

<b>Question Paper Name :</b>	B Tech 20072021 Shift 2
<b>Subject Name :</b>	B TECH
<b>Creation Date :</b>	2021-07-25 17:28:53
<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>	864351235
<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

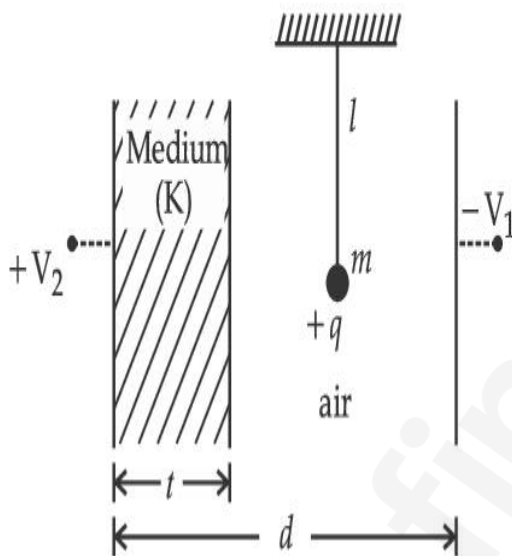
<b>Section Id :</b>	864351848
<b>Section Number :</b>	1
<b>Section type :</b>	Online
<b>Mandatory or Optional :</b>	Mandatory

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 :	8643511075
Question Shuffling Allowed :	Yes

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A simple pendulum of mass ' $m$ ', length ' $l$ ' and charge ' $+q$ ' suspended in the electric field produced by two conducting parallel plates as shown. The value of deflection of pendulum in equilibrium position will be :



Options :

1.  $\tan^{-1} \left[ \frac{q}{mg} \times \frac{C_1(V_1 + V_2)}{(C_1 + C_2)(d - t)} \right]$

2.  $\tan^{-1} \left[ \frac{q}{mg} \times \frac{C_2(V_1 + V_2)}{(C_1 + C_2)(d - t)} \right]$

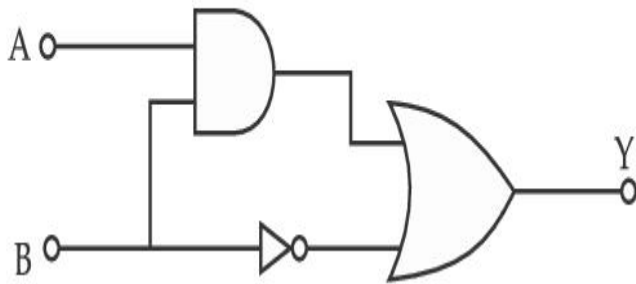
3.  $\tan^{-1} \left[ \frac{q}{mg} \times \frac{C_1(V_2 - V_1)}{(C_1 + C_2)(d - t)} \right]$

4.  $\tan^{-1} \left[ \frac{q}{mg} \times \frac{C_2(V_2 - V_1)}{(C_1 + C_2)(d - t)} \right]$

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

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

Find the truth table for the function Y of A and B represented in the following figure.



**Options :**

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	0

1.

2.

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	1

3.

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

4.

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A particle of mass  $M$  originally at rest is subjected to a force whose direction is constant but magnitude varies with time according to the relation

$$F = F_0 \left[ 1 - \left( \frac{t - T}{T} \right)^2 \right]$$

Where  $F_0$  and  $T$  are constants. The force acts only for the time interval  $2T$ . The velocity  $v$  of the particle after time  $2T$  is :

**Options :**

1.  $F_0 T / 3M$
2.  $4F_0 T / 3M$
3.  $F_0 T / 2M$
4.  $2F_0 T / M$

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

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

**Match List I with List II.**

**List I**

- (a) Capacitance,  $C$
- (b) Permittivity of free space,  $\epsilon_0$
- (c) Permeability of free space,  $\mu_0$
- (d) Electric field,  $E$

**List II**

- (i)  $M^1 L^1 T^{-3} A^{-1}$
- (ii)  $M^{-1} L^{-3} T^4 A^2$
- (iii)  $M^{-1} L^{-2} T^4 A^2$
- (iv)  $M^1 L^1 T^{-2} A^{-2}$

Choose the correct answer from the options given below :

**Options :**

1. (a)  $\rightarrow$  (iii), (b)  $\rightarrow$  (iv), (c)  $\rightarrow$  (ii), (d)  $\rightarrow$  (i)
2. (a)  $\rightarrow$  (iv), (b)  $\rightarrow$  (ii), (c)  $\rightarrow$  (iii), (d)  $\rightarrow$  (i)

3. (a)  $\rightarrow$  (iii), (b)  $\rightarrow$  (ii), (c)  $\rightarrow$  (iv), (d)  $\rightarrow$  (i)

4. (a)  $\rightarrow$  (iv), (b)  $\rightarrow$  (iii), (c)  $\rightarrow$  (ii), (d)  $\rightarrow$  (i)

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

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

One mole of an ideal gas is taken through an adiabatic process where the temperature rises from  $27^{\circ}\text{C}$  to  $37^{\circ}\text{C}$ . If the ideal gas is composed of polyatomic molecule that has 4 vibrational modes, which of the following is true ?

[  $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$  ]

**Options :**

1. work done by the gas is close to 582 J

2. work done on the gas is close to 582 J

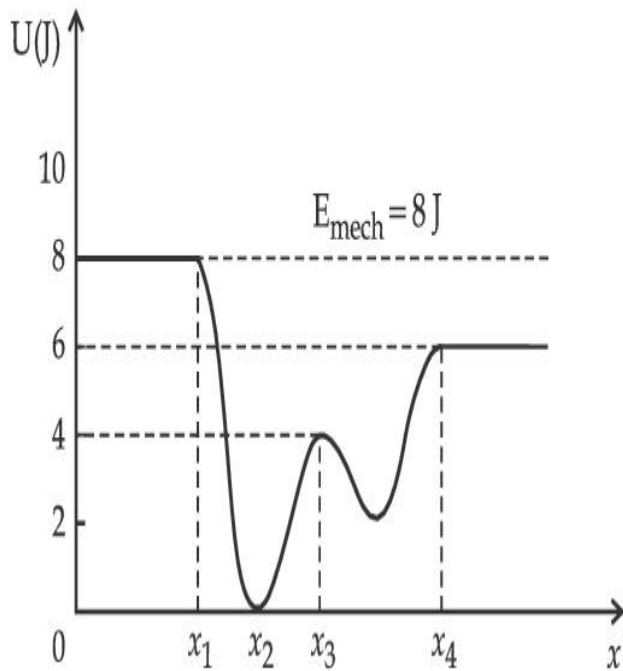
3. work done by the gas is close to 332 J

4. work done on the gas is close to 332 J

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

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

Given below is the plot of a potential energy function  $U(x)$  for a system, in which a particle is in one dimensional motion, while a conservative force  $F(x)$  acts on it. Suppose that  $E_{\text{mech}} = 8 \text{ J}$ , the incorrect statement for this system is :



[ where K.E. = kinetic energy ]

**Options :**

1. at  $x = x_2$ , K.E. is greatest and the particle is moving at the fastest speed.
2. at  $x < x_1$ , K.E. is smallest and the particle is moving at the slowest speed.
3. at  $x > x_4$ , K.E. is constant throughout the region.
4. at  $x = x_3$ , K.E. = 4 J.

