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Question Paper Name : B TECH 24th Feb 2021 Shift 1
Subject Name : B TECH
Creation Date : 2021-02-23 19:48:09
Duration : 180
Number of Questions : 90
Total Marks : 300
Display Marks: Yes

B TECH

Group Number : 1
Group Id : 708191162
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 : 708191550
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 :	708191830
Question Shuffling Allowed :	Yes

Question Number : 1 Question Id : 70819115154 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The workdone by a gas molecule in an isolated system is given by, $W = \alpha\beta^2 e^{-\frac{x^2}{\alpha kT}}$, where x is the displacement, k is the Boltzmann constant and T is the temperature. α and β are constants. Then the dimensions of β will be :

Options :

70819150611. $[M^2 L T^2]$

70819150612. $[M^0 L T^0]$

70819150613. $[M L T^{-2}]$

70819150614. $[M L^2 T^{-2}]$

Question Number : 2 Question Id : 70819115155 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Two stars of masses m and $2m$ at a distance d rotate about their common centre of mass in free space. The period of revolution is :

Options :

70819150615. $\frac{1}{2\pi} \sqrt{\frac{3Gm}{d^3}}$

70819150616. $2\pi \sqrt{\frac{d^3}{3Gm}}$

70819150617. $2\pi \sqrt{\frac{3Gm}{d^3}}$

70819150618. $\frac{1}{2\pi} \sqrt{\frac{d^3}{3Gm}}$

Question Number : 3 Question Id : 70819115156 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Four identical particles of equal masses 1 kg made to move along the circumference of a circle of radius 1 m under the action of their own mutual gravitational attraction. The speed of each particle will be :

Options :

70819150619. $\frac{\sqrt{(1+2\sqrt{2})G}}{2}$

70819150620. $\sqrt{\frac{G}{2}(1+2\sqrt{2})}$

70819150621. $\sqrt{G(1+2\sqrt{2})}$

70819150622. $\sqrt{\frac{G}{2}(2\sqrt{2}-1)}$

Question Number : 4 Question Id : 70819115157 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Moment of inertia (M.I.) of four bodies, having same mass and radius, are reported as ;

I_1 = M.I. of thin circular ring about its diameter,

I_2 = M.I. of circular disc about an axis perpendicular to disc and going through the centre,

I_3 = M.I. of solid cylinder about its axis and

I_4 = M.I. of solid sphere about its diameter.

Then :

Options :

70819150623. $I_1 + I_2 = I_3 + \frac{5}{2} I_4$

70819150624. $I_1 + I_3 < I_2 + I_4$

70819150625. $I_1 = I_2 = I_3 < I_4$

70819150626. $I_1 = I_2 = I_3 > I_4$

Question Number : 5 Question Id : 70819115158 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Consider two satellites S_1 and S_2 with periods of revolution 1 hr. and 8 hr. respectively revolving around a planet in circular orbits. The ratio of angular velocity of satellite S_1 to the angular velocity of satellite S_2 is :

Options :

70819150627. 8 : 1

70819150628. 1 : 8

70819150629. 2 : 1

70819150630. 1 : 4

Question Number : 6 Question Id : 70819115159 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Each side of a box made of metal sheet in cubic shape is 'a' at room temperature 'T', the coefficient of linear expansion of the metal sheet is ' α '. The metal sheet is heated uniformly, by a small temperature ΔT , so that its new temperature is $T + \Delta T$. Calculate the increase in the volume of the metal box.

Options :

70819150631. $4\pi a^3 \alpha \Delta T$

70819150632. $4a^3 \alpha \Delta T$

70819150633. $\frac{4}{3} \pi a^3 \alpha \Delta T$

70819150634. $3a^3 \alpha \Delta T$

Question Number : 7 Question Id : 70819115160 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If Y, K and η are the values of Young's modulus, bulk modulus and modulus of rigidity of any material respectively. Choose the correct relation for these parameters.

Options :

70819150635. $Y = \frac{9K\eta}{2\eta + 3K} \text{ N/m}^2$

70819150636. $Y = \frac{9K\eta}{3K - \eta} \text{ N/m}^2$

70819150637. $K = \frac{Y\eta}{9\eta - 3Y} \text{ N/m}^2$

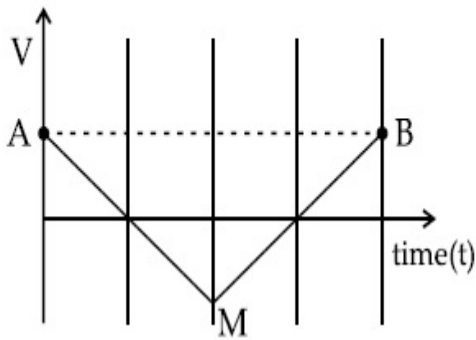
70819150638. $\eta = \frac{3YK}{9K+Y} \text{ N/m}^2$

