

JEE MAIN 2026 · QUESTION PAPER

# 28 Jan 2026 **Shift 1**

74 questions in exam order, with answer key

| Subject              | Section A multiple choice                   | Section B numerical value |
|----------------------|---------------------------------------------|---------------------------|
| ● <b>Physics</b>     | <b>20</b> Q1 to Q20                         | <b>5</b> Q21 to Q25       |
| ● <b>Chemistry</b>   | <b>20</b> Q26 to Q45                        | <b>5</b> Q46 to Q50       |
| ● <b>Mathematics</b> | <b>20</b> Q51 to Q70                        | <b>4</b> Q71 to Q74       |
| <b>In this PDF</b>   | <b>74</b> questions · answer key at the end |                           |

- 1 Set a 3 hour timer and attempt the paper in one sitting, like the real exam.
- 2 Check yourself against the answer key at the end. Every question names its chapter, so you can see where marks went.
- 3 Got one wrong? Tap “Step-by-step solution” at the top right of it for the full working, where available.

## Attempt this paper online

The same questions in the same order, with instant answer checking and step-by-step solutions where available.

[prepwisar.in/pyqs/paper/2026-01-28-morning](https://prepwisar.in/pyqs/paper/2026-01-28-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?  
[prepwisar.in/feedback](https://prepwisar.in/feedback) · Terms: [prepwisar.in/terms](https://prepwisar.in/terms)

**Q1** Alternating Current

[Step-by-step solution](#) › [prepwiser.in/questions/VBBYbOJu6J](https://www.prepwiser.in/questions/VBBYbOJu6J)

The electric current in the circuit is given as  $i = i_o(t/T)$ . The r.m.s current for the period  $t = 0$  to  $t = T$  is \_\_\_\_.

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

**Q2** Electromagnetic Waves

[Step-by-step solution](#) › [prepwiser.in/questions/2KQkH8ig6B](https://www.prepwiser.in/questions/2KQkH8ig6B)

The electric field of an electromagnetic wave travelling through a medium is given by  $\vec{E}(x, t) = 25 \sin(2.0 \times 10^{15}t - 10^7x) \hat{n}$  then the refractive index of the medium is \_\_\_\_.

(All given measurement are in SI units)

- (A) 2 (B) 1.2 (C) 1.5 (D) 1.7

**Q3** Moving Charges & Magnetism

[Step-by-step solution](#) › [prepwiser.in/questions/Z9jNulw06P](https://www.prepwiser.in/questions/Z9jNulw06P)

The magnetic field at the centre of a current carrying circular loop of radius  $R$  is  $16\mu\text{T}$ . The magnetic field at a distance  $x = \sqrt{3}R$  on its axis from the centre is \_\_\_\_  $\mu\text{T}$ .

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

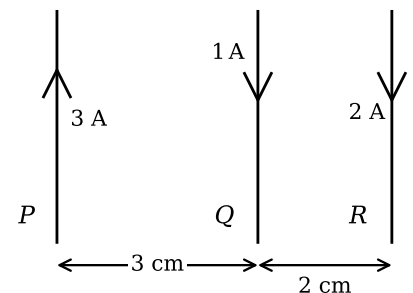
**Q4** Moving Charges & Magnetism

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

Three long straight wires carrying current are arranged mutually parallel as shown in the figure. The force experienced by 15 cm length of wire  $Q$  is \_\_\_\_.

( $\mu_o = 4\pi \times 10^{-7} \text{T.m/A}$ )

- (A)  $6 \times 10^{-6} \text{N}$  towards  $P$  (B)  $6 \times 10^{-6} \text{N}$  towards  $R$   
(C)  $6 \times 10^{-7} \text{N}$  towards  $P$  (D)  $6 \times 10^{-7} \text{N}$  towards  $R$



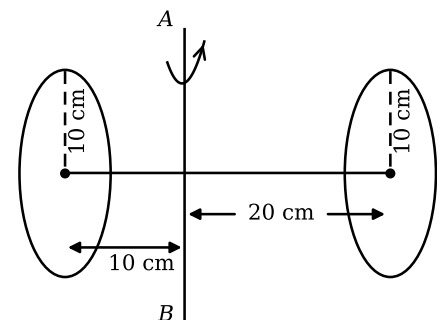
**Q5** Rotational Motion

[Step-by-step solution](#) › [prepwiser.in/questions/Xsa5Hngy79](https://www.prepwiser.in/questions/Xsa5Hngy79)

Two circular discs of radius each 10 cm are joined at their centres by a rod of length 30 cm and mass 600 gm as shown in figure.

If the mass of each disc is 600 gm and applied torque between two discs is  $43 \times 10^5 \text{ dyne.cm}$ , the angular acceleration of the discs about the given axis  $AB$  is \_\_\_\_  $\text{rad/s}^2$ .

- (A) 100 (B) 22 (C) 27 (D) 11



Attempt this paper online with instant answer checking › [prepwiser.in/pyqs/paper/2026-01-28-morning](https://www.prepwiser.in/pyqs/paper/2026-01-28-morning)

Given below are two statements:

**Statement I:** A plane wave after passing through prism remains as plane wave but passing through small pin hole may become spherical wave.

**Statement II:** The curvature of a spherical wave emerging from a slit will increase for increasing slit width.

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

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

An atom  ${}^8_3X$  is bombarded by shower of fundamental particles and in 10 s this atom absorbed 10 electrons, 10 protons and 9 neutrons. The percentage growth in the surface area of the nucleons is recorded by:

- (A) 150%      (B) 900%      (C) 125%      (D) 225%

For the two cells having same EMF  $\mathcal{E}$  and internal resistance  $r$ , the current passing through the external resistor  $6\Omega$  is same when both the cells are connected either in parallel or in series. The value of internal resistance  $r$  is \_\_\_\_  $\Omega$ .

