

JEE MAIN 2023 · QUESTION PAPER

13 Apr 2023 **Shift 2**

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.

prepwise.in/pyqs/paper/2023-04-13-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 Alternating Current

[Step-by-step solution](#) › [prepwisar.in/questions/kVEkbB8mDe](https://www.prepwisar.in/questions/kVEkbB8mDe)

Given below are two statements:

Statement I : An AC circuit undergoes electrical resonance if it contains either a capacitor or an inductor.

Statement II : An AC circuit containing a pure capacitor or a pure inductor consumes high power due to its non-zero power factor.

In the light of above statements, choose the correct answer form the options given below:

- (A) Both Statement I and Statement II are false (B) Statement I is true but statement II is false
(C) Statement I is false but statement II is true (D) Both Statement I and Statement II are true

Q2 Nuclear Physics

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

Given below are two statements: one is labelled as Assertion **A** and the other is labelled as Reason **R**.

Assertion A : The binding energy per nucleon is practically independent of the atomic number for nuclei of mass number in the range 30 to 170.

Reason R : Nuclear force is short ranged.

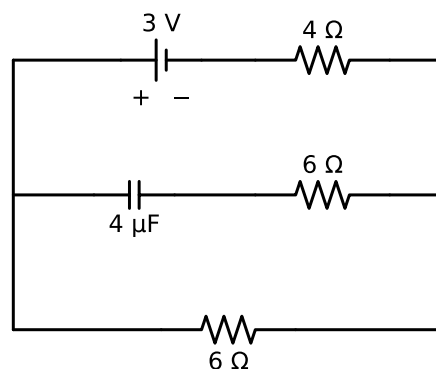
In the light of the above statements, choose the correct answer from the options given below

- (A) A is false but **R** is true
(B) A is true but **R** is false
(C) Both **A** and **R** are true and **R** is the correct explanation of **A**
(D) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**

Q3 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) › [prepwisar.in/questions/1iBwyNDefN](https://www.prepwisar.in/questions/1iBwyNDefN)

In the network shown below, the charge accumulated in the capacitor in steady state will be:



- (A) $10.3 \mu\text{C}$ (B) $7.2 \mu\text{C}$ (C) $4.8 \mu\text{C}$ (D) $12 \mu\text{C}$

Q4 Circular Motion

[Step-by-step solution](#) › [prepwisar.in/questions/q1vx4VWvEh](https://www.prepwisar.in/questions/q1vx4VWvEh)

A vehicle of mass 200kg is moving along a levelled curved road of radius 70m with angular velocity of 0.2rad/s . The centripetal force acting on the vehicle is:

- (A) 560N (B) 14N (C) 2800N (D) 2240N

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Given below are two statements:

Statement I : Out of microwaves, infrared rays and ultraviolet rays, ultraviolet rays are the most effective for the emission of electrons from a metallic surface.

Statement II : Above the threshold frequency, the maximum kinetic energy of photoelectrons is inversely proportional to the frequency of the incident light.

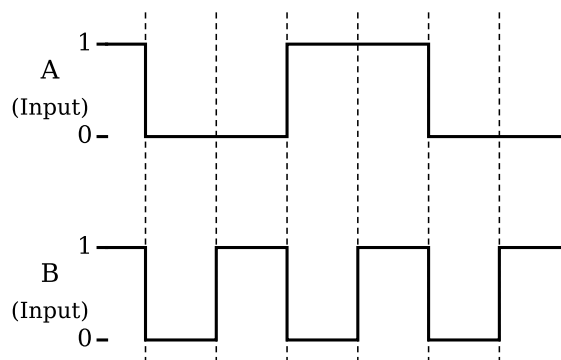
In the light of above statements, choose the correct answer form the options given below

- (A) Both Statement I and Statement II are true (B) Statement I is true but statement II is false
(C) Statement I is false but statement II is true (D) Both Statement I and Statement II are false

In an electromagnetic wave, at an instant and at particular position, the electric field is along the negative z -axis and magnetic field is along the positive x -axis. Then the direction of propagation of electromagnetic wave is:

- (A) at 45° angle from positive y -axis (B) positive y -axis
(C) negative y -axis (D) positive z -axis

The output from NAND gate having inputs A and B given below will be,



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

A $10\mu\text{C}$ charge is divided into two parts and placed at 1cm distance so that the repulsive force between them is maximum. The charges of the two parts are:

- (A) $9\mu\text{C}$, $1\mu\text{C}$ (B) $5\mu\text{C}$, $5\mu\text{C}$ (C) $8\mu\text{C}$, $2\mu\text{C}$ (D) $7\mu\text{C}$, $3\mu\text{C}$

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Given below are two statements:

Statement I : For a planet, if the ratio of mass of the planet to its radius increases, the escape velocity from the planet also increases.

