

Q:1

Topic Name:Mathematics-Section A

ItemCode:50111

Let  $\alpha$  be a root of the equation  $1 + x^2 + x^4 = 0$ .Question: Then the value of  $\alpha^{1011} + \alpha^{2022} - \alpha^{3033}$  is equal to :

- A 1
- B  $\alpha$
- C  $1 + \alpha$
- D  $1 + 2\alpha$

Q:2

Topic Name:Mathematics-Section A

ItemCode:50112

Let  $\arg(z)$  represent the principal argument of the complex number  $z$ .Question: Then,  $|z| = 3$  and  $\arg(z - 1) - \arg(z + 1) = \frac{\pi}{4}$  intersect

- A exactly at one point.
- B exactly at two points.
- C nowhere.
- D at infinitely many points.

Q:3

Topic Name:Mathematics-Section A

ItemCode:50113

Let  $A = \begin{pmatrix} 2 & -1 \\ 0 & 2 \end{pmatrix}$ . If  $B = I - {}^5C_1(\text{adj}A) + {}^5C_2(\text{adj}A)^2 - \dots - {}^5C_5(\text{adj}A)^5$ , then theQuestion: sum of all elements of the matrix  $B$  is

- A -5
- B -6
- C -7
- D -8

Q:4

Topic Name:Mathematics-Section A

ItemCode:50114

The sum of the infinite series  $1 + \frac{5}{6} + \frac{12}{6^2} + \frac{22}{6^3} + \frac{35}{6^4} + \frac{51}{6^5} + \frac{70}{6^6} + \dots$ 

Question: is equal to:

- A  $\frac{425}{216}$
- B  $\frac{429}{216}$
- C  $\frac{288}{125}$
- D  $\frac{280}{125}$

Q:5

ItemCode: 50115

The value of  $\lim_{x \rightarrow 1} \frac{(x^2 - 1)\sin^2(\pi x)}{x^4 - 2x^3 + 2x - 1}$

Question: is equal to:

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

Q:6

Topic Name: Mathematics-Section A

ItemCode: 50116

Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be a function defined by  $f(x) = (x - 3)^{n_1}(x - 5)^{n_2}$ ,  $n_1, n_2 \in \mathbb{N}$ .

Question: Then, which of the following is NOT true?

- A For  $n_1 = 3, n_2 = 4$ , there exists  $\alpha \in (3, 5)$  where  $f$  attains local maxima.
- B For  $n_1 = 4, n_2 = 3$ , there exists  $\alpha \in (3, 5)$  where  $f$  attains local minima.
- C For  $n_1 = 3, n_2 = 5$ , there exists  $\alpha \in (3, 5)$  where  $f$  attains local maxima.
- D For  $n_1 = 4, n_2 = 6$ , there exists  $\alpha \in (3, 5)$  where  $f$  attains local maxima.

Q:7

Topic Name: Mathematics-Section A

ItemCode: 50117

Let  $f$  be a real valued continuous function on  $[0, 1]$  and

$$f(x) = x + \int_0^1 (x-t)f(t)dt.$$

Question: Then, which of the following points  $(x, y)$  lies on the curve  $y = f(x)$ ?

- A (2, 4)
- B (1, 2)
- C (4, 17)
- D (6, 8)

Q:8

Topic Name: Mathematics-Section A

ItemCode: 50118

If  $\int_0^2 (\sqrt{2x} - \sqrt{2x-x^2}) dx = \int_0^1 \left(1 - \sqrt{1-y^2} - \frac{y^2}{2}\right) dy + \int_1^2 \left(2 - \frac{y^2}{2}\right) dy + I$

Question: then  $I$  equals

- A  $\int_0^1 (1 + \sqrt{1-y^2}) dy$
- B  $\int_0^1 \left(\frac{y^2}{2} - \sqrt{1-y^2} + 1\right) dy$
- C  $\int_0^1 (1 - \sqrt{1-y^2}) dy$

D  $\int_0^1 \left( \frac{y^2}{2} + \sqrt{1-y^2} + 1 \right) dy$

Q:9

Topic Name:Mathematics-Section A

ItemCode:50119

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

$$(1 + e^{2x}) \frac{dy}{dx} + 2(1 + y^2)e^x = 0 \text{ and } y(0) = 0, \text{ then}$$

$$6 \left\{ y'(0) + \left( y(\log_e \sqrt{3}) \right)^2 \right\} \text{ is equal to}$$

Question:

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

Q:10

Topic Name:Mathematics-Section A

ItemCode:501110

Let  $P : y^2 = 4ax, a > 0$  be a parabola with focus S. Let the tangents to the parabola

P make an angle of  $\frac{\pi}{4}$  with the line  $y = 3x + 5$  touch the parabola P at A and B.

