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|------------------------------|----------------------------|
| <b>Question Paper Name :</b> | B Tech 27July2021 Shift S1 |
| <b>Subject Name :</b>        | B TECH                     |
| <b>Creation Date :</b>       | 2021-07-24 17:19:13        |
| <b>Duration :</b>            | 180                        |
| <b>Total Marks :</b>         | 300                        |
| <b>Display Marks:</b>        | Yes                        |

## B TECH

|                                      |           |
|--------------------------------------|-----------|
| <b>Group Number :</b>                | 1         |
| <b>Group Id :</b>                    | 864351231 |
| <b>Group Maximum Duration :</b>      | 0         |
| <b>Group Minimum Duration :</b>      | 180       |
| <b>Show Attended Group? :</b>        | No        |
| <b>Edit Attended Group? :</b>        | No        |
| <b>Break time :</b>                  | 0         |
| <b>Group Marks :</b>                 | 300       |
| <b>Is this Group for Examiner? :</b> | No        |

## Physics Section A

|                                |           |
|--------------------------------|-----------|
| <b>Section Id :</b>            | 864351824 |
| <b>Section Number :</b>        | 1         |
| <b>Section type :</b>          | Online    |
| <b>Mandatory or Optional :</b> | Mandatory |

|                                                                     |            |
|---------------------------------------------------------------------|------------|
| <b>Number of Questions :</b>                                        | 20         |
| <b>Number of Questions to be attempted :</b>                        | 20         |
| <b>Section Marks :</b>                                              | 80         |
| <b>Enable Mark as Answered Mark for Review and Clear Response :</b> | Yes        |
| <b>Sub-Section Number :</b>                                         | 1          |
| <b>Sub-Section Id :</b>                                             | 8643511051 |
| <b>Question Shuffling Allowed :</b>                                 | Yes        |

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If ' $f$ ' denotes the ratio of the number of nuclei decayed ( $N_d$ ) to the number of nuclei at  $t=0$  ( $N_0$ ) then for a collection of radioactive nuclei, the rate of change of ' $f$ ' with respect to time is given as :

[ $\lambda$  is the radioactive decay constant]

**Options :**

1.  $-\lambda e^{-\lambda t}$
2.  $\lambda e^{-\lambda t}$
3.  $\lambda(1 - e^{-\lambda t})$
4.  $-\lambda(1 - e^{-\lambda t})$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

In Young's double slit experiment, if the source of light changes from orange to blue then :

**Options :**

1. the intensity of the minima will increase.
2. the distance between consecutive fringes will increase.
3. the distance between consecutive fringes will decrease.
4. the central bright fringe will become a dark fringe.

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

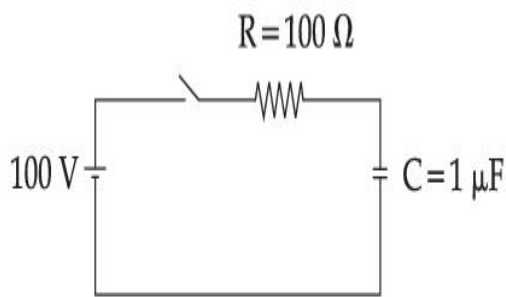
The relative permittivity of distilled water is 81. The velocity of light in it will be :  
(Given  $\mu_r = 1$ )

**Options :**

1.  $3.33 \times 10^7 \text{ m/s}$
2.  $4.33 \times 10^7 \text{ m/s}$
3.  $5.33 \times 10^7 \text{ m/s}$
4.  $2.33 \times 10^7 \text{ m/s}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**



A capacitor of capacitance  $C = 1 \mu\text{F}$  is suddenly connected to a battery of 100 volt through a resistance  $R = 100 \Omega$ . The time taken for the capacitor to be charged to get 50 V is :

[Take  $\ln 2 = 0.69$ ]

**Options :**

1.  $0.69 \times 10^{-4} \text{ s}$
2.  $0.30 \times 10^{-4} \text{ s}$
3.  $1.44 \times 10^{-4} \text{ s}$
4.  $3.33 \times 10^{-4} \text{ s}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A 0.07 H inductor and a  $12 \Omega$  resistor are connected in series to a 220 V, 50 Hz ac source. The approximate current in the circuit and the phase angle between current and source

voltage are respectively. [Take  $\pi$  as  $\frac{22}{7}$ ]

**Options :**

1.  $8.8 \text{ A and } \tan^{-1}\left(\frac{11}{6}\right)$
- 2.

0.88 A and  $\tan^{-1}\left(\frac{11}{6}\right)$

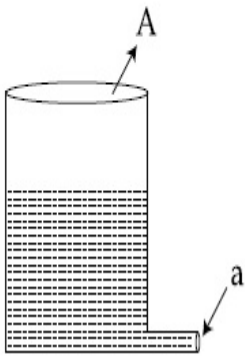
3. 88 A and  $\tan^{-1}\left(\frac{11}{6}\right)$

4. 8.8 A and  $\tan^{-1}\left(\frac{6}{11}\right)$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A light cylindrical vessel is kept on a horizontal surface. Area of base is A. A hole of cross-sectional area 'a' is made just at its bottom side. The minimum coefficient of friction necessary to prevent sliding the vessel due to the impact force of the emerging liquid is ( $a \ll A$ ) :



**Options :**

1.  $\frac{a}{A}$

2.  $\frac{2a}{A}$

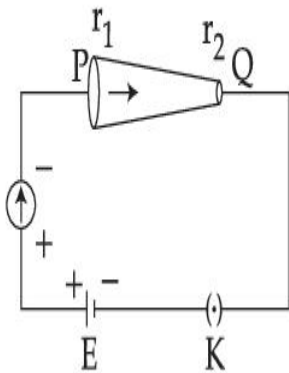
3.  $\frac{A}{2a}$

4. None of these

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

In the given figure, a battery of emf  $E$  is connected across a conductor PQ of length ' $l$ ' and different area of cross-sections having radii  $r_1$  and  $r_2$  ( $r_2 < r_1$ ).



