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Subject Name :	B TECH
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Duration :	180
Number of Questions :	90
Total Marks :	300
Display Marks:	Yes

B TECH

Group Number :	1
Group Id :	708191202
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 :	708191790
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 :	7081911070
Question Shuffling Allowed :	Yes

Question Number : 1 Question Id : 70819118754 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If e is the electronic charge, c is the speed of light in free space and h is Planck's constant, the quantity $\frac{1}{4\pi\varepsilon_0}\frac{|e|^2}{\hbar c}$ has dimensions of :

Options :

70819161411. $[M\ L\ T^0]$

70819161412. $[M\ L\ T^{-1}]$

70819161413. $[M^0\ L^0\ T^0]$

70819161414. $[L\ C^{-1}]$

Question Number : 2 Question Id : 70819118755 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A stone is dropped from the top of a building. When it crosses a point 5 m below the top, another stone starts to fall from a point 25 m below the top. Both stones reach the bottom of building simultaneously. The height of the building is :

Options :

70819161415. 45 m

70819161416. 25 m

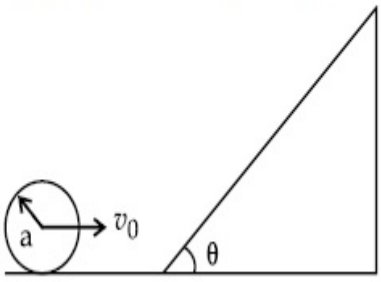
70819161417. 35 m

70819161418. 50 m

Question Number : 3 Question Id : 70819118756 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A sphere of radius 'a' and mass 'm' rolls along a horizontal plane with constant speed v_0. It encounters an inclined plane at angle θ and climbs upward. Assuming that it rolls without slipping, how far up the sphere will travel ?



Options :

70819161419. $\frac{v_0^2}{2g\ \sin\theta}$

70819161420. $\frac{v_0^2}{5g\ \sin\theta}$

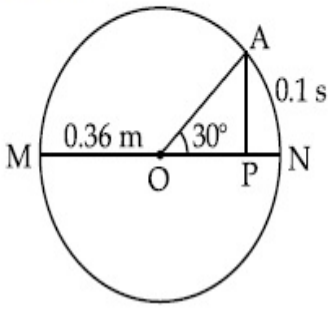
70819161421. $\frac{10v_0^2}{7g\ \sin\theta}$

70819161422. $\frac{2}{5}\ \frac{v_0^2}{g\ \sin\theta}$

Question Number : 4 Question Id : 70819118757 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The point A moves with a uniform speed along the circumference of a circle of radius 0.36 m and covers 30° in 0.1 s. The perpendicular projection 'P' from 'A' on the diameter MN represents the simple harmonic motion of 'P'. The restoration force per unit mass when P touches M will be :



Options :

70819161423. 100 N

70819161424. 9.87 N

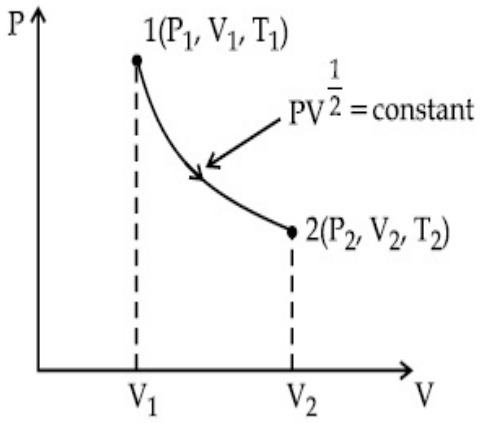
70819161425. 50 N

70819161426. 0.49 N

Question Number : 5 Question Id : 70819118758 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Thermodynamic process is shown below on a P-V diagram for one mole of an ideal gas. If $V_2 = 2V_1$ then the ratio of temperature T_2/T_1 is :



Options :

70819161427. $\frac{1}{\sqrt{2}}$

70819161428. $\sqrt{2}$

70819161429. $\frac{1}{2}$

70819161430. 2

Question Number : 6 Question Id : 70819118759 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Given below are two statements :

Statement I : In a diatomic molecule, the rotational energy at a given temperature obeys Maxwell's distribution.

