

Q:1

Topic Name:Mathematics-Section A

ItemCode:171

$$\text{If } \sum_{k=1}^{31} \binom{31}{k} \binom{31}{k-1} - \sum_{k=1}^{30} \binom{30}{k} \binom{30}{k-1} = \frac{\alpha(60!)}{(30!)(31!)}, \text{ where } \alpha \in \mathbb{R}, \text{ then the}$$

Question: value of  $16\alpha$  is equal to

- A 1411
- B 1320
- C 1615
- D 1855

Q:2

Topic Name:Mathematics-Section A

ItemCode:172

Let a function  $f : \mathbb{N} \rightarrow \mathbb{N}$  be defined by

$$f(n) = \begin{cases} 2n, & n = 2, 4, 6, 8, \dots \\ n-1, & n = 3, 7, 11, 15, \dots \\ \frac{n+1}{2}, & n = 1, 5, 9, 13, \dots \end{cases}$$

Question: then,  $f$  is

- A one-one but not onto
- B onto but not one-one
- C neither one-one nor onto
- D one-one and onto

Q:3

Topic Name:Mathematics-Section A

ItemCode:173

If the system of linear equations

$$\begin{aligned} 2x + 3y - z &= -2 \\ x + y + z &= 4 \\ x - y + |\lambda|z &= 4\lambda - 4 \end{aligned}$$

Question: where  $\lambda \in \mathbb{R}$ , has no solution, then

- A  $\lambda = 7$
- B  $\lambda = -7$
- C  $\lambda = 8$
- D  $\lambda^2 = 1$

Q:4

Topic Name:Mathematics-Section A

ItemCode:174

Let  $A$  be a matrix of order  $3 \times 3$  and  $\det(A) = 2$ . Then  $\det(\det(A) \operatorname{adj}(5 \operatorname{adj}(A^3)))$

Question: is equal to \_\_\_\_\_.

- A  $512 \times 10^6$
- B  $256 \times 10^6$

C  $1024 \times 10^6$

D  $256 \times 10^{11}$

Q:5

Topic Name:Mathematics-Section A

ItemCode:175

The total number of 5-digit numbers, formed by using the digits 1, 2, 3, 5, 6, 7

Question: without repetition, which are multiple of 6, is

A 36

B 48

C 60

D 72

Q:6

Topic Name:Mathematics-Section A

ItemCode:176

Let  $A_1, A_2, A_3, \dots$  be an increasing geometric progression of positive real

numbers. If  $A_1 A_3 A_5 A_7 = \frac{1}{1296}$  and  $A_2 + A_4 = \frac{7}{36}$ , then, the value of

Question:  $A_6 + A_8 + A_{10}$  is equal to

A 33

B 37

C 43

D 47

Q:7

Topic Name:Mathematics-Section A

ItemCode:177

Let  $[t]$  denote the greatest integer less than or equal to  $t$ . Then, the value of the

integral  $\int_0^1 [-8x^2 + 6x - 1] dx$  is equal to

Question:

A -1

B  $-\frac{5}{4}$

C  $\frac{\sqrt{17}-13}{8}$

D  $\frac{\sqrt{17}-16}{8}$

Q:8

Topic Name:Mathematics-Section A

ItemCode:178

Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  be defined as

$$f(x) = \begin{cases} [e^x], & x < 0 \\ ae^x + [x-1], & 0 \leq x < 1 \\ b + [\sin(\pi x)], & 1 \leq x < 2 \\ [e^{-x}] - c, & x \geq 2 \end{cases}$$

where  $a, b, c \in \mathbb{R}$  and  $[t]$  denotes greatest integer less than or equal to  $t$ . Then,

Question: which of the following statements is true ?

A There exists  $a, b, c \in \mathbb{R}$  such that  $f$  is continuous on  $\mathbb{R}$ .

B If  $f$  is discontinuous at exactly one point, then  $a + b + c = 1$

- C If  $f$  is discontinuous at exactly one point, then  $a + b + c \neq 1$
- D  $f$  is discontinuous at atleast two points, for any values of  $a, b$  and  $c$

Q:9

Topic Name:Mathematics-Section A

ItemCode:179

Question: The area of the region  $S = \{(x, y) : y^2 \leq 8x, y \geq \sqrt{2}x, x \geq 1\}$  is

- A  $\frac{13\sqrt{2}}{6}$
- B  $\frac{11\sqrt{2}}{6}$
- C  $\frac{5\sqrt{2}}{6}$
- D  $\frac{19\sqrt{2}}{6}$

Q:10

Topic Name:Mathematics-Section A

ItemCode:1710

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

$$\left[ \frac{x}{\sqrt{x^2 - y^2}} + e^{\frac{y}{x}} \right] x \frac{dy}{dx} = x + \left[ \frac{x}{\sqrt{x^2 - y^2}} + e^{\frac{y}{x}} \right] y$$

Question: pass through the points  $(1, 0)$  and  $(2\alpha, \alpha)$ ,  $\alpha > 0$ . Then  $\alpha$  is equal to

- A  $\frac{1}{2} \exp\left(\frac{\pi}{6} + \sqrt{e} - 1\right)$
- B  $\frac{1}{2} \exp\left(\frac{\pi}{3} + e - 1\right)$
- C  $\exp\left(\frac{\pi}{6} + \sqrt{e} + 1\right)$
- D  $2 \exp\left(\frac{\pi}{3} + \sqrt{e} - 1\right)$

Q:11

Topic Name:Mathematics-Section A

ItemCode:1711

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

Question:  $x(1-x^2) \frac{dy}{dx} + (3x^2y - y - 4x^3) = 0$ ,  $x > 1$ , with  $y(2) = -2$ . Then  $y(3)$  is equal to

- A -18
- B -12
- C -6
- D -3

Q:12

Topic Name:Mathematics-Section A

ItemCode:1712

Question: The number of real solutions of  $x^7 + 5x^3 + 3x + 1 = 0$  is equal to \_\_\_\_\_.

