

# National Testing Agency

|                              |                                |
|------------------------------|--------------------------------|
| <b>Question Paper Name :</b> | B TECH 18th March 2021 Shift 2 |
| <b>Subject Name :</b>        | B TECH                         |
| <b>Creation Date :</b>       | 2021-03-18 19:51:24            |
| <b>Duration :</b>            | 180                            |
| <b>Number of Questions :</b> | 90                             |
| <b>Total Marks :</b>         | 300                            |
| <b>Display Marks:</b>        | Yes                            |

## B TECH

|                                      |          |
|--------------------------------------|----------|
| <b>Group Number :</b>                | 1        |
| <b>Group Id :</b>                    | 86435163 |
| <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>                          | 864351373 |
| <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>Mark As Answered Required? :</b>          | Yes       |
| <b>Sub-Section Number :</b>                  | 1         |
| <b>Sub-Section Id :</b>                      | 864351373 |
| <b>Question Shuffling Allowed :</b>          | Yes       |

**Question Number : 1 Question Id : 8643515581 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

Consider a sample of oxygen behaving like an ideal gas. At 300 K, the ratio of root mean square (rms) velocity to the average velocity of gas molecule would be :

(Molecular weight of oxygen is 32 g/mol;  $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$ )

Options :

86435116741.  $\sqrt{\frac{3\pi}{8}}$

86435116742.  $\sqrt{\frac{8\pi}{3}}$

86435116743.  $\sqrt{\frac{8}{3}}$

86435116744.  $\sqrt{\frac{3}{3}}$

Question Number : 2 Question Id : 8643515582 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

An object of mass  $m_1$  collides with another object of mass  $m_2$ , which is at rest. After the collision the objects move with equal speeds in opposite direction. The ratio of the masses  $m_2 : m_1$  is :

Options :

86435116745. 1 : 1

86435116746. 1 : 2

86435116747. 2 : 1

86435116748. 3 : 1

Question Number : 3 Question Id : 8643515583 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

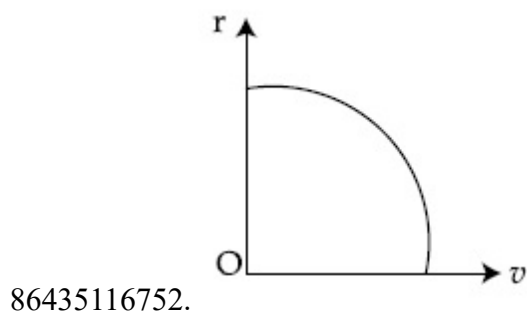
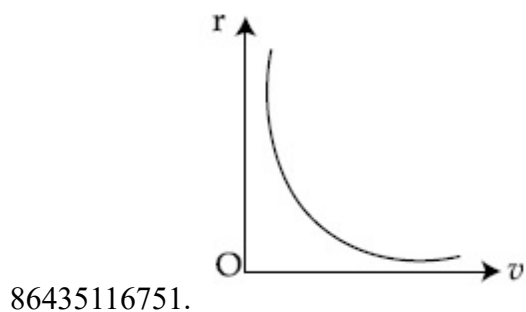
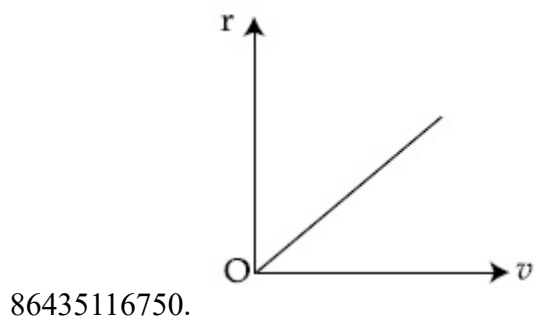
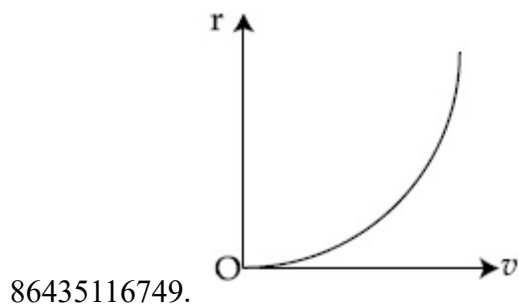
Correct Marks : 4 Wrong Marks : 1

A particle of mass  $m$  moves in a circular orbit under the central potential field,  $U(r) = -\frac{C}{r}$ ,

where  $C$  is a positive constant.

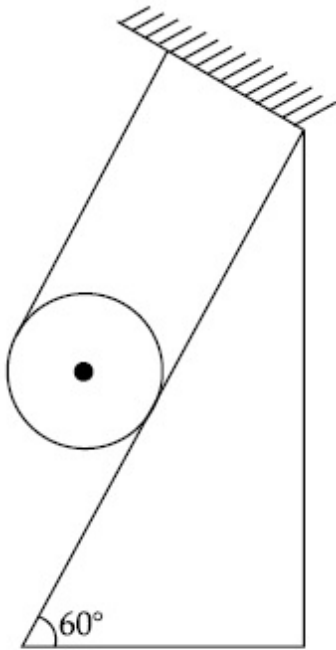
The correct radius – velocity graph of the particle's motion is :

Options :



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

A solid cylinder of mass  $m$  is wrapped with an inextensible light string and, is placed on a rough inclined plane as shown in the figure. The frictional force acting between the cylinder and the inclined plane is :



[The coefficient of static friction,  $\mu_s$  is 0.4]

**Options :**

86435116753.  $\frac{mg}{5}$

86435116754.  $5 mg$

86435116755.  $\frac{7}{2} mg$

86435116756.  $0$

**Question Number : 5 Question Id : 8643515585 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

If the angular velocity of earth's spin is increased such that the bodies at the equator start floating, the duration of the day would be approximately :

[Take  $g = 10 \text{ ms}^{-2}$ , the radius of earth,  $R = 6400 \times 10^3 \text{ m}$ , Take  $\pi = 3.14$ ]

**Options :**

86435116757. does not change

86435116758. 1200 minutes

86435116759. 60 minutes

86435116760. 84 minutes

**Question Number : 6 Question Id : 8643515586 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Consider a uniform wire of mass  $M$  and length  $L$ . It is bent into a semicircle. Its moment of inertia about a line perpendicular to the plane of the wire passing through the centre is :

**Options :**

86435116761.  $\frac{ML^2}{\pi^2}$

86435116762.  $\frac{1}{2} \frac{ML^2}{\pi^2}$

86435116763.  $\frac{1}{4} \frac{ML^2}{\pi^2}$

86435116764.  $\frac{2}{5} \frac{ML^2}{\pi^2}$

**Question Number : 7 Question Id : 8643515587 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The speed of electrons in a scanning electron microscope is  $1 \times 10^7 \text{ ms}^{-1}$ . If the protons having the same speed are used instead of electrons, then the resolving power of scanning proton microscope will be changed by a factor of :

**Options :**

86435116765.  $1837$

86435116766.  $\frac{1}{1837}$

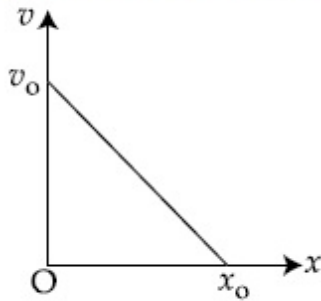
86435116767.  $\frac{1}{\sqrt{1837}}$

86435116768.  $\sqrt{1837}$

Question Number : 8 Question Id : 8643515588 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

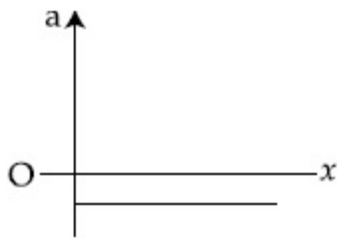
Correct Marks : 4 Wrong Marks : 1

The velocity - displacement graph of a particle is shown in the figure.