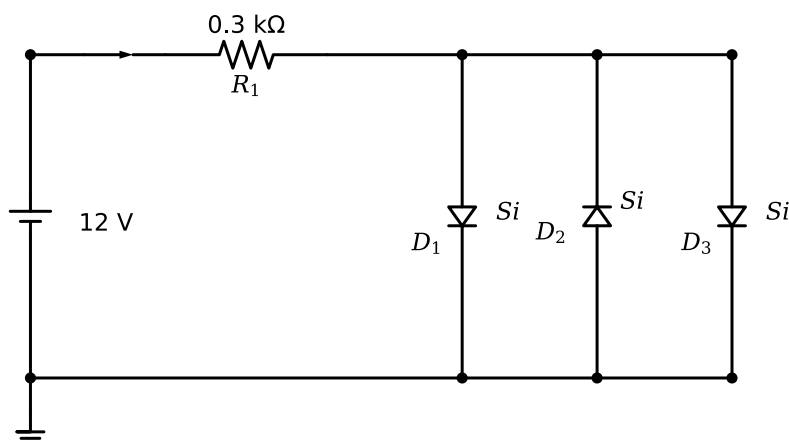
- (A) 3      (B) 6      (C) 4      (D) 9

In the potentiometer, when the cell in the secondary circuit is shunted with  $4\Omega$  resistance, the balance is obtained at the length 120 cm of wire. Now when the same cell is shunted with  $12\Omega$  resistance, the balance is shifted to a length of 180 cm. The internal resistance of cell is \_\_\_\_  $\Omega$

- (A) 4      (B) 12      (C) 6      (D) 3

Assuming in forward bias condition there is a voltage drop of 0.7 V across a silicon diode, the current through diode  $D_1$  in the circuit is \_\_\_\_ mA.

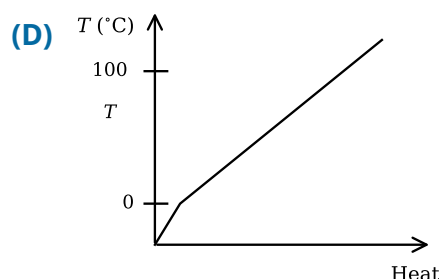
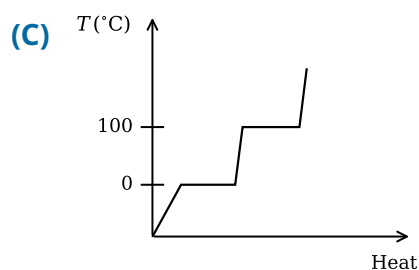
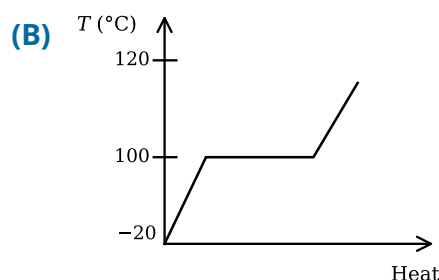
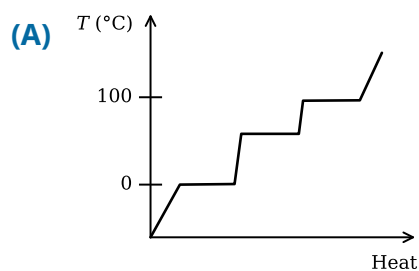
(Assume all diodes in the given circuit are identical)



- (A) 17.6      (B) 18.8      (C) 20.15      (D) 11.7

**Q11** Thermometry & Calorimetry[Step-by-step solution > prepwiser.in/questions/Cw8Oe2g-j3](https://www.prepwiser.in/questions/Cw8Oe2g-j3)

Which of the following best represents the temperature versus heat supplied graph for water, in the range of  $-20^{\circ}\text{C}$  to  $120^{\circ}\text{C}$ ?

**Q12** Thermometry & Calorimetry[Step-by-step solution > prepwiser.in/questions/EMRmWGogWh](https://www.prepwiser.in/questions/EMRmWGogWh)

10 kg of ice at  $-10^{\circ}\text{C}$  is added to 100 kg of water to lower its temperature from  $25^{\circ}\text{C}$ . Consider no heat exchange to surroundings. The decrement to the temperature of water is \_\_\_\_  $^{\circ}\text{C}$ .

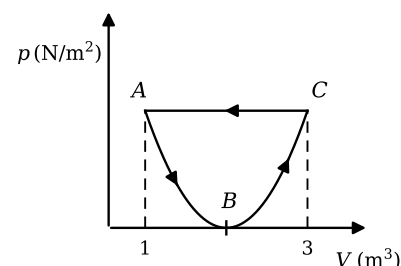
(specific heat of ice =  $2100\text{J/Kg}\cdot^{\circ}\text{C}$ , specific heat of water =  $4200\text{J/Kg}\cdot^{\circ}\text{C}$ , latent heat of fusion of ice =  $3.36 \times 10^5\text{J/Kg}$ )

- (A) 15                      (B) 10                      (C) 6.67                      (D) 11.6

**Q13** Thermodynamics[Step-by-step solution > prepwiser.in/questions/EPFuy4P0DS](https://www.prepwiser.in/questions/EPFuy4P0DS)

In the following  $p - V$  diagram the equation of state along the curved path is given by  $(V - 2)^2 = 4ap$  where  $a$  is a constant. The total work done in the closed path is

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

**Q14** Electrostatics II: Potential & Capacitance[Step-by-step solution > prepwiser.in/questions/5IiSWwwwPQ](https://www.prepwiser.in/questions/5IiSWwwwPQ)

Two point charges of 1 nC and 2 nC are placed at the two corners of equilateral triangle of side 3 cm. The work done in bringing a charge of 3 nC from infinity to the third corner of the triangle is \_\_\_\_  $\mu\text{J}$ .

$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{N} \cdot \text{m}^2/\text{C}^2$$

- (A) 3.3                      (B) 27                      (C) 2.7                      (D) 5.4

**Q15** Friction[Step-by-step solution > prepwiser.in/questions/vleFktHdR0](https://www.prepwiser.in/questions/vleFktHdR0)

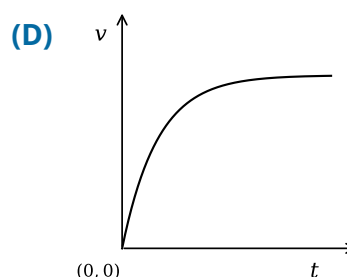
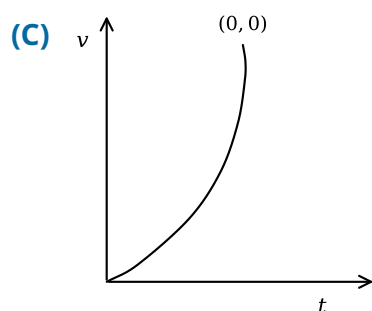
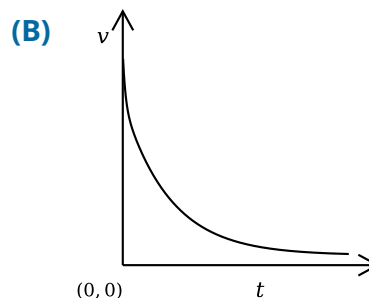
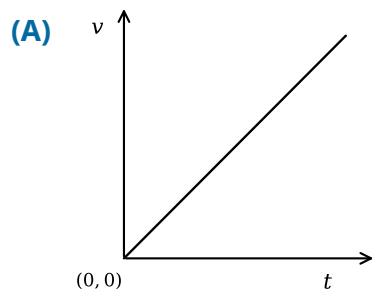
A block of mass 5 kg is moving on an inclined plane which makes an angle of  $30^{\circ}$  with the horizontal. Friction coefficient between the block and inclined plane surface is  $\frac{\sqrt{3}}{2}$ . The force to be applied on the block so that the block will move down without acceleration is \_\_\_\_ N.

