

# National Testing Agency

**Question Paper Name :** B TECH 16th March 2021 Shift 1  
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**Creation Date :** 2021-03-16 14:04:33  
**Duration :** 180  
**Number of Questions :** 90  
**Total Marks :** 300  
**Display Marks:** Yes

## B TECH

**Group Number :** 1  
**Group Id :** 8643512  
**Group Maximum Duration :** 0  
**Group Minimum Duration :** 180  
**Show Attended Group? :** No  
**Edit Attended Group? :** No  
**Break time :** 0  
**Group Marks :** 300  
**Is this Group for Examiner? :** No

## Physics Section A

**Section Id :** 8643517  
**Section Number :** 1  
**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 :** 8643517  
**Question Shuffling Allowed :** Yes

**Question Number : 1 Question Id : 86435191 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

For an electromagnetic wave travelling in free space, the relation between average energy densities due to electric ( $U_e$ ) and magnetic ( $U_m$ ) fields is :

Options :

864351271.  $U_e = U_m$

864351272.  $U_e \neq U_m$

864351273.  $U_e > U_m$

864351274.  $U_e < U_m$

Question Number : 2 Question Id : 86435192 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The volume  $V$  of an enclosure contains a mixture of three gases, 16 g of oxygen, 28 g of nitrogen and 44 g of carbon dioxide at absolute temperature  $T$ . Consider  $R$  as universal gas constant. The pressure of the mixture of gases is :

Options :

864351275.  $\frac{5}{2} \frac{RT}{V}$

864351276.  $\frac{3RT}{V}$

864351277.  $\frac{4RT}{V}$

864351278.  $\frac{88RT}{V}$

Question Number : 3 Question Id : 86435193 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

For changing the capacitance of a given parallel plate capacitor, a dielectric material of dielectric constant  $K$  is used, which has the same area as the plates of the capacitor. The thickness of the dielectric slab is  $\frac{3}{4}d$ , where 'd' is the separation between the plates of parallel plate capacitor. The new capacitance ( $C'$ ) in terms of original capacitance ( $C_0$ ) is given by the following relation :

Options :

864351279.  $C' = \frac{4K}{K+3}C_0$

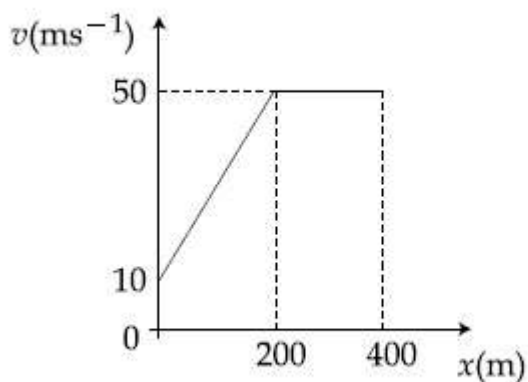
864351280.  $C' = \frac{4}{3+K}C_0$

864351281.  $C' = \frac{3+K}{4K}C_0$

864351282.  $C' = \frac{4+K}{3}C_0$

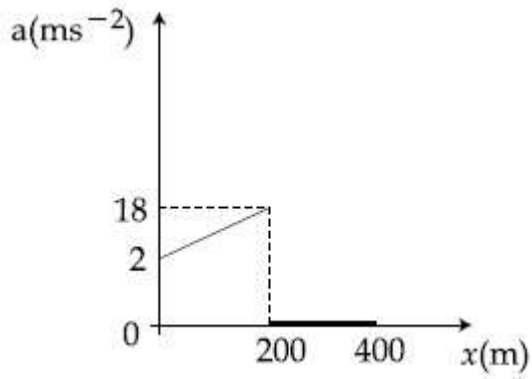
Question Number : 4 Question Id : 86435194 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

The velocity-displacement graph describing the motion of a bicycle is shown in the figure.