Question Number : 8 Question Id : 70819115161 Question Type : MCQ Option Shuffling : Yes Is

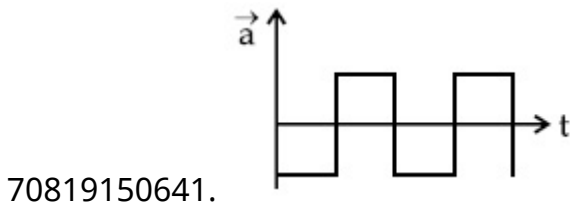
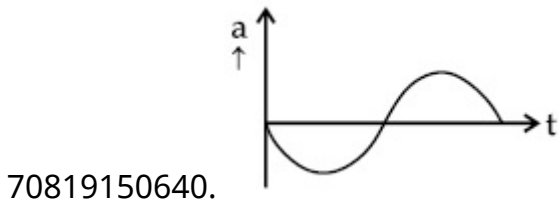
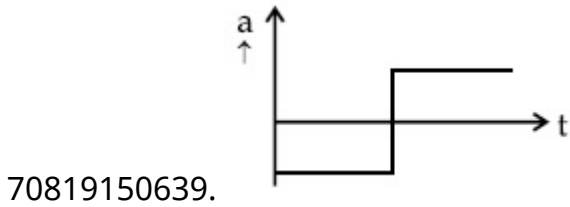
Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

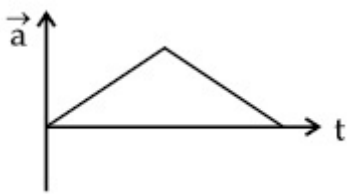
If the velocity-time graph has the shape AMB, what would be the shape of the corresponding acceleration-time graph ?



Options :



70819150642.



Question Number : 9 Question Id : 70819115162 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

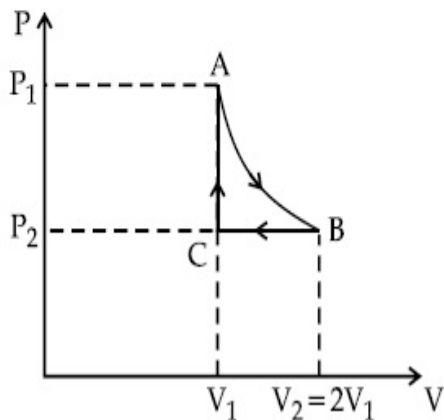
n mole of a perfect gas undergoes a cyclic process ABCA (see figure) consisting of the following processes.

A \rightarrow B : Isothermal expansion at temperature T so that the volume is doubled from V_1 to $V_2 = 2V_1$ and pressure changes from P_1 to P_2 .

B \rightarrow C : Isobaric compression at pressure P_2 to initial volume V_1 .

C \rightarrow A : Isochoric change leading to change of pressure from P_2 to P_1 .

Total workdone in the complete cycle ABCA is :



Options :

70819150643. 0

70819150644. $nRT \ln 2$

70819150645. $nRT \left(\ln 2 + \frac{1}{2} \right)$

70819150646. $nRT \left(\ln 2 - \frac{1}{2} \right)$

Question Number : 10 Question Id : 70819115163 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) Isothermal	(i) Pressure constant
(b) Isochoric	(ii) Temperature constant
(c) Adiabatic	(iii) Volume constant
(d) Isobaric	(iv) Heat content is constant

Choose the correct answer from the options given below :

Options :

70819150647. (a) \rightarrow (i), (b) \rightarrow (iii), (c) \rightarrow (ii), (d) \rightarrow (iv)

70819150648. (a) \rightarrow (iii), (b) \rightarrow (ii), (c) \rightarrow (i), (d) \rightarrow (iv)

70819150649. (a) \rightarrow (ii), (b) \rightarrow (iv), (c) \rightarrow (iii), (d) \rightarrow (i)

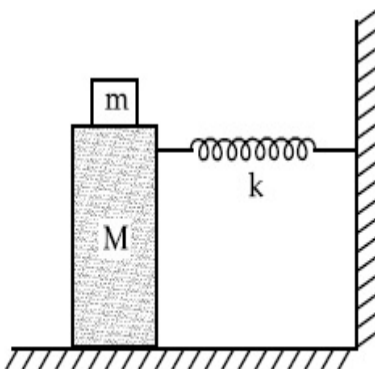
70819150650. (a) \rightarrow (ii), (b) \rightarrow (iii), (c) \rightarrow (iv), (d) \rightarrow (i)

Question Number : 11 Question Id : 70819115164 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

In the given figure, a mass M is attached to a horizontal spring which is fixed on one side to a rigid support. The spring constant of the spring is k . The mass oscillates on a frictionless surface with time period T and amplitude A . When the mass is in equilibrium position, as shown in the figure, another mass m is gently fixed upon it. The new amplitude of oscillation will be :



