

Q:1

Topic Name: Mathematics-Section A

|                                                                                                                |                       |
|----------------------------------------------------------------------------------------------------------------|-----------------------|
| ItemCode:101361                                                                                                |                       |
| Question: The area of the polygon, whose vertices are the non-real roots of the equation $\bar{z} = iz^2$ is : |                       |
| A                                                                                                              | $\frac{3\sqrt{3}}{4}$ |
| B                                                                                                              | $\frac{3\sqrt{3}}{2}$ |
| C                                                                                                              | $\frac{3}{2}$         |
| D                                                                                                              | $\frac{3}{4}$         |

Q:2

Topic Name: Mathematics-Section A

|                                                                                                                                                                            |                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| ItemCode:101362                                                                                                                                                            |                |
| Question: Let the system of linear equations $x + 2y + z = 2$ , $\alpha x + 3y - z = \alpha$ , $-\alpha x + y + 2z = -\alpha$ be inconsistent. Then $\alpha$ is equal to : |                |
| A                                                                                                                                                                          | $\frac{5}{2}$  |
| B                                                                                                                                                                          | $-\frac{5}{2}$ |
| C                                                                                                                                                                          | $\frac{7}{2}$  |
| D                                                                                                                                                                          | $-\frac{7}{2}$ |

Q:3

Topic Name: Mathematics-Section A

|                                                                                                                                                                                                        |                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| ItemCode:101363                                                                                                                                                                                        |                                                     |
| Question: If $x = \sum_{n=0}^{\infty} a^n$ , $y = \sum_{n=0}^{\infty} b^n$ , $z = \sum_{n=0}^{\infty} c^n$ , where $a, b, c$ are in A.P. and $ a  < 1$ , $ b  < 1$ , $ c  < 1$ , $abc \neq 0$ , then : |                                                     |
| A                                                                                                                                                                                                      | $x, y, z$ are in A.P.                               |
| B                                                                                                                                                                                                      | $x, y, z$ are in G.P.                               |
| C                                                                                                                                                                                                      | $\frac{1}{x}, \frac{1}{y}, \frac{1}{z}$ are in A.P. |

D  $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1 - (a+b+c)$

Q:4  
Topic Name: Mathematics-Section A

ItemCode:101364

Let  $\frac{dy}{dx} = \frac{ax - by + a}{bx + cy + a}$ , where a, b, c are constants, represent a circle passing through the point (2, 5). Then the shortest distance of the point (11, 6) from this circle is :

- A 10
- B 8
- C 7
- D 5

Q:5  
Topic Name: Mathematics-Section A

ItemCode:101365

Let a be an integer such that  $\lim_{x \rightarrow 7} \frac{18 - [1 - x]}{[x - 3a]}$  exists, where [t] is greatest integer  $\leq t$ . Then a is equal to :

- A - 6
- B - 2
- C 2
- D 6

Q:6  
Topic Name: Mathematics-Section A

ItemCode:101366

Question: The number of distinct real roots of  $x^4 - 4x + 1 = 0$  is :

- A 4
- B 2
- C 1
- D 0

Q:7  
Topic Name: Mathematics-Section A

ItemCode:101367

The lengths of the sides of a triangle are  $10 + x^2$ ,  $10 + x^2$  and  $20 - 2x^2$ . If for  $x = k$ , the area of the triangle is maximum, then  $3k^2$  is equal to :

- A 5
- B 8
- C 10

Q:8

Topic Name:Mathematics-Section A

ItemCode:101368

If  $\cos^{-1}\left(\frac{y}{2}\right) = \log_e\left(\frac{x}{5}\right)^5$ ,  $|y| < 2$ , then :

Question:

A  $x^2y'' + xy' - 25y = 0$

B  $x^2y'' - xy' - 25y = 0$

C  $x^2y'' - xy' + 25y = 0$

D  $x^2y'' + xy' + 25y = 0$

Q:9

Topic Name:Mathematics-Section A

ItemCode:101369

If  $\int \frac{(x^2 + 1)e^x}{(x + 1)^2} dx = f(x)e^x + C$ , where C is a constant, then  $\frac{d^3f}{dx^3}$  at  $x = 1$  is equal to :

Question:

A  $-\frac{3}{4}$

B  $\frac{3}{4}$

C  $-\frac{3}{2}$

D  $\frac{3}{2}$

Q:10

Topic Name:Mathematics-Section A

ItemCode:101370

The value of the integral  $\int_{-2}^2 \frac{|x^3 + x|}{(e^{x|x|} + 1)} dx$  is equal to :

Question:

A  $5e^2$

B  $3e^{-2}$

C 4

D 6

Q:11

Topic Name:Mathematics-Section A

ItemCode:101371

If  $\frac{dy}{dx} + \frac{2^{x-y}(2^y - 1)}{2^x - 1} = 0$ ,  $x, y > 0$ ,  $y(1) = 1$ , then  $y(2)$  is equal to :

Question:

A  $2 + \log_2 3$   
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B  $2 + \log_3 2$

C  $2 - \log_3 2$

D  $2 - \log_2 3$

Q:12

Topic Name: Mathematics-Section A

ItemCode:101372

In an isosceles triangle ABC, the vertex A is (6, 1) and the equation of the base BC is  $2x + y = 4$ . Let the point B lie on the line  $x + 3y = 7$ . If  $(\alpha, \beta)$  is the centroid of  $\Delta ABC$ , then  $15(\alpha + \beta)$  is equal to :

Question:

A 39

B 41

C 51

D 63

Q:13

Topic Name: Mathematics-Section A

ItemCode:101373

Let the eccentricity of an ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ ,  $a > b$ , be  $\frac{1}{4}$ . If this ellipse passes through the point  $\left(-4\sqrt{\frac{2}{5}}, 3\right)$ , then  $a^2 + b^2$  is equal to :

Question:

A 29

B 31

C 32

D 34

Q:14

Topic Name: Mathematics-Section A

ItemCode:101374

If two straight lines whose direction cosines are given by the relations  $l + m - n = 0$ ,  $3l^2 + m^2 + cnl = 0$  are parallel, then the positive value of c is :

Question:

A 6

B 4

C 3

D 2

Q:15

Topic Name: Mathematics-Section A

ItemCode:101375

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Let  $\vec{a} = \hat{i} + \hat{j} - \hat{k}$  and  $\vec{c} = 2\hat{i} - 3\hat{j} + 2\hat{k}$ . Then the number of vectors  $\vec{b}$  such that

