

National Testing Agency

Question Paper Name : B Tech 27 Aug 2021 Shift 2
Subject Name : B TECH
Creation Date : 2021-08-27 22:20:30
Duration : 180
Total Marks : 300
Display Marks: Yes

B TECH

Group Number : 1
Group Id : 864351251
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 : 864351944
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 : 8643511171
Question Shuffling Allowed : Yes

Question Number : 1 Question Id : 86435120620 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Water drops are falling from a nozzle of a shower onto the floor, from a height of 9.8 m. The drops fall at a regular interval of time. When the first drop strikes the floor, at that instant, the third drop begins to fall. Locate the position of second drop from the floor when the first drop strikes the floor.

Options :

86435168441. 2.45 m

86435168442. 7.35 m

86435168443. 2.94 m

86435168444. 4.18 m

Question Number : 2 Question Id : 86435120621 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) R_H (Rydberg constant)
- (b) h (Planck's constant)
- (c) μ_B (Magnetic field energy density)
- (d) η (coefficient of viscosity)

List - II

- (i) $\text{kg m}^{-1}\text{s}^{-1}$
- (ii) $\text{kg m}^2\text{s}^{-1}$
- (iii) m^{-1}
- (iv) $\text{kg m}^{-1}\text{s}^{-2}$

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

Options :

86435168445. (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

86435168446. (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv)

86435168447. (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

86435168448. (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)

Question Number : 3 Question Id : 86435120622 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Two discs have moments of inertia I_1 and I_2 about their respective axes perpendicular to the plane and passing through the centre. They are rotating with angular speeds, ω_1 and ω_2 respectively and are brought into contact face to face with their axes of rotation coaxial. The loss in kinetic energy of the system in the process is given by :

Options :

86435168449.
$$\frac{I_1 I_2}{2(I_1 + I_2)} (\omega_1 - \omega_2)^2$$

86435168450.
$$\frac{I_1 I_2}{(I_1 + I_2)} (\omega_1 - \omega_2)^2$$

86435168451.
$$\frac{(\omega_1 - \omega_2)^2}{2(I_1 + I_2)}$$

86435168452.
$$\frac{(I_1 - I_2)^2 \omega_1 \omega_2}{2(I_1 + I_2)}$$

Question Number : 4 Question Id : 86435120623 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A player kicks a football with an initial speed of 25 ms^{-1} at an angle of 45° from the ground. What are the maximum height and the time taken by the football to reach at the highest point during motion ? (Take $g = 10 \text{ ms}^{-2}$)

Options :

86435168453.
$$h_{\max} = 10 \text{ m} \quad T = 2.5 \text{ s}$$

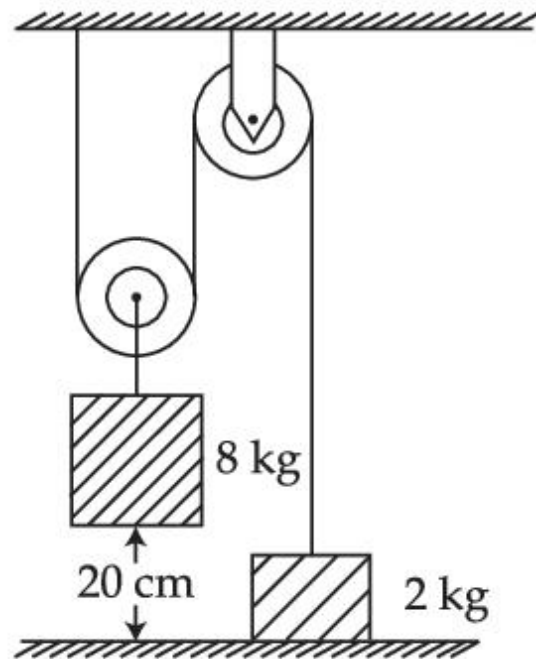
86435168454.
$$h_{\max} = 15.625 \text{ m} \quad T = 3.54 \text{ s}$$

86435168455. $h_{\max} = 15.625 \text{ m}$ $T = 1.77 \text{ s}$

86435168456. $h_{\max} = 3.54 \text{ m}$ $T = 0.125 \text{ s}$

Question Number : 5 Question Id : 86435120624 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

The boxes of masses 2 kg and 8 kg are connected by a massless string passing over smooth pulleys. Calculate the time taken by box of mass 8 kg to strike the ground starting from rest. (use $g = 10 \text{ m/s}^2$) :



Options :

86435168457. 0.2 s

86435168458. 0.34 s

86435168459. 0.25 s

86435168460. 0.4 s

Question Number : 6 Question Id : 86435120625 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A mass of 50 kg is placed at the centre of a uniform spherical shell of mass 100 kg and radius 50 m. If the gravitational potential at a point, 25 m from the centre is V kg/m. The value of V is :

Options :

86435168461. $-60 G$

86435168462. $-20 G$

86435168463. $-4 G$

86435168464. $+2 G$

Question Number : 7 Question Id : 86435120626 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

The height of victoria falls is 63 m. What is the difference in temperature of water at the top and at the bottom of fall ?

