

JEE MAIN 2024 · QUESTION PAPER

4 Apr 2024 **Shift 1**

85 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	19 Q1 to Q19	10 Q20 to Q29
● Chemistry	17 Q30 to Q46	10 Q47 to Q56
● Mathematics	19 Q57 to Q75	10 Q76 to Q85
In this PDF	85 questions · answer key at the end	

- 1 Set a 3 hour timer and attempt the paper in one sitting, like the real exam.
- 2 In the 2021 to 2024 papers, Section B asked you to answer any 5 numerical questions per subject. Try each one here.
- 3 Check yourself against the answer key at the end. Every question names its chapter, so you can see where marks went.
- 4 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/2024-04-04-morning · Free, no signup needed to start

Answers follow NTA's final answer keys. Typing errors are possible, so check doubtful answers against the official key. Spotted a mistake?
prepwisar.in/feedback · Terms: prepwisar.in/terms

Q1 Alternating Current

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

In an ac circuit, the instantaneous current is zero, when the instantaneous voltage is maximum. In this case, the source may be connected to:

- A. pure inductor.
- B. pure capacitor.
- C. pure resistor.
- D. combination of an inductor and capacitor.

Choose the correct answer from the options given below:

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

Q2 Nuclear Physics

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

Which of the following nuclear fragments corresponding to nuclear fission between neutron (${}_0^1\text{n}$) and uranium isotope (${}_{92}^{235}\text{U}$) is correct:

- (A) ${}_{56}^{140}\text{Xe} + {}_{38}^{94}\text{Sr} + 3{}_0^1\text{n}$ (B) ${}_{51}^{153}\text{Sb} + {}_{41}^{99}\text{Nb} + 3{}_0^1\text{n}$ (C) ${}_{56}^{144}\text{Ba} + {}_{36}^{89}\text{Kr} + 4{}_0^1\text{n}$ (D) ${}_{56}^{144}\text{Ba} + {}_{36}^{89}\text{Kr} + 3{}_0^1\text{n}$

Q3 Current Electricity

[Step-by-step solution](#) > [prepwisar.in/questions/bFvayjst3](https://www.prepwisar.in/questions/bFvayjst3)

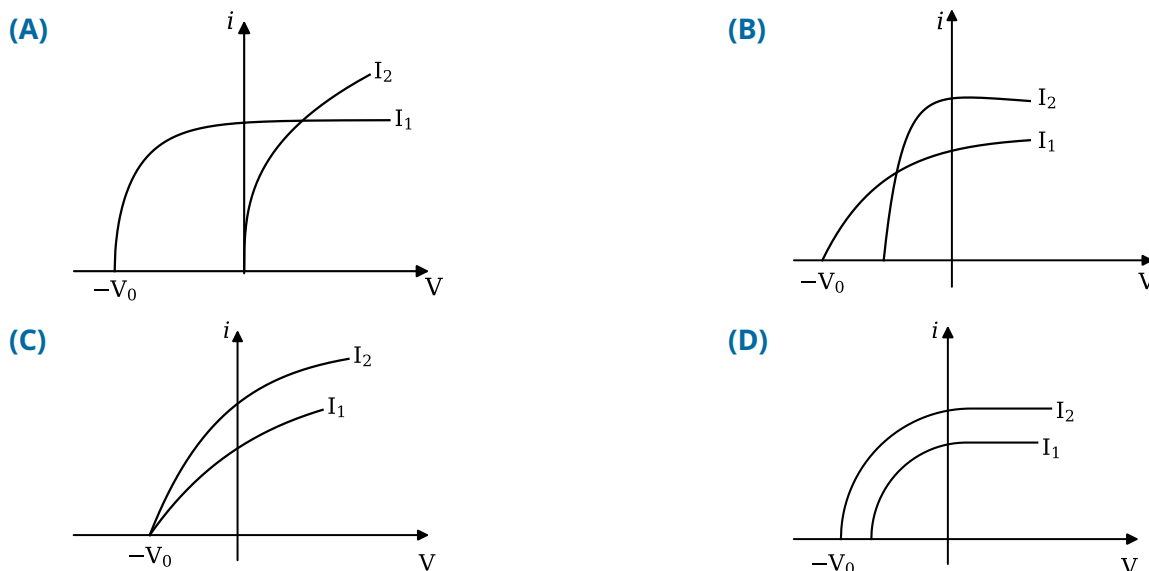
To measure the internal resistance of a battery, potentiometer is used. For $R = 10\Omega$, the balance point is observed at $l = 500\text{cm}$ and for $R = 1\Omega$ the balance point is observed at $l = 400\text{cm}$. The internal resistance of the battery is approximately:

- (A) 0.1Ω (B) 0.3Ω (C) 0.2Ω (D) 0.4Ω

Q4 Dual Nature of Radiation & Matter

[Step-by-step solution](#) > [prepwisar.in/questions/IOz1nhRHWO](https://www.prepwisar.in/questions/IOz1nhRHWO)

Which figure shows the correct variation of applied potential difference (V) with photoelectric current (I) at two different intensities of light ($I_1 < I_2$) of same wavelengths:



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Q5 Electromagnetic Waves[Step-by-step solution > prepwiser.in/questions/ZkhhG359PN](https://www.prepwiser.in/questions/ZkhhG359PN)

The electric field in an electromagnetic wave is given by

$$\vec{E} = \hat{i}40 \cos \omega(t - z/c) \text{ NC}^{-1}$$

. The magnetic field induction of this wave is (in SI unit):

(A) $\vec{B} = \hat{j} \frac{40}{c} \cos \omega(t - z/c)$

(B) $\vec{B} = \hat{i} \frac{40}{c} \cos \omega(t - z/c)$

(C) $\vec{B} = \hat{j}40 \cos \omega(t - z/c)$

(D) $\vec{B} = \hat{k} \frac{40}{c} \cos \omega(t - z/c)$

Q6 Current Electricity[Step-by-step solution > prepwiser.in/questions/KXVOV-BBvf](https://www.prepwiser.in/questions/KXVOV-BBvf)