- A 0
- B 1

C 3

D 5

Q:13

Topic Name:Mathematics-Section A

ItemCode:1713

Let the eccentricity of the hyperbola  $H: \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$  be  $\sqrt{\frac{5}{2}}$  and length of its

latus rectum be  $6\sqrt{2}$ . If  $y = 2x + c$  is a tangent to the hyperbola  $H$ , then the value

Question: of  $c^2$  is equal to

A 18

B 20

C 24

D 32

Q:14

Topic Name:Mathematics-Section A

ItemCode:1714

If the tangents drawn at the points  $O(0, 0)$  and  $P(1 + \sqrt{5}, 2)$  on the circle

$x^2 + y^2 - 2x - 4y = 0$  intersect at the point  $Q$ , then the area of the triangle  $OPQ$  is

Question: equal to

A  $\frac{3 + \sqrt{5}}{2}$

B  $\frac{4 + 2\sqrt{5}}{2}$

C  $\frac{5 + 3\sqrt{5}}{2}$

D  $\frac{7 + 3\sqrt{5}}{2}$

Q:15

Topic Name:Mathematics-Section A

ItemCode:1715

If two distinct points  $Q, R$  lie on the line of intersection of the planes

$-x + 2y - z = 0$  and  $3x - 5y + 2z = 0$  and  $PQ = PR = \sqrt{18}$  where the point  $P$  is

Question:  $(1, -2, 3)$ , then the area of the triangle  $PQR$  is equal to

A  $\frac{2}{3}\sqrt{38}$

B  $\frac{4}{3}\sqrt{38}$

C  $\frac{8}{3}\sqrt{38}$

D  $\sqrt{\frac{152}{3}}$

Q:16

Topic Name:Mathematics-Section A

ItemCode:1716

The acute angle between the planes  $P_1$  and  $P_2$ , when  $P_1$  and  $P_2$  are the planes

passing through the intersection of the planes  $5x + 8y + 13z - 29 = 0$  and

Question:  $8x - 7y + z - 20 = 0$  and the points  $(2, 1, 3)$  and  $(0, 1, 2)$ , respectively, is

- A  $\frac{\pi}{3}$
- B  $\frac{\pi}{4}$
- C  $\frac{\pi}{6}$
- D  $\frac{\pi}{12}$

Q:17

Topic Name:Mathematics-Section A

ItemCode:1717

Let the plane  $P: \vec{r} \cdot \vec{a} = d$  contain the line of intersection of two planes

$$\vec{r} \cdot (\hat{i} + 3\hat{j} - \hat{k}) = 6 \text{ and } \vec{r} \cdot (-6\hat{i} + 5\hat{j} - \hat{k}) = 7. \text{ If the plane } P \text{ passes through the}$$

point  $\left(2, 3, \frac{1}{2}\right)$ , then the value of  $\frac{|13\vec{a}|^2}{d^2}$  is equal to

Question:

- A 90
- B 93
- C 95
- D 97

Q:18

Topic Name:Mathematics-Section A

ItemCode:1718

The probability, that in a randomly selected 3-digit number at least two digits are

Question: odd, is

- A  $\frac{19}{36}$
- B  $\frac{15}{36}$
- C  $\frac{13}{36}$
- D  $\frac{23}{36}$

Q:19

Topic Name:Mathematics-Section A

ItemCode:1719

Let AB and PQ be two vertical poles, 160 m apart from each other. Let C be the middle point of B and Q, which are feet of these two poles. Let  $\frac{\pi}{8}$  and  $\theta$  be the angles of elevation from C to P and A, respectively. If the height of pole PQ is

Question: twice the height of pole AB, then  $\tan^2\theta$  is equal to

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

Q:20  
Topic Name:Mathematics-Section A

ItemCode:1720

Let  $p, q, r$  be three logical statements. Consider the compound statements

$$S_1 : ((\sim p) \vee q) \vee ((\sim p) \vee r) \text{ and}$$

$$S_2 : p \rightarrow (q \vee r)$$

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

- A If  $S_2$  is True, then  $S_1$  is True
- B If  $S_2$  is False, then  $S_1$  is False
- C If  $S_2$  is False, then  $S_1$  is True
- D If  $S_1$  is False, then  $S_2$  is False

Q:21  
Topic Name:Mathematics-Section B

ItemCode:1721

Let  $R_1$  and  $R_2$  be relations on the set  $\{1, 2, \dots, 50\}$  such that

$$R_1 = \{(p, p^n) : p \text{ is a prime and } n \geq 0 \text{ is an integer}\} \text{ and}$$

$$R_2 = \{(p, p^n) : p \text{ is a prime and } n = 0 \text{ or } 1\}.$$

Question: Then, the number of elements in  $R_1 - R_2$  is \_\_\_\_\_.

