

JEE MAIN 2022 · QUESTION PAPER

28 Jul 2022 Shift 1

82 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	15 Q30 to Q44	10 Q45 to Q54
● Mathematics	18 Q55 to Q72	10 Q73 to Q82
In this PDF		
82 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.

prepwisser.in/pyqs/paper/2022-07-28-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?
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Q1 Alternating Current

[Step-by-step solution](#) › [prepwisar.in/questions/k4shsZdMjR](https://www.prepwisar.in/questions/k4shsZdMjR)

The equation of current in a purely inductive circuit is $5 \sin(49\pi t - 30^\circ)$. If the inductance is 30 mH then the equation for the voltage across the inductor, will be:

{ Let $\pi = \frac{22}{7}$ }

(A) $1.47 \sin(49\pi t - 30^\circ)$

(B) $1.47 \sin(49\pi t + 60^\circ)$

(C) $23.1 \sin(49\pi t - 30^\circ)$

(D) $23.1 \sin(49\pi t + 60^\circ)$

Q2 Nuclear Physics

[Step-by-step solution](#) › [prepwisar.in/questions/hDyhM3x9d2](https://www.prepwisar.in/questions/hDyhM3x9d2)

The half life period of a radioactive substance is 60 days. The time taken for $\frac{7}{8}$ th of its original mass to disintegrate will be:

(A) 120 days

(B) 130 days

(C) 180 days

(D) 20 days

Q3 Electrostatics II: Potential & Capacitance

[Step-by-step solution](#) › [prepwisar.in/questions/mu0MD7BfEe](https://www.prepwisar.in/questions/mu0MD7BfEe)

Two capacitors, each having capacitance $40 \mu\text{F}$ are connected in series. The space between one of the capacitors is filled with dielectric material of dielectric constant K such that the equivalence capacitance of the system became $24 \mu\text{F}$. The value of K will be:

(A) 1.5

(B) 2.5

(C) 1.2

(D) 3

Q4 Centre of Mass & Linear Momentum

[Step-by-step solution](#) › [prepwisar.in/questions/BqY9ne8VQR](https://www.prepwisar.in/questions/BqY9ne8VQR)

In two different experiments, an object of mass 5kg moving with a speed of 25ms^{-1} hits two different walls and comes to rest within (i) 3 second, (ii) 5 seconds, respectively. Choose the correct option out of the following:

(A) Impulse and average force acting on the object will be same for both the cases.

(B) Impulse will be same for both the cases but the average force will be different.

(C) Average force will be same for both the cases but the impulse will be different.

(D) Average force and impulse will be different for both the cases.

Q5 Current Electricity

[Step-by-step solution](#) › [prepwisar.in/questions/R3Tp2r7vEc](https://www.prepwisar.in/questions/R3Tp2r7vEc)

A wire of resistance R_1 is drawn out so that its length is increased by twice of its original length. The ratio of new resistance to original resistance is:

(A) 9 : 1

(B) 1 : 9

(C) 4 : 1

(D) 3 : 1

Q6 Dual Nature of Radiation & Matter

[Step-by-step solution](#) › [prepwisar.in/questions/Om2-K2pQEk](https://www.prepwisar.in/questions/Om2-K2pQEk)

The equation $\lambda = \frac{1.227}{x} \text{nm}$ can be used to find the de-Broglie wavelength of an electron. In this equation x stands for:

Where

m = mass of electron

P = momentum of electron

K = Kinetic energy of electron

V = Accelerating potential in volts for electron

(A) $\sqrt{mK}$

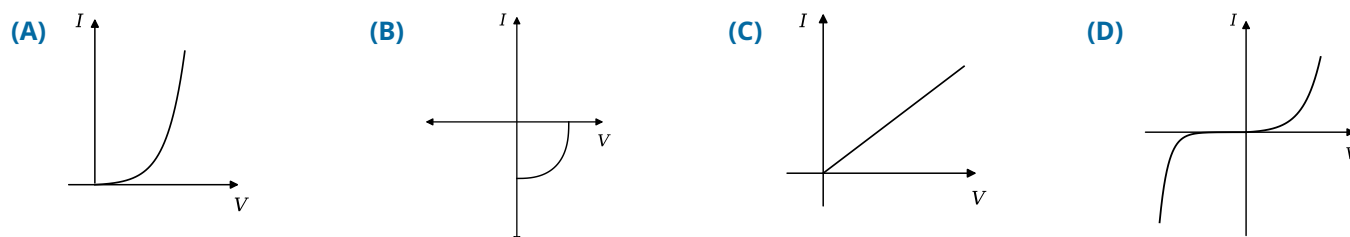
(B) $\sqrt{P}$

(C) $\sqrt{K}$

(D) $\sqrt{V}$

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Identify the solar cell characteristics from the following options:



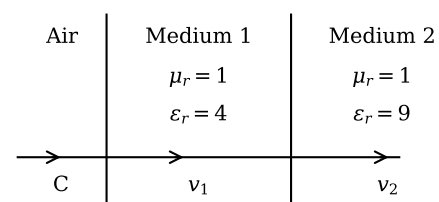
Q8 Ray Optics

[Step-by-step solution](#) > [prepwiser.in/questions/TyqNXr2Cab](#)