[Given $1 \text{ cal} = 4.2 \text{ J}$ and specific heat of water $= 1 \text{ cal g}^{-1} \text{ }^\circ\text{C}^{-1}$]

Options :

86435168465. 0.014°C

86435168466. 0.147°C

86435168467. 1.476°C

86435168468. 14.76°C

Question Number : 8 Question Id : 86435120627 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

If the rms speed of oxygen molecules at 0°C is 160 m/s , find the rms speed of hydrogen molecules at 0°C .

Options :

86435168469. 332 m/s

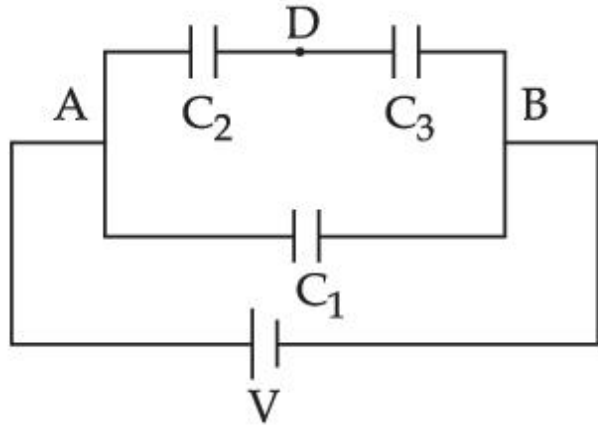
86435168470. 80 m/s

86435168471. 640 m/s

86435168472. 40 m/s

Question Number : 9 Question Id : 86435120628 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Three capacitors $C_1 = 2 \mu\text{F}$, $C_2 = 6 \mu\text{F}$ and $C_3 = 12 \mu\text{F}$ are connected as shown in figure. Find the ratio of the charges on capacitors C_1 , C_2 and C_3 respectively :



Options :

86435168473. 3 : 4 : 4

86435168474. 2 : 3 : 3

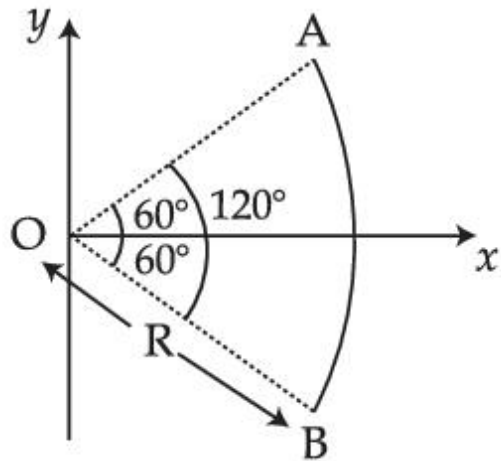
86435168475. 2 : 1 : 1

86435168476. 1 : 2 : 2

Question Number : 10 Question Id : 86435120629 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Figure shows a rod AB, which is bent in a 120° circular arc of radius R. A charge $(-Q)$ is uniformly distributed over rod AB. What is the electric field \vec{E} at the centre of curvature O?



Options :

86435168477. $\frac{3\sqrt{3} Q}{8 \pi^2 \epsilon_0 R^2} (\hat{i})$

86435168478. $\frac{3\sqrt{3} Q}{8 \pi^2 \epsilon_0 R^2} (-\hat{i})$

86435168479. $\frac{3\sqrt{3} Q}{8 \pi \epsilon_0 R^2} (\hat{i})$

86435168480. $\frac{3\sqrt{3} Q}{16 \pi^2 \epsilon_0 R^2} \left(\hat{i}\right)$

Question Number : 11 Question Id : 86435120630 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
 Correct Marks : 4 Wrong Marks : 1

A coaxial cable consists of an inner wire of radius 'a' surrounded by an outer shell of inner and outer radii 'b' and 'c' respectively. The inner wire carries an electric current i_0 , which is distributed uniformly across cross-sectional area. The outer shell carries an equal current in opposite direction and distributed uniformly. What will be the ratio of the magnetic field at a distance x from the axis when (i) $x < a$ and (ii) $a < x < b$?

