National Testing Agency

Question Paper Name :	B Tech 26 Aug 2021 Shift 1
Subject Name :	B TECH
Creation Date :	2021-08-26 17:34:07
Duration :	180
Total Marks :	300
Display Marks:	Yes

B TECH

Group Number :	1
Group Id :	864351244
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 :	864351902
Section Number :	1
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	20
Number of Questions to be attempted :	20
Section Marks :	80

Question Number : 1 Question Id : 86435119990 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

In a Screw Gauge, fifth division of the circular scale coincides with the reference line when the ratchet is closed. There are 50 divisions on the circular scale, and the main scale moves by 0.5 mm on a complete rotation. For a particular observation the reading on the main scale is 5 mm and the 20th division of the circular scale coincides with reference line. Calculate the true reading.

Options :

86435166551. 5.20 mm

86435166552. 5.25 mm

86435166553. 5.15 mm

86435166554. 5.00 mm

Question Number : 2 Question Id : 86435119991 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

The rms speeds of the molecules of Hydrogen, Oxygen and Carbondioxide at the same temperature are V_H, V_O and V_C respectively then :

Options :

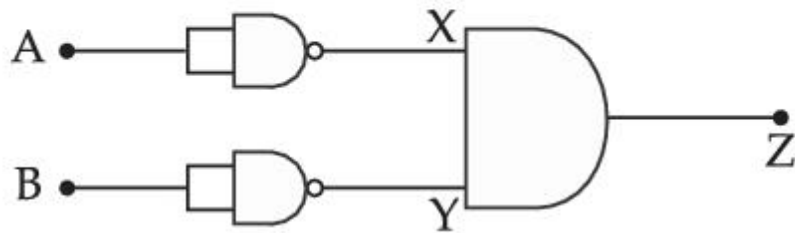86435166555. $V_H = V_O = V_C$

86435166556. $V_H = V_O > V_C$

86435166557. $V_H > V_O > V_C$

86435166558. $V_C > V_O > V_H$

Question Number : 3 Question Id : 86435119992 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Identify the logic operation carried out by the given circuit :

Options :

86435166559. AND

86435166560. OR

86435166561. NAND

86435166562. NOR

Question Number : 4 Question Id : 86435119993 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

An electric appliance supplies 6000 J/min heat to the system. If the system delivers a power of 90 W. How long it would take to increase the internal energy by 2.5×10^3 J ?

Options :

86435166563. 2.5×10^1 s

86435166564. 2.5×10^2 s

86435166565. 2.4×10^3 s

86435166566. 4.1×10^1 s

Question Number : 5 Question Id : 86435119994 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

A particular hydrogen like ion emits radiation of frequency 2.92×10^{15} Hz when it makes transition from n=3 to n=1. The frequency in Hz of radiation emitted in transition from n=2 to n=1 will be :

Options :

86435166567. 4.38×10^{15}

86435166568. 6.57×10^{15}

86435166569. 0.44×10^{15}

86435166570. 2.46×10^{15}

Question Number : 6 Question Id : 86435119995 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Two narrow bores of diameter 5.0 mm and 8.0 mm are joined together to form a U-shaped tube open at both ends. If this U-tube contains water, what is the difference in the level of two limbs of the tube.

[Take surface tension of water $T = 7.3 \times 10^{-2}$ Nm^{-1}, angle of contact $= 0$, $g = 10$ ms^{-2} and density of water $= 1.0 \times 10^3$ kg m^{-3}]

Options :

86435166571. 5.34 mm

86435166572. 3.62 mm

86435166573. 4.97 mm

86435166574. 2.19 mm

Question Number : 7 Question Id : 86435119996 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

In a photoelectric experiment ultraviolet light of wavelength 280 nm is used with lithium cathode having work function $\phi = 2.5$ eV. If the wavelength of incident light is switched to 400 nm, find out the change in the stopping potential. ($h = 6.63 \times 10^{-34}$ Js, $c = 3 \times 10^8$ ms^{-1})

Options :

86435166575. 1.3 V

86435166576. 1.9 V

86435166577. 0.6 V

86435166578. 1.1 V

Question Number : 8 Question Id : 86435119997 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Car B overtakes another car A at a relative speed of 40 ms^{-1}. How fast will the image of car B appear to move in the mirror of focal length 10 cm fitted in car A, when the car B is 1.9 m away from the car A ?