Q:22  
Topic Name:Mathematics-Section B

ItemCode:1722

The number of real solutions of the equation  $e^{4x} + 4e^{3x} - 58e^{2x} + 4e^x + 1 = 0$  is

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

Q:23  
Topic Name:Mathematics-Section B

ItemCode:1723

The mean and standard deviation of 15 observations are found to be 8 and 3 respectively. On rechecking it was found that, in the observations, 20 was misread

Question: as 5. Then, the correct variance is equal to \_\_\_\_\_.

Q:24  
Topic Name:Mathematics-Section B

ItemCode:1724

If  $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$ ,  $\vec{b} = 3\hat{i} + 3\hat{j} + \hat{k}$  and  $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$  are coplanar

Question: vectors and  $\vec{a} \cdot \vec{c} = 5$ ,  $\vec{b} \perp \vec{c}$ , then  $122(c_1 + c_2 + c_3)$  is equal to \_\_\_\_\_.

Q:25  
Topic Name:Mathematics-Section B

ItemCode:1725

A ray of light passing through the point P (2, 3) reflects on the x-axis at point A and the reflected ray passes through the point Q (5, 4). Let R be the point that divides the line segment AQ internally into the ratio 2:1. Let the co-ordinates of the foot of the perpendicular M from R on the bisector of the angle PAQ be  $(\alpha, \beta)$ . Then, the

Question: value of  $7\alpha + 3\beta$  is equal to \_\_\_\_\_.

Q:26  
Topic Name:Mathematics-Section B

ItemCode:1726

Let  $l$  be a line which is normal to the curve  $y = 2x^2 + x + 2$  at a point P on the curve. If the point Q(6, 4) lies on the line  $l$  and O is origin, then the area of the

Question: triangle OPQ is equal to \_\_\_\_\_.

Q:27

ItemCode: 1727

Let  $A = \{1, a_1, a_2, \dots, a_{18}, 77\}$  be a set of integers with  $1 < a_1 < a_2 < \dots < a_{18} < 77$ . Let the set  $A + A = \{x + y : x, y \in A\}$  contain exactly 39 elements. Then, the value of  $a_1 + a_2 + \dots + a_{18}$  is equal to

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

Q:28

Topic Name: Mathematics-Section B

ItemCode: 1728

The number of positive integers  $k$  such that the constant term in the binomial expansion of  $\left(2x^3 + \frac{3}{x^k}\right)^{12}$ ,  $x \neq 0$  is  $2^8 \cdot \ell$ , where  $\ell$  is an odd integer, is \_\_\_\_\_.

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

Q:29

Topic Name: Mathematics-Section B

ItemCode: 1729

The number of elements in the set  $\{z = a + ib \in \mathbb{C} : a, b \in \mathbb{Z} \text{ and } 1 < |z - 3 + 2i| < 4\}$  is \_\_\_\_\_.

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

Q:30

Topic Name: Mathematics-Section B

ItemCode: 1730

Let the lines  $y + 2x = -\sqrt{11} + 7\sqrt{7}$  and  $2y + x = 2\sqrt{11} + 6\sqrt{7}$  be normal to a circle  $C : (x - h)^2 + (y - k)^2 = r^2$ . If the line  $\sqrt{11}y - 3x = \frac{5\sqrt{77}}{3} + 11$  is tangent to the

Question: circle  $C$ , then the value of  $(5h - 8k)^2 + 5r^2$  is equal to \_\_\_\_\_.

Q:31

Topic Name: Physics-Section A

ItemCode: 1731

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

**Assertion A** : Product of Pressure (P) and time (t) has the same dimension as that of coefficient of viscosity.

**Reason R** : Coefficient of viscosity =  $\frac{\text{Force}}{\text{Velocity gradient}}$

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

- A Both **A** and **R** true, and **R** is correct explanation of **A**.
- B Both **A** and **R** are true but **R** is NOT the correct explanation of **A**.
- C **A** is true but **R** is false.
- D **A** is false but **R** is true.

Q:32

Topic Name: Physics-Section A

ItemCode: 1732

A particle of mass  $m$  is moving in a circular path of constant radius  $r$  such that its centripetal acceleration ( $a$ ) is varying with time  $t$  as  $a = k^2 r t^2$ , where  $k$  is a constant. The power delivered to the particle by the force acting on it is given as

- A zero
- B  $mk^2 r^2 t^2$
- C  $mk^2 r^2 t$

Q:33

Topic Name:Physics-Section A

ItemCode:1733

Motion of a particle in  $x$ - $y$  plane is described by a set of following equations

$$x = 4 \sin\left(\frac{\pi}{2} - \omega t\right) \text{ m and } y = 4 \sin(\omega t) \text{ m. The path of the particle will be :}$$

Question:

- A circular  
 B helical  
 C parabolic  
 D elliptical

Q:34

Topic Name:Physics-Section A

ItemCode:1734

Match List-I with List-II

	List - I		List - II
A.	Moment of inertia of solid sphere of radius $R$ about any tangent.	I.	$\frac{5}{3}MR^2$
B.	Moment of inertia of hollow sphere of radius ( $R$ ) about any tangent.	II.	$\frac{7}{5}MR^2$
C.	Moment of inertia of circular ring of radius ( $R$ ) about its diameter.	III.	$\frac{1}{4}MR^2$
D.	Moment of inertia of circular disc of radius ( $R$ ) about any diameter.	IV.	$\frac{1}{2}MR^2$

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

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

Q:35

Topic Name:Physics-Section A

ItemCode:1735

Two planets A and B of equal mass are having their period of revolutions  $T_A$  and  $T_B$  such that  $T_A = 2T_B$ . These planets are revolving in the circular orbits of radii  $r_A$  and  $r_B$  respectively. Which out of the following would be the correct

Question: relationship of their orbits?