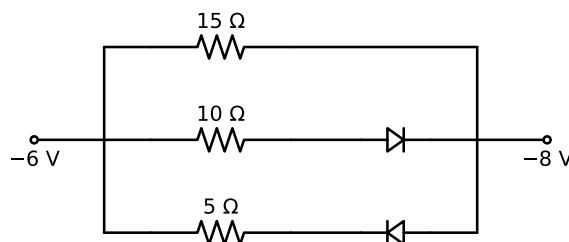
The value of net resistance of the network as shown in the given figure is:

(A) $(30/11)\Omega$

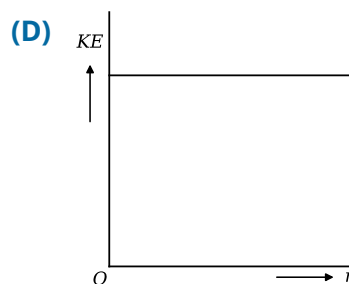
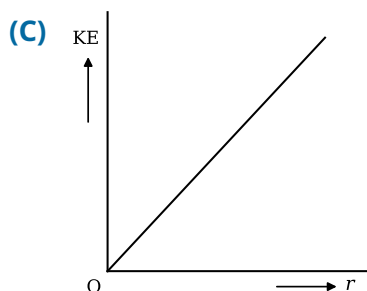
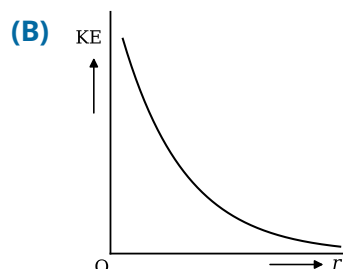
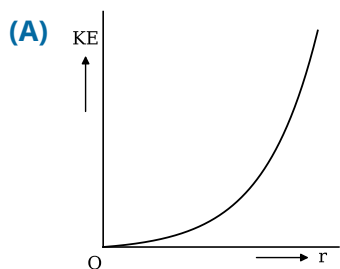
(B) 6Ω

(C) $(5/2)\Omega$

(D) $(15/4)\Omega$

**Q7** Electrostatics I: Charges, Field & Gauss's Law[Step-by-step solution > prepwiser.in/questions/Y7dXuksJ30](https://www.prepwiser.in/questions/Y7dXuksJ30)

An infinitely long positively charged straight thread has a linear charge density $\lambda \text{ Cm}^{-1}$. An electron revolves along a circular path having axis along the length of the wire. The graph that correctly represents the variation of the kinetic energy of electron as a function of radius of circular path from the wire is:

**Q8** Ray Optics[Step-by-step solution > prepwiser.in/questions/VIXvOhGHBU](https://www.prepwiser.in/questions/VIXvOhGHBU)

An effective power of a combination of 5 identical convex lenses which are kept in contact along the principal axis is 25D . Focal length of each of the convex lens is:

(A) 50 cm

(B) 20 cm

(C) 25 cm

(D) 500 cm

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Q9 Experimental Skills[Step-by-step solution](#) › [prepwisar.in/questions/5H0ucaSxoR](https://www.prepwisar.in/questions/5H0ucaSxoR)

In an experiment to measure focal length (f) of convex lens, the least counts of the measuring scales for the position of object (u) and for the position of image (v) are Δu and Δv , respectively. The error in the measurement of the focal length of the convex lens will be:

- (A) $2f \left[\frac{\Delta u}{u} + \frac{\Delta v}{v} \right]$ (B) $f \left[\frac{\Delta u}{u} + \frac{\Delta v}{v} \right]$ (C) $f^2 \left[\frac{\Delta u}{u^2} + \frac{\Delta v}{v^2} \right]$ (D) $\frac{\Delta u}{u} + \frac{\Delta v}{v}$

Q10 Gravitation[Step-by-step solution](#) › [prepwisar.in/questions/K2s34JZHWH](https://www.prepwisar.in/questions/K2s34JZHWH)

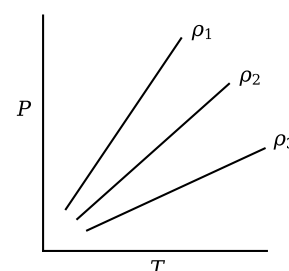
A metal wire of uniform mass density having length L and mass M is bent to form a semicircular arc and a particle of mass m is placed at the centre of the arc. The gravitational force on the particle by the wire is:

- (A) $\frac{GmM\pi^2}{L^2}$ (B) $\frac{GMm\pi}{2L^2}$ (C) 0 (D) $\frac{2GmM\pi}{L^2}$

Q11 Kinetic Theory of Gases[Step-by-step solution](#) › [prepwisar.in/questions/nmgallvaav](https://www.prepwisar.in/questions/nmgallvaav)

P-T diagram of an ideal gas having three different densities ρ_1, ρ_2, ρ_3 (in three different cases) is shown in the figure. Which of the following is correct:

- (A) $\rho_1 > \rho_2$ (B) $\rho_2 < \rho_3$ (C) $\rho_1 = \rho_2 = \rho_3$ (D) $\rho_1 < \rho_2$

**Q12** Thermometry & Calorimetry[Step-by-step solution](#) › [prepwisar.in/questions/BbdMKCNltn](https://www.prepwisar.in/questions/BbdMKCNltn)

The resistances of the platinum wire of a platinum resistance thermometer at the ice point and steam point are 8Ω and 10Ω respectively. After inserting in a hot bath of temperature 400°C , the resistance of platinum wire is:

- (A) 10Ω (B) 16Ω (C) 8Ω (D) 2Ω

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

On celcius scale the temperature of body increases by 40°C . The increase in temperature on Fahrenheit scale is:

- (A) 75°F (B) 70°F (C) 72°F (D) 68°F

Q14 Moving Charges & Magnetism[Step-by-step solution](#) › [prepwisar.in/questions/kPk_yO_fw8](https://www.prepwisar.in/questions/kPk_yO_fw8)

An electron is projected with uniform velocity along the axis inside a current carrying long solenoid. Then:

- (A) the electron will experience a force at 45° to the axis and execute a helical path.
(B) the electron will be accelerated along the axis.
(C) the electron path will be circular about the axis.
(D) the electron will continue to move with uniform velocity along the axis of the solenoid.

