

JEE MAIN 2022 · QUESTION PAPER

28 Jul 2022 **Shift 2**

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.

prepwis.in/pyqs/paper/2022-07-28-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? prepwis.in/feedback · Terms: prepwis.in/terms

Q1 Alternating Current

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

A transformer operating at primary voltage 8 kV and secondary voltage 160V serves a load of 80kW. Assuming the transformer to be ideal with purely resistive load and working on unity power factor, the loads in the primary and secondary circuit would be

- (A) 800 Ω and 1.06 Ω (B) 10 Ω and 500 Ω (C) 800 Ω and 0.32 Ω (D) 1.06 Ω and 500 Ω

Q2 Nuclear Physics

[Step-by-step solution](#) > [prepwisar.in/questions/QkmH2pUbOZ](https://www.prepwisar.in/questions/QkmH2pUbOZ)

A radioactive sample decays $\frac{7}{8}$ times its original quantity in 15 minutes. The half-life of the sample is

- (A) 5 min (B) 7.5 min (C) 15 min (D) 30 min

Q3 Electrostatics II: Potential & Capacitance

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

A slab of dielectric constant K has the same cross-sectional area as the plates of a parallel plate capacitor and thickness $\frac{3}{4}d$, where d is the separation of the plates. The capacitance of the capacitor when the slab is inserted between the plates will be:

(Given C_0 = capacitance of capacitor with air as medium between plates.)

- (A) $\frac{4KC_0}{3+K}$ (B) $\frac{3KC_0}{3+K}$ (C) $\frac{3+K}{4KC_0}$ (D) $\frac{K}{4+K}$

Q4 Current Electricity

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

Given below are two statements:

Statement I : A uniform wire of resistance 80 Ω is cut into four equal parts. These parts are now connected in parallel. The equivalent resistance of the combination will be 5 Ω .

Statement II: Two resistances 2R and 3R are connected in parallel in a electric circuit. The value of thermal energy developed in 3R and 2R will be in the ratio 3 : 2.

In the light of the above statements, choose the most appropriate answer from the option 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

Q5 Dual Nature of Radiation & Matter

[Step-by-step solution](#) > [prepwisar.in/questions/34jx2lun8R](https://www.prepwisar.in/questions/34jx2lun8R)

Two streams of photons, possessing energies equal to five and ten times the work function of metal are incident on the metal surface successively. The ratio of maximum velocities of the photoelectron emitted, in the two cases respectively, will be

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

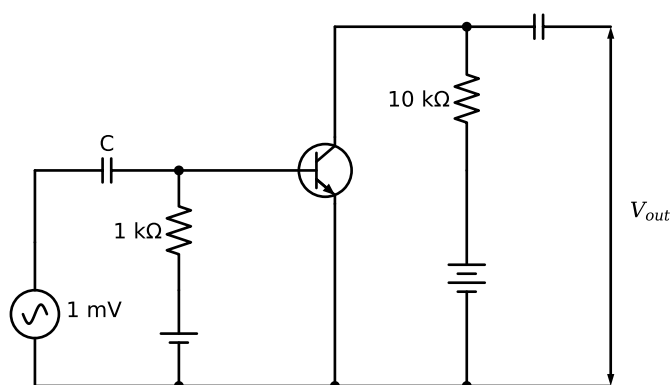
Q6 Electromagnetic Waves

[Step-by-step solution](#) > [prepwisar.in/questions/JSdS8tG-3g](https://www.prepwisar.in/questions/JSdS8tG-3g)

Sun light falls normally on a surface of area 36cm² and exerts an average force of 7.2×10^{-9} N within a time period of 20 minutes. Considering a case of complete absorption, the energy flux of incident light is

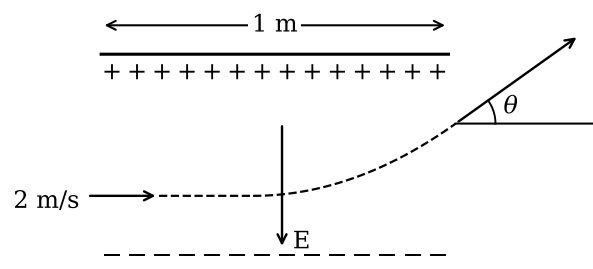
- (A) $25.92 \times 10^2 \text{W/cm}^2$ (B) $8.64 \times 10^{-6} \text{W/cm}^2$ (C) 6.0W/cm^2 (D) 0.06W/cm^2

An n.p.n transistor with current gain $\beta = 100$ in common emitter configuration is shown in figure. The output voltage of the amplifier will be



- (A) 0.1 V (B) 1.0 V (C) 10 V (D) 100 V

A uniform electric field $E = (8m/e) \text{ V/m}$ is created between two parallel plates of length 1m as shown in figure, (where $m =$ mass of electron and $e =$ charge of electron). An electron enters the field symmetrically between the plates with a speed of $2m/s$. The angle of the deviation (θ) of the path of the electron as it comes out of the field will be _____.