- A  $2r_A^2 = r_B^3$   
 B  $r_A^3 = 2r_B^3$   
 C  $r_A^3 = 4r_B^3$   
 D  $T_A^2 - T_B^2 = \frac{\pi^2}{GM}(r_B^3 - 4r_A^3)$

Q:36

Topic Name:Physics-Section A

ItemCode:1736

A water drop of diameter 2 cm is broken into 64 equal droplets. The surface

Question: tension of water is 0.075 N/m. In this process the gain in surface energy will be :

- A  $2.8 \times 10^{-4} \text{ J}$   
 B  $1.5 \times 10^{-3} \text{ J}$



C  $1.9 \times 10^{-4}$  J

D  $9.4 \times 10^{-5}$  J

Q:37

Topic Name:Physics-Section A

ItemCode:1737

Given below are two statements :

Statement – I : When  $\mu$  amount of an ideal gas undergoes adiabatic change from state  $(P_1, V_1, T_1)$  to state  $(P_2, V_2, T_2)$ , then work done is  $W = \frac{\mu R (T_2 - T_1)}{1 - \gamma}$ , where

$\gamma = \frac{C_p}{C_v}$  and R = universal gas constant.

Statement – II : In the above case, when work is done on the gas, the temperature of the gas would rise.

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

A Both statement-I and statement-II are true.

B Both statement-I and statement-II are false.

C Statement-I is true but statement-II is false.

D Statement-I is false but statement-II is true.

Q:38

Topic Name:Physics-Section A

ItemCode:1738

Given below are two statements :

Statement-I : A point charge is brought in an electric field. The value of electric field at a point near to the charge may increase if the charge is positive.

Statement-II : An electric dipole is placed in a non-uniform electric field. The net electric force on the dipole will not be zero.

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

A Both statement-I and statement-II are true.

B Both statement-I and statement-II are false.

C Statement-I is true but statement-II is false.

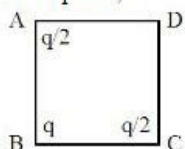
D Statement-I is false but statement-II is true.

Q:39

Topic Name:Physics-Section A

ItemCode:1739

The three charges  $q/2$ ,  $q$  and  $q/2$  are placed at the corners A, B and C of a square of side 'a' as shown in figure. The magnitude of electric field (E) at the corner D of the square, is :



Question: B

A  $\frac{q}{4\pi\epsilon_0 a^2} \left( \frac{1}{\sqrt{2}} + \frac{1}{2} \right)$

B  $\frac{q}{4\pi\epsilon_0 a^2} \left( 1 + \frac{1}{\sqrt{2}} \right)$

C  $\frac{q}{4\pi\epsilon_0 a^2} \left( 1 - \frac{1}{\sqrt{2}} \right)$

D  $\frac{q}{4\pi\epsilon_0 a^2} \left( \frac{1}{\sqrt{2}} - \frac{1}{2} \right)$

Q:40

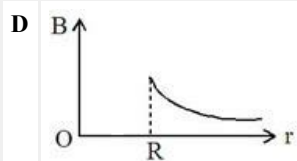
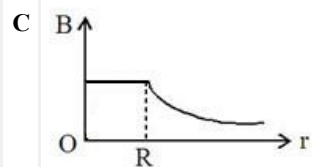
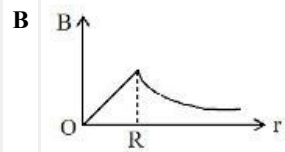
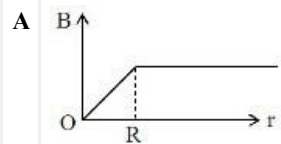
Topic Name:Physics-Section A

ItemCode:1740

An infinitely long hollow conducting cylinder with radius  $R$  carries a uniform current along its surface.

Choose the correct representation of magnetic field ( $B$ ) as a function of radial distance ( $r$ ) from the axis of cylinder.

Question:



Q:41

Topic Name:Physics-Section A

ItemCode:1741

A radar sends an electromagnetic signal of electric field ( $E_0$ ) = 2.25 V/m and magnetic field ( $B_0$ ) =  $1.5 \times 10^{-8}$  T which strikes a target on line of sight at a distance of 3 km in a medium. After that, a part of signal (echo) reflects back towards the radar with same velocity and by same path. If the signal was transmitted at time  $t=0$  from radar, then after how much time echo will reach to the

Question: radar?