**Question:**  $\vec{b} \times \vec{c} = \vec{a}$  and  $|\vec{b}| \in \{1, 2, \dots, 10\}$  is :

A 0

B 1

C 2

D 3

Q:16

Topic Name: Mathematics-Section A

ItemCode:101376

Five numbers  $x_1, x_2, x_3, x_4, x_5$  are randomly selected from the numbers 1, 2, 3, ..., 18 and are arranged in the increasing order ( $x_1 < x_2 < x_3 < x_4 < x_5$ ). The probability that  $x_2 = 7$  and  $x_4 = 11$  is :

**Question:**

A  $\frac{1}{136}$

B  $\frac{1}{72}$

C  $\frac{1}{68}$

D  $\frac{1}{34}$

Q:17

Topic Name: Mathematics-Section A

ItemCode:101377

Let X be a random variable having binomial distribution B(7, p). If  $P(X=3) = 5P(X=4)$ , then the sum of the mean and the variance of X is :

**Question:**

A  $\frac{105}{16}$

B  $\frac{7}{16}$

C  $\frac{77}{36}$

D  $\frac{49}{16}$

Q:18

Topic Name: Mathematics-Section A

The value of  $\cos\left(\frac{2\pi}{7}\right) + \cos\left(\frac{4\pi}{7}\right) + \cos\left(\frac{6\pi}{7}\right)$  is equal to :

Question:

- A  $-1$
- B  $-\frac{1}{2}$
- C  $-\frac{1}{3}$
- D  $-\frac{1}{4}$

Q:19

Topic Name:Mathematics-Section A

ItemCode:101379

$\sin^{-1}\left(\sin\frac{2\pi}{3}\right) + \cos^{-1}\left(\cos\frac{7\pi}{6}\right) + \tan^{-1}\left(\tan\frac{3\pi}{4}\right)$  is equal to :

Question:

- A  $\frac{11\pi}{12}$
- B  $\frac{17\pi}{12}$
- C  $\frac{31\pi}{12}$
- D  $-\frac{3\pi}{4}$

Q:20

Topic Name:Mathematics-Section A

ItemCode:101380

The boolean expression  $(\sim(p \wedge q)) \vee q$  is equivalent to :

Question:

- A  $q \rightarrow (p \wedge q)$
- B  $p \rightarrow q$
- C  $p \rightarrow (p \rightarrow q)$
- D  $p \rightarrow (p \vee q)$

Q:21

Topic Name:Mathematics-Section B

ItemCode:101381

Let  $f: \mathbf{R} \rightarrow \mathbf{R}$  be a function defined by  $f(x) = \frac{2e^{2x}}{e^{2x} + e}$ . Then

$f\left(\frac{1}{100}\right) + f\left(\frac{2}{100}\right) + f\left(\frac{3}{100}\right) + \dots + f\left(\frac{99}{100}\right)$  is equal to \_\_\_\_\_.

Question:

Q:22

Topic Name: Mathematics-Section B

ItemCode:101382

If the sum of all the roots of the equation  $e^{2x} - 11e^x - 45e^{-x} + \frac{81}{2} = 0$  is  $\log_e p$ , then p is

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

Q:23

Topic Name: Mathematics-Section B

ItemCode:101383

The positive value of the determinant of the matrix A, whose

$$\text{Adj}(\text{Adj}(A)) = \begin{pmatrix} 14 & 28 & -14 \\ -14 & 14 & 28 \\ 28 & -14 & 14 \end{pmatrix}, \text{ is } \underline{\hspace{2cm}}.$$

Question:

Q:24

Topic Name: Mathematics-Section B

ItemCode:101384

The number of ways, 16 identical cubes, of which 11 are blue and rest are red, can be placed in a row so that between any two red cubes there should be at least 2 blue cubes, is \_\_\_\_\_.

Question:

Q:25

Topic Name: Mathematics-Section B

ItemCode:101385

If the coefficient of  $x^{10}$  in the binomial expansion of  $\left(\frac{\sqrt{x}}{5^{\frac{1}{4}}} + \frac{\sqrt{5}}{x^{\frac{1}{3}}}\right)^{60}$  is  $5^k \cdot l$ , where  $l, k \in \mathbb{N}$  and

Question:  $l$  is co-prime to 5, then k is equal to \_\_\_\_\_.

Q:26

Topic Name: Mathematics-Section B

ItemCode:101386

Let

$$A_1 = \{(x, y) : |x| \leq y^2, |x| + 2y \leq 8\} \text{ and}$$

Question:  $A_2 = \{(x, y) : |x| + |y| \leq k\}$ . If  $27 (\text{Area } A_1) = 5 (\text{Area } A_2)$ , then k is equal to :

Q:27

Topic Name: Mathematics-Section B

ItemCode:101387

If the sum of the first ten terms of the series

$$\frac{1}{5} + \frac{2}{65} + \frac{3}{325} + \frac{4}{1025} + \frac{5}{2501} + \dots$$

Question: is  $\frac{m}{n}$ , where m and n are co-prime numbers, then m + n is equal to \_\_\_\_\_.

Q:28

Topic Name: Mathematics-Section B

Item Code: 101388

A rectangle R with end points of one of its sides as (1, 2) and (3, 6) is inscribed in a circle. If the equation of a diameter of the circle is  $2x - y + 4 = 0$ , then the area of R is \_\_\_\_\_.

Question:

Q:29

Topic Name: Mathematics-Section B

Item Code: 101389

A circle of radius 2 unit passes through the vertex and the focus of the parabola  $y^2 = 2x$  and touches the parabola  $y = \left(x - \frac{1}{4}\right)^2 + \alpha$ , where  $\alpha > 0$ . Then  $(4\alpha - 8)^2$  is equal to \_\_\_\_\_.

Question:

Q:30

Topic Name: Mathematics-Section B

Item Code: 101390

Let the mirror image of the point (a, b, c) with respect to the plane  $3x - 4y + 12z + 19 = 0$  be  $(a - 6, \beta, \gamma)$ . If  $a + b + c = 5$ , then  $7\beta - 9\gamma$  is equal to \_\_\_\_\_.