- (A) $\tan^{-1}(4)$ (B) $\tan^{-1}(2)$ (C) $\tan^{-1}\left(\frac{1}{3}\right)$ (D) $\tan^{-1}(3)$

The power of a lens (biconvex) is $1.25m^{-1}$ in particular medium. Refractive index of the lens is 1.5 and radii of curvature are 20cm and 40cm respectively. The refractive index of surrounding medium:

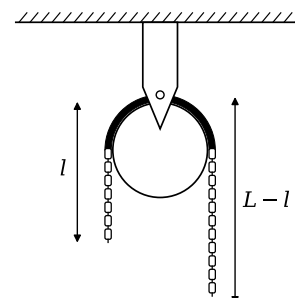
- (A) 1.0 (B) $\frac{9}{7}$ (C) $\frac{3}{2}$ (D) $\frac{4}{3}$

A vessel contains 14g of nitrogen gas at a temperature of 27°C . The amount of heat to be transferred to the gas to double the r.m.s speed of its molecules will be:

Take $R = 8.32\text{Jmol}^{-1}\text{K}^{-1}$.

- (A) 2229 J (B) 5616 J (C) 9360 J (D) 13,104 J

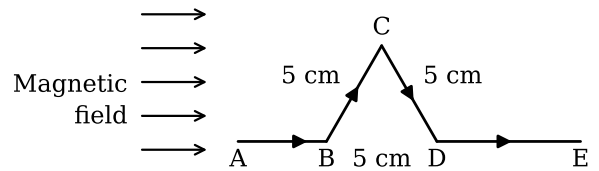
A uniform metal chain of mass m and length ' L ' passes over a massless and frictionless pulley. It is released from rest with a part of its length ' l ' is hanging on one side and rest of its length ' $L - l$ ' is hanging on the other side of the pulley. At a certain point of time, when $l = \frac{L}{x}$, the acceleration of the chain is $\frac{g}{2}$. The value of x is _____.



- (A) 6 (B) 2 (C) 1.5 (D) 4

Q12 Moving Charges & Magnetism[Step-by-step solution > prepwiser.in/questions/a_ptFgi2XK](https://www.prepwiser.in/questions/a_ptFgi2XK)

A triangular shaped wire carrying 10A current is placed in a uniform magnetic field of 0.5T, as shown in figure. The magnetic force on segment CD is
(Given $BC = CD = BD = 5\text{cm}$.)



- (A) 0.126 N (B) 0.312 N (C) 0.216 N (D) 0.245 N

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

The magnetic field at the center of current carrying circular loop is B_1 . The magnetic field at a distance of $\sqrt{3}$ times radius of the given circular loop from the center on its axis is B_2 . The value of B_1/B_2 will be

- (A) 9 : 4 (B) $12:\sqrt{5}$ (C) 8 : 1 (D) $5:\sqrt{3}$

Q14 Rectilinear Motion[Step-by-step solution > prepwiser.in/questions/KIKbznvYwP](https://www.prepwiser.in/questions/KIKbznvYwP)

At time $t = 0$ a particle starts travelling from a height $7\hat{z}\text{cm}$ in a plane keeping z coordinate constant. At any instant of time it's position along the $\hat{x}$ and $\hat{y}$ directions are defined as $3t$ and $5t^3$ respectively. At $t = 1\text{s}$ acceleration of the particle will be

- (A) $-30\hat{y}$ (B) $30\hat{y}$ (C) $3\hat{x} + 15\hat{y}$ (D) $3\hat{x} + 15\hat{y} + 7\hat{z}$

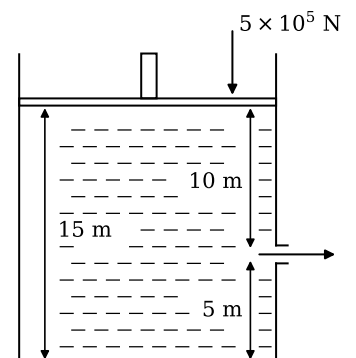
Q15 Fluid Mechanics[Step-by-step solution > prepwiser.in/questions/t5znQlaV5k](https://www.prepwiser.in/questions/t5znQlaV5k)

A pressure-pump has a horizontal tube of cross sectional area 10cm^2 for the outflow of water at a speed of 20m/s . The force exerted on the vertical wall just in front of the tube which stops water horizontally flowing out of the tube, is:
[given: density of water = 1000kg/m^3]

- (A) 300 N (B) 500 N (C) 250 N (D) 400 N

Q16 Fluid Mechanics[Step-by-step solution > prepwiser.in/questions/SXU7HY1KwI](https://www.prepwiser.in/questions/SXU7HY1KwI)

Consider a cylindrical tank of radius 1m is filled with water. The top surface of water is at 15m from the bottom of the cylinder. There is a hole on the wall of cylinder at a height of 5m from the bottom. A force of $5 \times 10^5\text{N}$ is applied on the top surface of water using a piston. The speed of efflux from the hole will be : (given atmospheric pressure $P_A = 1.01 \times 10^5\text{Pa}$, density of water $\rho_W = 1000\text{kg/m}^3$ and gravitational acceleration $g = 10\text{m/s}^2$)



- (A) 11.6 m/s (B) 10.8 m/s (C) 17.8 m/s (D) 14.4 m/s

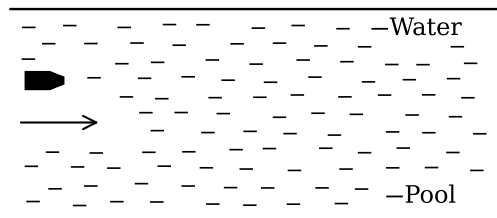
Q17 Gravitation[Step-by-step solution > prepwiser.in/questions/dVtCqLw4q0](https://www.prepwiser.in/questions/dVtCqLw4q0)