Question: Then the value of  $a$  for which A, B and S are collinear is

- A 8 only
- B 2 only
- C  $\frac{1}{4}$  only
- D any  $a > 0$

Q:11

Topic Name:Mathematics-Section A

ItemCode:501111

Let a triangle  $ABC$  be inscribed in the circle  $x^2 - \sqrt{2}(x + y) + y^2 = 0$  such that

Question:  $\angle BAC = \frac{\pi}{2}$ . If the length of side  $AB$  is  $\sqrt{2}$ , then the area of the  $\triangle ABC$  is equal to :

- A  $(\sqrt{2} + \sqrt{6})/3$
- B  $(\sqrt{6} + \sqrt{3})/2$
- C  $(3 + \sqrt{3})/4$
- D  $(\sqrt{6} + 2\sqrt{3})/4$

Q:12

Topic Name:Mathematics-Section A

ItemCode:501112

Let  $\frac{x-2}{3} = \frac{y+1}{-2} = \frac{z+3}{-1}$  lie on the plane  $px - qy + z = 5$ , for some  $p, q \in \mathbb{R}$ . The

Question: shortest distance of the plane from the origin is:

- A  $\frac{\sqrt{3}}{\sqrt{109}}$
- B  $\frac{\sqrt{5}}{\sqrt{142}}$

C  $\frac{5}{\sqrt{71}}$

D  $\frac{1}{\sqrt{142}}$

Q:13

Topic Name:Mathematics-Section A

ItemCode:501113

The distance of the origin from the centroid of the triangle whose two sides have the equations

$x - 2y + 1 = 0$  and  $2x - y - 1 = 0$  and whose orthocenter is  $\left(\frac{7}{3}, \frac{7}{3}\right)$  is:

Question:

A  $\sqrt{2}$

B 2

C  $2\sqrt{2}$

D 4

Q:14

Topic Name:Mathematics-Section A

ItemCode:501114

Let Q be the mirror image of the point P(1, 2, 1) with respect to the plane  $x + 2y + 2z = 16$ . Let T be a plane passing through the point Q and contains the

line  $\vec{r} = -\hat{k} + \lambda(\hat{i} + \hat{j} + 2\hat{k}), \lambda \in \mathbb{R}$ . Then, which of the following points lies on T?

Question:

A (2, 1, 0)

B (1, 2, 1)

C (1, 2, 2)

D (1, 3, 2)

Q:15

Topic Name:Mathematics-Section A

ItemCode:501115

Let A, B, C be three points whose position vectors respectively are

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

$$\vec{b} = 2\hat{i} + \alpha\hat{j} + 4\hat{k}, \alpha \in \mathbb{R}$$

$$\vec{c} = 3\hat{i} - 2\hat{j} + 5\hat{k}$$

If  $\alpha$  is the smallest positive integer for which  $\vec{a}, \vec{b}, \vec{c}$  are noncollinear, then the

Question: length of the median, in  $\Delta ABC$ , through A is :

A  $\frac{\sqrt{82}}{2}$

B  $\frac{\sqrt{62}}{2}$

C  $\frac{\sqrt{69}}{2}$

D  $\frac{\sqrt{66}}{2}$

Q:16

Topic Name:Mathematics-Section A

ItemCode:501116

The probability that a relation R from  $\{x, y\}$  to  $\{x, y\}$  is both symmetric and

Question: transitive, is equal to

A  $\frac{5}{16}$

B  $\frac{9}{16}$

C  $\frac{11}{16}$

D  $\frac{13}{16}$

Q:17

Topic Name:Mathematics-Section A

ItemCode:501117

The number of values of  $a \in \mathbb{N}$  such that the variance of 3, 7, 12,  $a$ ,  $43 - a$  is a

Question: natural number is:

A 0

B 2

C 5

D infinite

Q:18

Topic Name:Mathematics-Section A

ItemCode:501118

From the base of a pole of height 20 meter, the angle of elevation of the top of a tower is  $60^\circ$ . The pole subtends an angle  $30^\circ$  at the top of the tower. Then the

Question: height of the tower is:

A  $15\sqrt{3}$

B  $20\sqrt{3}$

C  $20 + 10\sqrt{3}$

D 30

Q:19

Topic Name:Mathematics-Section A

ItemCode:501119

Question: Negation of the Boolean statement  $(p \vee q) \Rightarrow ((\sim r) \vee p)$  is equivalent to

A  $p \wedge (\sim q) \wedge r$

B  $(\sim p) \wedge (\sim q) \wedge r$

C  $(\sim p) \wedge q \wedge r$

D  $p \wedge q \wedge (\sim r)$

Q:20

Topic Name:Mathematics-Section A

ItemCode:501120

Let  $n \geq 5$  be an integer. If  $9^n - 8n - 1 = 64\alpha$  and  $6^n - 5n - 1 = 25\beta$ , then  $\alpha - \beta$  is

Question: equal to

A  $1 + {}^nC_2(8-5) + {}^nC_3(8^2-5^2) + \dots + {}^nC_n(8^{n-1}-5^{n-1})$

B  $1 + {}^nC_3(8-5) + {}^nC_4(8^2-5^2) + \dots + {}^nC_n(8^{n-2}-5^{n-2})$

C  ${}^nC_3(8-5) + {}^nC_4(8^2-5^2) + \dots + {}^nC_n(8^{n-2}-5^{n-2})$

D  ${}^nC_4(8-5) + {}^nC_5(8^2-5^2) + \dots + {}^nC_n(8^{n-3}-5^{n-3})$

Q:21

ItemCode:501121

Let  $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ ,  $\vec{b} = \hat{i} + \hat{j} + \hat{k}$  and  $\vec{c}$  be a vector such that  $\vec{a} + (\vec{b} \times \vec{c}) = \vec{0}$  and

Question:  $\vec{b} \cdot \vec{c} = 5$ . Then, the value of  $3(\vec{c} \cdot \vec{a})$  is equal to \_\_\_.