Question:

Q:31

Topic Name: Physics-Section A

Item Code: 101301

A projectile is launched at an angle ' $\alpha$ ' with the horizontal with a velocity  $20 \text{ ms}^{-1}$ . After 10 s, its inclination with horizontal is ' $\beta$ '. The value of  $\tan\beta$  will be : ( $g = 10 \text{ ms}^{-2}$ ).

Question:

- A  $\tan\alpha + 5\sec\alpha$
- B  $\tan\alpha - 5\sec\alpha$
- C  $2\tan\alpha - 5\sec\alpha$
- D  $2\tan\alpha + 5\sec\alpha$

Q:32

Topic Name: Physics-Section A

Item Code: 101302

A girl standing on road holds her umbrella at  $45^\circ$  with the vertical to keep the rain away. If she starts running without umbrella with a speed of  $15\sqrt{2} \text{ kmh}^{-1}$ , the rain drops hit her head vertically. The speed of rain drops with respect to the moving girl is :

Question:

- A  $30 \text{ kmh}^{-1}$
- B  $\frac{25}{\sqrt{2}} \text{ kmh}^{-1}$
- C  $\frac{30}{\sqrt{2}} \text{ kmh}^{-1}$
- D  $25 \text{ kmh}^{-1}$

Q:33

Topic Name: Physics-Section A

ItemCode:101303

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A silver wire has a mass  $(0.6 \pm 0.006)$  g, radius  $(0.5 \pm 0.005)$  mm and length  $(4.2 \pm 0.04)$  m.

The maximum percentage error in the measurement of its density will be

Question:

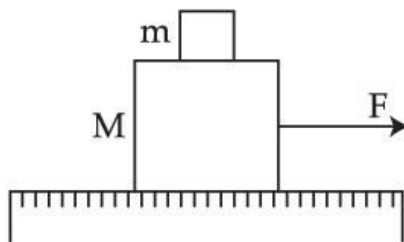
- A 4 %
- B 3 %
- C 6 %
- D 7 %

Q:34

Topic Name:Physics-Section A

ItemCode:101304

A system of two blocks of masses  $m = 2$  kg and  $M = 8$  kg is placed on a smooth table as shown in figure. The coefficient of static friction between two blocks is 0.5. The maximum horizontal force  $F$  that can be applied to the block of mass  $M$  so that the blocks move together will be :



Question:

- A 9.8 N
- B 39.2 N
- C 49 N
- D 78.4 N

Q:35

Topic Name:Physics-Section A

ItemCode:101305

Two blocks of masses 10 kg and 30 kg are placed on the same straight line with coordinates  $(0, 0)$  cm and  $(x, 0)$  cm respectively. The block of 10 kg is moved on the same line through a distance of 6 cm towards the other block. The distance through which the block of 30 kg must be moved to keep the position of centre of mass of the system unchanged is :

Question:

- A 4 cm towards the 10 kg block
- B 2 cm away from the 10 kg block
- C 2 cm towards the 10 kg block
- D 4 cm away from the 10 kg block

Q:36

Topic Name:Physics-Section A

ItemCode:101306

A  $72 \Omega$  galvanometer is shunted by a resistance of  $8 \Omega$  . The percentage of the total current which passes through the galvanometer is :

Question:

- A 0.1%
- B 10%
- C 25%
- D 0.25%

Q:37  
 Topic Name:Physics-Section A

ItemCode:101307
 

Given below are two statements :

**Statement I :** The law of gravitation holds good for any pair of bodies in the universe.

**Statement II :** The weight of any person becomes zero when the person is at the centre of the earth.

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

|   |                                                             |
|---|-------------------------------------------------------------|
| A | Both <b>Statement I</b> and <b>Statement II</b> are true    |
| B | Both <b>Statement I</b> and <b>Statement II</b> are false   |
| C | <b>Statement I</b> is true but <b>Statement II</b> is false |
| D | <b>Statement I</b> is false but <b>Statement II</b> is true |

Q:38  
 Topic Name:Physics-Section A

ItemCode:101308
 

What percentage of kinetic energy of a moving particle is transferred to a stationary particle when it strikes the stationary particle of 5 times its mass ?

**Question:** (Assume the collision to be head-on elastic collision)

|   |       |
|---|-------|
| A | 50.0% |
| B | 66.6% |
| C | 55.6% |
| D | 33.3% |

Q:39  
 Topic Name:Physics-Section A

ItemCode:101309
 

The velocity of a small ball of mass ‘m’ and density  $d_1$ , when dropped in a container filled with glycerine, becomes constant after some time. If the density of glycerine is  $d_2$ , then the viscous force acting on the ball, will be :

**Question:**

|   |                                         |
|---|-----------------------------------------|
| A | $mg \left( 1 - \frac{d_1}{d_2} \right)$ |
| B | $mg \left( 1 - \frac{d_2}{d_1} \right)$ |
| C | $mg \left( \frac{d_1}{d_2} - 1 \right)$ |

Q:40  
Topic Name:Physics-Section A

ItemCode:101310  
The susceptibility of a paramagnetic material is 99. The permeability of the material in Wb/A-m, is :

Question: [Permeability of free space  $\mu_0 = 4\pi \times 10^{-7}$  Wb/A-m]

- A  $4\pi \times 10^{-7}$
- B  $4\pi \times 10^{-4}$
- C  $4\pi \times 10^{-5}$
- D  $4\pi \times 10^{-6}$

Q:41  
Topic Name:Physics-Section A

ItemCode:101311  
The current flowing through an ac circuit is given by  
 $I = 5 \sin(120\pi t)$  A  
How long will the current take to reach the peak value starting from zero ?

- Question:
- A  $\frac{1}{60}$  s
  - B 60 s
  - C  $\frac{1}{120}$  s
  - D  $\frac{1}{240}$  s

Q:42  
Topic Name:Physics-Section A

ItemCode:101312  
Match List - I with List - II :

**List - I**

**List - II**

- |                      |                                       |
|----------------------|---------------------------------------|
| (a) Ultraviolet rays | (i) Study crystal structure           |
| (b) Microwaves       | (ii) Greenhouse effect                |
| (c) Infrared waves   | (iii) Sterilizing surgical instrument |
| (d) X-rays           | (iv) Radar system                     |

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

- A (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)
- B (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)

Q:43  
Topic Name:Physics-Section A

ItemCode:101313  
An  $\alpha$  particle and a carbon 12 atom has same kinetic energy K. The ratio of their de-Broglie wavelengths ( $\lambda_\alpha : \lambda_{C12}$ ) is :

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

Q:44  
Topic Name:Physics-Section A

ItemCode:101314  
A force of 10 N acts on a charged particle placed between two plates of a charged capacitor. If one plate of capacitor is removed, then the force acting on that particle will be.

