

Question ID:101761

Topic Name:Mathematics-Section A

Question:

The probability that a randomly chosen  $2 \times 2$  matrix with all the entries from the set of first 10 primes, is singular, is equal to :

A  $\frac{133}{10^4}$

B  $\frac{18}{10^3}$

C  $\frac{19}{10^3}$

D  $\frac{271}{10^4}$

Question ID:101762

Topic Name:Mathematics-Section A

Let the solution curve of the differential equation

$$x \frac{dy}{dx} - y = \sqrt{y^2 + 16x^2}, \quad y(1) = 3 \text{ be } y = y(x). \text{ Then } y(2) \text{ is equal to :}$$

Question:

A 15

B 11

C 13

D 17

Question ID:101763

Topic Name:Mathematics-Section A

Question:

If the mirror image of the point  $(2, 4, 7)$  in the plane  $3x - y + 4z = 2$  is  $(a, b, c)$ , then  $2a + b + 2c$  is equal to :

A 54

B 50

C -6

D -42

Question ID:101764

Topic Name:Mathematics-Section A

Question:

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

$$f(x) = \begin{cases} \max_{t \leq x} \{t^3 - 3t\} & ; x \leq 2 \\ x^2 + 2x - 6 & ; 2 < x < 3 \\ [x - 3] + 9 & ; 3 \leq x \leq 5 \\ 2x + 1 & ; x > 5 \end{cases}$$

where  $[t]$  is the greatest integer less than or equal to  $t$ . Let  $m$  be the number of points where
 $f$  is not differentiable and  $I = \int_{-2}^2 f(x) dx$ . Then the ordered pair  $(m, I)$  is equal to :

A  $\left(3, \frac{27}{4}\right)$

B  $\left(3, \frac{23}{4}\right)$

C  $\left(4, \frac{27}{4}\right)$

D  $\left(4, \frac{23}{4}\right)$

Question ID:101765

Topic Name:Mathematics-Section A

Question:

Let  $\vec{a} = \alpha \hat{i} + 3 \hat{j} - \hat{k}$ ,  $\vec{b} = 3 \hat{i} - \beta \hat{j} + 4 \hat{k}$  and  $\vec{c} = \hat{i} + 2 \hat{j} - 2 \hat{k}$  where  $\alpha, \beta \in \mathbf{R}$ , be threevectors. If the projection of  $\vec{a}$  on  $\vec{c}$  is  $\frac{10}{3}$  and  $\vec{b} \times \vec{c} = -6 \hat{i} + 10 \hat{j} + 7 \hat{k}$ , then the value of $\alpha + \beta$  is equal to :

A 3

B 4

C 5

D 6

Question ID:101766

Topic Name:Mathematics-Section A

Question:

The area enclosed by  $y^2=8x$  and  $y=\sqrt{2}x$  that lies outside the triangle formed by  $y=\sqrt{2}x$ ,  $x=1$ ,  $y=2\sqrt{2}$ , is equal to :

A  $\frac{16\sqrt{2}}{6}$

B  $\frac{11\sqrt{2}}{6}$

C  $\frac{13\sqrt{2}}{6}$

D  $\frac{5\sqrt{2}}{6}$

Question ID:101767

Topic Name:Mathematics-Section A

If the system of linear equations

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

$$x - 3y + 2z = 1$$

$$x + 4y + \delta z = k, \text{ where } \delta, k \in \mathbf{R}$$

Question: has infinitely many solutions, then  $\delta + k$  is equal to :

A  $-3$

B  $3$

C  $6$

D  $9$

Question ID:101768

Topic Name:Mathematics-Section A

Question:

Let  $\alpha$  and  $\beta$  be the roots of the equation  $x^2 + (2i - 1)x = 0$ . Then, the value of  $|\alpha^8 + \beta^8|$  is equal to :

A  $50$

B  $250$

C  $1250$

D  $1500$

Question ID:101769

Topic Name:Mathematics-Section A

Question:

Let  $\Delta \in \{\wedge, \vee, \Rightarrow, \Leftrightarrow\}$  be such that  $(p \wedge q) \Delta ((p \vee q) \Rightarrow q)$  is a tautology. Then  $\Delta$  is equal to :

- A  $\wedge$
- B  $\vee$
- C  $\Rightarrow$
- D  $\Leftrightarrow$

Question ID:101770

Topic Name:Mathematics-Section A

Let  $A = [a_{ij}]$  be a square matrix of order 3 such that  $a_{ij} = 2^{j-i}$ , for all  $i, j = 1, 2, 3$ . Then, the matrix  $A^2 + A^3 + \dots + A^{10}$  is equal to :

Question:

- A  $\left(\frac{3^{10} - 3}{2}\right)A$
- B  $\left(\frac{3^{10} - 1}{2}\right)A$
- C  $\left(\frac{3^{10} + 1}{2}\right)A$
- D  $\left(\frac{3^{10} + 3}{2}\right)A$

Question ID:101771

Topic Name:Mathematics-Section A

Question:

Let a set  $A = A_1 \cup A_2 \cup \dots \cup A_k$ , where  $A_i \cap A_j = \phi$  for  $i \neq j, 1 \leq i, j \leq k$ . Define the relation R from A to A by  $R = \{(x, y) : y \in A_i \text{ if and only if } x \in A_i, 1 \leq i \leq k\}$ . Then, R is :

- A reflexive, symmetric but not transitive
- B reflexive, transitive but not symmetric
- C reflexive but not symmetric and transitive
- D an equivalence relation

Question ID:101772

Topic Name:Mathematics-Section A

**Question:**

Let  $\{a_n\}_{n=0}^{\infty}$  be a sequence such that  $a_0 = a_1 = 0$  and  $a_{n+2} = 2a_{n+1} - a_n + 1$  for all  $n \geq 0$ .