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

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

Consider the following statements :

- A. Atoms of each element emit characteristics spectrum.
- B. According to Bohr's Postulate, an electron in a hydrogen atom, revolves in a certain stationary orbit.
- C. The density of nuclear matter depends on the size of the nucleus.
- D. A free neutron is stable but a free proton decay is possible.
- E. Radioactivity is an indication of the instability of nuclei.

Choose the correct answer from the options given below :

**Options :**

- 1. A, B and E only
- 2. A, C and E only
- 3. B and D only
- 4. A, B, C, D and E

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

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

A raindrop with radius  $R=0.2$  mm falls from a cloud at a height  $h=2000$  m above the ground. Assume that the drop is spherical throughout its fall and the force of buoyance may be neglected, then the terminal speed attained by the raindrop is :

[ Density of water  $f_w=1000$  kg m<sup>-3</sup>

and Density of air  $f_a=1.2$  kg m<sup>-3</sup>,

$g=10$  m/s<sup>2</sup>

Coefficient of viscosity of air =  $1.8 \times 10^{-5}$  Nsm<sup>-2</sup> ]

**Options :**

- 1. 250.6 ms<sup>-1</sup>

2.  $4.94 \text{ ms}^{-1}$

3.  $14.4 \text{ ms}^{-1}$

4.  $43.56 \text{ ms}^{-1}$

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

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

A physical quantity 'y' is represented by the formula  $y = m^2 r^{-4} g^x l^{\frac{3}{2}}$

If the percentage errors found in  $y, m, r, l$  and  $g$  are 18, 1, 0.5, 4 and  $p$  respectively, then find the value of  $x$  and  $p$ .

**Options :**

1. 4 and  $\pm 3$

2. 5 and  $\pm 2$

3. 8 and  $\pm 2$

4.  $\frac{16}{3}$  and  $\pm \frac{3}{2}$

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

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

Two Carnot engines A and B operate in series such that engine A absorbs heat at  $T_1$  and rejects heat to a sink at temperature  $T$ . Engine B absorbs half of the heat rejected by Engine A and rejects heat to the sink at  $T_2$ . When workdone in both the cases is equal, the value of  $T$  is :

Options :

1.  $\frac{2}{3}T_1 + \frac{1}{3}T_3$

2.  $\frac{3}{2}T_1 + \frac{1}{3}T_3$

3.  $\frac{2}{3}T_1 + \frac{3}{2}T_3$

4.  $\frac{1}{3}T_1 + \frac{2}{3}T_3$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The planet Mars has two moons, if one of them has a period 7 hours, 30 minutes and an orbital radius of  $9.0 \times 10^3$  km. Find the mass of Mars.

$$\left\{ \text{Given } \frac{4\pi^2}{G} = 6 \times 10^{11} \text{ N}^{-1} \text{ m}^{-2} \text{ kg}^2 \right\}$$

Options :

1.  $5.96 \times 10^{19} \text{ kg}$

2.  $3.25 \times 10^{21} \text{ kg}$

3.  $6.00 \times 10^{23} \text{ kg}$

4.  $7.02 \times 10^{25} \text{ kg}$

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

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

An object of mass 0.5 kg is executing simple harmonic motion. Its amplitude is 5 cm and time period (T) is 0.2 s. What will be the potential energy of the object at an instant  $t = \frac{T}{4}$  s starting from mean position. Assume that the initial phase of the oscillation is zero.

**Options :**

1.  $6.2 \times 10^{-3}$  J
2.  $1.2 \times 10^3$  J
3. 0.62 J
4.  $6.2 \times 10^3$  J

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

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

An automobile of mass ' $m$ ' accelerates starting from origin and initially at rest, while the engine supplies constant power P. The position is given as a function of time by :

**Options :**

1.  $\left(\frac{9P}{8m}\right)^{\frac{1}{2}} t^{\frac{3}{2}}$
- 2.

$$\left(\frac{8P}{9m}\right)^{\frac{1}{2}} t^{\frac{2}{3}}$$

3.  $\left(\frac{8P}{9m}\right)^{\frac{1}{2}} t^{\frac{3}{2}}$

4.  $\left(\frac{9m}{8P}\right)^{\frac{1}{2}} t^{\frac{3}{2}}$

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

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

Figure A and B show two long straight wires of circular cross-section (a and b with  $a < b$ ), carrying current  $I$  which is uniformly distributed across the cross-section. The magnitude of magnetic field  $B$  varies with radius  $r$  and can be represented as :

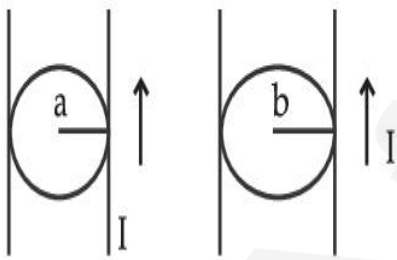
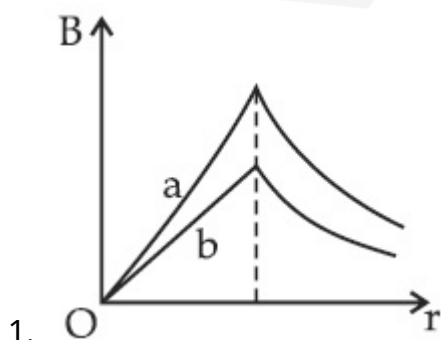
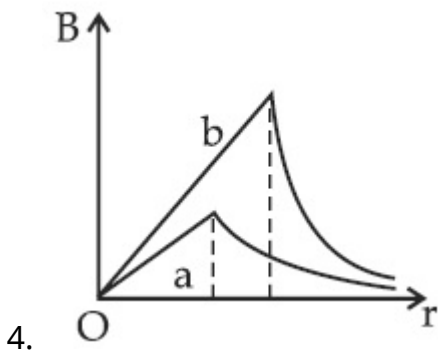
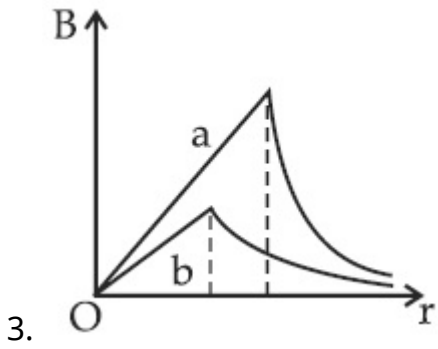
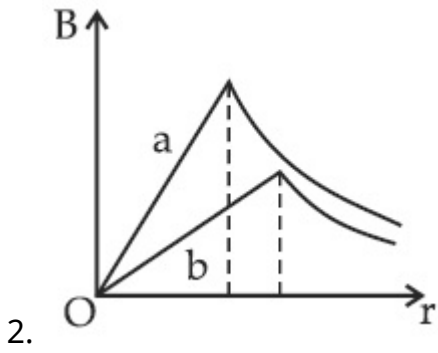


Fig. A

Fig. B

**Options :**





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

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

Two identical particles of mass 1 kg each go round a circle of radius  $R$ , under the action of their mutual gravitational attraction. The angular speed of each particle is :

**Options :**

1.  $\sqrt{\frac{G}{2R^3}}$

2.

$$\frac{1}{2} \sqrt{\frac{G}{R^3}}$$

3.  $\frac{1}{2R} \sqrt{\frac{1}{G}}$

4.  $\sqrt{\frac{2G}{R^3}}$

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

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

An electron and proton are separated by a large distance. The electron starts approaching the proton with energy 3 eV. The proton captures the electron and forms a hydrogen atom in second excited state. The resulting photon is incident on a photosensitive metal of threshold wavelength 4000 Å. What is the maximum kinetic energy of the emitted photoelectron?