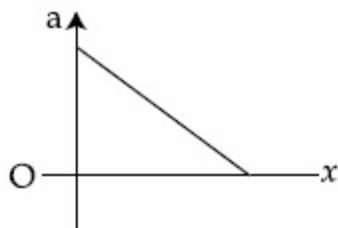


The acceleration - displacement graph of the same particle is represented by :

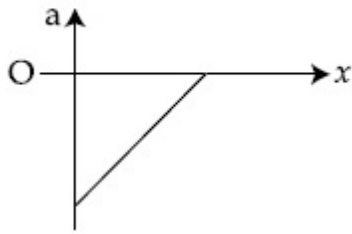
Options :



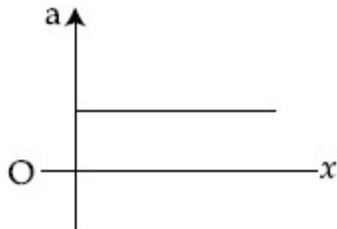
86435116769.



86435116770.



86435116771.



86435116772.

**Question Number : 9 Question Id : 8643515589 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

For an adiabatic expansion of an ideal gas, the fractional change in its pressure is equal to (where  $\gamma$  is the ratio of specific heats) :

**Options :**

$$-\gamma \frac{dV}{V}$$

86435116773.

$$-\gamma \frac{V}{dV}$$

86435116774.

$$-\frac{1}{\gamma} \frac{dV}{V}$$

86435116775.

$$\frac{dV}{V}$$

86435116776.

**Question Number : 10 Question Id : 8643515590 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The angular momentum of a planet of mass  $M$  moving around the sun in an elliptical orbit is  $\vec{L}$ . The magnitude of the areal velocity of the planet is :

Options :

86435116777.  $\frac{L}{M}$

86435116778.  $\frac{L}{2M}$

86435116779.  $\frac{2L}{M}$

86435116780.  $\frac{4L}{M}$

Question Number : 11 Question Id : 8643515591 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

An ideal gas in a cylinder is separated by a piston in such a way that the entropy of one part is  $S_1$  and that of the other part is  $S_2$ . Given that  $S_1 > S_2$ . If the piston is removed then the total entropy of the system will be :

Options :

86435116781.  $S_1 \times S_2$

86435116782.  $S_1 - S_2$

86435116783.  $S_1 + S_2$

86435116784.  $\frac{S_1}{S_2}$

Question Number : 12 Question Id : 8643515592 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1



The function of time representing a simple harmonic motion with a period of  $\frac{\pi}{\omega}$  is :

**Options :**

86435116785.  $\sin(\omega t) + \cos(\omega t)$

86435116786.  $\sin^2(\omega t)$

86435116787.  $3 \cos\left(\frac{\pi}{4} - 2\omega t\right)$

86435116788.  $\cos(\omega t) + \cos(2\omega t) + \cos(3\omega t)$

**Question Number : 13 Question Id : 8643515593 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

In a series LCR circuit, the inductive reactance ( $X_L$ ) is  $10 \Omega$  and the capacitive reactance ( $X_C$ ) is  $4 \Omega$ . The resistance ( $R$ ) in the circuit is  $6 \Omega$ .

The power factor of the circuit is :

**Options :**

86435116789.  $\frac{1}{\sqrt{2}}$

86435116790.  $\frac{\sqrt{3}}{2}$

86435116791.  $\frac{1}{2}$

86435116792.  $\frac{1}{2\sqrt{2}}$

**Question Number : 14 Question Id : 8643515594 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Which of the following statements are correct ?

- (A) Electric monopoles do not exist whereas magnetic monopoles exist.
- (B) Magnetic field lines due to a solenoid at its ends and outside cannot be completely straight and confined.
- (C) Magnetic field lines are completely confined within a toroid.
- (D) Magnetic field lines inside a bar magnet are not parallel.
- (E)  $\chi = -1$  is the condition for a perfect diamagnetic material, where  $\chi$  is its magnetic susceptibility.

Choose the correct answer from the options given below :

**Options :**

86435116793. (B) and (D) only

86435116794. (B) and (C) only

86435116795. (A) and (B) only

86435116796. (C) and (E) only

**Question Number : 15 Question Id : 8643515595 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

The correct relation between  $\alpha$  (ratio of collector current to emitter current) and  $\beta$  (ratio of collector current to base current) of a transistor is :

**Options :**

86435116797. 
$$\beta = \frac{\alpha}{1 + \alpha}$$

86435116798. 
$$\alpha = \frac{\beta}{1 - \alpha}$$

86435116799. 
$$\beta = \frac{1}{1 - \alpha}$$

$$\alpha = \frac{\beta}{1 + \beta}$$

86435116800.

**Question Number : 16 Question Id : 8643515596 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

A proton and an  $\alpha$ -particle, having kinetic energies  $K_p$  and  $K_\alpha$  respectively, enter into a magnetic field at right angles.

The ratio of the radii of trajectory of proton to that of  $\alpha$ -particle is 2 : 1. The ratio of  $K_p : K_\alpha$  is :

**Options :**

86435116801. 1 : 4

86435116802. 4 : 1

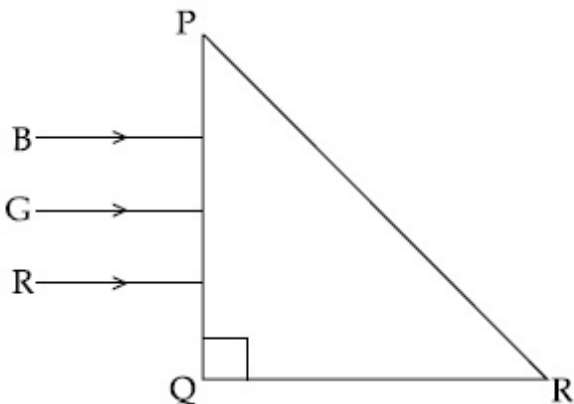
86435116803. 8 : 1

86435116804. 1 : 8

**Question Number : 17 Question Id : 8643515597 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Three rays of light, namely red (R), green (G) and blue (B) are incident on the face PQ of a right angled prism PQR as shown in the figure.



The refractive indices of the material of the prism for red, green and blue wavelength are 1.27, 1.42 and 1.49 respectively. The colour of the ray(s) emerging out of

**Options :**

86435116805. blue and green

86435116806. blue

86435116807. green

86435116808. red

**Question Number : 18 Question Id : 8643515598 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

The time taken for the magnetic energy to reach 25% of its maximum value, when a solenoid of resistance R, inductance L is connected to a battery, is :

**Options :**

86435116809.  $\frac{L}{R} \ln 2$

86435116810.  $\frac{L}{R} \ln 5$

86435116811.  $\frac{L}{R} \ln 10$

86435116812. infinite

**Question Number : 19 Question Id : 8643515599 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

A plane electromagnetic wave propagating along  $y$ -direction can have the following pair of electric field  $(\vec{E})$  and magnetic field  $(\vec{B})$  components.