Choose the correct option as one moves from P to Q :

**Options :**

1. Drift velocity of electron increases.
2. Electron current decreases.
3. Electric field decreases.
4. All of these

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Two capacitors of capacities  $2C$  and  $C$  are joined in parallel and charged up to potential  $V$ . The battery is removed and the capacitor of capacity  $C$  is filled completely with a medium of dielectric constant  $K$ . The potential difference across the capacitors will now be :

**Options :**

1.  $\frac{V}{K}$

2.  $\frac{3V}{K}$

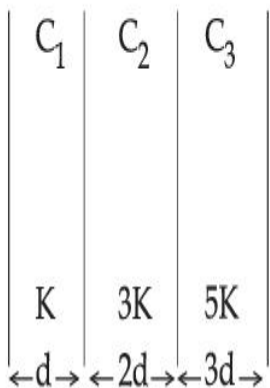
3.  $\frac{V}{K+2}$

4.  $\frac{3V}{K+2}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

In the reported figure, a capacitor is formed by placing a compound dielectric between the plates of parallel plate capacitor. The expression for the capacity of the said capacitor will be : (Given area of plate =  $A$ )



**Options :**

1.

$$\frac{25}{6} \frac{K\epsilon_0 A}{d}$$

2.  $\frac{15}{34} \frac{K\epsilon_0 A}{d}$

3.  $\frac{9}{6} \frac{K\epsilon_0 A}{d}$

4.  $\frac{15}{6} \frac{K\epsilon_0 A}{d}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A particle starts executing simple harmonic motion (SHM) of amplitude 'a' and total energy

E. At any instant, its kinetic energy is  $\frac{3E}{4}$  then its displacement 'y' is given by :

**Options :**

1.  $y = \frac{a}{\sqrt{2}}$

2.  $y = \frac{a}{2}$

3.  $y = \frac{a\sqrt{3}}{2}$

4.  $y = a$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Two identical tennis balls each having mass 'm' and charge 'q' are suspended from a fixed point by threads of length 'l'. What is the equilibrium separation when each thread makes a small angle 'θ' with the vertical ?

**Options :**

1. 
$$x = \left( \frac{q^2 l^2}{2\pi\epsilon_0 m^2 g} \right)^{1/3}$$

2. 
$$x = \left( \frac{q^2 l}{2\pi\epsilon_0 m g} \right)^{1/3}$$

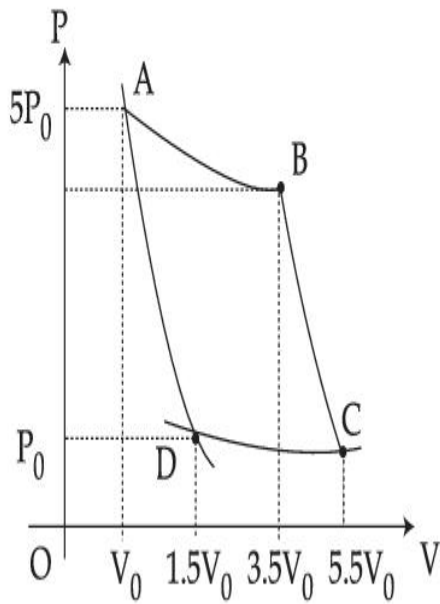
3. 
$$x = \left( \frac{q^2 l}{2\pi\epsilon_0 m g} \right)^{1/2}$$

4. 
$$x = \left( \frac{q^2 l^2}{2\pi\epsilon_0 m^2 g^2} \right)^{1/3}$$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

In the reported figure, there is a cyclic process ABCDA on a sample of 1 mol of a diatomic gas. The temperature of the gas during the process  $A \rightarrow B$  and  $C \rightarrow D$  are  $T_1$  and  $T_2$  ( $T_1 > T_2$ ) respectively.



Choose the correct option out of the following for work done if processes BC and DA are adiabatic.

**Options :**

1.  $W_{BC} + W_{DA} > 0$
2.  $W_{AB} < W_{CD}$
3.  $W_{AB} = W_{DC}$
4.  $W_{AD} = W_{BC}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A body takes 4 min. to cool from  $61^\circ\text{C}$  to  $59^\circ\text{C}$ . If the temperature of the surroundings is  $30^\circ\text{C}$ , the time taken by the body to cool from  $51^\circ\text{C}$  to  $49^\circ\text{C}$  is :

**Options :**

1. 3 min.
2. 4 min.
3. 6 min.
4. 8 min.

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The number of molecules in one litre of an ideal gas at 300 K and 2 atmospheric pressure with mean kinetic energy  $2 \times 10^{-9}$  J per molecule is :

**Options :**

1.  $0.75 \times 10^{11}$
2.  $1.5 \times 10^{11}$
3.  $3 \times 10^{11}$
4.  $6 \times 10^{11}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

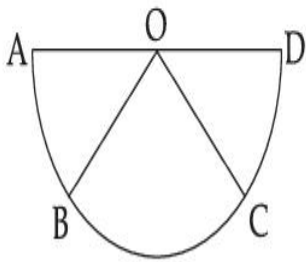
**Assertion A :** If A, B, C, D are four points on a semi-circular arc with centre at 'O' such

that  $|\overrightarrow{AB}| = |\overrightarrow{BC}| = |\overrightarrow{CD}|$ , then

$$\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} = 4\overrightarrow{AO} + \overrightarrow{OB} + \overrightarrow{OC}$$

**Reason R :** Polygon law of vector addition yields

$$\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD} = \overrightarrow{AD} = 2\overrightarrow{AO}$$



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

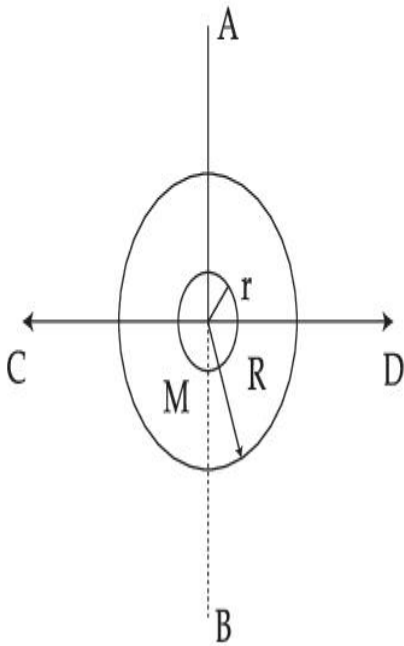
**Options :**

1. Both **A** and **R** are correct and **R** is the correct explanation of **A**.
2. Both **A** and **R** are correct but **R** is not the correct explanation of **A**.
3. **A** is correct but **R** is not correct.
4. **A** is not correct but **R** is correct.