**Options :**

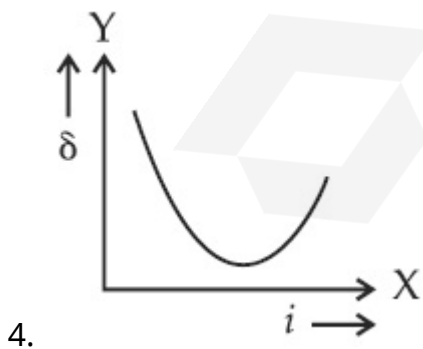
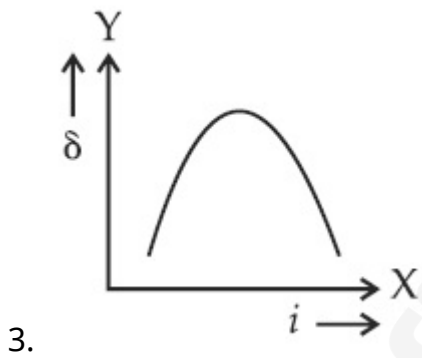
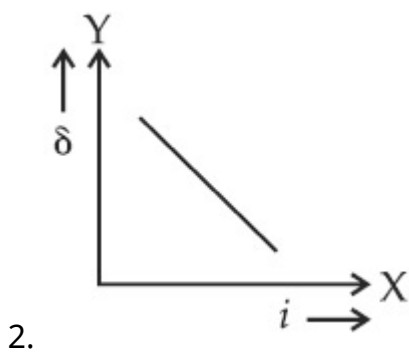
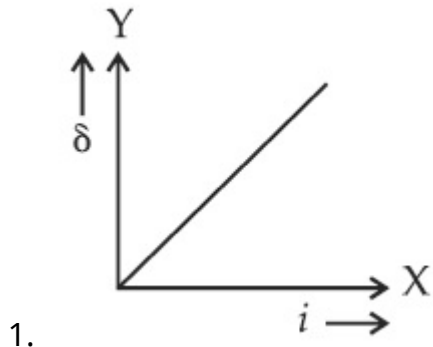
1. 3.3 eV
2. No photoelectron would be emitted
3. 7.61 eV
4. 1.41 eV

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

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

The expected graphical representation of the variation of angle of deviation ' $\delta$ ' with angle of incidence ' $i$ ' in a prism is :

Options :



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

A  $100\ \Omega$  resistance, a  $0.1\ \mu\text{F}$  capacitor and an inductor are connected in series across a  $250\ \text{V}$  supply at variable frequency. Calculate the value of inductance of inductor at which resonance will occur. Given that the resonant frequency is  $60\ \text{Hz}$ .

**Options :**

1.  $7.03 \times 10^{-5}\ \text{H}$
2.  $70.3\ \text{H}$
3.  $0.70\ \text{H}$
4.  $70.3\ \text{mH}$

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

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

The resistance of a conductor at  $15^\circ\text{C}$  is  $16\ \Omega$  and at  $100^\circ\text{C}$  is  $20\ \Omega$ . What will be the temperature coefficient of resistance of the conductor ?

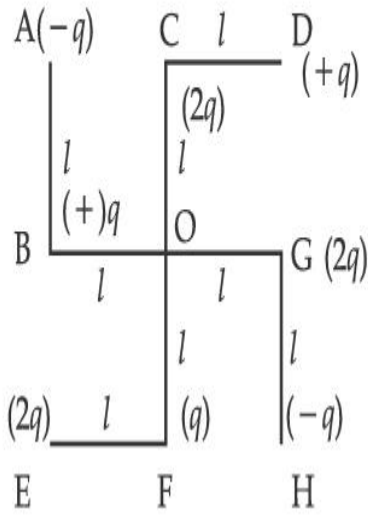
**Options :**

1.  $0.003^\circ\text{C}^{-1}$
2.  $0.010^\circ\text{C}^{-1}$
3.  $0.033^\circ\text{C}^{-1}$
4.  $0.042^\circ\text{C}^{-1}$

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

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

What will be the magnitude of electric field at point O as shown in figure? Each side of the figure is  $l$  and perpendicular to each other?



Options :

1.  $\frac{1}{4\pi\epsilon_0} \frac{q}{l^2}$
2.  $\frac{1}{4\pi\epsilon_0} \frac{2q}{2l^2} (\sqrt{2})$
3.  $\frac{1}{4\pi\epsilon_0} \frac{q}{(2l^2)} (2\sqrt{2} - 1)$
4.  $\frac{q}{4\pi\epsilon_0 (2l)^2}$

## Physics Section B

Section Id :

864351849

Section Number :

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>	8643511076
<b>Question Shuffling Allowed :</b>	Yes

**Question Type : SA**

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

The maximum amplitude for an amplitude modulated wave is found to be 12 V while the minimum amplitude is found to be 3 V. The modulation index is  $0.6x$  where  $x$  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**

For the circuit shown, the value of current at time  $t=3.2$  s will be \_\_\_\_\_ A.

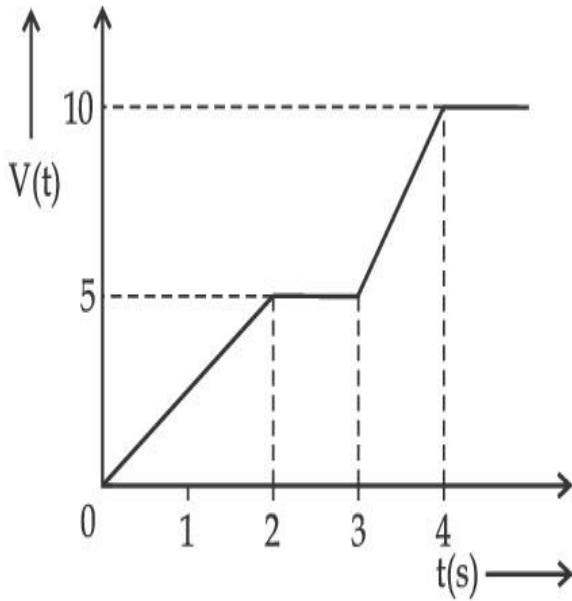


Figure 1

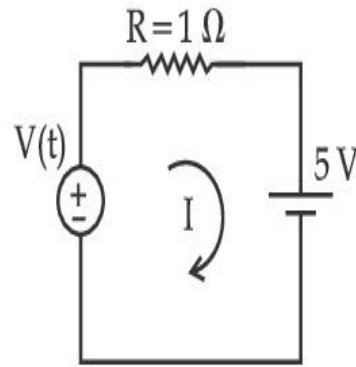


Figure 2

[Voltage distribution  $V(t)$  is shown by Fig. (1) and the circuit is shown in Fig. (2) ]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

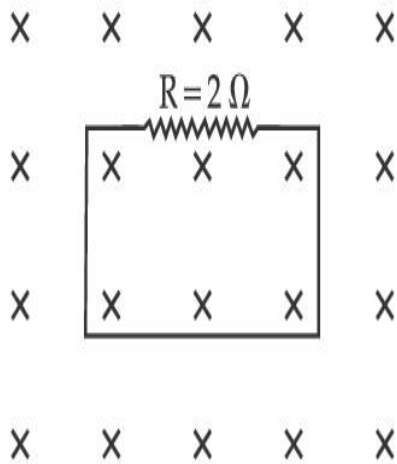
1

**Question Type :** SA

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

In the given figure the magnetic flux through the loop increases according to the relation  $\phi_B(t) = 10t^2 + 20t$ , where  $\phi_B$  is in milliwebers and  $t$  is in seconds.