Statement II : Escape velocity is independent of the radius of the planet.

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

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

Two planets A and B of radii R and $1.5R$ have densities ρ and $\rho/2$ respectively. The ratio of acceleration due to gravity at the surface of B to A is:

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

The initial pressure and volume of an ideal gas are P_0 and V_0 . The final pressure of the gas when the gas is suddenly compressed to volume $\frac{V_0}{4}$ will be:

(Given γ = ratio of specific heats at constant pressure and at constant volume)

- (A) $P_0(4)^{\frac{1}{\gamma}}$
- (B) P_0
- (C) $4P_0$
- (D) $P_0(4)^\gamma$

The mean free path of molecules of a certain gas at STP is $1500d$, where d is the diameter of the gas molecules. While maintaining the standard pressure, the mean free path of the molecules at $373K$ is approximately:

- (A) $750d$
- (B) $1500d$
- (C) $2049d$
- (D) $1098d$

An electron is moving along the positive x-axis. If the uniform magnetic field is applied parallel to the negative z-axis, then

- A. The electron will experience magnetic force along positive y-axis
- B. The electron will experience magnetic force along negative y-axis
- C. The electron will not experience any force in magnetic field
- D. The electron will continue to move along the positive x-axis
- E. The electron will move along circular path in magnetic field

Choose the correct answer from the options given below:

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

The distance travelled by an object in time t is given by $s = (2.5)t^2$. The instantaneous speed of the object at $t = 5s$ will be:

- (A) $5ms^{-1}$
- (B) $12.5ms^{-1}$
- (C) $62.5ms^{-1}$
- (D) $25ms^{-1}$

A passenger sitting in a train A moving at 90km/h observes another train B moving in the opposite direction for 8s . If the velocity of the train B is 54km/h , then length of train B is:

- (A) 80 m (B) 200 m (C) 120 m (D) 320 m

Given below are two statements: one is labelled as Assertion **A** and the other is labelled as Reason **R**.

Assertion A : A spherical body of radius $(5 \pm 0.1)\text{mm}$ having a particular density is falling through a liquid of constant density. The percentage error in the calculation of its terminal velocity is 4% .

Reason R : The terminal velocity of the spherical body falling through the liquid is inversely proportional to its radius.

In the light of the above statements, choose the correct answer from the options given below

- (A) A is false but **R** is true
(B) A is true but **R** is false
(C) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**
(D) Both **A** and **R** are true and **R** is the correct explanation of **A**

A particle executes SHM of amplitude A . The distance from the mean position when its kinetic energy becomes equal to its potential energy is:

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

In a Young's double slits experiment, the ratio of amplitude of light coming from slits is $2 : 1$. The ratio of the maximum to minimum intensity in the interference pattern is:

- (A) $25 : 9$ (B) $9 : 1$ (C) $9 : 4$ (D) $2 : 1$

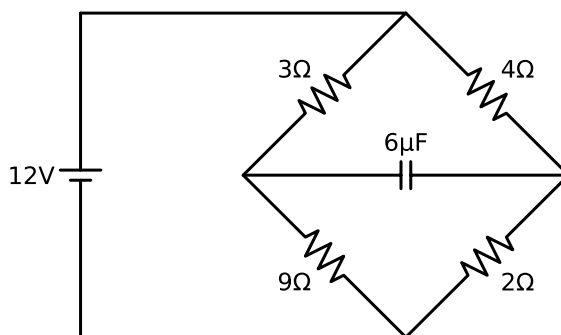
In the equation $\left[X + \frac{a}{Y^2}\right][Y - b] = RT$, X is pressure, Y is volume, R is universal gas constant and T is temperature. The physical quantity equivalent to the ratio $\frac{a}{b}$ is:

- (A) Impulse (B) Energy
(C) Pressure gradient (D) Coefficient of viscosity

Q20 Electrostatics II: Potential & Capacitance **NUMERICAL**

[Step-by-step solution](#) > [prepwise.in/questions/suqeilzO1o](https://www.prepwise.in/questions/suqeilzO1o)