A  $2.0 \times 10^{-5}$  s

B  $4.0 \times 10^{-5}$  s

C  $1.0 \times 10^{-5}$  s

D  $8.0 \times 10^{-5}$  s

Q:42

Topic Name:Physics-Section A

ItemCode:1742

The refracting angle of a prism is  $A$  and refractive index of the material of the prism is  $\cot(A/2)$ . Then the angle of minimum deviation will be -

Question:

A  $180 - 2A$

B  $90 - A$

C  $180 + 2A$

D  $180 - 3A$

Q:43

Topic Name:Physics-Section A

ItemCode:1743

The aperture of the objective is 24.4 cm. The resolving power of this telescope, if a light of wavelength  $2440 \text{ \AA}$  is used to see the object will be :

Question:

A  $8.1 \times 10^6$

B  $10.0 \times 10^7$

C  $8.2 \times 10^5$

D  $1.0 \times 10^{-8}$

Q:44

Topic Name:Physics-Section A

ItemCode:1744

The de Broglie wavelengths for an electron and a photon are  $\lambda_e$  and  $\lambda_p$  respectively. For the same kinetic energy of electron and photon, which of the following presents the correct relation between the de Broglie wavelengths of two

Question:?

A  $\lambda_p \propto \lambda_e^2$

B  $\lambda_p \propto \lambda_e$

C  $\lambda_p \propto \sqrt{\lambda_e}$

D  $\lambda_p \propto \sqrt{\frac{1}{\lambda_e}}$

Q:45

Topic Name:Physics-Section A

ItemCode:1745

The Q-value of a nuclear reaction and kinetic energy of the projectile particle,  $K_p$

Question:are related as :

A  $Q = K_p$

B  $(K_p + Q) < 0$

C  $Q < K_p$

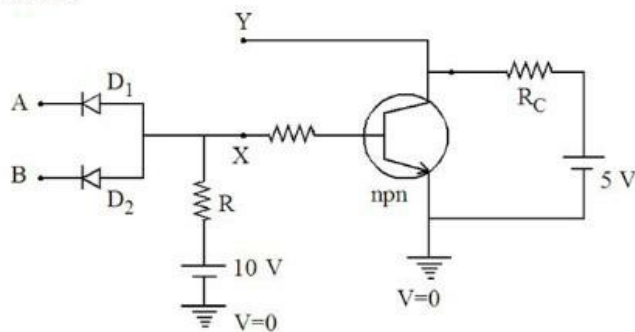
D  $(K_p + Q) > 0$

Q:46

Topic Name:Physics-Section A

ItemCode:1746

In the following circuit, the correct relation between output (Y) and inputs A and B will be :



Question:

A  $Y = AB$

B  $Y = A + B$

C  $Y = \overline{AB}$

D  $Y = \overline{A + B}$

Q:47

Topic Name:Physics-Section A

ItemCode:1747

For using a multimeter to identify diode from electrical components, choose the

Question:correct statement out of the following about the diode :

A It is two terminal device which conducts current in both directions.

B It is two terminal device which conducts current in one direction only

- C** It does not conduct current gives an initial deflection which decays to zero.
- D** It is three terminal device which conducts current in one direction only between central terminal and either of the remaining two terminals

Q:48

Topic Name:Physics-Section A

ItemCode:1748

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

**Assertion A** : n-p-n transistor permits more current than a p-n-p transistor.

**Reason R** : Electrons have greater mobility as a charge carrier.

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

- A** Both **A** and **R** true, and **R** is correct explanation of **A**.
- B** Both **A** and **R** are true but **R** is NOT the correct explanation of **A**.
- C** **A** is true but **R** is false.
- D** **A** is false but **R** is true.

Q:49

Topic Name:Physics-Section A

ItemCode:1749

Match List-I with List-II

	List - I		List - II
A.	Television signal	I.	03 KHz
B.	Radio signal	II.	20 KHz
C.	High Quality Music	III.	02 MHz
D.	Human speech	IV.	06 MHz

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

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

Q:50

Topic Name:Physics-Section A

ItemCode:1750

The velocity of sound in a gas, in which two wavelengths 4.08m and 4.16m

Question: produce 40 beats in 12s, will be :

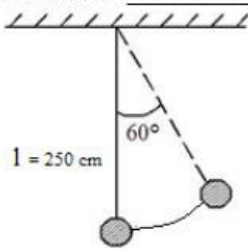
- A**  $282.8 \text{ ms}^{-1}$
- B**  $175.5 \text{ ms}^{-1}$
- C**  $353.6 \text{ ms}^{-1}$
- D**  $707.2 \text{ ms}^{-1}$

Q:51

Topic Name:Physics-Section B

ItemCode:1751

A pendulum is suspended by a string of length 250 cm. The mass of the bob of the pendulum is 200 g. The bob is pulled aside until the string is at  $60^\circ$  with vertical as shown in the figure. After releasing the bob, the maximum velocity attained by the bob will be \_\_\_\_\_  $\text{ms}^{-1}$ . (if  $g = 10 \text{ m/s}^2$ )



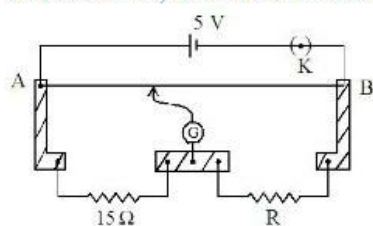
Question:

Q:52

Topic Name:Physics-Section B

ItemCode:1752

A meter bridge setup is shown in the figure. It is used to determine an unknown resistance  $R$  using a given resistor of  $15 \Omega$ . The galvanometer ( $G$ ) shows null deflection when tapping key is at 43 cm mark from end A. If the end correction for end A is 2 cm, then the determined value of  $R$  will be \_\_\_\_\_  $\Omega$ .