- Question:
- A 5 N
  - B 10 N
  - C 20 N
  - D Zero

Q:45  
Topic Name:Physics-Section A

ItemCode:101315  
The displacement of simple harmonic oscillator after 3 seconds starting from its mean position is equal to half of its amplitude. The time period of harmonic motion is :

- Question:
- A 6 s
  - B 8 s
  - C 12 s
  - D 36 s

Q:46  
Topic Name:Physics-Section A

ItemCode:101316  
An observer moves towards a stationary source of sound with a velocity equal to one-fifth of the velocity of sound. The percentage change in the frequency will be :

- Question:
- A 20 %
  - B 10 %
  - C 5 %
  - D 0 %

Q:47

Topic Name: Physics-Section A

ItemCode:101317

Consider a light ray travelling in air is incident into a medium of refractive index  $\sqrt{2n}$ . The incident angle is twice that of refracting angle. Then, the angle of incidence will be :

Question:

- A  $\sin^{-1}(\sqrt{n})$
- B  $\cos^{-1}\left(\sqrt{\frac{n}{2}}\right)$
- C  $\sin^{-1}(\sqrt{2n})$
- D  $2 \cos^{-1}\left(\sqrt{\frac{n}{2}}\right)$

Q:48

Topic Name: Physics-Section A

ItemCode:101318

A hydrogen atom in its ground state absorbs 10.2 eV of energy. The angular momentum of electron of the hydrogen atom will increase by the value of :

(Given, Planck's constant =  $6.6 \times 10^{-34}$  Js).

Question:

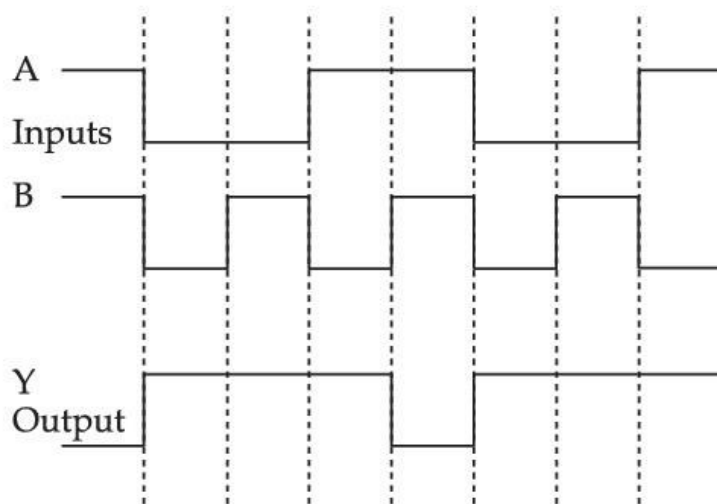
- A  $2.10 \times 10^{-34}$  Js
- B  $1.05 \times 10^{-34}$  Js
- C  $3.15 \times 10^{-34}$  Js
- D  $4.2 \times 10^{-34}$  Js

Q:49

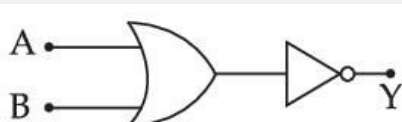
Topic Name: Physics-Section A

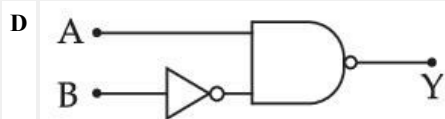
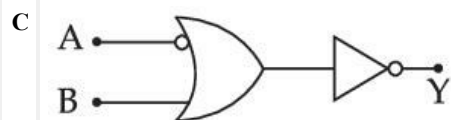
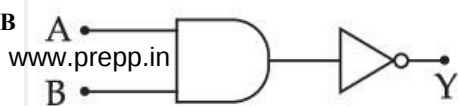
ItemCode:101319

Identify the correct Logic Gate for the following output (Y) of two inputs A and B.



Question:

- A 



Q:50

Topic Name:Physics-Section A

ItemCode:101320

A mixture of hydrogen and oxygen has volume  $2000 \text{ cm}^3$ , temperature  $300 \text{ K}$ , pressure  $100 \text{ kPa}$  and mass  $0.76 \text{ g}$ . The ratio of number of moles of hydrogen to number of moles of oxygen in the mixture will be :

[Take gas constant  $R = 8.3 \text{ JK}^{-1}\text{mol}^{-1}$ ]

Question:

A  $\frac{1}{3}$

B  $\frac{3}{1}$

C  $\frac{1}{16}$

D  $\frac{16}{1}$

Q:51

Topic Name:Physics-Section B

ItemCode:101321

In a carnot engine, the temperature of reservoir is  $527^\circ\text{C}$  and that of sink is  $200 \text{ K}$ . If the workdone by the engine when it transfers heat from reservior to sink is  $12000 \text{ kJ}$ , the quantity of heat absorbed by the engine from reservoir is \_\_\_\_\_  $\times 10^6 \text{ J}$ .

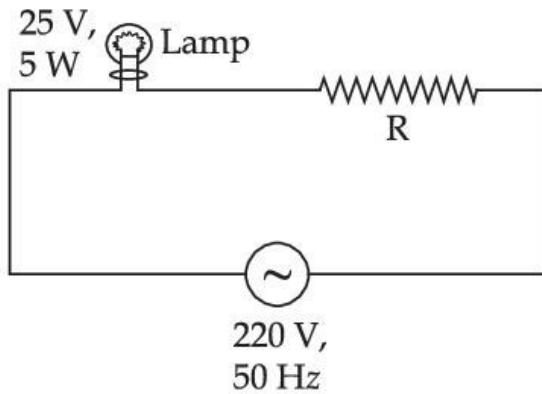
Question:

Q:52

Topic Name:Physics-Section B

ItemCode:101322

A 220 V, 50 Hz AC source is connected to a 25 V, 5 W lamp and an additional resistance  $R$  in series (as shown in figure) to run the lamp at its peak brightness, then the value of  $R$  (in ohm) will be \_\_\_\_\_.