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Q15 Projectile Motion & Relative Motion[Step-by-step solution](https://www.prepwisar.in/questions/JyR92j8ZYO) > prepwisar.in/questions/JyR92j8ZYO

The co-ordinates of a particle moving in x - y plane are given by: $x = 2 + 4t$, $y = 3t + 8t^2$.

The motion of the particle is:

- (A) uniform motion along a straight line.
- (B) non-uniformly accelerated.
- (C) uniformly accelerated having motion along a straight line.
- (D) uniformly accelerated having motion along a parabolic path.

Q16 Rectilinear Motion[Step-by-step solution](https://www.prepwisar.in/questions/HbNnhXQ8uz) > prepwisar.in/questions/HbNnhXQ8uz

A body travels 102.5m in n^{th} second and 115.0m in $(n + 2)^{\text{th}}$ second. The acceleration is:

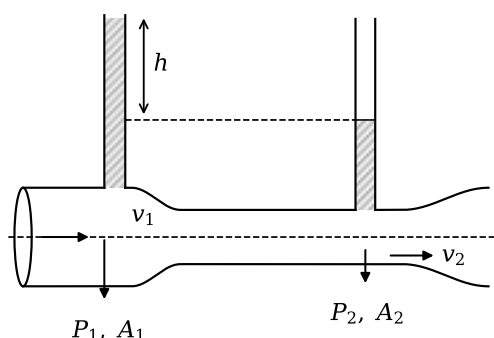
- (A) 6.25m/s^2
- (B) 5m/s^2
- (C) 12.5m/s^2
- (D) 9m/s^2

Q17 Fluid Mechanics[Step-by-step solution](https://www.prepwisar.in/questions/hxED3m44rY) > prepwisar.in/questions/hxED3m44rY

Given below are two statements:

Statement I : When speed of liquid is zero everywhere, pressure difference at any two points depends on equation $P_1 - P_2 = \rho g (h_2 - h_1)$.

Statement II : In ventury tube shown $2gh = v_1^2 - v_2^2$



In the light of the above statements, choose the most appropriate answer from the options given below.

- (A) Statement I is correct but Statement II is incorrect.
- (B) Both Statement I and Statement II are correct.
- (C) Both Statement I and Statement II are incorrect.
- (D) Statement I is incorrect but Statement II is correct.

Q18 Work, Energy & Power[Step-by-step solution](https://www.prepwisar.in/questions/tKux_RVBYb) > prepwisar.in/questions/tKux_RVBYb

If a rubber ball falls from a height h and rebounds upto the height of $h/2$. The percentage loss of total energy of the initial system as well as velocity ball before it strikes the ground, respectively, are:

- (A) 50%, $\sqrt{2gh}$
- (B) 50%, $\sqrt{gh}$
- (C) 50%, $\sqrt{\frac{gh}{2}}$
- (D) 40%, $\sqrt{2gh}$

Q19 Units, Dimensions & Errors[Step-by-step solution](https://www.prepwisar.in/questions/D2csfr3edb) > prepwisar.in/questions/D2csfr3edb

The equation of stationary wave is:

$$y = 2a \sin\left(\frac{2\pi nt}{\lambda}\right) \cos\left(\frac{2\pi x}{\lambda}\right).$$

Which of the following is NOT correct:

- (A) The dimensions of nt is $[L]$
- (B) The dimensions of n is $[LT^{-1}]$
- (C) The dimensions of x is $[L]$
- (D) The dimensions of n/λ is $[T]$

Q20 Alternating Current **NUMERICAL**

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

A alternating current at any instant is given by $i = [6 + \sqrt{56} \sin(100\pi t + \pi/3)]$ A. The *rms* value of the current is ____ A.

Q21 Atomic Physics **NUMERICAL**

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

A hydrogen atom changes its state from $n = 3$ to $n = 2$. Due to recoil, the percentage change in the wave length of emitted light is approximately 1×10^{-n} . The value of n is ____.

[Given Rhc

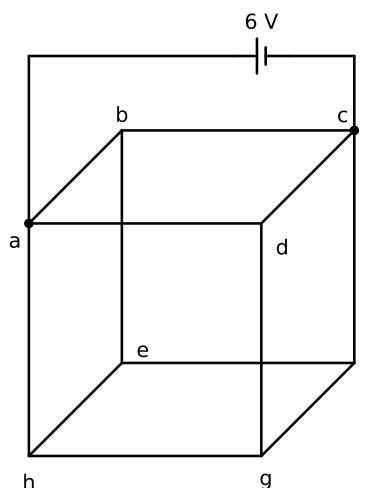
$$= 13.6\text{eV}, hc = 1242\text{eVnm}, h = 6.6 \times 10^{-34}\text{Js}$$

mass of the hydrogenatom = $1.6 \times 10^{-27}\text{kg}$]

Q22 Current Electricity **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/0CsY0xGacU](https://www.prepwise.in/questions/0CsY0xGacU)

Twelve wires each having resistance 2Ω are joined to form a cube. A battery of 6V emf is joined across point a and c . The voltage difference between e and f is ____ V.



Q23 Electrostatics I: Charges, Field & Gauss's Law **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/szp1X6ZS20](https://www.prepwise.in/questions/szp1X6ZS20)

An infinite plane sheet of charge having uniform surface charge density $+\sigma_s \text{C/m}^2$ is placed on x - y plane. Another infinitely long line charge having uniform linear charge density $+\lambda_e \text{C/m}$ is placed at $z = 4\text{m}$ plane and parallel to y -axis. If the magnitude values $|\sigma_s| = 2|\lambda_e|$ then at point $(0, 0, 2)$, the ratio of magnitudes of electric field values due to sheet charge to that of line charge is $\pi\sqrt{n} : 1$. The value of n is ____.