Options :

86435166579. 0.1 ms^{-1}

86435166580. 0.2 ms^{-1}

86435166581. 40 ms^{-1}

86435166582. 4 ms^{-1}

Question Number : 9 Question Id : 86435119998 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

An inductor coil stores 64 J of magnetic field energy and dissipates energy at the rate of 640 W when a current of 8 A is passed through it. If this coil is joined across an ideal battery, find the time constant of the circuit in seconds :

Options :

86435166583. 0.2

86435166584. 0.4

86435166585. 0.8

86435166586. 0.125

Question Number : 10 Question Id : 86435119999 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

A series LCR circuit driven by 300 V at a frequency of 50 Hz contains a resistance $R = 3$ kΩ, an inductor of inductive reactance $X_L = 250\pi$ Ω and an unknown capacitor. The value of capacitance to maximize the average power should be :

(take $\pi^2 = 10$)

Options :

86435166587. 400 μF

86435166588. 40 μF

86435166589. 25 μF
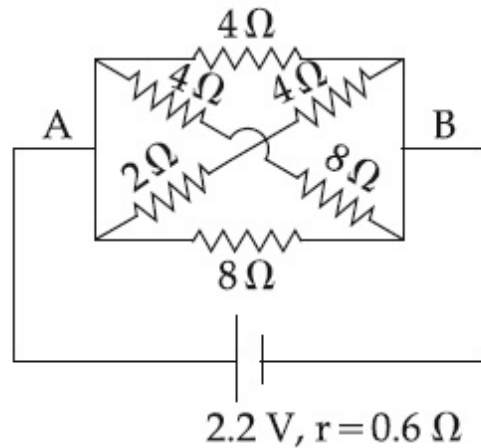
86435166590. $4\ \mu F$

Question Number : 11 Question Id : 86435120000 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

The fractional change in the magnetic field intensity at a distance 'r' from centre on the axis of current carrying coil of radius 'a' to the magnetic field intensity at the centre of the same coil is : (Take r < a).

Options :

86435166591. $\dfrac{3}{2}\dfrac{a^2}{r^2}$

86435166592. $\dfrac{2}{3}\dfrac{a^2}{r^2}$

86435166593. $\dfrac{2}{3}\dfrac{r^2}{a^2}$

86435166594. $\dfrac{3}{2}\dfrac{r^2}{a^2}$

Question Number : 12 Question Id : 86435120001 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

In the given figure, the emf of the cell is 2.2 V and if internal resistance is 0.6 Ω. Calculate the power dissipated in the whole circuit :


4 Ω

4 Ω   4 Ω

A   B

2 Ω   8 Ω

8 Ω

2.2 V, r = 0.6 Ω

Options :