Question:

Q:53

Topic Name:Physics-Section B

ItemCode:101323

In Young's double slit experiment the two slits are 0.6 mm distance apart. Interference pattern is observed on a screen at a distance 80 cm from the slits. The first dark fringe is observed on the screen directly opposite to one of the slits. The wavelength of light will be

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

Q:54

Topic Name:Physics-Section B

ItemCode:101324

A beam of monochromatic light is used to excite the electron in  $\text{Li}^{++}$  from the first orbit to the third orbit. The wavelength of monochromatic light is found to be  $x \times 10^{-10}$  m. The value of  $x$  is \_\_\_\_\_.

Question: [Given  $hc = 1242 \text{ eV nm}$ ]

Q:55

Topic Name:Physics-Section B

ItemCode:101325

A cell, shunted by a  $8 \Omega$  resistance, is balanced across a potentiometer wire of length 3 m. The balancing length is 2 m when the cell is shunted by  $4 \Omega$  resistance. The value of internal resistance of the cell will be \_\_\_\_\_  $\Omega$ .

Question:

Q:56

Topic Name:Physics-Section B

ItemCode:101326

The current density in a cylindrical wire of radius 4 mm is  $4 \times 10^6 \text{ Am}^{-2}$ . The current through the outer portion of the wire between radial distances  $\frac{R}{2}$  and  $R$  is \_\_\_\_\_  $\pi \text{ A}$ .

Question:

Q:57

Topic Name:Physics-Section B

A capacitor of capacitance  $50 \text{ pF}$  is charged by  $100 \text{ V}$  source. It is then connected to another uncharged identical capacitor. Electrostatic energy loss in the process is \_\_\_\_\_.

Question:

Q:58

Topic Name:Physics-Section B

ItemCode:101328

The height of a transmitting antenna at the top of a tower is  $25 \text{ m}$  and that of receiving antenna is,  $49 \text{ m}$ . The maximum distance between them, for satisfactory communication in LOS (Line-Of-Sight) is  $K\sqrt{5} \times 10^2 \text{ m}$ . The value of  $K$  is \_\_\_\_\_.

(Assume radius of Earth is  $64 \times 10^5 \text{ m}$ ) [Calculate upto nearest integer value]

Question:

Q:59

Topic Name:Physics-Section B

ItemCode:101329

The area of cross-section of a large tank is  $0.5 \text{ m}^2$ . It has a narrow opening near the bottom having area of cross-section  $1 \text{ cm}^2$ . A load of  $25 \text{ kg}$  is applied on the water at the top in the tank. Neglecting the speed of water in the tank, the velocity of the water, coming out of the opening at the time when the height of water level in the tank is  $40 \text{ cm}$  above the bottom, will be \_\_\_\_\_  $\text{cms}^{-1}$ . [Take  $g = 10 \text{ ms}^{-2}$ ]

Question:

Q:60

Topic Name:Physics-Section B

ItemCode:101330

A pendulum of length  $2 \text{ m}$  consists of a wooden bob of mass  $50 \text{ g}$ . A bullet of mass  $75 \text{ g}$  is fired towards the stationary bob with a speed  $v$ . The bullet emerges out of the bob with a speed  $\frac{v}{3}$  and the bob just completes the vertical circle. The value of  $v$  is \_\_\_\_\_  $\text{ms}^{-1}$ . (if  $g = 10 \text{ m/s}^2$ ).

Question:

Q:61

Topic Name:Chemistry-Section A

ItemCode:101331

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

**Assertion (A) :** At  $10^\circ\text{C}$ , the density of a  $5 \text{ M}$  solution of  $\text{KCl}$  [atomic masses of  $\text{K}$  &  $\text{Cl}$  are  $39$  &  $35.5 \text{ g mol}^{-1}$  respectively], is ' $x$ '  $\text{g ml}^{-1}$ . The solution is cooled to  $-21^\circ\text{C}$ . The molality of the solution will remain unchanged.

**Reason (R) :** The molality of a solution does not change with temperature as mass remains unaffected with temperature.

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

Question:

A Both (A) and (R) are true and (R) is the correct explanation of (A).

B Both (A) and (R) are true but (R) is not the correct explanation of (A).

C (A) is true but (R) is false.

Q:62

Topic Name: Chemistry-Section A

ItemCode: 101332

Based upon VSEPR theory, match the shape (geometry) of the molecules in **List-I** with the molecules in **List - II** and select the **most appropriate** option.

**List - I**

**(Shape)**

- (A) T-shaped
- (B) Trigonal planar
- (C) Square planar
- (D) See-saw

**List - II**

**(Molecules)**

- (I)  $\text{XeF}_4$
- (II)  $\text{SF}_4$
- (III)  $\text{ClF}_3$
- (IV)  $\text{BF}_3$

Question:

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

Q:63

Topic Name: Chemistry-Section A

ItemCode: 101333

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

**List - I**

- (A) Spontaneous process
- (B) Process with  $\Delta P = 0$ ,  $\Delta T = 0$
- (C)  $\Delta H_{\text{reaction}}$
- (D) Exothermic Process

**List - II**

- (I)  $\Delta H < 0$
- (II)  $\Delta G_{T,P} < 0$
- (III) Isothermal and isobaric process
- (IV) [Bond energies of molecules in reactants] – [Bond energies of product molecules]

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

Question:

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

Q:64

Topic Name: Chemistry-Section A

## Match List - I with List - II.

## List - I

- (A) Lyophilic colloid  
 (B) Emulsion  
 (C) Positively charged colloid  
 (D) Negatively charged colloid

## List - II

- (I) Liquid-liquid colloid  
 (II) Protective colloid  
 (III)  $\text{FeCl}_3 + \text{NaOH}$   
 (IV)  $\text{FeCl}_3 + \text{hot water}$

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

Question:

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

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

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

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

Q:65

Topic Name:Chemistry-Section A

ItemCode:101335

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

**Assertion (A) :** The ionic radii of  $\text{O}^{2-}$  and  $\text{Mg}^{2+}$  are same.

**Reason (R) :** Both  $\text{O}^{2-}$  and  $\text{Mg}^{2+}$  are isoelectronic species.

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

Question:

A Both (A) and (R) are true and (R) is the correct explanation of (A).