Then,  $\sum_{n=2}^{\infty} \frac{a_n}{7^n}$  is equal to :

A  $\frac{6}{343}$

B  $\frac{7}{216}$

C  $\frac{8}{343}$

D  $\frac{49}{216}$

**Question ID:**101773

**Topic Name:**Mathematics-Section A

**Question:**

The distance between the two points A and A' which lie on  $y=2$  such that both the line segments AB and A' B (where B is the point (2, 3)) subtend angle  $\frac{\pi}{4}$  at the origin, is equal to :

A 10

B  $\frac{48}{5}$

C  $\frac{52}{5}$

D 3

**Question ID:**101774

**Topic Name:**Mathematics-Section A

**Question:**

A wire of length 22 m is to be cut into two pieces. One of the pieces is to be made into a square and the other into an equilateral triangle. Then, the length of the side of the equilateral triangle, so that the combined area of the square and the equilateral triangle is minimum, is :

A  $\frac{22}{9 + 4\sqrt{3}}$

B

$$\frac{66}{9 + 4\sqrt{3}}$$

C 
$$\frac{22}{4 + 9\sqrt{3}}$$

D 
$$\frac{66}{4 + 9\sqrt{3}}$$

Question ID:101775

Topic Name:Mathematics-Section A

The domain of the function  $\cos^{-1} \left( \frac{2 \sin^{-1} \left( \frac{1}{4x^2-1} \right)}{\pi} \right)$  is :

Question:

A 
$$\mathbf{R} - \left\{ -\frac{1}{2}, \frac{1}{2} \right\}$$

B 
$$(-\infty, -1] \cup [1, \infty) \cup \{0\}$$

C 
$$\left(-\infty, \frac{-1}{2}\right) \cup \left(\frac{1}{2}, \infty\right) \cup \{0\}$$

D 
$$\left(-\infty, \frac{-1}{\sqrt{2}}\right] \cup \left[\frac{1}{\sqrt{2}}, \infty\right) \cup \{0\}$$

Question ID:101776

Topic Name:Mathematics-Section A

Question:

If the constant term in the expansion of  $\left(3x^3 - 2x^2 + \frac{5}{x^5}\right)^{10}$  is  $2^k \cdot l$ , where  $l$  is an odd

integer, then the value of  $k$  is equal to :

A 6

B 7

C 8

D 9

Question ID:101777

Topic Name:Mathematics-Section A

$$\int_0^5 \cos \left( \pi \left( x - \left[ \frac{x}{2} \right] \right) \right) dx,$$

**Question:** where  $[t]$  denotes greatest integer less than or equal to  $t$ , is equal to :

- A  $-3$
- B  $-2$
- C  $2$
- D  $0$

**Question ID:**101778

**Topic Name:**Mathematics-Section A

**Question:**

Let PQ be a focal chord of the parabola  $y^2 = 4x$  such that it subtends an angle of  $\frac{\pi}{2}$  at the point  $(3, 0)$ . Let the line segment PQ be also a focal chord of the ellipse

$E: \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, a^2 > b^2$ . If  $e$  is the eccentricity of the ellipse  $E$ , then the value of  $\frac{1}{e^2}$  is

equal to :

- A  $1 + \sqrt{2}$
- B  $3 + 2\sqrt{2}$
- C  $1 + 2\sqrt{3}$
- D  $4 + 5\sqrt{3}$

**Question ID:**101779

**Topic Name:**Mathematics-Section A

**Question:**

Let the tangent to the circle  $C_1 : x^2 + y^2 = 2$  at the point  $M(-1, 1)$  intersect the circle  $C_2 : (x-3)^2 + (y-2)^2 = 5$ , at two distinct points A and B. If the tangents to  $C_2$  at the points A and B intersect at N, then the area of the triangle ANB is equal to :

- A  $\frac{1}{2}$
- B  $\frac{2}{3}$
- C  $\frac{1}{6}$
- D

$$\frac{5}{3}$$

Question ID:101780

Topic Name:Mathematics-Section A

Question:

Let the mean and the variance of 5 observations  $x_1, x_2, x_3, x_4, x_5$  be  $\frac{24}{5}$  and  $\frac{194}{25}$  respectively.

If the mean and variance of the first 4 observation are  $\frac{7}{2}$  and  $a$  respectively, then  $(4a + x_5)$  is equal to :

- A 13
- B 15
- C 17
- D 18

Question ID:101781

Topic Name:Mathematics-Section B

Question:

Let  $S = \{z \in \mathbb{C} : |z - 2| \leq 1, z(1 + i) + \bar{z}(1 - i) \leq 2\}$ . Let  $|z - 4i|$  attains minimum and maximum values, respectively, at  $z_1 \in S$  and  $z_2 \in S$ . If  $5(|z_1|^2 + |z_2|^2) = \alpha + \beta\sqrt{5}$ , where  $\alpha$  and  $\beta$  are integers, then the value of  $\alpha + \beta$  is equal to \_\_\_\_\_.

Question ID:101782

Topic Name:Mathematics-Section B

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

$$\frac{dy}{dx} + \frac{\sqrt{2}y}{2\cos^4 x - \cos 2x} = xe^{\tan^{-1}(\sqrt{2}\cot 2x)}, \quad 0 < x < \frac{\pi}{2} \quad \text{with} \quad y\left(\frac{\pi}{4}\right) = \frac{\pi^2}{32}.$$

If  $y\left(\frac{\pi}{3}\right) = \frac{\pi^2}{18} e^{-\tan^{-1}(\alpha)}$ , then the value of  $3\alpha^2$  is equal to \_\_\_\_\_.

