

National Testing Agency

Question Paper Name : B TECH 24th Feb 2021 Shift 2
Subject Name : B TECH
Creation Date : 2021-02-25 09:54:33
Duration : 180
Number of Questions : 90
Total Marks : 300
Display Marks: Yes

B TECH

Group Number : 1
Group Id : 708191175
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 : 708191628
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 :	708191908
Question Shuffling Allowed :	Yes

Question Number : 1 Question Id : 70819116324 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

The period of oscillation of a simple pendulum is $T = 2\pi\sqrt{\frac{L}{g}}$. Measured value of 'L' is 1.0 m from meter scale having a minimum division of 1 mm and time of one complete oscillation is 1.95 s measured from stopwatch of 0.01 s resolution. The percentage error in the determination of 'g' will be :

Options :

70819154121. 1.33%

70819154122. 1.03%

70819154123. 1.13%

70819154124. 1.30%

Question Number : 2 Question Id : 70819116325 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

A particle is projected with velocity v_0 along x -axis. A damping force is acting on the particle which is proportional to the square of the distance from the origin i.e. $ma = -\alpha x^2$. The distance at which the particle stops :

Options :

70819154125. $\left(\frac{2v_0^2}{3\alpha}\right)^{\frac{1}{2}}$

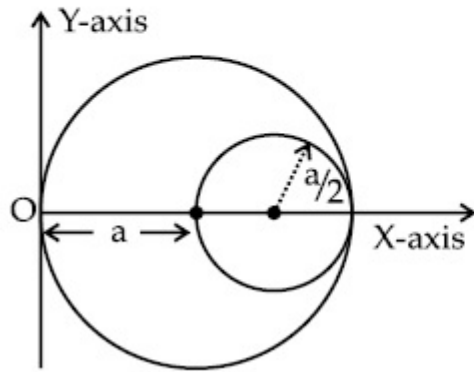
70819154126. $\left(\frac{3v_0^2}{2\alpha}\right)^{\frac{1}{2}}$

70819154127. $\left(\frac{3v_0^2}{2\alpha}\right)^{\frac{1}{3}}$

70819154128. $\left(\frac{2v_0}{3\alpha}\right)^{\frac{1}{3}}$

**Question Number : 3 Question Id : 70819116326 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1**

A circular hole of radius $\left(\frac{a}{2}\right)$ is cut out of a circular disc of radius 'a' as shown in figure. The centroid of the remaining circular portion with respect to point 'O' will be :



Options :

70819154129. $\frac{1}{6}a$

70819154130. $\frac{5}{6}a$

70819154131. $\frac{2}{3}a$

70819154132. $\frac{10}{11}a$

Question Number : 4 Question Id : 70819116327 Question Type : MCQ Option Shuffling : Yes Is Question Marked : No Correct Marks : 4 Wrong Marks : 1

A body weighs 49 N on a spring balance at the north pole. What will be its weight recorded on the same weighing machine, if it is shifted to the equator ?

[Use $g = \frac{GM}{R^2} = 9.8 \text{ ms}^{-2}$ and radius of earth, $R = 6400 \text{ km}$.]

Options :

70819154133. 49.17 N

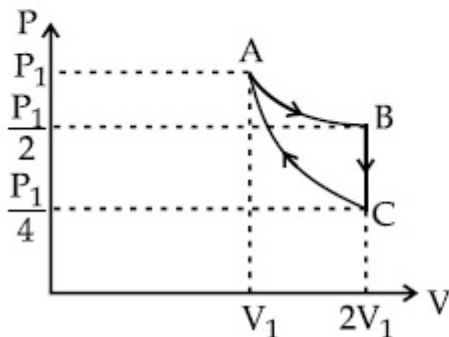
70819154134. 49 N

70819154135. 48.83 N

70819154136. 49.83 N

Question Number : 5 Question Id : 70819116328 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

If one mole of an ideal gas at (P_1, V_1) is allowed to expand reversibly and isothermally (A to B) its pressure is reduced to one-half of the original pressure (see figure). This is followed by a constant volume cooling till its pressure is reduced to one-fourth of the initial value ($B \rightarrow C$). Then it is restored to its initial state by a reversible adiabatic compression (C to A). The net workdone by the gas is equal to :



Options :

70819154137. $RT \left(\ln 2 - \frac{1}{2(\gamma - 1)} \right)$

70819154138. $-\frac{RT}{2(\gamma - 1)}$

70819154139. $RT \ln 2$

70819154140. 0

Question Number : 6 Question Id : 70819116329 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

On the basis of kinetic theory of gases, the gas exerts pressure because its molecules :

Options :

70819154141. continuously lose their energy till it reaches wall.