B Both (A) and (R) are true but (R) is not the correct explanation of (A).

C (A) is true but (R) is false.

D (A) is false but (R) is true.

Q:66

Topic Name:Chemistry-Section A

ItemCode:101336

## Match List - I with List - II.

## List - I

- (A) Concentration of gold ore  
 (B) Leaching of alumina  
 (C) Froth stabiliser  
 (D) Blister copper

## List - II

- (I) Aniline  
 (II)  $\text{NaOH}$   
 (III)  $\text{SO}_2$   
 (IV)  $\text{NaCN}$

Choose the **correct** answer from the options given below.

Question:

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

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

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

Q:67

Topic Name: Chemistry-Section A

|                                                                            |                                                       |
|----------------------------------------------------------------------------|-------------------------------------------------------|
| ItemCode: 101337                                                           |                                                       |
| Question: Addition of $\text{H}_2\text{SO}_4$ to $\text{BaO}_2$ produces : |                                                       |
| A                                                                          | $\text{BaO}$ , $\text{SO}_2$ and $\text{H}_2\text{O}$ |
| B                                                                          | $\text{BaHSO}_4$ and $\text{O}_2$                     |
| C                                                                          | $\text{BaSO}_4$ , $\text{H}_2$ and $\text{O}_2$       |
| D                                                                          | $\text{BaSO}_4$ and $\text{H}_2\text{O}_2$            |

Q:68

Topic Name: Chemistry-Section A

|                                                                  |                                                       |
|------------------------------------------------------------------|-------------------------------------------------------|
| ItemCode: 101338                                                 |                                                       |
| Question: $\text{BeCl}_2$ reacts with $\text{LiAlH}_4$ to give : |                                                       |
| A                                                                | $\text{Be} + \text{Li}[\text{AlCl}_4] + \text{H}_2$   |
| B                                                                | $\text{Be} + \text{AlH}_3 + \text{LiCl} + \text{HCl}$ |
| C                                                                | $\text{BeH}_2 + \text{LiCl} + \text{AlCl}_3$          |
| D                                                                | $\text{BeH}_2 + \text{Li}[\text{AlCl}_4]$             |

Q:69

Topic Name: Chemistry-Section A

| ItemCode: 101339                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------|--------------------------------------------|--------------------------------|--------------------|-------------------------------------------|-----------------------|---------------------------------------------|--------------|-------------------------------------------|--------------------|
| Match List - I with List - II.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |
| <table> <tr> <th>List - I<br/>(Si-Compounds)</th><th>List - II<br/>(Si-Polymeric/Other Products)</th></tr> <tr> <td>(A) <math>(\text{CH}_3)_4\text{Si}</math></td><td>(I) Chain Silicone</td></tr> <tr> <td>(B) <math>(\text{CH}_3)\text{Si}(\text{OH})_3</math></td><td>(II) Dimeric Silicone</td></tr> <tr> <td>(C) <math>(\text{CH}_3)_2\text{Si}(\text{OH})_2</math></td><td>(III) Silane</td></tr> <tr> <td>(D) <math>(\text{CH}_3)_3\text{Si}(\text{OH})</math></td><td>(IV) 2D - Silicone</td></tr> </table> |                                                | List - I<br>(Si-Compounds) | List - II<br>(Si-Polymeric/Other Products) | (A) $(\text{CH}_3)_4\text{Si}$ | (I) Chain Silicone | (B) $(\text{CH}_3)\text{Si}(\text{OH})_3$ | (II) Dimeric Silicone | (C) $(\text{CH}_3)_2\text{Si}(\text{OH})_2$ | (III) Silane | (D) $(\text{CH}_3)_3\text{Si}(\text{OH})$ | (IV) 2D - Silicone |
| List - I<br>(Si-Compounds)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | List - II<br>(Si-Polymeric/Other Products)     |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |
| (A) $(\text{CH}_3)_4\text{Si}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | (I) Chain Silicone                             |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |
| (B) $(\text{CH}_3)\text{Si}(\text{OH})_3$                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (II) Dimeric Silicone                          |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |
| (C) $(\text{CH}_3)_2\text{Si}(\text{OH})_2$                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (III) Silane                                   |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |
| (D) $(\text{CH}_3)_3\text{Si}(\text{OH})$                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (IV) 2D - Silicone                             |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |
| Question: Choose the <b>correct</b> answer from the options given below :                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | (A) - (III), (B) - (II), (C) - (I), (D) - (IV) |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |
| B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | (A) - (IV), (B) - (I), (C) - (II), (D) - (III) |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |
| C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | (A) - (II), (B) - (I), (C) - (IV), (D) - (III) |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |
| D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | (A) - (III), (B) - (IV), (C) - (I), (D) - (II) |                            |                                            |                                |                    |                                           |                       |                                             |              |                                           |                    |

Q:70

Topic Name: Chemistry-Section A

ItemCode:101340

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Heating white phosphorus with conc. NaOH solution gives mainly :

Question:

- A  $\text{Na}_3\text{P}$  and  $\text{H}_2\text{O}$
- B  $\text{H}_3\text{PO}$  and  $\text{NaH}$
- C  $\text{P}(\text{OH})_3$  and  $\text{NaH}_2\text{PO}_4$
- D  $\text{PH}_3$  and  $\text{NaH}_2\text{PO}_2$

Q:71

Topic Name:Chemistry-Section A

ItemCode:101341

Question: Which of the following will have maximum stabilization due to crystal field ?

- A  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$
- B  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$
- C  $[\text{Co}(\text{CN})_6]^{3-}$
- D  $[\text{Cu}(\text{NH}_3)_4]^{2+}$

Q:72

Topic Name:Chemistry-Section A

ItemCode:101342

Given below are two Statements :

**Statement I :** Classical smog occurs in cool humid climate. It is a reducing mixture of smoke, fog and sulphur dioxide.

**Statement II :** Photochemical smog has components, ozone, nitric oxide, acrolein, formaldehyde, PAN etc.

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

Question:

- 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:73

Topic Name:Chemistry-Section A

ItemCode:101343

Question: Which of the following is structure of a separating funnel ?