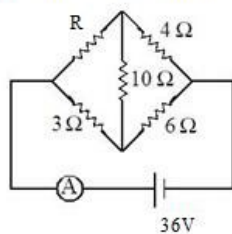
Question:

Q:53

Topic Name:Physics-Section B

ItemCode:1753

Current measured by the ammeter  $\text{A}$  in the reported circuit when no current flows through  $10 \Omega$  resistance, will be \_\_\_\_\_ A.



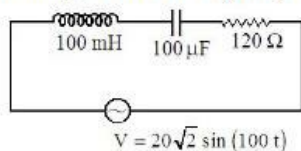
Question:

Q:54

Topic Name:Physics-Section B

ItemCode:1754

An AC source is connected to an inductance of 100 mH, a capacitance of  $100 \mu\text{F}$  and a resistance of  $120 \Omega$  as shown in figure. The time in which the resistance having a thermal capacity  $2 \text{ J/}^\circ\text{C}$  will get heated by  $16^\circ\text{C}$  is \_\_\_\_\_ s.



Question:

Q:55

Topic Name:Physics-Section B

ItemCode:1755

The position vector of 1 kg object is  $\vec{r} = (3\hat{i} - \hat{j}) \text{ m}$  and its velocity

$\vec{v} = (3\hat{j} + \hat{k}) \text{ ms}^{-1}$ . The magnitude of its angular momentum is  $\sqrt{x} \text{ Nm}$  where  $x$  is

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

Q:56

Topic Name:Physics-Section B

ItemCode:1756

A man of 60 kg is running on the road and suddenly jumps into a stationary trolley car of mass 120 kg. Then, the trolley car starts moving with velocity  $2 \text{ ms}^{-1}$ . The

Question: velocity of the running man was \_\_\_\_\_  $\text{ms}^{-1}$ , when he jumps into the car.

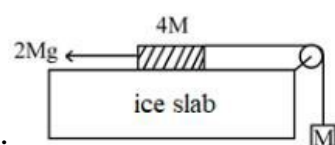
Q:57

Topic Name:Physics-Section B

ItemCode:1757

A hanging mass  $M$  is connected to a four times bigger mass by using a string-pulley arrangement, as shown in the figure. The bigger mass is placed on a horizontal ice-slab and being pulled by  $2Mg$  force. In this situation, tension in the string is  $\frac{x}{5}Mg$  for  $x =$  \_\_\_\_\_. Neglect mass of the string and friction of the block (bigger mass) with ice slab.

(Given  $g =$  acceleration due to gravity)



Question:

Q:58

Topic Name:Physics-Section B

ItemCode:1758

The total internal energy of two mole monoatomic ideal gas at temperature

Question:  $T = 300 \text{ K}$  will be \_\_\_\_\_ J. (Given  $R = 8.31 \text{ J/mol.K}$ )

Q:59

Topic Name:Physics-Section B

ItemCode:1759

A singly ionized magnesium atom ( $A=24$ ) ion is accelerated to kinetic energy  $5 \text{ keV}$ , and is projected perpendicularly into a magnetic field  $B$  of the

Question: magnitude  $0.5 \text{ T}$ . The radius of path formed will be \_\_\_\_\_ cm.

Q:60

Topic Name:Physics-Section B

ItemCode:1760

A telegraph line of length  $100 \text{ km}$  has a capacity of  $0.01 \mu\text{F/km}$  and it carries an alternating current at  $0.5$  kilo cycle per second. If minimum impedance is required, then the value of the inductance that needs to be introduced in series is

Question: \_\_\_\_\_ mH. (if  $\pi = \sqrt{10}$ )

Q:61

Topic Name:Chemistry-Section A

ItemCode:1761

Question: The **incorrect** statement about the imperfections in solids is :

- A Schottky defect decreases the density of the substance.
- B Interstitial defect increases the density of the substance.
- C Frenkel defect does not alter the density of the substance.
- D Vacancy defect increases the density of the substance.

Q:62

Topic Name:Chemistry-Section A

ItemCode:1762

Question: The Zeta potential is related to which property of colloids ?

- A Colour
- B Tyndall effect

C Charge on the surface of colloidal particles

D Brownian movement

Q:63

Topic Name:Chemistry-Section A

ItemCode:1763

Element "E" belongs to the period 4 and group 16 of the periodic table. The valence shell electron configuration of the element, which is just above "E" in the

Question: group is

A  $3s^2, 3p^4$

B  $3d^{10}, 4s^2, 4p^4$

C  $4d^{10}, 5s^2, 5p^4$

D  $2s^2, 2p^4$

Q:64

Topic Name:Chemistry-Section A

ItemCode:1764

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

**Assertion A** :Magnesium can reduce  $Al_2O_3$  at a temperature below  $1350^\circ C$ , while above  $1350^\circ C$  aluminium can reduce  $MgO$ .

**Reason R** : The melting and boiling points of magnesium are lower than those of aluminium.

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

Question: given below :

A Both **A** and **R** are correct, and **R** is correct explanation of **A**.

B Both **A** and **R** are correct, but **R** is NOT the correct explanation of **A**.

C **A** is correct **R** is not correct.

D **A** is not correct, **R** is correct.