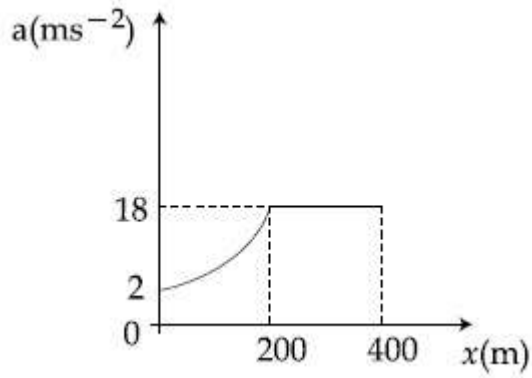


The acceleration-displacement graph of the bicycle's motion is best described by :

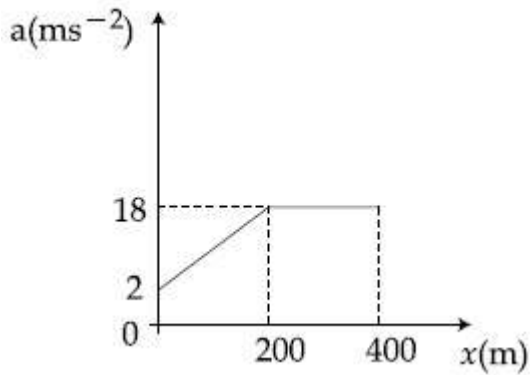
Options :



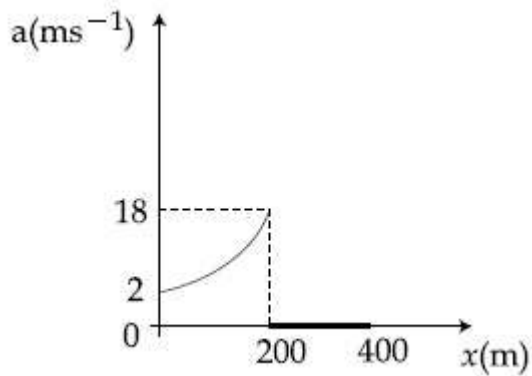
864351283.



864351284.



864351285.

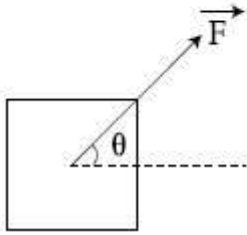


864351286.

Question Number : 5 Question Id : 86435195 Question Type : MCQ Option Shuf  
 Question Mandatory : No  
 Correct Marks : 4 Wrong Marks : 1

A block of mass  $m$  slides along a floor while a force of magnitude  $F$  is applied to it at an angle  $\theta$  as shown in figure. The coefficient of kinetic friction is  $\mu_K$ . Then, the block's acceleration 'a' is given by :

( $g$  is acceleration due to gravity)



Options :

864351287.  $-\frac{F}{m}\cos\theta - \mu_K\left(g - \frac{F}{m}\sin\theta\right)$

864351288.  $\frac{F}{m}\cos\theta + \mu_K\left(g - \frac{F}{m}\sin\theta\right)$

864351289.  $\frac{F}{m}\cos\theta - \mu_K\left(g + \frac{F}{m}\sin\theta\right)$

864351290.  $\frac{F}{m}\cos\theta - \mu_K\left(g - \frac{F}{m}\sin\theta\right)$

Question Number : 6 Question Id : 86435196 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A bar magnet of length 14 cm is placed in the magnetic meridian with its north pole pointing towards the geographic north pole. A neutral point is obtained at a distance of 18 cm from the center of the magnet. If  $B_H = 0.4$  G, the magnetic moment of the magnet is ( $1 \text{ G} = 10^{-4} \text{ T}$ )

Options :

864351291.  $28.80 \text{ J T}^{-1}$

864351292.  $2.880 \times 10^2 \text{ J T}^{-1}$

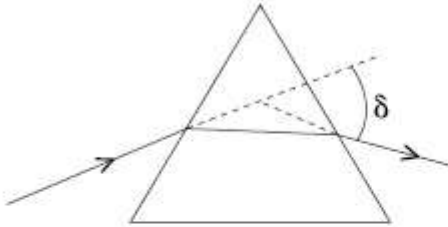
864351293.  $2.880 \text{ J T}^{-1}$

864351294.  $2.880 \times 10^3 \text{ J T}^{-1}$

**Question Number : 7 Question Id : 86435197 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The angle of deviation through a prism is minimum when



- (A) Incident ray and emergent ray are symmetric to the prism
- (B) The refracted ray inside the prism becomes parallel to its base
- (C) Angle of incidence is equal to that of the angle of emergence
- (D) When angle of emergence is double the angle of incidence

Choose the correct answer from the options given below :