Question:

Question ID:101783

Topic Name:Mathematics-Section B

Question:

Let  $d$  be the distance between the foot of perpendiculars of the points  $P(1, 2, -1)$  and  $Q(2, -1, 3)$  on the plane  $-x + y + z = 1$ . Then  $d^2$  is equal to \_\_\_\_\_.



**Question ID:101784****Topic Name:**Mathematics-Section B**Question:**

The number of elements in the set  $S = \{\theta \in [-4\pi, 4\pi] : 3 \cos^2 2\theta + 6 \cos 2\theta - 10 \cos^2 \theta + 5 = 0\}$  is \_\_\_\_\_.

**Question ID:101785****Topic Name:**Mathematics-Section B**Question:**

The number of solutions of the equation  $2\theta - \cos^2 \theta + \sqrt{2} = 0$  in  $\mathbf{R}$  is equal to \_\_\_\_\_.

**Question ID:101786****Topic Name:**Mathematics-Section B**Question:**

$50 \tan \left( 3 \tan^{-1} \left( \frac{1}{2} \right) + 2 \cos^{-1} \left( \frac{1}{\sqrt{5}} \right) \right) + 4\sqrt{2} \tan \left( \frac{1}{2} \tan^{-1} (2\sqrt{2}) \right)$  is equal to \_\_\_\_\_.

**Question ID:101787****Topic Name:**Mathematics-Section B**Question:**

Let  $c, k \in \mathbf{R}$ . If  $f(x) = (c+1)x^2 + (1-c^2)x + 2k$  and  $f(x+y) = f(x) + f(y) - xy$ , for all  $x, y \in \mathbf{R}$ , then the value of  $|2(f(1) + f(2) + f(3) + \dots + f(20))|$  is equal to \_\_\_\_\_.

**Question ID:101788****Topic Name:**Mathematics-Section B**Question:**

Let  $H: \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1, a > 0, b > 0$ , be a hyperbola such that the sum of lengths of the transverse and the conjugate axes is  $4(2\sqrt{2} + \sqrt{14})$ . If the eccentricity  $H$  is  $\frac{\sqrt{11}}{2}$ , then the value of  $a^2 + b^2$  is equal to \_\_\_\_\_.

**Question ID:101789****Topic Name:**Mathematics-Section B**Question:**

Let  $P_1: \vec{r} \cdot (2\hat{i} + \hat{j} - 3\hat{k}) = 4$  be a plane. Let  $P_2$  be another plane which passes through the points  $(2, -3, 2), (2, -2, -3)$  and  $(1, -4, 2)$ . If the direction ratios of the line of intersection of  $P_1$  and  $P_2$  be  $16, \alpha, \beta$ , then the value of  $\alpha + \beta$  is equal to \_\_\_\_\_.

**Question ID:101790****Topic Name:**Mathematics-Section B

**Question:**

Let  $b_1b_2b_3b_4$  be a 4-element permutation with  $b_i \in \{1, 2, 3, \dots, 100\}$  for  $1 \leq i \leq 4$  and  $b_i \neq b_j$  for  $i \neq j$ , such that either  $b_1, b_2, b_3$  are consecutive integers or  $b_2, b_3, b_4$  are consecutive integers. Then the number of such permutations  $b_1b_2b_3b_4$  is equal to \_\_\_\_\_.

**Question ID:101701****Topic Name:**Physics-Section A**Question:**

Two balls A and B are placed at the top of 180 m tall tower. Ball A is released from the top at  $t=0$  s. Ball B is thrown vertically down with an initial velocity 'u' at  $t=2$  s. After a certain time, both balls meet 100 m above the ground. Find the value of 'u' in  $\text{ms}^{-1}$ . [use  $g=10 \text{ ms}^{-2}$ ]:

- A 10
- B 15
- C 20
- D 30

**Question ID:101702****Topic Name:**Physics-Section A**Question:**

A body of mass M at rest explodes into three pieces, in the ratio of masses 1 : 1 : 2. Two smaller pieces fly off perpendicular to each other with velocities of  $30 \text{ ms}^{-1}$  and  $40 \text{ ms}^{-1}$  respectively. The velocity of the third piece will be :

- A  $15 \text{ ms}^{-1}$
- B  $25 \text{ ms}^{-1}$
- C  $35 \text{ ms}^{-1}$
- D  $50 \text{ ms}^{-1}$

**Question ID:101703****Topic Name:**Physics-Section A**Question:**

The activity of a radioactive material is  $2.56 \times 10^{-3}$  Ci. If the half life of the material is 5 days, after how many days the activity will become  $2 \times 10^{-5}$  Ci ?

- A 30 days
- B 35 days
- C 40 days
- D 25 days

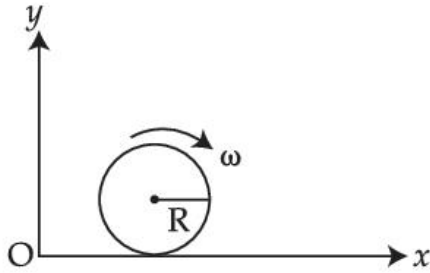
Answer Given By Candidate: B

Question ID:101704

Topic Name:Physics-Section A

Question:

A spherical shell of 1 kg mass and radius  $R$  is rolling with angular speed  $\omega$  on horizontal plane (as shown in figure). The magnitude of angular momentum of the shell about the origin  $O$  is  $\frac{a}{3} R^2\omega$ . The value of  $a$  will be :



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

Question ID:101705

Topic Name:Physics-Section A

Question:

A cylinder of fixed capacity of 44.8 litres contains helium gas at standard temperature and pressure. The amount of heat needed to raise the temperature of gas in the cylinder by  $20.0^\circ\text{C}$  will be :

(Given gas constant  $R = 8.3 \text{ JK}^{-1}\text{-mol}^{-1}$ )

- A 249 J
- B 415 J
- C 498 J
- D 830 J

Question ID:101706

Topic Name:Physics-Section A

Question:

A wire of length  $L$  is hanging from a fixed support. The length changes to  $L_1$  and  $L_2$  when masses 1 kg and 2 kg are suspended respectively from its free end. Then the value of  $L$  is equal to :

- A  $\sqrt{L_1 L_2}$

- B  $\frac{L_1 + L_2}{2}$
- C  $2L_1 - L_2$
- D  $3L_1 - 2L_2$

Question ID:101707

Topic Name:Physics-Section A

Question:

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

**Assertion A :** The photoelectric effect does not takes place, if the energy of the incident radiation is less than the work function of a metal.

**Reason R :** Kinetic energy of the photoelectrons is zero, if the energy of the incident radiation is equal to the work function of a metal.

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

Question ID:101708

Topic Name:Physics-Section A

Question:

A particle of mass 500 gm is moving in a straight line with velocity  $v = b x^{5/2}$ . The work done by the net force during its displacement from  $x=0$  to  $x=4$  m is : (Take  $b=0.25 \text{ m}^{-3/2} \text{ s}^{-1}$ ).

- A 2 J
- B 4 J
- C 8 J
- D 16 J

Question ID:101709

Topic Name:Physics-Section A

Question:

A charge particle moves along circular path in a uniform magnetic field in a cyclotron. The kinetic energy of the charge particle increases to 4 times its initial value. What will be the ratio of new radius to the original radius of circular path of the charge particle :

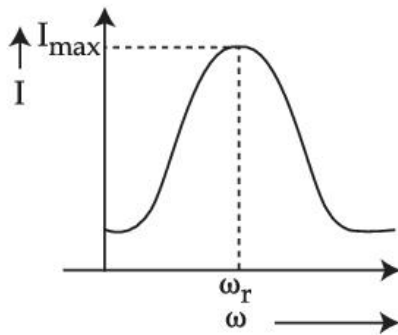
- A 1 : 1
- B 1 : 2
- C 2 : 1
- D 1 : 4

Question ID:101710

Topic Name:Physics-Section A

For a series LCR circuit, I vs  $\omega$  curve is shown :

- (a) To the left of  $\omega_r$ , the circuit is mainly capacitive.
- (b) To the left of  $\omega_r$ , the circuit is mainly inductive.
- (c) At  $\omega_r$ , impedance of the circuit is equal to the resistance of the circuit.
- (d) At  $\omega_r$ , impedance of the circuit is 0.



Question: Choose the **most appropriate** answer from the options given below :

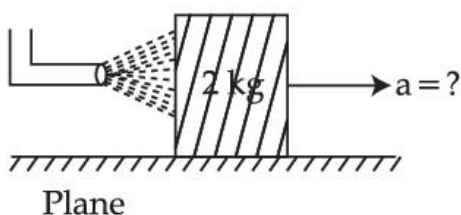
- A (a) and (d) only
- B (b) and (d) only
- C (a) and (c) only
- D (b) and (c) only

Question ID:101711

Topic Name:Physics-Section A

Question:

A block of metal weighing 2 kg is resting on a frictionless plane (as shown in figure). It is struck by a jet releasing water at a rate of  $1 \text{ kg s}^{-1}$  and at a speed of  $10 \text{ ms}^{-1}$ . Then, the initial acceleration of the block, in  $\text{ms}^{-2}$ , will be :



- A 3

B 6

C 5

D 4

**Question ID:101712**

Topic Name:Physics-Section A

Question:

In van der Waals equation  $\left[P + \frac{a}{V^2}\right] [V - b] = RT$ ; P is pressure, V is volume, R is universal gas

constant and T is temperature. The ratio of constants  $\frac{a}{b}$  is dimensionally equal to :

A  $\frac{P}{V}$ B  $\frac{V}{P}$ 

C PV

D  $PV^3$ **Question ID:101713**

Topic Name:Physics-Section A

Question:

Two vectors  $\vec{A}$  and  $\vec{B}$  have equal magnitudes. If magnitude of  $\vec{A} + \vec{B}$  is equal to two times the magnitude of  $\vec{A} - \vec{B}$ , then the angle between  $\vec{A}$  and  $\vec{B}$  will be :

A  $\sin^{-1}\left(\frac{3}{5}\right)$ B  $\sin^{-1}\left(\frac{1}{3}\right)$ C  $\cos^{-1}\left(\frac{3}{5}\right)$ D  $\cos^{-1}\left(\frac{1}{3}\right)$ **Question ID:101714**

Topic Name:Physics-Section A



**Question:**

The escape velocity of a body on a planet 'A' is  $12 \text{ kms}^{-1}$ . The escape velocity of the body on another planet 'B', whose density is four times and radius is half of the planet 'A', is :

- A  $12 \text{ kms}^{-1}$
- B  $24 \text{ kms}^{-1}$
- C  $36 \text{ kms}^{-1}$
- D  $6 \text{ kms}^{-1}$

**Question ID:101715**

**Topic Name:**Physics-Section A

**Question:**

At a certain place the angle of dip is  $30^\circ$  and the horizontal component of earth's magnetic field is  $0.5 \text{ G}$ . The earth's total magnetic field (in G), at that certain place, is :

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

**Question ID:101716**

**Topic Name:**Physics-Section A

**Question:**

A longitudinal wave is represented by  $x = 10 \sin 2\pi \left( nt - \frac{x}{\lambda} \right)$  cm. The maximum particle velocity will be four times the wave velocity if the determined value of wavelength is equal to :

- A  $2\pi$
- B  $5\pi$
- C  $\pi$
- D  $\frac{5\pi}{2}$

**Question ID:101717**

**Topic Name:**Physics-Section A

**Question:**

A parallel plate capacitor filled with a medium of dielectric constant 10, is connected across a battery and is charged. The dielectric slab is replaced by another slab of dielectric constant 15. Then the energy of capacitor will :

- A increase by 50%
- B decrease by 15%
- C increase by 25%
- D increase by 33%

**Question ID:101718****Topic Name:**Physics-Section A**Question:**

A positive charge particle of 100 mg is thrown in opposite direction to a uniform electric field of strength  $1 \times 10^5 \text{ NC}^{-1}$ . If the charge on the particle is  $40 \mu\text{C}$  and the initial velocity is  $200 \text{ ms}^{-1}$ , how much distance it will travel before coming to the rest momentarily :

- A 1 m
- B 5 m
- C 10 m
- D 0.5 m

**Question ID:101719****Topic Name:**Physics-Section A

Using Young's double slit experiment, a monochromatic light of wavelength  $5000 \text{ \AA}$  produces fringes of fringe width 0.5 mm. If another monochromatic light of wavelength  $6000 \text{ \AA}$  is used and the separation between the slits is doubled, then the new fringe width will be :

**Question:**

- A 0.5 mm
- B 1.0 mm
- C 0.6 mm
- D 0.3 mm

**Question ID:101720****Topic Name:**Physics-Section A**Question:**

Only 2% of the optical source frequency is the available channel bandwidth for an optical communicating system operating at 1000 nm. If an audio signal requires a bandwidth of 8 kHz, how many channels can be accommodated for transmission :

- A  $375 \times 10^7$



- B  $75 \times 10^7$
- C  $375 \times 10^8$
- D  $75 \times 10^9$

Question ID:101721

Topic Name:Physics-Section B

Question:

Two coils require 20 minutes and 60 minutes respectively to produce same amount of heat energy when connected separately to the same source. If they are connected in parallel arrangement to the same source; the time required to produce same amount of heat by the combination of coils, will be \_\_\_\_\_ min.

Question ID:101722

Topic Name:Physics-Section B

Question:

The intensity of the light from a bulb incident on a surface is  $0.22 \text{ W/m}^2$ . The amplitude of the magnetic field in this light-wave is \_\_\_\_\_  $\times 10^{-9} \text{ T}$ .

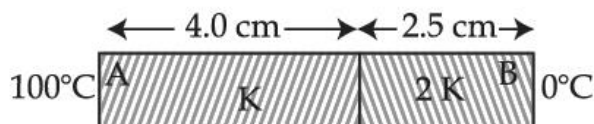
(Given : Permittivity of vacuum  $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$ , speed of light in vacuum  $c = 3 \times 10^8 \text{ ms}^{-1}$ )

Question ID:101723

Topic Name:Physics-Section B

Question:

As per the given figure, two plates A and B of thermal conductivity  $K$  and  $2K$  are joined together to form a compound plate. The thickness of plates are  $4.0 \text{ cm}$  and  $2.5 \text{ cm}$  respectively and the area of cross-section is  $120 \text{ cm}^2$  for each plate. The equivalent thermal conductivity of the compound plate is  $\left(1 + \frac{5}{\alpha}\right) K$ , then the value of  $\alpha$  will be \_\_\_\_\_.



Question ID:101724

Topic Name:Physics-Section B

Question:

A body is performing simple harmonic with an amplitude of  $10 \text{ cm}$ . The velocity of the body was tripled by air Jet when it is at  $5 \text{ cm}$  from its mean position. The new amplitude of vibration is  $\sqrt{x} \text{ cm}$ . The value of  $x$  is \_\_\_\_\_.

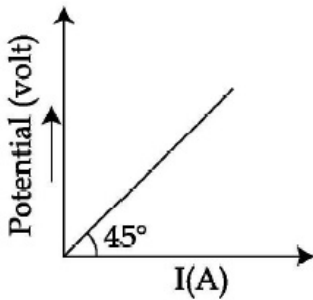
Question ID:101725

Topic Name:Physics-Section B

**Question:**

The variation of applied potential and current flowing through a given wire is shown in figure. The length of wire is 31.4 cm. The diameter of wire is measured as 2.4 cm. The resistivity of the given wire is measured as  $x \times 10^{-3} \Omega \text{ cm}$ . The value of  $x$  is \_\_\_\_\_.

[Take  $\pi = 3.14$ ]

**Question ID:101726**

Topic Name:Physics-Section B

**Question:**

300 cal. of heat is given to a heat engine and it rejects 225 cal. of heat. If source temperature is  $227^\circ\text{C}$ , then the temperature of sink will be \_\_\_\_\_  $^\circ\text{C}$ .

**Question ID:101727**

Topic Name:Physics-Section B

$\sqrt{d_1}$  and  $\sqrt{d_2}$  are the impact parameters corresponding to scattering angles  $60^\circ$  and  $90^\circ$  respectively, when an  $\alpha$  particle is approaching a gold nucleus. For  $d_1 = x d_2$ , the value of

**Question:**  $x$  will be \_\_\_\_\_.

**Question ID:101728**

Topic Name:Physics-Section B

**Question:**

A transistor is used in an amplifier circuit in common emitter mode. If the base current changes by  $100 \mu\text{A}$ , it brings a change of 10 mA in collector current. If the load resistance is  $2 \text{ k}\Omega$  and input resistance is  $1 \text{ k}\Omega$ , the value of power gain is  $x \times 10^4$ . The value of  $x$  is

\_\_\_\_\_.

**Question ID:101729**

Topic Name:Physics-Section B

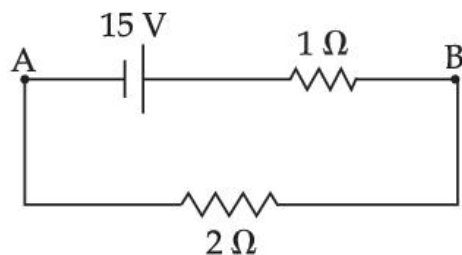
**Question:**

A parallel beam of light is allowed to fall on a transparent spherical globe of diameter 30 cm and refractive index 1.5. The distance from the centre of the globe at which the beam of light can converge is \_\_\_\_\_ mm.

**Question ID:101730**

Topic Name:Physics-Section B

For the network shown below, the value of  $V_B - V_A$  is \_\_\_\_\_ V.



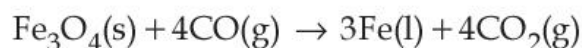
Question:

Question ID:101731

Topic Name:Chemistry-Section A

Question:

Production of iron in blast furnace follows the following equation



when 4.640 kg of  $\text{Fe}_3\text{O}_4$  and 2.520 kg of  $\text{CO}$  are allowed to react then the amount of iron (in g) produced is :

[Given : Molar Atomic mass ( $\text{g mol}^{-1}$ ) : Fe = 56

Molar Atomic mass ( $\text{g mol}^{-1}$ ) : O = 16

Molar Atomic mass ( $\text{g mol}^{-1}$ ) : C = 12]

- A 1400
- B 2200
- C 3360
- D 4200

Question ID:101732

Topic Name:Chemistry-Section A

Question:

Which of the following statements are **correct** ?

- (A) The electronic configuration of Cr is  $[\text{Ar}] 3d^5 4s^1$ .
- (B) The magnetic quantum number may have a negative value.
- (C) In the ground state of an atom, the orbitals are filled in order of their increasing energies.
- (D) The total number of nodes are given by  $n - 2$ .

Choose the **most appropriate** answer from the options given below :

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

Question ID:101733

Topic Name:Chemistry-Section A

Arrange the following in the decreasing order of their covalent character :

- (A) LiCl
- (B) NaCl
- (C) KCl
- (D) CsCl

Question:

Choose the **most appropriate** answer from the options given below :

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

Question ID:101734

Topic Name:Chemistry-Section A

Question: The solubility of AgCl will be maximum in which of the following ?

- A 0.01 M KCl
- B 0.01 M HCl
- C 0.01 M AgNO<sub>3</sub>
- D Deionised water

Question ID:101735

Topic Name:Chemistry-Section A

Question: Which of the following is a **correct** statement ?

- A Brownian motion destabilises sols.
- B Any amount of dispersed phase can be added to emulsion without destabilising it.
- C Mixing two oppositely charged sols in equal amount neutralises charges and stabilises colloids.
- D Presence of equal and similar charges on colloidal particles provides stability to the colloidal solution.

Question ID:101736

Topic Name:Chemistry-Section A

Question: The electronic configuration of Pt (atomic number 78) is :

- A [Xe] 4f<sup>14</sup> 5d<sup>9</sup> 6s<sup>1</sup>

- B  $[\text{Kr}] 4f^{14} 5d^{10}$
- C  $[\text{Xe}] 4f^{14} 5d^{10}$
- D  $[\text{Xe}] 4f^{14} 5d^8 6s^2$

Question ID:101737

Topic Name:Chemistry-Section A

Question:

In isolation of which one of the following metals from their ores, the use of cyanide salt is not commonly involved ?

- A Zinc
- B Gold
- C Silver
- D Copper

Question ID:101738

Topic Name:Chemistry-Section A

Question:

Which one of the following reactions indicates the reducing ability of hydrogen peroxide in basic medium ?

- A  $\text{HOCl} + \text{H}_2\text{O}_2 \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^- + \text{O}_2$
- B  $\text{PbS} + 4\text{H}_2\text{O}_2 \rightarrow \text{PbSO}_4 + 4\text{H}_2\text{O}$
- C  $2\text{MnO}_4^- + 3\text{H}_2\text{O}_2 \rightarrow 2\text{MnO}_2 + 3\text{O}_2 + 2\text{H}_2\text{O} + 2\text{OH}^-$
- D  $\text{Mn}^{2+} + \text{H}_2\text{O}_2 \rightarrow \text{Mn}^{4+} + 2\text{OH}^-$

Question ID:101739

Topic Name:Chemistry-Section A

Match List - I with List - II.

List - I	List - II
(Metal)	(Emitted light wavelength (nm))
(A) Li	(I) 670.8
(B) Na	(II) 589.2
(C) Rb	(III) 780.0
(D) Cs	(IV) 455.5

Question: Choose the **most appropriate** answer from the options given below :

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



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

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

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

Question ID:101740

Topic Name:Chemistry-Section A

Match List - I with List - II.

List - I	List - II
(Metal)	(Application)
(A) Cs	(I) High temperature thermometer
(B) Ga	(II) Water repellent sprays
(C) B	(III) Photoelectric cells
(D) Si	(IV) Bullet proof vest

Question: Choose the **most appropriate** answer from the options given below :

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

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

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

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

Question ID:101741

Topic Name:Chemistry-Section A

Question:

The oxoacid of phosphorus that is easily obtained from a reaction of alkali and white phosphorus and has two P-H bonds, is :

A Phosphonic acid

B Phosphinic acid

C Pyrophosphorus acid

D Hypophosphoric acid

Question ID:101742

Topic Name:Chemistry-Section A

Question: The acid that is believed to be mainly responsible for the damage of Taj Mahal is

A sulfuric acid.

B hydrofluoric acid.

- C phosphoric acid.  
D hydrochloric acid.