**Question Type :** MCQ **Is Question Mandatory :** No

**Correct Marks :** 4 **Wrong Marks :** 1

The figure shows two solid discs with radius  $R$  and  $r$  respectively. If mass per unit area is same for both, what is the ratio of MI of bigger disc around axis  $AB$  (which is  $\perp$  to the plane of the disc and passing through its centre) to MI of smaller disc around one of its diameters lying on its plane? Given 'M' is the mass of the larger disc. (MI stands for moment of inertia)



**Options :**

1.  $2R^2 : r^2$
2.  $R^2 : r^2$
3.  $2R^4 : r^4$
4.  $2r^4 : R^4$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

**List - I****List - II**

- |                                                                                                               |                 |
|---------------------------------------------------------------------------------------------------------------|-----------------|
| (a) MI of the rod (length $L$ , Mass $M$ , about an axis $\perp$ to the rod passing through the midpoint)     | (i) $8 ML^2/3$  |
| (b) MI of the rod (length $L$ , Mass $2M$ , about an axis $\perp$ to the rod passing through one of its end)  | (ii) $ML^2/3$   |
| (c) MI of the rod (length $2L$ , Mass $M$ , about an axis $\perp$ to the rod passing through its midpoint)    | (iii) $ML^2/12$ |
| (d) MI of the rod (length $2L$ , Mass $2M$ , about an axis $\perp$ to the rod passing through one of its end) | (iv) $2 ML^2/3$ |

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

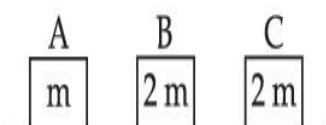
**Options :**

1. (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)
2. (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)
3. (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)
4. (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Three objects A, B and C are kept in a straight line on a frictionless horizontal surface. The masses of A, B and C are  $m$ ,  $2m$  and  $2m$  respectively. A moves towards B with a speed of  $9\text{ m/s}$  and makes an elastic collision with it. Thereafter B makes a completely inelastic collision with C. All motions occur along same straight line. The final speed of C is :



**Options :**

1.  $6 \text{ m/s}$
2.  $3 \text{ m/s}$
3.  $4 \text{ m/s}$
4.  $9 \text{ m/s}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A ball is thrown up with a certain velocity so that it reaches a height 'h'. Find the ratio of the

two different times of the ball reaching  $\frac{h}{3}$  in both the directions.

**Options :**

1.  $\frac{\sqrt{3} - \sqrt{2}}{\sqrt{3} + \sqrt{2}}$
2.  $\frac{\sqrt{3} - 1}{\sqrt{3} + 1}$
3.  $\frac{1}{3}$
4.  $\frac{\sqrt{2} - 1}{\sqrt{2} + 1}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

**Assertion A :** If in five complete rotations of the circular scale, the distance travelled on main scale of the screw gauge is 5 mm and there are 50 total divisions on circular scale, then least count is 0.001 cm.

**Reason R :** 
$$\text{Least Count} = \frac{\text{Pitch}}{\text{Total divisions on circular scale}}$$

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

**Options :**

1. Both **A** and **R** are correct and **R** is the correct explanation of **A**.
2. Both **A** and **R** are correct and **R** is NOT the correct explanation of **A**.
3. **A** is correct but **R** is not correct.
4. **A** is not correct but **R** is correct.

## Physics Section B

|                                              |           |
|----------------------------------------------|-----------|
| <b>Section Id :</b>                          | 864351825 |
| <b>Section Number :</b>                      | 2         |
| <b>Section type :</b>                        | Online    |
| <b>Mandatory or Optional :</b>               | Mandatory |
| <b>Number of Questions :</b>                 | 10        |
| <b>Number of Questions to be attempted :</b> | 5         |

|                                                                     |            |
|---------------------------------------------------------------------|------------|
| <b>Section Marks :</b>                                              | 20         |
| <b>Enable Mark as Answered Mark for Review and Clear Response :</b> | Yes        |
| <b>Sub-Section Number :</b>                                         | 1          |
| <b>Sub-Section Id :</b>                                             | 8643511052 |
| <b>Question Shuffling Allowed :</b>                                 | Yes        |

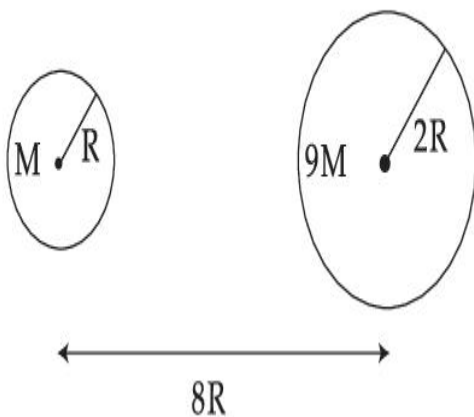
**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

Suppose two planets (spherical in shape) of radii  $R$  and  $2R$ , but mass  $M$  and  $9M$  respectively have a centre to centre separation  $8R$  as shown in the figure. A satellite of mass ' $m$ ' is projected from the surface of the planet of mass ' $M$ ' directly towards the centre of the second planet. The minimum speed ' $v$ ' required for the satellite to reach the surface of the second

planet is  $\sqrt{\frac{a}{7} \frac{GM}{R}}$  then the value of ' $a$ ' is \_\_\_\_\_.

[Given : The two planets are fixed in their position]



**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1

**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

In a uniform magnetic field, the magnetic needle has a magnetic moment  $9.85 \times 10^{-2} \text{ A/m}^2$  and moment of inertia  $5 \times 10^{-6} \text{ kg m}^2$ . If it performs 10 complete oscillations in 5 seconds then the magnitude of the magnetic field is \_\_\_\_\_ mT. [Take  $\pi^2$  as 9.85]

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1

**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

A stone of mass 20 g is projected from a rubber catapult of length 0.1 m and area of cross section  $10^{-6} \text{ m}^2$  stretched by an amount 0.04 m. The velocity of the projected stone is \_\_\_\_\_ m/s.

(Young's modulus of rubber =  $0.5 \times 10^9 \text{ N/m}^2$ )

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1

**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

A transistor is connected in common emitter circuit configuration, the collector supply voltage is 10 V and the voltage drop across a resistor of  $1000\ \Omega$  in the collector circuit is 0.6 V. If the current gain factor ( $\beta$ ) is 24, then the base current is \_\_\_\_\_  $\mu\text{A}$ . (Round off to the Nearest Integer)

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1

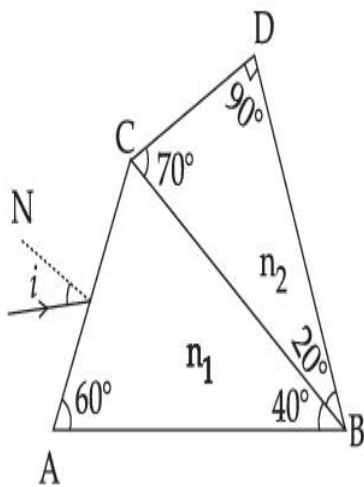
**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

A prism of refractive index  $n_1$  and another prism of refractive index  $n_2$  are stuck together (as shown in the figure).  $n_1$  and  $n_2$  depend on  $\lambda$ , the wavelength of light, according to the relation

$$n_1 = 1.2 + \frac{10.8 \times 10^{-14}}{\lambda^2} \text{ and } n_2 = 1.45 + \frac{1.8 \times 10^{-14}}{\lambda^2}$$

The wavelength for which rays incident at any angle on the interface BC pass through without bending at that interface will be \_\_\_\_\_ nm.