Q:22

Topic Name: Mathematics-Section B

ItemCode:501122

Let  $y = y(x)$ ,  $x > 1$ , be the solution of the differential equation

$(x-1)\frac{dy}{dx} + 2xy = \frac{1}{x-1}$ , with  $y(2) = \frac{1+e^4}{2e^4}$ . If  $y(3) = \frac{e^\alpha + 1}{\beta e^\alpha}$ , then the value of

Question:  $\alpha + \beta$  is equal to \_\_\_.

Q:23

Topic Name: Mathematics-Section B

ItemCode:501123

Let 3, 6, 9, 12, ... upto 78 terms and 5, 9, 13, 17, ... upto 59 terms be two series.

Question: Then, the sum of the terms common to both the series is equal to \_\_\_.

Q:24

Topic Name: Mathematics-Section B

ItemCode:501124

Question: The number of solutions of the equation  $\sin x = \cos^2 x$  in the interval  $(0, 10)$  is \_\_\_.

Q:25

Topic Name: Mathematics-Section B

ItemCode:501125

For real numbers  $a, b$  ( $a > b > 0$ ), let

Area  $\left\{ (x, y) : x^2 + y^2 \leq a^2 \text{ and } \frac{x^2}{a^2} + \frac{y^2}{b^2} \geq 1 \right\} = 30\pi$

and

Area  $\left\{ (x, y) : x^2 + y^2 \geq b^2 \text{ and } \frac{x^2}{a^2} + \frac{y^2}{b^2} \leq 1 \right\} = 18\pi$

Question: Then the value of  $(a-b)^2$  is equal to \_\_\_.

Q:26

Topic Name: Mathematics-Section B

ItemCode:501126

Let  $f$  and  $g$  be twice differentiable even functions on  $(-2, 2)$  such that

$f\left(\frac{1}{4}\right) = 0$ ,  $f\left(\frac{1}{2}\right) = 0$ ,  $f(1) = 1$  and  $g\left(\frac{3}{4}\right) = 0$ ,  $g(1) = 2$

Then, the minimum number of solutions of  $f(x)g''(x) + f'(x)g'(x) = 0$  in  $(-2, 2)$  is

Question: equal to \_\_\_.

Q:27

Topic Name: Mathematics-Section B

ItemCode:501127

Let the coefficients of  $x^{-1}$  and  $x^{-3}$  in the expansion of  $\left(2x^{\frac{1}{5}} - \frac{1}{x^{\frac{1}{5}}}\right)^{15}$ ,  $x > 0$ , be  $m$

and  $n$  respectively. If  $r$  is a positive integer such that  $mn^2 = {}^{15}C_r \cdot 2^r$ , then the

Question: value of  $r$  is equal to \_\_\_.

Q:28



ItemCode:501128

The total number of four digit numbers such that each of first three digits is

Question: divisible by the last digit, is equal to \_\_\_\_\_.

Q:29

Topic Name:Mathematics-Section B

ItemCode:501129

Let  $M = \begin{bmatrix} 0 & -\alpha \\ \alpha & 0 \end{bmatrix}$ , where  $\alpha$  is a non-zero real number and  $N = \sum_{k=1}^{49} M^{2k}$ . IfQuestion:  $(I - M^2)N = -2I$ , then the positive integral value of  $\alpha$  is \_\_\_\_.

Q:30

Topic Name:Mathematics-Section B

ItemCode:501130

Let  $f(x)$  and  $g(x)$  be two real polynomials of degree 2 and 1 respectively. If $f(g(x)) = 8x^2 - 2x$ , and  $g(f(x)) = 4x^2 + 6x + 1$ , then the value of  $f(2) + g(2)$  is

Question: \_\_\_\_\_.

Q:31

Topic Name:Physics-Section A

ItemCode:501131

A small toy starts moving from the position of rest under a constant acceleration. If it travels a distance of 10m in  $t$  s, the distance travelled by the toy in the next  $t$  s

Question: will be :

- A 10m
- B 20m
- C 30m
- D 40m

Q:32

Topic Name:Physics-Section A

ItemCode:501132

At what temperature a gold ring of diameter 6.230 cm be heated so that it can be fitted on a wooden bangle of diameter 6.241 cm ? Both the diameters have been measured at room temperature ( $27^\circ\text{C}$ ).Question: (Given: coefficient of linear thermal expansion of gold  $\alpha_L = 1.4 \times 10^{-5} \text{ K}^{-1}$ )

- A  $125.7^\circ\text{C}$
- B  $91.7^\circ\text{C}$
- C  $425.7^\circ\text{C}$
- D  $152.7^\circ\text{C}$

Q:33

Topic Name:Physics-Section A

ItemCode:501133

Two point charges  $Q$  each are placed at a distance  $d$  apart. A third point charge  $q$  is placed at a distance  $x$  from mid-point on the perpendicular bisector. The value of  $x$ Question: at which charge  $q$  will experience the maximum Coulomb's force is:

- A  $x = d$
- B  $x = \frac{d}{2}$
- C  $x = \frac{d}{\sqrt{2}}$
- D  $x = \frac{d}{2\sqrt{2}}$

Q:34

Topic Name:Physics-Section A

ItemCode:501134

The speed of light in media 'A' and 'B' are  $2.0 \times 10^{10} \text{ cm/s}$  and  $1.5 \times 10^{10} \text{ cm/s}$  respectively. A ray of light enters from the medium B to A at an incident angle