The magnitude of current through  $R = 2 \Omega$  resistor at  $t = 5$  s is \_\_\_\_\_ mA.



**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  $K_\alpha$  X-ray of molybdenum has wavelength 0.071 nm. If the energy of a molybdenum atom with a K electron knocked out is 27.5 keV, the energy of this atom when an L electron is knocked out will be \_\_\_\_\_ keV. (Round off to the nearest integer)

[  $h = 4.14 \times 10^{-15}$  eVs,  $c = 3 \times 10^8$  ms<sup>-1</sup> ]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

**Question Type : SA**

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

The water is filled upto height of 12 m in a tank having vertical sidewalls. A hole is made in one of the walls at a depth ' $h$ ' below the water level. The value of ' $h$ ' for which the emerging stream of water strikes the ground at the maximum range is \_\_\_\_\_ m.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

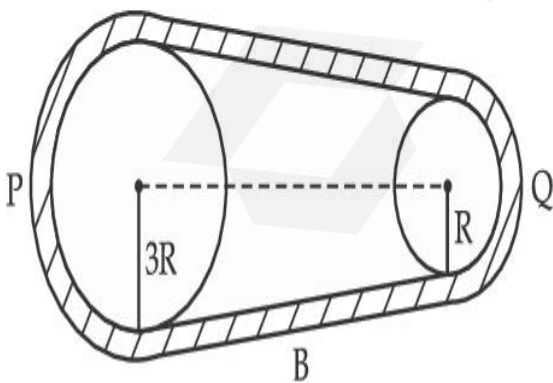
1

**Question Type : SA**

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

In the given figure, two wheels P and Q are connected by a belt B. The radius of P is three times as that of Q. In case of same rotational kinetic energy, the ratio of rotational inertias

$\left(\frac{I_1}{I_2}\right)$  will be  $x : 1$ . The value of  $x$  will be \_\_\_\_\_.



**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

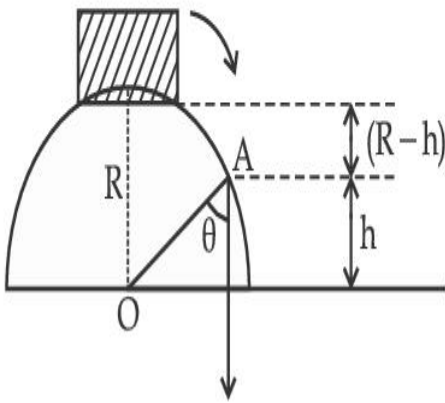
1

**Question Type :** SA

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

A small block slides down from the top of hemisphere of radius  $R=3$  m as shown in the figure. The height 'h' at which the block will lose contact with the surface of the sphere is \_\_\_\_\_ m.

(Assume there is no friction between the block and the hemisphere)



**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

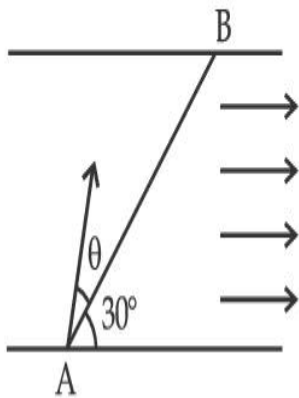
**Possible Answers :**

1

**Question Type :** SA

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

A swimmer wants to cross a river from point A to point B. Line AB makes an angle of  $30^\circ$  with the flow of river. Magnitude of velocity of the swimmer is same as that of the river. The angle  $\theta$  with the line AB should be \_\_\_\_\_  $^\circ$ , so that the swimmer reaches point B.



**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 executes simple harmonic motion represented by displacement function as

$$x(t) = A \sin(\omega t + \phi)$$

If the position and velocity of the particle at  $t=0$  s are 2 cm and  $2\omega$  cm s<sup>-1</sup> respectively, then its amplitude is  $x\sqrt{2}$  cm where the value of  $x$  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**

The difference in the number of waves when yellow light propagates through air and vacuum columns of the same thickness is one. The thickness of the air column is \_\_\_\_\_ mm.

[ Refractive index of air = 1.0003, wavelength of yellow light in vacuum = 6000 Å ]

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1

## Chemistry Section A

<b>Section Id :</b>	864351850
<b>Section Number :</b>	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>Enable Mark as Answered Mark for Review and Clear Response :</b>	Yes
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	8643511077
<b>Question Shuffling Allowed :</b>	Yes

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

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

Select the correct statements.

- (A) Crystalline solids have long range order.
- (B) Crystalline solids are isotropic.
- (C) Amorphous solids are sometimes called pseudo solids.
- (D) Amorphous solids soften over a range of temperatures.
- (E) Amorphous solids have a definite heat of fusion.

Choose the most appropriate answer from the options given below :

**Options :**

1. (A), (C), (D) only
2. (A), (B), (E) only
3. (C), (D) only
4. (B), (D) only

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

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

If the Thompson model of the atom was correct, then the result of Rutherford's gold foil experiment would have been :

**Options :**

1. All of the  $\alpha$ -particles pass through the gold foil without decrease in speed.
2.  $\alpha$ -Particles pass through the gold foil deflected by small angles and with reduced speed.

3.  $\alpha$ -Particles are deflected over a wide range of angles.
4. All  $\alpha$ -particles get bounced back by  $180^\circ$ .

**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 :**  $\text{SO}_2(\text{g})$  is adsorbed to a larger extent than  $\text{H}_2(\text{g})$  on activated charcoal.

**Reason R :**  $\text{SO}_2(\text{g})$  has a higher critical temperature than  $\text{H}_2(\text{g})$ .

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 **CORRECT** order of first ionisation enthalpy is :

**Options :**

- 1.

$Mg < Al < P < S$

2.  $Mg < Al < S < P$

3.  $Mg < S < Al < P$

4.  $Al < Mg < S < P$

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

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

The addition of silica during the extraction of copper from its sulphide ore

**Options :**

1. converts copper sulphide into copper silicate

2. reduces copper sulphide into metallic copper

3. converts iron oxide into iron silicate

4. reduces the melting point of the reaction mixture

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

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

The number of neutrons and electrons, respectively, present in the radioactive isotope of hydrogen is :

**Options :**

1. 2 and 1

2. 3 and 1
3. 2 and 2
4. 1 and 1

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

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

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

<b>List - I</b>	<b>List - II</b>
(a) Li	(i) photoelectric cell
(b) Na	(ii) absorbent of CO <sub>2</sub>
(c) K	(iii) coolant in fast breeder nuclear reactor
(d) Cs	(iv) treatment of cancer
	(v) bearings for motor engines

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

**Options :**

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

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

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

Number of Cl=O bonds in chlorous acid, chloric acid and perchloric acid respectively are :

**Options :**

1. 1, 1 and 3
2. 3, 1 and 1
3. 1, 2 and 3
4. 4, 1 and 0

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

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

To an aqueous solution containing ions such as  $\text{Al}^{3+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Ba}^{2+}$  and  $\text{Cu}^{2+}$  was added conc. HCl, followed by  $\text{H}_2\text{S}$ .