Assume there are two identical simple pendulum clocks. Clock - 1 is placed on the earth and Clock - 2 is placed on a space station located at a height h above the earth surface. Clock - 1 and Clock - 2 operate at time periods 4 s and 6 s respectively. Then the value of h is -
(consider radius of earth $R_E = 6400\text{km}$ and g on earth 10m/s^2)

- (A) 1200 km (B) 1600 km (C) 3200 km (D) 4800 km

Q18 Work, Energy & Power[Step-by-step solution > prepwiser.in/questions/ovp1Nf5Tu5](https://www.prepwiser.in/questions/ovp1Nf5Tu5)

A bullet of mass 200g having initial kinetic energy 90J is shot inside a long swimming pool as shown in the figure. If its kinetic energy reduces to 40J within 1s, the minimum length of the pool, the bullet has to travel so that it completely comes to rest is



- (A) 45 m (B) 90 m (C) 125 m (D) 25 m

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

Consider the efficiency of carnot's engine is given by $\eta = \frac{\alpha\beta}{\sin\theta} \log_e \frac{\beta x}{kT}$, where α and β are constants. If T is temperature, k is Boltzmann constant, θ is angular displacement and x has the dimensions of length. Then, choose the incorrect option:

- (A) Dimensions of β is same as that of force.
 (B) Dimensions of $\alpha^{-1}x$ is same as that of energy.
 (C) Dimensions of $\eta^{-1} \sin\theta$ is same as that of $\alpha\beta$.
 (D) Dimensions of α is same as that of β .

Physics Section B · Numerical value

Q20 to Q29

Q20 Centre of Mass & Linear Momentum **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/zUV05-1vWy](https://www.prepwiser.in/questions/zUV05-1vWy)

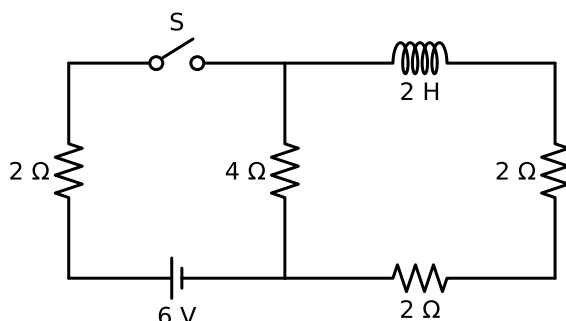
The distance of centre of mass from end A of a one dimensional rod (AB) having mass density $\rho = \rho_0 \left(1 - \frac{x^2}{L^2}\right)$ kg/m and length L (in meter) is $\frac{3L}{\alpha}$ m. The value of α is _____. (where x is the distance from end A)

Q21 Current Electricity **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/1dI702zgsc](https://www.prepwiser.in/questions/1dI702zgsc)

An electrical bulb rated 220 V, 100 W, is connected in series with another bulb rated 220 V, 60 W. If the voltage across combination is 220 V, the power consumed by the 100 W bulb will be about _____ W.

Q22 Electromagnetic Induction **NUMERICAL**[Step-by-step solution > prepwiser.in/questions/IDUGGgIypB](https://www.prepwiser.in/questions/IDUGGgIypB)

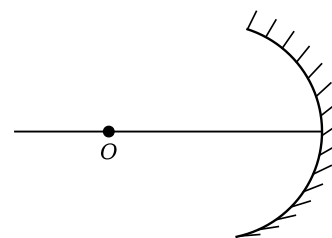
For the given circuit the current through battery of 6 V just after closing the switch 'S' will be _____ A.



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Q23 Ray Optics **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/8nF_vQRwKy)

An object 'O' is placed at a distance of 100cm in front of a concave mirror of radius of curvature 200cm as shown in the figure. The object starts moving towards the mirror at a speed 2cm/s. The position of the image from the mirror after 10s will be at _____ cm.

**Q24** Ray Optics **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/XuY6niqR_h)

In an experiment with a convex lens, The plot of the image distance (v') against the object distance (μ') measured from the focus gives a curve $v'\mu' = 225$. If all the distances are measured in cm. The magnitude of the focal length of the lens is _____ cm.

Q25 Thermodynamics **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/xfmkacFg69)

At a certain temperature, the degrees of freedom per molecule for gas is 8. The gas performs 150 J of work when it expands under constant pressure. The amount of heat absorbed by the gas will be _____ J.

Q26 Rectilinear Motion **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/0qvw_fAVhr)

A ball is thrown vertically upwards with a velocity of 19.6ms^{-1} from the top of a tower. The ball strikes the ground after 6s. The height from the ground up to which the ball can rise will be $\left(\frac{k}{5}\right)$ m. The value of k is _____. (use $g = 9.8\text{m/s}^2$)

Q27 Elasticity **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/j0pUf2dsVy)

A string of area of cross-section 4mm^2 and length 0.5m is connected with a rigid body of mass 2kg. The body is rotated in a vertical circular path of radius 0.5m. The body acquires a speed of 5m/s at the bottom of the circular path. Strain produced in the string when the body is at the bottom of the circle is _____ $\times 10^{-5}$.