**Options :**

864351295. Only statements (A) and (B) are true

864351296. Statements (A), (B) and (C) are true

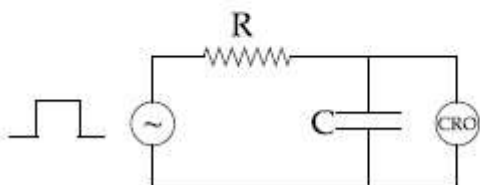
864351297. Only statement (D) is true

864351298. Statements (B) and (C) are true

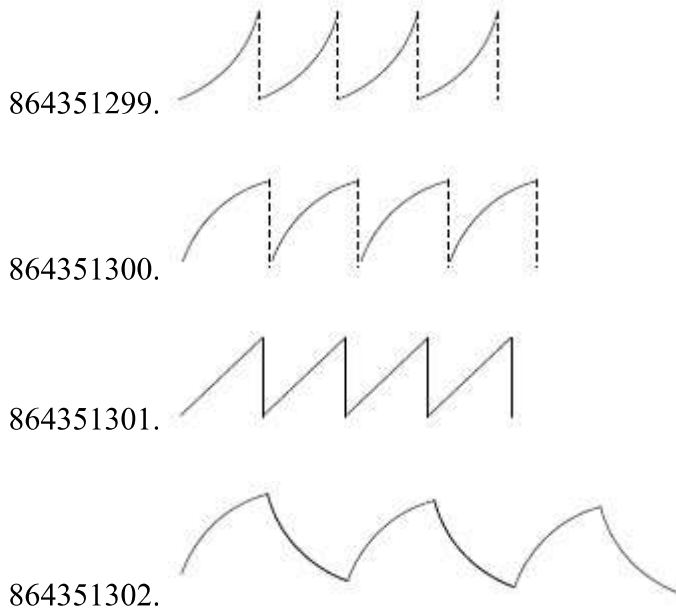
**Question Number : 8 Question Id : 86435198 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

An RC circuit as shown in the figure is driven by a AC source generating a square wave. The output wave pattern monitored by CRO would look close to :



**Options :**



**Question Number : 9 Question Id : 86435199 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

A block of 200 g mass moves with a uniform speed in a horizontal circular groove, with vertical side walls of radius 20 cm. If the block takes 40 s to complete one round, the normal force by the side walls of the groove is :

**Options :**

864351303. 0.0314 N
864351304.  $9.859 \times 10^{-4}$  N
864351305.  $6.28 \times 10^{-3}$  N
864351306.  $9.859 \times 10^{-2}$  N

**Question Number : 10 Question Id : 864351100 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

In thermodynamics, heat and work are :

**Options :**

864351307. Point functions
864351308. Path functions

864351309. Intensive thermodynamic state variables

864351310. Extensive thermodynamic state variables

**Question Number : 11 Question Id : 864351101 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

The maximum and minimum distances of a comet from the Sun are  $1.6 \times 10^{12}$  m and  $8.0 \times 10^{10}$  m respectively. If the speed of the comet at the nearest point is  $6 \times 10^4 \text{ ms}^{-1}$ , the speed at the farthest point is :

**Options :**

864351311.  $1.5 \times 10^3 \text{ m/s}$

864351312.  $3.0 \times 10^3 \text{ m/s}$

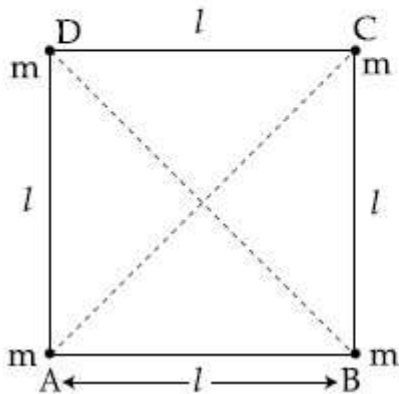
864351313.  $6.0 \times 10^3 \text{ m/s}$

864351314.  $4.5 \times 10^3 \text{ m/s}$

**Question Number : 12 Question Id : 864351102 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

Four equal masses,  $m$  each are placed at the corners of a square of length ( $l$ ) as shown in the figure. The moment of inertia of the system about an axis passing through A and parallel to DB would be :



**Options :**

864351315.  $2 ml^2$



864351316.  $\sqrt{3} \text{ ml}^2$

864351317.  $3 \text{ ml}^2$

864351318.  $\text{ml}^2$

**Question Number : 13 Question Id : 864351103 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

A 25 m long antenna is mounted on an antenna tower. The height of the antenna tower is 75 m. The wavelength (in meter) of the signal transmitted by this antenna would be :

**Options :**

864351319. 200

864351320. 300

864351321. 400

864351322. 100

**Question Number : 14 Question Id : 864351104 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

The stopping potential in the context of photoelectric effect depends on the following property of incident electromagnetic radiation :

**Options :**

864351323. Frequency

864351324. Amplitude

864351325. Intensity

864351326. Phase

**Question Number : 15 Question Id : 864351105 Question Type : MCQ Option Sh**

**Question Mandatory : No**

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

Time period of a simple pendulum is  $T$  inside a lift when the lift is stationary. If the lift moves upwards with an acceleration  $g/2$ , the time period of pendulum will be :

**Options :**

864351327.  $\frac{T}{\sqrt{3}}$

864351328.  $\sqrt{3}T$

864351329.  $\sqrt{\frac{3}{2}} T$

864351330.  $\sqrt{\frac{2}{3}} T$

**Question Number : 16 Question Id : 864351106 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

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

A plane electromagnetic wave of frequency 500 MHz is travelling in vacuum along  $y$ -direction.

At a particular point in space and time,  $\vec{B} = 8.0 \times 10^{-8} \hat{z} \text{ T}$ . The value of electric field at this point is :

(speed of light =  $3 \times 10^8 \text{ ms}^{-1}$ )

$\hat{x}$ ,  $\hat{y}$ ,  $\hat{z}$  are unit vectors along  $x$ ,  $y$  and  $z$  directions.

**Options :**

864351331.  $-24 \hat{x} \text{ V/m}$

864351332.  $2.6 \hat{x} \text{ V/m}$

864351333.  $24 \hat{x} \text{ V/m}$

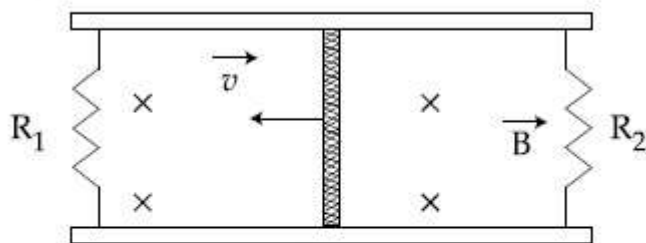
864351334.  $-2.6 \hat{y} \text{ V/m}$

Question Number : 17 Question Id : 864351107 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A conducting bar of length  $L$  is free to slide on two parallel conducting rails as shown in the figure



Two resistors  $R_1$  and  $R_2$  are connected across the ends of the rails. There is a uniform magnetic field  $\vec{B}$  pointing into the page. An external agent pulls the bar to the left at a constant speed  $v$ .

The correct statement about the directions of induced currents  $I_1$  and  $I_2$  flowing through  $R_1$  and  $R_2$  respectively is :

Options :

864351335.  $I_1$  is in anticlockwise direction and  $I_2$  is in clockwise direction

864351336.  $I_1$  is in clockwise direction and  $I_2$  is in anticlockwise direction

864351337. Both  $I_1$  and  $I_2$  are in anticlockwise direction

864351338. Both  $I_1$  and  $I_2$  are in clockwise direction

Question Number : 18 Question Id : 864351108 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The pressure acting on a submarine is  $3 \times 10^5$  Pa at a certain depth. If the depth is doubled, the percentage increase in the pressure acting on the submarine would be :

(Assume that atmospheric pressure is  $1 \times 10^5$  Pa density of water is  $10^3$  kg m $^{-3}$ ,  $g = 10$  ms $^{-2}$ )

Options :

864351339.  $\frac{5}{200}\%$

864351340.  $\frac{200}{5}\%$

864351341.  $\frac{200}{3}\%$

864351342.  $\frac{3}{200}\%$

**Question Number : 19 Question Id : 864351109 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

A conducting wire of length ' $l$ ', area of cross-section  $A$  and electric resistivity  $\rho$  is connected between the terminals of a battery. A potential difference  $V$  is developed between its ends, causing an electric current.

If the length of the wire of the same material is doubled and the area of cross-section is halved, the resultant current would be :

**Options :**

864351343.  $4 \frac{VA}{\rho l}$

864351344.  $\frac{1}{4} \frac{\rho l}{VA}$

864351345.  $\frac{1}{4} \frac{VA}{\rho l}$

864351346.  $\frac{3}{4} \frac{VA}{\rho l}$

**Question Number : 20 Question Id : 864351110 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

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

One main scale division of a vernier callipers is ' $a$ ' cm and  $n^{\text{th}}$  division of the vernier scale coincide with  $(n - 1)^{\text{th}}$  division of the main scale. The least count of the "

**Options :**

864351347.  $\left(\frac{n-1}{10n}\right)a$

864351348.  $\frac{10na}{(n-1)}$

864351349.  $\frac{10a}{n}$

864351350.  $\frac{10a}{(n-1)}$

## Physics Section B

<b>Section Id :</b>	8643518
<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>	8643518
<b>Question Shuffling Allowed :</b>	Yes

**Question Number : 21 Question Id : 864351111 Question Type : SA**

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

A sinusoidal voltage of peak value 250 V is applied to a series LCR circuit, in which  $R = 8 \Omega$ ,  $L = 24 \text{ mH}$  and  $C = 60 \mu\text{F}$ . The value of power dissipated at resonant condition is 'x' kW.

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

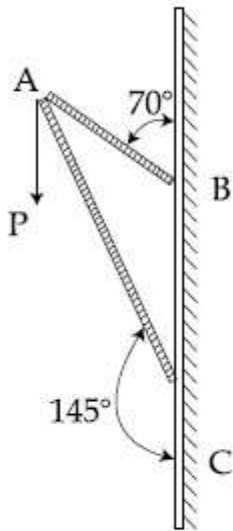
**Possible Answers :**

100

Question Number : 22 Question Id : 864351112 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Consider a frame that is made up of two thin massless rods AB and AC as shown in the figure. A vertical force  $\vec{P}$  of magnitude 100 N is applied at point A of the frame.



Suppose the force is  $\vec{P}$  resolved parallel to the arms AB and AC of the frame.

The magnitude of the resolved component along the arm AC is  $xN$ .

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

[Given :  $\sin(35^\circ) = 0.573$ ,  $\cos(35^\circ) = 0.819$   
 $\sin(110^\circ) = 0.939$ ,  $\cos(110^\circ) = -0.342$  ]

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 : 864351113 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The first three spectral lines of H-atom in the Balmer series are given  $\lambda_1, \lambda_2, \lambda_3$  considering the

Bohr atomic model, the wave lengths of first and third spectral lines  $\left(\frac{\lambda_1}{\lambda_3}\right)$  are related by a

factor of approximately ' $x$ '  $\times 10^{-1}$ .

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

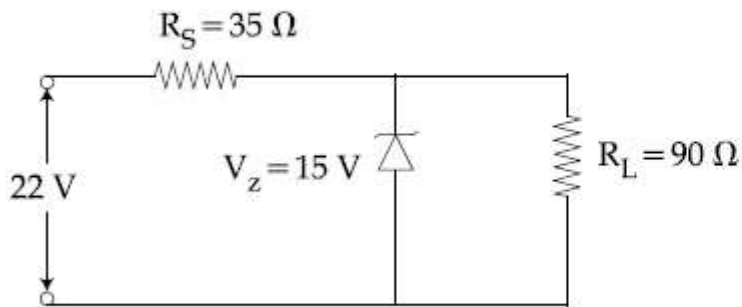
**Possible Answers :**

100

**Question Number :** 24 **Question Id :** 864351114 **Question Type :** SA

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

The value of power dissipated across the zener diode ( $V_z = 15 \text{ V}$ ) connected in the circuit as shown in the figure is  $x \times 10^{-1}$  watt.



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

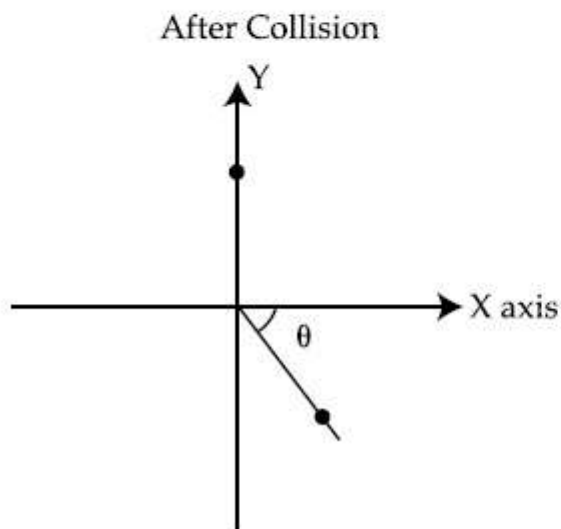
**Question Number :** 25 **Question Id :** 864351115 **Question Type :** SA