Options :

70819150651. $A \sqrt{\frac{M+m}{M}}$

70819150652. $A \sqrt{\frac{M}{M+m}}$

70819150653. $A \sqrt{\frac{M-m}{M}}$

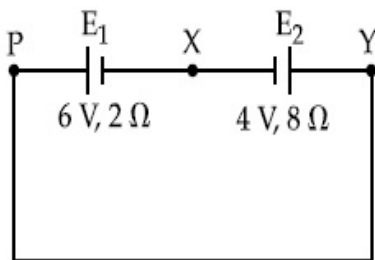
70819150654. $A \sqrt{\frac{M}{M-m}}$

Question Number : 12 Question Id : 70819115165 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A cell E_1 of emf 6 V and internal resistance 2Ω is connected with another cell E_2 of emf 4 V and internal resistance 8Ω (as shown in the figure). The potential difference across points X and Y is :



Options :

70819150655. 2.0 V

70819150656. 3.6 V

70819150657. 5.6 V

70819150658. 10.0 V

Question Number : 13 Question Id : 70819115166 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A current through a wire depends on time as

$$i = \alpha_0 t + \beta t^2$$

where $\alpha_0 = 20 \text{ A/s}$ and $\beta = 8 \text{ As}^{-2}$. Find the charge crossed through a section of the wire in 15 s.

Options :

70819150659. 260 C

70819150660. 2100 C

70819150661. 11250 C

70819150662. 2250 C

Question Number : 14 Question Id : 70819115167 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Two equal capacitors are first connected in series and then in parallel. The ratio of the equivalent capacities in the two cases will be :

Options :

70819150663. 1 : 2

70819150664. 2 : 1

70819150665. 4 : 1

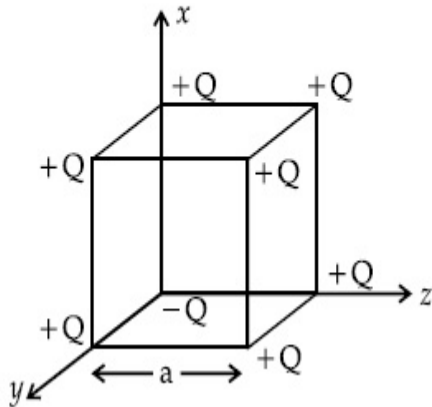
70819150666. 1 : 4

Question Number : 15 Question Id : 70819115168 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A cube of side 'a' has point charges +Q located at each of its vertices except at the origin where the charge is -Q. The electric field at the centre of cube is :



Options :

70819150667.
$$\frac{-Q}{3\sqrt{3} \pi \epsilon_0 a^2} (\hat{x} + \hat{y} + \hat{z})$$

70819150668.
$$\frac{Q}{3\sqrt{3} \pi \epsilon_0 a^2} (\hat{x} + \hat{y} + \hat{z})$$

70819150669.
$$\frac{-2Q}{3\sqrt{3} \pi \epsilon_0 a^2} (\hat{x} + \hat{y} + \hat{z})$$

70819150670.
$$\frac{2Q}{3\sqrt{3} \pi \epsilon_0 a^2} (\hat{x} + \hat{y} + \hat{z})$$

Question Number : 16 Question Id : 70819115169 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If an emitter current is changed by 4 mA, the collector current changes by 3.5 mA. The value of β will be :

Options :

70819150671. 7

70819150672. 0.875

70819150673. 0.5

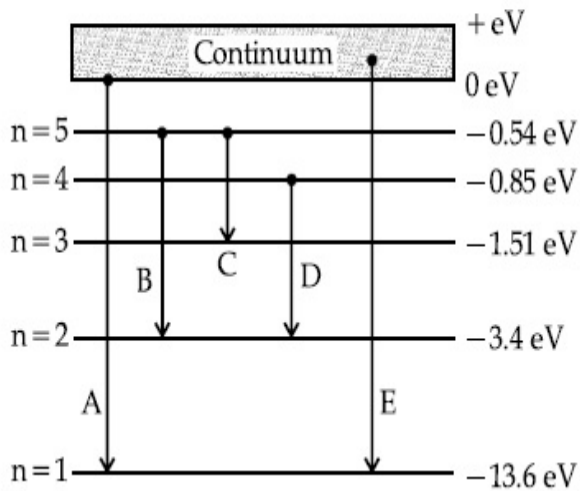
70819150674. 3.5

Question Number : 17 Question Id : 70819115170 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

In the given figure, the energy levels of hydrogen atom have been shown along with some transitions marked A, B, C, D and E.