(use Young's modulus 10^{11}N/m^2 and $g = 10\text{m/s}^2$)

Q28 Simple Harmonic Motion **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/hkk-ALYnMs)

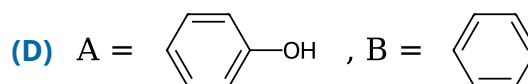
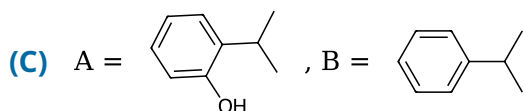
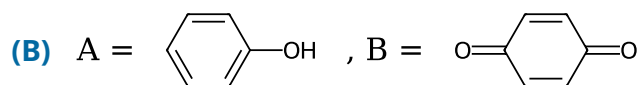
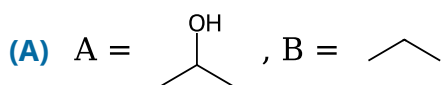
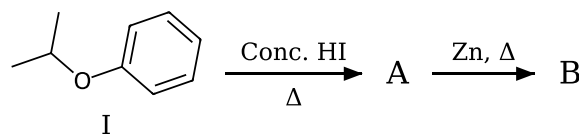
The potential energy of a particle of mass 4kg in motion along the x-axis is given by $U = 4(1 - \cos 4x)$ J. The time period of the particle for small oscillation ($\sin \theta \simeq \theta$) is $\left(\frac{\pi}{K}\right)$ s. The value of K is _____.

Q29 Units, Dimensions & Errors **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/xY_QG0jw_X)

In an experiment to find acceleration due to gravity (g) using simple pendulum, time period of 0.5s is measured from time of 100 oscillation with a watch of 1s resolution. If measured value of length is 10cm known to 1mm accuracy, The accuracy in the determination of g is found to be $x\%$. The value of x is _____.

Q30 Alcohols, Phenols & Ethers[Step-by-step solution](https://www.prepwisar.in/questions/Fm88MHsWdA) > prepwisar.in/questions/Fm88MHsWdA

Compound I is heated with Conc. HI to give a hydroxy compound A which is further heated with Zn dust to give compound B. Identify A and B.

**Q31** Chemistry in Everyday Life[Step-by-step solution](https://www.prepwisar.in/questions/O5kcV2RrNs) > prepwisar.in/questions/O5kcV2RrNs

Two statements in respect of drug-enzyme interaction are given below

Statement I : Action of an enzyme can be blocked only when an inhibitor blocks the active site of the enzyme.

Statement II : An inhibitor can form a strong covalent bond with the enzyme.

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

Q32 Coordination Compounds[Step-by-step solution](https://www.prepwisar.in/questions/4fjtsyFShu) > prepwisar.in/questions/4fjtsyFShu

Match List I with List II

	List - I (Complex)		List - II (Hybridization)
(A)	$Ni(CO)_4$	(I)	sp^3
(B)	$[Ni(CN)_4]^{2-}$	(II)	sp^3d^2
(C)	$[Co(CN)_6]^{3-}$	(III)	d^2sp^3
(D)	$[CoF_6]^{3-}$	(IV)	dsp^2

Choose the correct answer from the options given below:

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

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

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

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

Q33 Hydrogen & s-Block Elements[Step-by-step solution](https://www.prepwisar.in/questions/8-EAWfx0G4) > prepwisar.in/questions/8-EAWfx0G4

The products obtained during treatment of hard water using Clark's method are:

(A) $CaCO_3$ and $MgCO_3$

(B) $Ca(OH)_2$ and $Mg(OH)_2$

(C) $CaCO_3$ and $Mg(OH)_2$

(D) $Ca(OH)_2$ and $MgCO_3$

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

Assertion A : Permanganate titrations are not performed in presence of hydrochloric acid.

Reason R : Chlorine is formed as a consequence of oxidation of hydrochloric acid.

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

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

White phosphorus reacts with thionyl chloride to give:

- (A) PCl_5 , SO_2 and S_2Cl_2
- (B) PCl_3 , SO_2 and S_2Cl_2
- (C) PCl_3 , SO_2 and Cl_2
- (D) PCl_5 , SO_2 and Cl_2

Concentrated HNO_3 reacts with Iodine to give:

- (A) HI , NO_2 and H_2O
- (B) HIO_2 , N_2O and H_2O
- (C) HIO_3 , NO_2 and H_2O
- (D) HIO_4 , NO_2 and H_2O

Dinitrogen and dioxygen, the main constituents of air do not react with each other in atmosphere to form oxides of nitrogen because:

- (A) N_2 is unreactive in the condition of atmosphere.
- (B) Oxides of nitrogen are unstable.
- (C) Reaction between them can occur in the presence of a catalyst.
- (D) The reaction is endothermic and require very high temperature.

The correct decreasing order for metallic character is:

- (A) $\text{Na} > \text{Mg} > \text{Be} > \text{Si} > \text{P}$
- (B) $\text{P} > \text{Si} > \text{Be} > \text{Mg} > \text{Na}$
- (C) $\text{Si} > \text{P} > \text{Be} > \text{Na} > \text{Mg}$
- (D) $\text{Be} > \text{Na} > \text{Mg} > \text{Si} > \text{P}$

Statement I : An alloy of lithium and magnesium is used to make aircraft plates.

Statement II : The magnesium ions are important for cell-membrane integrity.

In the light 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

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

Assertion **A**: Zero orbital overlap is an out of phase overlap.