$$(g = 10\text{m/s}^2).$$

- (A) 25                      (B) 12.5                      (C) 15                      (D) 7.5

**Q16** Newton's Laws of Motion[Step-by-step solution](https://prepwiser.in/questions/VBR3Tw4vUn) › [prepwiser.in/questions/VBR3Tw4vUn](https://prepwiser.in/questions/VBR3Tw4vUn)

A particle of mass  $m$  falls from rest through a resistive medium having resistive force,  $F = -kv$ , where  $v$  is the velocity of the particle and  $k$  is a constant. Which of the following graphs represents velocity ( $v$ ) versus time ( $t$ )?

**Q17** Rectilinear Motion[Step-by-step solution](https://prepwiser.in/questions/eRHQy2HQ5W) › [prepwiser.in/questions/eRHQy2HQ5W](https://prepwiser.in/questions/eRHQy2HQ5W)

Water drops fall from a tap on the floor, 5 m below, at regular intervals of time, the first drop strikes the floor when the sixth drop begins to fall. The height at which the fourth drop will be from ground, at the instant when the first drop strikes the ground is \_\_\_\_ m.

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

(A) 3.8

(B) 4.0

(C) 4.2

(D) 2.5

**Q18** Experimental Skills[Step-by-step solution](https://prepwiser.in/questions/X8P_VTZ1WV) › [prepwiser.in/questions/X8P\\_VTZ1WV](https://prepwiser.in/questions/X8P_VTZ1WV)

When both jaws of vernier callipers touch each other, zero mark of the vernier scale is right to zero mark of main scale, 4<sup>th</sup> mark on vernier scale coincides with certain mark on the main scale. While measuring the length of a cylinder, observer observes 15 divisions on main scale and 5<sup>th</sup> division of vernier scale coincides with a main scale division. Measured length of cylinder is \_\_\_\_ mm.

(Least count of Vernier calliper = 0.1mm )

(A) 15.5

(B) 15.4

(C) 15.9

(D) 15.1

**Q19** Ray Optics[Step-by-step solution](https://prepwiser.in/questions/IOf8zyKrve) › [prepwiser.in/questions/IOf8zyKrve](https://prepwiser.in/questions/IOf8zyKrve)

The magnitudes of power of a biconvex lens (refractive index 1.5) and that of a plano-concave lens (refractive index = 1.7 ) are same. If the curvature of planoconcave lens exactly matches with the curvature of back surface of the biconvex lens, then ratio of radius of curvature of front and back surface of the biconvex lens is \_\_\_\_

(A) 2 : 5

(B) 5 : 2

(C) 12 : 5

(D) 5 : 12

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**Q20** Elasticity[Step-by-step solution](https://www.prepwise.in/questions/vUWKA1YsCL)

Two wires  $A$  and  $B$  made of different materials of lengths  $6.0\text{ cm}$  and  $5.4\text{ cm}$ , respectively and area of cross sections  $3.0 \times 10^{-5}\text{ m}^2$  and  $4.5 \times 10^{-5}\text{ m}^2$ , respectively are stretched by the same magnitude under a given load. The ratio of the Young's modulus of  $A$  to that of  $B$  is  $x : 3$ . The value of  $x$  is \_\_\_\_

**(A)** 2**(B)** 1**(C)** 4**(D)** 5**Physics** Section B • Numerical value

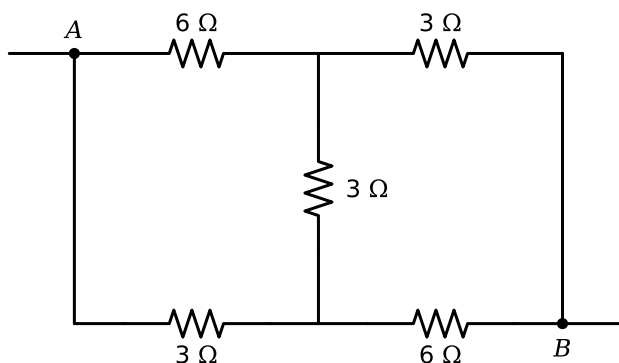
Q21 to Q25

**Q21** Rotational Motion **NUMERICAL**[Step-by-step solution](https://www.prepwise.in/questions/NKB0DxQm4Q)

A solid sphere of radius  $10\text{ cm}$  is rotating about an axis which is at a distance  $15\text{ cm}$  from its centre. The radius of gyration about this axis is  $\sqrt{n}\text{ cm}$ . The value of  $n$  is

**Q22** Current Electricity **NUMERICAL**[Step-by-step solution](https://www.prepwise.in/questions/w9BYSrRyNj)

The equivalent resistance between the points  $A$  and  $B$  in the following circuit is  $\frac{x}{5}\Omega$ . The value of  $x$  is \_\_\_\_.

**Q23** Simple Harmonic Motion **NUMERICAL**[Step-by-step solution](https://www.prepwise.in/questions/OIeeyj4gR)

The displacement of a particle, executing simple harmonic motion with time period  $T$ , is expressed as  $x(t) = A \sin \omega t$ , where  $A$  is the amplitude. The maximum value of potential energy of this oscillator is found at  $t = T/2\beta$ . The value of  $\beta$  is \_\_\_\_.

**Q24** Dual Nature of Radiation & Matter **NUMERICAL**[Step-by-step solution](https://www.prepwise.in/questions/anjraSfojp)

The ratio of de Broglie wavelength of a deuteron with kinetic energy  $E$  to that of an alpha particle with kinetic energy  $2E$ , is  $n : 1$ . The value of  $n$  is \_\_\_\_.