86435166595. 2.2 W

86435166596. 4.4 W

86435166597. 0.65 W

86435166598. 1.32 W

Question Number : 13 Question Id : 86435120002 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
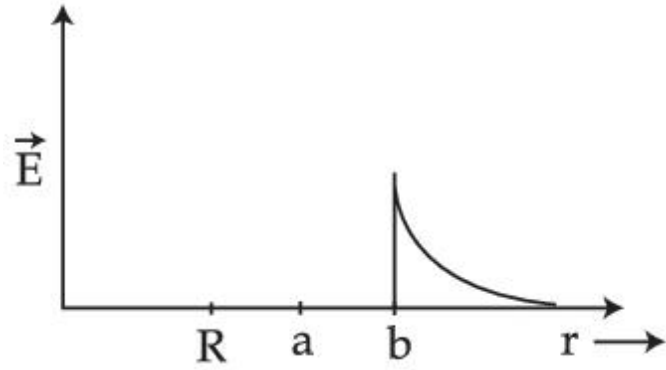
A solid metal sphere of radius R having charge q is enclosed inside the concentric spherical shell of inner radius a and outer radius b as shown in figure. The approximate variation electric field $\vec{E}$ as a function of distance r from centre O is given by :
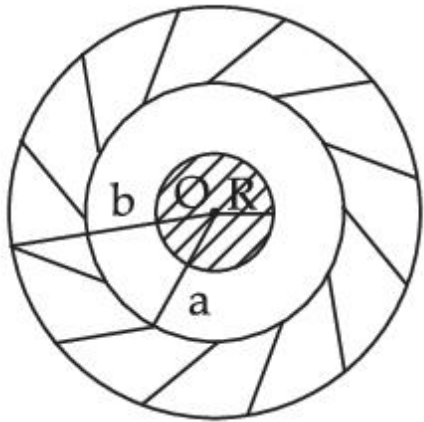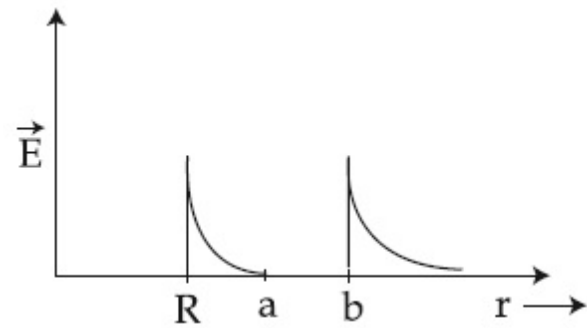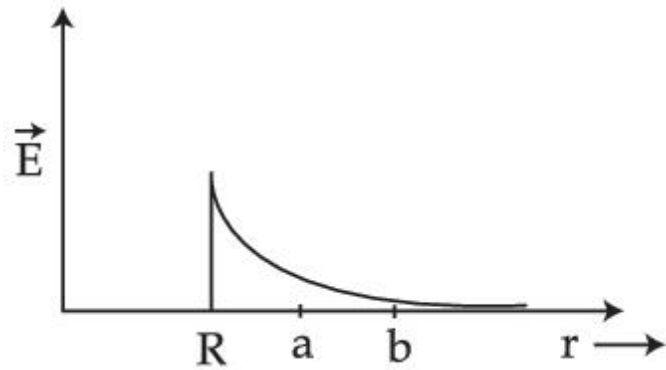

Options :
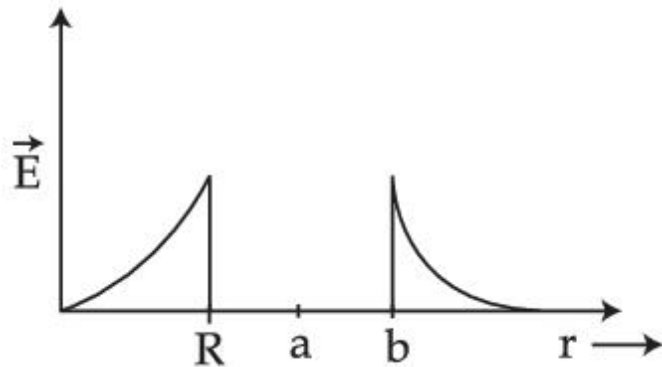
86435166600.

86435166601.

86435166602.

Question Number : 14 Question Id : 86435120003 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

The material filled between the plates of a parallel plate capacitor has resistivity 200 Ωm. The value of capacitance of the capacitor is 2 pF. If a potential difference of 40 V is applied across the plates of the capacitor, then the value of leakage current flowing out of the capacitor is : (given the value of relative permitivity of material is 50)

Options :

86435166603. 9.0 mA

86435166604. 0.9 mA

86435166605. 0.9 μA

86435166606. 9.0 μA

Inside a uniform spherical shell :

(a)   the gravitational field is zero.

(b)   the gravitational potential is zero.

(c)   the gravitational field is same everywhere.

(d)   the gravitation potential is same everywhere.

(e)   all of the above

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

Options :

86435166607. (b), (c) and (d) only

86435166608. (a), (b) and (c) only

86435166609. (a), (c) and (d) only

86435166610. (e) only

Question Number : 16 Question Id : 86435120005 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

The initial mass of a rocket is 1000 kg. Calculate at what rate the fuel should be burnt so that the rocket is given an acceleration of 20 ms^{-2}. The gases come out at a relative speed of 500 ms^{-1} with respect to the rocket :

[Use g = 10 m/s^2]

Options :

86435166611. 60 kg s^{-1}

86435166612. 6.0×10^2 kg s^{-1}

86435166613. 500 kg s^{-1}

86435166614. 10 kg s^{-1}

Question Number : 17 Question Id : 86435120006 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

What equal length of an iron wire and a copper-nickel alloy wire, each of 2 mm diameter connected parallel to give an equivalent resistance of 3 Ω ?