The total number of cations precipitated during this reaction is/are :

**Options :**

1. 3
2. 2
3. 1
4. 4

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Given below are two statements :

Statement I :  $[\text{Mn}(\text{CN})_6]^{3-}$ ,  $[\text{Fe}(\text{CN})_6]^{3-}$  and  $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$  are  $d^2sp^3$  hybridised.

Statement II :  $[\text{MnCl}_6]^{3-}$  and  $[\text{FeF}_6]^{3-}$  are paramagnetic and have 4 and 5 unpaired electrons, respectively.

In the light of the above statements, choose the **correct** 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 correct but **statement II** is false
4. **Statement I** is incorrect 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

(compound)

- (a) Carbon monoxide
- (b) Sulphur dioxide
- (c) Polychlorinated biphenyls
- (d) Oxides of nitrogen

List - II

(effect/affected species)

- (i) Carcinogenic
- (ii) Metabolized by pyrus plants
- (iii) Haemoglobin
- (iv) Stiffness of flower buds

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

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

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

Which one of the following set of elements can be detected using sodium fusion extract ?

**Options :**

1. Nitrogen, Phosphorous, Carbon, Sulfur
2. Sulfur, Nitrogen, Phosphorous, Halogens
3. Phosphorous, Oxygen, Nitrogen, Halogens

## 4. Halogens, Nitrogen, Oxygen, Sulfur

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

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

Given below are two statements :

**Statement I :** Hyperconjugation is a permanent effect.

**Statement II :** Hyperconjugation in ethyl cation  $(\text{CH}_3 - \overset{+}{\text{C}}\text{H}_2)$  involves the overlapping of  $\text{C}_{\text{sp}^2} - \text{H}_{1s}$  bond with empty 2p orbital of other carbon.

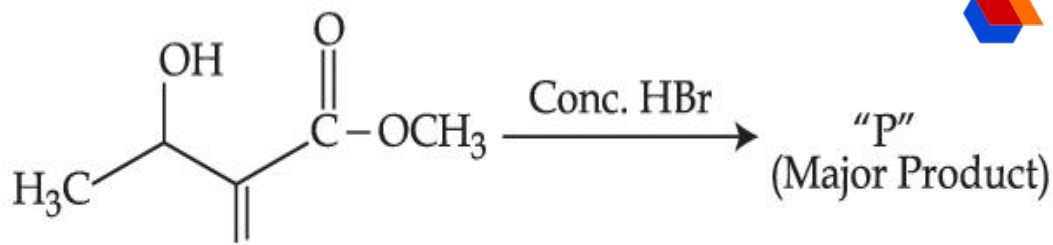
Choose the correct option :

**Options :**

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

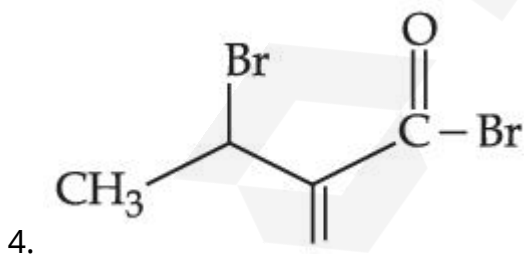
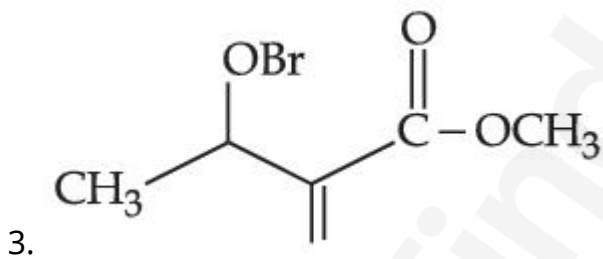
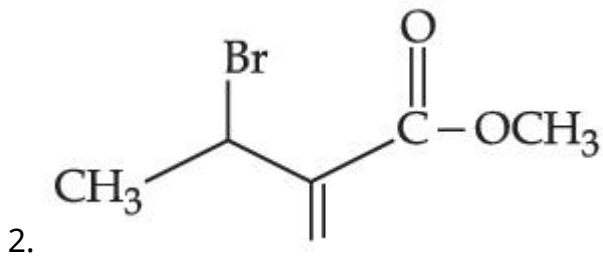
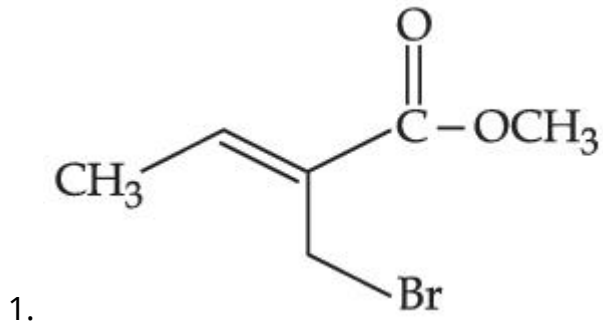
**Question Type : MCQ Is Question Mandatory : No**

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



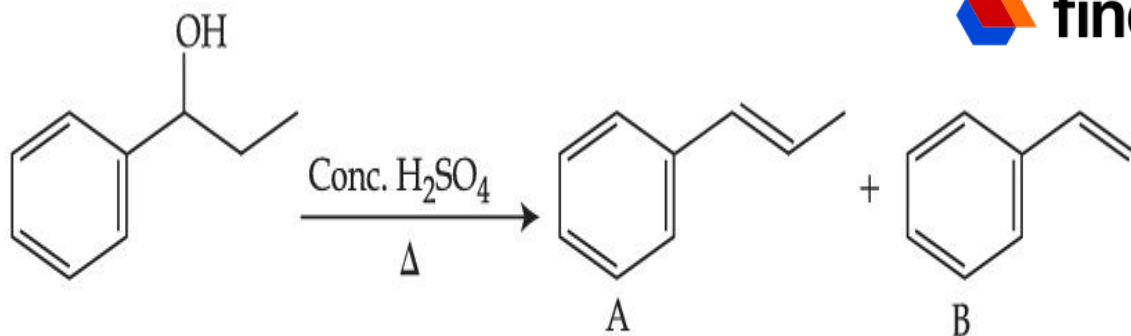
Consider the above reaction, the major product "P" formed is :

Options :



Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1



Consider the above reaction, and choose the correct statement :

**Options :**

1. Compound **A** will be the major product
2. Compound **B** will be the major product
3. Both compounds **A** and **B** are formed equally
4. The reaction is not possible in acidic medium

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

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



Consider the above reaction and identify "Y".