C



D

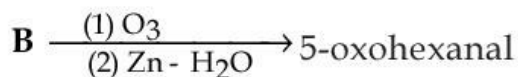


Q:74

Topic Name: Chemistry-Section A

ItemCode: 101344

'A' and 'B' respectively are :



Question:

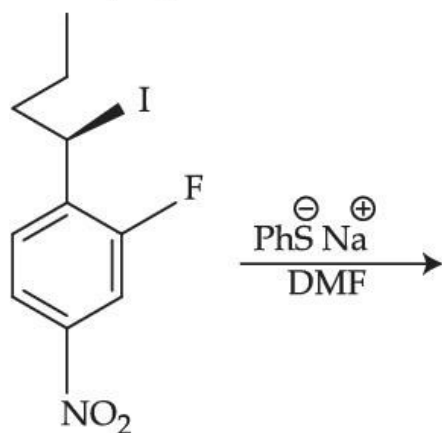
- A 1-methylcyclohex-1,3-diene & cyclopentene.
- B Cyclohex-1,3-diene & cyclopentene
- C 1-methylcyclohex-1,4-diene & 1-methylcyclopent-1-ene
- D Cyclohex-1,3-diene & 1-methylcyclopent-1-ene

Q:75

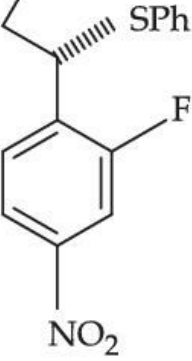
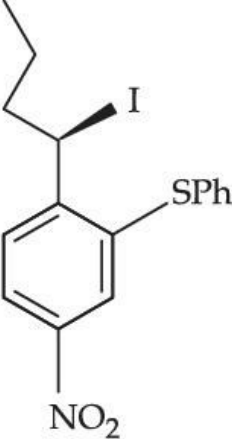
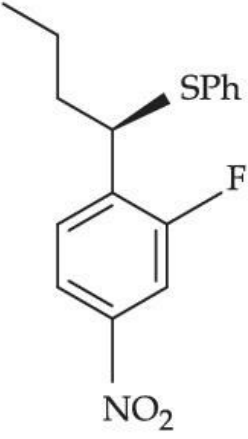
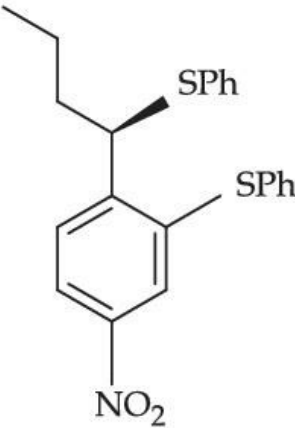
Topic Name: Chemistry-Section A

ItemCode: 101345

The major product of the following reaction is :



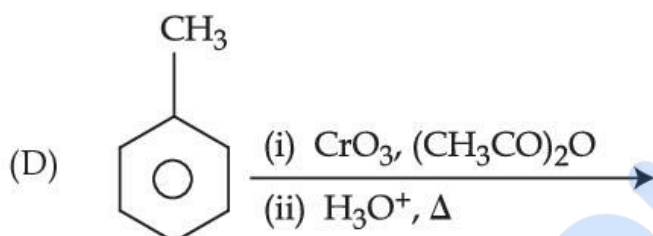
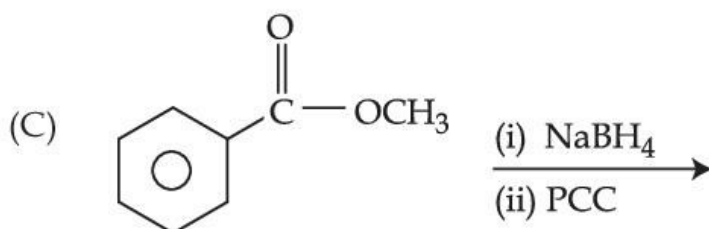
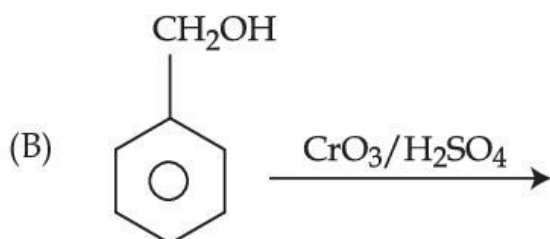
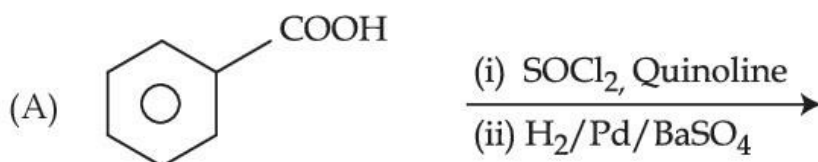
Question:

|   |                                                                                                                                                   |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------|
| A |  <chem>CC[C@H](c1ccc(cc1)F)c2ccccc2</chem>                        |
| B |  <chem>CC[C@H](I)c1ccc(cc1)S2=CC=CC=C2</chem>                     |
| C |  <chem>CC[C@H](c1ccc(cc1)F)c2ccccc2</chem>                       |
| D |  <chem>CC[C@H](c1ccc(cc1)S2=CC=CC=C2)c3ccccc3S4=CC=CC=C4</chem> |

Q:76

Topic Name: Chemistry-Section A

Which of the following reactions will yield benzaldehyde as a product?



Question:

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

Q:77

Topic Name: Chemistry-Section A

ItemCode:101347

Given below are two statements :

**Statement - I :** In Hofmann degradation reaction, the migration of only an alkyl group takes place from carbonyl carbon of the amide to the nitrogen atom.

**Statement - II :** The group is migrated in Hofmann degradation reaction to electron deficient atom.

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

Question:

- 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.

Match List - I with List - II.