(Given resistivities of iron and copper-nickel alloy wire are 12 μΩ cm and 51 μΩ cm respectively)

Options :

86435166615. 110 m
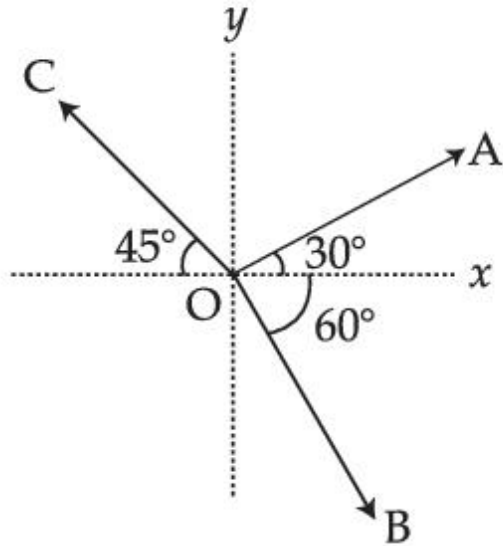
86435166616. 97 m

86435166617. 90 m

86435166618. 82 m

Question Number : 18 Question Id : 86435120007 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

The magnitude of vectors $\vec{OA}$, $\vec{OB}$ and $\vec{OC}$ in the given figure are equal. The direction of

$\vec{OA} + \vec{OB} - \vec{OC}$ with x-axis will be :

Options :

86435166619.

$$\tan^{-1} \frac{(1 - \sqrt{3} - \sqrt{2})}{(1 + \sqrt{3} + \sqrt{2})}$$

86435166620.

$$\tan^{-1} \frac{(\sqrt{3} - 1 + \sqrt{2})}{(1 + \sqrt{3} - \sqrt{2})}$$

86435166621.

$$\tan^{-1} \frac{(1 + \sqrt{3} - \sqrt{2})}{(1 - \sqrt{3} - \sqrt{2})}$$

86435166622. $\tan^{-1} \dfrac{(\sqrt{3} - 1 + \sqrt{2})}{(1 - \sqrt{3} + \sqrt{2})}$

Question Number : 19 Question Id : 86435120008 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Statement I :

By doping silicon semiconductor with pentavalent material, the electrons density increases.

Statement II :

The n-type semiconductor has net negative charge.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

Options :

86435166623. Both **Statement I** and **Statement II** are true.

86435166624. Both **Statement I** and **Statement II** are false.

86435166625. **Statement I** is true but **Statement II** is false.

86435166626. **Statement I** is false but **Statement II** is true.

Question Number : 20 Question Id : 86435120009 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

If E, L, M and G denote the quantities as energy, angular momentum, mass and constant of gravitation respectively, then the dimensions of P in the formula $P = EL^2 M^{-5} G^{-2}$ are :

Options :

86435166627. $[M^1 L^1 T^{-2}]$

86435166628. $[M^{-1} L^{-1} T^2]$

86435166629. $[M^0 L^1 T^0]$

86435166630. $[M^0 L^0 T^0]$

Physics Section B

Section Id :	864351903
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 :	8643511130
Question Shuffling Allowed :	Yes

Question Number : 21 Question Id : 86435120010 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

A uniform chain of length 3 meter and mass 3 kg overhangs a smooth table with 2 meter laying on the table. If k is the kinetic energy of the chain in joule as it completely slips off the table, then the value of k is _____.

(Take $g = 10$ m/s^2)