**Options :**

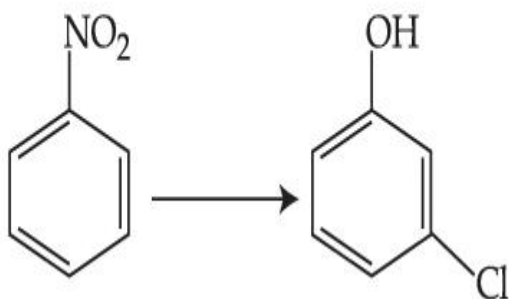
1.  $-COOH$
2.  $-CH_2NH_2$
3.  $-CHO$

4.  $-\text{CONH}_2$

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

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

The correct sequence of correct reagents for the following transformation is :



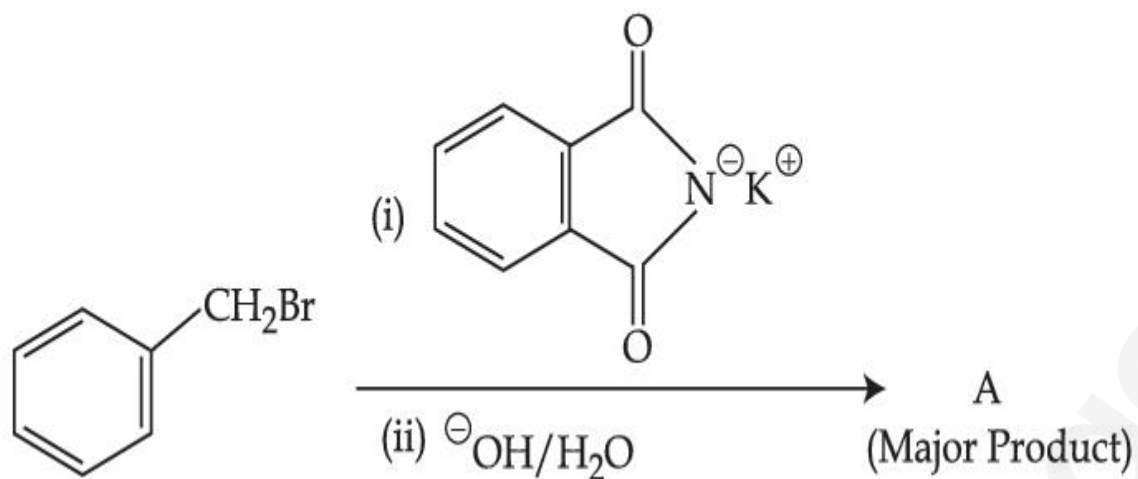
**Options :**

1. (i)  $\text{Cl}_2, \text{FeCl}_3$       (ii)  $\text{Fe}, \text{HCl}$       (iii)  $\text{NaNO}_2, \text{HCl}, 0^\circ\text{C}$       (iv)  $\text{H}_2\text{O}/\text{H}^+$
2. (i)  $\text{Fe}, \text{HCl}$       (ii)  $\text{NaNO}_2, \text{HCl}, 0^\circ\text{C}$       (iii)  $\text{H}_2\text{O}/\text{H}^+$       (iv)  $\text{Cl}_2, \text{FeCl}_3$
3. (i)  $\text{Fe}, \text{HCl}$       (ii)  $\text{Cl}_2, \text{HCl}$       (iii)  $\text{NaNO}_2, \text{HCl}, 0^\circ\text{C}$       (iv)  $\text{H}_2\text{O}/\text{H}^+$
4. (i)  $\text{Cl}_2, \text{FeCl}_3$       (ii)  $\text{NaNO}_2, \text{HCl}, 0^\circ\text{C}$       (iii)  $\text{Fe}, \text{HCl}$       (iv)  $\text{H}_2\text{O}/\text{H}^+$

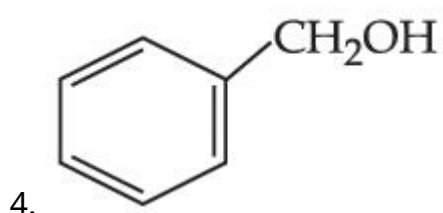
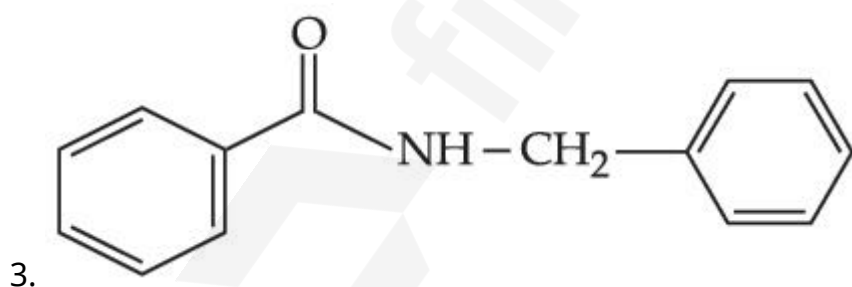
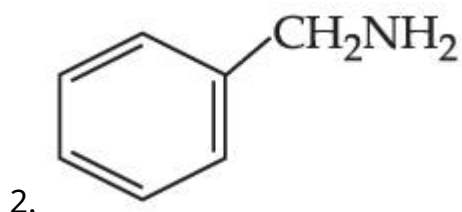
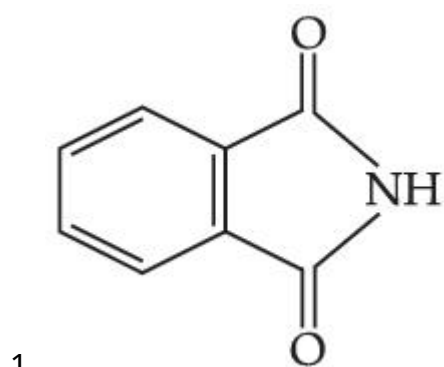
**Question Type : MCQ Is Question Mandatory : No**

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

What is A in the following reaction ?



Options :



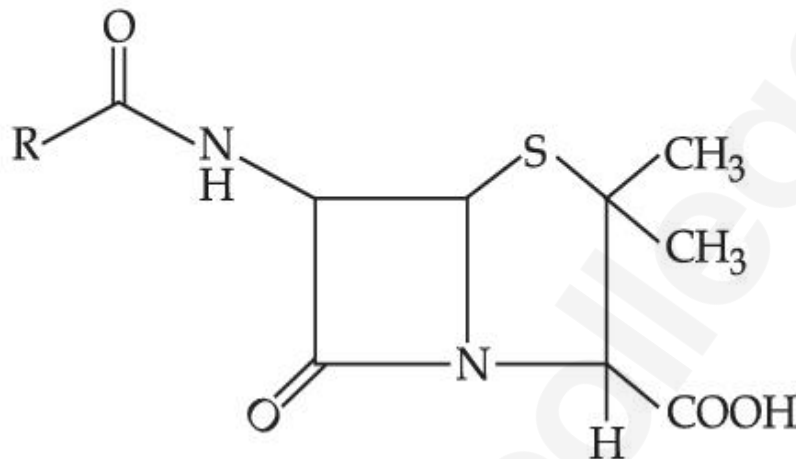
Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Given below are two statements :

**Statement I :** Penicillin is a bacteriostatic type antibiotic.

**Statement II :** The general structure of Penicillin is :



Choose the correct option :

**Options :**

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

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Compound A gives D-Galactose and D-Glucose on hydrolysis. The compound A is :

**Options :**

1. Maltose

2. Lactose

3. Sucrose

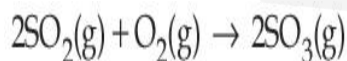
4. Amylose

## Chemistry Section B

<b>Section Id :</b>	864351851
<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>Enable Mark as Answered Mark for Review and Clear Response :</b>	Yes
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	8643511078
<b>Question Shuffling Allowed :</b>	Yes

**Question Type : SA**

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



The above reaction is carried out in a vessel starting with partial pressures  $P_{\text{SO}_2} = 250$  m bar,  $P_{\text{O}_2} = 750$  m bar and  $P_{\text{SO}_3} = 0$  bar. When the reaction is complete, the total pressure in the reaction vessel is \_\_\_\_\_ m bar. (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 total number of electrons in all bonding molecular orbitals of  $O_2^{2-}$  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 :**

1

**Question Type :** SA

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

When 400 mL of 0.2 M  $H_2SO_4$  solution is mixed with 600 mL of 0.1 M NaOH solution, the increase in temperature of the final solution is \_\_\_\_\_  $\times 10^{-2}$  K. (Round off to the Nearest Integer).