As shown in the figure, after passing through the medium 1. The speed of light v_2 in medium 2 will be:

(Given $c = 3 \times 10^8 \text{ms}^{-1}$)

- (A) $1.0 \times 10^8 \text{ms}^{-1}$ (B) $0.5 \times 10^8 \text{ms}^{-1}$
(C) $1.5 \times 10^8 \text{ms}^{-1}$ (D) $3.0 \times 10^8 \text{ms}^{-1}$



Q9 Ray Optics

[Step-by-step solution](#) > [prepwiser.in/questions/jmaWePY2mx](#)

In normal adjustment, for a refracting telescope, the distance between objective and eye piece is 30cm. The focal length of the objective, when the angular magnification of the telescope is 2, will be:

- (A) 20 cm (B) 30 cm (C) 10 cm (D) 15 cm

Q10 Gravitation

[Step-by-step solution](#) > [prepwiser.in/questions/d01Q-wxXrr](#)

If the radius of earth shrinks by 2% while its mass remains same. The acceleration due to gravity on the earth's surface will approximately:

- (A) decrease by 2% (B) decrease by 4% (C) increase by 2% (D) increase by 4%

Q11 Thermodynamics

[Step-by-step solution](#) > [prepwiser.in/questions/3FVwCQVB7j](#)

A Carnot engine has efficiency of 50%. If the temperature of sink is reduced by 40°C , its efficiency increases by 30%. The temperature of the source will be:

- (A) 166.7 K (B) 255.1 K (C) 266.7 K (D) 367.7 K

Q12 Kinetic Theory of Gases

[Step-by-step solution](#) > [prepwiser.in/questions/1fl7xyTq2_](#)

Given below are two statements:

Statement I : The average momentum of a molecule in a sample of an ideal gas depends on temperature.

Statement II : The rms speed of oxygen molecules in a gas is v . If the temperature is doubled and the oxygen molecules dissociate into oxygen atoms, the rms speed will become $2v$.

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

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

Q13 Moving Charges & Magnetism

[Step-by-step solution](#) > [prepwiser.in/questions/AKMMZ7CAg_](#)

The current sensitivity of a galvanometer can be increased by:

- (A) decreasing the number of turns
(B) increasing the magnetic field
(C) decreasing the area of the coil
(D) decreasing the torsional constant of the spring

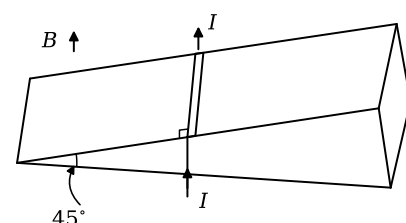
Choose the most appropriate answer from the options given below:

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

Q14 Moving Charges & Magnetism[Step-by-step solution](#) > [prepwisar.in/questions/PtIyqVStYl](#)

As shown in the figure, a metallic rod of linear density 0.45kgm^{-1} is lying horizontally on a smooth inclined plane which makes an angle of 45° with the horizontal. The minimum current flowing in the rod required to keep it stationary, when 0.15T magnetic field is acting on it in the vertical upward direction, will be:

{Use $g = 10\text{m/s}^2$ }



- (A) 30 A (B) 15 A (C) 10 A (D) 3 A

Q15 Projectile Motion & Relative Motion[Step-by-step solution](#) > [prepwisar.in/questions/cuDYYIWHL](#)

A NCC parade is going at a uniform speed of 9km/h under a mango tree on which a monkey is sitting at a height of 19.6m . At any particular instant, the monkey drops a mango. A cadet will receive the mango whose distance from the tree at time of drop is: (Given $g = 9.8\text{m/s}^2$)

- (A) 5 m (B) 10 m (C) 19.8 m (D) 24.5 m

Q16 Centre of Mass & Linear Momentum[Step-by-step solution](#) > [prepwisar.in/questions/usWf0SX7AC](#)

A balloon has mass of 10g in air. The air escapes from the balloon at a uniform rate with velocity 4.5cm/s . If the balloon shrinks in 5s completely. Then, the average force acting on that balloon will be (in dyne).

- (A) 3 (B) 9 (C) 12 (D) 18

Q17 Elasticity[Step-by-step solution](#) > [prepwisar.in/questions/Jbg8phhXtW](#)

The force required to stretch a wire of cross-section 1cm^2 to double its length will be : (Given Yong's modulus of the wire $= 2 \times 10^{11}\text{N/m}^2$)

- (A) $1 \times 10^7\text{N}$ (B) $1.5 \times 10^7\text{N}$ (C) $2 \times 10^7\text{N}$ (D) $2.5 \times 10^7\text{N}$

Q18 Mechanical Waves[Step-by-step solution](#) > [prepwisar.in/questions/JkWFbPS8aG](#)

In the wave equation

$$y = 0.5 \sin \frac{2\pi}{\lambda} (400t - x) \text{ m}$$

the velocity of the wave will be:

- (A) 200 m/s (B) $200\sqrt{2}$ m/s (C) 400 m/s (D) $400\sqrt{2}$ m/s

Q19 Units, Dimensions & Errors[Step-by-step solution](#) > [prepwisar.in/questions/sEx-MPLnzp](#)

The dimensions of $\left(\frac{B^2}{\mu_0}\right)$ will be:

(if μ_0 : permeability of free space and B : magnetic field)

- (A) $[M L^2 T^{-2}]$ (B) $[M L T^{-2}]$ (C) $[M L^{-1} T^{-2}]$ (D) $[M L^2 T^{-2} A^{-1}]$

Physics Section B · Numerical value

Q20 to Q29

Q20 Alternating Current **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/ZkZJJUzeiM](#)

The frequencies at which the current amplitude in an LCR series circuit becomes $\frac{1}{\sqrt{2}}$ times its maximum value, are 212rad s^{-1} and 232rad s^{-1} . The value of resistance in the circuit is $R = 5\Omega$. The self inductance in the circuit is _____ mH.

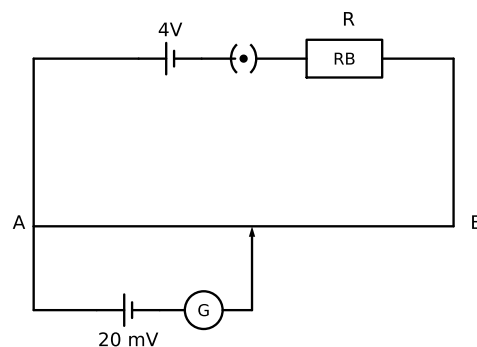
Q21 Nuclear Physics **NUMERICAL**[Step-by-step solution](#) > [prepwisar.in/questions/QnwkmLD-3L](#)

A freshly prepared radioactive source of half life 2 hours 30 minutes emits radiation which is 64 times the permissible safe level. The minimum time, after which it would be possible to work safely with source, will be _____ hours.

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Q22 Current Electricity **NUMERICAL**

As shown in the figure, a potentiometer wire of resistance $20\ \Omega$ and length 300cm is connected with resistance box (R.B.) and a standard cell of emf 4V . For a resistance ' R ' of resistance box introduced into the circuit, the null point for a cell of 20mV is found to be 60cm . The value of ' R ' is _____ Ω .

[Step-by-step solution](https://www.prepwisar.in/questions/QIMLJv9Lwq)
**Q23** Electrostatics I: Charges, Field & Gauss's Law **NUMERICAL**
[Step-by-step solution](https://www.prepwisar.in/questions/JbKMTt5kiM)

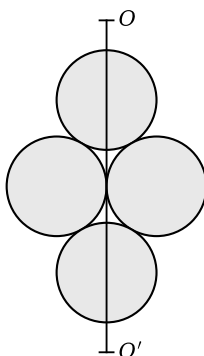
Two electric dipoles of dipole moments $1.2 \times 10^{-30}\text{ Cm}$ and $2.4 \times 10^{-30}\text{ Cm}$ are placed in two different uniform electric fields of strengths $5 \times 10^4\text{ NC}^{-1}$ and $15 \times 10^4\text{ NC}^{-1}$ respectively. The ratio of maximum torque experienced by the electric dipoles will be $\frac{1}{x}$. The value of x is _____.

Q24 Fluid Mechanics **NUMERICAL**
[Step-by-step solution](https://www.prepwisar.in/questions/kxjzGn_qKK)

The diameter of an air bubble which was initially 2mm , rises steadily through a solution of density 1750kgm^{-3} at the rate of 0.35 cms^{-1} . The coefficient of viscosity of the solution is _____ poise (in nearest integer). (the density of air is negligible).

Q25 Rotational Motion **NUMERICAL**
[Step-by-step solution](https://www.prepwisar.in/questions/7jPrJSMmR)

Four identical discs each of mass ' M ' and diameter ' a ' are arranged in a small plane as shown in figure. If the moment of inertia of the system about OO' is $\frac{x}{4} Ma^2$. Then, the value of x will be _____.

**Q26** Wave Optics **NUMERICAL**
[Step-by-step solution](https://www.prepwisar.in/questions/IjFfGm7KyC)

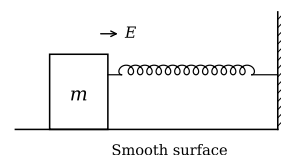
In a Young's double slit experiment, a laser light of 560 nm produces an interference pattern with consecutive bright fringes' separation of 7.2 mm . Now another light is used to produce an interference pattern with consecutive bright fringes' separation of 8.1 mm . The wavelength of second light is _____ nm .

Q27 Sound Waves **NUMERICAL**
[Step-by-step solution](https://www.prepwisar.in/questions/1FHCLXf6ju)

The frequency of echo will be _____ Hz if the train blowing a whistle of frequency 320 Hz is moving with a velocity of 36 km/h towards a hill from which an echo is heard by the train driver. Velocity of sound in air is 330 m/s .