Q:65

Topic Name:Chemistry-Section A

ItemCode:1765

Question: Dihydrogen reacts with  $CuO$  to give

A  $CuH_2$

B  $Cu$

C  $Cu_2O$

D  $Cu(OH)_2$

Q:66

Topic Name:Chemistry-Section A

ItemCode:1766

Question: Nitrogen gas is obtained by thermal decomposition of

A  $Ba(NO_3)_2$

B  $Ba(N_3)_2$

C  $NaNO_2$

D  $NaNO_3$

Q:67

Topic Name:Chemistry-Section A

ItemCode:1767

Given below are two statements :

Statement I :The pentavalent oxide of group-15 element,  $E_2O_5$ , is less acidic than trivalent oxide,  $E_2O_3$ , of the same element.

Statement II :The acidic character of trivalent oxide of group 15 elements,  $E_2O_3$ , decreases down the group.

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

Question: options given below :

- A Both Statement I and Statement II are true.
- B Both Statement I and Statement II are false.
- C Statement I true, but statement II is false.
- D Statement I is false but statement II is true.

Q:68

Topic Name:Chemistry-Section A

ItemCode:1768

Question: Which one of the lanthanoids given below is the most stable in divalent form?

- A Ce (Atomic Number 58)
- B Sm (Atomic Number 62)
- C Eu (Atomic Number 63)
- D Yb (Atomic Number 70)

Q:69

Topic Name:Chemistry-Section A

ItemCode:1769

Given below are two statements :

Statement I :  $[Ni(CN)_4]^{2-}$  is square planar and diamagnetic complex, with  $dsp^2$  hybridization for Ni but  $[Ni(CO)_4]$  is tetrahedral, paramagnetic and with  $sp^3$ - hybridization for Ni.

Statement II :  $[NiCl_4]^{2-}$  and  $[Ni(CO)_4]$  both have same d-electron configuration, have same geometry and are paramagnetic.

In light the above statements, choose the **correct** answer form the options given

Question: below :

- A Both Statement I and Statement II are true.
- B Both Statement I and Statement II are false.
- C Statement I is correct but statement II is false.
- D Statement I is incorrect but statement II is true.

Q:70

Topic Name:Chemistry-Section A

ItemCode:1770

Question: Which amongst the following is **not** a pesticide ?

- A DDT
- B Organophosphates
- C Dieldrin
- D Sodium arsenite

Q:71

Topic Name:Chemistry-Section A

ItemCode:1771

Question: Which one of the following techniques is **not** used to spot components of a mixture separated on thin layer chromatographic plate ?



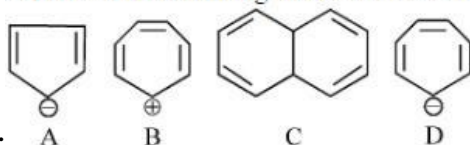
- A I<sub>2</sub> (Solid)
- B U.V. Light
- C Visualisation agent as a component of mobile phase
- D Spraying of an appropriate reagent

Q:72

Topic Name: Chemistry-Section A

ItemCode: 1772

Which of the following structures are aromatic in nature ?



Question:

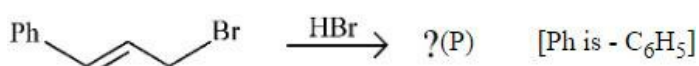
- A A, B, C and D
- B Only A and B
- C Only A and C
- D Only B, C and D

Q:73

Topic Name: Chemistry-Section A

ItemCode: 1773

The major product (P) in the reaction



Question: .is

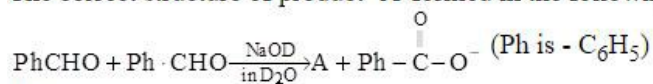
- A
- B
- C
- D

Q:74

Topic Name: Chemistry-Section A

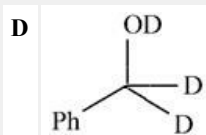
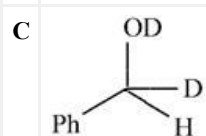
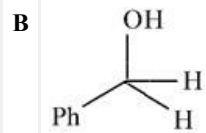
ItemCode: 1774

The correct structure of product 'A' formed in the following reaction,



Question: .is

- A

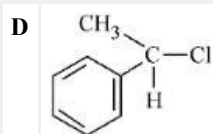
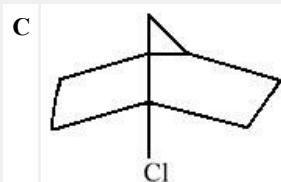
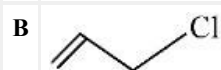
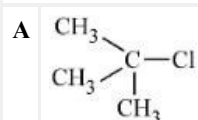


Q:75

Topic Name: Chemistry-Section A

ItemCode: 1775

Question: Which one of the following compounds is inactive towards  $S_N1$  reaction ?

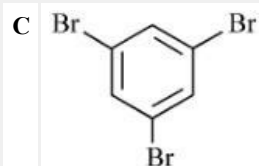
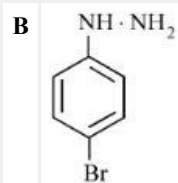
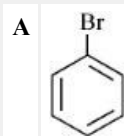
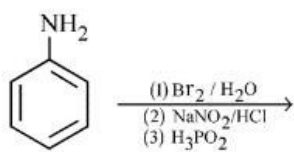


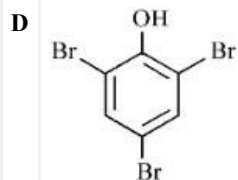
Q:76

Topic Name: Chemistry-Section A

ItemCode: 1776

Identify the major product formed in the following sequence of reactions :





Q:77

Topic Name:Chemistry-Section A

ItemCode:1777

A primary aliphatic amine on reaction with nitrous acid in cold (273 K) and there after raising temperature of reaction mixture to room temperature (298 K), gives

Question: a/an

- A nitrile
- B alcohol
- C diazonium salt
- D secondary amine

Q:78

Topic Name:Chemistry-Section A

ItemCode:1778

Question: Which one of the following is **NOT** a copolymer ?