Statement II : In a diatomic molecule, the rotational energy at a given temperature equals the translational kinetic energy for each molecule.

In the light of the above statements, choose the correct answer from the options given below :

Options :

70819161431. Both Statement I and Statement II are true.

70819161432. Both Statement I and Statement II are false.

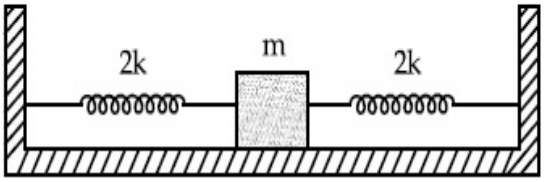
70819161433. Statement I is true but Statement II is false.

70819161434. Statement I is false but Statement II is true.

Question Number : 7 Question Id : 70819118760 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Two identical springs of spring constant '2k' are attached to a block of mass m and to fixed support (see figure). When the mass is displaced from equilibrium position on either side, it executes simple harmonic motion. The time period of oscillations of this system is :



Options :

70819161435. $2\pi\sqrt{\frac{m}{2k}}$

70819161436. $2\pi\sqrt{\frac{m}{k}}$

70819161437. $\pi\sqrt{\frac{m}{k}}$

70819161438. $\pi\sqrt{\frac{m}{2k}}$

Question Number : 8 Question Id : 70819118761 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

$Y = A\sin(\omega t + \phi_0)$ is the time-displacement equation of a SHM. At $t = 0$ the displacement of the particle is $Y = \frac{A}{2}$ and it is moving along negative x-direction. Then the initial phase angle ϕ_0 will be :

Options :

70819161439. $\frac{\pi}{3}$

70819161440. $\frac{5\pi}{6}$

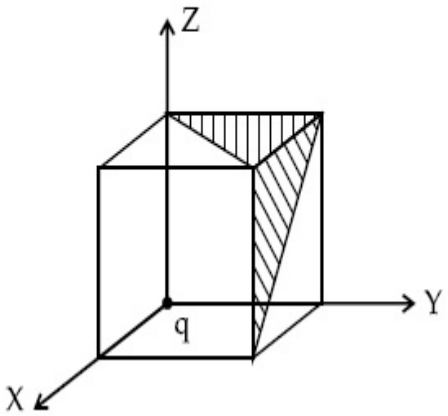
70819161441. $\frac{\pi}{6}$

70819161442. $\frac{2\pi}{3}$

Question Number : 9 Question Id : 70819118762 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A charge 'q' is placed at one corner of a cube as shown in figure. The flux of electrostatic field $\vec{E}$ through the shaded area is :



Options :

70819161443. $\frac{q}{48\varepsilon_0}$

70819161444. $\frac{q}{4\varepsilon_0}$

70819161445. $\frac{q}{8\varepsilon_0}$

70819161446. $\frac{q}{24\varepsilon_0}$

Question Number : 10 Question Id : 70819118763 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

An electron with kinetic energy K_1 enters between parallel plates of a capacitor at an angle 'α' with the plates. It leaves the plates at angle 'β' with kinetic energy K_2. Then the ratio of kinetic energies $K_1 : K_2$ will be :

Options :

70819161447. $\frac{\cos\beta}{\cos\alpha}$

70819161448. $\frac{\cos\beta}{\sin\alpha}$

70819161449. $\frac{\sin^2\beta}{\cos^2\alpha}$

70819161450. $\frac{\cos^2\beta}{\cos^2\alpha}$

Question Number : 11 Question Id : 70819118764 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

In a ferromagnetic material, below the curie temperature, a domain is defined as :

Options :

70819161451. a macroscopic region with zero magnetization.

70819161452. a macroscopic region with saturation magnetization.

70819161453. a macroscopic region with randomly oriented magnetic dipoles.

70819161454. a macroscopic region with consecutive magnetic dipoles oriented in opposite direction.