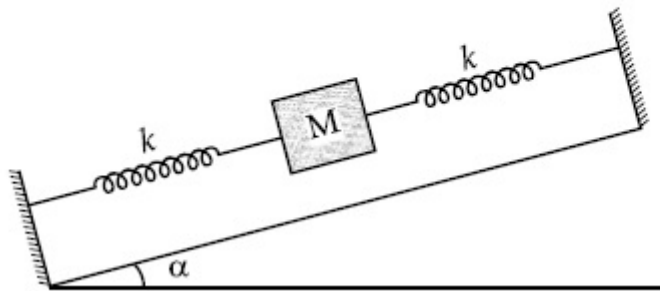
70819154142. continuously stick to the walls of container.

70819154143. are attracted by the walls of container.

70819154144. suffer change in momentum when impinge on the walls of container.

Question Number : 7 Question Id : 70819116330 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

In the given figure, a body of mass M is held between two massless springs, on a smooth inclined plane. The free ends of the springs are attached to firm supports. If each spring has spring constant k , the frequency of oscillation of given body is :



Options :

70819154145. $\frac{1}{2\pi} \sqrt{\frac{k}{Mg \sin\alpha}}$

70819154146. $\frac{1}{2\pi} \sqrt{\frac{2k}{Mg \sin\alpha}}$

70819154147. $\frac{1}{2\pi} \sqrt{\frac{2k}{M}}$

70819154148. $\frac{1}{2\pi} \sqrt{\frac{k}{2M}}$

Question Number : 8 Question Id : 70819116331 Question Type : MCQ Option Shuffling : Yes Is Question Marked Correct : Yes Correct Marks : 4 Wrong Marks : 1

When a particle executes SHM, the nature of graphical representation of velocity as a function of displacement is :

Options :

70819154149. circular

70819154150. elliptical

70819154151. parabolic

70819154152. straight line

Question Number : 9 Question Id : 70819116332 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Which of the following equations represents a travelling wave ?

Options :

70819154153. $y = Ae^x \cos(\omega t - \theta)$

70819154154. $y = Ae^{-x^2} (vt + \theta)$

70819154155. $y = A \sin(15x - 2t)$

70819154156. $y = A \sin x \cos \omega t$

Question Number : 10 Question Id : 70819116333 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Two electrons each are fixed at a distance '2d'. A third charge proton placed at the midpoint is displaced slightly by a distance x ($x \ll d$) perpendicular to the line joining the two fixed charges. Proton will execute simple harmonic motion having angular frequency : (m = mass of charged particle)

Options :

70819154157. $\left(\frac{q^2}{2\pi\epsilon_0 md^3} \right)^{\frac{1}{2}}$

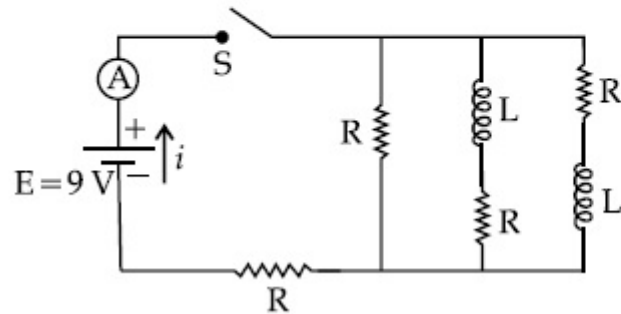
70819154158. $\left(\frac{2q^2}{\pi\epsilon_0 md^3} \right)^{\frac{1}{2}}$

70819154159. $\left(\frac{\pi\epsilon_0 md^3}{2q^2} \right)^{\frac{1}{2}}$

70819154160. $\left(\frac{2\pi\epsilon_0 md^3}{q^2} \right)^{\frac{1}{2}}$

Question Number : 11 Question Id : 70819116334 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Figure shows a circuit that contains four identical resistors with resistance $R=2.0\ \Omega$, two identical inductors with inductance $L=2.0\ \text{mH}$ and an ideal battery with *emf* $E=9\ \text{V}$. The current ' i ' just after the switch ' S ' is closed will be :



Options :

70819154161. 2.25 A
70819154162. 3.0 A
70819154163. 3.37 A
70819154164. 9 A

Question Number : 12 Question Id : 70819116335 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
 Correct Marks : 4 Wrong Marks : 1

A soft ferromagnetic material is placed in an external magnetic field. The magnetic domains :

Options :

70819154165. increase in size but no change in orientation.
70819154166. decrease in size and changes orientation.

70819154167. may increase or decrease in size and change its orientation.

70819154168. have no relation with external magnetic field.

Question Number : 13 Question Id : 70819116336 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) Source of microwave frequency
- (b) Source of infrared frequency
- (c) Source of Gamma Rays
- (d) Source of X-rays

List - II

- (i) Radioactive decay of nucleus
- (ii) Magnetron
- (iii) Inner shell electrons
- (iv) Vibration of atoms and molecules
- (v) LASER
- (vi) RC circuit

Choose the correct answer from the options given below :

Options :

70819154169. (a)-(vi), (b)-(v), (c)-(i), (d)-(iv)

70819154170. (a)-(vi), (b)-(iv), (c)-(i), (d)-(v)

70819154171. (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

70819154172. (a)-(ii), (b)-(iv), (c)-(vi), (d)-(iii)

Question Number : 14 Question Id : 70819116337 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

If the source of light used in a Young's double slit experiment is changed from red to violet :

Options :

70819154173. the fringes will become brighter.
70819154174. consecutive fringe lines will come closer.
70819154175. the intensity of minima will increase.
70819154176. the central bright fringe will become a dark fringe.

Question Number : 15 Question Id : 70819116338 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

An X-ray tube is operated at 1.24 million volt. The shortest wavelength of the produced photon will be :

Options :

70819154177. 10^{-1} nm
70819154178. 10^{-2} nm
70819154179. 10^{-3} nm
70819154180. 10^{-4} nm

Question Number : 16 Question Id : 70819116339 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

The de Broglie wavelength of a proton and α -particle are equal. The ratio of their velocities is :

Options :

70819154181. 4 : 1

70819154182. 4 : 2

70819154183. 4 : 3

70819154184. 1 : 4

Question Number : 17 Question Id : 70819116340 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

According to Bohr atom model, in which of the following transitions will the frequency be maximum ?

Options :

70819154185. $n=2$ to $n=1$

70819154186. $n=3$ to $n=2$

70819154187. $n=4$ to $n=3$

70819154188. $n=5$ to $n=4$

Question Number : 18 Question Id : 70819116341 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Zener breakdown occurs in a $p-n$ junction having p and n both :

Options :

70819154189. lightly doped and have narrow depletion layer.

70819154190. lightly doped and have wide depletion layer.

70819154191. heavily doped and have narrow depletion layer.

70819154192. heavily doped and have wide depletion layer.

**Question Number : 19 Question Id : 70819116342 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1**

Given below are two statements :

Statement I : PN junction diodes can be used to function as transistor, simply by connecting two diodes, back to back, which acts as the base terminal.

Statement II : In the study of transistor, the amplification factor β indicates ratio of the collector current to the base current.

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

Options :

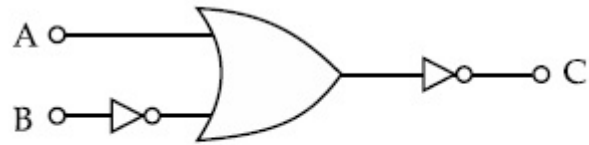
70819154193. Both Statement I and Statement II are true

70819154194. Both Statement I and Statement II are false

70819154195. Statement I is true but Statement II is false

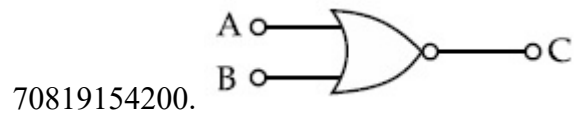
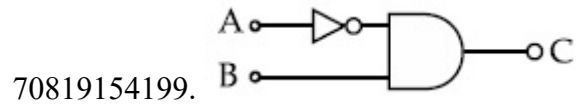
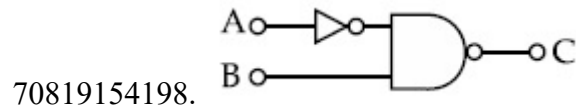
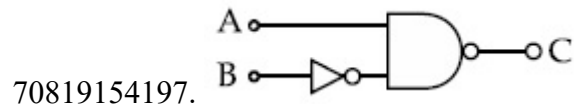
70819154196. Statement I is false but Statement II is true

**Question Number : 20 Question Id : 70819116343 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1**



The logic circuit shown above is equivalent to :

Options :



Physics Section B

Section Id :	708191629
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 :

708191909

Question Shuffling Allowed :

Yes

Question Number : 21 Question Id : 70819116344 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Two solids A and B of mass 1 kg and 2 kg respectively are moving with equal linear momentum. The ratio of their kinetic energies $(K.E.)_A : (K.E.)_B$ will be $\frac{A}{1}$, so the value of A 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 : 70819116345 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A uniform metallic wire is elongated by 0.04 m when subjected to a linear force F. The elongation, if its length and diameter is doubled and subjected to the same force will be _____ cm.

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 : 70819116346 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A uniform thin bar of mass 6 kg and length 2.4 meter is bent to make an equilateral hexagon. The moment of inertia about an axis passing through the centre of mass and perpendicular to the plane of hexagon is _____ $\times 10^{-1}$ kg m².

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 : 70819116347 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The root mean square speed of molecules of a given mass of a gas at 27°C and 1 atmosphere pressure is 200 ms⁻¹. The root mean square speed of molecules of the gas at 127°C and

2 atmosphere pressure is $\frac{x}{\sqrt{3}}$ ms⁻¹. 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 : 25 Question Id : 70819116348 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Two cars are approaching each other at an equal speed of 7.2 km/hr. When they see each other, both blow horns having frequency of 676 Hz. The beat frequency heard by each driver will be _____ Hz. [Velocity of sound in air is 340 m/s.]

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

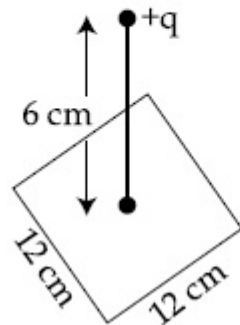
Possible Answers :

5 to 5.001

Question Number : 26 **Question Id :** 70819116349 **Question Type :** SA

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

A point charge of $+12 \mu\text{C}$ is at a distance 6 cm vertically above the centre of a square of side 12 cm as shown in figure. The magnitude of the electric flux through the square will be _____ $\times 10^3 \text{ Nm}^2/\text{C}$.



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 : 70819116350 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A cylindrical wire of radius 0.5 mm and conductivity 5×10^7 S/m is subjected to an electric field of 10 mV/m. The expected value of current in the wire will be $x^3\pi$ mA. 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 : 28 Question Id : 70819116351 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A series LCR circuit is designed to resonate at an angular frequency $\omega_0 = 10^5$ rad/s. The circuit draws 16 W power from 120 V source at resonance. The value of resistance 'R' in the circuit is _____ Ω .

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 : 70819116352 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

An electromagnetic wave of frequency 3 GHz enters a dielectric medium of relative electric permittivity 2.25 from vacuum. The wavelength of this wave in that medium will be _____ $\times 10^{-2}$ cm.

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 :** 70819116353 **Question Type :** SA

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

A signal of 0.1 kW is transmitted in a cable. The attenuation of cable is -5 dB per km and cable length is 20 km. The power received at receiver is 10^{-x} W. The value of x is _____.

$$[\text{Gain in dB} = 10 \log_{10} \left(\frac{P_o}{P_i} \right)]$$

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001