Options :

86435168481. $\frac{x^2}{a^2}$

86435168482. $\frac{a^2}{x^2}$

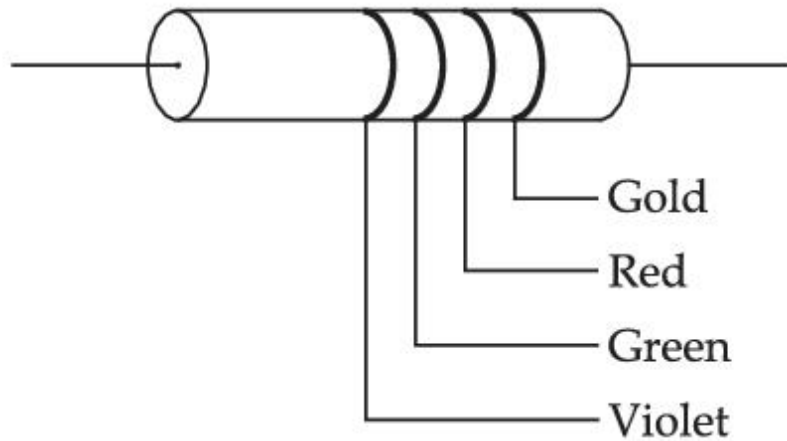
86435168483. $\frac{x^2}{b^2 - a^2}$

86435168484. $\frac{b^2 - a^2}{x^2}$

Question Number : 12 Question Id : 86435120631 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The colour coding on a carbon resistor is shown in the given figure. The resistance value of the given resistor is :



Options :

86435168485. $(5700 \pm 375) \Omega$

86435168486. $(7500 \pm 750) \Omega$

86435168487. $(5700 \pm 285) \Omega$

86435168488. $(7500 \pm 375) \Omega$

Question Number : 13 Question Id : 86435120632 Question Type : MCQ Option Shuffling : Yes Is Question Ma

Correct Marks : 4 Wrong Marks : 1

For full scale deflection of total 50 divisions, 50 mV voltage is required in galvanometer. The resistance of galvanometer if its current sensitivity is 2 div/mA will be :

Options :

86435168489. 1Ω

86435168490. 2Ω

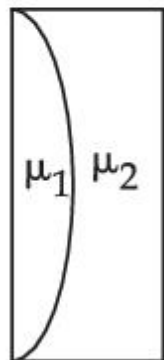
86435168491. 4Ω

86435168492. 5Ω

Question Number : 14 Question Id : 86435120633 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Curved surfaces of a plano-convex lens of refractive index μ_1 and a plano-concave lens of refractive index μ_2 have equal radius of curvature as shown in figure. Find the ratio of radius of curvature to the focal length of the combined lenses.



Options :

86435168493. $\mu_1 - \mu_2$

$$\frac{1}{\mu_1 - \mu_2}$$

$$\mu_2 - \mu_1$$

$$\frac{1}{\mu_2 - \mu_1}$$

Question Number : 15 Question Id : 86435120634 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If force (F), length (L) and time (T) are taken as the fundamental quantities. Then what will be the dimension of density :

Options :

$$[FL^{-3}T^3]$$

$$[FL^{-5}T^2]$$

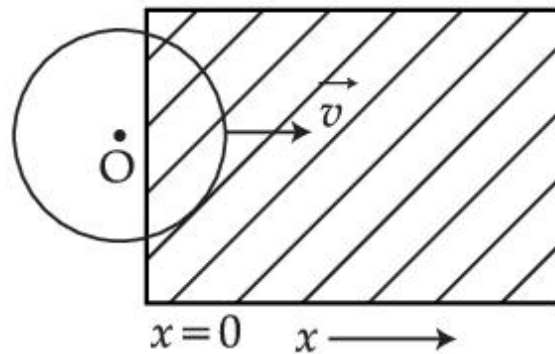
$$[FL^{-4}T^2]$$

$$[FL^{-3}T^2]$$

Question Number : 16 Question Id : 86435120635 Question Type : MCQ Option Shuffling : Yes Is Question Ma

Correct Marks : 4 Wrong Marks : 1

A constant magnetic field of 1 T is applied in the $x > 0$ region. A metallic circular ring of radius 1 m is moving with a constant velocity of 1 m/s along the x -axis. At $t=0$ s, the centre O of the ring is at $x = -1$ m. What will be the value of the induced emf in the ring at $t=1$ s? (Assume the velocity of the ring does not change.)