**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

A particle of mass  $9.1 \times 10^{-31}$  kg travels in a medium with a speed of  $10^6$  m/s and a photon of a radiation of linear momentum  $10^{-27}$  kg m/s travels in vacuum. The wavelength of photon is \_\_\_\_\_ times the wavelength of the particle.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks : 4 Wrong Marks : 0**

A radioactive sample has an average life of 30 ms and is decaying. A capacitor of capacitance  $200\text{ }\mu\text{F}$  is first charged and later connected with resistor 'R'. If the ratio of charge on capacitor to the activity of radioactive sample is fixed with respect to time then the value of 'R' should be \_\_\_\_\_  $\Omega$ .

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks : 4 Wrong Marks : 0**

In Bohr's atomic model, the electron is assumed to revolve in a circular orbit of radius  $0.5\text{ }\text{\AA}$ . If the speed of electron is  $2.2 \times 10^6\text{ m/s}$ , then the current associated with the electron will be \_\_\_\_\_  $\times 10^{-2}\text{ mA}$ . [Take  $\pi$  as  $\frac{22}{7}$ ]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

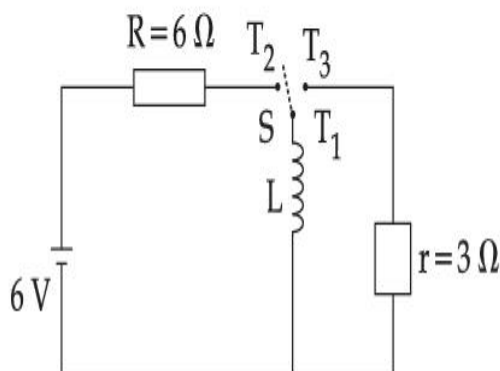
**Possible Answers :**

1

**Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

Consider an electrical circuit containing a two way switch 'S'. Initially S is open and then  $T_1$  is connected to  $T_2$ . As the current in  $R=6\ \Omega$  attains a maximum value of steady state level,  $T_1$  is disconnected from  $T_2$  and immediately connected to  $T_3$ . Potential drop across  $r=3\ \Omega$  resistor immediately after  $T_1$  is connected to  $T_3$  is \_\_\_\_\_ V. (Round off to the Nearest Integer)



**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

The amplitude of upper and lower side bands of A.M. wave where a carrier signal with frequency 11.21 MHz, peak voltage 15 V is amplitude modulated by a 7.7 kHz sine wave of

5 V amplitude are  $\frac{a}{10}$  V and  $\frac{b}{10}$  V respectively. Then the value of  $\frac{a}{b}$  is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

## Chemistry Section A

|                                                              |            |
|--------------------------------------------------------------|------------|
| Section Id :                                                 | 864351826  |
| Section Number :                                             | 3          |
| Section type :                                               | Online     |
| Mandatory or Optional :                                      | Mandatory  |
| Number of Questions :                                        | 20         |
| Number of Questions to be attempted :                        | 20         |
| Section Marks :                                              | 80         |
| Enable Mark as Answered Mark for Review and Clear Response : | Yes        |
| Sub-Section Number :                                         | 1          |
| Sub-Section Id :                                             | 8643511053 |
| Question Shuffling Allowed :                                 | Yes        |

**Question Type :** MCQ **Is Question Mandatory :** No

**Correct Marks :** 4 **Wrong Marks :** 1

The parameters of the unit cell of a substance are  $a=2.5$ ,  $b=3.0$ ,  $c=4.0$ ,  $\alpha=90^\circ$ ,  $\beta=120^\circ$ ,  $\gamma=90^\circ$ . The crystal system of the substance is :

**Options :**

1. Triclinic
2. Hexagonal
3. Orthorhombic
4. Monoclinic

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Given below are two statements :

**Statement I :** Rutherford's gold foil experiment cannot explain the line spectrum of hydrogen atom.

**Statement II :** Bohr's model of hydrogen atom contradicts Heisenberg's uncertainty principle.

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

**Options :**

1. Both **statement I** and **statement II** are true.
2. Both **statement I** and **statement II** are false.
3. **Statement I** is true but **statement II** is false.
4. **Statement I** is false but **statement II** is true.

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

For a reaction of order  $n$ , the unit of the rate constant is :

**Options :**

1.  $\text{mol}^{1-n} \text{L}^{1-n} \text{s}^{-1}$

2.  $\text{mol}^{1-n} \text{L}^{1-n} \text{s}$

3.  $\text{mol}^{1-n} \text{L}^{2n} \text{s}^{-1}$

4.  $\text{mol}^{1-n} \text{L}^{n-1} \text{s}^{-1}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Match List - I with List - II :

**List - I**

**List - II**

- |                              |                  |
|------------------------------|------------------|
| (a) NaOH                     | (i) Acidic       |
| (b) $\text{Be}(\text{OH})_2$ | (ii) Basic       |
| (c) $\text{Ca}(\text{OH})_2$ | (iii) Amphoteric |
| (d) $\text{B}(\text{OH})_3$  |                  |
| (e) $\text{Al}(\text{OH})_3$ |                  |

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

**Options :**

1. (a)-(ii), (b)-(i), (c)-(ii), (d)-(iii), (e)-(iii)

2. (a)-(ii), (b)-(ii), (c)-(iii), (d)-(i), (e)-(iii)
3. (a)-(ii), (b)-(iii), (c)-(ii), (d)-(i), (e)-(iii)
4. (a)-(ii), (b)-(ii), (c)-(iii), (d)-(ii), (e)-(iii)

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The statement that is INCORRECT about Ellingham diagram is :

**Options :**

1. provides idea about reduction of metal oxide.
2. provides idea about the reaction rate.
3. provides idea about free energy change.
4. provides idea about changes in the phases during the reaction.

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The product obtained from the electrolytic oxidation of acidified sulphate solutions, is :

**Options :**

1.  $\text{HO}_3\text{SOSO}_3\text{H}$
2.  $\text{HO}_2\text{SOSO}_2\text{H}$



**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

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

**Assertion A :** Lithium halides are some what covalent in nature.

**Reason R :** Lithium possess high polarisation capability.

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

**Options :**

1. Both **A** and **R** are true and **R** is the correct explanation of **A**
2. Both **A** and **R** are true but **R** is NOT the correct explanation of **A**
3. **A** is true but **R** is false
4. **A** is false but **R** is true

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The oxidation states of 'P' in  $\text{H}_4\text{P}_2\text{O}_7$ ,  $\text{H}_4\text{P}_2\text{O}_5$  and  $\text{H}_4\text{P}_2\text{O}_6$ , respectively, are :

**Options :**

1. 6, 4 and 5

2. 5, 4 and 3
3. 5, 3 and 4
4. 7, 5 and 6

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The type of hybridisation and magnetic property of the complex  $[\text{MnCl}_6]^{3-}$ , respectively, are :

**Options :**

1.  $d^2sp^3$  and paramagnetic
2.  $sp^3d^2$  and diamagnetic
3.  $sp^3d^2$  and paramagnetic
4.  $d^2sp^3$  and diamagnetic

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The number of geometrical isomers found in the metal complexes  $[\text{PtCl}_2(\text{NH}_3)_2]$ ,  $[\text{Ni}(\text{CO})_4]$ ,  $[\text{Ru}(\text{H}_2\text{O})_3\text{Cl}_3]$  and  $[\text{CoCl}_2(\text{NH}_3)_4]^+$  respectively, are :

**Options :**

1. 1, 1, 1, 1

2. 2, 0, 2, 2

3. 2, 1, 2, 1

4. 2, 1, 2, 2

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Which one of the following statements is **NOT** correct ?

**Options :**

1. The dissolved oxygen concentration below 6 ppm inhibits fish growth
2. Eutrophication indicates that water body is polluted
3. Eutrophication leads to increase in the oxygen level in water
4. Eutrophication leads to anaerobic conditions

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Which one among the following chemical tests is used to distinguish monosaccharide from disaccharide ?

**Options :**

1. Seliwanoff's test

2. Barfoed test
3. Tollen's test
4. Iodine test

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

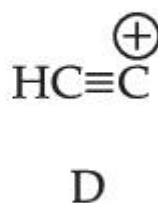
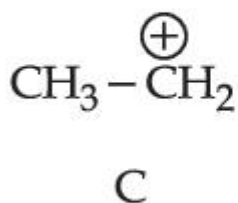
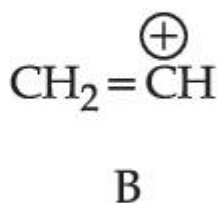
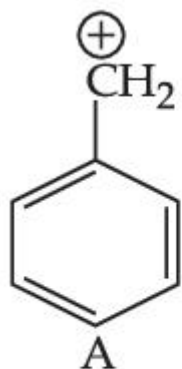
Staggered and eclipsed conformers of ethane are :

**Options :**

1. Rotamers
2. Mirror images
3. Enantiomers
4. Polymers

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**



The correct order of stability of given carbocations is :

**Options :**

1.  $D > B > C > A$
2.  $A > C > B > D$
3.  $C > A > D > B$
4.  $D > B > A > C$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Presence of which reagent will affect the reversibility of the following reaction, and change it to a irreversible reaction :



**Options :**

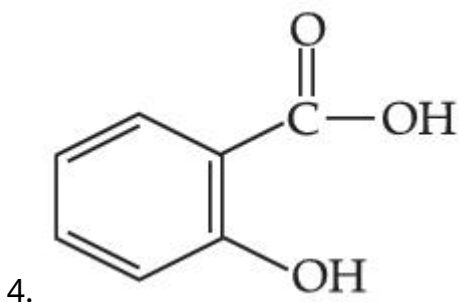
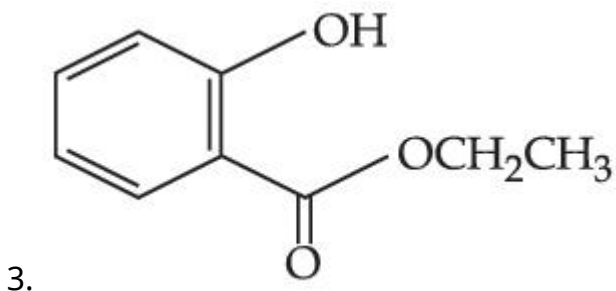
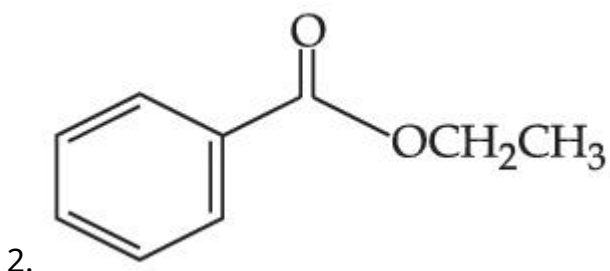
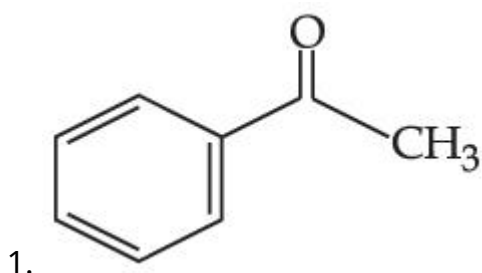
1. Concentrated  $\text{HIO}_3$
2.  $\text{HOCl}$
3. Liquid  $\text{NH}_3$
4. dilute  $\text{HNO}_2$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

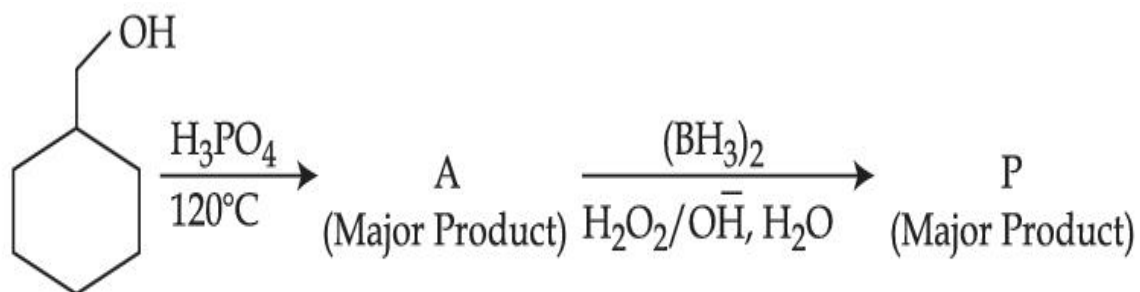
Which one of the following compounds will give orange precipitate when treated with 2,4-dinitrophenyl hydrazine ?

**Options :**



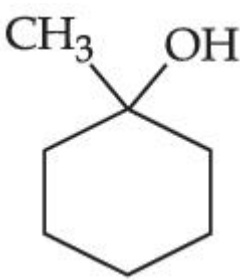
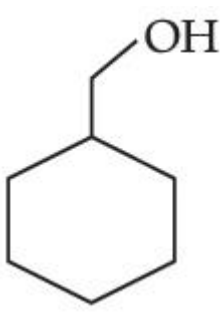
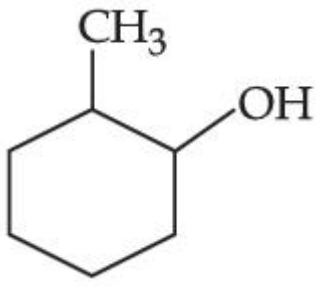
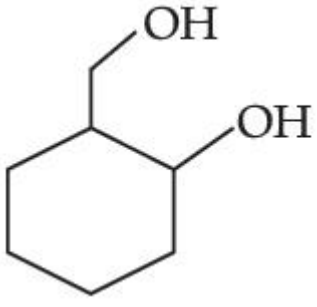
**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**



Consider the above reaction and identify the Product P :

**Options :**

1. 
2. 
3. 
4. 