Question Number : 12 Question Id : 70819118765 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

An LCR circuit contains resistance of 110 Ω and a supply of 220 V at 300 rad/s angular frequency. If only capacitance is removed from the circuit, current lags behind the voltage by 45°. If on the other hand, only inductor is removed the current leads by 45° with the applied voltage. The rms current flowing in the circuit will be :

Options :

70819161455. 1 A

70819161456. 1.5 A

70819161457. 2 A

70819161458. 2.5 A

Question Number : 13 Question Id : 70819118766 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The stopping potential for electrons emitted from a photosensitive surface illuminated by light of wavelength 491 nm is 0.710 V. When the incident wavelength is changed to a new value, the stopping potential is 1.43 V. The new wavelength is :

Options :

70819161459. 309 nm

70819161460. 329 nm

70819161461. 382 nm

70819161462. 400 nm

Question Number : 14 Question Id : 70819118767 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Consider the diffraction pattern obtained from the sunlight incident on a pinhole of diameter 0.1 μm. If the diameter of the pinhole is slightly increased, it will affect the diffraction pattern such that :

Options :

70819161463. its size increases, and intensity increases

70819161464. its size increases, but intensity decreases

70819161465. its size decreases, but intensity increases

70819161466. its size decreases, and intensity decreases

Question Number : 15 Question Id : 70819118768 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

An electron of mass m_e and a proton of mass $m_p = 1836\ m_e$ are moving with the same speed.

The ratio of their de Broglie wavelength $\frac{\lambda_{electron}}{\lambda_{proton}}$ will be :

Options :

70819161467. 1

70819161468. 1836

70819161469. $\frac{1}{1836}$

70819161470. 918

Question Number : 16 Question Id : 70819118769 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The wavelength of the photon emitted by a hydrogen atom when an electron makes a transition from $n = 2$ to $n = 1$ state is :

Options :

70819161471. $121.8\ nm$

70819161472. $194.8\ nm$

70819161473. $490.7\ nm$

70819161474. $913.3\ nm$

Question Number : 17 Question Id : 70819118770 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If a message signal of frequency 'f_m' is amplitude modulated with a carrier signal of frequency 'f_c' and radiated through an antenna, the wavelength of the corresponding signal in air is :

Options :

70819161475. $\frac{c}{f_c - f_m}$

70819161476. $\frac{c}{f_c + f_m}$

70819161477. $\frac{c}{f_c}$

70819161478. $\frac{c}{f_m}$

Question Number : 18 Question Id : 70819118771 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

For extrinsic semiconductors; when doping level is increased;

Options :

70819161479. Fermi-level of p-type semiconductor will go upward and Fermi-level of n-type semiconductors will go downward.

70819161480. Fermi-level of p-type semiconductors will go downward and Fermi-level of n-type semiconductor will go upward.

70819161481. Fermi-level of p and n-type semiconductors will not be affected.

70819161482. Fermi-level of both p-type and n-type semiconductors will go upward for $T > T_F$ K and downward for $T < T_F$ K, where T_F is Fermi temperature.

Question Number : 19 Question Id : 70819118772 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Match List I with List II.

	List I		List II
(a)	Rectifier	(i)	Used either for stepping up or stepping down the a.c. voltage
(b)	Stabilizer	(ii)	Used to convert a.c. voltage into d.c. voltage
(c)	Transformer	(iii)	Used to remove any ripple in the rectified output voltage
(d)	Filter	(iv)	Used for constant output voltage even when the input voltage or load current change

Choose the correct answer from the options given below :

Options :

70819161483. (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)

70819161484. (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

70819161485. (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

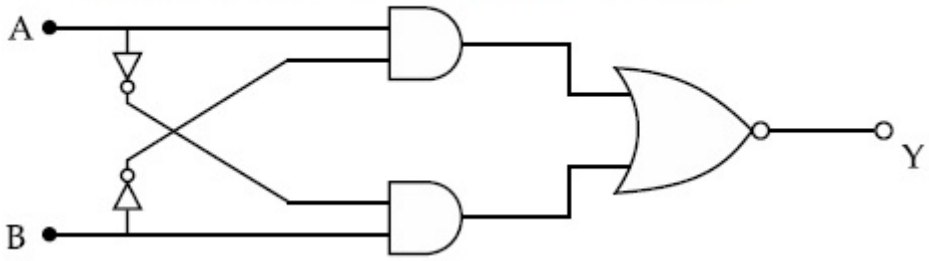
70819161486. (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

Question Number : 20 Question Id : 70819118773 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The truth table for the following logic circuit is :



Options :

70819161487.