**Options :**

86435116813.  $E_y, B_y$  or  $E_z, B_z$

86435116814.  $E_x, B_y$  or  $E_y, B_x$

86435116815.  $E_x, B_z$  or  $E_z, B_x$

86435116816.  $E_y, B_x$  or  $E_x, B_y$

**Question Number : 20 Question Id : 8643515600 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The decay of a proton to neutron is :

**Options :**

86435116817. not possible as proton mass is less than the neutron mass

86435116818. possible only inside the nucleus

86435116819. always possible as it is associated only with  $\beta^+$  decay

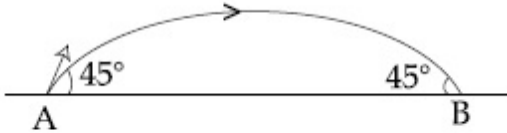
86435116820. not possible but neutron to proton conversion is possible

## Physics Section B

|  |           |
|--|-----------|
| <b>Section Id :</b>                          | 864351374 |
| <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>Mark As Answered Required? :</b>          | Yes       |
| <b>Sub-Section Number :</b>                  | 1         |
| <b>Sub-Section Id :</b>                      | 864351374 |
| <b>Question Shuffling Allowed :</b>          | Yes       |

**Question Number : 21 Question Id : 8643515601 Question Type : SA Correct Marks : 4 Wrong Marks : 0**

The projectile motion of a particle of mass 5 g is shown in the figure.



The initial velocity of the particle is  $5\sqrt{2} \text{ ms}^{-1}$  and the air resistance is assumed to be negligible.

The magnitude of the change in momentum between the points A and B is  $x \times 10^{-2} \text{ kgms}^{-1}$ .

The value of  $x$ , to the nearest integer, is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number :** 22 **Question Id :** 8643515602 **Question Type :** SA

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

An infinite number of point charges, each carrying  $1 \mu\text{C}$  charge, are placed along the  $y$ -axis at  $y = 1 \text{ m}, 2 \text{ m}, 4 \text{ m}, 8 \text{ m} \dots\dots\dots$ .

The total force on a  $1 \text{ C}$  point charge, placed at the origin, is  $x \times 10^3 \text{ N}$ .

The value of  $x$ , to the nearest integer, is \_\_\_\_\_.

[Take  $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2$ ]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number :** 23 **Question Id :** 8643515603 **Question Type :** SA

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

Two wires of same length and thickness having specific resistances  $6 \Omega \text{ cm}$  and  $3 \Omega \text{ cm}$  respectively are connected in parallel. The effective resistivity is  $\rho \Omega \text{ cm}$ . The value of  $\rho$ , to the nearest integer, is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number :** 24 **Question Id :** 8643515604 **Question Type :** SA

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

A ball of mass  $4 \text{ kg}$ , moving with a velocity of  $10 \text{ ms}^{-1}$ , collides with a spring of length  $8 \text{ m}$  and force constant  $100 \text{ Nm}^{-1}$ . The length of the compressed spring is  $x \text{ m}$ . The value of  $x$ , to the nearest integer, is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

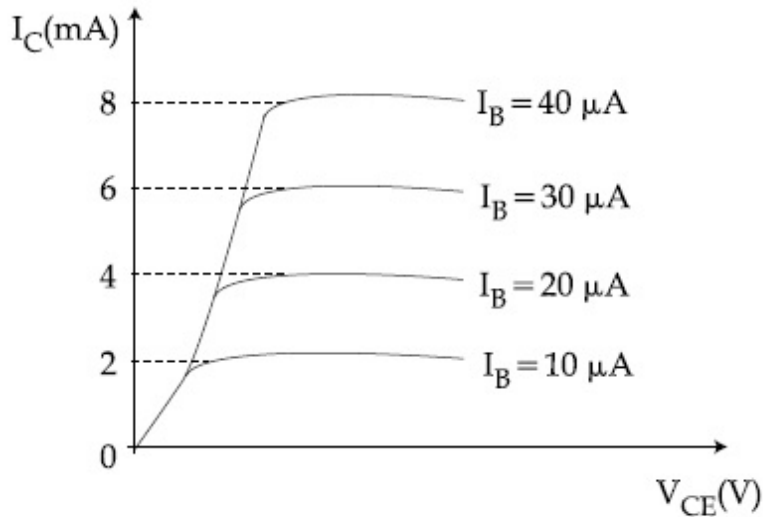
**Possible Answers :**

100

**Question Number :** 25 **Question Id :** 8643515605 **Question Type :** SA

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

The typical output characteristics curve for a transistor working in the common-emitter configuration is shown in the figure.



The estimated current gain from the figure is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

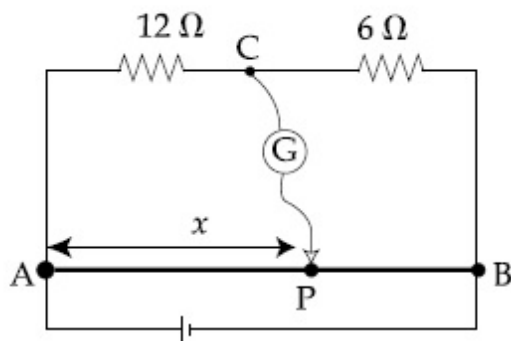
**Possible Answers :**

100

**Question Number :** 26 **Question Id :** 8643515606 **Question Type :** SA

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

Consider a 72 cm long wire AB as shown in the figure. The galvanometer jockey is placed at P on AB at a distance  $x$  cm from A. The galvanometer shows zero deflection.



The value of  $x$ , to the nearest integer, is \_\_\_\_\_.

**Response Type :** Numeric



**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 27 Question Id : 8643515607 Question Type : SA**

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

A galaxy is moving away from the earth at a speed of  $286 \text{ kms}^{-1}$ . The shift in the wavelength of a redline at  $630 \text{ nm}$  is  $x \times 10^{-10} \text{ m}$ .

The value of  $x$ , to the nearest integer, is \_\_\_\_\_.

[Take the value of speed of light  $c$ , as  $3 \times 10^8 \text{ ms}^{-1}$ ]

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

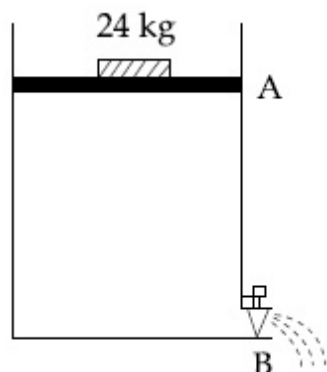
**Question Number : 28 Question Id : 8643515608 Question Type : SA**

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

Consider a water tank as shown in the figure. It's cross-sectional area is  $0.4 \text{ m}^2$ . The tank has an opening B near the bottom whose cross-section area is  $1 \text{ cm}^2$ . A load of  $24 \text{ kg}$  is applied on the water at the top when the height of the water level is  $40 \text{ cm}$  above the bottom, the velocity of water coming out the opening B is  $v \text{ ms}^{-1}$ .

The value of  $v$ , to the nearest integer, is \_\_\_\_\_.

[Take value of  $g$  to be  $10 \text{ ms}^{-2}$ ]



**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 29 Question Id : 8643515609 Question Type : SA**

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

A TV transmission tower antenna is at a height of 20 m. Suppose that the receiving antenna is at.

(i) ground level

(ii) a height of 5 m.

The increase in antenna range in case (ii) relative to case (i) is  $n\%$ .

The value of  $n$ , to the nearest integer, is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 30 Question Id : 8643515610 Question Type : SA**

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

The radius of a sphere is measured to be  $(7.50 \pm 0.85)$  cm. Suppose the percentage error in its volume is  $x$ .

The value of  $x$ , to the nearest  $x$ , is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

## Chemistry Section A

**Section Id :**

864351375

**Section Number :**

3

|  |           |
|--|-----------|
| <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>Mark As Answered Required? :</b>          | Yes       |
| <b>Sub-Section Number :</b>                  | 1         |
| <b>Sub-Section Id :</b>                      | 864351375 |
| <b>Question Shuffling Allowed :</b>          | Yes       |

**Question Number : 31 Question Id : 8643515611 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

A hard substance melts at high temperature and is an insulator in both solid and in molten state. This solid is most likely to be a/an :

**Options :**

86435116831. Ionic solid

86435116832. Covalent solid

86435116833. Metallic solid

86435116834. Molecular solid

**Question Number : 32 Question Id : 8643515612 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

Given below are two statements :

**Statement I :** Bohr's theory accounts for the stability and line spectrum of  $\text{Li}^+$  ion.

**Statement II :** Bohr's theory was unable to explain the splitting of spectral lines in the presence of a magnetic field.

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

**Options :**

86435116835. Both statement I and statement II are true.

86435116836. Both statement I and statement II are false.

86435116837. Statement I is true but statement II is false.

86435116838. Statement I is false but statement II is true.

**Question Number : 33 Question Id : 8643515613 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The charges on the colloidal CdS sol and  $\text{TiO}_2$  sol are, respectively :

**Options :**

86435116839. positive and positive

86435116840. negative and positive

86435116841. positive and negative

86435116842. negative and negative

**Question Number : 34 Question Id : 8643515614 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The first ionization energy of magnesium is smaller as compared to that of elements X and Y, but higher than that of Z. The elements X, Y and Z, respectively, are :

**Options :**

86435116843. argon, chlorine and sodium

86435116844. chlorine, lithium and sodium

86435116845. argon, lithium and sodium

86435116846. neon, sodium and chlorine

**Question Number : 35 Question Id : 8643515615 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Match List - I with List - II :

| List - I    | List - II                   |
|-------------|-----------------------------|
| (a) Mercury | (i) Vapour phase refining   |
| (b) Copper  | (ii) Distillation Refining  |
| (c) Silicon | (iii) Electrolytic Refining |
| (d) Nickel  | (iv) Zone Refining          |

Choose the most appropriate answer from the option given below :

**Options :**

86435116847. (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

86435116848. (a)-(i), (b)-(iv), (c)-(ii), (d)-(iii)

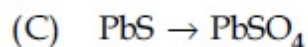
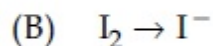
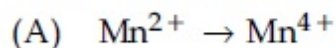
86435116849. (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)

86435116850. (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i)

**Question Number : 36 Question Id : 8643515616 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

In basic medium,  $\text{H}_2\text{O}_2$  exhibits which of the following reactions ?



Choose the most appropriate answer from the options given below :

**Options :**

86435116851. (A) only

86435116852. (B) only

86435116853. (A), (B) only

86435116854. (A), (C) only

**Question Number : 37 Question Id : 8643515617 Question Type : MCQ Option Shuffling : No Question Mandatory : No**

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

Match List - I with List - II :

| List - I | List - II                          |
|----------|------------------------------------|
| (a) Be   | (i) treatment of cancer            |
| (b) Mg   | (ii) extraction of metals          |
| (c) Ca   | (iii) incendiary bombs and signals |
| (d) Ra   | (iv) windows of X-ray tubes        |
|          | (v) bearings for motor engines.    |

Choose the most appropriate answer from the option given below :

**Options :**

86435116855. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

86435116856. (a)-(iii), (b)-(iv), (c)-(ii), (d)-(v)

86435116857. (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)

86435116858. (a)-(iii), (b)-(iv), (c)-(v), (d)-(ii)

**Question Number : 38 Question Id : 8643515618 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The oxidation states of nitrogen in NO, NO<sub>2</sub>, N<sub>2</sub>O and NO<sub>3</sub><sup>-</sup> are in the order of :

**Options :**

86435116859. NO > NO<sub>2</sub> > N<sub>2</sub>O > NO<sub>3</sub><sup>-</sup>

86435116860. N<sub>2</sub>O > NO<sub>2</sub> > NO > NO<sub>3</sub><sup>-</sup>

86435116861. NO<sub>2</sub> > NO<sub>3</sub><sup>-</sup> > NO > N<sub>2</sub>O

86435116862. NO<sub>3</sub><sup>-</sup> > NO<sub>2</sub> > NO > N<sub>2</sub>O

**Question Number : 39 Question Id : 8643515619 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The oxide that shows magnetic property is :

**Options :**

86435116863.  $\text{SiO}_2$

86435116864.  $\text{Mn}_3\text{O}_4$

86435116865.  $\text{MgO}$

86435116866.  $\text{Na}_2\text{O}$

**Question Number : 40 Question Id : 8643515620 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

The secondary valency and the number of hydrogen bonded water molecule(s) in  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , respectively, are :

**Options :**

86435116867. 4 and 1

86435116868. 6 and 4

86435116869. 5 and 1

86435116870. 6 and 5

**Question Number : 41 Question Id : 8643515621 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

Given below are two statements :

**Statement I :** Non-biodegradable wastes are generated by the thermal power plants.

**Statement II :** Bio-degradable detergents leads to eutrophication.

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

**Options :**

86435116871. Both statement I and statement II are true.

86435116872. Both statement I and statement II are false.

86435116873. Statement I is true but statement II is false.

86435116874. Statement I is false but statement II is true.

**Question Number : 42 Question Id : 8643515622 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Given below are two statements :

**Statement I :**  $C_2H_5OH$  and  $AgCN$  both can generate nucleophile.

**Statement II :**  $KCN$  and  $AgCN$  both will generate nitrile nucleophile with all reaction conditions.

Choose the most appropriate option :

**Options :**

86435116875. Both statement I and statement II are true.

86435116876. Both statement I and statement II are false.

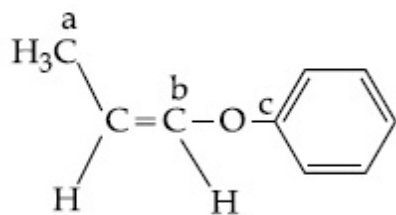
86435116877. Statement I is true but statement II is false.

86435116878. Statement I is false but statement II is true.

**Question Number : 43 Question Id : 8643515623 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

In the following molecule,



Hybridisation of Carbon a, b and c respectively are :

**Options :**

86435116879.  $sp^3, sp^2, sp^2$



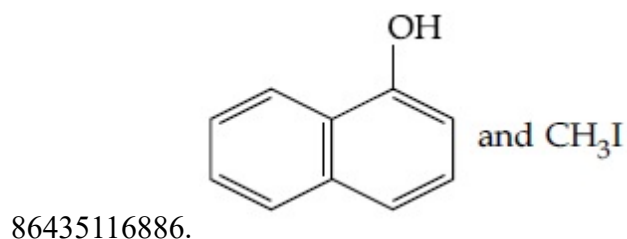
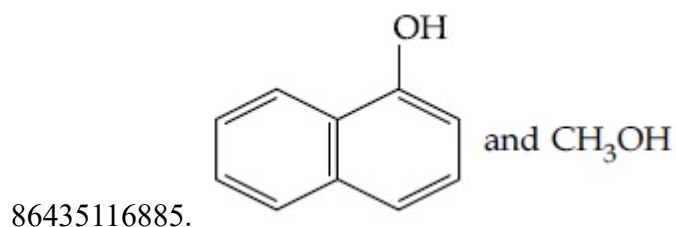
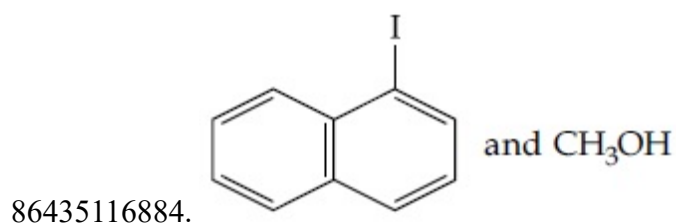
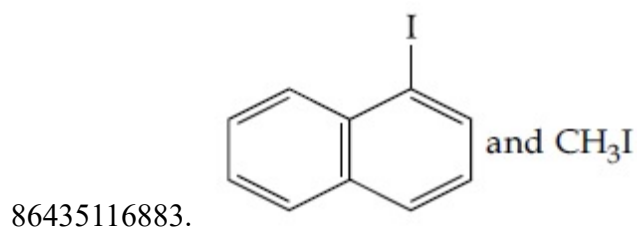
86435116880.  $sp^3, sp^2, sp$ 86435116881.  $sp^3, sp, sp$ 86435116882.  $sp^3, sp, sp^2$ 

Question Number : 44 Question Id : 8643515624 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Main Products formed during a reaction of 1-methoxy naphthalene with hydroiodic acid are :

Options :



Question Number : 45 Question Id : 8643515625 Question Type : MCQ Option Sh Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

In the reaction of hypobromite with amide, the carbonyl carbon is lost as :

Options :

86435116887. CO

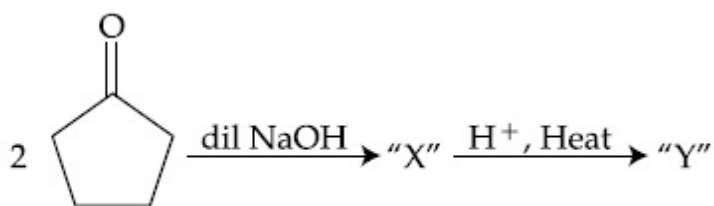
86435116888. CO<sub>2</sub>

86435116889. CO<sub>3</sub><sup>2-</sup>

86435116890. HCO<sub>3</sub><sup>-</sup>

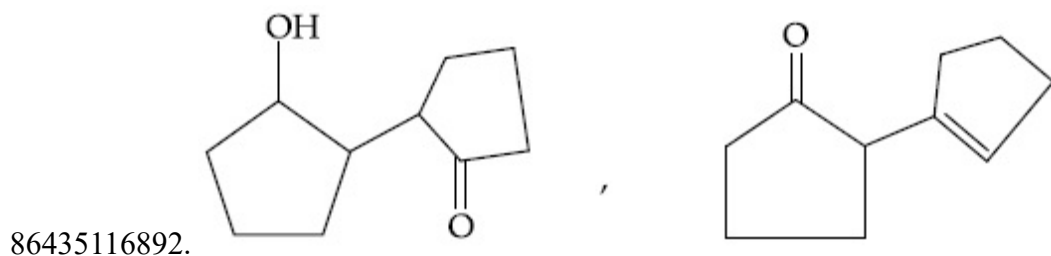
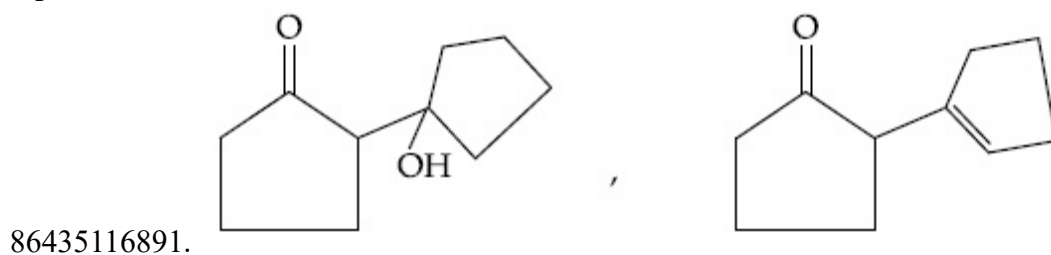
Question Number : 46 Question Id : 8643515626 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

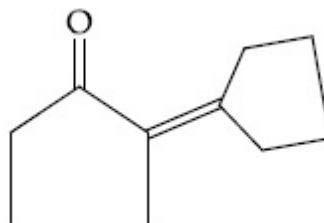
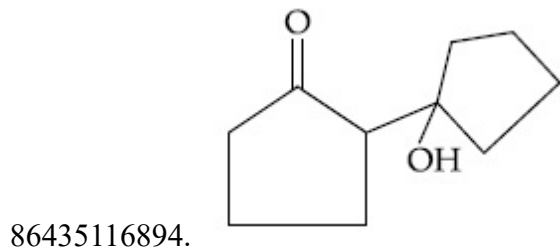
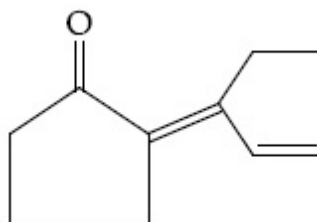
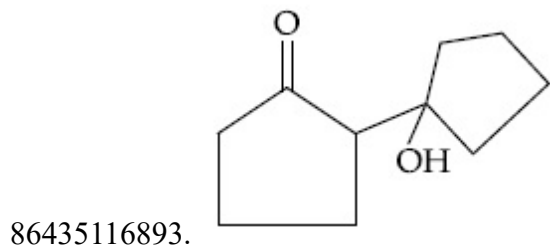
Correct Marks : 4 Wrong Marks : 1



Consider the above reaction, the product 'X' and 'Y' respectively are :

Options :



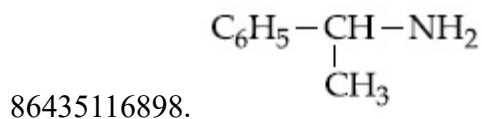
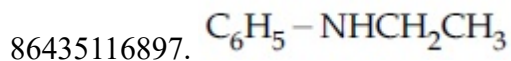
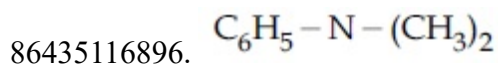
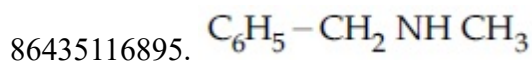


**Question Number : 47 Question Id : 8643515627 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

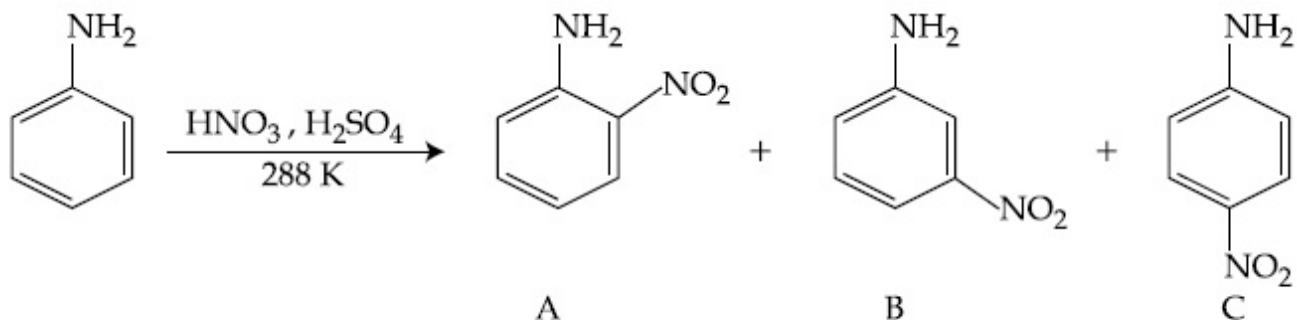
An organic compound "A" on treatment with benzene sulphonyl chloride gives compound B. B is soluble in dil. NaOH solution. Compound A is :