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Given below are two statements :

**Statement I :** Aniline is less basic than acetamide.

**Statement II :** In aniline, the lone pair of electrons on nitrogen atom is delocalised over benzene ring due to resonance and hence less available to a proton.

Choose the **most appropriate** option :

**Options :**

1. Both **statement I** and **statement II** are true.
2. Both **statement I** and **statement II** are false.
3. **Statement I** is true but **statement II** is false.
4. **Statement I** is false but **statement II** is true.

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Match **List - I** with **List - II** :

**List - I**

**(Drug)**

**List - II**

**(Class of Drug)**

- |                  |                               |
|------------------|-------------------------------|
| (a) Furacin      | (i) Antibiotic                |
| (b) Arsphenamine | (ii) Tranquilizers            |
| (c) Dimetone     | (iii) Antiseptic              |
| (d) Valium       | (iv) Synthetic antihistamines |

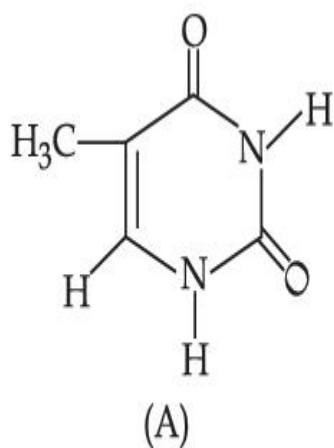
Choose the **most appropriate** match :

**Options :**

1. (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)
2. (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)
3. (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)
4. (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**



The compound 'A' is a complementary base of \_\_\_\_\_ in DNA strands.

**Options :**

1. Guanine
2. Adenine
3. Cytosine
4. Uracil

## Chemistry Section B

|                                                              |            |
|--------------------------------------------------------------|------------|
| Section Id :                                                 | 864351827  |
| Section Number :                                             | 4          |
| Section type :                                               | Online     |
| Mandatory or Optional :                                      | Mandatory  |
| Number of Questions :                                        | 10         |
| Number of Questions to be attempted :                        | 5          |
| Section Marks :                                              | 20         |
| Enable Mark as Answered Mark for Review and Clear Response : | Yes        |
| Sub-Section Number :                                         | 1          |
| Sub-Section Id :                                             | 8643511054 |
| Question Shuffling Allowed :                                 | Yes        |

**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

The density of NaOH solution is  $1.2 \text{ g cm}^{-3}$ . The molality of this solution is \_\_\_\_\_m.

(Round off to the Nearest Integer)

[Use : Atomic masses : Na : 23.0 u O : 16.0 u H : 1.0 u

Density of  $\text{H}_2\text{O}$  :  $1.0 \text{ g cm}^{-3}$ ]

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1

**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

The difference between bond orders of CO and  $\text{NO}^{\oplus}$  is  $\frac{x}{2}$  where  $x = \underline{\hspace{2cm}}$ . (Round off to the Nearest Integer)

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1

**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

For water at  $100^{\circ}\text{C}$  and 1 bar,

$\Delta_{\text{vap}} H - \Delta_{\text{vap}} U = \underline{\hspace{2cm}} \times 10^2 \text{ J mol}^{-1}$ . (Round off to the Nearest Integer)

[Use :  $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$ ]

[Assume volume of  $\text{H}_2\text{O}(\text{l})$  is much smaller than volume of  $\text{H}_2\text{O}(\text{g})$ . Assume  $\text{H}_2\text{O}(\text{g})$  can be treated as an ideal gas]

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1

**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

1.46 g of a biopolymer dissolved in a 100 mL water at 300 K exerted an osmotic pressure of  $2.42 \times 10^{-3}$  bar.

The molar mass of the biopolymer is \_\_\_\_\_  $\times 10^4$  g mol<sup>-1</sup>. (Round off to the Nearest Integer)

[Use : R = 0.083 L bar mol<sup>-1</sup> K<sup>-1</sup>]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

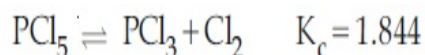
**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks : 4 Wrong Marks : 0**



3.0 moles of PCl<sub>5</sub> is introduced in a 1 L closed reaction vessel at 380 K. The number of moles of PCl<sub>5</sub> at equilibrium is \_\_\_\_\_  $\times 10^{-3}$ . (Round off to the Nearest Integer)

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks : 4 Wrong Marks : 0**

The conductivity of a weak acid HA of concentration  $0.001 \text{ mol L}^{-1}$  is  $2.0 \times 10^{-5} \text{ S cm}^{-1}$ . If  $\Lambda_m^\circ(\text{HA}) = 190 \text{ S cm}^2 \text{ mol}^{-1}$ , the ionization constant ( $K_a$ ) of HA is equal to \_\_\_\_\_  $\times 10^{-6}$ . (Round off to the Nearest Integer)

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks : 4 Wrong Marks : 0**

$\text{CO}_2$  gas adsorbs on charcoal following Freundlich adsorption isotherm. For a given amount of charcoal, the mass of  $\text{CO}_2$  adsorbed becomes 64 times when the pressure of  $\text{CO}_2$  is doubled. The value of  $n$  in the Freundlich isotherm equation is \_\_\_\_\_  $\times 10^{-2}$ . (Round off to the Nearest Integer)

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks : 4 Wrong Marks : 0**

The number of geometrical isomers possible in triamminetrinitrocobalt (III) is X and in trioxalatochromate (III) is Y. Then the value of  $X+Y$  is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks : 4 Wrong Marks : 0**

In gaseous triethyl amine the " $\text{--C--N--C--}$ " bond angle is \_\_\_\_\_ degree.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks : 4 Wrong Marks : 0**

An organic compound is subjected to chlorination to get compound A using 5.0 g of chlorine. When 0.5 g of compound A is reacted with  $\text{AgNO}_3$  [Carius Method], the percentage of chlorine in compound A is \_\_\_\_\_ when it forms 0.3849 g of AgCl. (Round off to the Nearest Integer)

(Atomic masses of Ag and Cl are 107.87 and 35.5 respectively)

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

## Mathematics Section A

|                                                                     |            |
|---------------------------------------------------------------------|------------|
| <b>Section Id :</b>                                                 | 864351828  |
| <b>Section Number :</b>                                             | 5          |
| <b>Section type :</b>                                               | Online     |
| <b>Mandatory or Optional :</b>                                      | Mandatory  |
| <b>Number of Questions :</b>                                        | 20         |
| <b>Number of Questions to be attempted :</b>                        | 20         |
| <b>Section Marks :</b>                                              | 80         |
| <b>Enable Mark as Answered Mark for Review and Clear Response :</b> | Yes        |
| <b>Sub-Section Number :</b>                                         | 1          |
| <b>Sub-Section Id :</b>                                             | 8643511055 |
| <b>Question Shuffling Allowed :</b>                                 | Yes        |