Reason **R**: It results due to different orientation / direction of approach of orbitals.

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

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

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

Assertion **A**: The reduction of a metal oxide is easier if the metal formed is in liquid state than solid state.

Reason **R**: The value of $\Delta G^\ominus$ becomes more on negative side as entropy is higher in liquid state than solid state.

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

- (A) Both A and R are correct and R is the correct explanation of A
- (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) A is not correct but R is correct

Arrange the following in increasing order of reactivity towards nitration

- A. p-xylene
- B. bromobenzene
- C. mesitylene
- D. nitrobenzene
- E. benzene

Choose the correct answer from the options given below

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

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

Assertion A : Thin layer chromatography is an adsorption chromatography.

Reason R : A thin layer of silica gel is spread over a glass plate of suitable size in thin layer chromatography which acts as an adsorbent.

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

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

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

Assertion A : Aniline on nitration yields ortho, meta & para nitro derivatives of aniline.

Reason R: Nitrating mixture is a strong acidic mixture.

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

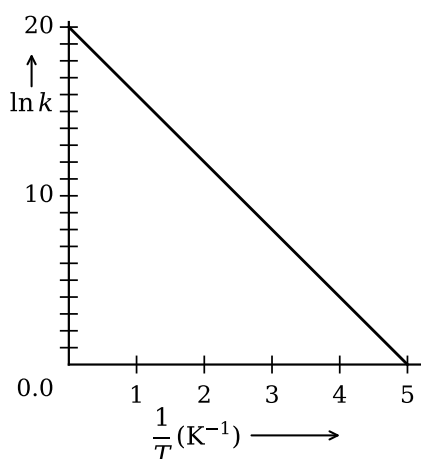
- (A) Both A and R are true and R is the correct explanation of A
- (B) Both A and R are true but R is NOT the correct explanation of A
- (C) A is true but R is false
- (D) A is false but R is true

Chemistry Section B · Numerical value

Q45 to Q54

For a reaction, given below is the graph of $\ln k$ vs $\frac{1}{T}$. The activation energy for the reaction is equal to _____ cal mol^{-1} . (nearest integer)

(Given: $R = 2 \text{ cal K}^{-1} \text{ mol}^{-1}$)



On reaction with stronger oxidizing agent like KIO_4 , hydrogen peroxide oxidizes with the evolution of O_2 . The oxidation number of I in KIO_4 changes to _____.

Q47 Solid State **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/ZuminP7DpE](#)

Metal M crystallizes into a fcc lattice with the edge length of 4.0×10^{-8} cm. The atomic mass of the metal is _____ g/mol. (Nearest integer)

(Use: $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$, density of metal, $M = 9.03 \text{ g cm}^{-3}$)

Q48 Solutions & Colligative Properties **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/J8KCXbaNqw](#)

A gaseous mixture of two substances A and B, under a total pressure of 0.8 atm is in equilibrium with an ideal liquid solution. The mole fraction of substance A is 0.5 in the vapour phase and 0.2 in the liquid phase. The vapour pressure of pure liquid A is _____ atm. (Nearest integer)

Q49 Mole Concept & Stoichiometry **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/-biYFr9zF6](#)

2L of 0.2M H_2SO_4 is reacted with 2L of 0.1M NaOH solution, the molarity of the resulting product Na_2SO_4 in the solution is _____ millimolar. (Nearest integer)

Q50 Atomic Structure **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/Jn_xrXM9uE](#)

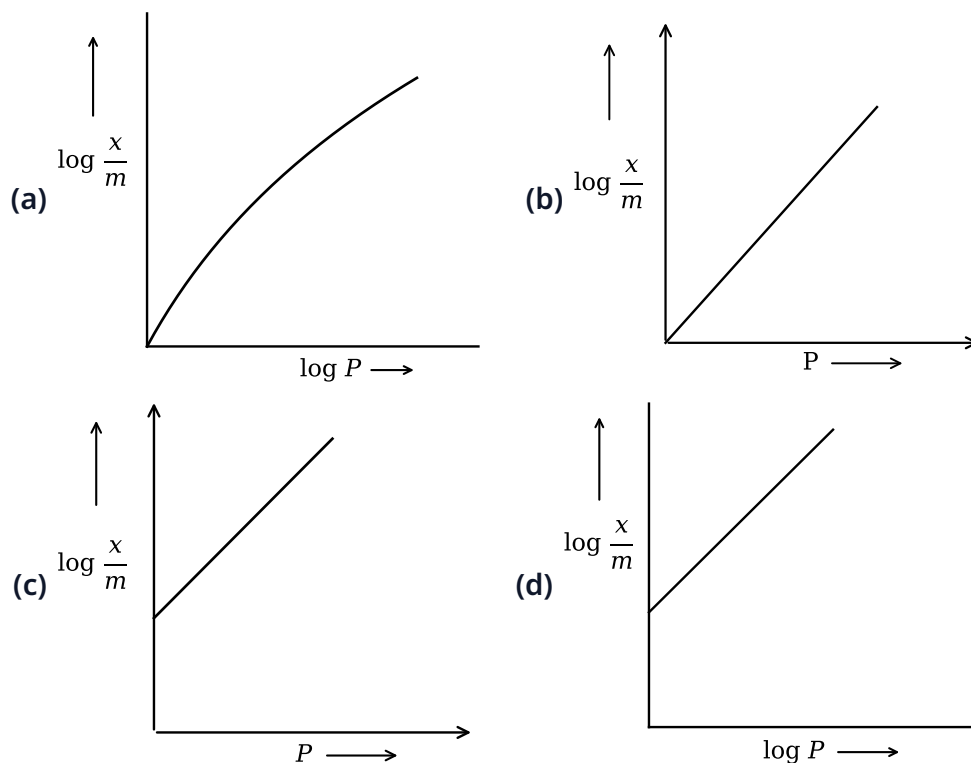
If the wavelength for an electron emitted from H-atom is 3.3×10^{-10} m, then energy absorbed by the electron in its ground state compared to minimum energy required for its escape from the atom, is _____ times. (Nearest integer)