**Options :**



**Question Number : 48 Question Id : 8643515628 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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



Consider the given reaction, percentage yield of :

**Options :**

86435116899.  $A > C > B$

86435116900.  $C > A > B$

86435116901.  $B > C > A$

86435116902.  $C > B > A$

**Question Number : 49 Question Id : 8643515629 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

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

| List - I<br>(Class of Chemicals) | List - II<br>(Example) |
|----------------------------------|------------------------|
| (a) Antifertility drug           | (i) Meprobamate        |
| (b) Antibiotic                   | (ii) Alitame           |
| (c) Tranquilizer                 | (iii) Norethindrone    |
| (d) Artificial Sweetener         | (iv) Salvarsan         |

Choose the most appropriate match :

**Options :**

86435116903. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

86435116904. (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

86435116905. (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

86435116906. (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

**Question Number : 50 Question Id : 8643515630 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Deficiency of vitamin K causes :

**Options :**

86435116907. Increase in blood clotting time

86435116908. Decrease in blood clotting time

86435116909. Cheilosis

86435116910. Increase in fragility of RBC's

## Chemistry Section B

|  |           |
|--|-----------|
| <b>Section Id :</b>                          | 864351376 |
| <b>Section Number :</b>                      | 4         |
| <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>Mark As Answered Required? :</b>          | Yes       |
| <b>Sub-Section Number :</b>                  | 1         |
| <b>Sub-Section Id :</b>                      | 864351376 |
| <b>Question Shuffling Allowed :</b>          | Yes       |

**Question Number : 51 Question Id : 8643515631 Question Type : SA**

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

10.0 mL of  $\text{Na}_2\text{CO}_3$  solution is titrated against 0.2 M HCl solution. The following titre values were obtained in 5 readings :

4.8 mL, 4.9 mL, 5.0 mL, 5.0 mL and 5.0 mL.

Based on these readings, and convention of titrimetric estimation the concentration of  $\text{Na}_2\text{CO}_3$  solution is \_\_\_\_\_ mM.

(Round off to the Nearest Integer).

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

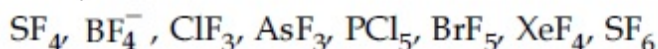
**Possible Answers :**

100

**Question Number : 52 Question Id : 8643515632 Question Type : SA**

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

The number of species below that have two lone pairs of electrons in their central atom is \_\_\_\_\_. (Round off to the Nearest Integer).



**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

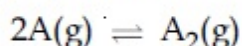
**Possible Answers :**

100

**Question Number : 53 Question Id : 8643515633 Question Type : SA**

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

The gas phase reaction



at 400 K has  $\Delta G^\circ = +25.2 \text{ kJ mol}^{-1}$ .

The equilibrium constant  $K_C$  for this reaction is \_\_\_\_\_  $\times 10^{-2}$ . (Round off to the Nearest Integer).

[Use :  $R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$ ,  $\ln 10 = 2.3$

$\log_{10} 2 = 0.30$ ,  $1 \text{ atm} = 1 \text{ bar}$ ]

[antilog  $(-0.3) = 0.501$ ]

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 54 Question Id : 8643515634 Question Type : SA**

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

A solute A dimerizes in water. The boiling point of a 2 molal solution of A is  $100.52^{\circ}\text{C}$ . The percentage association of A is \_\_\_\_\_. (Round off to the Nearest Integer).

[Use :  $K_b$  for water =  $0.52 \text{ K kg mol}^{-1}$

Boiling point of water =  $100^{\circ}\text{C}$ ]

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 55 Question Id : 8643515635 Question Type : SA**

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

The solubility of  $\text{CdSO}_4$  in water is  $8.0 \times 10^{-4} \text{ mol L}^{-1}$ . Its solubility in  $0.01 \text{ M H}_2\text{SO}_4$  solution is \_\_\_\_\_  $\times 10^{-6} \text{ mol L}^{-1}$ . (Round off to the Nearest Integer).

(Assume that solubility is much less than  $0.01 \text{ M}$ )

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 56 Question Id : 8643515636 Question Type : SA**

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

The molar conductivities at infinite dilution of barium chloride, sulphuric acid and hydrochloric acid are 280, 860 and  $426 \text{ S cm}^2 \text{ mol}^{-1}$  respectively. The molar conductivity at infinite dilution of barium sulphate is \_\_\_\_\_  $\text{S cm}^2 \text{ mol}^{-1}$ . (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 :**

100

**Question Number : 57 Question Id : 8643515637 Question Type : SA**

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

A reaction has a half life of 1 min. The time required for 99.9% completion of the reaction is \_\_\_\_\_ min. (Round off to the Nearest Integer).

[Use :  $\ln 2 = 0.69$ ;  $\ln 10 = 2.3$ ]

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 58 Question Id : 8643515638 Question Type : SA**

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

A xenon compound 'A' upon partial hydrolysis gives  $\text{XeO}_2\text{F}_2$ . The number of lone pair of electrons present in compound A is \_\_\_\_\_. (Round off to the Nearest Integer)

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

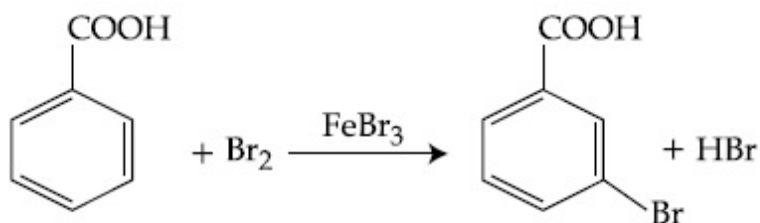
**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 59 Question Id : 8643515639 Question Type : SA**

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



Consider the above reaction where 6.1 g of Benzoic acid is used to get 7.8 g of m-bromo benzoic acid. The percentage yield of the product is \_\_\_\_\_.

(Round off to the Nearest Integer).

[Given : Atomic masses : C : 12.0 u, H : 1.0 u, O : 16.0 u, Br : 80.0 u]

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**



Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 60 Question Id : 8643515640 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

In Tollen's test for aldehyde, the overall number of electron(s) transferred to the Tollen's reagent formula  $[\text{Ag}(\text{NH}_3)_2]^+$  per aldehyde group to form silver mirror is \_\_\_\_\_.  
(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 :

100

## Mathematics Section A

|                                       |           |
|---------------------------------------|-----------|
| Section Id :                          | 864351377 |
| Section Number :                      | 5         |
| Section type :                        | Online    |
| Mandatory or Optional :               | Mandatory |
| Number of Questions :                 | 20        |
| Number of Questions to be attempted : | 20        |
| Section Marks :                       | 80        |
| Mark As Answered Required? :          | Yes       |
| Sub-Section Number :                  | 1         |
| Sub-Section Id :                      | 864351377 |
| Question Shuffling Allowed :          | Yes       |

Question Number : 61 Question Id : 8643515641 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If  $15\sin^4\alpha + 10\cos^4\alpha = 6$ , for some  $\alpha \in \mathbb{R}$ , then the value of  $27\sec^6\alpha + 8\text{cosec}^6\alpha$  is equal to :

Options :

86435116921. 500

86435116922. 400

86435116923. 350

86435116924. 250

**Question Number : 62 Question Id : 8643515642 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

If P and Q are two statements, then which of the following compound statement is a tautology ?

**Options :**

86435116925.  $((P \Rightarrow Q) \wedge \sim Q) \Rightarrow P$ 86435116926.  $((P \Rightarrow Q) \wedge \sim Q) \Rightarrow Q$ 86435116927.  $((P \Rightarrow Q) \wedge \sim Q) \Rightarrow \sim P$ 86435116928.  $((P \Rightarrow Q) \wedge \sim Q) \Rightarrow (P \wedge Q)$ 

**Question Number : 63 Question Id : 8643515643 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

A pole stands vertically inside a triangular park ABC. Let the angle of elevation of the top of the pole from each corner of the park be  $\frac{\pi}{3}$ . If the radius of the circumcircle of  $\Delta ABC$  is 2,

then the height of the pole is equal to :

**Options :**

86435116929.  $\frac{2\sqrt{3}}{3}$ 86435116930.  $2\sqrt{3}$ 86435116931.  $\frac{1}{\sqrt{3}}$ 86435116932.  $\sqrt{3}$

**Question Number : 64 Question Id : 8643515644 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

Let in a series of  $2n$  observations, half of them are equal to  $a$  and remaining half are equal to  $-a$ . Also by adding a constant  $b$  in each of these observations, the mean and standard deviation of new set become 5 and 20, respectively. Then the value of  $a^2 + b^2$  is equal to :

**Options :**

86435116933.  $925$

86435116934.  $425$

86435116935.  $650$

86435116936.  $250$

**Question Number : 65 Question Id : 8643515645 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

Let in a Binomial distribution, consisting of 5 independent trials, probabilities of exactly 1 and 2 successes be 0.4096 and 0.2048 respectively. Then the probability of getting exactly 3 successes is equal to :

**Options :**

86435116937.  $\frac{40}{243}$

86435116938.  $\frac{80}{243}$

86435116939.  $\frac{128}{625}$

86435116940.  $\frac{32}{625}$

**Question Number : 66 Question Id : 8643515646 Question Type : MCQ Option Sh**

**Question Mandatory : No**

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

In a triangle ABC, if  $|\vec{BC}| = 8$ ,  $|\vec{CA}| = 7$ ,  $|\vec{AB}| = 10$ , then the projection of the vector  $\vec{AB}$  on  $\vec{AC}$  is equal to :

**Options :**

86435116941.  $\frac{115}{16}$

86435116942.  $\frac{85}{14}$

86435116943.  $\frac{127}{20}$

86435116944.  $\frac{25}{4}$

**Question Number : 67 Question Id : 8643515647 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

Let the centroid of an equilateral triangle ABC be at the origin. Let one of the sides of the equilateral triangle be along the straight line  $x + y = 3$ . If R and r be the radius of circumcircle and incircle respectively of  $\Delta ABC$ , then  $(R + r)$  is equal to :

**Options :**

86435116945.  $2\sqrt{2}$

86435116946.  $\frac{9}{\sqrt{2}}$

86435116947.  $7\sqrt{2}$

86435116948.  $3\sqrt{2}$

**Question Number : 68 Question Id : 8643515648 Question Type : MCQ Option Sh**

**Question Mandatory : No**

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

Let a tangent be drawn to the ellipse  $\frac{x^2}{27} + y^2 = 1$  at  $(3\sqrt{3}\cos\theta, \sin\theta)$  where  $\theta \in \left(0, \frac{\pi}{2}\right)$ .

Then the value of  $\theta$  such that the sum of intercepts on axes made by this tangent is minimum is equal to :

**Options :**

86435116949.  $\frac{\pi}{3}$

86435116950.  $\frac{\pi}{6}$

86435116951.  $\frac{\pi}{8}$

86435116952.  $\frac{\pi}{4}$

**Question Number : 69 Question Id : 8643515649 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

Let  $y = y(x)$  be the solution of the differential equation  $\frac{dy}{dx} = (y + 1) \left( (y + 1)e^{x^{2/2} - x} \right)$ ,

$0 < x < 2.1$ , with  $y(2) = 0$ . Then the value of  $\frac{dy}{dx}$  at  $x = 1$  is equal to :

**Options :**

86435116953.  $\frac{e^{5/2}}{(1 + e^2)^2}$

86435116954.  $-\frac{2e^2}{(1 + e^2)^2}$

$$\frac{5e^{1/2}}{(e^2 + 1)^2}$$

86435116955.

$$\frac{-e^{3/2}}{(e^2 + 1)^2}$$

86435116956.

**Question Number : 70 Question Id : 8643515650 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The area bounded by the curve  $4y^2 = x^2(4 - x)(x - 2)$  is equal to :

**Options :**

$$\frac{3\pi}{8}$$

86435116957.

$$\frac{\pi}{16}$$

86435116958.

$$\frac{\pi}{8}$$

86435116959.

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

86435116960.

**Question Number : 71 Question Id : 8643515651 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Let  $g(x) = \int_0^x f(t)dt$ , where  $f$  is continuous function in  $[0, 3]$  such that  $\frac{1}{3} \leq f(t) \leq 1$  for all  $t \in [0, 1]$  and  $0 \leq f(t) \leq \frac{1}{2}$  for all  $t \in (1, 3]$ . The largest possible interval in which  $g(3)$  lies is :

**Options :**

$$\left[ \frac{1}{3}, 2 \right]$$

86435116961.

$$86435116962. \quad \left[ -1, -\frac{1}{2} \right]$$

$$86435116963. \quad [1, 3]$$

$$86435116964. \quad \left[ -\frac{3}{2}, -1 \right]$$

**Question Number : 72 Question Id : 8643515652 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

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

$$f(x) = \begin{cases} \frac{\sin(a+1)x + \sin 2x}{2x}, & \text{if } x < 0 \\ b, & \text{if } x = 0 \\ \frac{\sqrt{x + bx^3} - \sqrt{x}}{bx^{5/2}}, & \text{if } x > 0 \end{cases}$$

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

**Options :**

$$86435116965. \quad -\frac{5}{2}$$

$$86435116966. \quad -3$$

$$86435116967. \quad -2$$

$$86435116968. \quad -\frac{3}{2}$$

**Question Number : 73 Question Id : 8643515653 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Let  $S_1$  be the sum of first  $2n$  terms of an arithmetic progression. Let  $S_2$  be the sum of first  $4n$  terms of the same arithmetic progression. If  $(S_2 - S_1)$  is 1000, then the sum of the first  $6n$  terms of the arithmetic progression is equal to :

**Options :**

86435116969. 7000

86435116970. 5000

86435116971. 3000

86435116972. 1000

**Question Number : 74 Question Id : 8643515654 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Let  $S_1 : x^2 + y^2 = 9$  and  $S_2 : (x - 2)^2 + y^2 = 1$ . Then the locus of center of a variable circle  $S$  which touches  $S_1$  internally and  $S_2$  externally always passes through the points :

**Options :**

86435116973.  $\left(2, \pm \frac{3}{2}\right)$

86435116974.  $(0, \pm \sqrt{3})$

86435116975.  $(1, \pm 2)$

86435116976.  $\left(\frac{1}{2}, \pm \frac{\sqrt{5}}{2}\right)$

**Question Number : 75 Question Id : 8643515655 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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



Let the system of linear equations

$$4x + \lambda y + 2z = 0$$

$$2x - y + z = 0$$

$$\mu x + 2y + 3z = 0, \lambda, \mu \in \mathbb{R}.$$

has a non-trivial solution. Then which of the following is true ?