In the circuit shown, the energy stored in the capacitor is $n\mu\text{J}$. The value of n is _____



Q21 Atomic Physics **NUMERICAL**

[Step-by-step solution](#) > [prepwise.in/questions/DG6ESLVP-Q](https://www.prepwise.in/questions/DG6ESLVP-Q)

An atom absorbs a photon of wavelength 500nm and emits another photon of wavelength 600nm . The net energy absorbed by the atom in this process is $n \times 10^{-4}\text{eV}$. The value of n is _____. [Assume the atom to be stationary during the absorption and emission process] (Take $h = 6.6 \times 10^{-34}\text{Js}$ and $c = 3 \times 10^8\text{m/s}$)

Q22 Electromagnetic Induction **NUMERICAL**

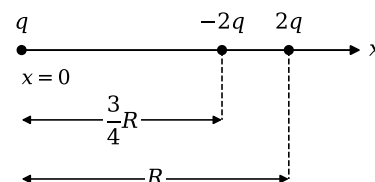
[Step-by-step solution](#) > [prepwise.in/questions/QC9TaXx0Ih](https://www.prepwise.in/questions/QC9TaXx0Ih)

An insulated copper wire of 100 turns is wrapped around a wooden cylindrical core of the cross-sectional area 24cm^2 . The two ends of the wire are connected to a resistor. The total resistance in the circuit is 12Ω . If an externally applied uniform magnetic field in the core along its axis changes from 1.5T in one direction to 1.5T in the opposite direction, the charge flowing through a point in the circuit during the change of magnetic field will be _____ mC .

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

[Step-by-step solution](#) > [prepwise.in/questions/Dlo6Z6O6h-](https://www.prepwise.in/questions/Dlo6Z6O6h-)

Three point charges q , $-2q$ and $2q$ are placed on x -axis at a distance $x = 0$, $x = \frac{3}{4}R$ and $x = R$ respectively from origin as shown. If $q = 2 \times 10^{-6}\text{C}$ and $R = 2\text{cm}$, the magnitude of net force experienced by the charge $-2q$ is _____ N .



Q24 Ray Optics **NUMERICAL**

[Step-by-step solution](#) > [prepwise.in/questions/foarkEv6u9](https://www.prepwise.in/questions/foarkEv6u9)

A bi convex lens of focal length 10cm is cut in two identical parts along a plane perpendicular to the principal axis. The power of each lens after cut is _____ D .

Q25 Heat Transfer **NUMERICAL**

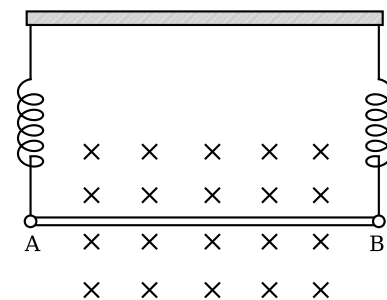
[Step-by-step solution](#) > [prepwise.in/questions/IxkixZYdfX](https://www.prepwise.in/questions/IxkixZYdfX)

Two plates A and B have thermal conductivities $84\text{Wm}^{-1}\text{K}^{-1}$ and $126\text{Wm}^{-1}\text{K}^{-1}$ respectively. They have same surface area and same thickness. They are placed in contact along their surfaces. If the temperatures of the outer surfaces of A and B are kept at 100°C and 0°C respectively, then the temperature of the surface of contact in steady state is _____ $^\circ\text{C}$.

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Q26 Moving Charges & Magnetism **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/4KtID8T-Mv)

A straight wire AB of mass 40g and length 50cm is suspended by a pair of flexible leads in uniform magnetic field of magnitude 0.40T as shown in the figure. The magnitude of the current required in the wire to remove the tension in the supporting leads is _____ A.
(Take $g = 10\text{ms}^{-2}$).

**Q27** Rotational Motion **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/NrI_1y12XD)

A light rope is wound around a hollow cylinder of mass 5 kg and radius 70 cm. The rope is pulled with a force of 52.5 N. The angular acceleration of the cylinder will be _____ rad s^{-2} .

Q28 Mechanical Waves **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/VtXE2TiTzS)

In an experiment with sonometer when a mass of 180g is attached to the string, it vibrates with fundamental frequency of 30Hz. When a mass m is attached, the string vibrates with fundamental frequency of 50Hz. The value of m is _____ g.