The transitions A, B and C respectively represent :



Options :

70819150675. The first member of the Lyman series, third member of Balmer series and second member of Paschen series.

70819150676. The ionization potential of hydrogen, second member of Balmer series and third member of Paschen series.

70819150677. The series limit of Lyman series, second member of Balmer series and second member of Paschen series.

70819150678. The series limit of Lyman series, third member of Balmer series and second member of Paschen series.

**Question Number : 18 Question Id : 70819115171 Question Type : MCQ Option Shuffling : Yes
Is Question Mandatory : No**

Correct Marks : 4 Wrong Marks : 1

Given below are two statements :

Statement I : Two photons having equal linear momenta have equal wavelengths.

Statement II : If the wavelength of photon is decreased, then the momentum and energy of a photon will also decrease.

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

Options :

70819150679. Both Statement I and Statement II are true

70819150680. Both Statement I and Statement II are false

70819150681. Statement I is true but Statement II is false

70819150682. Statement I is false but Statement II is true

**Question Number : 19 Question Id : 70819115172 Question Type : MCQ Option Shuffling : Yes
Is Question Mandatory : No**

Correct Marks : 4 Wrong Marks : 1

The focal length f is related to the radius of curvature r of the spherical convex mirror by :

Options :

70819150683. $f = r$

70819150684. $f = -r$

70819150685. $f = -\frac{1}{2}r$

70819150686. $f = + \frac{1}{2}r$

Question Number : 20 Question Id : 70819115173 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

In a Young's double slit experiment, the width of the one of the slit is three times the other slit. The amplitude of the light coming from a slit is proportional to the slit-width. Find the ratio of the maximum to the minimum intensity in the interference pattern.

Options :

70819150687. 4 : 1

70819150688. 2 : 1

70819150689. 1 : 4

70819150690. 3 : 1

Physics Section B

Section Id :	708191551
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 :

708191831

Question Shuffling Allowed :

Yes

Question Number : 21 Question Id : 70819115174 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The coefficient of static friction between a wooden block of mass 0.5 kg and a vertical rough wall is 0.2. The magnitude of horizontal force that should be applied on the block to keep it adhere to the wall will be _____ N.

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

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 : 22 Question Id : 70819115175 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

An unpolarized light beam is incident on the polarizer of a polarization experiment and the intensity of light beam emerging from the analyzer is measured as 100 Lumens. Now, if the analyzer is rotated around the horizontal axis (direction of light) by 30° in clockwise direction, the intensity of emerging light will be _____ Lumens.

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 : 70819115176 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A ball with a speed of 9 m/s collides with another identical ball at rest. After the collision, the direction of each ball makes an angle of 30° with the original direction. The ratio of velocities of the balls after collision is $x : y$, where 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 : 24 Question Id : 70819115177 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A hydraulic press can lift 100 kg when a mass 'm' is placed on the smaller piston. It can lift _____ kg when the diameter of the larger piston is increased by 4 times and that of the smaller piston is decreased by 4 times keeping the same mass 'm' on the smaller piston.

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 : 70819115178 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

An inclined plane is bent in such a way that the vertical cross-section is given by $y = \frac{x^2}{4}$

where y is in vertical and x in horizontal direction. If the upper surface of this curved plane is rough with coefficient of friction $\mu = 0.5$, the maximum height in cm at which a stationary block will not slip downward is _____ 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 : 26 **Question Id :** 70819115179 **Question Type :** SA

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

A resonance circuit having inductance and resistance 2×10^{-4} H and 6.28Ω respectively oscillates at 10 MHz frequency. The value of quality factor of this resonator is _____.

$[\pi = 3.14]$

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 :** 70819115180 **Question Type :** SA

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

An audio signal $v_m = 20 \sin 2\pi(1500t)$ amplitude modulates a carrier $v_c = 80 \sin 2\pi(100,000t)$.

The value of percent modulation is _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

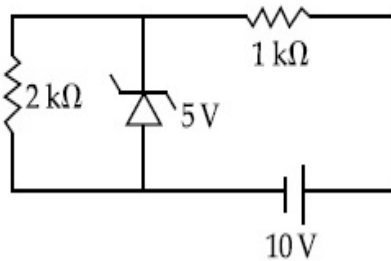
Possible Answers :

5 to 5.001

Question Number : 28 Question Id : 70819115181 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

In connection with the circuit drawn below, the value of current flowing through $2\text{ k}\Omega$ resistor is _____ $\times 10^{-4}$ A.



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 : 70819115182 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

An electromagnetic wave of frequency 5 GHz , is travelling in a medium whose relative electric permittivity and relative magnetic permeability both are 2. Its velocity in this medium is _____ $\times 10^7$ 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 : 30 Question Id : 70819115183 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A common transistor radio set requires 12 V (D.C.) for its operation. The D.C. source is constructed by using a transformer and a rectifier circuit, which are operated at 220 V (A.C.) on standard domestic A.C. supply. The number of turns of secondary coil are 24, then the number of turns of primary are _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001