(Assume mass of proton = mass of neutron) :

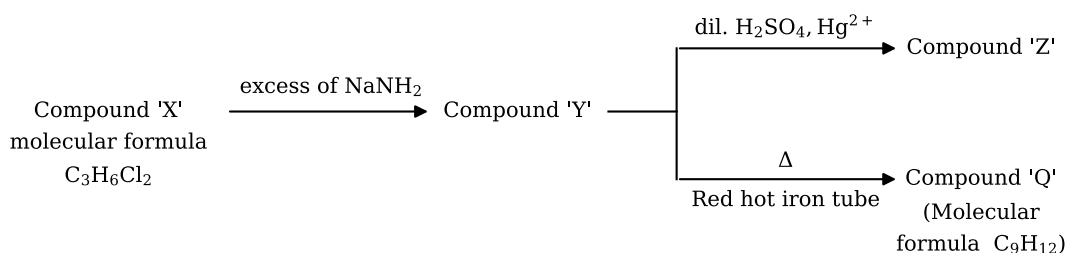
**Q25** Ray Optics **NUMERICAL**[Step-by-step solution](https://www.prepwise.in/questions/UidIEdktLG)

A convex lens of refractive index  $1.5$  and focal length  $f = 18\text{ cm}$  is immersed in water. The difference in focal lengths of the given lens when it is in water and in air is  $\alpha \times f$ . The value of  $\alpha$  is \_\_\_\_.

(refractive index of water =  $4/3$ )

**Q26** Aldehydes & Ketones[Step-by-step solution > prepwiser.in/questions/GSqTTNKUsK](https://www.prepwiser.in/questions/GSqTTNKUsK)

Given below are two statements for the following reaction sequence.



**Statement I:** Compound 'Z' will give yellow precipitate with NaOI.

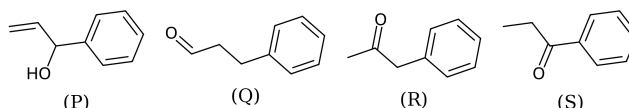
**Statement II:** Compound 'Q' has two different types of 'H' atoms (aromatic : aliphatic) in the ratio 1 : 3.

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

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

**Q27** Practical Organic Chemistry[Step-by-step solution > prepwiser.in/questions/e8dwcPpyY4](https://www.prepwiser.in/questions/e8dwcPpyY4)

Given below are the four isomeric compounds (P, Q, R, S)



Identify correct statements from below.

- A. Q, R and S will give precipitate with 2, 4-DNP.  
B. P and Q will give positive Bayer's test.  
C. Q and R will give sooty flame.  
D. R and S will give yellow precipitate with  $I_2/NaOH$ .  
E. Q alone will deposit silver with Tollen's reagent

Choose the correct option.

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

**Q28** Coordination Compounds[Step-by-step solution > prepwiser.in/questions/otxq4Gppe2](https://www.prepwiser.in/questions/otxq4Gppe2)

The correct statement among the following is:

- (A)  $[Ni(CN)_4]^{2-}$  and  $[NiCl_4]^{2-}$  are diamagnetic and  $Ni(CO)_4$  is paramagnetic.  
(B)  $Ni(CO)_4$  is diamagnetic and  $[NiCl_4]^{2-}$  and  $[Ni(CN)_4]^{2-}$  are paramagnetic.  
(C)  $Ni(CO)_4$  and  $[NiCl_4]^{2-}$  are diamagnetic and  $[Ni(CN)_4]^{2-}$  is paramagnetic.  
(D)  $Ni(CO)_4$  and  $[Ni(CN)_4]^{2-}$  are diamagnetic and  $[NiCl_4]^{2-}$  is paramagnetic.

**Q29** Ionic Equilibrium[Step-by-step solution > prepwiser.in/questions/KymM7d\\_Fqk](https://www.prepwiser.in/questions/KymM7d_Fqk)

Consider a weak base 'B' of  $pK_b = 5.699$ . ' $x$ ' mL of 0.02 M HCl and ' $y$ ' mL of 0.02 M weak base 'B' are mixed to make 100 mL of a buffer of pH 9 at 25°C. The values of ' $x$ ' and ' $y$ ' respectively are:  
[Given:  $\log 2 = 0.3010$ ,  $\log 3 = 0.4771$ ,  $\log 5 = 0.699$ ]

- (A)  $\begin{matrix} x & y \\ 42.7 & 57.3 \end{matrix}$       (B)  $\begin{matrix} x & y \\ 14.3 & 85.7 \end{matrix}$       (C)  $\begin{matrix} x & y \\ 85.7 & 14.3 \end{matrix}$       (D)  $\begin{matrix} x & y \\ 11.1 & 88.9 \end{matrix}$

**Q30** Qualitative Analysis: Salt Analysis[Step-by-step solution > prepwiser.in/questions/aBzx6ktwDd](https://www.prepwiser.in/questions/aBzx6ktwDd)

Given below are two statements:

**Statement I:** Griss-Ilosvay test is used for the detection of nitrite ion, which involves the use of sulphanilic acid and  $\alpha$ -naphthylamine reagent.

**Statement II:** In the above test, sulphanilic acid is diazotized by the acidified nitrite ion, which on further coupling with  $\alpha$ -naphthylamine forms an azo-dye.

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

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

**Q31** Atomic Structure[Step-by-step solution > prepwiser.in/questions/CUqAhS1UsA](https://www.prepwiser.in/questions/CUqAhS1UsA)

The wave numbers of three spectral lines of H atom are considered. Identify the set of spectral lines belonging to Balmer series.

( $R$  = Rydberg constant)

- (A)  $\frac{5R}{36}, \frac{3R}{16}, \frac{21R}{100}$       (B)  $\frac{7R}{144}, \frac{3R}{16}, \frac{16R}{255}$       (C)  $\frac{3R}{4}, \frac{3R}{16}, \frac{7R}{144}$       (D)  $\frac{5R}{36}, \frac{8R}{9}, \frac{15R}{16}$

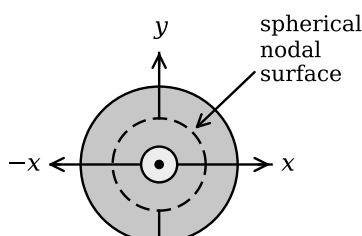
**Q32** Atomic Structure[Step-by-step solution > prepwiser.in/questions/p9FH\\_DFzbx](https://www.prepwiser.in/questions/p9FH_DFzbx)

Figure 1. electron probability density for 2s orbital

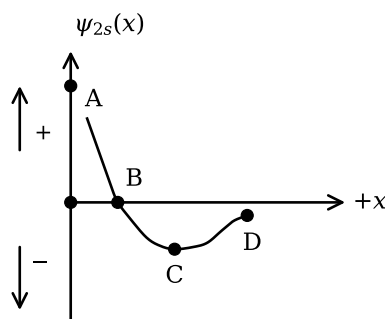
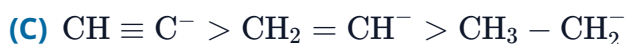
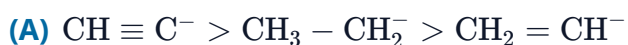
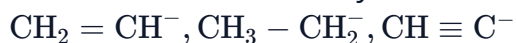


Figure 2. wave function for 2s orbital

Which of the following point in Figure 2 most accurately represents the nodal surface as shown in Figure 1?

