q45

The number of sp^2 hybridised carbons present in "Aspartame" is

Consider the following reactions:



→ (C) + Side products

The sum of the total number of atoms in one molecule each of (A) and (B) and (C) is

3 g of acetic acid is added to 250 mL of 0.1 M HCL and the solution made up to 500 mL. To 20 mL of this solutions $\frac{1}{2}$ mL of 5 M NaOH is added. The pH of the solution is _____. (Round off to the nearest integer)

[Given : pKa of acetic acid = 4.75, molar mass of acetic of acid = 60 g/mol, log 3 = 0.4771] Neglect any changes in volume.

The flocculation value of HCl for arsenic sulphide sol.

is 30 m mol L⁻¹ If H₂SO₄ is used for the flocculation of arsenic sulphide, the amount in mg, of H₂SO₄ in 500 ml required for the above purpose is ____.

(molecular mass of H₂SO₄ = 98 g/mol)

The standard heat of formation ($\Delta_f H_{298}^0$) of ethane (in kJ/mol), if the heat of combustion of ethane, hydrogen and graphite are - 1560, -286 and -393.5 KJ/mol, respectively is:

Mathematics Section A · Multiple choice

Q46 to Q64

Let $f(x)$ be a polynomial of degree 5 such that $x = \pm 1$ are its critical points.

If

$$\lim_{x \rightarrow 0} \left(2 + \frac{f(x)}{x^3} \right) = 4$$

, then which one of the following is not true?

- (A) $f(1) - 4f(-1) = 4$.
- (B) $x = 1$ is a point of minima and $x = -1$ is a point of maxima of f .
- (C) $x = 1$ is a point of maxima and $x = -1$ is a point of minimum of f .
- (D) f is an odd function.

The value of c in the Lagrange's mean value theorem for the function

$f(x) = x^3 - 4x^2 + 8x + 11$, when $x \in [0, 1]$ is:

- (A) $\frac{2}{3}$
- (B) $\frac{\sqrt{7} - 2}{3}$
- (C) $\frac{4 - \sqrt{5}}{3}$
- (D) $\frac{4 - \sqrt{7}}{3}$

Q48 Binomial Theorem[Step-by-step solution](https://www.prepwiser.in/questions/sOp02YtvuO)

The coefficient of x^7 in the expression $(1+x)^{10} + x(1+x)^9 + x^2(1+x)^8 + \dots + x^{10}$ is:

- (A) 120 (B) 330 (C) 420 (D) 210

Q49 Circles[Step-by-step solution](https://www.prepwiser.in/questions/KYOREkGgBBT)

Let the tangents drawn from the origin to the circle, $x^2 + y^2 - 8x - 4y + 16 = 0$ touch it at the points A and B. The $(AB)^2$ is equal to:

- (A) $\frac{56}{5}$ (B) $\frac{32}{5}$ (C) $\frac{52}{5}$ (D) $\frac{64}{5}$

Q50 Complex Numbers[Step-by-step solution](https://www.prepwiser.in/questions/wTsyn4-nbG)

If $\frac{3+i\sin\theta}{4-i\cos\theta}$, $\theta \in [0, 2\theta]$, is a real number, then an argument of $\sin\theta + i\cos\theta$ is:

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

Q51 Trigonometric Equations[Step-by-step solution](https://www.prepwiser.in/questions/HP-0dSvvqS)

If θ_1 and θ_2 be respectively the smallest and the largest values of θ in $(0, 2\pi) - \{\pi\}$ which satisfy the equation,

$$2\cot^2\theta - \frac{5}{\sin\theta} + 4 = 0, \text{ then}$$

$\int_{\theta_1}^{\theta_2} \cos^2 3\theta d\theta$ is equal to:

- (A) $\frac{\pi}{9}$ (B) $\frac{2\pi}{3}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{3} + \frac{1}{6}$

Q52 Definite Integration[Step-by-step solution](https://www.prepwiser.in/questions/mXSvxY9jy5)

The value of α for which

$$4\alpha \int_{-1}^2 e^{-\alpha|x|} dx = 5, \text{ is:}$$

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

Q53 Differential Equations[Step-by-step solution](https://www.prepwiser.in/questions/s4yYMP3yT3)

Let $y = y(x)$ be the solution curve of the differential equation,

$(y^2 - x) \frac{dy}{dx} = 1$, satisfying $y(0) = 1$. This curve intersects the x-axis at a point whose abscissa is:

- (A) $2 + e$ (B) $-e$ (C) 2 (D) $2 - e$

Q54 Differentiation[Step-by-step solution](https://www.prepwiser.in/questions/Ex1pWZbgh6)

Let $y = y(x)$ be a function of x satisfying

$$y\sqrt{1-x^2} = k - x\sqrt{1-y^2} \text{ where } k \text{ is a constant and}$$

$y\left(\frac{1}{2}\right) = -\frac{1}{4}$. Then $\frac{dy}{dx}$ at $x = \frac{1}{2}$, is equal to:

- (A) $\frac{2}{\sqrt{5}}$ (B) $-\frac{\sqrt{5}}{2}$ (C) $\frac{\sqrt{5}}{2}$ (D) $-\frac{\sqrt{5}}{4}$

Q55 Ellipse[Step-by-step solution](#) > [prepwiser.in/questions/fY3LgXjZE6](https://www.prepwiser.in/questions/fY3LgXjZE6)

If $3x + 4y = 12\sqrt{2}$ is a tangent to the ellipse

$\frac{x^2}{a^2} + \frac{y^2}{9} = 1$ for some $a \in \mathbb{R}$, then the distance between the foci of the ellipse is:

- (A) $2\sqrt{5}$ (B) $2\sqrt{7}$ (C) 4 (D) $2\sqrt{2}$

Q56 Determinants[Step-by-step solution](#) > [prepwiser.in/questions/To4cZnwf6k](https://www.prepwiser.in/questions/To4cZnwf6k)

Let $A = [a_{ij}]$ and $B = [b_{ij}]$ be two 3×3 real matrices such that $b_{ij} = (3)^{(i+j-2)}a_{ji}$, where $i, j = 1, 2, 3$. If the determinant of B is 81, then the determinant of A is:

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

Q57 Binomial Theorem[Step-by-step solution](#) > [prepwiser.in/questions/kJlQMj6IU_](https://www.prepwiser.in/questions/kJlQMj6IU_)

The number of ordered pairs (r, k) for which

$6 \cdot {}^{35}C_r = (k^2 - 3) \cdot {}^{36}C_{r+1}$, where k is an integer, is:

- (A) 6 (B) 3 (C) 2 (D) 4

Q58 Probability: Advanced[Step-by-step solution](#) > [prepwiser.in/questions/tmAeGZ68PX](https://www.prepwiser.in/questions/tmAeGZ68PX)

In a workshop, there are five machines and the probability of any one of them to be out of service on a day is $\frac{1}{4}$. If the probability that at most two machines will be out of service on the same day is $\left(\frac{3}{4}\right)^3 k$, then k is equal to:

- (A) $\frac{17}{4}$ (B) $\frac{17}{2}$ (C) $\frac{17}{8}$ (D) 4

Q59 Sequences & Series[Step-by-step solution](#) > [prepwiser.in/questions/Bndqr3OLs1](https://www.prepwiser.in/questions/Bndqr3OLs1)

Let α and β be the roots of the equation $x^2 - x - 1 = 0$.

If $p_k = (\alpha)^k + (\beta)^k$, $k \geq 1$, then which one of the following statements is not true?

- (A) $(p_1 + p_2 + p_3 + p_4 + p_5) = 26$ (B) $p_5 = 11$
(C) $p_3 = p_5 - p_4$ (D) $p_5 = p_2 \cdot p_3$

Q60 Sequences & Series[Step-by-step solution](#) > [prepwiser.in/questions/YD_iyGIhsw](https://www.prepwiser.in/questions/YD_iyGIhsw)

If the sum of the first 40 terms of the series,

$3 + 4 + 8 + 9 + 13 + 14 + 18 + 19 + \dots$ is $(102)m$, then m is equal to:

- (A) 20 (B) 5 (C) 10 (D) 25

Q61 Sequences & Series[Step-by-step solution](#) > [prepwiser.in/questions/L3PIW85OyV](https://www.prepwiser.in/questions/L3PIW85OyV)

Let $a_1, a_2, a_3, \dots$ be a G.P. such that

$a_1 < 0$, $a_1 + a_2 = 4$ and $a_3 + a_4 = 16$.