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

A ball of mass 10 kg moving with a velocity  $10\sqrt{3} \text{ m s}^{-1}$  along X-axis, hits another ball of mass 20 kg which is at rest. After collision, the first ball comes to rest and the second one disintegrates into two equal pieces. One of the pieces starts moving along Y-axis at a speed of 10 m/s. The second piece starts moving at a speed of 20 m/s at an angle  $\theta$  (degree) with respect to the X-axis.

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

The value of  $\theta$  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 :**

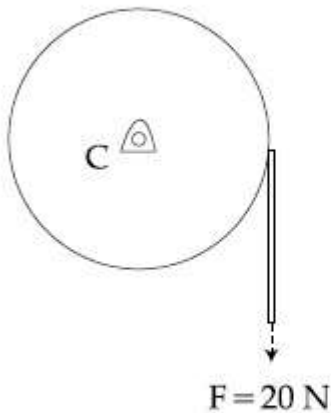
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**Question Number :** 26 **Question Id :** 864351116 **Question Type :** SA

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



Consider a 20 kg uniform circular disk of radius 0.2 m. It is pin supported at its center and is at rest initially. The disk is acted upon by a constant force  $F = 20 \text{ N}$  through a massless string wrapped around its periphery as shown in the figure.



Suppose the disk makes  $n$  number of revolutions to attain an angular speed of  $50 \text{ rad s}^{-1}$ . The value of  $n$ , to the nearest integer, is \_\_\_\_\_.

[Given : In one complete revolution, the disk rotates by 6.28 rad]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

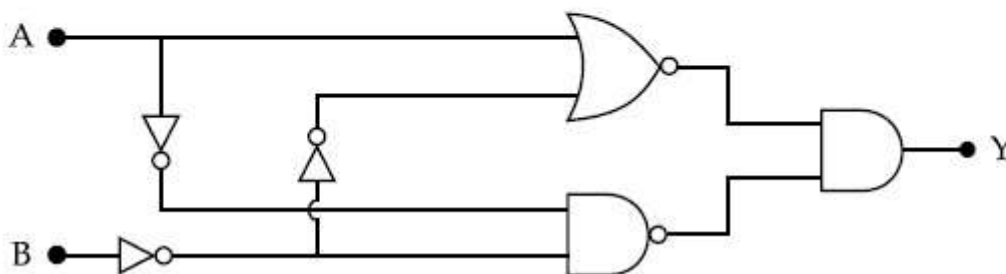
100

**Question Number :** 27 **Question Id :** 864351117 **Question Type :** SA

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

In the logic circuit shown in the figure, if input A and B are 0 to 1 respectively, the output at Y would be 'x'.

The value of  $x$  is \_\_\_\_\_.



**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

Text Areas : PlainText

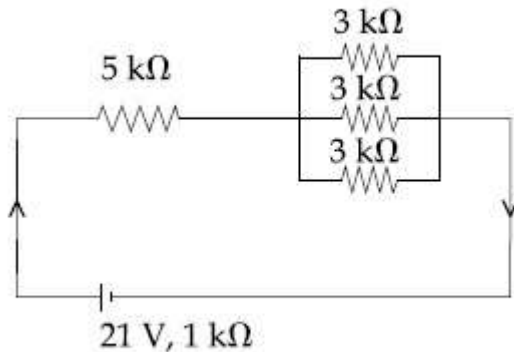
Possible Answers :

100

Question Number : 28 Question Id : 864351118 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

In the figure given, the electric current flowing through the  $5\text{ k}\Omega$  resistor is ' $x$ ' mA.



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 : 29 Question Id : 864351119 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A fringe width of 6 mm was produced for two slits separated by 1 mm apart. The screen is placed 10 m away. The wavelength of light used is ' $x$ ' nm.

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 : 864351120 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The resistance  $R = \frac{V}{I}$ , where  $V = (50 \pm 2)V$  and  $I = (20 \pm 0.2)A$ . The percentage error in R is 'x' %.

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