Question: ' $\theta$ '. If the ray suffers total internal reflection, then

A  $\theta = \sin^{-1}\left(\frac{3}{4}\right)$

B  $\theta > \sin^{-1}\left(\frac{2}{3}\right)$

C  $\theta < \sin^{-1}\left(\frac{3}{4}\right)$

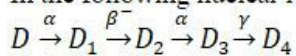
D  $\theta > \sin^{-1}\left(\frac{3}{4}\right)$

Q:35

Topic Name:Physics-Section A

ItemCode:501135

In the following nuclear reaction,



Mass number of D is 182 and atomic number is 74. Mass number and atomic

Question: number of  $D_4$  respectively will be \_\_\_\_

A 174 and 71

B 174 and 69

C 172 and 69

D 172 and 71

Q:36

Topic Name:Physics-Section A

ItemCode:501136

The electric field at a point associated with a light wave is given by

$$E = 200 [\sin(6 \times 10^{15})t + \sin(9 \times 10^{15})t] \text{Vm}^{-1}$$

Given :  $h = 4.14 \times 10^{-15} \text{ eVs}$

If this light falls on a metal surface having a work function of  $2.50 \text{ eV}$ , the

Question: maximum kinetic energy of the photoelectrons will be

A  $1.90 \text{ eV}$

B  $3.27 \text{ eV}$

C  $3.60 \text{ eV}$

D  $3.42 \text{ eV}$

Q:37

Topic Name:Physics-Section A

ItemCode:501137

A capacitor is discharging through a resistor R. Consider in time  $t_1$ , the energy stored in the capacitor reduces to half of its initial value and in time  $t_2$ , the charge

Question: stored reduces to one eighth of its initial value. The ratio  $t_1/t_2$  will be

A  $1/2$

B  $1/3$

C  $1/4$

D  $1/6$

Q:38

Topic Name:Physics-Section A



ItemCode:501138

Starting with the same initial conditions, an ideal gas expands from volume  $V_1$  to  $V_2$  in three different ways. The work done by the gas is  $W_1$  if the process is purely isothermal,  $W_2$ , if the process is purely adiabatic and  $W_3$  if the process is purely

isobaric. Then, choose the correct option

- A  $W_1 < W_2 < W_3$
- B  $W_2 < W_3 < W_1$
- C  $W_3 < W_1 < W_2$
- D  $W_2 < W_1 < W_3$

Q:39

Topic Name:Physics-Section A

ItemCode:501139

Two long current carrying conductors are placed parallel to each other at a distance of 8 cm between them. The magnitude of magnetic field produced at mid-point between the two conductors due to current flowing in them is  $300 \mu T$ . The equal

current flowing in the two conductors is :

- A 30A in the same direction.
- B 30A in the opposite direction.
- C 60A in the opposite direction.
- D 300A in the opposite direction.

Q:40

Topic Name:Physics-Section A

ItemCode:501140

The time period of a satellite revolving around earth in a given orbit is 7 hours. If the radius of orbit is increased to three times its previous value, then approximate

new time period of the satellite will be

- A 40 hours
- B 36 hours
- C 30 hours
- D 25 hours

Q:41

Topic Name:Physics-Section A

ItemCode:501141

The TV transmission tower at a particular station has a height of 125 m. For

doubling the coverage of its range, the height of the tower should be increased by

- A 125 m
- B 250 m
- C 375 m
- D 500 m

Q:42

Topic Name:Physics-Section A

ItemCode:501142

The motion of a simple pendulum executing S.H.M. is represented by the following equation.

$$y = A \sin(\pi t + \phi), \text{ where time is measured in second.}$$

Question: The length of pendulum is

- A 97.23 cm
- B 25.3 cm

C 99.4 cm

D 406.1 cm

Q:43

Topic Name:Physics-Section A

ItemCode:501143

A vessel contains 16g of hydrogen and 128 g of oxygen at standard temperature

Question: and pressure. The volume of the vessel in  $\text{cm}^3$  is :

A  $72 \times 10^5$

B  $32 \times 10^5$

C  $27 \times 10^4$

D  $54 \times 10^4$

Q:44

Topic Name:Physics-Section A

ItemCode:501144

Given below are two statements :

Statement I: The electric force changes the speed of the charged particle and hence changes its kinetic energy; whereas the magnetic force does not change the kinetic energy of the charged particle.

Statement II: The electric force accelerates the positively charged particle perpendicular to the direction of electric field. The magnetic force accelerates the moving charged particle along the direction of magnetic field.

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

Question: options given below :

A Both Statement I and Statement II are correct.

B Both Statement I and Statement II are incorrect.

C Statement I is correct but Statement II is incorrect.

D Statement I is incorrect but Statement II is correct.

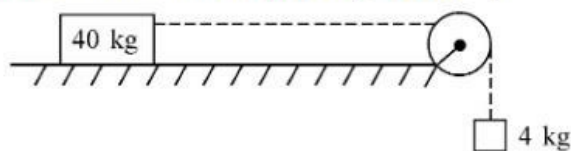
Q:45

Topic Name:Physics-Section A

ItemCode:501145

A block of mass 40 kg slides over a surface, when a mass of 4 kg is suspended through an inextensible massless string passing over frictionless pulley as shown below.

The coefficient of kinetic friction between the surface and block is 0.02. The acceleration of block is. (Given  $g = 10 \text{ ms}^{-2}$ .)