Options :

86435168501. 0 V
86435168502. 1 V
86435168503. 2 V
86435168504. 2π V

Question Number : 17 Question Id : 86435120636 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

For a transistor α and β are given as $\alpha = \frac{I_C}{I_E}$ and $\beta = \frac{I_C}{I_B}$. Then the correct relation between α and β will be :

Options :

86435168505. $\alpha = \frac{\beta}{1 - \beta}$

86435168506. $\alpha\beta = 1$

86435168507. $\beta = \frac{\alpha}{1 - \alpha}$

86435168508. $\alpha = \frac{1 - \beta}{\beta}$

Question Number : 18 Question Id : 86435120637 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

The light waves from two coherent sources have same intensity $I_1 = I_2 = I_0$. In interference pattern the intensity of light at minima is zero. What will be the intensity of light at maxima ?

Options :

86435168509. $2 I_0$

86435168510. $5 I_0$

86435168511. $4 I_0$

86435168512. I_0

Question Number : 19 Question Id : 86435120638 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A monochromatic neon lamp with wavelength of 670.5 nm illuminates a photo-sensitive material which has a stopping voltage of 0.48 V. What will be the stopping voltage if the source light is changed with another source of wavelength of 474.6 nm ?

Options :

86435168513. 0.96 V

86435168514. 1.5 V

86435168515. 1.25 V

86435168516. 0.24 V

Question Number : 20 Question Id : 86435120639 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

An antenna is mounted on a 400 m tall building. What will be the wavelength of signal that can be radiated effectively by the transmission tower upto a range of 44 km ?

Options :

86435168517. 37.8 m

86435168518. 75.6 m

86435168519. 302 m

86435168520. 605 m

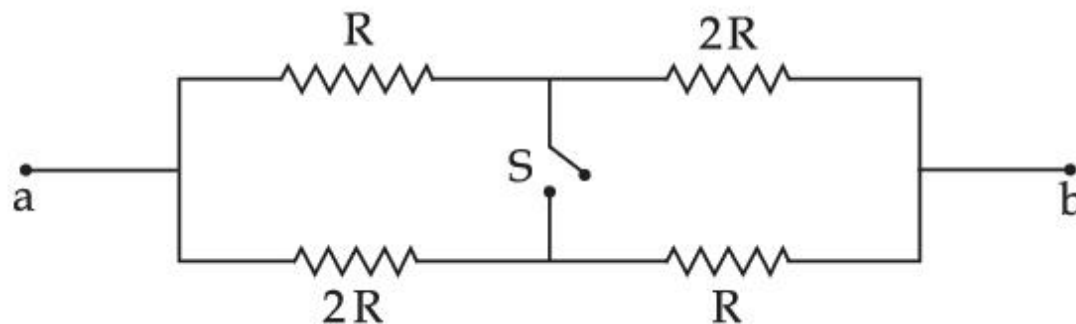
Physics Section B

Section Id :	864351945
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 :	8643511172
Question Shuffling Allowed :	Yes

Question Number : 21 Question Id : 86435120640 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The ratio of the equivalent resistance of the network (shown in figure) between the points a and b when switch is open and switch is closed is $x : 8$. 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 : 22 **Question Id :** 86435120641 **Question Type :** SA

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

An ac circuit has an inductor and a resistor of resistance R in series, such that $X_L = 3 R$. Now, a capacitor is added in series such that $X_C = 2 R$. The ratio of new power factor with the old power factor of the circuit is $\sqrt{5} : x$. 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 :

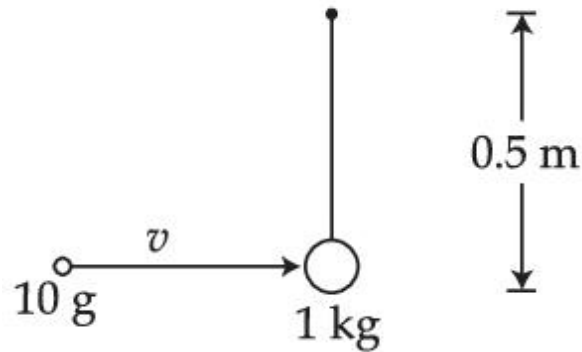
1

Question Number : 23 **Question Id :** 86435120642 **Question Type :** SA

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

A bullet of 10 g, moving with velocity v , collides head-on with the stationary bob of a pendulum and recoils with velocity 100 m/s. The length of the pendulum is 0.5 m and mass of the bob is 1 kg. The minimum value of $v =$ _____ m/s so that the pendulum describes a circle.