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

CORRECT order of stability for the following is



An organic compound undergoes first order decomposition. The time taken for decomposition to  $\left(\frac{1}{8}\right)^{\text{th}}$  and  $\left(\frac{1}{10}\right)^{\text{th}}$  of its initial concentration are  $t_{1/8}$  and  $t_{1/10}$  respectively.

What is the value of  $\frac{t_{1/8}}{t_{1/10}} \times 10$ ?

( $\log 2 = 0.3$ )

(A) 30

(B) 9

(C) 3

(D) 0.9

Given below are two statements:

**Statement I:** The number of pairs, from the following, in which both the ions are coloured in aqueous solution is 3.



**Statement II:**  $\text{Th}^{4+}$  is the strongest reducing agent among  $\text{Th}^{4+}$ ,  $\text{Ce}^{4+}$ ,  $\text{Gd}^{3+}$  and  $\text{Eu}^{2+}$ .

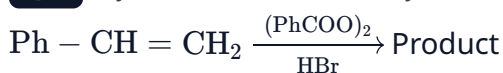
In the light of the above statements, choose the correct answer from the options given below

(A) Statement I is false but Statement II is true

(B) Both Statement I and Statement II are false

(C) Both Statement I and Statement II are true

(D) Statement I is true but Statement II is false



Consider the above reaction

A. The reaction proceeds through a more stable radical intermediate.

B. The role of peroxide is to generate



(Hydrogen radical).

C. During this reaction, benzene is formed as a byproduct.

D. 1-Bromo-2-phenylethane is formed as the minor product.

E. The same reaction in absence of peroxide proceeds via carbocation intermediate.

Identify the correct statements. Choose the correct answer from the options given below:

(A) A & E Only

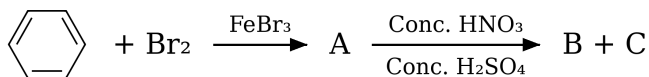
(B) A, B & D Only

(C) A, C & E Only

(D) C, D & E Only

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Method used for separation of mixture of products ( B and C ) obtained in the following reaction is



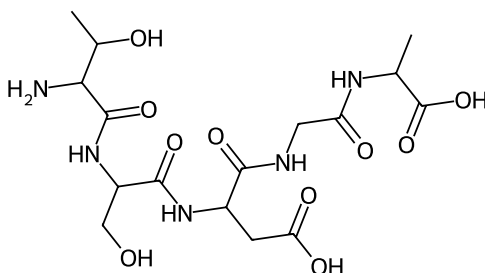
(A) simple distillation

(B) sublimation

(C) fractional distillation

(D) steam distillation

In the given pentapeptide, find out an essential amino acid (Y) and the sequence present in the pentapeptide:



Choose the correct answer from the options given below:

(A) (Y) Serine (Sequence) Thr-Ser-Asp-Ala-Gly

(B) (Y) Serine (Sequence) Ser-Asp-Thr-Ala-Gly

(C) (Y) Threonine (Sequence) Ser-Thr-Asp-Gly-Ala

(D) (Y) Threonine (Sequence) Thr-Ser-Asp-Gly-Ala

Regarding the hydrides of group 15 elements  $\text{EH}_3$  ( $\text{E} = \text{N}, \text{P}, \text{As}, \text{Sb}$ ), select the correct statement from the following:

A. The stability of hydrides decreases down the group.

B. The basicity of hydrides decreases down the group.

C. The reducing character increases down the group.

D. The boiling point increases down the group.

Choose the correct answer from the options given below:

(A) A, B & C only

(B) A, B, C & D

(C) A & D only

(D) B & C only

At  $T(K)$ , 2 moles of liquid A and 3 moles of liquid B are mixed. The vapour pressure of ideal solution formed is 320 mm Hg. At this stage, one mole of A and one mole of B are added to the solution. The vapour pressure is now measured as 328.6 mm Hg. The vapour pressure (in mm Hg) of A and B are respectively:

(A) 400, 300

(B) 600, 400

(C) 500, 200

(D) 300, 200

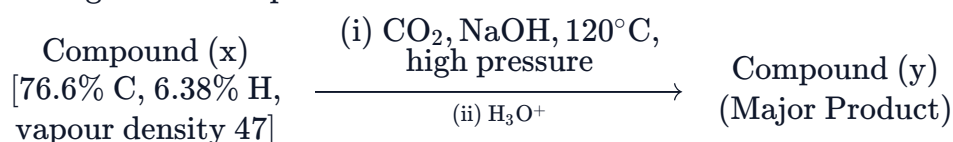
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20.0 dm<sup>3</sup> of an ideal gas 'X' at 600 K and 0.5 MPa undergoes isothermal reversible expansion until pressure of the gas is 0.2 MPa. Which of the following option is correct?

(Given:  $\log 2 = 0.3010$  and  $\log 5 = 0.6989$ )

- (A)  $w = -9.1 \text{ kJ}$ ,  $\Delta U = 0$ ,  $\Delta H = 0$ ,  $q = 9.1 \text{ kJ}$       (B)  $w = 9.1 \text{ J}$ ,  $\Delta U = 9.1 \text{ J}$ ,  $\Delta H = 0$ ;  $q = 0$   
 (C)  $w = -3.9 \text{ kJ}$ ,  $\Delta U = 0$ ,  $\Delta H = 0$ ;  $q = 3.9 \text{ kJ}$       (D)  $w = +4.1 \text{ kJ}$ ,  $\Delta U = 0$ ,  $\Delta H = 0$ ;  $q = -4.1 \text{ kJ}$

Consider the following reaction sequence



Compound (y) develops characteristic colour with neutral  $\text{FeCl}_3$  solution.

Identify the **INCORRECT** statement from the following for the above sequence.