Q24 Vectors **NUMERICAL**

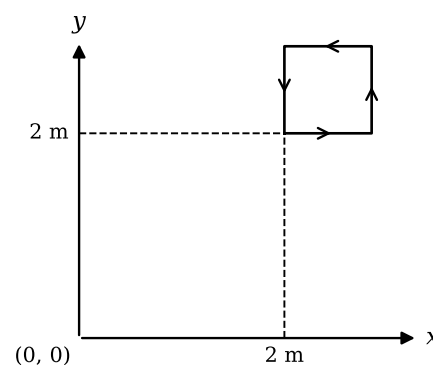
[Step-by-step solution](#) › [prepwise.in/questions/-9guevPQg0](https://www.prepwise.in/questions/-9guevPQg0)

Two forces $\vec{F}_1$ and $\vec{F}_2$ are acting on a body. One force has magnitude thrice that of the other force and the resultant of the two forces is equal to the force of larger magnitude. The angle between $\vec{F}_1$ and $\vec{F}_2$ is $\cos^{-1}(\frac{1}{n})$. The value of $|n|$ is ____.

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Q25 Moving Charges & Magnetism **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/h_Kd7mn8HO)

The magnetic field existing in a region is given by $\vec{B} = 0.2(1 + 2x)\hat{k}$. A square loop of edge 50cm carrying 0.5 A current is placed in x - y plane with its edges parallel to the x - y axes, as shown in figure. The magnitude of the net magnetic force experienced by the loop is _____ mN.

**Q26** Surface Tension **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/u2su6ebMEU)

A soap bubble is blown to a diameter of 7cm. 36960erg of work is done in blowing it further. If surface tension of soap solution is 40 dyne/cm then the new radius is _____ cm Take $(\pi = \frac{22}{7})$.

Q27 Elasticity **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/pObiF4ljOd)

An elastic spring under tension of 3N has a length a . Its length is b under tension 2N. For its length $(3a - 2b)$, the value of tension will be _____ N.

Q28 Rotational Motion **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/yEECGmNZ3Y)

A solid sphere and a hollow cylinder roll up without slipping on same inclined plane with same initial speed v . The sphere and the cylinder reaches upto maximum heights h_1 and h_2 respectively, above the initial level. The ratio $h_1 : h_2$ is $\frac{n}{10}$. The value of n is _____.

Q29 Wave Optics **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/QSVHavDEIU)

Two wavelengths λ_1 and λ_2 are used in Young's double slit experiment. $\lambda_1 = 450\text{nm}$ and $\lambda_2 = 650\text{nm}$. The minimum order of fringe produced by λ_2 which overlaps with the fringe produced by λ_1 is n . The value of n is _____.

Chemistry Section A · Multiple choice

Q30 to Q46

Q30 Aldehydes & Ketones[Step-by-step solution](https://www.prepwisar.in/questions/ilrxEasdfG)

Given below are two statements:

Statements I : Acidity of α -hydrogens of aldehydes and ketones is responsible for Aldol reaction.

Statement II : Reaction between benzaldehyde and ethanal will NOT give Cross - Aldol product.

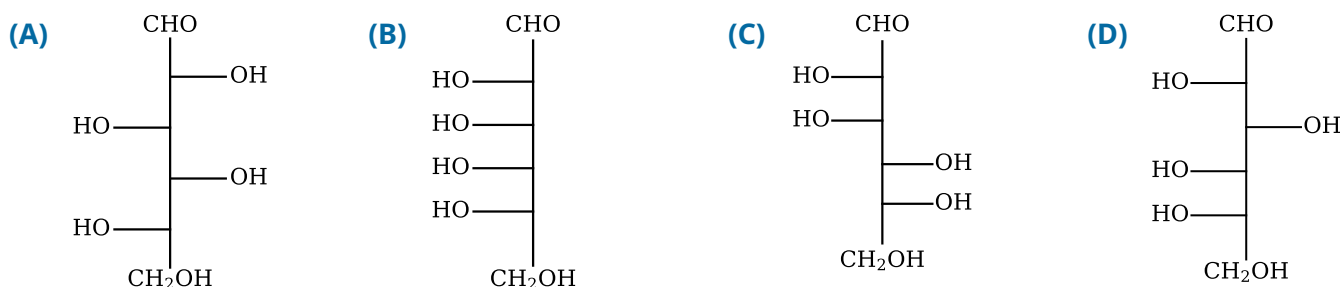
In the light of the above statements, choose the most appropriate answer from the options given below:

- (A) Both Statement I and Statement II are incorrect
- (B) Statement I is correct but Statement II is incorrect
- (C) Both Statement I and Statement II are correct
- (D) Statement I is incorrect but Statement II is correct

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Q31 Carbohydrates & Biomolecules[Step-by-step solution](https://www.prepwisar.in/questions/GTK8EFhCLK)

Which of the following is the correct structure of L-Glucose?

**Q32** Chemical Bonding & Molecular Structure[Step-by-step solution](https://www.prepwisar.in/questions/DXhte_PbNe)Number of molecules/ions from the following in which the central atom is involved in sp^3 hybridization is _____.

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

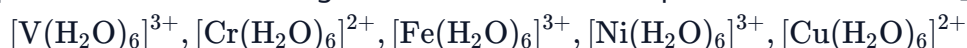
Q33 Chemical Bonding & Molecular Structure[Step-by-step solution](https://www.prepwisar.in/questions/NGCbs4gDph)

Which one of the following molecules has maximum dipole moment?