(Assume the string to be inextensible and $g = 10 \text{ m/s}^2$)



Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

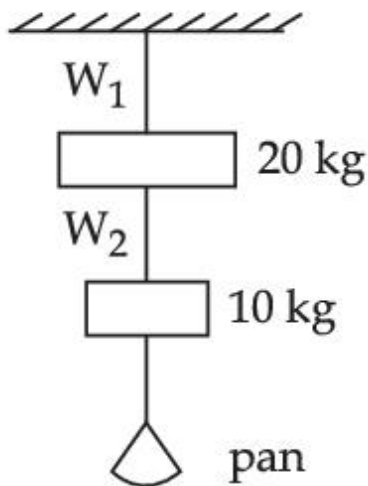
Possible Answers :

1

Question Number : 24 **Question Id :** 86435120643 **Question Type :** SA

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

Wires W_1 and W_2 are made of same material having the breaking stress of $1.25 \times 10^9 \text{ N/m}^2$. W_1 and W_2 have cross-sectional area of $8 \times 10^{-7} \text{ m}^2$ and $4 \times 10^{-7} \text{ m}^2$, respectively. Masses of 20 kg and 10 kg hang from them as shown in the figure. The maximum mass that can be placed in the pan without breaking the wires is _____ kg. (Use $g = 10 \text{ m/s}^2$)



Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 25 **Question Id :** 86435120644 **Question Type :** SA

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

A tuning fork is vibrating at 250 Hz. The length of the shortest closed organ pipe that will resonate with the tuning fork will be _____ cm.

(Take speed of sound in air as 340 ms^{-1})

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 :** 86435120645 **Question Type :** SA

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

A heat engine operates between a cold reservoir at temperature $T_2 = 400$ K and a hot reservoir at temperature T_1 . It takes 300 J of heat from the hot reservoir and delivers 240 J of heat to the cold reservoir in a cycle. The minimum temperature of the hot reservoir has to be _____ K.

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 :** 86435120646 **Question Type :** SA

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

Two simple harmonic motion, are represented by the equations

$$y_1 = 10 \sin\left(3\pi t + \frac{\pi}{3}\right)$$

$$y_2 = 5 (\sin 3\pi t + \sqrt{3} \cos 3\pi t)$$

Ratio of amplitude of y_1 to $y_2 = x : 1$. 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 : 28 **Question Id :** 86435120647 **Question Type :** SA

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

A plane electromagnetic wave with frequency of 30 MHz travels in free space. At particular point in space and time, electric field is 6 V/m. The magnetic field at this point will be $x \times 10^{-8}$ T. 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 : 29 **Question Id :** 86435120648 **Question Type :** SA

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

X different wavelengths may be observed in the spectrum from a hydrogen sample if the atoms are excited to states with principal quantum number $n=6$? The value of X is _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

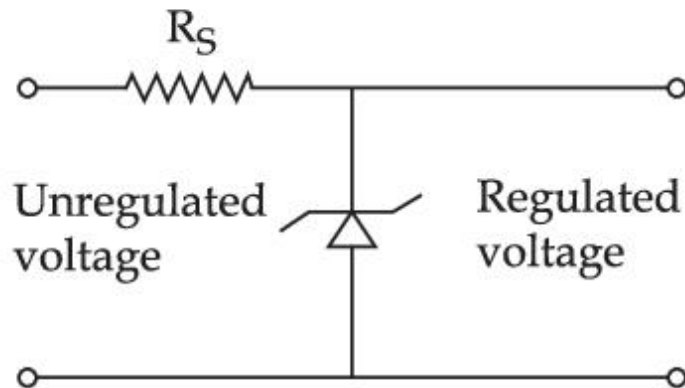
Possible Answers :

1

Question Number : 30 **Question Id :** 86435120649 **Question Type :** SA

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

A zener diode of power rating 2 W is to be used as a voltage regulator. If the zener diode has a breakdown of 10 V and it has to regulate voltage fluctuated between 6 V and 14 V, the value of R_S for safe operation should be _____ Ω .



Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1