**List - I**

**(Polymer)**

- (A) Bakelite  
(B) Glyptal  
(C) PVC  
(D) Polystyrene

**List - II**

**(Used in)**

- (I) Radio and television cabinets  
(II) Electrical switches  
(III) Paints and Lacquers  
(IV) Water pipes

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

**Question:**

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

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

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

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

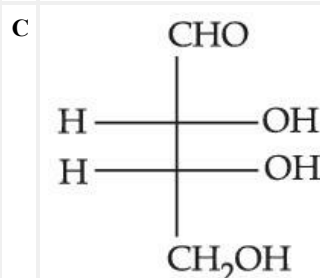
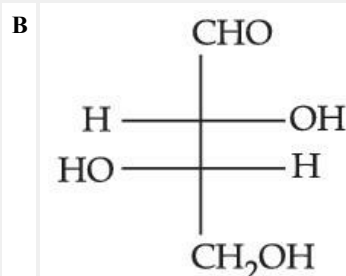
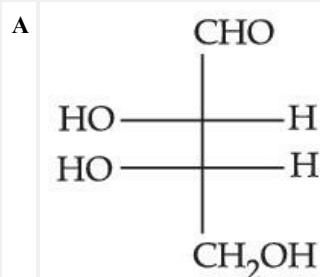
**Q:79**

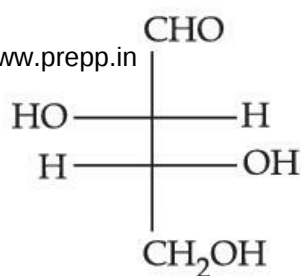
**Topic Name:** Chemistry-Section A

**Item Code:** 101349

L-isomer of a compound 'A' ( $C_4H_8O_4$ ) gives a positive test with  $[Ag(NH_3)_2]^+$ . Treatment of 'A' with acetic anhydride yields triacetate derivative. Compound 'A' produces an optically active compound (B) and an optically inactive compound (C) on treatment with bromine water and  $HNO_3$  respectively. Compound (A) is :

**Question:**





Q:80

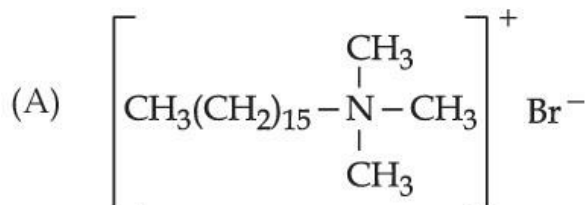
Topic Name: Chemistry-Section A

ItemCode:101350

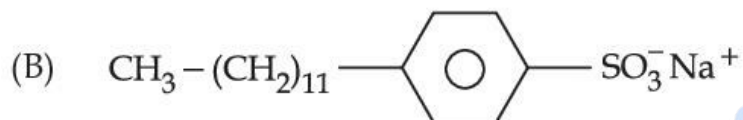
Match List - I with List - II.

List - I

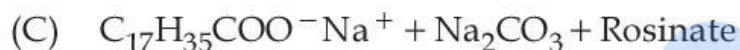
List - II



(I) Dishwashing powder



(II) Toothpaste



(III) Laundry soap



(IV) Hair conditioner

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

Question:

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

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

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

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

Q:81

Topic Name: Chemistry-Section B

ItemCode:101351

Metal deficiency defect is shown by  $\text{Fe}_{0.93}\text{O}$ . In the crystal, some  $\text{Fe}^{2+}$  cations are missing and loss of positive charge is compensated by the presence of  $\text{Fe}^{3+}$  ions. The percentage of  $\text{Fe}^{2+}$  ions in the  $\text{Fe}_{0.93}\text{O}$  crystals is \_\_\_\_\_. (Nearest integer)

Question:

Q:82

Topic Name: Chemistry-Section B

ItemCode:101352

If the uncertainty in velocity and position of a minute particle in space are,  $2.4 \times 10^{-26} \text{ (m s}^{-1}\text{)}$  and  $10^{-7} \text{ (m)}$  respectively. The mass of the particle in g is \_\_\_\_\_. (Nearest integer)

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

Question:

Q:83

Topic Name: Chemistry-Section B

ItemCode:101353

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20 g of a non-volatile non-electrolyte solute is dissolved in 200 g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1 : 8. The elevation in boiling points of A

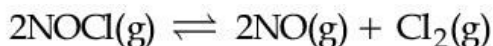
and B are in the ratio  $\frac{x}{y}$  ( $x : y$ ). The value of  $y$  is \_\_\_\_\_. (Nearest Integer)

Question:

Q:84

Topic Name:Chemistry-Section B

ItemCode:101354



In an experiment, 2.0 moles of NOCl was placed in a one-litre flask and the concentration of NO after equilibrium established, was found to be 0.4 mol/L. The equilibrium constant at

30°C is \_\_\_\_\_  $\times 10^{-4}$ .

Question:

Q:85

Topic Name:Chemistry-Section B

ItemCode:101355

The limiting molar conductivities of NaI, NaNO<sub>3</sub> and AgNO<sub>3</sub> are 12.7, 12.0 and 13.3 mS m<sup>2</sup> mol<sup>-1</sup>, respectively (all at 25°C). The limiting molar conductivity of AgI at this temperature is \_\_\_\_\_ mS m<sup>2</sup> mol<sup>-1</sup>.

Question:

Q:86

Topic Name:Chemistry-Section B

ItemCode:101356

The rate constant for a first order reaction is given by the following equation :

$$\ln k = 33.24 - \frac{2.0 \times 10^4 \text{ K}}{T}$$

The Activation energy for the reaction is given by \_\_\_\_\_ kJ mol<sup>-1</sup>. (In Nearest integer)  
(Given : R = 8.3 J K<sup>-1</sup> mol<sup>-1</sup>)

Question:

Q:87

Topic Name:Chemistry-Section B

ItemCode:101357

The number of statement(s) **correct** from the following for Copper (at. no. 29) is/are \_\_\_\_\_.

- (A) Cu(II) complexes are always paramagnetic
- (B) Cu(I) complexes are generally colourless
- (C) Cu(I) is easily oxidized
- (D) In Fehling solution, the active reagent has Cu(I)

Question:

Q:88

Topic Name:Chemistry-Section B

ItemCode:101358

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Acidified potassium permanganate solution oxidises oxalic acid. The spin only magnetic moment of the manganese product formed from the above reaction is \_\_\_\_\_ BM (Nearest Integer)

Question:

Q:89

Topic Name:Chemistry-Section B

ItemCode:101359

Two elements A and B which form 0.15 moles of  $A_2B$  and  $AB_3$  type compounds. If both  $A_2B$  and  $AB_3$  weigh equally, then the atomic weight of A is \_\_\_\_\_ times of atomic weight of B.

Question:

Q:90

Topic Name:Chemistry-Section B

ItemCode:101360

Total number of possible stereoisomers of dimethyl cyclopentane is \_\_\_\_\_.

Question: