

# National Testing Agency

<b>Question Paper Name :</b>	B TECH 18th March 2021 Shift 1
<b>Subject Name :</b>	B TECH
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<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>	86435153
<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>	864351313
<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>	864351313
<b>Question Shuffling Allowed :</b>	Yes

**Question Number : 1 Question Id : 8643514681 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

An oil drop of radius 2 mm with a density  $3 \text{ g cm}^{-3}$  is held stationary under a constant electric field  $3.55 \times 10^5 \text{ V m}^{-1}$  in the Millikan's oil drop experiment. What is the number of excess electrons that the oil drop will possess ?

Consider  $g = 9.81 \text{ m/s}^2$

**Options :**

86435114041.  $17.3 \times 10^{10}$

86435114042.  $1.73 \times 10^{10}$

86435114043.  $1.73 \times 10^{12}$

86435114044.  $48.8 \times 10^{11}$

**Question Number : 2 Question Id : 8643514682 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

A constant power delivering machine has towed a box, which was initially at rest, along a horizontal straight line. The distance moved by the box in time 't' is proportional to :

**Options :**

86435114045.  $t^{3/2}$

86435114046.  $t^{1/2}$

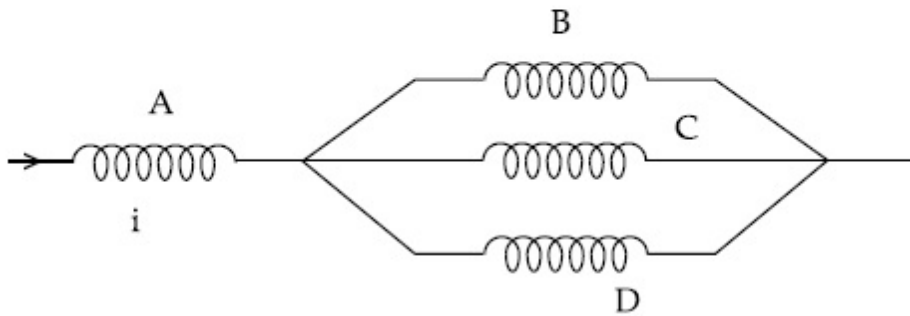
86435114047.  $t^{2/3}$

86435114048.  $t$

**Question Number : 3 Question Id : 8643514683 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Four identical long solenoids A, B, C and D are connected to each other as shown in the figure. If the magnetic field at the center of A is 3 T, the field at the center of C would be : (Assume that the magnetic field is confined within the volume of respective solenoid).



**Options :**

86435114049. 1 T

86435114050. 9 T

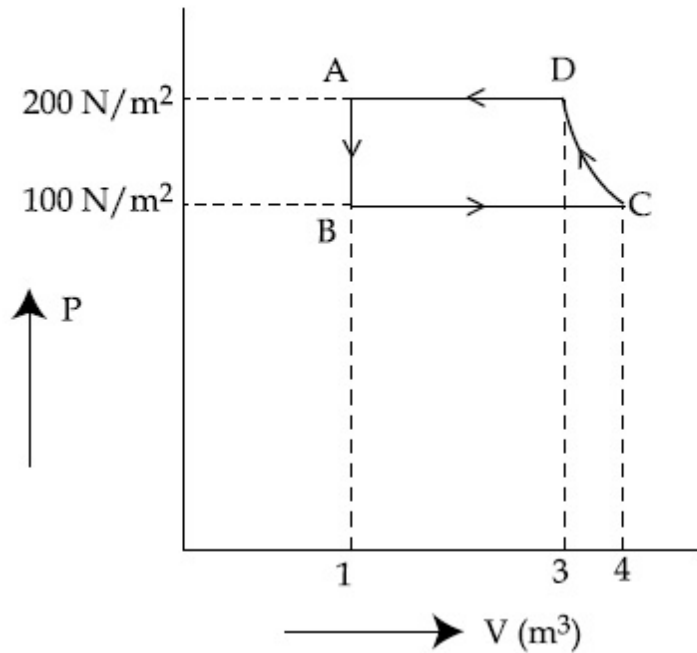
86435114051. 6 T

86435114052. 12 T

**Question Number : 4 Question Id : 8643514684 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The P-V diagram of a diatomic ideal gas system going under cyclic process as shown in figure. The work done during an adiabatic process CD is (use  $\gamma = 1.4$ ) :



Options :

86435114053. 400 J

86435114054. -500 J

86435114055. 200 J

86435114056. -400 J

Question Number : 5 Question Id : 8643514685 Question Type : MCQ Option Shuffling : Yes Is

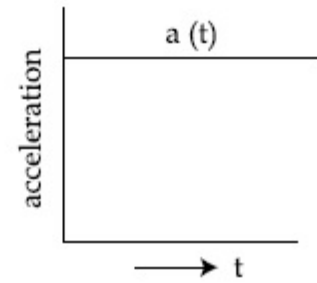
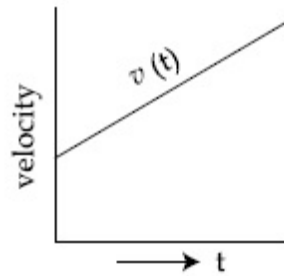
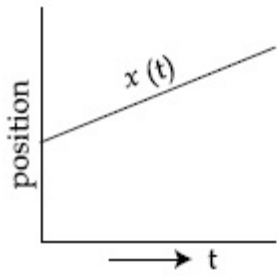
Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

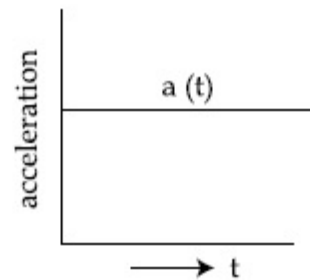
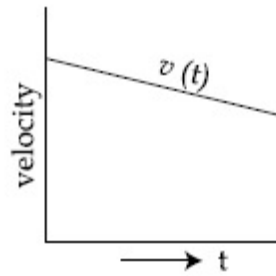
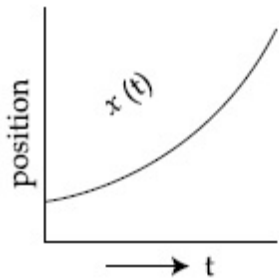
The position, velocity and acceleration of a particle moving with a constant acceleration can be represented by :

Options :

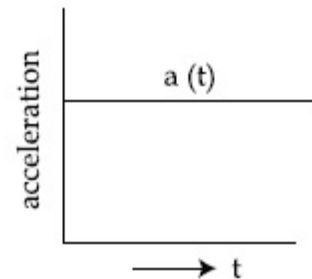
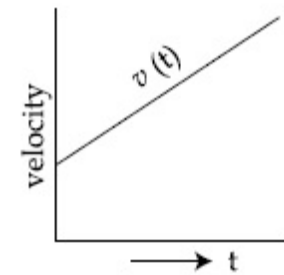
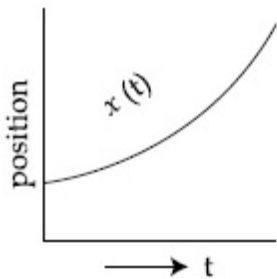
86435114057.



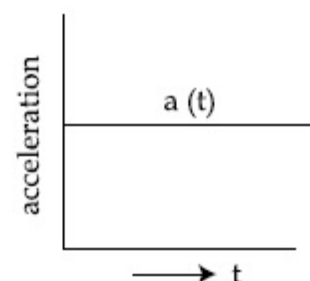
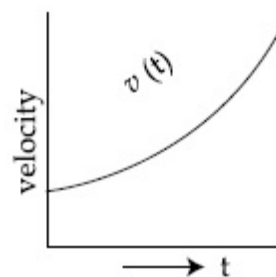
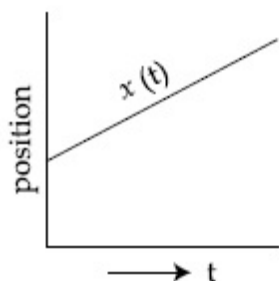
86435114058.



86435114059.



86435114060.



**Question Number : 6 Question Id : 8643514686 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

An AC source rated 220 V, 50 Hz is connected to a resistor. The time taken by the current to change from its maximum to the rms value is :

**Options :**

86435114061. 2.5 ms

86435114062. 25 ms

86435114063. 0.25 ms

86435114064. 2.5 s

**Question Number : 7 Question Id : 8643514687 Question Type : MCQ Option Shuffling : Yes Is****Question Mandatory : No****Correct Marks : 4 Wrong Marks : 1**

In Young's double slit arrangement, slits are separated by a gap of 0.5 mm, and the screen is placed at a distance of 0.5 m from them. The distance between the first and the third bright fringe formed when the slits are illuminated by a monochromatic light of 5890 Å is :

**Options :**86435114065.  $1178 \times 10^{-12}$  m86435114066.  $5890 \times 10^{-7}$  m86435114067.  $1178 \times 10^{-9}$  m86435114068.  $1178 \times 10^{-6}$  m**Question Number : 8 Question Id : 8643514688 Question Type : MCQ Option Shuffling : Yes Is****Question Mandatory : No****Correct Marks : 4 Wrong Marks : 1**

A particle is travelling 4 times as fast as an electron. Assuming the ratio of de-Broglie wavelength of a particle to that of electron is 2 : 1, the mass of the particle is :

**Options :**86435114069. 8 times the mass of  $e^-$ 86435114070.  $\frac{1}{16}$  times the mass of  $e^-$ 86435114071. 16 times the mass of  $e^-$

86435114072.  $\frac{1}{8}$  times the mass of  $e^-$

**Question Number : 9 Question Id : 8643514689 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The time period of a simple pendulum is given by  $T = 2\pi\sqrt{\frac{l}{g}}$ . The measured value of the

length of pendulum is 10 cm known to a 1 mm accuracy. The time for 200 oscillations of the pendulum is found to be 100 second using a clock of 1 s resolution. The percentage accuracy in the determination of 'g' using this pendulum is 'x'. The value of 'x' to the nearest integer is,

**Options :**

86435114073. 2%

86435114074. 3%

86435114075. 4%

86435114076. 5%

**Question Number : 10 Question Id : 8643514690 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Imagine that the electron in a hydrogen atom is replaced by a muon ( $\mu$ ). The mass of muon particle is 207 times that of an electron and charge is equal to the charge of an electron. The ionization potential of this hydrogen atom will be :

**Options :**

86435114077. 13.6 eV

86435114078. 27.2 eV

86435114079. 331.2 eV

86435114080. 2815.2 eV

**Question Number : 11 Question Id : 8643514691 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

A radioactive sample disintegrates via two independent decay processes having half lives

$T_{1/2}^{(1)}$  and  $T_{1/2}^{(2)}$  respectively. The effective half-life,  $T_{1/2}$  of the nuclei is :

**Options :**

$$T_{1/2} = \frac{T_{1/2}^{(1)} T_{1/2}^{(2)}}{T_{1/2}^{(1)} + T_{1/2}^{(2)}}$$

86435114081.

$$T_{1/2} = T_{1/2}^{(1)} + T_{1/2}^{(2)}$$

86435114082.

$$T_{1/2} = \frac{T_{1/2}^{(1)} + T_{1/2}^{(2)}}{T_{1/2}^{(1)} - T_{1/2}^{(2)}}$$

86435114083.

86435114084. None of the above

**Question Number : 12 Question Id : 8643514692 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

A loop of flexible wire of irregular shape carrying current is placed in an external magnetic field. Identify the effect of the field on the wire.

**Options :**

86435114085. shape of the loop remains unchanged

86435114086. loop assumes circular shape with its plane normal to the field

86435114087. loop assumes circular shape with its plane parallel to the field

86435114088. wire gets stretched to become straight



**Question Number : 13 Question Id : 8643514693 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

In the experiment of Ohm's law, a potential difference of 5.0 V is applied across the end of a conductor of length 10.0 cm and diameter of 5.00 mm. The measured current in the conductor is 2.00 A. The maximum permissible percentage error in the resistivity of the conductor is :

**Options :**

86435114089. 3.9

86435114090. 7.5

86435114091. 8.4

86435114092. 3.0

**Question Number : 14 Question Id : 8643514694 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The time period of a satellite in a circular orbit of radius  $R$  is  $T$ . The period of another satellite in a circular orbit of radius  $9R$  is :

**Options :**

86435114093. 3 T

86435114094. 9 T

86435114095. 27 T

86435114096. 12 T

**Question Number : 15 Question Id : 8643514695 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

In a series LCR resonance circuit, if we change the resistance only, from a lower to higher value :

**Options :**

86435114097. The resonance frequency will increase
86435114098. The bandwidth of resonance circuit will increase
86435114099. The quality factor will increase
86435114100. The quality factor and the resonance frequency will remain constant

**Question Number : 16 Question Id : 8643514696 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

Your friend is having eye sight problem. She is not able to see clearly a distant uniform window mesh and it appears to her as non-uniform and distorted. The doctor diagnosed the problem as :

**Options :**

86435114101. Myopia and hypermetropia
86435114102. Presbyopia with Astigmatism
86435114103. Astigmatism
86435114104. Myopia with Astigmatism

**Question Number : 17 Question Id : 8643514697 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

What will be the average value of energy along one degree of freedom for an ideal gas in thermal equilibrium at a temperature  $T$  ? ( $k_B$  is Boltzmann constant)

**Options :**

86435114105.  $k_B T$
86435114106.  $\frac{1}{2} k_B T$

$$\frac{3}{2} k_B T$$

86435114107.

$$\frac{2}{3} k_B T$$

86435114108.

**Question Number : 18 Question Id : 8643514698 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Match List - I with List - II.

**List - I**

- (a) 10 km height over earth's surface
- (b) 70 km height over earth's surface
- (c) 180 km height over earth's surface
- (d) 270 km height over earth's surface

**List - II**

- (i) Thermosphere
- (ii) Mesosphere
- (iii) Stratosphere
- (iv) Troposphere

**Options :**

86435114109. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

86435114110. (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv)

86435114111. (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

86435114112. (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)

**Question Number : 19 Question Id : 8643514699 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

A plane electromagnetic wave of frequency 100 MHz is travelling in vacuum along the x-direction. At a particular point in space and time,  $\vec{B} = 2.0 \times 10^{-8} \hat{k}$  T. (where,  $\hat{k}$  is unit vector along z-direction) What is  $\vec{E}$  at this point ?

(speed of light  $c = 3 \times 10^8$  m/s)

**Options :**

$$0.6 \hat{j} \text{ V/m}$$

86435114113.

86435114114.  $6.0 \hat{j} \text{ V/m}$

86435114115.  $6.0 \hat{k} \text{ V/m}$

86435114116.  $0.6 \hat{k} \text{ V/m}$

**Question Number : 20 Question Id : 8643514700 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

A thin circular ring of mass  $M$  and radius  $r$  is rotating about its axis with an angular speed  $\omega$ . Two particles having mass  $m$  each are now attached at diametrically opposite points. The angular speed of the ring will become :

**Options :**

86435114117.  $\omega \frac{M}{M + m}$

86435114118.  $\omega \frac{M}{M + 2m}$

86435114119.  $\omega \frac{M - 2m}{M + 2m}$

86435114120.  $\omega \frac{M + 2m}{M}$

## Physics Section B

<b>Section Id :</b>	864351314
<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

Sub-Section Id :

864351314

Question Shuffling Allowed :

Yes

Question Number : 21 Question Id : 8643514701 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

An npn transistor operates as a common emitter amplifier with a power gain of  $10^6$ . The input circuit resistance is  $100\ \Omega$  and the output load resistance is  $10\ \text{k}\Omega$ . The common emitter current gain ' $\beta$ ' will be \_\_\_\_\_. (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 : 22 Question Id : 8643514702 Question Type : SA

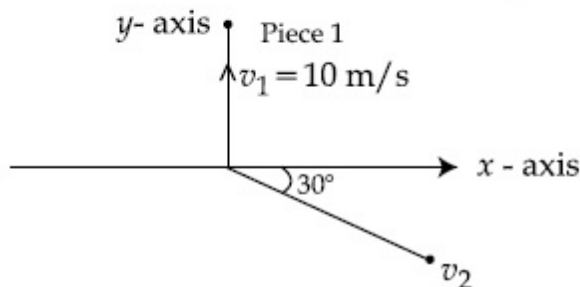
Correct Marks : 4 Wrong Marks : 0

A ball of mass  $10\ \text{kg}$  moving with a velocity  $10\sqrt{3}\ \text{m/s}$  along the  $x$ -axis, hits another ball of mass  $20\ \text{kg}$  which is at rest. After the collision, first ball comes to rest while the second ball disintegrates into two equal pieces. One piece starts moving along  $y$ -axis with a speed of  $10\ \text{m/s}$ . The second piece starts moving at an angle of  $30^\circ$  with respect to the  $x$ -axis.

The velocity of the ball moving at  $30^\circ$  with  $x$ -axis is  $x\ \text{m/s}$ .

The configuration of pieces after collision is shown in the figure below.

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

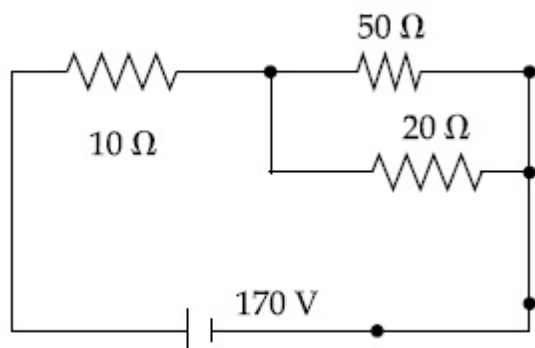
Possible Answers :

100

Question Number : 23 Question Id : 8643514703 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The voltage across the  $10\ \Omega$  resistor in the given circuit is  $x$  volt.