**Options :**

86435116977.  $\lambda = 3, \mu \in \mathbb{R}$

86435116978.  $\mu = -6, \lambda \in \mathbb{R}$

86435116979.  $\lambda = 2, \mu \in \mathbb{R}$

86435116980.  $\mu = 6, \lambda \in \mathbb{R}$

**Question Number : 76 Question Id : 8643515656 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

Let  $f: \mathbb{R} - \{3\} \rightarrow \mathbb{R} - \{1\}$  be defined by  $f(x) = \frac{x-2}{x-3}$ .

Let  $g: \mathbb{R} \rightarrow \mathbb{R}$  be given as  $g(x) = 2x - 3$ . Then, the sum of all the values of  $x$  for which

$f^{-1}(x) + g^{-1}(x) = \frac{13}{2}$  is equal to.

**Options :**

86435116981. 2

86435116982. 5

86435116983. 3

86435116984. 7

**Question Number : 77 Question Id : 8643515657 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

Let a complex number be  $w = 1 - \sqrt{3}i$ . Let another complex number  $z$  be such that  $|zw| = 1$  and  $\arg(z) - \arg(w) = \frac{\pi}{2}$ . Then the area of the triangle with vertices origin,  $z$  and  $w$  is equal

to :

**Options :**

86435116985.  $\frac{1}{2}$

86435116986. 2

86435116987.  $\frac{1}{4}$

86435116988. 4

**Question Number : 78 Question Id : 8643515658 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Define a relation  $R$  over a class of  $n \times n$  real matrices  $A$  and  $B$  as

“ $ARB$  iff there exists a non-singular matrix  $P$  such that  $PAP^{-1} = B$ ”.

Then which of the following is true ?

**Options :**

86435116989.  $R$  is reflexive, symmetric but not transitive

86435116990.  $R$  is reflexive, transitive but not symmetric

86435116991.  $R$  is symmetric, transitive but not reflexive,

86435116992.  $R$  is an equivalence relation

**Question Number : 79 Question Id : 8643515659 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Consider a hyperbola  $H : x^2 - 2y^2 = 4$ . Let the tangent at a point  $P (4, \sqrt{6})$  meet the  $x$ -axis at  $Q$  and latus rectum at  $R (x_1, y_1)$ ,  $x_1 > 0$ . If  $F$  is a focus of  $H$  which is nearer to the point  $P$ , then the area of  $\Delta QFR$  is equal to .

Options :

86435116993.  $\sqrt{6} - 1$

86435116994.  $\frac{7}{\sqrt{6}} - 2$

86435116995.  $4\sqrt{6} - 1$

86435116996.  $4\sqrt{6}$

Question Number : 80 Question Id : 8643515660 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let  $\vec{a}$  and  $\vec{b}$  be two non-zero vectors perpendicular to each other and  $|\vec{a}| = |\vec{b}|$ . If

$|\vec{a} \times \vec{b}| = |\vec{a}|$ , then the angle between the vectors  $(\vec{a} + \vec{b} + (\vec{a} \times \vec{b}))$  and  $\vec{a}$  is equal to :

Options :

86435116997.  $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

86435116998.  $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$

86435116999.  $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

86435117000.  $\sin^{-1}\left(\frac{1}{\sqrt{6}}\right)$

## Mathematics Section B

|  |           |
|--|-----------|
| <b>Section Id :</b>                          | 864351378 |
| <b>Section Number :</b>                      | 6         |
| <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>Mark As Answered Required? :</b>          | Yes       |
| <b>Sub-Section Number :</b>                  | 1         |
| <b>Sub-Section Id :</b>                      | 864351378 |
| <b>Question Shuffling Allowed :</b>          | Yes       |

**Question Number : 81 Question Id : 8643515661 Question Type : SA**  
**Correct Marks : 4 Wrong Marks : 0**

If  $f(x)$  and  $g(x)$  are two polynomials such that the polynomial  $P(x) = f(x^3) + x g(x^3)$  is divisible by  $x^2 + x + 1$ , then  $P(1)$  is equal to \_\_\_\_\_.

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

100

**Question Number : 82 Question Id : 8643515662 Question Type : SA**  
**Correct Marks : 4 Wrong Marks : 0**

Let  $I$  be an identity matrix of order  $2 \times 2$  and  $P = \begin{bmatrix} 2 & -1 \\ 5 & -3 \end{bmatrix}$ . Then the value of  $n \in \mathbb{N}$  for which

$P^n = 5I - 8P$  is equal to \_\_\_\_\_.

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

100

**Question Number : 83 Question Id : 8643515663 Question Type : SA**

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

The term independent of  $x$  in the expansion of  $\left[ \frac{x+1}{x^{2/3} - x^{1/3} + 1} - \frac{x-1}{x - x^{1/2}} \right]^{10}$ ,  $x \neq 1$ , is equal to \_\_\_\_\_.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 84 Question Id : 8643515664 Question Type : SA**

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

If  $\sum_{r=1}^{10} r! (r^3 + 6r^2 + 2r + 5) = \alpha (11!)$ ,

then the value of  $\alpha$  is equal to \_\_\_\_\_.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 85 Question Id : 8643515665 Question Type : SA**

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

Let  $P(x)$  be a real polynomial of degree 3 which vanishes at  $x = -3$ . Let  $P(x)$  have local

minima at  $x = 1$ , local maxima at  $x = -1$  and  $\int_{-1}^1 P(x) dx = 18$ , then the sum of all the coefficients

of the polynomial  $P(x)$  is equal to \_\_\_\_\_.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 86 Question Id : 8643515666 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let  $y = y(x)$  be the solution of the differential equation  $x dy - y dx = \sqrt{(x^2 - y^2)} dx$ ,  $x \geq 1$ , with  $y(1) = 0$ . If the area bounded by the line  $x = 1$ ,  $x = e^\pi$ ,  $y = 0$  and  $y = y(x)$  is  $\alpha e^{2\pi} + \beta$ , then the value of  $10(\alpha + \beta)$  is equal to \_\_\_\_\_.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 87 Question Id : 8643515667 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let P be a plane containing the line  $\frac{x-1}{3} = \frac{y+6}{4} = \frac{z+5}{2}$  and parallel to the line  $\frac{x-3}{4} = \frac{y-2}{-3} = \frac{z+5}{7}$ . If the point  $(1, -1, \alpha)$  lies on the plane P, then the value of  $|5\alpha|$  is equal to \_\_\_\_\_.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 88 Question Id : 8643515668 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let the mirror image of the point  $(1, 3, a)$  with respect to the plane  $\vec{r} \cdot (2\hat{i} - \hat{j} + \hat{k}) - b = 0$  be  $(-3, 5, 2)$ . Then, the value of  $|a + b|$  is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number :** 89 **Question Id :** 8643515669 **Question Type :** SA

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

Let  ${}^nC_r$  denote the binomial coefficient of  $x^r$  in the expansion of  $(1+x)^n$ .

If  $\sum_{k=0}^{10} (2^2 + 3k) {}^nC_k = \alpha \cdot 3^{10} + \beta \cdot 2^{10}$ ,  $\alpha, \beta \in \mathbb{R}$ , 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 :**

100

**Question Number :** 90 **Question Id :** 8643515670 **Question Type :** SA

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

Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  satisfy the equation  $f(x+y) = f(x) \cdot f(y)$  for all  $x, y \in \mathbb{R}$  and  $f(x) \neq 0$  for any  $x \in \mathbb{R}$ .

If the function  $f$  is differentiable at  $x=0$  and  $f'(0)=3$ , then  $\lim_{h \rightarrow 0} \frac{1}{h} (f(h) - 1)$  is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100