[Given : $h = 6.626 \times 10^{-34} \text{ Js}$]

Mass of electron = $9.1 \times 10^{-31} \text{ kg}$

Q51 Surface Chemistry **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/2VCVdK0gt6](#)

Among the following the number of curves not in accordance with Freundlich adsorption isotherm is _____.



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Among the following the number of state variables is _____.

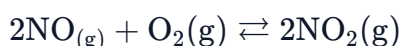
Internal energy (U)

Volume (V)

Heat (q)

Enthalpy (H)

At 600K, 2mol of NO are mixed with 1mol of O₂.



The reaction occurring as above comes to equilibrium under a total pressure of 1 atm. Analysis of the system shows that 0.6mol of oxygen are present at equilibrium. The equilibrium constant for the reaction is _____. (Nearest integer)

A sample of 0.125g of an organic compound when analyzed by Duma's method yields 22.78mL of nitrogen gas collected over KOH solution at 280K and 759mm Hg. The percentage of nitrogen in the given organic compound is _____. (Nearest integer)

Given:

(a) The vapour pressure of water of 280K is 14.2mm Hg.

(b) $R = 0.082\text{L atm K}^{-1}\text{mol}^{-1}$

Mathematics Section A · Multiple choice

Q55 to Q72

Let the lines

$$\frac{x-1}{\lambda} = \frac{y-2}{1} = \frac{z-3}{2} \text{ and}$$

$$\frac{x+26}{-2} = \frac{y+18}{3} = \frac{z+28}{\lambda} \text{ be coplanar}$$

and P be the plane containing these two lines.

Then which of the following points does **NOT** lie on P?

- (A) (0, -2, -2) (B) (-5, 0, -1) (C) (3, -1, 0) (D) (0, 4, 5)

A plane P is parallel to two lines whose direction ratios are -2, 1, -3 and -1, 2, -2 and it contains the point (2, 2, -2). Let P intersect the co-ordinate axes at the points A, B, C making the intercepts α, β, γ . If V is the volume of the tetrahedron OABC, where O is the origin, and $p = \alpha + \beta + \gamma$, then the ordered pair (V, p) is equal to:

- (A) (48, -13) (B) (24, -13) (C) (48, 11) (D) (24, -5)

The function $f(x) = xe^{x(1-x)}$, $x \in \mathbb{R}$, is:

- (A) increasing in $(-\frac{1}{2}, 1)$ (B) decreasing in $(\frac{1}{2}, 2)$
 (C) increasing in $(-1, -\frac{1}{2})$ (D) decreasing in $(-\frac{1}{2}, \frac{1}{2})$

Q58 Circles[Step-by-step solution](https://www.prepwiser.in/questions/Ab7GGseQtQ)

Let the tangents at two points A and B on the circle $x^2 + y^2 - 4x + 3 = 0$ meet at origin $O(0, 0)$. Then the area of the triangle OAB is:

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

Q59 Definite Integration[Step-by-step solution](https://www.prepwiser.in/questions/3A7xd8hSw9)

Let $I_n(x) = \int_0^x \frac{1}{(t^2+5)^n} dt, n = 1, 2, 3, \dots$. Then:

- (A) $50I_6 - 9I_5 = xI_5'$ (B) $50I_6 - 11I_5 = xI_5'$ (C) $50I_6 - 9I_5 = I_5'$ (D) $50I_6 - 11I_5 = I_5'$

Q60 Differential Equations[Step-by-step solution](https://www.prepwiser.in/questions/An-9k98mtR)

Let $y = y(x)$ be the solution curve of the differential equation $\frac{dy}{dx} + \frac{1}{x^2-1}y = \left(\frac{x-1}{x+1}\right)^{1/2}, x > 1$ passing through the point $\left(2, \sqrt{\frac{1}{3}}\right)$. Then $\sqrt{7}y(8)$ is equal to:

- (A) $11 + 6 \log_e 3$ (B) 19 (C) $12 - 2 \log_e 3$ (D) $19 - 6 \log_e 3$

Q61 Differential Equations[Step-by-step solution](https://www.prepwiser.in/questions/hc0XUUpv3D)

The differential equation of the family of circles passing through the points $(0, 2)$ and $(0, -2)$ is:

- (A) $2xy \frac{dy}{dx} + (x^2 - y^2 + 4) = 0$ (B) $2xy \frac{dy}{dx} + (x^2 + y^2 - 4) = 0$
(C) $2xy \frac{dy}{dx} + (y^2 - x^2 + 4) = 0$ (D) $2xy \frac{dy}{dx} - (x^2 - y^2 + 4) = 0$

Q62 Differentiation[Step-by-step solution](https://www.prepwiser.in/questions/elw-Hd4_69)

Let $x(t) = 2\sqrt{2} \cos t \sqrt{\sin 2t}$ and $y(t) = 2\sqrt{2} \sin t \sqrt{\sin 2t}, t \in (0, \frac{\pi}{2})$.