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

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

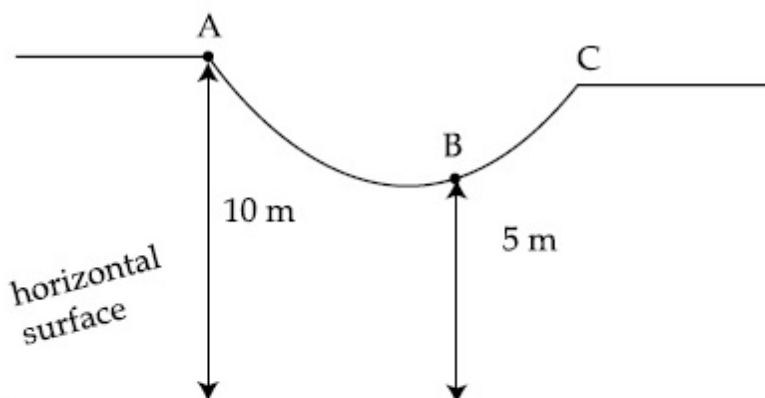
Text Areas : PlainText

Possible Answers :

100

Question Number : 24 Question Id : 8643514704 Question Type : SA

Correct Marks : 4 Wrong Marks : 0



As shown in the figure, a particle of mass 10 kg is placed at a point A. When the particle is slightly displaced to its right, it starts moving and reaches the point B. The speed of the particle at B is  $x$  m/s.

(Take  $g = 10\ \text{m/s}^2$ )

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 : 8643514705 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A particle performs simple harmonic motion with a period of 2 second. The time taken by the particle to cover a displacement equal to half of its amplitude from the mean position is  $\frac{1}{a}$  s.

The value of 'a' to the nearest integer is \_\_\_\_\_.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

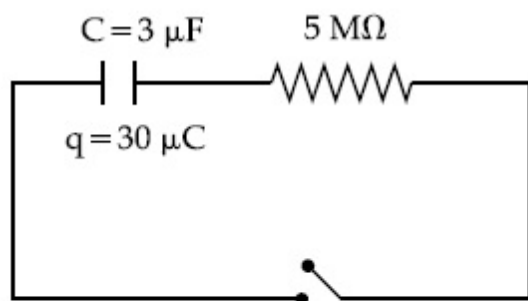
Text Areas : PlainText

Possible Answers :

100

Question Number : 26 Question Id : 8643514706 Question Type : SA

Correct Marks : 4 Wrong Marks : 0



The circuit shown in the figure consists of a charged capacitor of capacity  $3 \mu\text{F}$  and a charge of  $30 \mu\text{C}$ . At time  $t=0$ , when the key is closed, the value of current flowing through the  $5 \text{ M}\Omega$  resistor is ' $x$ '  $\mu\text{A}$ .

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 : 8643514707 Question Type : SA**

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

A person is swimming with a speed of 10 m/s at an angle of  $120^\circ$  with the flow and reaches to a point directly opposite on the other side of the river. The speed of the flow is 'x' m/s.

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 : 28 Question Id : 8643514708 Question Type : SA**

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

Two separate wires A and B are stretched by 2 mm and 4 mm respectively, when they are subjected to a force of 2 N. Assume that both the wires are made up of same material and the radius of wire B is 4 times that of the radius of wire A. The length of the wires A and B

are in the ratio of a : b. Then  $\frac{a}{b}$  can be expressed as  $\frac{1}{x}$  where x is \_\_\_\_\_.

**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 : 8643514709 Question Type : SA**

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

A parallel plate capacitor has plate area  $100 \text{ m}^2$  and plate separation of 10 m. The space between the plates is filled up to a thickness 5 m with a material of dielectric constant of 10. The resultant capacitance of the system is 'x' pF.

The value of  $\epsilon_0 = 8.85 \times 10^{-12} \text{ F.m}^{-1}$

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 : 30 Question Id : 8643514710 Question Type : SA**

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

A bullet of mass 0.1 kg is fired on a wooden block to pierce through it, but it stops after moving a distance of 50 cm into it. If the velocity of bullet before hitting the wood is 10 m/s and it slows down with uniform deceleration, then the magnitude of effective retarding force on the bullet is 'x' N.

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