Q29 Work, Energy & Power **NUMERICAL**[Step-by-step solution](https://www.prepwiser.in/questions/ND8k43WQkL)

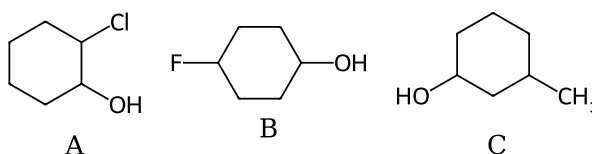
A car accelerates from rest to um/s . The energy spent in this process is EJ . The energy required to accelerate the car from um/s to $2um/s$ is nEJ . The value of n is _____.

Chemistry Section A · Multiple choice

Q30 to Q46

Q30 Alcohols, Phenols & Ethers[Step-by-step solution](https://www.prepwiser.in/questions/wHqifAiAzz)

Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A : Order of acidic nature of the following compounds is $A > B > C$.



Reason R : Fluoro is a stronger electron withdrawing group than Chloro group.

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

- (A) Both A and R are correct but R is NOT the correct explanation of A
(B) A is false but R is true
(C) A is true but R is false
(D) Both A and R are correct and R is the correct explanation of A

Q31 Carbohydrates & Biomolecules[Step-by-step solution](https://www.prepwiser.in/questions/0WV4hhwGwK)

The naturally occurring amino acid that contains only one basic functional group in its chemical structure is

- (A) asparagine (B) arginine (C) histidine (D) lysine

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Given below are two statements:

Statement I: SO_2 and H_2O both possess V-shaped structure.

Statement II : The bond angle of SO_2 is less than that of H_2O .

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

Q33 Coordination Compounds

[Step-by-step solution](https://www.prepwisar.in/questions/_nRblJNwk4) > prepwisar.in/questions/_nRblJNwk4

The total number of stereoisomers for the complex $[\text{Cr}(\text{ox})_2\text{ClBr}]^{3-}$ (where ox = oxalate) is:

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

Q34 d & f Block Elements

[Step-by-step solution](https://www.prepwisar.in/questions/vq192K8PZH) > prepwisar.in/questions/vq192K8PZH

Which of the following complexes will exhibit maximum attraction to an applied magnetic field?

- (A) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
- (B) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$
- (C) $[\text{Co}(\text{en})_3]^{3+}$
- (D) $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$

Q35 Hydrogen & s-Block Elements

[Step-by-step solution](https://www.prepwisar.in/questions/sEULt9rIHl) > prepwisar.in/questions/sEULt9rIHl

Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Isotopes of hydrogen have almost same chemical properties, but difference in their rates of reaction.

Reason R : Isotopes of hydrogen have different enthalpy of bond dissociation.

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

- (A) A is not correct but R is correct
- (B) Both A and R are correct but R is NOT the correct explanation of A
- (C) A is correct but R is not correct
- (D) Both A and R are correct and R is the correct explanation of A

Q36 Metallurgy

[Step-by-step solution](https://www.prepwisar.in/questions/PnZ4QispE7) > prepwisar.in/questions/PnZ4QispE7

Given below are two statements related to Ellingham diagram:

Statement I : Ellingham diagrams can be constructed for formation of oxides, sulfides and halides of metals.

Statement II : It consists of plots of $\Delta_f H^0$ vs T for formation of oxides of elements.

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

The correct group of halide ions which can be oxidised by oxygen in acidic medium is:

- (A) Br^- only (B) Cl^- , Br^- and I^- only
(C) Br^- and I^- only (D) I^- only

The covalency and oxidation state respectively of boron in $[\text{BF}_4]^-$, are:

- (A) 3 and 4 (B) 4 and 3 (C) 4 and 4 (D) 3 and 5

Match List I with List II

	LIST I		LIST II
A.	Weak intermolecular forces of attraction	I.	Hexamethylenediamine + adipic acid
B.	Hydrogen bonding	II.	$\text{AlEt}_3 + \text{TiCl}_4$
C.	Heavily branched polymer	III.	2 - chloro - 1, 3 - butadiene
D.	High density polymer	IV.	Phenol + formaldehyde

Choose the correct answer from the options given below:

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

Better method for preparation of BeF_2 , among the following is:

- (A) $\text{BeH}_2 + \text{F}_2 \xrightarrow{\Delta} \text{BeF}_2$ (B) $(\text{NH}_4)_2 \text{BeF}_4 \xrightarrow{\Delta} \text{BeF}_2$
(C) $\text{Be} + \text{F}_2 \xrightarrow{\Delta} \text{BeF}_2$ (D) $\text{BeO} + \text{C} + \text{F}_2 \xrightarrow{\Delta} \text{BeF}_2$

Identify the correct order of standard enthalpy of formation of sodium halides:

- (A) $\text{NaI} < \text{NaBr} < \text{NaCl} < \text{NaF}$ (B) $\text{NaI} < \text{NaBr} < \text{NaF} < \text{NaCl}$
(C) $\text{NaF} < \text{NaCl} < \text{NaBr} < \text{NaI}$ (D) $\text{NaCl} < \text{NaF} < \text{NaBr} < \text{NaI}$

Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

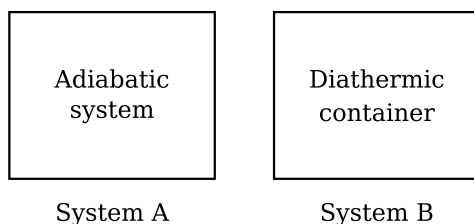
Assertion A : The diameter of colloidal particles in solution should not be much smaller than wavelength of light to show Tyndall effect.

Reason R : The light scatters in all directions when the size of particles is large enough.

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

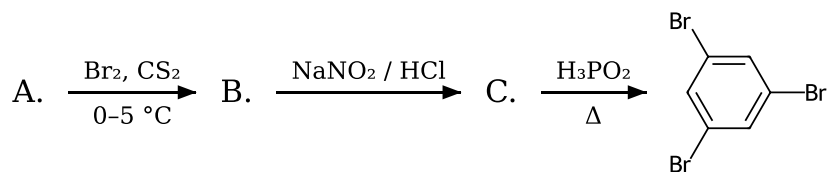
- (A) Both A and R are correct and R is the correct explanation of A
(B) A is true but R is false
(C) Both A and R are correct but R is NOT the correct explanation of A
(D) A is false but R is true

What happens when methane undergoes combustion in systems A and B respectively?



(A)	System A	System B
	Temperature falls	Temperature rises
(B)	System A	System B
	Temperature rises	Temperature remains same
(C)	System A	System B
	Temperature falls	Temperature remains same
(D)	System A	System B
	Temperature remains same	Temperature rises

Compound A from the following reaction sequence is:



- (A) Benzoic acid (B) Phenol (C) Salicylic acid (D) Aniline

Match List I with List II

1 - Bromopropane is reacted with reagents in List I to give product in List II

	LIST I - Reagent		LIST II - Product
A.	KOH (alc)	I.	Nitrile
B.	KCN (alc)	II.	Ester
C.	AgNO ₂	III.	Alkene
D.	H ₃ CCOOAg	IV.	Nitroalkane

Choose the correct answer from the options given below:

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

In the wet tests for detection of various cations by precipitation, Ba²⁺ cations are detected by obtaining precipitate of

- (A) BaSO₄ (B) Ba(OAc)₂
 (C) BaCO₃ (D) Ba(ox): Barium oxalate

Q47 Chemical Kinetics **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/K0sLH1Chuk) › prepwisar.in/questions/K0sLH1Chuk

$A(g) \rightarrow 2B(g) + C(g)$ is a first order reaction. The initial pressure of the system was found to be 800 mm Hg which increased to 1600 mm Hg after 10 min. The total pressure of the system after 30 min will be _____ mm Hg. (Nearest integer)

Q48 Electrochemistry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/gGEIHb5Efh) › prepwisar.in/questions/gGEIHb5Efh

At 298K, the standard reduction potential for Cu^{2+}/Cu electrode is 0.34V.