Question ID:101743

Topic Name:Chemistry-Section A

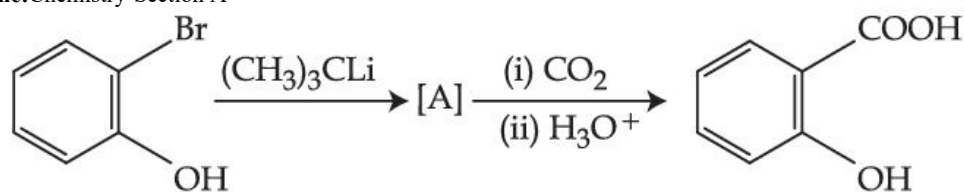
Question:

Two isomers 'A' and 'B' with molecular formula  $C_4H_8$  give different products on oxidation with  $KMnO_4$  in acidic medium. Isomer 'A' on reaction with  $KMnO_4/H^+$  results in effervescence of a gas and gives ketone. The compound 'A' is

- A But-1-ene.  
B cis-But-2-ene.  
C trans-But-2-ene.  
D 2-methyl propene.

Question ID:101744

Topic Name:Chemistry-Section A



Question: In the given conversion the compound A is :

- A
- B
- C
- D

Question ID:101745

Topic Name:Chemistry-Section A

Question:

Given below are two statements :

**Statement I :** The esterification of carboxylic acid with an alcohol is a nucleophilic acyl substitution.

**Statement II :** Electron withdrawing groups in the carboxylic acid will increase the rate of esterification reaction.

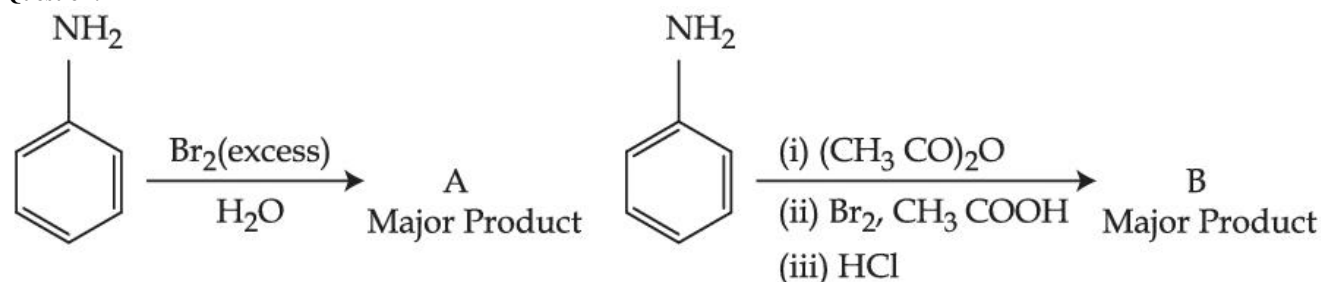
Choose the **most appropriate** option :

- 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.

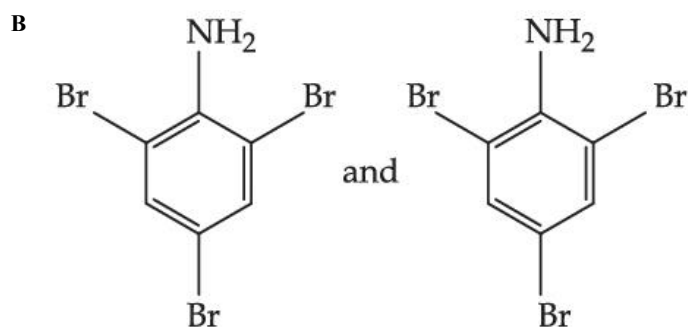
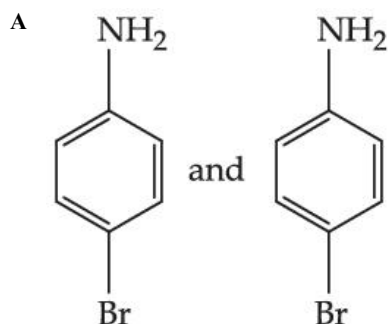
Question ID:101746

Topic Name:Chemistry-Section A

Question:

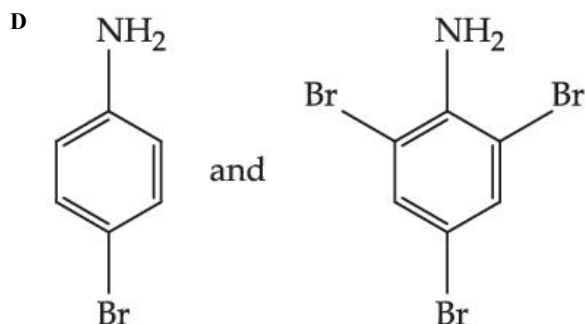
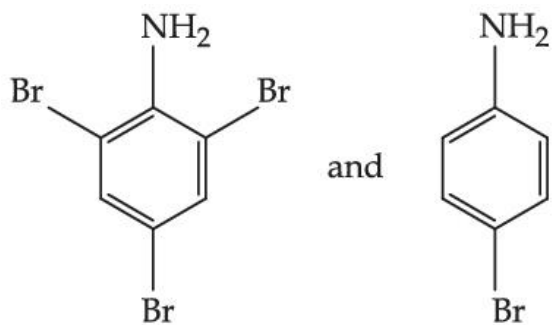


Consider the above reactions, the product A and product B respectively are



C





Question ID:101747

Topic Name:Chemistry-Section A

Question:

The polymer, which can be stretched and retains its original status on releasing the force is

- A Bakelite.
- B Nylon 6,6.
- C Buna-N.
- D Terylene.

Question ID:101748

Topic Name:Chemistry-Section A

Question: Sugar moiety in DNA and RNA molecules respectively are

- A  $\beta$ -D-2-deoxyribose,  $\beta$ -D-deoxyribose.
- B  $\beta$ -D-2-deoxyribose,  $\beta$ -D-ribose
- C  $\beta$ -D-ribose,  $\beta$ -D-2-deoxyribose.
- D  $\beta$ -D-deoxyribose,  $\beta$ -D-2-deoxyribose.

Question ID:101749

Topic Name:Chemistry-Section A

Question: Which of the following compound **does not** contain sulfur atom ?

- A Cimetidine
- B Ranitidine
- C

Histamine

D Saccharin

Question ID:101750

Topic Name:Chemistry-Section A

Question:

Given below are two statements.

**Statement I :** Phenols are weakly acidic.

**Statement II :** Therefore they are freely soluble in NaOH solution and are weaker acids than alcohols and water.

Choose the **most appropriate** option :

- 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.

Question ID:101751

Topic Name:Chemistry-Section B

Question:

Geraniol, a volatile organic compound, is a component of rose oil. The density of the vapour is  $0.46 \text{ g L}^{-1}$  at  $257^\circ\text{C}$  and 100 mm Hg. The molar mass of geraniol is \_\_\_\_\_  $\text{g mol}^{-1}$ . (Nearest Integer)

[Given :  $R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$ ]

Question ID:101752

Topic Name:Chemistry-Section B

Question:

17.0 g of  $\text{NH}_3$  completely vapourises at  $-33.42^\circ\text{C}$  and 1 bar pressure and the enthalpy change in the process is  $23.4 \text{ kJ mol}^{-1}$ . The enthalpy change for the vapourisation of 85 g of  $\text{NH}_3$  under the same conditions is \_\_\_\_\_ kJ.

Question ID:101753

Topic Name:Chemistry-Section B

Question:

1.2 mL of acetic acid is dissolved in water to make 2.0 L of solution. The depression in freezing point observed for this strength of acid is  $0.0198^\circ\text{C}$ . The percentage of dissociation of the acid is \_\_\_\_\_. (Nearest integer)

[Given : Density of acetic acid is  $1.02 \text{ g mL}^{-1}$

Molar mass of acetic acid is  $60 \text{ g mol}^{-1}$

$K_f(\text{H}_2\text{O}) = 1.85 \text{ K kg mol}^{-1}$ ]

**Question ID:101754**

Topic Name:Chemistry-Section B

Question:

A dilute solution of sulphuric acid is electrolysed using a current of 0.10 A for 2 hours to produce hydrogen and oxygen gas. The total volume of gases produced at STP is \_\_\_\_\_  $\text{cm}^3$ . (Nearest integer)

[Given : Faraday constant  $F = 96500 \text{ C mol}^{-1}$  at STP, molar volume of an ideal gas is  $22.7 \text{ L mol}^{-1}$ ]

**Question ID:101755**

Topic Name:Chemistry-Section B

Question:

The activation energy of one of the reactions in a biochemical process is  $532611 \text{ J mol}^{-1}$ . When the temperature falls from 310 K to 300 K, the change in rate constant observed is  $k_{300} = x \times 10^{-3} k_{310}$ . The value of  $x$  is \_\_\_\_\_.

[Given :  $\ln 10 = 2.3$

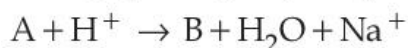
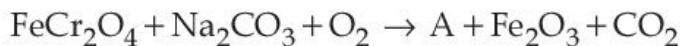
$R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$ ]

**Question ID:101756**

Topic Name:Chemistry-Section B

Question:

The number of terminal oxygen atoms present in the product B obtained from the following reaction is \_\_\_\_\_.

**Question ID:101757**

Topic Name:Chemistry-Section B

Question:

An acidified manganate solution undergoes disproportionation reaction. The spin-only magnetic moment value of the product having manganese in higher oxidation state is \_\_\_\_\_ B.M. (Nearest integer)

**Question ID:101758**

Topic Name:Chemistry-Section B

Question:

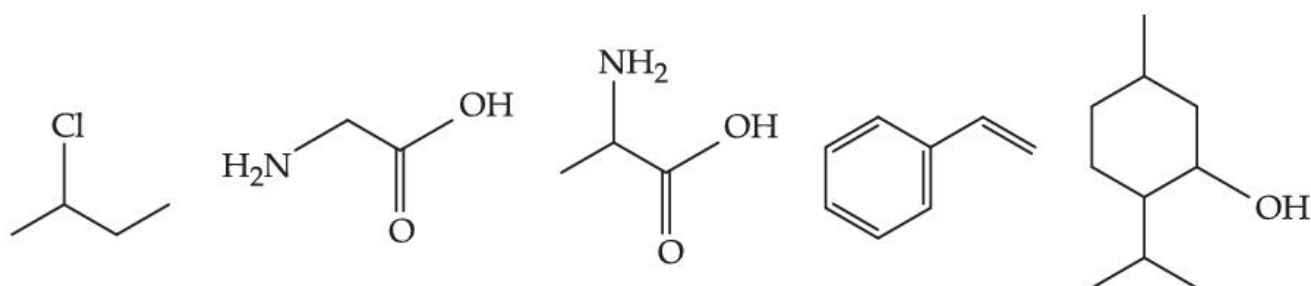
Kjeldahl's method was used for the estimation of nitrogen in an organic compound. The ammonia evolved from 0.55 g of the compound neutralised 12.5 mL of 1 M  $\text{H}_2\text{SO}_4$  solution. The percentage of nitrogen in the compound is \_\_\_\_\_. (Nearest integer)

**Question ID:101759**

Topic Name: Chemistry-Section B

Question:

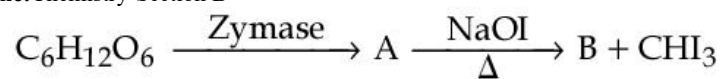
Observe structures of the following compounds



The total number of structures/compounds which possess asymmetric carbon atoms is \_\_\_\_\_.

Question ID: 101760

Topic Name: Chemistry-Section B



Question: The number of carbon atoms present in the product B is \_\_\_\_\_.