Question:

A  $1 \text{ ms}^{-2}$

B  $1/5 \text{ ms}^{-2}$

C  $4/5 \text{ ms}^{-2}$

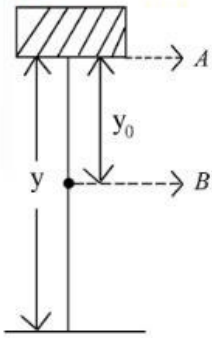
D  $8/11 \text{ ms}^{-2}$

Q:46

Topic Name:Physics-Section A

ItemCode:501146

In the given figure, the block of mass  $m$  is dropped from the point 'A'. The expression for kinetic energy of block when it reaches point 'B' is



Question: Ground

A  $\frac{1}{2}mg y_0^2$

B  $\frac{1}{2}mg y^2$

C  $mg(y - y_0)$

D  $mg y_0$

Q:47

Topic Name:Physics-Section A

ItemCode:501147

A block of mass  $M$  placed inside a box descends vertically with acceleration 'a'. The block exerts a force equal to one-fourth of its weight on the floor of the box.

Question: The value of 'a' will be

A  $\frac{g}{4}$

B  $\frac{g}{2}$

C  $\frac{3g}{4}$

D  $g$

Q:48

Topic Name:Physics-Section A

ItemCode:501148

If the electric potential at any point  $(x, y, z)$   $m$  in space is given by  $V = 3x^2$  volt.

Question: The electric field at the point  $(1, 0, 3)$   $m$  will be :

A  $3 Vm^{-1}$ , directed along positive  $x$ -axis.

B  $3 Vm^{-1}$ , directed along negative  $x$ -axis.

C  $6 Vm^{-1}$ , directed along positive  $x$ -axis.

D  $6 Vm^{-1}$ , directed along negative  $x$ -axis.

Q:49

Topic Name:Physics-Section A

ItemCode:501149

The combination of two identical cells, whether connected in series or parallel combination provides the same current through an external resistance of  $2\Omega$ . The

Question: value of internal resistance of each cell is

A  $2\Omega$

B  $4\Omega$

C  $6\Omega$

D  $8\Omega$

Q:50

Topic Name:Physics-Section A

ItemCode:501150

A person can throw a ball upto a maximum range of 100 m. How high above the

Question: ground he can throw the same ball?

A 25 m

B 50 m

C 100 m

D 200 m

Q:51

Topic Name:Physics-Section B

ItemCode:501151

The Vernier constant of Vernier callipers is 0.1 mm and it has zero error of  $(-0.05)$  cm. While measuring diameter of a sphere, the main scale reading is 1.7 cm and coinciding vernier division is 5. The corrected diameter will be \_\_\_\_\_ ×

Question:  $10^{-2}$  cm.

Q:52

Topic Name:Physics-Section B

ItemCode:501152

A small spherical ball of radius 0.1 mm and density  $10^4 \text{ kg m}^{-3}$  falls freely under gravity through a distance  $h$  before entering a tank of water. If, after entering the water the velocity of ball does not change and it continue to fall with same constant velocity inside water, then the value of  $h$  will be \_\_\_\_\_ m

Question: (Given  $g = 10 \text{ ms}^{-2}$ , viscosity of water =  $1.0 \times 10^{-5} \text{ N-sm}^{-2}$ ).

Q:53

Topic Name:Physics-Section B

ItemCode:501153

In an experiment to determine the velocity of sound in air at room temperature using a resonance tube, the first resonance is observed when the air column has a length of 20.0 cm for a tuning fork of frequency 400 Hz is used. The velocity of the sound at room temperature is  $336 \text{ ms}^{-1}$ . The third resonance is observed when

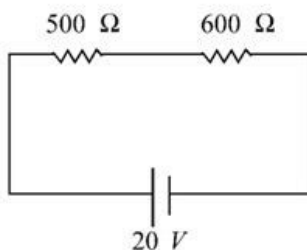
Question: the air column has a length of \_\_\_\_\_ cm

Q:54

Topic Name:Physics-Section B

ItemCode:501154

Two resistors are connected in series across a battery as shown in figure. If a voltmeter of resistance  $2000 \Omega$  is used to measure the potential difference across  $500 \Omega$  resistor, the reading of the voltmeter will be \_\_\_\_\_ V



Question:

Q:55

Topic Name:Physics-Section B

ItemCode:501155

A potential barrier of 0.4 V exists across a p-n junction. An electron enters the junction from the n-side with a speed of  $6.0 \times 10^5 \text{ ms}^{-1}$ . The speed with which electron enters the p side will be  $\frac{x}{3} \times 10^5 \text{ ms}^{-1}$  the value of  $x$  is \_\_\_\_\_.

Question: (Given mass of electron =  $9 \times 10^{-31} \text{ kg}$ , charge on electron =  $1.6 \times 10^{-19} \text{ C}$ .)



Q:56

Topic Name:Physics-Section B

ItemCode:501156

The displacement current of  $4.425 \mu\text{A}$  is developed in the space between the plates of parallel plate capacitor when voltage is changing at a rate of  $10^6 \text{Vs}^{-1}$ . The area of each plate of the capacitor is  $40 \text{cm}^2$ . The distance between each plate of the capacitor is  $x \times 10^{-3} \text{m}$ . The value of  $x$  is ,

Question: (Permittivity of free space,  $\epsilon_0 = 8.85 \times 10^{-12} \text{C}^2 \text{N}^{-1} \text{m}^{-2}$ ) \_\_\_\_\_

Q:57

Topic Name:Physics-Section B

ItemCode:501157

The moment of inertia of a uniform thin rod about a perpendicular axis passing through one end is  $I_1$ . The same rod is bent into a ring and its moment of inertia about a diameter is  $I_2$ . If  $\frac{I_1}{I_2}$  is  $\frac{x\pi^2}{3}$ , then the value of  $x$  will be \_\_\_\_\_.