[Use :  $H^+(aq) + OH^-(aq) \rightarrow H_2O$  :  $\Delta_f H = -57.1 \text{ kJ mol}^{-1}$

Specific heat of  $H_2O = 4.18 \text{ J K}^{-1} \text{ g}^{-1}$

density of  $H_2O = 1.0 \text{ g cm}^{-3}$

Assume no change in volume of solution on mixing.]

**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 solvent 50% of an acid HA dimerizes and the rest dissociates. The van't Hoff factor of the acid 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

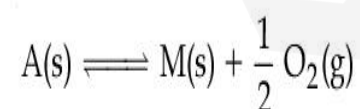
**Possible Answers :**

1

**Question Type :** SA

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

The equilibrium constant for the reaction



is  $K_p = 4$ . At equilibrium, the partial pressure of  $O_2$  is \_\_\_\_\_ atm. (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 the cell  $\text{Cu(s)}|\text{Cu}^{2+}(\text{aq}) (0.1\text{ M})||\text{Ag}^+(\text{aq}) (0.01\text{ M})|\text{Ag(s)}$

the cell potential  $E_1 = 0.3095\text{ V}$

For the cell  $\text{Cu(s)}|\text{Cu}^{2+}(\text{aq}) (0.01\text{ M})||\text{Ag}^+(\text{aq}) (0.001\text{ M})|\text{Ag(s)}$

the cell potential = \_\_\_\_\_  $\times 10^{-2}\text{ V}$ . (Round off to the Nearest Integer).

[Use :  $\frac{2.303\text{ RT}}{\text{F}} = 0.059$ ]

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 the first order reaction  $A \rightarrow 2B$ , 1 mole of reactant A gives 0.2 moles of B after 100 minutes. The half life of the reaction is \_\_\_\_\_ min. (Round off to the Nearest Integer).

[Use :  $\ln 2 = 0.69$ ,  $\ln 10 = 2.3$

Properties of logarithms :  $\ln x^y = y \ln x$ ;

$$\ln\left(\frac{x}{y}\right) = \ln x - \ln y]$$

**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 moles of metal complex with formula  $\text{Co(en)}_2\text{Cl}_3$  gives 3 moles of silver chloride on treatment with excess of silver nitrate. The secondary valency of Co in the complex 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 :**

1

**Question Type :** SA

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

The dihedral angle in staggered form of Newman projection of 1,1,1-Trichloro ethane is \_\_\_\_\_ degree. (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**

10.0 mL of 0.05 M  $\text{KMnO}_4$  solution was consumed in a titration with 10.0 mL of given oxalic acid dihydrate solution. The strength of given oxalic acid solution is \_\_\_\_\_  $\times 10^{-2}$  g/L. (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

## Mathematics Section A

**Section Id :** 864351852

**Section Number :** 5

**Section type :** 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>	8643511079
<b>Question Shuffling Allowed :</b>	Yes

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

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

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

$f(x+y) + f(x-y) = 2f(x)f(y)$ ,  $f\left(\frac{1}{2}\right) = -1$ . Then, the value of

$$\sum_{k=1}^{20} \frac{1}{\sin(k) \sin(k+f(k))} \text{ is equal to :}$$

**Options :**

1.  $\sec^2(1) \sec(21) \cos(20)$
2.  $\operatorname{cosec}^2(21) \cos(20) \cos(2)$
3.  $\operatorname{cosec}^2(1) \operatorname{cosec}(21) \sin(20)$
4.  $\sec^2(21) \sin(20) \sin(2)$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let the mean and variance of the frequency distribution

$$x: \quad x_1=2 \quad x_2=6 \quad x_3=8 \quad x_4=9$$

$$f: \quad 4 \quad 4 \quad \alpha \quad \beta$$

be 6 and 6.8 respectively. If  $x_3$  is changed from 8 to 7, then the mean for the new data will be :

Options :

1.  $\frac{17}{3}$

2. 5

3.  $\frac{16}{3}$

4. 4

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Consider a circle C which touches the  $y$ -axis at  $(0, 6)$  and cuts off an intercept  $6\sqrt{5}$  on the  $x$ -axis. Then the radius of the circle C is equal to :

Options :

1. 8

2.  $\sqrt{53}$

3. 9

4.  $\sqrt{82}$

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

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

Two sides of a parallelogram are along the lines  $4x + 5y = 0$  and  $7x + 2y = 0$ . If the equation of one of the diagonals of the parallelogram is  $11x + 7y = 9$ , then other diagonal passes through the point :

**Options :**

1.  $(1, 2)$

2.  $(2, 2)$

3.  $(2, 1)$

4.  $(1, 3)$

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

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

Let  $f : [0, \infty) \rightarrow [0, 3]$  be a function defined by

$$f(x) = \begin{cases} \max \{ \sin t : 0 \leq t \leq x \}, & 0 \leq x \leq \pi \\ 2 + \cos x, & x > \pi \end{cases}$$

Then which of the following is true ?

**Options :**

1.  $f$  is not continuous exactly at two points in  $(0, \infty)$

2.  $f$  is continuous everywhere but not differentiable exactly at two points in  $(0, \infty)$
3.  $f$  is continuous everywhere but not differentiable exactly at one point in  $(0, \infty)$
4.  $f$  is differentiable everywhere in  $(0, \infty)$

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

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

Which of the following is the negation of the statement "for all  $M > 0$ , there exists  $x \in S$  such that  $x \geq M$ " ?

**Options :**

1. there exists  $M > 0$ , there exists  $x \in S$  such that  $x < M$
2. there exists  $M > 0$ , there exists  $x \in S$  such that  $x \geq M$
3. there exists  $M > 0$ , such that  $x < M$  for all  $x \in S$
4. there exists  $M > 0$ , such that  $x \geq M$  for all  $x \in S$

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

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

The area of the region bounded by  $y - x = 2$  and  $x^2 = y$  is equal to :

**Options :**

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

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

3.  $\frac{9}{2}$

4.  $\frac{16}{3}$

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

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

Let  $y=y(x)$  be the solution of the differential equation  $(x-x^3)dy=(y+yx^2-3x^4)dx$ ,  $x > 2$ .

If  $y(3)=3$ , then  $y(4)$  is equal to :

**Options :**

1. 12

2. 8

3. 16

4. 4

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

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

- (a) reflection about the line  $y=x$ .
- (b) translation through 2 units along the positive direction of  $x$ -axis.
- (c) rotation through angle  $\frac{\pi}{4}$  about the origin in the anti-clockwise direction.

If the co-ordinates of the final position of the point P are  $\left(-\frac{1}{\sqrt{2}}, \frac{7}{\sqrt{2}}\right)$ , then the value of

$2a + b$  is equal to :

**Options :**

- 1. 5
- 2. 7
- 3. 9
- 4. 13

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

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

A possible value of 'x', for which the ninth term in the expansion of

$$\left\{ 3^{\log_3 \sqrt{25^x - 1} + 7} + 3 \left( -\frac{1}{8} \right)^{\log_3 (5^{x-1} + 1)} \right\}^{10}$$

in the increasing powers of  $3 \left( -\frac{1}{8} \right)^{\log_3 (5^{x-1} + 1)}$

is equal to 180, is :

**Options :**

1. 0

2. 1

3. -1

4. 2

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

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

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

$$S_1 = \{z \in \mathbb{C} : |z-2| \leq 1\} \text{ and}$$

$$S_2 = \{z \in \mathbb{C} : z(1+i) + \bar{z}(1-i) \geq 4\}.$$

Then, the maximum value of  $\left|z - \frac{5}{2}\right|^2$  for  $z \in S_1 \cap S_2$  is equal to :

**Options :**

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

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

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

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

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

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

Let  $f: (a, b) \rightarrow \mathbf{R}$  be twice differentiable function such that  $f(x) = \int_a^x g(t)dt$  for a differentiable function  $g(x)$ . If  $f(x)=0$  has exactly five distinct roots in  $(a, b)$ , then  $g(x)g'(x)=0$  has at least :

**Options :**

1. three roots in  $(a, b)$
2. five roots in  $(a, b)$
3. seven roots in  $(a, b)$
4. twelve roots in  $(a, b)$

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

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

Let  $A$  and  $B$  be two  $3 \times 3$  real matrices such that  $(A^2 - B^2)$  is invertible matrix. If  $A^5 = B^5$  and  $A^3B^2 = A^2B^3$ , then the value of the determinant of the matrix  $A^3 + B^3$  is equal to :

**Options :**

1. 0
2. 1
3. 2

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

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

Let  $\mathbf{N}$  be the set of natural numbers and a relation  $\mathbf{R}$  on  $\mathbf{N}$  be defined by  
 $\mathbf{R} = \{(x, y) \in \mathbf{N} \times \mathbf{N} : x^3 - 3x^2y - xy^2 + 3y^3 = 0\}$ . Then the relation  $\mathbf{R}$  is :

**Options :**

1. reflexive and symmetric, but not transitive
2. reflexive but neither symmetric nor transitive
3. symmetric but neither reflexive nor transitive
4. an equivalence relation

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

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

Let  $\alpha = \max_{x \in \mathbf{R}} \{8^{2\sin 3x} \cdot 4^{4\cos 3x}\}$  and  $\beta = \min_{x \in \mathbf{R}} \{8^{2\sin 3x} \cdot 4^{4\cos 3x}\}$ .

If  $8x^2 + bx + c = 0$  is a quadratic equation whose roots are  $\alpha^{1/5}$  and  $\beta^{1/5}$ , then the value of  $c - b$  is equal to :

**Options :**

1. 42
2. 43

3. 47

4. 50

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

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

The value of  $\lim_{x \rightarrow 0} \left( \frac{x}{\sqrt[8]{1 - \sin x} - \sqrt[8]{1 + \sin x}} \right)$  is equal to :

**Options :**

1. 0

2. -1

3. -4

4. 4

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

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

A student appeared in an examination consisting of 8 true - false type questions. The student guesses the answers with equal probability. The smallest value of n, so that the probability of

guessing at least 'n' correct answers is less than  $\frac{1}{2}$ , is :

**Options :**

1. 3

2. 4

3. 5

4. 6

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

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

For real numbers  $\alpha$  and  $\beta \neq 0$ , if the point of intersection of the straight lines

$$\frac{x - \alpha}{1} = \frac{y - 1}{2} = \frac{z - 1}{3} \text{ and } \frac{x - 4}{\beta} = \frac{y - 6}{3} = \frac{z - 7}{3},$$

lies on the plane  $x + 2y - z = 8$ , then  $\alpha - \beta$  is equal to :

**Options :**

1. 3

2. 5

3. 7

4. 9

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

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

If  $\tan\left(\frac{\pi}{9}\right), x, \tan\left(\frac{7\pi}{18}\right)$  are in arithmetic progression and  $\tan\left(\frac{\pi}{9}\right), y, \tan\left(\frac{5\pi}{18}\right)$  are also in

arithmetic progression, then  $|x - 2y|$  is equal to :

**Options :**

1. 0

2. 1

3. 3

4. 4

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

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

Let  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  be three vectors such that  $\vec{a} = \vec{b} \times (\vec{b} \times \vec{c})$ . If magnitudes of the vectors

$\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are  $\sqrt{2}$ , 1 and 2 respectively and the angle between  $\vec{b}$  and  $\vec{c}$  is  $\theta$   $\left(0 < \theta < \frac{\pi}{2}\right)$ ,

then the value of  $1 + \tan \theta$  is equal to :

**Options :**

1. 1

2. 2

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

**Section Id :** 864351853  
**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 :** 8643511080  
**Question Shuffling Allowed :** Yes

**Question Type : SA**

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

If the real part of the complex number  $z = \frac{3 + 2i \cos \theta}{1 - 3i \cos \theta}$ ,  $\theta \in \left(0, \frac{\pi}{2}\right)$  is zero, then the value of

$\sin^2 3\theta + \cos^2 \theta$  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  $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$  and  $M = A + A^2 + A^3 + \dots + A^{20}$ , then the sum of all the elements of the

matrix  $M$  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  $n$  be a non-negative integer. Then the number of divisors of the form " $4n+1$ " of the number  $(10)^{10} \cdot (11)^{11} \cdot (13)^{13}$  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**

The distance of the point  $P(3, 4, 4)$  from the point of intersection of the line joining the points  $Q(3, -4, -5)$  and  $R(2, -3, 1)$  and the plane  $2x + y + z = 7$ , 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  $y=y(x)$  be the solution of the differential equation  $dy=e^{\alpha x+y}dx$ ;  $\alpha \in \mathbb{N}$ .

If  $y(\log_e 2)=\log_e 2$  and  $y(0)=\log_e\left(\frac{1}{2}\right)$ , 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 :**

1

**Question Type :** SA

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

If  $\int_0^\pi (\sin^3 x) e^{-\sin^2 x} dx = \alpha - \frac{\beta}{e} \int_0^1 \sqrt{t} e^t dt$ , 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  $\vec{a} = \hat{i} - \alpha\hat{j} + \beta\hat{k}$ ,  $\vec{b} = 3\hat{i} + \beta\hat{j} - \alpha\hat{k}$  and  $\vec{c} = -\alpha\hat{i} - 2\hat{j} + \hat{k}$ , where  $\alpha$  and  $\beta$  are

integers. If  $\vec{a} \cdot \vec{b} = -1$  and  $\vec{b} \cdot \vec{c} = 10$ , then  $(\vec{a} \times \vec{b}) \cdot \vec{c}$  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 E be an ellipse whose axes are parallel to the co-ordinates axes, having its center at  $(3, -4)$ , one focus at  $(4, -4)$  and one vertex at  $(5, -4)$ . If  $mx - y = 4$ ,  $m > 0$  is a tangent to the ellipse E, then the value of  $5m^2$  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  $A = \{n \in \mathbf{N} \mid n^2 \leq n + 10,000\}$ ,  $B = \{3k + 1 \mid k \in \mathbf{N}\}$  and  $C = \{2k \mid k \in \mathbf{N}\}$ , then the sum of all the elements of the set  $A \cap (B - C)$  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**

The number of real roots of the equation  $e^{4x} - e^{3x} - 4e^{2x} - e^x + 1 = 0$  is equal to \_\_\_\_\_.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

1