Given: $K_{sp} Cu(OH)_2 = 1 \times 10^{-20}$

Take $\frac{2.303RT}{F} = 0.059V$

The reduction potential at pH = 14 for the above couple is $(-)x \times 10^{-2}V$. The value of x is _____

Q49 Ionic Equilibrium **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/4SIO5Ns4eT) › prepwisar.in/questions/4SIO5Ns4eT

20 mL of 0.1M NaOH is added to 50mL of 0.1M acetic acid solution. The pH of the resulting solution is _____ $\times 10^{-2}$ (Nearest integer)

Given: $pK_a (CH_3COOH) = 4.76$

$\log 2 = 0.30$

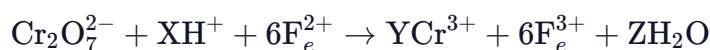
$\log 3 = 0.48$

Q50 p-Block Elements: Part I (Group 13 & 14) **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/1pxCjFp45t) › prepwisar.in/questions/1pxCjFp45t

If the formula of Borax is $Na_2B_4O_x(OH)_y \cdot zH_2O$, then $x + y + z =$ _____

Q51 Redox Reactions **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/mRsTYiMwnz) › prepwisar.in/questions/mRsTYiMwnz

See the following chemical reaction:



The sum of X, Y and Z is _____

Q52 Solid State **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/btp7xZCNZM) › prepwisar.in/questions/btp7xZCNZM

Sodium metal crystallizes in a body centred cubic lattice with unit cell edge length of $4\overset{\circ}{A}$. The radius of sodium atom is _____ $\times 10^{-1}\overset{\circ}{A}$ (Nearest integer)

Q53 Solutions & Colligative Properties **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/swlcOlJAUE) › prepwisar.in/questions/swlcOlJAUE

Sea water contains 29.25% NaCl and 19% $MgCl_2$ by weight of solution. The normal boiling point of the sea water is _____ $^{\circ}C$ (Nearest integer)

Assume 100% ionization for both NaCl and $MgCl_2$

Given:

$$K_b (H_2O) = 0.52 K kg mol^{-1}$$

Molar mass of NaCl and $MgCl_2$ is 58.5 and 95 gmol^{-1} respectively.

Q54 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/tKd5iai-Yy) › prepwisar.in/questions/tKd5iai-Yy

1g of a carbonate (M_2CO_3) on treatment with excess HCl produces 0.01mol of CO_2 . The molar mass of M_2CO_3 is _____ $gmol^{-1}$. (Nearest integer)

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The orbital angular momentum of an electron in 3s orbital is $\frac{xh}{2\pi}$. The value of x is _____ (nearest integer)

0.400g of an organic compound (X) gave 0.376g of AgBr in Carius method for estimation of bromine. % of bromine in the compound (X) is _____.

(Given: Molar mass AgBr = 188g mol^{-1}

Br = 80g mol^{-1})

Mathematics Section A · Multiple choice

Q57 to Q75

The line, that is coplanar to the line $\frac{x+3}{-3} = \frac{y-1}{1} = \frac{z-5}{5}$, is:

- (A) $\frac{x+1}{-1} = \frac{y-2}{2} = \frac{z-5}{4}$ (B) $\frac{x+1}{-1} = \frac{y-2}{2} = \frac{z-5}{5}$ (C) $\frac{x-1}{-1} = \frac{y-2}{2} = \frac{z-5}{5}$ (D) $\frac{x+1}{1} = \frac{y-2}{2} = \frac{z-5}{5}$

The plane, passing through the points $(0, -1, 2)$ and $(-1, 2, 1)$ and parallel to the line passing through $(5, 1, -7)$ and $(1, -1, -1)$, also passes through the point:

- (A) $(0, 5, -2)$ (B) $(2, 0, 1)$ (C) $(1, -2, 1)$ (D) $(-2, 5, 0)$

Let N be the foot of perpendicular from the point P $(1, -2, 3)$ on the line passing through the points $(4, 5, 8)$ and $(1, -7, 5)$. Then the distance of N from the plane $2x - 2y + z + 5 = 0$ is:

- (A) 7 (B) 6 (C) 9 (D) 8

The coefficient of x^5 in the expansion of $(2x^3 - \frac{1}{3x^2})^5$ is:

- (A) $\frac{26}{3}$ (B) $\frac{80}{9}$ (C) 9 (D) 8

Let the centre of a circle C be (α, β) and its radius $r < 8$. Let $3x + 4y = 24$ and $3x - 4y = 32$ be two tangents and $4x + 3y = 1$ be a normal to C. Then $(\alpha - \beta + r)$ is equal to:

- (A) 7 (B) 9 (C) 5 (D) 6

Let

$$S = \{z \in \mathbb{C} : \bar{z} = i(z^2 + \text{Re}(\bar{z}))\}$$

. Then $\sum_{z \in S} |z|^2$ is equal to:

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

The value of

$$\frac{e^{-\frac{\pi}{4}} + \int_0^{\frac{\pi}{4}} e^{-x} \tan^{50} x dx}{\int_0^{\frac{\pi}{4}} e^{-x} (\tan^{49} x + \tan^{51} x) dx}$$

is

- (A) 51 (B) 50 (C) 25 (D) 49

The range of $f(x) = 4 \sin^{-1} \left(\frac{x^2}{x^2+1} \right)$ is

- (A) $[0, 2\pi]$ (B) $[0, 2\pi)$ (C) $[0, \pi)$ (D) $[0, \pi]$

If

$$\lim_{x \rightarrow 0} \frac{e^{ax} - \cos(bx) - \frac{cxe^{-cx}}{2}}{1 - \cos(2x)} = 17$$

, then $5a^2 + b^2$ is equal to

- (A) 64 (B) 68 (C) 72 (D) 76

Let for

$$A = \begin{bmatrix} 1 & 2 & 3 \\ \alpha & 3 & 1 \\ 1 & 1 & 2 \end{bmatrix}, |A| = 2$$

. If $|2 \operatorname{adj}(2 \operatorname{adj}(2A))| = 32^n$, then $3n + \alpha$ is equal to

- (A) 11 (B) 9 (C) 12 (D) 10

If the system of equations

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

$$2x - 5y + \lambda z = \mu$$

$$x + 2y - 5z = 7$$

has infinitely many solutions, then $(\lambda + \mu)^2 + (\lambda - \mu)^2$ is equal to

- (A) 916 (B) 912 (C) 920 (D) 904

All words, with or without meaning, are made using all the letters of the word MONDAY. These words are written as in a dictionary with serial numbers. The serial number of the word MONDAY is:

- (A) 324 (B) 328 (C) 326 (D) 327

The random variable X follows binomial distribution $B(n, p)$, for which the difference of the mean and the variance is 1. If $2P(X = 2) = 3P(X = 1)$, then $n^2P(X > 1)$ is equal to:

- (A) 15 (B) 12 (C) 11 (D) 16

Let α, β be the roots of the equation $x^2 - \sqrt{2}x + 2 = 0$. Then $\alpha^{14} + \beta^{14}$ is equal to

- (A) -64 (B) $-64\sqrt{2}$ (C) $-128\sqrt{2}$ (D) -128

Let $a_1, a_2, a_3, \dots$ be a G.P. of increasing positive numbers. Let the sum of its 6th and 8th terms be 2 and the product of its 3rd and 5th terms be $\frac{1}{9}$. Then $6(a_2 + a_4)(a_4 + a_6)$ is equal to

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

Let $|\vec{a}| = 2, |\vec{b}| = 3$ and the angle between the vectors $\vec{a}$ and $\vec{b}$ be $\frac{\pi}{4}$. Then $|(\vec{a} + 2\vec{b}) \times (2\vec{a} - 3\vec{b})|^2$ is equal to:

- (A) 441 (B) 482 (C) 841 (D) 882

Let for a triangle ABC,

$$\vec{AB} = -2\hat{i} + \hat{j} + 3\hat{k}$$

$$\vec{CB} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$$

$$\vec{CA} = 4\hat{i} + 3\hat{j} + \delta\hat{k}$$

If $\delta > 0$ and the area of the triangle ABC is $5\sqrt{6}$, then $\vec{CB} \cdot \vec{CA}$ is equal to

- (A) 60 (B) 54 (C) 120 (D) 108

The area of the region $\{(x, y) : x^2 \leq y \leq |x^2 - 4|, y \geq 1\}$ is

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

Let (α, β) be the centroid of the triangle formed by the lines $15x - y = 82, 6x - 5y = -4$ and $9x + 4y = 17$. Then $\alpha + 2\beta$ and $2\alpha - \beta$ are the roots of the equation:

- (A) $x^2 - 7x + 12 = 0$ (B) $x^2 - 13x + 42 = 0$ (C) $x^2 - 14x + 48 = 0$ (D) $x^2 - 10x + 25 = 0$

Q76 Binomial Theorem **NUMERICAL**

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

The remainder, when 7^{103} is divided by 17, is _____

Q77 Definite Integration **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/sDan_ffh2](https://www.prepwise.in/questions/sDan_ffh2)