- (A) Compound y will dissolve in  $\text{NaHCO}_3$  and evolve a gas.  
 (B) Compound x is more acidic than compound y.  
 (C) Both compounds x and y will dissolve in  $\text{NaOH}$ .  
 (D) Both compounds x and y will burn with sooty flame.

Given below are two statements:

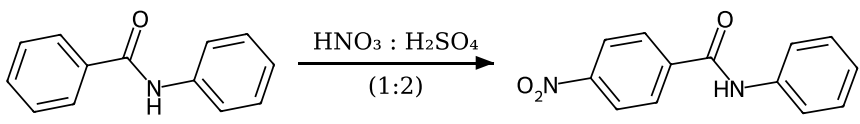
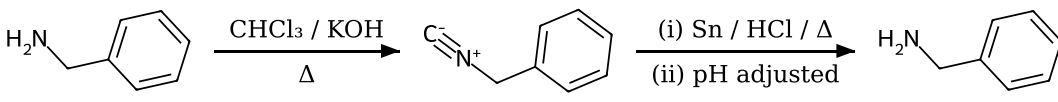
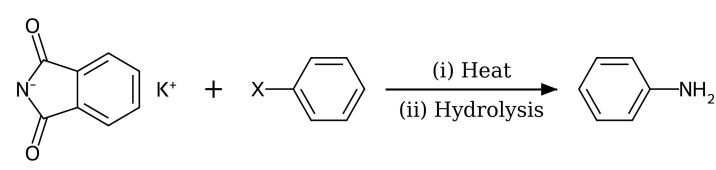
**Statement I:** The number of species among  $\text{BF}_4^-$ ,  $\text{SiF}_4$ ,  $\text{XeF}_4$  and  $\text{SF}_4$ , that have unequal E – F bond lengths is two. Here, E is the central atom.

**Statement II:** Among  $\text{O}_2^-$ ,  $\text{O}_2^{2-}$ ,  $\text{F}_2$  and  $\text{O}_2^+$ ,  $\text{O}_2^-$  has the highest bond order.

In the light of the above statements, choose the correct answer from 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

Consider the following reactions giving major product. Identify the correct reaction.

- (A) 
- (B) 
- (C) 
- (D) 
$$\text{H}_3\text{CCH}_2\text{C}(=\text{O})\text{NH}_2 + \text{Br}_2 + 4 \text{KOH (alc)} \xrightarrow{\Delta} \text{H}_3\text{CCH}_2\text{NH}_2 + 2\text{KBr} + \text{K}_2\text{CO}_3 + 2\text{H}_2\text{O}$$

In period 4 of the periodic table, the elements with highest and lowest atomic radii are respectively.

(A) Rb &amp; Br

(B) Na &amp; Cl

(C) K &amp; Br

(D) K &amp; Se

**Chemistry** Section B · Numerical value

Q46 to Q50

**Q46** Coordination Compounds **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/hkgJFcX\\_-E](https://www.prepwiser.in/questions/hkgJFcX_-E)

X is the number of geometrical isomers exhibited by  $[\text{Pt}(\text{NH}_3)(\text{H}_2\text{O})\text{BrCl}]$ .

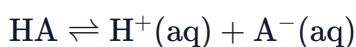
Y is the number of optically inactive isomer(s) exhibited by  $[\text{CrCl}_2(\text{ox})_2]^{3-}$

Z is the number of geometrical isomers exhibited by  $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]$ .

The value of  $X + Y + Z$  is \_\_\_\_.

**Q47** Ionic Equilibrium **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/5tSzerAWqS](https://www.prepwiser.in/questions/5tSzerAWqS)

Consider the dissociation equilibrium of the following weak acid



If the  $\text{pK}_a$  of the acid is 4, then the pH of 10 mM HA solution is \_\_\_\_.(Nearest integer)

[Given: The degree of dissociation can be neglected with respect to unity]

**Q48** Purification & Characterisation of Organic Compounds **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/d4FIYtnG\\_f](https://www.prepwiser.in/questions/d4FIYtnG_f)

0.53 g of an organic compound (x) when heated with excess of nitric acid (concentrated) and then with silver nitrate gave 0.75 g of silver bromide precipitate. 1.0 g of (x) gave 1.32 g of  $\text{CO}_2$  gas on combustion. The percentage of hydrogen in the compound (x) is \_\_\_\_ %. [Nearest Integer]

[Given: Molar mass in  $\text{gmol}^{-1}$  H : 1, C : 12, Br : 80, Ag : 108, O : 16; Compound (x):  $\text{C}_x\text{H}_y\text{Br}_z$ ]

**Q49** Electrochemistry **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/8wCaR70maN](https://www.prepwiser.in/questions/8wCaR70maN)

Consider the following redox reaction taking place in acidic medium



If the Nernst equation for the above balanced reaction is

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{RT}{nF} \ln Q,$$

then the value of  $n$  is \_\_\_\_.(Nearest integer)

**Q50** Redox Reactions **NUMERICAL**[Step-by-step solution](#) > [prepwiser.in/questions/Xwc8YL-PeN](https://www.prepwiser.in/questions/Xwc8YL-PeN)

500 mL of 1.2 M KI solution is mixed with 500 mL of 0.2M  $\text{KMnO}_4$  solution in basic medium. The liberated iodine was titrated with standard 0.1M  $\text{Na}_2\text{S}_2\text{O}_3$  solution in the presence of starch indicator till the blue color disappeared. The volume (in L) of  $\text{Na}_2\text{S}_2\text{O}_3$  consumed is \_\_\_\_.(Nearest integer)

**Q51** Complex Numbers

[Step-by-step solution](#) › [prepwisar.in/questions/jvtsk5sRvt](https://www.prepwisar.in/questions/jvtsk5sRvt)

Let  $z$  be a complex number such that  $|z - 6| = 5$  and  $|z + 2 - 6i| = 5$ . Then the value of  $z^3 + 3z^2 - 15z + 141$  is equal to:

- (A) 61 (B) 37 (C) 42 (D) 50

**Q52** Indefinite Integration

[Step-by-step solution](#) › [prepwisar.in/questions/n58Sj-4BxH](https://www.prepwisar.in/questions/n58Sj-4BxH)

If  $\int \left( \frac{1-5\cos^2 x}{\sin^5 x \cos^2 x} \right) dx = f(x) + C$ , where  $C$  is the constant of integration, then  $f\left(\frac{\pi}{6}\right) - f\left(\frac{\pi}{4}\right)$  is equal to

- (A)  $\frac{1}{\sqrt{3}}(26 - \sqrt{3})$  (B)  $\frac{4}{\sqrt{3}}(8 - \sqrt{6})$  (C)  $\frac{1}{\sqrt{3}}(26 + \sqrt{3})$  (D)  $\frac{2}{\sqrt{3}}(4 + \sqrt{6})$

**Q53** Matrices

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

Let  $A, B$  and  $C$  be three  $2 \times 2$  matrices with real entries such that  $B = (I + A)^{-1}$  and  $A + C = I$ .