- A Buna-S
- B Neoprene
- C PHBV
- D Butadiene-styrene

Q:79

Topic Name:Chemistry-Section A

ItemCode:1779

Question: Stability of  $\alpha$  - Helix structure of proteins depends upon

- A dipolar interaction
- B H-bonding interaction
- C van der Waals forces
- D  $\pi$  -stacking interaction

Q:80

Topic Name:Chemistry-Section A

ItemCode:1780

The formula of the purple colour formed in Laissaigne's test for sulphur using

Question: sodium nitroprusside is

- A  $\text{NaFe}[\text{Fe}(\text{CN})_6]$
- B  $\text{Na}[\text{Cr}(\text{NH}_3)_2(\text{NCS})_4]$
- C  $\text{Na}_2[\text{Fe}(\text{CN})_5(\text{NO})]$
- D  $\text{Na}_4[\text{Fe}(\text{CN})_5(\text{NOS})]$

Q:81

Topic Name:Chemistry-Section B

ItemCode:1781

A 2.0 g sample containing  $\text{MnO}_2$  is treated with  $\text{HCl}$  liberating  $\text{Cl}_2$ . The  $\text{Cl}_2$  gas is passed into a solution of  $\text{KI}$  and 60.0 mL of 0.1 M  $\text{Na}_2\text{S}_2\text{O}_3$  is required to titrate the liberated iodine. The percentage of  $\text{MnO}_2$  in the sample is \_\_\_\_\_. (Nearest integer)

[Atomic masses (in u) Mn = 55; Cl = 35.5; O = 16, I = 127, Na = 23, K = 39,

Question: S = 32]

Q:82

Topic Name:Chemistry-Section B

ItemCode:1782

If the work function of a metal is  $6.63 \times 10^{-19} \text{J}$ , the maximum wavelength of the photon required to remove a photoelectron from the metal is \_\_\_\_\_ nm. (Nearest integer)

Question: [Given :  $h = 6.63 \times 10^{-34} \text{J s}$ , and  $c = 3 \times 10^8 \text{ m s}^{-1}$ ]

Q:83

Topic Name:Chemistry-Section B

ItemCode:1783

Question: The hybridization of P exhibited in  $\text{PF}_5$  is  $\text{sp}^x\text{d}^y$ . The value of  $y$  is \_\_\_\_\_

Q:84

Topic Name:Chemistry-Section B

ItemCode:1784

4.0 L of an ideal gas is allowed to expand isothermally into vacuum until the total

Question: volume is 20 L. The amount of heat absorbed in this expansion is \_\_\_\_\_ L atm.

Q:85

Topic Name:Chemistry-Section B

ItemCode:1785

The vapour pressures of two volatile liquids A and B at  $25^\circ\text{C}$  are 50 Torr and 100 Torr, respectively. If the liquid mixture contains 0.3 mole fraction of A, then the

Question: mole fraction of liquid B in the vapour phase is  $\frac{x}{17}$ . The value of  $x$  is \_\_\_\_\_.

Q:86

Topic Name:Chemistry-Section B

ItemCode:1786

The solubility product of a sparingly soluble salt  $\text{A}_2\text{X}_3$  is  $1.1 \times 10^{-23}$ . If specific conductance of the solution is  $3 \times 10^{-5} \text{ S m}^{-1}$ , the limiting molar conductivity of

Question: the solution is  $x \times 10^{-3} \text{ S m}^2 \text{ mol}^{-1}$ . The value of  $x$  is \_\_\_\_\_.

Q:87

Topic Name:Chemistry-Section B

ItemCode:1787

The quantity of electricity in Faraday needed to reduce 1 mol of  $\text{Cr}_2\text{O}_7^{2-}$  to  $\text{Cr}^{3+}$  is

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

Q:88

Topic Name:Chemistry-Section B

ItemCode:1788

For a first order reaction  $\text{A} \rightarrow \text{B}$ , the rate constant,  $k = 5.5 \times 10^{-14} \text{ s}^{-1}$ . The time required for 67% completion of reaction is  $x \times 10^{-1}$  times the half life of reaction.

The value of  $x$  is \_\_\_\_\_ (Nearest integer)

Question: (Given :  $\log 3 = 0.4771$ )

Q:89

Topic Name:Chemistry-Section B

ItemCode:1789

Number of complexes which will exhibit synergic bonding amongst,

Question:  $[\text{Cr}(\text{CO})_6]$ ,  $[\text{Mn}(\text{CO})_5]$  and  $[\text{Mn}_2(\text{CO})_{10}]$  is \_\_\_\_\_.

Q:90

Topic Name:Chemistry-Section B

**ItemCode:1790**

In the estimation of bromine, 0.5 g of an organic compound gave 0.40 g of silver bromide. The percentage of bromine in the given compound is \_\_\_\_\_ % (nearest integer)

**Question:** (Relative atomic masses of Ag and Br are 108u and 80u, respectively).