Let

$$f_n = \int_0^{\frac{\pi}{2}} \left(\sum_{k=1}^n \sin^{k-1} x \right) \left(\sum_{k=1}^n (2k-1) \sin^{k-1} x \right) \cos x dx, n \in \mathbb{N}$$

. Then $f_{21} - f_{20}$ is equal to _____

Q78 Differential Equations **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/4mBzfizyUj](https://www.prepwise.in/questions/4mBzfizyUj)

If $y = y(x)$ is the solution of the differential equation

$$\frac{dy}{dx} + \frac{4x}{(x^2-1)}y = \frac{x+2}{(x^2-1)^{\frac{3}{2}}}, x > 1$$

such that

$$y(2) = \frac{2}{9} \log_e(2 + \sqrt{3}) \text{ and } y(\sqrt{2}) = \alpha \log_e(\sqrt{\alpha} + \beta) + \beta - \sqrt{\gamma}, \alpha, \beta, \gamma \in \mathbb{N}, \text{ then } \alpha\beta\gamma \text{ is equal to}$$

:

Q79 Sequences & Series **NUMERICAL**

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

Let $f(x) = \sum_{k=1}^{10} kx^k, x \in \mathbb{R}$. If $2f(2) + f'(2) = 119(2)^n + 1$ then n is equal to _____

Q80 Hyperbola **NUMERICAL**

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

The foci of a hyperbola are $(\pm 2, 0)$ and its eccentricity is $\frac{3}{2}$. A tangent, perpendicular to the line $2x + 3y = 6$, is drawn at a point in the first quadrant on the hyperbola. If the intercepts made by the tangent on the x - and y -axes are a and b respectively, then $|6a| + |5b|$ is equal to _____

Q81 Inverse Trigonometric Functions **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/QLI_ow_06g](https://www.prepwise.in/questions/QLI_ow_06g)

For $x \in (-1, 1]$, the number of solutions of the equation $\sin^{-1} x = 2 \tan^{-1} x$ is equal to _____.

Q82 Permutations & Combinations **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/HHdEWd-2xw](https://www.prepwise.in/questions/HHdEWd-2xw)

Total numbers of 3-digit numbers that are divisible by 6 and can be formed by using the digits 1, 2, 3, 4, 5 with repetition, is _____.

Q83 Relations & Functions (Basic) **NUMERICAL**

[Step-by-step solution](#) › [prepwise.in/questions/y263nNiVAd](https://www.prepwise.in/questions/y263nNiVAd)

Let $[\alpha]$ denote the greatest integer $\leq \alpha$. Then $[\sqrt{1}] + [\sqrt{2}] + [\sqrt{3}] + \dots + [\sqrt{120}]$ is equal to _____

Q84 Relations & Functions (Basic) **NUMERICAL**

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

Let $A = \{-4, -3, -2, 0, 1, 3, 4\}$ and $R = \{(a, b) \in A \times A : b = |a| \text{ or } b^2 = a + 1\}$ be a relation on A . Then the minimum number of elements, that must be added to the relation R so that it becomes reflexive and symmetric, is _____

The mean and standard deviation of the marks of 10 students were found to be 50 and 12 respectively. Later, it was observed that two marks 20 and 25 were wrongly read as 45 and 50 respectively. Then the correct variance is _____

Answer key: JEE Main 2023 · 13 Apr · Shift 2

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Physics

1. A	2. C	3. B	4. A	5. B	6. C	7. B	8. B
9. B	10. D	11. D	12. C	13. C	14. D	15. D	16. B
17. A	18. B	19. B	20. 75	21. 4125	22. 60	23. 5440	24. 5
25. 40	26. 2	27. 15	28. 500	29. 3			

Chemistry

30. A	31. A	32. C	33. B	34. B	35. D	36. C	37. D
38. B	39. A	40. B	41. A	42. A	43. B	44. D	45. C
46. C	47. 2200	48. 25	49. 458	50. 17	51. 23	52. 17	53. 116
54. 100	55. 0	56. 40					

Mathematics

57. B	58. D	59. A	60. B	61. A	62. B	63. B	64. B
65. B	66. A	67. A	68. D	69. C	70. D	71. D	72. D
73. A	74. C	75. B	76. 12	77. 41	78. 6	79. 10	80. 12
81. 2	82. 16	83. 825	84. 7	85. 269			

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