Then $\frac{1 + \left(\frac{dy}{dx}\right)^2}{\frac{d^2y}{dx^2}}$ at $t = \frac{\pi}{4}$ is equal to:

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

Q63 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](https://www.prepwiser.in/questions/ZGTLZzEZnX)

Let $f(x) = ax^2 + bx + c$ be such that $f(1) = 3, f(-2) = \lambda$ and $f(3) = 4$. If $f(0) + f(1) + f(-2) + f(3) = 14$, then λ is equal to:

- (A) -4 (B) $\frac{13}{2}$ (C) $\frac{23}{2}$ (D) 4

Q64 Parabola[Step-by-step solution](https://www.prepwiser.in/questions/mbANaoDEGL)

Let the hyperbola $H : \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ pass through the point $(2\sqrt{2}, -2\sqrt{2})$. A parabola is drawn whose focus is same as the focus of H with positive abscissa and the directrix of the parabola passes through the other focus of H. If the length of the latus rectum of the parabola is e times the length of the latus rectum of H, where e is the eccentricity of H, then which of the following points lies on the parabola?

- (A) $(2\sqrt{3}, 3\sqrt{2})$ (B) $(3\sqrt{3}, -6\sqrt{2})$ (C) $(\sqrt{3}, -\sqrt{6})$ (D) $(3\sqrt{6}, 6\sqrt{2})$

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Q65 Applications of Derivatives[Step-by-step solution](#) › [prepwisar.in/questions/UkiF4uInL-](https://www.prepwisar.in/questions/UkiF4uInL-)

The sum of the absolute maximum and absolute minimum values of the function $f(x) = \tan^{-1}(\sin x - \cos x)$ in the interval $[0, \pi]$ is:

- (A) 0 (B) $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right) - \frac{\pi}{4}$ (C) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right) - \frac{\pi}{4}$ (D) $\frac{-\pi}{12}$

Q66 Continuity & Differentiability[Step-by-step solution](#) › [prepwisar.in/questions/dFbjScTKmT](https://www.prepwisar.in/questions/dFbjScTKmT)

The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by

$$f(x) = \lim_{n \rightarrow \infty} \frac{\cos(2\pi x) - x^{2n} \sin(x-1)}{1 + x^{2n+1} - x^{2n}}$$

is continuous for all x in:

- (A) $\mathbb{R} - \{-1\}$ (B) $\mathbb{R} - \{-1, 1\}$ (C) $\mathbb{R} - \{1\}$ (D) $\mathbb{R} - \{0\}$

Q67 Matrices[Step-by-step solution](#) › [prepwisar.in/questions/NixFzy9xg1](https://www.prepwisar.in/questions/NixFzy9xg1)

Let A and B be any two 3×3 symmetric and skew symmetric matrices respectively. Then which of the following is NOT true?

- (A) $A^4 - B^4$ is a symmetric matrix (B) $AB - BA$ is a symmetric matrix
(C) $B^5 - A^5$ is a skew-symmetric matrix (D) $AB + BA$ is a skew-symmetric matrix

Q68 Probability: Advanced[Step-by-step solution](#) › [prepwisar.in/questions/CNhXZjh3JX](https://www.prepwisar.in/questions/CNhXZjh3JX)

Let A and B be two events such that $P(B|A) = \frac{2}{5}$, $P(A|B) = \frac{1}{7}$ and $P(A \cap B) = \frac{1}{9}$. Consider

(S1) $P(A' \cup B) = \frac{5}{6}$,

(S2) $P(A' \cap B') = \frac{1}{18}$

Then:

- (A) Both (S1) and (S2) are true (B) Both (S1) and (S2) are false
(C) Only (S1) is true (D) Only (S2) is true

Q69 Sets[Step-by-step solution](#) › [prepwisar.in/questions/EjjzetkTQu](https://www.prepwisar.in/questions/EjjzetkTQu)

$$\text{Let } S = \left\{ x \in [-6, 3] - \{-2, 2\} : \frac{|x+3| - 1}{|x| - 2} \geq 0 \right\} \text{ and}$$

$$T = \{x \in \mathbb{Z} : x^2 - 7|x| + 9 \leq 0\}.$$

Then the number of elements in $S \cap T$ is:

- (A) 7 (B) 5 (C) 4 (D) 3

Q70 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](#) › [prepwisar.in/questions/rKhv9wY2SW](https://www.prepwisar.in/questions/rKhv9wY2SW)

Let α, β be the roots of the equation $x^2 - \sqrt{2}x + \sqrt{6} = 0$ and $\frac{1}{\alpha^2} + 1, \frac{1}{\beta^2} + 1$ be the roots of the equation $x^2 + ax + b = 0$. Then the roots of the equation $x^2 - (a+b-2)x + (a+b+2) = 0$ are:

- (A) non-real complex numbers (B) real and both negative
(C) real and both positive (D) real and exactly one of them is positive

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Q71 Vectors[Step-by-step solution](#) › prepwiser.in/questions/MatNiRZ1-5