- (A) CH_4 (B) NF_3 (C) NH_3 (D) PF_5

Q34 Coordination Compounds[Step-by-step solution](https://www.prepwisar.in/questions/7Ss5Fe050U)

Number of complexes from the following with even number of unpaired "d" electrons is _____



[Given atomic numbers: V = 23, Cr = 24, Fe = 26, Ni = 28, Cu = 29]

- (A) 1 (B) 5 (C) 2 (D) 4

Q35 Coordination Compounds[Step-by-step solution](https://www.prepwisar.in/questions/a4oNKkkI4o)

The correct sequence of ligands in the order of decreasing field strength is:

- (A) $\text{NCS}^- > \text{EDTA}^{4-} > \text{CN}^- > \text{CO}$ (B) $\text{CO} > \text{H}_2\text{O} > \text{F}^- > \text{S}^{2-}$
 (C) $\text{S}^{2-} > ^-\text{OH} > \text{EDTA}^{4-} > \text{CO}$ (D) $^-\text{OH} > \text{F}^- > \text{NH}_3 > \text{CN}^-$

Q36 d & f Block Elements[Step-by-step solution](https://www.prepwisar.in/questions/OECAZje25K)

The element which shows only one oxidation state other than its elemental form is:

- (A) Nickel (B) Titanium (C) Cobalt (D) Scandium

Q37 Electrochemistry[Step-by-step solution](https://www.prepwisar.in/questions/Z4IUwhvaux)

One of the commonly used electrode is calomel electrode. Under which of the following categories, calomel electrode comes?

- (A) Metal ion - Metal electrodes (B) Oxidation - Reduction electrodes
 (C) Metal - Insoluble Salt - Anion electrodes (D) Gas - Ion electrodes

Q38 Electrochemistry[Step-by-step solution](https://www.prepwisar.in/questions/wb11WDv9qF)What pressure (bar) of H_2 would be required to make emf of hydrogen electrode zero in pure water at 25°C ?

- (A) 0.5 (B) 10^{-14} (C) 1 (D) 10^{-7}

The correct order of first ionization enthalpy values of the following elements is:

- (A) O
- (B) N
- (C) Be
- (D) F
- (E) B

Choose the correct answer from the options given below:

- | | |
|--------------------------------|--------------------------------|
| (A) $A < B < D < C < E$ | (B) $C < E < A < B < D$ |
| (C) $E < C < A < B < D$ | (D) $B < D < C < E < A$ |

Number of elements from the following that CANNOT form compounds with valencies which match with their respective group valencies is _____. B, C, N, S, O, F, P, Al, Si

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

The Molarity (M) of an aqueous solution containing 5.85g of NaCl in 500mL water is : (Given : Molar Mass Na : 23 and Cl : 35.5gmol⁻¹)

- | | | | |
|---------------|--------------|--------------|----------------|
| (A) 20 | (B) 4 | (C) 2 | (D) 0.2 |
|---------------|--------------|--------------|----------------|

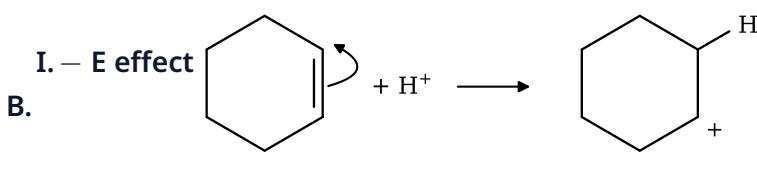
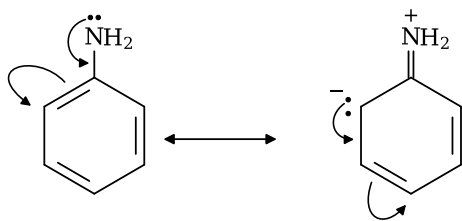
What will be the decreasing order of basic strength of the following conjugate bases?

^-OH , $\text{R}\bar{\text{O}}$, $\text{CH}_3\text{CO}\bar{\text{O}}$, Cl^-

- | | |
|--|--|
| (A) $\text{Cl}^- > \text{R}\bar{\text{O}} > ^-\text{OH} > \text{CH}_3\text{CO}\bar{\text{O}}$ | (B) $^-\text{OH} > \text{R}\bar{\text{O}} > \text{CH}_3\text{CO}\bar{\text{O}} > \text{Cl}^-$ |
| (C) $\text{Cl}^- > ^-\text{OH} > \text{R}\bar{\text{O}} > \text{CH}_3\text{CO}\bar{\text{O}}$ | (D) $\text{R}\bar{\text{O}} > ^-\text{OH} > \text{CH}_3\text{CO}\bar{\text{O}} > \text{Cl}^-$ |

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Match List I with List II:



	LIST I Mechanism steps		LIST II Effect
A.			
	II.	— R effect	
C.		III.	+ E effect
D.		IV.	+ R effect

Choose the correct answer from the options given below:

- (A) (A) - (I), (B) - (II), (C) - (IV), (D) - (III) (B) (A) - (II), (B) - (IV), (C) - (III), (D) - (I)
- (C) (A) - (III), (B) - (I), (C) - (II), (D) - (IV) (D) (A) - (IV), (B) - (III), (C) - (I), (D) - (II)

Which among the following is incorrect statement?

- (A) The electromeric effect is, temporary effect
- (B) Hydrogen ion (H^+) shows negative electromeric effect
- (C) The organic compound shows electromeric effect in the presence of the reagent only.
- (D) Electromeric effect dominates over inductive effect

Which of the following nitrogen containing compound does not give Lassaigne's test?

- (A) Glycene (B) Phenyl hydrazine (C) Urea (D) Hydrazine

In the precipitation of the iron group (III) in qualitative analysis, ammonium chloride is added before adding ammonium hydroxide to:

- (A) decrease concentration of OH^- ions (B) increase concentration of Cl^- ions
- (C) prevent interference by phosphate ions (D) increase concentration of NH_4^+ ions

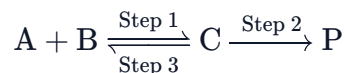
Chemistry Section B · Numerical value

Q47 to Q56

Number of molecules/species from the following having one unpaired electron is _____.

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Consider the following transformation involving first order elementary reaction in each step at constant temperature as shown below.



Some details of the above reactions are listed below.