Question:

Q:58

Topic Name:Physics-Section B

ItemCode:501158

The half life of a radioactive substance is 5 years. After  $x$  years a given sample of the radioactive substance gets reduced to 6.25% of its initial value. The value of  $x$

Question: is \_\_\_\_\_

Q:59

Topic Name:Physics-Section B

ItemCode:501159

In a double slit experiment with monochromatic light, fringes are obtained on a screen placed at some distance from the plane of slits. If the screen is moved by  $5 \times 10^{-2} \text{m}$  towards the slits, the change in fringe width is  $3 \times 10^{-3} \text{cm}$ . If the distance between the slits is 1 mm, then the wavelength of the light will be

Question: \_\_\_\_\_ mm.

Q:60

Topic Name:Physics-Section B

ItemCode:501160

An inductor of 0.5 mH, a capacitor of 200  $\mu\text{F}$  and a resistor of 2  $\Omega$  are connected in series with a 220 V ac source. If the current is in phase with the emf, the

Question: frequency of ac source will be \_\_\_\_\_  $\times 10^2 \text{Hz}$ .

Q:61

Topic Name:Chemistry-Section A

ItemCode:501161

Using the rules for significant figures, the correct answer for the expression  $\frac{0.02858 \times 0.112}{0.5702}$  will be

Question:

A 0.005613

B 0.00561

C 0.0056

D 0.006

Q:62

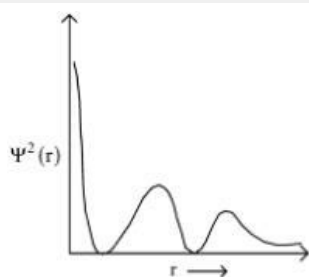
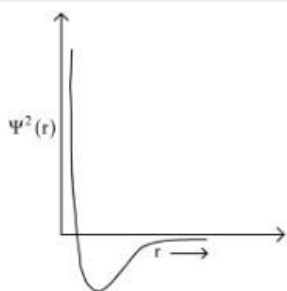
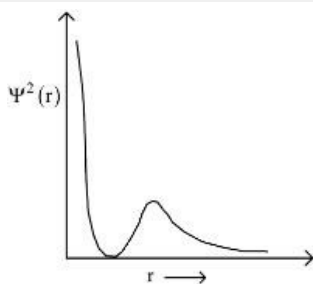
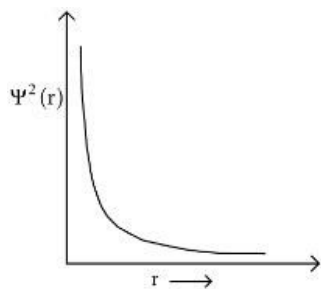
Topic Name:Chemistry-Section A

ItemCode:501162

Which of the following is the correct plot for the probability density  $\Psi^2(r)$  as a function of distance ' $r$ ' of the electron from the nucleus for 2s orbital?

Question:





Q:63

Topic Name:Chemistry-Section A

ItemCode:501163

Consider the species  $\text{CH}_4$ ,  $\text{NH}_4^+$  and  $\text{BH}_4^-$ . Choose the correct option with respect

Question: to the there species.

- A They are isoelectronic and only two have tetrahedral structures.
- B They are isoelectronic and all have tetrahedral structures.
- C Only two are isoelectronic and all have tetrahedral structures.
- D Only two are isoelectronic and only two have tetrahedral structures.

Q:64

Topic Name:Chemistry-Section A

ItemCode:501164

4.0 moles of argon and 5.0 moles of  $\text{PCl}_5$  are introduced into an evacuated flask of 100 litre capacity at 610 K. The system is allowed to equilibrate. At equilibrium, the total pressure of mixture was found to be 6.0 atm. The  $K_p$  for the reaction is

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

- A 2.25
- B 6.24
- C 12.13
- D 15.24

Q:65

Topic Name:Chemistry-Section A

ItemCode:501165

A 42.12% (w/v) solution of NaCl causes precipitation of a certain sol in 10 hours.  
The coagulating value of NaCl for the sol is

Question: [Given: Molar mass : Na = 23.0 g mol<sup>-1</sup> ; Cl = 35.5 g mol<sup>-1</sup>]

- A 36 mmol L<sup>-1</sup>
- B 36 mol L<sup>-1</sup>
- C 1440 mol L<sup>-1</sup>
- D 1440 mmol L<sup>-1</sup>

Q:66

Topic Name:Chemistry-Section A

ItemCode:501166

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

**Assertion A:** The first ionization enthalpy for oxygen is lower than that of nitrogen.

**Reason R:** The four electrons in 2p orbitals of oxygen experience more electron-electron repulsion.

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

Question: 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.

Q:67

Topic Name:Chemistry-Section A

ItemCode:501167

Match **List I** with **List II**.