If  $BC = \begin{bmatrix} 1 & -5 \\ -1 & 2 \end{bmatrix}$  and  $CB \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 12 \\ -6 \end{bmatrix}$ , then  $x_1 + x_2$  is

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

**Q54** Statistics

[Step-by-step solution](#) › [prepwisar.in/questions/Jx57rU0vUL](https://www.prepwisar.in/questions/Jx57rU0vUL)

The mean and variance of 10 observations are 9 and 34.2, respectively. If 8 of these observations are 2, 3, 5, 10, 11, 13, 15, 21, then the mean deviation about the median of all the 10 observations is

- (A) 7 (B) 4 (C) 5 (D) 6

**Q55** Vectors

[Step-by-step solution](#) › [prepwisar.in/questions/9u9wfFILST](https://www.prepwisar.in/questions/9u9wfFILST)

For three unit vectors  $\vec{a}, \vec{b}, \vec{c}$  satisfying

$$|\vec{a} - \vec{b}|^2 + |\vec{b} - \vec{c}|^2 + |\vec{c} - \vec{a}|^2 = 9 \text{ and } |2\vec{a} + k\vec{b} + k\vec{c}| = 3,$$

the positive value of  $k$  is:

- (A) 4 (B) 5 (C) 6 (D) 3

**Q56** Area Under Curves

[Step-by-step solution](#) › [prepwisar.in/questions/ZkVKf0QaAs](https://www.prepwisar.in/questions/ZkVKf0QaAs)

The area of the region  $R = \{(x, y) : xy \leq 8, 1 \leq y \leq x^2, x \geq 0\}$  is

- (A)  $\frac{2}{3}(20 \log_e(2) + 9)$  (B)  $\frac{1}{3}(40 \log_e(2) + 27)$  (C)  $\frac{1}{3}(49 \log_e(2) - 15)$  (D)  $\frac{2}{3}(24 \log_e(2) - 7)$

**Q57** Definite Integration

[Step-by-step solution](#) › [prepwisar.in/questions/rqPaAI\\_Tel](https://www.prepwisar.in/questions/rqPaAI_Tel)

Let  $f$  be a polynomial function such that  $f(x^2 + 1) = x^4 + 5x^2 + 2$ , for all  $x \in \mathbb{R}$ .

Then  $\int_0^3 f(x) dx$  is equal to

- (A)  $\frac{33}{2}$  (B)  $\frac{5}{3}$  (C)  $\frac{27}{2}$  (D)  $\frac{41}{3}$

**Q58** Relations & Functions (Basic)

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

If  $g(x) = 3x^2 + 2x - 3$ ,  $f(0) = -3$  and  $4g(f(x)) = 3x^2 - 32x + 72$ , then  $f(g(2))$  is equal to:

- (A)  $\frac{7}{2}$  (B)  $-\frac{25}{6}$  (C)  $\frac{25}{6}$  (D)  $-\frac{7}{2}$

**Q59** Quadratic Equations & Polynomial Inequalities[Step-by-step solution](https://www.prepwiser.in/questions/pRLmaJ8ce3) › prepwiser.in/questions/pRLmaJ8ce3

If  $\alpha, \beta$ , where  $\alpha < \beta$ , are the roots of the equation  $\lambda x^2 - (\lambda + 3)x + 3 = 0$  such that  $\frac{1}{\alpha} - \frac{1}{\beta} = \frac{1}{3}$ , then the sum of all possible values of  $\lambda$  is

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

**Q60** Quadratic Equations & Polynomial Inequalities[Step-by-step solution](https://www.prepwiser.in/questions/qJb8mphEEp) › prepwiser.in/questions/qJb8mphEEp

Let  $S = \{x^3 + ax^2 + bx + c : a, b, c \in \mathbb{N} \text{ and } a, b, c \leq 20\}$  be a set of polynomials. Then the number of polynomials in  $S$ , which are divisible by  $x^2 + 2$ , is

- (A) 6 (B) 120 (C) 20 (D) 10

**Q61** Straight Lines[Step-by-step solution](https://www.prepwiser.in/questions/YmLqd5X282) › prepwiser.in/questions/YmLqd5X282

Let ABC be an equilateral triangle with orthocenter at the origin and the side BC on the line  $x + 2\sqrt{2}y = 4$ . If the co-ordinates of the vertex A are  $(\alpha, \beta)$ , then the greatest integer less than or equal to  $|\alpha + \sqrt{2}\beta|$  is

- (A) 5 (B) 4 (C) 2 (D) 3

**Q62** Differential Equations[Step-by-step solution](https://www.prepwiser.in/questions/IDEeygxb5H) › prepwiser.in/questions/IDEeygxb5H

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

$$x \frac{dy}{dx} - \sin 2y = x^3 (2 - x^3) \cos^2 y, x \neq 0.$$

If  $y(2) = 0$ , then  $\tan(y(1))$  is equal to

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

**Q63** Limits[Step-by-step solution](https://www.prepwiser.in/questions/chJoEKg8b9) › prepwiser.in/questions/chJoEKg8b9

The value of

$$\lim_{x \rightarrow 0} \frac{\log_e (\sec(ex) \cdot \sec(e^2x) \cdot \dots \cdot \sec(e^{10}x))}{e^2 - e^{2 \cos x}}$$

is equal to

- (A)  $\frac{(e^{10} - 1)}{2e^2(e^2 - 1)}$  (B)  $\frac{(e^{20} - 1)}{2e^2(e^2 - 1)}$  (C)  $\frac{(e^{10} - 1)}{2(e^2 - 1)}$  (D)  $\frac{(e^{20} - 1)}{2(e^2 - 1)}$

**Q64** Permutations & Combinations[Step-by-step solution](https://www.prepwiser.in/questions/zo1jclFgSz) › prepwiser.in/questions/zo1jclFgSz

Let  $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ . Let  $x$  be the number of 9-digit numbers formed using the digits of the set  $S$  such that only one digit is repeated and it is repeated exactly twice. Let  $y$  be the number of 9-digit numbers formed using the digits of the set  $S$  such that only two digits are repeated and each of these is repeated exactly twice. Then,