Step	Rate constant (sec ⁻¹)	Activation energy (kJ mol ⁻¹)
1	k ₁	300
2	k ₂	200
3	k ₃	E _{a3}

If the overall rate constant of the above transformation (k) is given as $k = \frac{k_1 k_2}{k_3}$ and the overall activation energy (E_a) is 400 kJ mol⁻¹, then the value of E_{a3} is _____ integer)

Consider the following reaction



Product 'A' in neutral or acidic medium disproportionate to give products 'B' and 'C' along with water. The sum of spin-only magnetic moment values of B and C is _____ BM. (nearest integer) (Given atomic number of Mn is 25)

Only 2 mL of KMnO₄ solution of unknown molarity is required to reach the end point of a titration of 20 mL of oxalic acid (2M) in acidic medium. The molarity of KMnO₄ solution should be _____ M.

2.5 g of a non-volatile, non-electrolyte is dissolved in 100 g of water at 25°C. The solution showed a boiling point elevation by 2°C. Assuming the solute concentration is negligible with respect to the solvent concentration, the vapor pressure of the resulting aqueous solution is _____ mm of Hg (nearest integer)

[Given : Molal boiling point elevation constant of water (K_b) = 0.52 K.kg mol⁻¹, 1 atm pressure = 760 mm of Hg, molar mass of water = 18 g mol⁻¹]

X g of ethylamine is subjected to reaction with NaNO₂/HCl followed by water; evolved dinitrogen gas which occupied 2.24 L volume at STP. X is _____ × 10⁻¹ g.

The de-Broglie's wavelength of an electron in the 4th orbit is _____ π a₀. (a₀ = Bohr's radius)

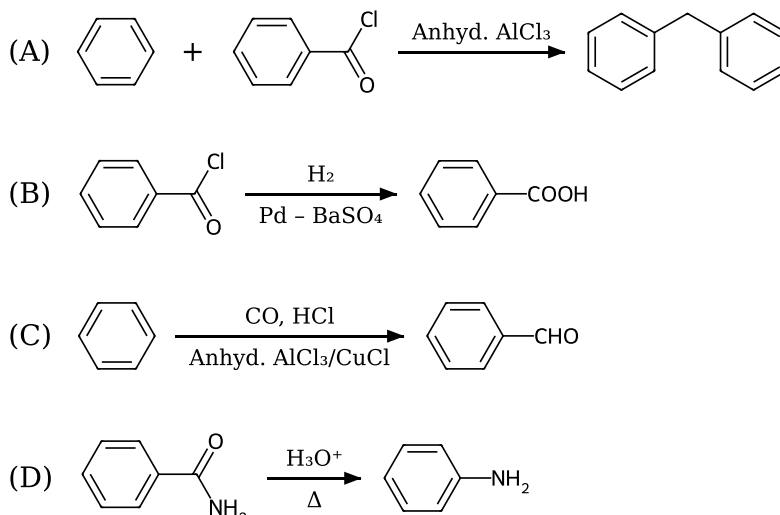
The enthalpy of formation of ethane (C₂H₆) from ethylene by addition of hydrogen where the bond-energies of



are 414 kJ, 347 kJ, 615 kJ and 435 kJ respectively is – _____ kJ

The number of different chain isomers for C₇H₁₆ is _____.

The number of the correct reaction(s) among the following is _____.



Mathematics Section A · Multiple choice

Q57 to Q75

Q57 Three Dimensional Geometry

Step-by-step solution > prepwisar.in/questions/_GYDYdFaRB

Let the point, on the line passing through the points $P(1, -2, 3)$ and $Q(5, -4, 7)$, farther from the origin and at a distance of 9 units from the point P , be (α, β, γ) . Then $\alpha^2 + \beta^2 + \gamma^2$ is equal to:

- (A) 150 (B) 155 (C) 160 (D) 165

Q58 Applications of Derivatives

Step-by-step solution > prepwisar.in/questions/VZjGBBU_Ox

Let the sum of the maximum and the minimum values of the function $f(x) = \frac{2x^2 - 3x + 8}{2x^2 + 3x + 8}$ be $\frac{m}{n}$, where $\gcd(m, n) = 1$. Then $m + n$ is equal to:

- (A) 217 (B) 182 (C) 201 (D) 195

Q59 Binomial Theorem

Step-by-step solution > prepwisar.in/questions/a7AEu4p4-G

The sum of all rational terms in the expansion of $\left(2^{\frac{1}{5}} + 5^{\frac{1}{3}}\right)^{15}$ is equal to:

- (A) 633 (B) 6131 (C) 3133 (D) 931

Q60 Circles

Step-by-step solution > prepwisar.in/questions/vaM4vROdFe

A square is inscribed in the circle $x^2 + y^2 - 10x - 6y + 30 = 0$. One side of this square is parallel to $y = x + 3$. If (x_i, y_i) are the vertices of the square, then $\sum (x_i^2 + y_i^2)$ is equal to:

- (A) 152 (B) 148 (C) 156 (D) 160

Q61 Complex Numbers

Step-by-step solution > prepwisar.in/questions/Jp9AS1Et1C

Let α and β be the sum and the product of all the non-zero solutions of the equation $(\bar{z})^2 + |z| = 0, z \in \mathbb{C}$. Then $4(\alpha^2 + \beta^2)$ is equal to:

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

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Q62 Differential Equations[Step-by-step solution](https://www.prepwisar.in/questions/DOQ1Mm3ZX4) › prepwisar.in/questions/DOQ1Mm3ZX4

If the solution $y = y(x)$ of the differential equation $(x^4 + 2x^3 + 3x^2 + 2x + 2)dy - (2x^2 + 2x + 3)dx = 0$ satisfies $y(-1) = -\frac{\pi}{4}$, then $y(0)$ is equal to:

- (A) $-\frac{\pi}{12}$ (B) $\frac{\pi}{2}$ (C) 0 (D) $\frac{\pi}{4}$

Q63 Functions (Advanced)[Step-by-step solution](https://www.prepwisar.in/questions/VBuKSEvePk) › prepwisar.in/questions/VBuKSEvePk

Let $f(x) = x^5 + 2e^{x/4}$ for all $x \in \mathbf{R}$. Consider a function $g(x)$ such that $(g \circ f)(x) = x$ for all $x \in \mathbf{R}$. Then the value of $8g'(2)$ is:

- (A) 4 (B) 2 (C) 16 (D) 8

Q64 Inverse Trigonometric Functions[Step-by-step solution](https://www.prepwisar.in/questions/1g47ZwnRaN) › prepwisar.in/questions/1g47ZwnRaN

If the domain of the function

$$\sin^{-1}\left(\frac{3x-22}{2x-19}\right) + \log_e\left(\frac{3x^2-8x+5}{x^2-3x-10}\right)$$

is $(\alpha, \beta]$, then $3\alpha + 10\beta$ is equal to:

- (A) 95 (B) 100 (C) 97 (D) 98

Q65 Continuity & Differentiability[Step-by-step solution](https://www.prepwisar.in/questions/0LMPUO1vtD) › prepwisar.in/questions/0LMPUO1vtD

Let $f : \mathbf{R} \rightarrow \mathbf{R}$ be a function given by

$$f(x) = \begin{cases} \frac{1-\cos 2x}{x^2}, & x < 0 \\ \alpha, & x = 0, \\ \frac{\beta\sqrt{1-\cos x}}{x}, & x > 0 \end{cases}$$

where $\alpha, \beta \in \mathbf{R}$. If f is continuous at $x = 0$, then $\alpha^2 + \beta^2$ is equal to:

- (A) 48 (B) 6 (C) 3 (D) 12

Q66 Determinants[Step-by-step solution](https://www.prepwisar.in/questions/i6dDeZ-6Bi) › prepwisar.in/questions/i6dDeZ-6Bi

Let $\alpha \in (0, \infty)$ and

$$A = \begin{bmatrix} 1 & 2 & \alpha \\ 1 & 0 & 1 \\ 0 & 1 & 2 \end{bmatrix}$$

. If

$$\det(\operatorname{adj}(2A - A^T) \cdot \operatorname{adj}(A - 2A^T)) = 2^8$$

, then $(\det(A))^2$ is equal to:

- (A) 16 (B) 36 (C) 49 (D) 1

Q67 Determinants[Step-by-step solution](https://www.prepwisar.in/questions/g8v87FnVUi) › prepwisar.in/questions/g8v87FnVUi

If the system of equations

$$x + (\sqrt{2} \sin \alpha)y + (\sqrt{2} \cos \alpha)z = 0$$

$$x + (\cos \alpha)y + (\sin \alpha)z = 0$$

$$x + (\sin \alpha)y - (\cos \alpha)z = 0$$

has a non-trivial solution, then $\alpha \in (0, \frac{\pi}{2})$ is equal to:

- (A) $\frac{5\pi}{24}$ (B) $\frac{11\pi}{24}$ (C) $\frac{7\pi}{24}$ (D) $\frac{3\pi}{4}$

There are 5 points P_1, P_2, P_3, P_4, P_5 on the side AB , excluding A and B , of a triangle ABC . Similarly there are 6 points $P_6, P_7, \dots, P_{11}$ on the side BC and 7 points $P_{12}, P_{13}, \dots, P_{18}$ on the side CA of the triangle. The number of triangles, that can be formed using the points $P_1, P_2, \dots, P_{18}$ as vertices, is:

- (A) 751 (B) 776 (C) 796 (D) 771

Three urns A, B and C contain 7 red, 5 black; 5 red, 7 black and 6 red, 6 black balls, respectively. One of the urn is selected at random and a ball is drawn from it. If the ball drawn is black, then the probability that it is drawn from urn A is:

- (A) $\frac{4}{17}$ (B) $\frac{5}{16}$ (C) $\frac{5}{18}$ (D) $\frac{7}{18}$

If 2 and 6 are the roots of the equation $ax^2 + bx + 1 = 0$, then the quadratic equation, whose roots are $\frac{1}{2a+b}$ and $\frac{1}{6a+b}$, is:

- (A) $x^2 + 8x + 12 = 0$ (B) $2x^2 + 11x + 12 = 0$
(C) $4x^2 + 14x + 12 = 0$ (D) $x^2 + 10x + 16 = 0$

Let the first three terms 2, p and q, with $q \neq 2$, of a G.P. be respectively the 7th, 8th and 13th terms of an A.P. If the 5th term of the G.P. is the n^{th} term of the A.P., then n is equal to:

- (A) 151 (B) 177 (C) 163 (D) 169

Let $\alpha, \beta \in \mathbf{R}$. Let the mean and the variance of 6 observations $-3, 4, 7, -6, \alpha, \beta$ be 2 and 23, respectively. The mean deviation about the mean of these 6 observations is:

- (A) $\frac{16}{3}$ (B) $\frac{11}{3}$ (C) $\frac{14}{3}$ (D) $\frac{13}{3}$

Let a unit vector which makes an angle of 60° with $2\hat{i} + 2\hat{j} - \hat{k}$ and an angle of 45° with $\hat{i} - \hat{k}$ be $\vec{C}$. Then

$$\vec{C} + \left(-\frac{1}{2}\hat{i} + \frac{1}{3\sqrt{2}}\hat{j} - \frac{\sqrt{2}}{3}\hat{k} \right)$$

is:

- (A) $-\frac{\sqrt{2}}{3}\hat{i} + \frac{\sqrt{2}}{3}\hat{j} + \left(\frac{1}{2} + \frac{2\sqrt{2}}{3} \right)\hat{k}$
(B) $\left(\frac{1}{\sqrt{3}} + \frac{1}{2} \right)\hat{i} + \left(\frac{1}{\sqrt{3}} - \frac{1}{3\sqrt{2}} \right)\hat{j} + \left(\frac{1}{\sqrt{3}} + \frac{\sqrt{2}}{3} \right)\hat{k}$
(C) $\frac{\sqrt{2}}{3}\hat{i} - \frac{1}{2}\hat{k}$
(D) $\frac{\sqrt{2}}{3}\hat{i} + \frac{1}{3\sqrt{2}}\hat{j} - \frac{1}{2}\hat{k}$

Q74 Area Under Curves[Step-by-step solution](#) › prepwiser.in/questions/kXAiGdRino

