National Testing Agency

Question Paper Name :	B TECH 3rd Aug 2021 Shift 2
Subject Name :	B TECH
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Duration :	180
Total Marks :	300
Display Marks:	Yes

B TECH

Group Number :	1
Group Id :	67603316
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 :	67603391
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 : 6760331351 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A particle is executing simple harmonic motion with time period T. What is the time taken by the particle to go directly to $\dfrac{1}{\sqrt{2}}$ of its amplitude from its mean position ?

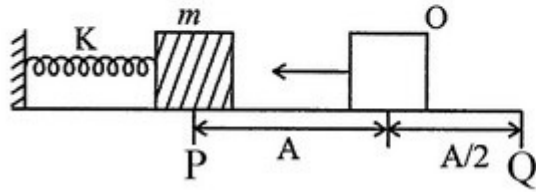**Options :**

6760334051. $\dfrac{T}{8}$

6760334052. $\dfrac{T}{4}$

6760334053. $\dfrac{T}{12}$

6760334054. T

Question Number : 2 Question Id : 6760331352 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A block of mass m rigidly attached with a spring of spring constant K, is compressed through a small distance A. If the block is now released, the time taken by the block in going from P to Q will be

Options :

6760334055. $\dfrac{3}{4\pi}\sqrt{\dfrac{m}{K}}$

6760334056. $\dfrac{2\pi}{3}\sqrt{\dfrac{m}{K}}$

6760334057. $\dfrac{3\pi}{4}\sqrt{\dfrac{m}{K}}$

6760334058. $\dfrac{3\pi}{4}\sqrt{\dfrac{K}{m}}$

Question Number : 3 Question Id : 6760331353 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
One mole Argon gas is sealed inside a thermally isolated chamber of 1 litre. A 100 W heater kept inside the chamber is switched on for 30 seconds. What will be the rise in temperature of the Argon gas? [R = 8.314 J mol·K^{-1}]
Options :

6760334059. 144.3 K

6760334060. 240.5 K

6760334061. 300.2 K

6760334062. 360.8 K

Question Number : 4 Question Id : 6760331354 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A solid sphere of radius R has mass M. A rod of mass m is attached tangentially to the sphere. What would be the moment of inertia of the system about the axis of the rod, if its diameter is negligibly small compared to R ?

Options :

6760334063. MR^2
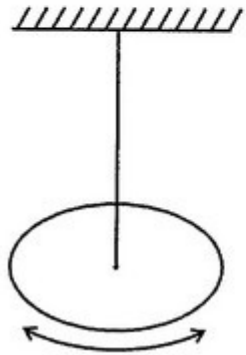
6760334064. $1.4\ MR^2$

6760334065. $1.6\ MR^2$

6760334066. $4.4\ MR^2$

Question Number : 5 Question Id : 6760331355 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

One end of a metal wire is fixed at the centre of a uniform disc of radius 4.0 cm and mass 100 g. The other end of the wire is fixed with a clamp. The hanging disc is rotated about the wire through a small angle and is released. If the disc makes torsional oscillations with time period 0.20 s, the torsional constant of wire is (Given $\pi^2 = 10$)

Options :

6760334067. $4 \times 10^{-2} \, kg \, m^2 s^{-2}$

6760334068. $8 \times 10^{-2} \, kg \, m^2 s^{-2}$

6760334069. $1.2 \times 10^{-2} \, kg \, m^2 s^{-2}$

6760334070. $8 \times 10^{-1} \, kg \, m^2 s^{-2}$

Question Number : 6 Question Id : 6760331356 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A particle is projected from the mid-point of the line joining two fixed particles each of mass m in free space. If the separation between the fixed particles is l, the minimum velocity of projection of the particle so as to escape to far away is equal to

Options :

6760334071. $2\sqrt{\dfrac{2Gm}{l}}$

6760334072. $\sqrt{\dfrac{Gm}{l}}$

6760334073. $\sqrt{\dfrac{2Gm}{l}}$

6760334074. $2\sqrt{\dfrac{Gm}{l}}$

Question Number : 7 Question Id : 6760331357 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A solid sphere of mass M and radius R lies on a horizontal rough surface. A horizontal force F is applied at the centre of the sphere. The acceleration of the centre of the sphere will be : (the sphere rolls without slipping)

Options :