Let S be the set of all $a \in \mathbb{R}$ for which the angle between the vectors $\vec{u} = a(\log_e b)\hat{i} - 6\hat{j} + 3\hat{k}$ and $\vec{v} = (\log_e b)\hat{i} + 2\hat{j} + 2a(\log_e b)\hat{k}$, ($b > 1$) is acute. Then S is equal to:

- (A) $(-\infty, -\frac{4}{3})$ (B) Φ (C) $(-\frac{4}{3}, 0)$ (D) $(\frac{12}{7}, \infty)$

Q72 Area Under Curves[Step-by-step solution](#) › prepwiser.in/questions/borS5n_Q_A

The area enclosed by the curves $y = \log_e(x + e^2)$, $x = \log_e(\frac{2}{y})$ and $x = \log_e 2$, above the line $y = 1$ is:

- (A) $2 + e - \log_e 2$ (B) $1 + e - \log_e 2$ (C) $e - \log_e 2$ (D) $1 + \log_e 2$

Mathematics Section B · Numerical value

Q73 to Q82

Q73 Binomial Theorem **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/M-33pUM8S6

Let the coefficients of the middle terms in the expansion of $(\frac{1}{\sqrt{6}} + \beta x)^4$, $(1 - 3\beta x)^2$ and $(1 - \frac{\beta}{2}x)^6$, $\beta > 0$, respectively form the first three terms of an A.P. If d is the common difference of this A.P., then $50 - \frac{2d}{\beta^2}$ is equal to _____.

Q74 Binomial Theorem **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/ykStMh2jIX

If $1 + (2 + {}^{49}C_1 + {}^{49}C_2 + \dots + {}^{49}C_{49})({}^{50}C_2 + {}^{50}C_4 + \dots + {}^{50}C_{50})$ is equal to $2^n \cdot m$, where m is odd, then $n + m$ is equal to _____.

Q75 Complex Numbers **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/CXjSmEcjwL

Let $z = a + ib$, $b \neq 0$ be complex numbers satisfying $z^2 = \bar{z} \cdot 2^{1-|z|}$. Then the least value of $n \in \mathbb{N}$, such that $z^n = (z + 1)^n$, is equal to _____.

Q76 Definite Integration **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/52BuA9l5ES

The value of the integral $\int_0^{\frac{\pi}{2}} 60 \frac{\sin(6x)}{\sin x} dx$ is equal to _____.

Q77 Ellipse **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/3WQkaJGI6

Let the tangents at the points P and Q on the ellipse $\frac{x^2}{2} + \frac{y^2}{4} = 1$ meet at the point $R(\sqrt{2}, 2\sqrt{2} - 2)$. If S is the focus of the ellipse on its negative major axis, then $SP^2 + SQ^2$ is equal to _____.

Q78 Parabola **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/79uGKgEvE

Two tangent lines l_1 and l_2 are drawn from the point $(2, 0)$ to the parabola $2y^2 = -x$. If the lines l_1 and l_2 are also tangent to the circle $(x - 5)^2 + y^2 = r$, then $17r$ is equal to _____.

Q79 Permutations & Combinations **NUMERICAL**[Step-by-step solution](#) › prepwiser.in/questions/gQGR-SdGu6

A class contains b boys and g girls. If the number of ways of selecting 3 boys and 2 girls from the class is 168, then $b + 3g$ is equal to _____.

A bag contains 4 white and 6 black balls. Three balls are drawn at random from the bag. Let X be the number of white balls, among the drawn balls. If σ^2 is the variance of X , then $100\sigma^2$ is equal to _____.

$$\frac{6}{3^{12}} + \frac{10}{3^{11}} + \frac{20}{3^{10}} + \frac{40}{3^9} + \dots + \frac{10240}{3} = 2^n \cdot m$$

, where m is odd, then $m \cdot n$ is equal to _____.

Let

$$S = \left[-\pi, \frac{\pi}{2}\right) - \left\{-\frac{\pi}{2}, -\frac{\pi}{4}, -\frac{3\pi}{4}, \frac{\pi}{4}\right\}$$

. Then the number of elements in the set

$$A = \{\theta \in S : \tan \theta (1 + \sqrt{5} \tan(2\theta)) = \sqrt{5} - \tan(2\theta)\}$$

is _____.

Answer key: JEE Main 2022 · 28 Jul · Shift 2

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Physics

1. C	2. A	3. A	4. C	5. C	6. D	7. B	8. B	9. B	10. C
11. D	12. C	13. C	14. B	15. D	16. C	17. C	18. A	19. D	20. 8
21. 14	22. 1	23. 400	24. 15	25. 750	26. 392	27. 30	28. 2	29. 5	

Chemistry

30. D	31. D	32. B	33. C	34. A	35. B	36. C	37. D	38. A	39. B
40. A	41. A	42. B	43. A	44. A	45. 8	46. 5	47. 87	48. 2	49. 25
50. 2	51. 3	52. 3	53. 2	54. 22					

Mathematics

55. D	56. B	57. A	58. B	59. A	60. D	61. A	62. D	63. D	64. B
65. C	66. B	67. C	68. A	69. D	70. B	71. B	72. B	73. 57	74. 99
75. 6	76. 104	77. 13	78. 9	79. 17	80. 56	81. 12	82. 5		

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