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
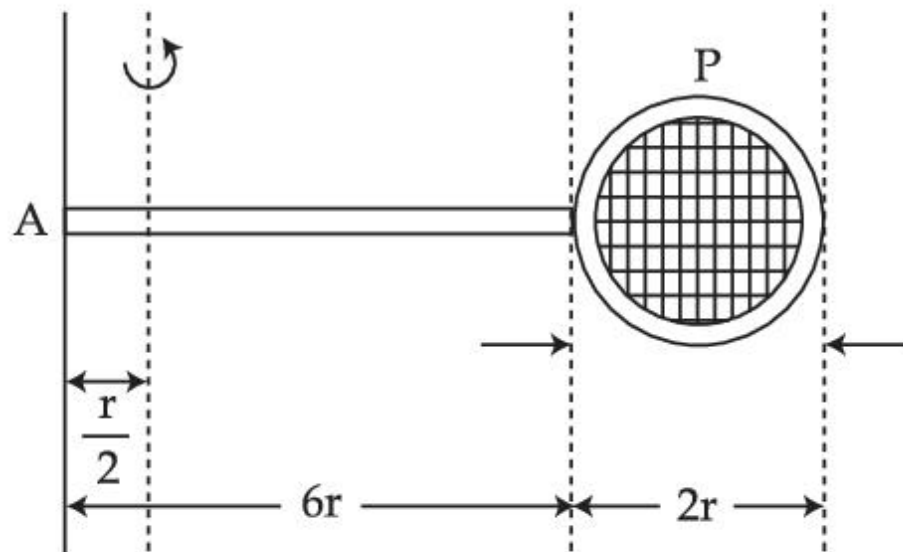**Answers Type :** Equal
Text Areas : PlainText
Possible Answers :

1

Question Number : 22 Question Id : 86435120011 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

Consider a badminton racket with length scales as shown in the figure.

A

P

$\frac{r}{2}$

6r — 2r

If the mass of the linear and circular portions of the badminton racket are same (M) and the mass of the threads are negligible, the moment of inertia of the racket about an axis perpendicular to the handle and in the plane of the ring at, $\frac{r}{2}$ distance from the end A of the

handle will be _____ Mr^2.

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 : 86435120012 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A soap bubble of radius 3 cm is formed inside the another soap bubble of radius 6 cm. The radius of an equivalent soap bubble which has the same excess pressure as inside the smaller bubble with respect to the atmospheric pressure is _____ cm.

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 : 86435120013 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

Two travelling waves produces a standing wave represented by equation.

$y = 1.0$ mm $\cos(1.57$ cm$^{-1})$ x $\sin(78.5$ s$^{-1})$t. The node closest to the origin in the region $x > 0$ will be at $x =$ _____ cm.

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
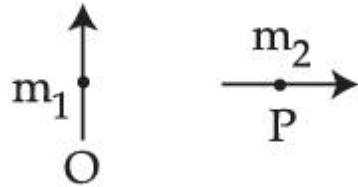**Text Areas :** PlainText
Possible Answers :
1

Question Number : 25 Question Id : 86435120014 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

Two short magnetic dipoles m_1 and m_2 each having magnetic moment of 1 Am^2 are placed at point O and P respectively. The distance between OP is 1 meter. The torque experienced by the magnetic dipole m_2 due to the presence of m_1 is _____ $\times 10^{-7}$ Nm.

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 : 86435120015 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

The electric field in a plane electromagnetic wave is given by

$$\vec{E} = 200 \cos\left[\left(\frac{0.5 \times 10^3}{m}\right)x - \left(1.5 \times 10^{11}\frac{rad}{s} \times t\right)\right]\frac{V}{m}\hat{j}$$

If this wave falls normally on a perfectly reflecting surface having an area of 100 cm². If the

radiation pressure exerted by the E.M. wave on the surface during a 10 minute exposure is

$\frac{x}{10^9}\frac{N}{m^2}$. Find the value of x.

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 : 86435120016 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

White light is passed through a double slit and interference is observed on a screen 1.5 m away. The separation between the slits is 0.3 mm. The first violet and red fringes are formed 2.0 mm and 3.5 mm away from the central white fringes. The difference in wavelengths of red and voilet light is _____ nm.

Response Type : Numeric
Evaluation Required For SA : Yes

Question Number : 28 Question Id : 86435120017 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

An amplitude modulated wave is represented by

$C_m(t) = 10(1 + 0.2 \cos 12560t) \sin (111 \times 10^4 t)$ volts. The modulating frequency in kHz will be _____.

Question Number : 29 Question Id : 86435120018 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Two spherical balls having equal masses with radius of 5 cm each are thrown upwards along the same vertical direction at an interval of 3 s with the same initial velocity of 35 m/s, then these balls collide at a height of _____ m.

(take g = 10 m/s^2)

Question Number : 30 Question Id : 86435120019 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

A source and a detector move away from each other in absence of wind with a speed of 20 m/s with respect to the ground. If the detector detects a frequency of 1800 Hz of the sound coming from the source, then the original frequency of source considering speed of sound in air 340 m/s will be _____ Hz.

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :

1