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let P and Q be two distinct points on a circle which has center at C(2, 3) and which passes through origin O. If OC is perpendicular to both the line segments CP and CQ, then the set{P, Q} is equal to :

**Options :**

1.  $\{(2 + 2\sqrt{2}, 3 + \sqrt{5}), (2 - 2\sqrt{2}, 3 - \sqrt{5})\}$

2.  $\{(2 + 2\sqrt{2}, 3 - \sqrt{5}), (2 - 2\sqrt{2}, 3 + \sqrt{5})\}$

3.  $\{(-1, 5), (5, 1)\}$

4.  $\{(4, 0), (0, 6)\}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let  $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$  and  $\vec{b} = -\hat{i} + 2\hat{j} + 3\hat{k}$ . Then the vector product

$(\vec{a} + \vec{b}) \times \left( \left( \vec{a} \times \left( (\vec{a} - \vec{b}) \times \vec{b} \right) \right) \times \vec{b} \right)$  is equal to :

**Options :**

1.  $5(30\hat{i} - 5\hat{j} + 7\hat{k})$

2.  $7(30\hat{i} - 5\hat{j} + 7\hat{k})$

3.  $5(34\hat{i} - 5\hat{j} + 3\hat{k})$

4.  $7(34\hat{i} - 5\hat{j} + 3\hat{k})$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If the coefficients of  $x^7$  in  $\left(x^2 + \frac{1}{bx}\right)^{11}$  and  $x^{-7}$  in  $\left(x - \frac{1}{bx^2}\right)^{11}$ ,  $b \neq 0$ , are equal, then the value of  $b$  is equal to :

**Options :**

1.  $-1$
2.  $2$
3.  $-2$
4.  $1$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If the area of the bounded region

$$R = \left\{ (x, y) : \max\{0, \log_e x\} \leq y \leq 2^x, \frac{1}{2} \leq x \leq 2 \right\}$$

is,  $\alpha(\log_e 2)^{-1} + \beta(\log_e 2) + \gamma$ , then the value of  $(\alpha + \beta - 2\gamma)^2$  is equal to :

**Options :**

1.  $1$
2.  $2$
3.  $4$
4.  $8$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let  $A = \begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$ . If  $A^{-1} = \alpha I + \beta A$ ,  $\alpha, \beta \in \mathbf{R}$ ,  $I$  is a  $2 \times 2$  identity matrix, then  $4(\alpha - \beta)$  is

equal to :

**Options :**

1. 2

2. 4

3. 5

4.  $\frac{8}{3}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Two tangents are drawn from the point  $P(-1, 1)$  to the circle  $x^2 + y^2 - 2x - 6y + 6 = 0$ . If these tangents touch the circle at points  $A$  and  $B$ , and if  $D$  is a point on the circle such that length of the segments  $AB$  and  $AD$  are equal, then the area of the triangle  $ABD$  is equal to :

**Options :**

1. 2

2. 4

3.  $(3\sqrt{2} + 2)$

4.  $3(\sqrt{2} - 1)$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let  $\mathbb{C}$  be the set of all complex numbers. Let

$$S_1 = \{z \in \mathbb{C} \mid |z - 3 - 2i|^2 = 8\},$$

$$S_2 = \{z \in \mathbb{C} \mid \operatorname{Re}(z) \geq 5\} \text{ and}$$

$$S_3 = \{z \in \mathbb{C} \mid |z - \bar{z}| \geq 8\}.$$

Then the number of elements in  $S_1 \cap S_2 \cap S_3$  is equal to :

**Options :**

1. 0
2. 1
3. 2
4. Infinite

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let the plane passing through the point  $(-1, 0, -2)$  and perpendicular to each of the planes  $2x + y - z = 2$  and  $x - y - z = 3$  be  $ax + by + cz + 8 = 0$ . Then the value of  $a + b + c$  is equal to :

**Options :**

1. 5
2. 3

3. 4

4. 8

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let  $\alpha, \beta$  be two roots of the equation  $x^2 + (20)^{\frac{1}{4}}x + (5)^{\frac{1}{2}} = 0$ . Then  $\alpha^8 + \beta^8$  is equal to :

**Options :**

1. 100

2. 10

3. 50

4. 160

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let  $f : \left(-\frac{\pi}{4}, \frac{\pi}{4}\right) \rightarrow \mathbf{R}$  be defined as

$$f(x) = \begin{cases} (1 + |\sin x|)^{\frac{3a}{|\sin x|}}, & -\frac{\pi}{4} < x < 0 \\ b, & x = 0 \\ e^{\cot 4x / \cot 2x}, & 0 < x < \frac{\pi}{4} \end{cases}$$

If  $f$  is continuous at  $x=0$ , then the value of  $6a + b^2$  is equal to :

**Options :**

1.  $1 + e$
2.  $1 - e$
3.  $e$
4.  $e - 1$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let

$$A = \{(x, y) \in \mathbf{R} \times \mathbf{R} \mid 2x^2 + 2y^2 - 2x - 2y = 1\},$$

$$B = \{(x, y) \in \mathbf{R} \times \mathbf{R} \mid 4x^2 + 4y^2 - 16y + 7 = 0\} \text{ and}$$

$$C = \{(x, y) \in \mathbf{R} \times \mathbf{R} \mid x^2 + y^2 - 4x - 2y + 5 \leq r^2\}.$$

Then the minimum value of  $|r|$  such that  $A \cup B \subseteq C$  is equal to :

**Options :**

1.  $\frac{3 + \sqrt{10}}{2}$

2.  $1 + \sqrt{5}$

3.  $\frac{2 + \sqrt{10}}{2}$

4.  $\frac{3 + 2\sqrt{5}}{2}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If the mean and variance of the following data :

6, 10, 7, 13, a, 12, b, 12

are 9 and  $\frac{37}{4}$  respectively, then  $(a - b)^2$  is equal to :

**Options :**

1. 16

2. 12

3. 24

4. 32

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let  $y=y(x)$  be solution of the differential equation  $\log_e\left(\frac{dy}{dx}\right) = 3x + 4y$ , with  $y(0)=0$ .