- (A)  $56x = 9y$  (B)  $21x = 4y$  (C)  $45x = 7y$  (D)  $29x = 5y$

**Q65** Sequences & Series[Step-by-step solution](https://www.prepwiser.in/questions/gU_dYv5yIT) › prepwiser.in/questions/gU\_dYv5yIT

The value of  $\sum_{k=1}^{\infty} (-1)^{k+1} \left( \frac{k(k+1)}{k!} \right)$  is

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

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**Q66** Sequences & Series[Step-by-step solution](#) > prepwiser.in/questions/9TpsoTqfxl

The common difference of the A.P.:  $a_1, a_2, \dots, a_m$  is 13 more than the common difference of the A.P.:  $b_1, b_2, \dots, b_n$ . If  $b_{31} = -277, b_{43} = -385$  and  $a_{78} = 327$ , then  $a_1$  is equal to

- (A) 21 (B) 19 (C) 24 (D) 16

**Q67** Three Dimensional Geometry[Step-by-step solution](#) > prepwiser.in/questions/jWCD4Vz\_uI

If the distances of the point  $(1, 2, a)$  from the line  $\frac{x-1}{1} = \frac{y}{2} = \frac{z-1}{1}$  along the lines  $L_1 : \frac{x-1}{3} = \frac{y-2}{4} = \frac{z-a}{b}$  and  $L_2 : \frac{x-1}{1} = \frac{y-2}{4} = \frac{z-a}{c}$  are equal, then  $a + b + c$  is equal to

- (A) 4 (B) 6 (C) 7 (D) 5

**Q68** Circles[Step-by-step solution](#) > prepwiser.in/questions/cNZayL4Y3O

Let  $y = x$  be the equation of a chord of the circle  $C_1$  (in the closed half-plane  $x \geq 0$ ) of diameter 10 passing through the origin. Let  $C_2$  be another circle described on the given chord as its diameter. If the equation of the chord of the circle  $C_2$ , which passes through the point  $(2, 3)$  and is farthest from the center of  $C_2$ , is  $x + ay + b = 0$ , then  $a - b$  is equal to

- (A) -6 (B) 10 (C) 6 (D) -2

**Q69** Probability: Advanced[Step-by-step solution](#) > prepwiser.in/questions/89St\_gzGEv

A bag contains 10 balls out of which  $k$  are red and  $(10 - k)$  are black, where  $0 \leq k \leq 10$ . If three balls are drawn at random without replacement and all of them are found to be black, then the probability that the bag contains 1 red and 9 black balls is:

- (A)  $\frac{7}{110}$  (B)  $\frac{7}{11}$  (C)  $\frac{7}{55}$  (D)  $\frac{14}{55}$

**Q70** Trigonometric Ratios & Identities[Step-by-step solution](#) > prepwiser.in/questions/WAP9Zen2Op

If  $\frac{\tan(A-B)}{\tan A} + \frac{\sin^2 C}{\sin^2 A} = 1, A, B, C \in (0, \frac{\pi}{2})$ , then

- (A)  $\tan A, \tan C, \tan B$  are in A.P. (B)  $\tan A, \tan C, \tan B$  are in G.P.  
(C)  $\tan A, \tan B, \tan C$  are in G.P. (D)  $\tan A, \tan B, \tan C$  are in A.P.

**Mathematics Section B · Numerical value**

Q71 to Q74

**Q71** Definite Integration **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/Rvs5OTZ7Mc

The value of  $\sum_{r=1}^{20} \left( \left| \sqrt{\pi \left( \int_0^r x |\sin \pi x| dx \right)} \right| \right)$  is

**Q72** Inverse Trigonometric Functions **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/PZRuvjL7C-

If  $k = \tan \left( \frac{\pi}{4} + \frac{1}{2} \cos^{-1} \left( \frac{2}{3} \right) \right) + \tan \left( \frac{1}{2} \sin^{-1} \left( \frac{2}{3} \right) \right)$ , then the number of solutions of the equation  $\sin^{-1}(kx - 1) = \sin^{-1} x - \cos^{-1} x$  is \_\_\_\_.

**Q73** Sequences & Series **NUMERICAL**[Step-by-step solution](#) > prepwiser.in/questions/Rm2KF8gKr\_

In a G.P., if the product of the first three terms is 27 and the set of all possible values for the sum of its first three terms is  $\mathbb{R} - (a, b)$ , then  $a^2 + b^2$  is equal to

\_\_\_\_.

For some  $\theta \in (0, \frac{\pi}{2})$ , let the eccentricity and the length of the latus rectum of the hyperbola  $x^2 - y^2 \sec^2 \theta = 8$  be  $e_1$  and  $l_1$ , respectively, and let the eccentricity and the length of the latus rectum of the ellipse  $x^2 \sec^2 \theta + y^2 = 6$  be  $e_2$  and  $l_2$ , respectively. If  $e_1^2 = e_2^2 (\sec^2 \theta + 1)$ , then  $\left(\frac{l_1 l_2}{e_1 e_2}\right) \tan^2 \theta$  is equal to

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### Physics

|         |        |       |       |       |       |       |       |       |       |
|---------|--------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. B    | 2. C   | 3. B  | 4. B  | 5. D  | 6. C  | 7. C  | 8. B  | 9. A  | 10. B |
| 11. C   | 12. B  | 13. D | 14. C | 15. B | 16. D | 17. C | 18. D | 19. B | 20. D |
| 21. 265 | 22. 21 | 23. 2 | 24. 2 | 25. 3 |       |       |       |       |       |

### Chemistry

|       |       |       |        |       |       |       |       |       |       |
|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|
| 26. B | 27. D | 28. D | 29. B  | 30. D | 31. A | 32. B | 33. C | 34. B | 35. B |
| 36. C | 37. C | 38. D | 39. A  | 40. C | 41. A | 42. B | 43. A | 44. D | 45. C |
| 46. 6 | 47. 3 | 48. 4 | 49. 24 | 50. 3 |       |       |       |       |       |

### Mathematics

|         |       |        |       |       |       |       |       |       |       |
|---------|-------|--------|-------|-------|-------|-------|-------|-------|-------|
| 51. D   | 52. B | 53. C  | 54. C | 55. B | 56. D | 57. A | 58. A | 59. B | 60. D |
| 61. B   | 62. D | 63. D  | 64. B | 65. D | 66. B | 67. C | 68. D | 69. D | 70. B |
| 71. 210 | 72. 1 | 73. 90 | 74. 8 |       |       |       |       |       |       |

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