

National Testing Agency

Question Paper Name : B Tech 31st Aug 2021 Shift 1
Subject Name : B TECH
Creation Date : 2021-08-31 15:55:08
Duration : 180
Total Marks : 300
Display Marks: Yes

B TECH

Group Number : 1
Group Id : 864351257
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 : 864351980
Section Number : 1
Section type : Online
Mandatory or Optional : Mandatory
Number of Questions : 20
Number of Questions to be attempted : 20
Section Marks : 80

Enable Mark as Answered Mark for Review and Clear Response :

Yes

Sub-Section Number :

1

Sub-Section Id :

8643511207

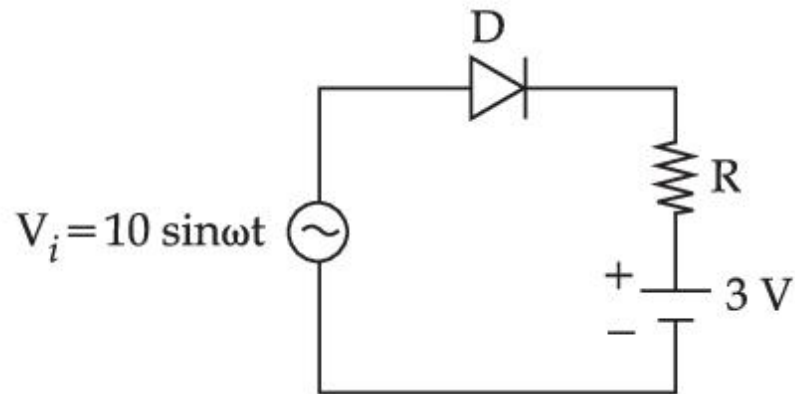
Question Shuffling Allowed :

Yes

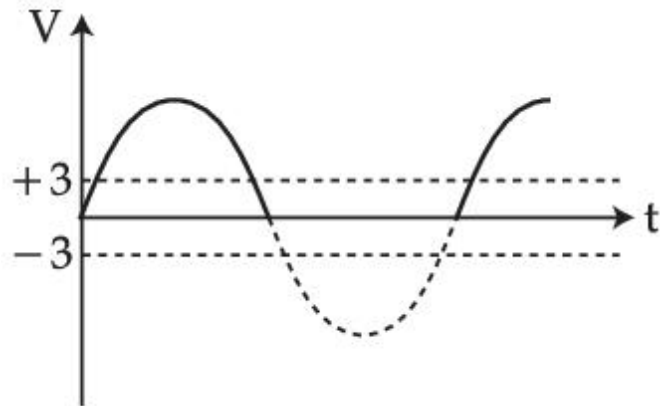
Question Number : 1 Question Id : 86435121160 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

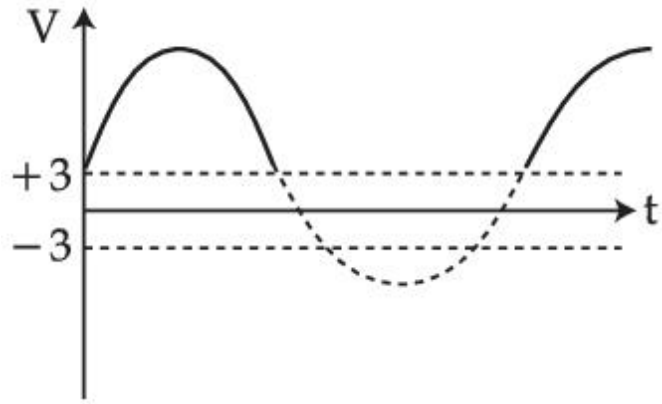
Choose the correct waveform that can represent the voltage across R of the following circuit, assuming the diode is ideal one :



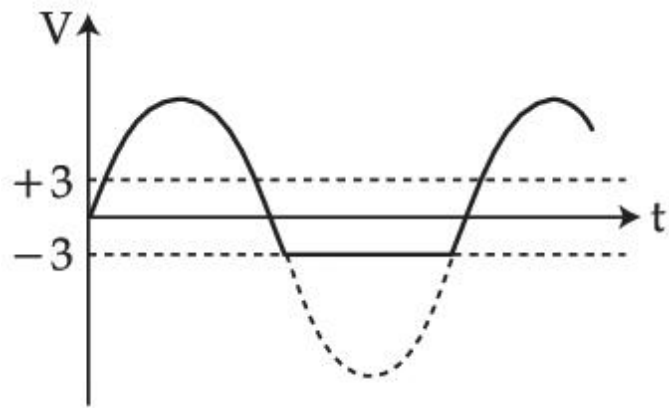
Options :



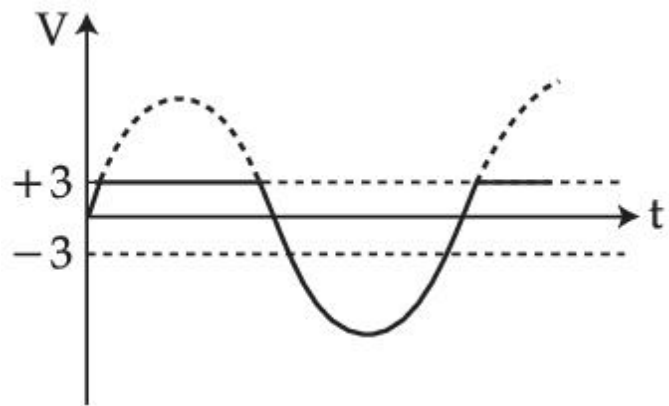
86435170061.



86435170062.



86435170063.

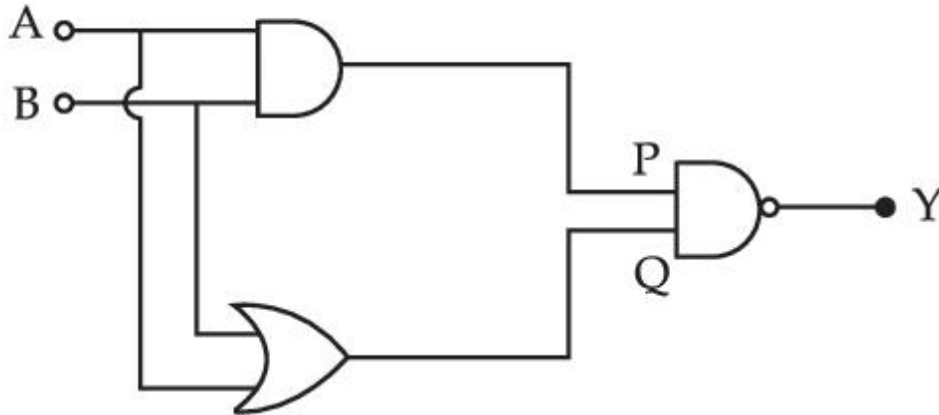


86435170064.

Question Number : 2 Question Id : 86435121161 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

In the following logic circuit the sequence of the inputs A, B are (0, 0), (0, 1), (1, 0) and (1, 1). The output Y for this sequence will be :



Options :

86435170065. 1, 1, 1, 0

86435170066. 1, 0, 1, 0

86435170067. 0, 1, 0, 1

86435170068. 0, 0, 1, 1

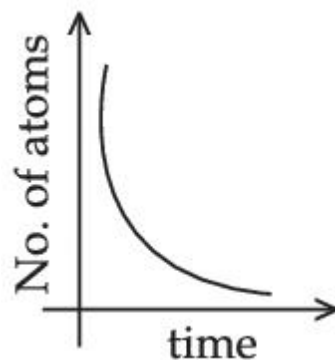
Question Number : 3 Question Id : 86435121162 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

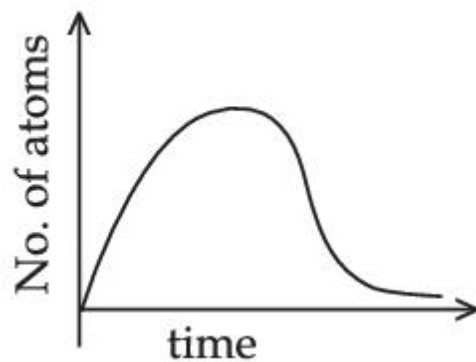
A sample of a radioactive nucleus A disintegrates to another radioactive nucleus B, which in turn disintegrates to some other stable nucleus C. Plot of a graph showing the variation of number of atoms of nucleus B versus time is :

(Assume that at $t=0$, there are no B atoms in the sample)

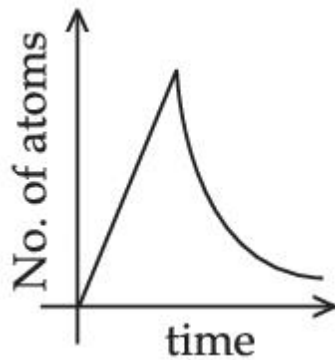
Options :



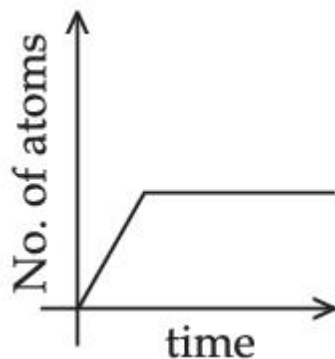
86435170069.



86435170070.



86435170071.



86435170072.

Question Number : 4 Question Id : 86435121163 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A moving proton and electron have the same de-Broglie wavelength. If K and P denote the K.E. and momentum respectively. Then choose the correct option :

Options :

86435170073. $K_p = K_e$ and $P_p = P_e$

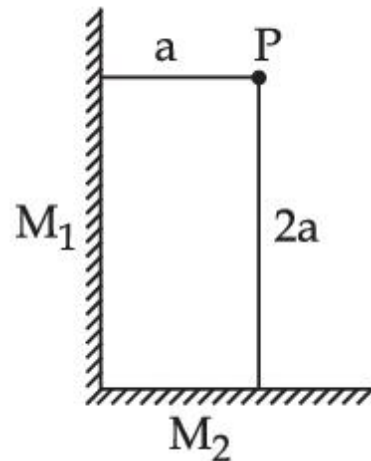
86435170074. $K_p > K_e$ and $P_p = P_e$

86435170075. $K_p < K_e$ and $P_p = P_e$

86435170076. $K_p < K_e$ and $P_p < P_e$

Question Number : 5 Question Id : 86435121164 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Two plane mirrors M_1 and M_2 are at right angle to each other shown. A point source 'P' is placed at 'a' and '2a' meter away from M_1 and M_2 respectively. The shortest distance between the images thus formed is : (Take $\sqrt{5} = 2.3$)



Options :

86435170077. $3a$

86435170078. $4.6a$

86435170079. $2\sqrt{10} a$

86435170080. $2.3a$

Question Number : 6 Question Id : 86435121165 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

An object is placed at the focus of concave lens having focal length f . What is the magnification and distance of the image from the optical centre of the lens ?

Options :

86435170081. Very high, ∞

86435170082. $1, \infty$

86435170083. $\frac{1}{2}, \frac{f}{2}$

86435170084. $\frac{1}{4}, \frac{f}{4}$

Question Number : 7 Question Id : 86435121166 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A small square loop of side 'a' and one turn is placed inside a larger square loop of side b and one turn ($b \gg a$). The two loops are coplanar with their centres coinciding. If a current I is passed in the square loop of side 'b', then the coefficient of mutual inductance between the two loops is :

Options :

86435170085. $\frac{\mu_0}{4\pi} 8\sqrt{2} \frac{a^2}{b}$

86435170086. $\frac{\mu_0}{4\pi} 8\sqrt{2} \frac{b^2}{a}$

86435170087. $\frac{\mu_0}{4\pi} \frac{8\sqrt{2}}{a}$

86435170088. $\frac{\mu_0}{4\pi} \frac{8\sqrt{2}}{b}$

Question Number : 8 Question Id : 86435121167 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

In an ac circuit, an inductor, a capacitor and a resistor are connected in series with $X_L = R = X_C$. Impedance of this circuit is :

Options :

86435170089. Zero

86435170090. $R\sqrt{2}$

86435170091. R

86435170092. $2R^2$

Question Number : 9 Question Id : 86435121168 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Consider a galvanometer shunted with 5Ω resistance and 2% of current passes through it. What is the resistance of the given galvanometer ?

Options :

86435170093. 300Ω

86435170094. 245Ω

86435170095. 344Ω

86435170096. 226Ω

Question Number : 10 Question Id : 86435121169 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A coil having N turns is wound tightly in the form of a spiral with inner radius a and 'b' respectively. Find the magnetic field at centre, when a current i flows through the coil :

Options :

86435170097. $\frac{\mu_0 IN}{2(b-a)} \log_e \left(\frac{b}{a} \right)$

86435170098. $\frac{\mu_0 I}{8} \left(\frac{a-b}{a+b} \right)$

86435170099. $\frac{\mu_0 I}{4(a-b)} \left[\frac{1}{a} - \frac{1}{b} \right]$

86435170100. $\frac{\mu_0 I}{8} \left[\frac{a+b}{a-b} \right]$

Question Number : 11 Question Id : 86435121170 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) Torque
- (b) Impulse
- (c) Tension
- (d) Surface Tension

List - II

- (i) MLT^{-1}
- (ii) MT^{-2}
- (iii) ML^2T^{-2}
- (iv) MLT^{-2}

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

Options :

86435170101. (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)

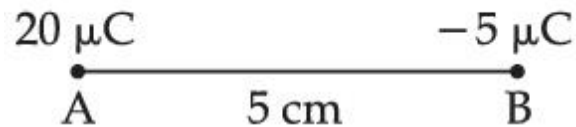
86435170102. (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

86435170103. (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

86435170104. (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

Question Number : 12 Question Id : 86435121171 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Two particles A and B having charges $20 \mu\text{C}$ and $-5 \mu\text{C}$ respectively are held fixed with a separation of 5 cm. At what position a third charged particle should be placed so that it does not experience a net electric force ?



Options :

86435170105. At midpoint between two charges

86435170106. At 5 cm from $-5 \mu\text{C}$ on the right side

86435170107. At 5 cm from $20 \mu\text{C}$ on the left side of system

86435170108. At 1.25 cm from a $-5 \mu\text{C}$ between two charges

Question Number : 13 Question Id : 86435121172 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Which of the following equations is dimensionally incorrect ?

Where t = time, h = height, s = surface tension, θ = angle, ρ = density, a , r = radius, g = acceleration due to gravity, v = volume, p = pressure, W = work done, Γ = torque, ϵ = permittivity, E = electric field, J = current density, L = length.

Options :

86435170109.
$$h = \frac{2s \cos\theta}{\rho r g}$$

86435170110.
$$v = \frac{\pi p a^4}{8 \eta L}$$

86435170111.
$$W = \Gamma \theta$$

86435170112.
$$J = \epsilon \frac{\partial E}{\partial t}$$

Question Number : 14 Question Id : 86435121173 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

For an ideal gas the instantaneous change in pressure 'p' with volume 'v' is given by the equation $\frac{dp}{dv} = -ap$. If $p = p_0$ at $v = 0$ is the given boundary condition, then the maximum temperature one mole of gas can attain is :
(Here R is the gas constant)

Options :

86435170113. 0°C

86435170114. $\frac{P_0}{a e R}$

86435170115. $\frac{ap_0}{e R}$

86435170116. infinity

Question Number : 15 Question Id : 86435121174 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

A reversible engine has an efficiency of $\frac{1}{4}$. If the temperature of the sink is reduced by 58°C , its efficiency becomes double. Calculate the temperature of the sink :

Options :

86435170117. 280°C

86435170118. 382°C

86435170119. 180.4°C

86435170120. 174°C

**Question Number : 16 Question Id : 86435121175 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1**

A uniform heavy rod of weight 10 kg ms^{-2} , cross-sectional area 100 cm^2 and length 20 cm is hanging from a fixed support. Young modulus of the material of the rod is $2 \times 10^{11} \text{ Nm}^{-2}$. Neglecting the lateral contraction, find the elongation of rod due to its own weight :

Options :

86435170121. $2 \times 10^{-9} \text{ m}$

86435170122. $5 \times 10^{-10} \text{ m}$

86435170123. $5 \times 10^{-8} \text{ m}$

86435170124. $4 \times 10^{-8} \text{ m}$

**Question Number : 17 Question Id : 86435121176 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1**

The masses and radii of the earth and moon are (M_1, R_1) and (M_2, R_2) respectively. Their centres are at a distance 'r' apart. Find the minimum escape velocity for a particle of mass 'm' to be projected from the middle of these two masses :

Options :

$$V = \frac{\sqrt{2G} (M_1 + M_2)}{r}$$

86435170125.

$$V = \frac{1}{2} \sqrt{\frac{2G (M_1 + M_2)}{r}}$$

86435170126.

$$V = \sqrt{\frac{4G (M_1 + M_2)}{r}}$$

86435170127.

$$V = \frac{1}{2} \sqrt{\frac{4G (M_1 + M_2)}{r}}$$

86435170128.

Question Number : 18 Question Id : 86435121177 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Angular momentum of a single particle moving with constant speed along circular path :

Options :

86435170129. is zero

86435170130. remains same in magnitude but changes in the direction

86435170131. changes in magnitude but remains same in the direction

86435170132. remains same in magnitude and direction

Question Number : 19 Question Id : 86435121178 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A helicopter is flying horizontally with a speed 'v' at an altitude 'h' has to drop a food packet for a man on the ground. What is the distance of helicopter from the man when the food packet is dropped ?

Options :

86435170133. $\sqrt{\frac{2gh}{v^2} + h^2}$

86435170134. $\sqrt{\frac{2v^2h}{g} + h^2}$

86435170135. $\sqrt{2ghv^2 + h^2}$

86435170136. $\sqrt{\frac{2ghv^2 + 1}{h^2}}$

Question Number : 20 Question Id : 86435121179 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A body of mass M moving at speed V_0 collides elastically with a mass ' m ' at rest. After the collision, the two masses move at angles θ_1 and θ_2 with respect to the initial direction of motion of the body of mass M . The largest possible value of the ratio M/m , for which the angles θ_1 and θ_2 will be equal, is :

Options :

86435170137. 2

86435170138. 3

86435170139. 1

86435170140. 4

Physics Section B

Section Id :	864351981
Section Number :	2
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 :

8643511208

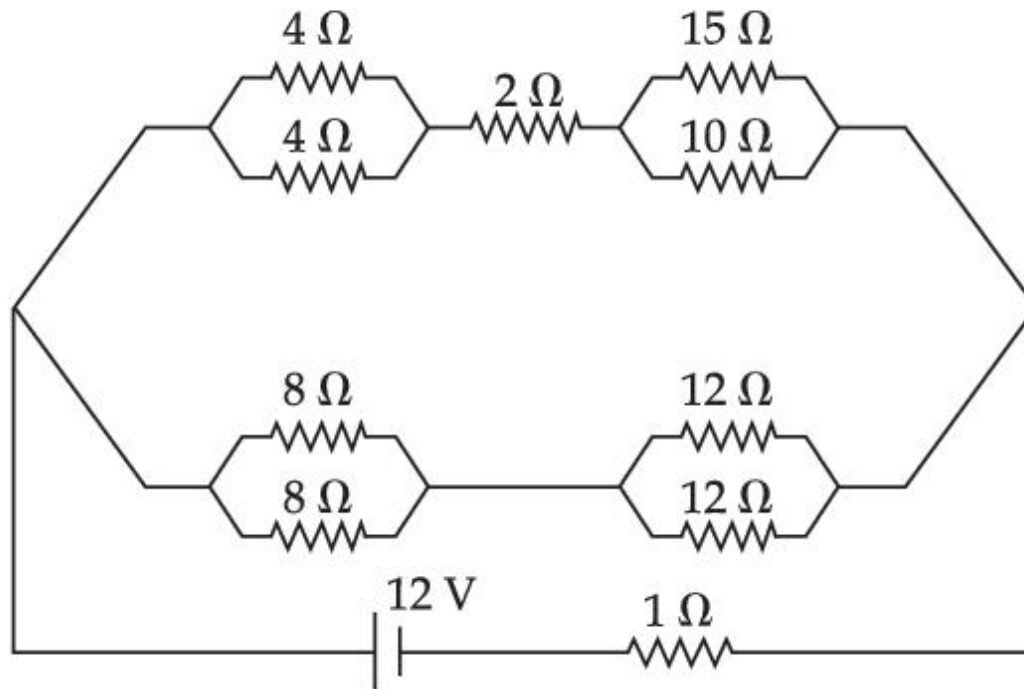
Question Shuffling Allowed :

Yes

Question Number : 21 Question Id : 86435121180 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The voltage drop across $15\ \Omega$ resistance in the given figure will be _____ V.



Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 22 Question Id : 86435121181 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A particle of mass 1 kg is hanging from a spring of force constant 100 Nm^{-1} . The mass is pulled slightly downward and released so that it executes free simple harmonic motion with time period T . The time when the kinetic energy and potential energy of the system will

become equal, is $\frac{T}{x}$. 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 :

1

Question Number : 23 Question Id : 86435121182 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A car is moving on a plane inclined at 30° to the horizontal with an acceleration of 10 ms^{-2} parallel to the plane upward. A bob is suspended by a string from the roof of the car. The angle in degrees which the string makes with the vertical is _____.

(Take $g = 10 \text{ ms}^{-2}$)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 24 Question Id : 86435121183 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A block moving horizontally on a smooth surface with a speed of 40 ms^{-1} splits into two equal parts. If one of the parts moves at 60 ms^{-1} in the same direction, then the fractional change in the kinetic energy will be $x : 4$ where $x =$ _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 25 Question Id : 86435121184 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

When a rubber ball is taken to a depth of _____ m in deep sea, its volume decreases by 0.5%.

(The bulk modulus of rubber $= 9.8 \times 10^8 \text{ Nm}^{-2}$

Density of sea water $= 10^3 \text{ kgm}^{-3}$

$g = 9.8 \text{ m/s}^2$)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 26 Question Id : 86435121185 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A wire having a linear mass density 9.0×10^{-4} kg/m is stretched between two rigid supports with a tension of 900 N. The wire resonates at a frequency of 500 Hz. The next higher frequency at which the same wire resonates is 550 Hz. The length of the wire is _____m.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

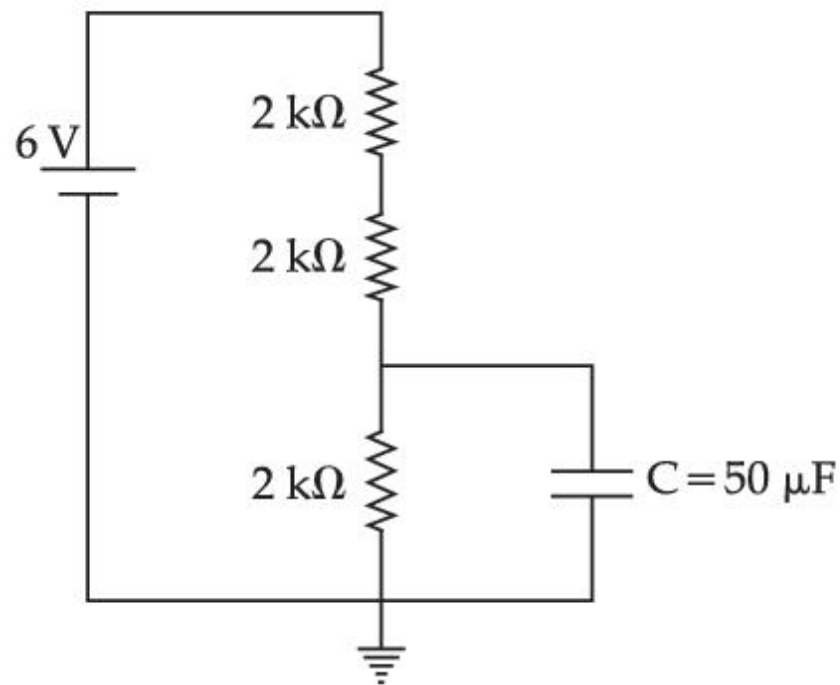
Possible Answers :

1

Question Number : 27 Question Id : 86435121186 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A capacitor of $50 \mu\text{F}$ is connected in a circuit as shown in figure. The charge on the upper plate of the capacitor is _____ μC .



Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 28 **Question Id :** 86435121187 **Question Type :** SA

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

A square shaped wire with resistance of each side 3Ω is bent to form a circle. The resistance between two diametrically opposite points of the circle is _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 29 **Question Id :** 86435121188 **Question Type :** SA

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

The electric field in an electromagnetic wave is given by

$$E = (50 \text{ NC}^{-1}) \sin \omega(t - x/c)$$

The energy contained in a cylinder of volume V is 5.5×10^{-12} J. The value of V is _____ cm^3 .

(given $\epsilon_0 = 8.8 \times 10^{-12} \text{ C}^2\text{N}^{-1}\text{m}^{-2}$)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 30 **Question Id :** 86435121189 **Question Type :** SA

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

If the sum of the heights of transmitting and receiving antennas in the line of sight of communication is fixed at 160 m, then the maximum range of LOS communication is _____ km.

(Take radius of Earth = 6400 km)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1