If  $y\left(-\frac{2}{3}\log_e 2\right) = \alpha \log_e 2$ , then the value of  $\alpha$  is equal to :

**Options :**

1.  $-\frac{1}{4}$

2.  $\frac{1}{4}$

3. 2

4.  $-\frac{1}{2}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If  $\sin\theta + \cos\theta = \frac{1}{2}$ , then  $16(\sin(2\theta) + \cos(4\theta) + \sin(6\theta))$  is equal to :

**Options :**

1. 23

2. -23

3. 27

4.  $-27$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The probability that a randomly selected 2-digit number belongs to the set  $\{n \in \mathbb{N} : (2^n - 2) \text{ is a multiple of } 3\}$  is equal to :

**Options :**

1.  $\frac{1}{2}$

2.  $\frac{1}{3}$

3.  $\frac{2}{3}$

4.  $\frac{1}{6}$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A ray of light through  $(2, 1)$  is reflected at a point  $P$  on the  $y$ -axis and then passes through the point  $(5, 3)$ . If this reflected ray is the directrix of an ellipse with eccentricity  $\frac{1}{3}$  and the distance of the nearer focus from this directrix is  $\frac{8}{\sqrt{53}}$ , then the equation of the other directrix can be :

**Options :**

1.  $2x - 7y - 39 = 0$  or  $2x - 7y - 7 = 0$
2.  $11x + 7y + 8 = 0$  or  $11x + 7y - 15 = 0$
3.  $2x - 7y + 29 = 0$  or  $2x - 7y - 7 = 0$
4.  $11x - 7y - 8 = 0$  or  $11x + 7y + 15 = 0$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The compound statement  $(P \vee Q) \wedge (\sim P) \Rightarrow Q$  is equivalent to :

**Options :**

1.  $\sim(P \Rightarrow Q)$
2.  $P \wedge \sim Q$
3.  $\sim(P \Rightarrow Q) \Leftrightarrow P \wedge \sim Q$
4.  $P \vee Q$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be a function such that  $f(2)=4$  and  $f'(2)=1$ . Then, the value of

$\lim_{x \rightarrow 2} \frac{x^2 f(2) - 4f(x)}{x - 2}$  is equal to :

**Options :**

1. 4
2. 8
3. 12
4. 16

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The value of  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{j=1}^n \frac{(2j-1) + 8n}{(2j-1) + 4n}$  is equal to :

**Options :**

1.  $5 + \log_e \left( \frac{3}{2} \right)$
2.  $1 + 2 \log_e \left( \frac{3}{2} \right)$

3.  $2 - \log_e \left( \frac{2}{3} \right)$

4.  $3 + 2 \log_e \left( \frac{2}{3} \right)$

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The value of the definite integral

$$\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \frac{dx}{(1 + e^{x \cos x}) (\sin^4 x + \cos^4 x)}$$

is equal to :

**Options :**

1.  $\frac{\pi}{2\sqrt{2}}$

2.  $-\frac{\pi}{4}$

3.  $-\frac{\pi}{2}$

4.  $\frac{\pi}{\sqrt{2}}$

## Mathematics Section B

|                                                              |            |
|--------------------------------------------------------------|------------|
| Section Id :                                                 | 864351829  |
| Section Number :                                             | 6          |
| Section type :                                               | Online     |
| Mandatory or Optional :                                      | Mandatory  |
| Number of Questions :                                        | 10         |
| Number of Questions to be attempted :                        | 5          |
| Section Marks :                                              | 20         |
| Enable Mark as Answered Mark for Review and Clear Response : | Yes        |
| Sub-Section Number :                                         | 1          |
| Sub-Section Id :                                             | 8643511056 |
| Question Shuffling Allowed :                                 | Yes        |

**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

Let a plane P pass through the point  $(3, 7, -7)$  and contain the line,

$\frac{x-2}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$ . If distance of the plane P from the origin is d, then  $d^2$  is equal to

\_\_\_\_\_.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1

**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

$$\text{Let } f(x) = \begin{vmatrix} \sin^2 x & -2 + \cos^2 x & \cos 2x \\ 2 + \sin^2 x & \cos^2 x & \cos 2x \\ \sin^2 x & \cos^2 x & 1 + \cos 2x \end{vmatrix}, x \in [0, \pi].$$

Then the maximum value of  $f(x)$  is equal to \_\_\_\_\_.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1

**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

Let  $F : [3, 5] \rightarrow \mathbb{R}$  be a twice differentiable function on  $(3, 5)$  such that

$$F(x) = e^{-x} \int_3^x (3t^2 + 2t + 4F'(t)) dt.$$

If  $F'(4) = \frac{\alpha e^\beta - 224}{(e^\beta - 4)^2}$ , then  $\alpha + \beta$  is equal to \_\_\_\_\_.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1

**Question Type : SA****Correct Marks : 4 Wrong Marks : 0**

Let  $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ ,  $\vec{b}$  and  $\vec{c} = \hat{j} - \hat{k}$  be three vectors such that  $\vec{a} \times \vec{b} = \vec{c}$  and

$\vec{a} \cdot \vec{b} = 1$ . If the length of projection vector of the vector  $\vec{b}$  on the vector  $\vec{a} \times \vec{c}$  is  $l$ , then the value of  $3l^2$  is equal to \_\_\_\_\_.

**Response Type : Numeric****Evaluation Required For SA : Yes****Show Word Count : Yes****Answers Type : Equal****Text Areas : PlainText****Possible Answers :**

1

**Question Type : SA****Correct Marks : 4 Wrong Marks : 0**

Let the domain of the function

$$f(x) = \log_4 \left( \log_5 \left( \log_3 \left( 18x - x^2 - 77 \right) \right) \right) \text{ be } (a, b).$$

Then the value of the integral

$$\int_a^b \frac{\sin^3 x}{(\sin^3 x + \sin^3(a + b - x))} dx$$

is equal to \_\_\_\_\_.

**Response Type : Numeric**

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks : 4 Wrong Marks : 0**

If  $\log_3 2, \log_3(2^x - 5), \log_3\left(2^x - \frac{7}{2}\right)$  are in an arithmetic progression, then the value of  $x$  is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks : 4 Wrong Marks : 0**

For real numbers  $\alpha$  and  $\beta$ , consider the following system of linear equations :

$$x + y - z = 2, x + 2y + \alpha z = 1, 2x - y + z = \beta.$$

If the system has infinite solutions, then  $\alpha + \beta$  is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

Let  $S = \{1, 2, 3, 4, 5, 6, 7\}$ . Then the number of possible functions  $f: S \rightarrow S$  such that  $f(m \cdot n) = f(m) \cdot f(n)$  for every  $m, n \in S$  and  $m \cdot n \in S$  is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

If  $y = y(x)$ ,  $y \in \left[0, \frac{\pi}{2}\right)$  is the solution of the differential equation

$\sec y \frac{dy}{dx} - \sin(x + y) - \sin(x - y) = 0$ , with  $y(0) = 0$ , then  $5y'\left(\frac{\pi}{2}\right)$  is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

1

**Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

Let  $f: [0, 3] \rightarrow \mathbb{R}$  be defined by

$$f(x) = \min\{x - [x], 1 + [x] - x\}$$

where  $[x]$  is the greatest integer less than or equal to  $x$ .

Let  $P$  denote the set containing all  $x \in [0, 3]$  where  $f$  is discontinuous, and  $Q$  denote the set containing all  $x \in (0, 3)$  where  $f$  is not differentiable. Then the sum of number of elements in  $P$  and  $Q$  is equal to \_\_\_\_\_.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1