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

70819161488.

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

70819161489.

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

70819161490.

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

Physics Section B

Section Id : 708191791

Section Number : 2

Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	10
Number of Questions to be attempted :	5
Section Marks :	20
Mark As Answered Required? :	Yes
Sub-Section Number :	1
Sub-Section Id :	7081911071
Question Shuffling Allowed :	Yes

Question Number : 21 Question Id : 70819118774 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Two particles having masses 4 g and 16 g respectively are moving with equal kinetic energies. The ratio of the magnitudes of their linear momentum is n : 2. The value of n will be _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001

Question Number : 22 Question Id : 70819118775 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The initial velocity v_i required to project a body vertically upward from the surface of the earth to reach a height of 10R, where R is the radius of the earth, may be described in terms of escape velocity v_e such that $v_i = \sqrt{\frac{x}{y}} \times v_e$. The value of x will be _____ .

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001

Question Number : 23 Question Id : 70819118776 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The percentage increase in the speed of transverse waves produced in a stretched string if the tension is increased by 4%, will be _____%.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001

Question Number : 24 Question Id : 70819118777 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

If $\vec{P} \times \vec{Q} = \vec{Q} \times \vec{P}$, the angle between $\vec{P}$ and $\vec{Q}$ is θ $(0° < \theta < 360°)$. The value of 'θ' will be _____°.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001

Question Number : 25 Question Id : 70819118778 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A reversible heat engine converts one-fourth of the heat input into work. When the temperature of the sink is reduced by 52 K, its efficiency is doubled. The temperature in Kelvin of the source will be _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001

Question Number : 26 Question Id : 70819118779 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Two small spheres each of mass 10 mg are suspended from a point by threads 0.5 m long. They are equally charged and repel each other to a distance of 0.20 m. The charge on each of the sphere is $\frac{a}{21} \times 10^{-8}$ C. The value of 'a' will be _____.

[Given $g = 10\ ms^{-2}$]

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001

Question Number : 27 Question Id : 70819118780 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Two identical conducting spheres with negligible volume have 2.1 nC and -0.1 nC charges, respectively. They are brought into contact and then separated by a distance of 0.5 m. The electrostatic force acting between the spheres is _____ $\times 10^{-9}$ N.

[Given : $4\pi\varepsilon_0 = \frac{1}{9 \times 10^9}$ SI unit]

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001

Question Number : 28 Question Id : 70819118781 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The peak electric field produced by the radiation coming from the 8 W bulb at a distance of 10 m is $\frac{x}{10}\sqrt{\frac{\mu_0 c}{\pi}}\ \frac{\text{V}}{\text{m}}$. The efficiency of the bulb is 10% and it is a point source. The value of x is _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

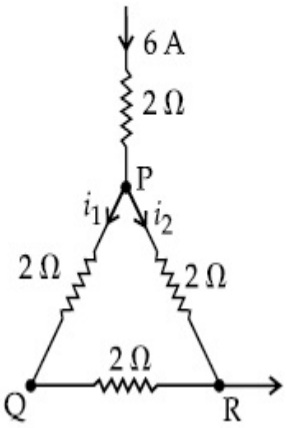
Possible Answers :

5 to 5.001

Question Number : 29 Question Id : 70819118782 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A current of 6 A enters one corner P of an equilateral triangle PQR having 3 wires of resistance 2 Ω each and leaves by the corner R. The currents i_1 in ampere is _____ .



Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001

Question Number : 30 Question Id : 70819118783 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The wavelength of an X-ray beam is 10 Å. The mass of a fictitious particle having the same energy as that of the X-ray photons is $\frac{x}{3}$h kg. The value of x is _____.
(h = Planck's constant)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001