List I Ore	List II Composition
A. Siderite	I. FeCO <sub>3</sub>
B. Malachite	II. CuCO <sub>3</sub> ·Cu(OH) <sub>2</sub>
C. Sphalerite	III. ZnS
D. Calamine	IV. ZnCO <sub>3</sub>

Question: Choose the correct answer from the options given below:

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

Q:68

Topic Name:Chemistry-Section A

ItemCode:501168

Given below are two statements.

• Statement I: In CuSO<sub>4</sub>·5H<sub>2</sub>O, Cu-O bonds are present.

• Statement II: In CuSO<sub>4</sub>·5H<sub>2</sub>O, ligands coordinating with Cu(II) ion are O- and S-based ligands.

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

Question: 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.

Q:69

Topic Name:Chemistry-Section A

ItemCode:501169

Amongst baking soda, caustic soda and washing soda, carbonate anion is present

Question: in

A washing soda only.

B washing soda and caustic soda only.

C washing soda and baking soda only.

D baking soda, caustic soda and washing soda.

Q:70

Topic Name:Chemistry-Section A

ItemCode:501170

Number of lone pair(s) of electrons on central atom and the shape of  $\text{BrF}_3$

Question: molecule respectively, are

A 0, triangular planar.

B 1, pyramidal.

C 2, bent T-shape.

D 1, bent T-shape.

Q:71

Topic Name:Chemistry-Section A

ItemCode:501171

Aqueous solution of which of the following boron compounds will be strongly

Question: basic in nature?

A  $\text{NaBH}_4$

B  $\text{LiBH}_4$

C  $\text{B}_2\text{H}_6$

D  $\text{Na}_2\text{B}_4\text{O}_7$

Q:72

Topic Name:Chemistry-Section A

ItemCode:501172

Sulphur dioxide is one of the components of polluted air.  $\text{SO}_2$  is also a major contributor to acid rain. The correct and complete reaction to represent acid rain

Question: caused by  $\text{SO}_2$  is

A  $2 \text{SO}_2 + \text{O}_2 \rightarrow 2 \text{SO}_3$

B  $\text{SO}_2 + \text{O}_3 \rightarrow \text{SO}_3 + \text{O}_2$

C  $\text{SO}_2 + \text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{SO}_4$

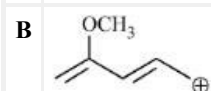
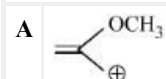
D  $2 \text{SO}_2 + \text{O}_2 + 2 \text{H}_2\text{O} \rightarrow 2 \text{H}_2\text{SO}_4$

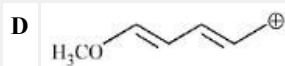
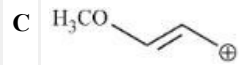
Q:73

Topic Name:Chemistry-Section A

ItemCode:501173

Question: Which of the following carbocations is most stable?

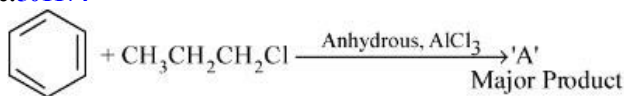




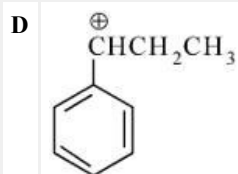
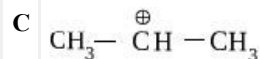
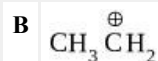
Q:74

Topic Name: Chemistry-Section A

ItemCode:501174



Question: The stable carbocation formed in the above reaction is



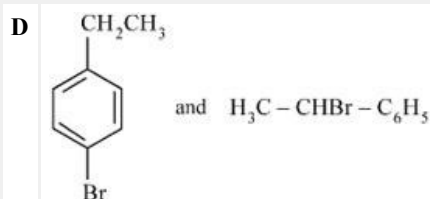
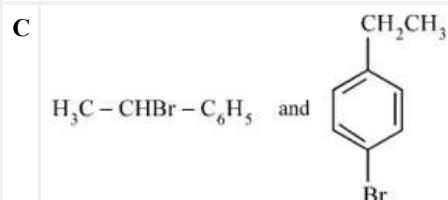
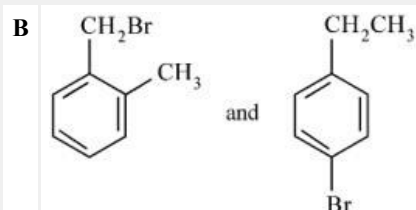
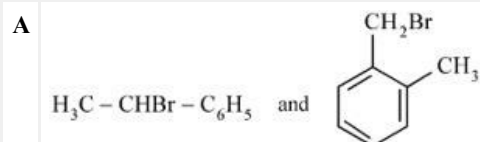
Q:75

Topic Name: Chemistry-Section A

ItemCode:501175

Two isomers (A) and (B) with Molar mass 184 g/mol and elemental composition C, 52.2% ; H, 4.9 % and Br 42.9% gave benzoic acid and p-bromobenzoic acid, respectively on oxidation with KMnO<sub>4</sub>. Isomer 'A' is optically active and gives a pale yellow precipitate when warmed with alcoholic AgNO<sub>3</sub>. Isomer 'A' and 'B'

Question: are, respectively



Q:76

Topic Name: Chemistry-Section A

ItemCode:501176

Question: In Friedel-Crafts alkylation of aniline, one gets

A alkylated product with ortho and para substitution.

- B secondary amine after acidic treatment.
- C an amide product.
- D positively charged nitrogen at benzene ring.