If $\sum_{i=1}^9 a_i = 4\lambda$, then λ is equal to:

- (A) 171 (B) -171 (C) -513 (D) $\frac{511}{3}$

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Q62 Vectors[Step-by-step solution](https://www.prepwisar.in/questions/u6b67Hi95z) › prepwisar.in/questions/u6b67Hi95z

Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$. If

$$\lambda = \vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$$

and

$$\vec{d} = \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}$$

, then the ordered pair, $(\lambda, \vec{d})$ is equal to:

- (A) $\left(\frac{3}{2}, 3\vec{a} \times \vec{c}\right)$ (B) $\left(-\frac{3}{2}, 3\vec{c} \times \vec{b}\right)$ (C) $\left(-\frac{3}{2}, 3\vec{a} \times \vec{b}\right)$ (D) $\left(\frac{3}{2}, 3\vec{b} \times \vec{c}\right)$

Q63 Area Under Curves[Step-by-step solution](https://www.prepwisar.in/questions/S0kwzhD0wv) › prepwisar.in/questions/S0kwzhD0wv

The area (in sq. units) of the region $\{(x, y) \in \mathbb{R}^2 \mid 4x^2 \leq y \leq 8x + 12\}$ is:

- (A) $\frac{125}{3}$ (B) $\frac{128}{3}$ (C) $\frac{127}{3}$ (D) $\frac{124}{3}$

Q64 Straight Lines[Step-by-step solution](https://www.prepwisar.in/questions/1Uh4YCK42I) › prepwisar.in/questions/1Uh4YCK42I

The locus of the mid-points of the perpendiculars drawn from points on the line, $x = 2y$ to the line $x = y$ is:

- (A) $3x - 2y = 0$ (B) $7x - 5y = 0$ (C) $2x - 3y = 0$ (D) $5x - 7y = 0$

Mathematics Section B · Numerical value

Q65 to Q69

Q65 Three Dimensional Geometry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/F_8h-erMrS) › prepwisar.in/questions/F_8h-erMrS

If the foot of the perpendicular drawn from the point $(1, 0, 3)$ on a line passing through $(\alpha, 7, 1)$ is $\left(\frac{5}{3}, \frac{7}{3}, \frac{17}{3}\right)$, then α is equal to ____.

Q66 Continuity & Differentiability **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/MYVnD0O-Ee) › prepwisar.in/questions/MYVnD0O-Ee

If the function f defined on $\left(-\frac{1}{3}, \frac{1}{3}\right)$ by $f(x) =$

$$\begin{cases} \frac{1}{x} \log_e \left(\frac{1+3x}{1-2x} \right), & \text{when } x \neq 0 \\ k, & \text{when } x = 0 \end{cases}$$

is continuous, then k is equal to ____.

Q67 Determinants **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/v0oS38ccw9) › prepwisar.in/questions/v0oS38ccw9

If the system of linear equations,

$$x + y + z = 6$$

$$x + 2y + 3z = 10$$

$$3x + 2y + \lambda z = \mu$$

has more than two solutions, then $\mu - \lambda^2$ is equal to ____.

Let $X = \{n \in \mathbb{N} : 1 \leq n \leq 50\}$. If

$A = \{n \in X : n \text{ is a multiple of } 2\}$ and

$B = \{n \in X : n \text{ is a multiple of } 7\}$, then the number of elements in the smallest subset of X containing both A and B is _____.

If the mean and variance of eight numbers 3, 7, 9, 12, 13, 20, x and y be 10 and 25 respectively, then $x \cdot y$ is equal to _____.

Answer key: JEE Main 2020 · 7 Jan · Shift 2

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Physics

1.	A	2.	A	3.	B	4.	B	5.	D	6.	C	7.	A	8.	C	9.	C	10.	C
11.	A	12.	A	13.	A	14.	C	15.	B	16.	A	17.	B	18.	C	19.	D	20.	C
21.	6	22.	12	23.	40	24.	90												

Chemistry

25.	A	26.	C	27.	B	28.	B	29.	D	30.	B	31.	B	32.	A	33.	A	34.	D
35.	C	36.	C	37.	A	38.	B	39.	C	40.	B	41.	9	42.	18	43.	5	44.	735
45.	-85																		

Mathematics

46.	B	47.	D	48.	B	49.	D	50.	D	51.	C	52.	A	53.	D	54.	B	55.	B
56.	C	57.	D	58.	C	59.	D	60.	A	61.	B	62.	C	63.	B	64.	D	65.	4
66.	5	67.	13	68.	29	69.	54												

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