One of the points of intersection of the curves $y = 1 + 3x - 2x^2$ and $y = \frac{1}{x}$ is $(\frac{1}{2}, 2)$. Let the area of the region enclosed by these curves be $\frac{1}{24}(l\sqrt{5} + m) - n \log_e(1 + \sqrt{5})$, where $l, m, n \in \mathbf{N}$. Then $l + m + n$ is equal to

(A) 30**(B)** 29**(C)** 31**(D)** 32**Q75** Straight Lines[Step-by-step solution](#) › prepwiser.in/questions/IE2KvJFkFL

The vertices of a triangle are $A(-1, 3)$, $B(-2, 2)$ and $C(3, -1)$. A new triangle is formed by shifting the sides of the triangle by one unit inwards. Then the equation of the side of the new triangle nearest to origin is:

(A) $-x + y - (2 - \sqrt{2}) = 0$ **(B)** $x + y - (2 - \sqrt{2}) = 0$ **(C)** $x + y + (2 - \sqrt{2}) = 0$ **(D)** $x - y - (2 + \sqrt{2}) = 0$ **Mathematics Section B · Numerical value**

Q76 to Q85

Q76 Binomial Theorem **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/t6emXrmd6a

Let

$$a = 1 + \frac{{}^2C_2}{3!} + \frac{{}^3C_2}{4!} + \frac{{}^4C_2}{5!} + \dots, b = 1 + \frac{{}^1C_0 + {}^1C_1}{1!} + \frac{{}^2C_0 + {}^2C_1 + {}^2C_2}{2!} + \frac{{}^3C_0 + {}^3C_1 + {}^3C_2 + {}^3C_3}{3!} + \dots$$

Then $\frac{2b}{a^2}$ is equal to _____.**Q77** Three Dimensional Geometry **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/6l6Fgo4x4K

If the shortest distance between the lines $\frac{x+2}{2} = \frac{y+3}{3} = \frac{z-5}{4}$ and $\frac{x-3}{1} = \frac{y-2}{-3} = \frac{z+4}{2}$ is $\frac{38}{3\sqrt{5}}k$, and

$\int_0^k [x^2] dx = \alpha - \sqrt{\alpha}$, where $[x]$ denotes the greatest integer function, then $6\alpha^3$ is equal to _____.

Q78 Definite Integration **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/k9CyYB3DZ5

If

$$\int_0^{\frac{\pi}{4}} \frac{\sin^2 x}{1 + \sin x \cos x} dx = \frac{1}{a} \log_e \left(\frac{a}{3} \right) + \frac{\pi}{b\sqrt{3}}$$

, where $a, b \in \mathbf{N}$, then $a + b$ is equal to _____.**Q79** Differential Equations **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/1VNkSPIq8h

Let the solution $y = y(x)$ of the differential equation $\frac{dy}{dx} - y = 1 + 4 \sin x$ satisfy $y(\pi) = 1$. Then $y\left(\frac{\pi}{2}\right) + 10$ is equal to _____.

Q80 Limits **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/a10QLivrcW

If

$$\lim_{x \rightarrow 1} \frac{(5x+1)^{1/3} - (x+5)^{1/3}}{(2x+3)^{1/2} - (x+4)^{1/2}} = \frac{m\sqrt{5}}{n(2n)^{2/3}}$$

, where $\gcd(m, n) = 1$, then $8m + 12n$ is equal to _____.**Q81** Matrices **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/S6gS3St_z

Let A be a square matrix of order 2 such that $|A| = 2$ and the sum of its diagonal elements is -3 . If the points (x, y) satisfying $A^2 + xA + yI = O$ lie on a hyperbola, whose transverse axis is parallel to the x -axis, eccentricity is e and the length of the latus rectum is l , then $e^4 + l^4$ is equal to _____.

Let A be a 3×3 matrix of non-negative real elements such that

$$A \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = 3 \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

. Then the maximum value of $\det(A)$ is _____.

Let the length of the focal chord PQ of the parabola $y^2 = 12x$ be 15 units. If the distance of PQ from the origin is p , then $10p^2$ is equal to _____.

In a survey of 220 students of a higher secondary school, it was found that at least 125 and at most 130 students studied Mathematics; at least 85 and at most 95 studied Physics; at least 75 and at most 90 studied Chemistry; 30 studied both Physics and Chemistry; 50 studied both Chemistry and Mathematics; 40 studied both Mathematics and Physics and 10 studied none of these subjects. Let m and n respectively be the least and the most number of students who studied all the three subjects. Then $m + n$ is equal to _____.

Let ABC be a triangle of area $15\sqrt{2}$ and the vectors

$$\overrightarrow{AB} = \hat{i} + 2\hat{j} - 7\hat{k}, \overrightarrow{BC} = a\hat{i} + b\hat{j} + c\hat{k}$$

and

$$\overrightarrow{AC} = 6\hat{i} + d\hat{j} - 2\hat{k}, d > 0$$

. Then the square of the length of the largest side of the triangle ABC is _____.

Answer key: JEE Main 2024 · 4 Apr · Shift 1

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Physics

1.	C	2.	D	3.	B	4.	C	5.	A	6.	B	7.	D	8.	B	9.	C	10.	D
11.	A	12.	B	13.	C	14.	D	15.	D	16.	A	17.	A	18.	A	19.	D	20.	8
21.	7	22.	1	23.	16	24.	6	25.	50	26.	7	27.	5	28.	7	29.	9		

Chemistry

30.	B	31.	D	32.	A	33.	C	34.	C	35.	B	36.	D	37.	C	38.	B	39.	C
40.	B	41.	D	42.	D	43.	D	44.	B	45.	D	46.	A	47.	2	48.	100	49.	4
50.	8	51.	707	52.	45	53.	8	54.	125	55.	9	56.	1						

Mathematics

57.	B	58.	C	59.	C	60.	A	61.	A	62.	D	63.	C	64.	C	65.	D	66.	A
67.	A	68.	A	69.	C	70.	A	71.	C	72.	D	73.	C	74.	A	75.	B	76.	8
77.	48	78.	8	79.	7	80.	100	81.	25	82.	27	83.	72	84.	45	85.	54		

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