Q:77

Topic Name:Chemistry-Section A

ItemCode:501177

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

**Assertion A:** Dacron is an example of polyester polymer.

**Reason R:** Dacron is made up of ethylene glycol and terephthalic acid monomers.

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

Question: 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.

Q:78

Topic Name:Chemistry-Section A

ItemCode:501178

Question: The structure of protein that is unaffected by heating is

- A secondary structure
- B tertiary structure
- C primary structure
- D quaternary structure

Q:79

Topic Name:Chemistry-Section A

ItemCode:501179

Question: The mixture of chloroxylenol and terpineol is an example of

- A antiseptic
- B pesticide
- C disinfectant
- D narcotic analgesic

Q:80

Topic Name:Chemistry-Section A

ItemCode:501180

A white precipitate was formed when  $\text{BaCl}_2$  was added to water extract of an inorganic salt. Further, a gas 'X' with characteristic odour was released when the formed white precipitate was dissolved in dilute HCl. The anion present in the

Question: inorganic salt is

- A  $\text{I}^-$
- B  $\text{SO}_3^{2-}$
- C  $\text{S}^{2-}$
- D  $\text{NO}_2^-$

Q:81

Topic Name:Chemistry-Section B



ItemCode:501181

A box contains 0.90 g of liquid water in equilibrium with water vapour at 27°C. The equilibrium vapour pressure of water at 27°C is 32.0 Torr. When the volume of the box is increased, some of the liquid water evaporates to maintain the equilibrium pressure. If all the liquid water evaporates, then the volume of the box must be \_\_\_\_ litre. [nearest integer]

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

(Ignore the volume of the liquid water and assume water vapours behave as an

Question: ideal gas.)

Q:82

Topic Name:Chemistry-Section B

ItemCode:501182

2.2 g of nitrous oxide ( $\text{N}_2\text{O}$ ) gas is cooled at a constant pressure of 1 atm from 310 K to 270 K causing the compression of the gas from 217.1 mL to 167.75 mL. The change in internal energy of the process,  $\Delta U$  is '-x' J. The value of 'x' is \_\_\_\_.

[nearest integer]  
(Given: atomic mass of N = 14 g mol<sup>-1</sup> and of O = 16 g mol<sup>-1</sup>.)

Question: Molar heat capacity of  $\text{N}_2\text{O}$  is 100 J K<sup>-1</sup>mol<sup>-1</sup>)

Q:83

Topic Name:Chemistry-Section B

ItemCode:501183

Elevation in boiling point for 1.5 molal solution of glucose in water is 4 K. The depression in freezing point for 4.5 molal solution of glucose in water is 4 K. The

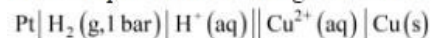
Question: ratio of molal elevation constant to molal depression constant ( $K_b/K_f$ ) is \_\_\_\_.

Q:84

Topic Name:Chemistry-Section B

ItemCode:501184

The cell potential for the given cell at 298 K



is 0.31V. The pH of the acidic solution is found to be 3, whereas the concentration of  $\text{Cu}^{2+}$  is  $10^{-x}$  M. The value of x is \_\_\_\_.

Question: (Given:  $E_{\text{Cu}^{2+}/\text{Cu}}^\ominus = 0.34 \text{ V}$  and  $\frac{2.303 RT}{F} = 0.06 \text{ V}$ )

Q:85

Topic Name:Chemistry-Section B

ItemCode:501185

The equation

$$k = (6.5 \times 10^{12} \text{ s}^{-1}) e^{-26000\text{K}/T}$$

is followed for the decomposition of compound A. The activation energy for the reaction is \_\_\_\_ kJ mol<sup>-1</sup>. [nearest integer]

Question: (Given:  $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ )

Q:86

Topic Name:Chemistry-Section B

ItemCode:501186

Spin only magnetic moment of  $[\text{MnBr}_6]^{4-}$  is \_\_\_\_ B.M. (round off to the closest

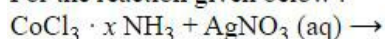
Question: integer)

Q:87

Topic Name:Chemistry-Section B

ItemCode:501187

For the reaction given below :



Question: If two equivalents of AgCl precipitate out, then the value of x will be \_\_\_\_\_.

Q:88

Topic Name:Chemistry-Section B

ItemCode:501188

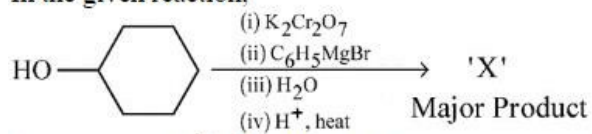
Question: The number of chiral alcohol(s) with molecular formula  $C_4H_{10}O$  is \_\_\_\_.

Q:89

Topic Name:Chemistry-Section B

ItemCode:501189

In the given reaction,



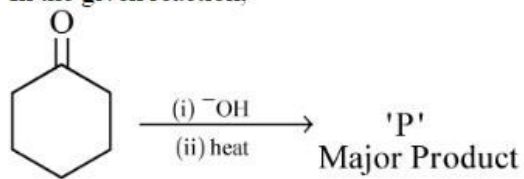
Question: the number of  $sp^2$  hybridised carbon(s) in compound 'X' is \_\_\_\_.

Q:90

Topic Name:Chemistry-Section B

ItemCode:501190

In the given reaction,



Question: The number of  $\pi$  electrons present in the product 'P' is \_\_\_\_.