Q28 Work, Energy & Power **NUMERICAL**
[Step-by-step solution](https://www.prepwisar.in/questions/kg4kt4_Y0a)

A block of mass ' m ' (as shown in figure) moving with kinetic energy E compresses a spring through a distance 25cm when, its speed is halved. The value of spring constant of used spring will be $nE\text{ Nm}^{-1}$ for $n =$ _____.

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

If the projection of $2\hat{i} + 4\hat{j} - 2\hat{k}$ on $\hat{i} + 2\hat{j} + \alpha\hat{k}$ is zero. Then, the value of α will be _____.

Q30 Chemical Kinetics[Step-by-step solution](#) › [prepwisar.in/questions/gVJpm9MAVq](https://www.prepwisar.in/questions/gVJpm9MAVq)

For kinetic study of the reaction of iodide ion with H_2O_2 at room temperature:

- (A) Always use freshly prepared starch solution.
 (B) Always keep the concentration of sodium thiosulphate solution less than that of KI solution.
 (C) Record the time immediately after the appearance of blue colour.
 (D) Record the time immediately before the appearance of blue colour.
 (E) Always keep the concentration of sodium thiosulphate solution more than that of KI solution.

Choose the correct answer from the options given below:

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

Q31 Chemistry in Everyday Life[Step-by-step solution](#) › [prepwisar.in/questions/rwh7RSelbB](https://www.prepwisar.in/questions/rwh7RSelbB)

Statements about Enzyme Inhibitor Drugs are given below:

- (A) There are Competitive and Non-competitive inhibitor drugs.
 (B) These can bind at the active sites and allosteric sites.
 (C) Competitive Drugs are allosteric site blocking drugs.
 (D) Non-competitive Drugs are active site blocking drugs.

Choose the correct answer from the options given below:

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

Q32 Qualitative Analysis: Salt Analysis[Step-by-step solution](#) › [prepwisar.in/questions/oJ1oLylkYm](https://www.prepwisar.in/questions/oJ1oLylkYm)

Match List - I with List - II, match the gas evolved during each reaction.

	List - I		List - II
(A)	$(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \xrightarrow{\Delta}$	(I)	H_2
(B)	$\text{KMnO}_4 + \text{HCl} \rightarrow$	(II)	N_2
(C)	$\text{Al} + \text{NaOH} + \text{H}_2\text{O} \rightarrow$	(III)	O_2
(D)	$\text{NaNO}_3 \xrightarrow{\Delta}$	(IV)	Cl_2

Choose the correct answer from the options given below:

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

Q33 d & f Block Elements[Step-by-step solution](#) › [prepwisar.in/questions/812illdEw5](https://www.prepwisar.in/questions/812illdEw5)

Which of the following has least tendency to liberate H_2 from mineral acids?

- (A) Cu (B) Mn (C) Ni (D) Zn

Q34 Electrochemistry[Step-by-step solution](#) › [prepwisar.in/questions/ckD63SORpz](https://www.prepwisar.in/questions/ckD63SORpz)

Match List - I with List - II.

	List - I		List - II
(A)	$\text{Cd}(s) + 2\text{Ni}(\text{OH})_3(s) \rightarrow \text{CdO}(s) + 2\text{Ni}(\text{OH})_2(s) + \text{H}_2\text{O}(l)$	(I)	Primary battery
(B)	$\text{Zn}(Hg) + \text{HgO}(s) \rightarrow \text{ZnO}(s) + \text{Hg}(l)$	(II)	Discharging of secondary battery
(C)	$2\text{PbSO}_4(s) + 2\text{H}_2\text{O}(l) \rightarrow \text{Pb}(s) + \text{PbO}_2(s) + 2\text{H}_2\text{SO}_4(aq)$	(III)	Fuel cell
(D)	$2\text{H}_2(g) + \text{O}_2(g) \rightarrow 2\text{H}_2\text{O}(l)$	(IV)	Charging of secondary battery

Choose the correct answer from the options given below:

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

The metal salts formed during softening of hardwater using Clark's method are:

- (A) Ca(OH)_2 and Mg(OH)_2 (B) CaCO_3 and Mg(OH)_2
(C) Ca(OH)_2 and MgCO_3 (D) CaCO_3 and MgCO_3

Which of the reaction is suitable for concentrating ore by leaching process?

- (A) $2\text{Cu}_2\text{S} + 3\text{O}_2 \rightarrow 2\text{Cu}_2\text{O} + 2\text{SO}_2$ (B) $\text{Fe}_3\text{O}_4 + \text{CO} \rightarrow 3\text{FeO} + \text{CO}_2$
(C) $\text{Al}_2\text{O}_3 + 2\text{NaOH} + 3\text{H}_2\text{O} \rightarrow 2\text{Na}[\text{Al(OH)}_4]$ (D) $\text{Al}_2\text{O}_3 + 6\text{Mg} \rightarrow 6\text{MgO} + 4\text{Al}$

In which of the following pairs, electron gain enthalpies of constituent elements are nearly the same or identical?

- (A) Rb and Cs
(B) Na and K
(C) Ar and Kr
(D) I and At

Choose the correct answer from the options given below:

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

Terylene polymer is obtained by condensation of:

- (A) Ethane-1,2-diol and Benzene-1,3 dicarboxylic acid
(B) Propane-1, 2-diol and Benzene-1, 4 dicarboxylic acid
(C) Ethane-1,2-diol and Benzene-1, 4 dicarboxylic acid
(D) Ethane-1,2-diol and Benzene-1, 2 dicarboxylic acid

Which of the following statement is **incorrect**?

- (A) Low solubility of LiF in water is due to its small hydration enthalpy.
(B) KO_2 is paramagnetic.
(C) Solution of sodium in liquid ammonia is conducting in nature.
(D) Sodium metal has higher density than potassium metal.

Identify the incorrect statement from the following.

- (A) A circular path around the nucleus in which an electron moves is proposed as Bohr's orbit.
(B) An orbital is the one electron wave function (ψ) in an atom.
(C) The existence of Bohr's orbits is supported by hydrogen spectrum.
(D) Atomic orbital is characterised by the quantum numbers n and l only.

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Match List - I with List - II.

	List - I Reaction		List - II Catalyst
(A)	$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$	(I)	$NO(g)$
(B)	$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	(II)	$H_2SO_4(l)$
(C)	$C_{12}H_{22}O_{11}(aq) + H_2O(l) \rightarrow \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$	(III)	$Pt(s)$
(D)	$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$	(IV)	$Fe(s)$

Choose the correct answer from the options given below:

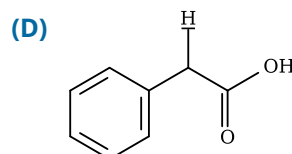
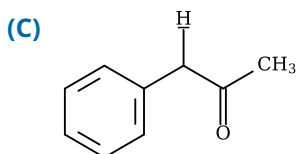
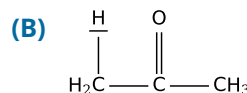
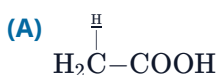
(A) (A) – (II), (B) – (III), (C) – (I), (D) – (IV)

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

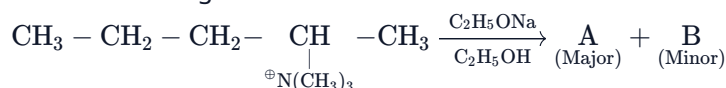
(C) (A) – (III), (B) – (IV), (C) – (II), (D) – (I)

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

Which of the following relation is not correct?

(A) $\Delta H = \Delta U - P\Delta V$ (B) $\Delta U = q + W$ (C) $\Delta S_{\text{sys}} + \Delta S_{\text{surr}} \geq 0$ (D) $\Delta G = \Delta H - T\Delta S$ Among the following marked proton of which compound shows lowest pK_a value?

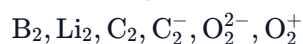
Identify the correct statement for the below given transformation.

(A) A – $CH_3CH_2CH=CH-CH_3$, B – $CH_3CH_2CH_2CH=CH_2$, Saytzeff products(B) A – $CH_3CH_2CH=CH-CH_3$, B – $CH_3CH_2CH_2CH=CH_2$, Hofmann products(C) A – $CH_3CH_2CH_2CH=CH_2$, B – $CH_3CH_2CH=CHCH_3$, Hofmann products(D) A – $CH_3CH_2CH_2CH=CH_2$, B – $CH_3CH_2CH=CHCH_3$, Saytzeff products

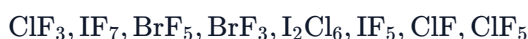
Chemistry Section B · Numerical value

Q45 to Q54

The number of paramagnetic species among the following is _____.

and He_2^+

The number of interhalogens from the following having square pyramidal structure is:

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For the given first order reaction



the half life of the reaction is 0.3010min. The ratio of the initial concentration of reactant to the concentration of reactant at time 2.0min will be equal to _____. (Nearest integer)

Total number of relatively more stable isomer(s) possible for octahedral complex $[\text{Cu}(\text{en})_2(\text{SCN})_2]$ will be _____. (Nearest integer)

The disproportionation of MnO_4^{2-} in acidic medium resulted in the formation of two manganese compounds A and B. If the oxidation state of Mn in B is smaller than that of A, then the spin-only magnetic moment (μ) value of B in BM is _____. (Nearest integer)

K_a for butyric acid ($\text{C}_3\text{H}_7\text{COOH}$) is 2×10^{-5} . The pH of 0.2 M solution of butyric acid is _____ $\times 10^{-1}$. (Nearest integer)

[Given $\log 2 = 0.30$]

An element M crystallises in a body centred cubic unit cell with a cell edge of 300 pm. The density of the element is 6.0 g cm^{-3} . The number of atoms present in 180g of the element is _____ $\times 10^{23}$. (Nearest integer)

150g of acetic acid was contaminated with 10.2g ascorbic acid ($\text{C}_6\text{H}_8\text{O}_6$) to lower down its freezing point by $(x \times 10^{-1})^\circ \text{C}$. The value of x is _____. (Nearest integer)

[Given $K_f = 3.9 \text{ K kg mol}^{-1}$; molar mass of ascorbic acid = 176 g mol^{-1}]

In the given reaction,



if one mole of each of X and Y with 0.05mol of Z gives compound XYZ_3 . (Given : Atomic masses of X , Y and Z are 10, 20 and 30 amu, respectively.) The yield of XYZ_3 is _____ g. (Nearest integer)

On complete combustion of 0.492g of an organic compound containing C, H and O, 0.7938g of CO_2 and 0.4428g of H_2O was produced. The % composition of oxygen in the compound is _____.

Mathematics Section A · Multiple choice

Q55 to Q72

The foot of the perpendicular from a point on the circle $x^2 + y^2 = 1, z = 0$ to the plane $2x + 3y + z = 6$ lies on which one of the following curves?

(A) $(6x + 5y - 12)^2 + 4(3x + 7y - 8)^2 = 1, z = 6 - 2x - 3y$

(B) $(5x + 6y - 12)^2 + 4(3x + 5y - 9)^2 = 1, z = 6 - 2x - 3y$

(C) $(6x + 5y - 14)^2 + 9(3x + 5y - 7)^2 = 1, z = 6 - 2x - 3y$

(D) $(5x + 6y - 14)^2 + 9(3x + 7y - 8)^2 = 1, z = 6 - 2x - 3y$

If the minimum value of $f(x) = \frac{5x^2}{2} + \frac{\alpha}{x^5}, x > 0$, is 14, then the value of α is equal to:

(A) 32

(B) 64

(C) 128

(D) 256

Q57 Binomial Theorem[Step-by-step solution](#) > prepwiser.in/questions/GS3YbqmPpC

The remainder when $7^{2022} + 3^{2022}$ is divided by 5 is:

- (A) 0 (B) 2 (C) 3 (D) 4

Q58 Circles[Step-by-step solution](#) > prepwiser.in/questions/vwf88m-rQ_

Let C be the centre of the circle $x^2 + y^2 - x + 2y = \frac{11}{4}$ and P be a point on the circle. A line passes through the point C , makes an angle of $\frac{\pi}{4}$ with the line CP and intersects the circle at the points Q and R . Then the area of the triangle PQR (in unit ^{2}) is:

- (A) 2 (B) $2\sqrt{2}$ (C) $8 \sin\left(\frac{\pi}{8}\right)$ (D) $8 \cos\left(\frac{\pi}{8}\right)$

Q59 Complex Numbers[Step-by-step solution](#) > prepwiser.in/questions/MP4c_6-3IQ

Let $S_1 = \{z_1 \in \mathbf{C} : |z_1 - 3| = \frac{1}{2}\}$ and

$$S_2 = \{z_2 \in \mathbf{C} : |z_2 - |z_2 + 1|| = |z_2 + |z_2 - 1||\}$$

. Then, for $z_1 \in S_1$ and $z_2 \in S_2$, the least value of $|z_2 - z_1|$ is:

- (A) 0 (B) $\frac{1}{2}$ (C) $\frac{3}{2}$ (D) $\frac{5}{2}$

Q60 Applications of Derivatives[Step-by-step solution](#) > prepwiser.in/questions/MDbyzEXWXn

The minimum value of the twice differentiable function

$$f(x) = \int_0^x e^{x-t} f'(t) dt - (x^2 - x + 1) e^x$$

, $x \in \mathbf{R}$, is:

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

Q61 Differential Equations[Step-by-step solution](#) > prepwiser.in/questions/gVWNZIrI5O

Let the solution curve of the differential equation $x dy = (\sqrt{x^2 + y^2} + y) dx$, $x > 0$, intersect the line $x = 1$ at $y = 0$ and the line $x = 2$ at $y = \alpha$. Then the value of α is:

- (A) $\frac{1}{2}$ (B) $\frac{3}{2}$ (C) $-\frac{3}{2}$ (D) $\frac{5}{2}$

Q62 Differential Equations[Step-by-step solution](#) > prepwiser.in/questions/5I5rLUauVQ

If $y = y(x)$, $x \in (0, \pi/2)$ be the solution curve of the differential equation

$$(\sin^2 2x) \frac{dy}{dx} + (8 \sin^2 2x + 2 \sin 4x) y = 2e^{-4x} (2 \sin 2x + \cos 2x)$$

with $y(\pi/4) = e^{-\pi}$, then $y(\pi/6)$ is equal to:

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

Q63 Functions (Advanced)[Step-by-step solution](#) > prepwiser.in/questions/zVw8OCR7SC

Let α, β and γ be three positive real numbers. Let $f(x) = \alpha x^5 + \beta x^3 + \gamma x$, $x \in \mathbf{R}$ and $g : \mathbf{R} \rightarrow \mathbf{R}$ be such that $g(f(x)) = x$ for all $x \in \mathbf{R}$. If $a_1, a_2, a_3, \dots, a_n$ be in arithmetic progression with mean zero, then the value of

$$f\left(g\left(\frac{1}{n} \sum_{i=1}^n f(a_i)\right)\right)$$

is equal to:

- (A) 0 (B) 3 (C) 9 (D) 27

Q64 Inverse Trigonometric Functions[Step-by-step solution](#) > [prepwisar.in/questions/hKPIP66QTJ](https://www.prepwisar.in/questions/hKPIP66QTJ)

Considering only the principal values of the inverse trigonometric functions, the domain of the function $f(x) = \cos^{-1}\left(\frac{x^2-4x+2}{x^2+3}\right)$ is:

- (A) $(-\infty, \frac{1}{4}]$ (B) $[-\frac{1}{4}, \infty)$ (C) $(-1/3, \infty)$ (D) $(-\infty, \frac{1}{3}]$

Q65 Inverse Trigonometric Functions[Step-by-step solution](#) > [prepwisar.in/questions/eaog3CQ_fq](https://www.prepwisar.in/questions/eaog3CQ_fq)

Considering the principal values of the inverse trigonometric functions, the sum of all the solutions of the equation $\cos^{-1}(x) - 2\sin^{-1}(x) = \cos^{-1}(2x)$ is equal to:

- (A) 0 (B) 1 (C) $\frac{1}{2}$ (D) $-\frac{1}{2}$

Q66 Determinants[Step-by-step solution](#) > [prepwisar.in/questions/FtjdKiA8fx](https://www.prepwisar.in/questions/FtjdKiA8fx)

Let the matrix

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

and the matrix $B_0 = A^{49} + 2A^{98}$. If $B_n = Adj(B_{n-1})$ for all $n \geq 1$, then $\det(B_4)$ is equal to:

- (A) 3^{28} (B) 3^{30} (C) 3^{32} (D) 3^{36}

Q67 Parabola[Step-by-step solution](#) > [prepwisar.in/questions/NPKNvwvb82](https://www.prepwisar.in/questions/NPKNvwvb82)

If the tangents drawn at the points P and Q on the parabola $y^2 = 2x - 3$ intersect at the point $R(0, 1)$, then the orthocentre of the triangle PQR is:

- (A) (0, 1) (B) (2, -1) (C) (6, 3) (D) (2, 1)

Q68 Probability: Advanced[Step-by-step solution](#) > [prepwisar.in/questions/VbXrxikGOy](https://www.prepwisar.in/questions/VbXrxikGOy)

Out of 60% female and 40% male candidates appearing in an exam, 60% candidates qualify it. The number of females qualifying the exam is twice the number of males qualifying it. A candidate is randomly chosen from the qualified candidates. The probability, that the chosen candidate is a female, is:

- (A) $\frac{2}{3}$ (B) $\frac{11}{16}$ (C) $\frac{23}{32}$ (D) $\frac{13}{16}$

Q69 Sequences & Series[Step-by-step solution](#) > [prepwisar.in/questions/tnFoNLPxjV](https://www.prepwisar.in/questions/tnFoNLPxjV)

Consider the sequence $a_1, a_2, a_3, \dots$ such that $a_1 = 1, a_2 = 2$ and $a_{n+2} = \frac{2}{a_{n+1}} + a_n$ for $n = 1, 2, 3, \dots$. If

$$\left(\frac{a_1 + \frac{1}{a_2}}{a_3}\right) \cdot \left(\frac{a_2 + \frac{1}{a_3}}{a_4}\right) \cdot \left(\frac{a_3 + \frac{1}{a_4}}{a_5}\right) \dots \left(\frac{a_{30} + \frac{1}{a_{31}}}{a_{32}}\right) = 2^\alpha ({}^{61}C_{31})$$

, then α is equal to:

- (A) -30 (B) -31 (C) -60 (D) -61

Q70 Relations & Functions (Basic)[Step-by-step solution](#) > [prepwisar.in/questions/m2-7jjjUZI](https://www.prepwisar.in/questions/m2-7jjjUZI)

For $\alpha \in \mathbb{N}$, consider a relation R on $\mathbb{N}$ given by $R = \{(x, y) : 3x + \alpha y \text{ is a multiple of } 7\}$. The relation R is an equivalence relation if and only if:

- (A) $\alpha = 14$ (B) α is a multiple of 4
(C) 4 is the remainder when α is divided by 10 (D) 4 is the remainder when α is divided by 7

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Let the vectors

$$\vec{a} = (1+t)\hat{i} + (1-t)\hat{j} + \hat{k}, \vec{b} = (1-t)\hat{i} + (1+t)\hat{j} + 2\hat{k}$$

and $\vec{c} = t\hat{i} - t\hat{j} + \hat{k}$, $t \in \mathbf{R}$ be such that for

$$\alpha, \beta, \gamma \in \mathbf{R}, \alpha\vec{a} + \beta\vec{b} + \gamma\vec{c} = \vec{0} \Rightarrow \alpha = \beta = \gamma = 0$$

. Then, the set of all values of t is:

(A) a non-empty finite set

(B) equal to $\mathbf{N}$

(C) equal to $\mathbf{R} - \{0\}$

(D) equal to $\mathbf{R}$

Let a vector $\vec{a}$ has magnitude 9. Let a vector $\vec{b}$ be such that for every $(x, y) \in \mathbf{R} \times \mathbf{R} - \{(0, 0)\}$, the vector $(x\vec{a} + y\vec{b})$ is perpendicular to the vector $(6y\vec{a} - 18x\vec{b})$. Then the value of $|\vec{a} \times \vec{b}|$ is equal to:

(A) $9\sqrt{3}$

(B) $27\sqrt{3}$

(C) 9

(D) 81

Mathematics Section B · Numerical value

Q73 to Q82

Let $P(-2, -1, 1)$ and $Q\left(\frac{56}{17}, \frac{43}{17}, \frac{111}{17}\right)$ be the vertices of the rhombus PQRS. If the direction ratios of the diagonal RS are $\alpha, -1, \beta$, where both α and β are integers of minimum absolute values, then $\alpha^2 + \beta^2$ is equal to _____.

If

$$\int_0^{\sqrt{3}} \frac{15x^3}{\sqrt{1+x^2} + \sqrt{(1+x^2)^3}} dx = \alpha\sqrt{2} + \beta\sqrt{3}$$

, where α, β are integers, then $\alpha + \beta$ is equal to _____.

For $p, q \in \mathbf{R}$, consider the real valued function $f(x) = (x-p)^2 - q$, $x \in \mathbf{R}$ and $q > 0$. Let a_1, a_2, a_3 and a_4 be in an arithmetic progression with mean p and positive common difference. If $|f(a_i)| = 500$ for all $i = 1, 2, 3, 4$, then the absolute difference between the roots of $f(x) = 0$ is _____.

For the hyperbola $H: x^2 - y^2 = 1$ and the ellipse $E: \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $a > b > 0$, let the

(1) eccentricity of E be reciprocal of the eccentricity of H , and

(2) the line $y = \sqrt{\frac{5}{2}}x + K$ be a common tangent of E and H .

Then $4(a^2 + b^2)$ is equal to _____.

Let $f: [0, 1] \rightarrow \mathbf{R}$ be a twice differentiable function in $(0, 1)$ such that $f(0) = 3$ and $f(1) = 5$. If the line $y = 2x + 3$ intersects the graph of f at only two distinct points in $(0, 1)$, then the least number of points $x \in (0, 1)$, at which $f''(x) = 0$, is _____.

$$\lim_{x \rightarrow 0} \left(\frac{(x + 2 \cos x)^3 + 2(x + 2 \cos x)^2 + 3 \sin(x + 2 \cos x)}{(x + 2)^3 + 2(x + 2)^2 + 3 \sin(x + 2)} \right)^{\frac{100}{x}}$$

is equal to _____.

Let

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

and

$$B = \begin{bmatrix} \beta & 1 \\ 1 & 0 \end{bmatrix}, \alpha, \beta \in \mathbf{R}$$

. Let α_1 be the value of α which satisfies

$$(A + B)^2 = A^2 + \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}$$

and α_2 be the value of α which satisfies $(A + B)^2 = B^2$. Then $|\alpha_1 - \alpha_2|$ is equal to _____.

Let S be the set of all passwords which are six to eight characters long, where each character is either an alphabet from $\{A, B, C, D, E\}$ or a number from $\{1, 2, 3, 4, 5\}$ with the repetition of characters allowed. If the number of passwords in S whose at least one character is a number from $\{1, 2, 3, 4, 5\}$ is $\alpha \times 5^6$, then α is equal to _____.

The sum of all real values of x for which $\frac{3x^2-9x+17}{x^2+3x+10} = \frac{5x^2-7x+19}{3x^2+5x+12}$ is equal to _____.

Let $x_1, x_2, x_3, \dots, x_{20}$ be in geometric progression with $x_1 = 3$ and the common ratio $\frac{1}{2}$. A new data is constructed replacing each x_i by $(x_i - i)^2$. If $\bar{x}$ is the mean of new data, then the greatest integer less than or equal to $\bar{x}$ is _____.

Answer key: JEE Main 2022 · 28 Jul · Shift 1

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Physics

1. D	2. C	3. A	4. B	5. A	6. D	7. B	8. A
9. A	10. D	11. C	12. D	13. D	14. A	15. A	16. B
17. C	18. C	19. C	20. 250	21. 15	22. 780	23. 6	24. 11
25. 3	26. 630	27. 340	28. 24	29. 5			

Chemistry

30. A	31. C	32. C	33. A	34. C	35. B	36. C	37. C
38. C	39. A	40. D	41. C	42. A	43. C	44. C	45. 4
46. 3	47. 100	48. 3	49. 4	50. 27	51. 22	52. 15	53. 2
54. 46							

Mathematics

55. B	56. C	57. C	58. B	59. C	60. A	61. B	62. A
63. A	64. B	65. A	66. C	67. B	68. A	69. C	70. D
71. C	72. B	73. 450	74. 10	75. 50	76. 3	77. 2	78. 1
79. 2	80. 7073	81. 6	82. 142				

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