6760334075. $\dfrac{F}{M}$

6760334076. $\dfrac{3F}{5M}$

6760334077. $\dfrac{2F}{3M}$

6760334078. $\dfrac{5F}{7M}$

Question Number : 8 Question Id : 6760331358 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A projectile is thrown with initial velocity of $(3\hat{i} + 4\hat{j})m/s$. Here '$\hat{i}$' is along

the horizontal direction and '$\hat{j}$' is assumed in vertical direction. The equation of the trajectory is - (Take $g = 10\ m/s^2$)

Options :

6760334079. $9y = 12x - 5x^2$

6760334080. $9y = 4x - 5x^2$

6760334081. $9y = 4x - 25x^2$

6760334082. $5y = 12x - 9x^2$

Question Number : 9 Question Id : 6760331359 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

The velocity of a particle starting from origin which is set into motion at $t = 0$ varies as $V = V_0(2 - t)$, where V_0 is a positive constant. Find the distance covered and displacement by the particle in 4 second.

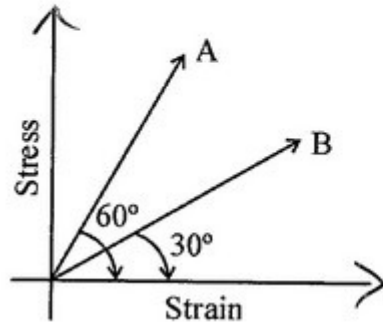**Options :**

6760334083. $4V_0, 0$

6760334084. $4V_0, V_0$

6760334085. $V_0, 4V_0$

6760334086. $V_0, 0$

Question Number : 10 Question Id : 6760331360 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

The following diagram shows the relation between stress and strain of two materials A and B. The ratio of Young's modulus of A and B is -

Options :

6760334087. $1 : 3$

6760334088. $1 : 1$

6760334089. $3 : 1$

6760334090. $1 : \sqrt{2}$

Question Number : 11 Question Id : 6760331361 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

An electric charge $10^{-2} \mu C$ is placed at the origin (0, 0) of X–Y coordinate system. The coordinates of two points A and B are $\left(\sqrt{2}, \sqrt{2}\right)$ and (2, 0), respectively. The potential difference between the point A and B will be -

Options :

6760334091. $4\ V$

6760334092. $0\ V$

6760334093. $8\ V$

6760334094. $6\ V$

Question Number : 12 Question Id : 6760331362 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

If A, Z and M represents the number of nucleons, protons and mass of the nucleus respectively, then mass defect ΔM is represented by (m_p and m_n are mass of a proton and a neutron respectively)

Options :

6760334095. $\Delta M = [Am_p + (A-Z)m_n] - M$

6760334096. $\Delta M = \cdot[Am_p + (A-Z)m_n] - M$

6760334097. $\Delta M = [Zm_n + (A-Z)m_p] - M$

6760334098. $\Delta M = [Zm_p + (A-Z)m_n] - M$

Question Number : 13 Question Id : 6760331363 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

A magnetic needle of length 12 cm, suspended at its middle point by a thread, stays at an angle of 45° with the horizontal. If the pole strength of the needle is 2.4 Am, what vertical force should be applied to an end so as to keep it in horizontal position ? The horizontal component of the earth's magnetic field is 20 μT.

Options :

6760334099. $4.8 \times 10^{-5} N$

6760334100. $2.4 \times 10^{-5} N$

6760334101. Zero

6760334102. $9.6 \times 10^{-5} N$

Question Number : 14 Question Id : 6760331364 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Two concentric and coplanar circular coils have radius a and b ($>>a$) as shown in figure. Resistance of the inner coil is R. Current in the outer coil is increased from 0 to i, then total charge circulating the inner coil is
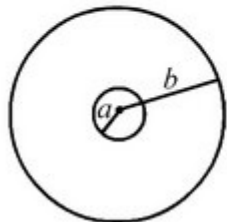
Options :

6760334103. $\dfrac{\mu_0 i \pi a}{2R}$

6760334104. $\dfrac{\mu_0 i^2 \pi a}{2R}$

6760334105. $\dfrac{\mu_0 i^2 \pi a}{3R}$

6760334106. $\dfrac{\mu_0 i \pi a^2}{2Rb}$

Question Number : 15 Question Id : 6760331365 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

To view a small object with angular magnification 5, the power of the microscope needed is [The final image is formed at infinity]
(Distance of distinct vision = 25 cm)

Options :

6760334107. 5 D

6760334108. 10 D

6760334109. 20 D

6760334110. 25 D

Question Number : 16 Question Id : 6760331366 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

If a man having the least distance of distinct vision of 50 cm, what should be the focal length of the spectacles for the man ?
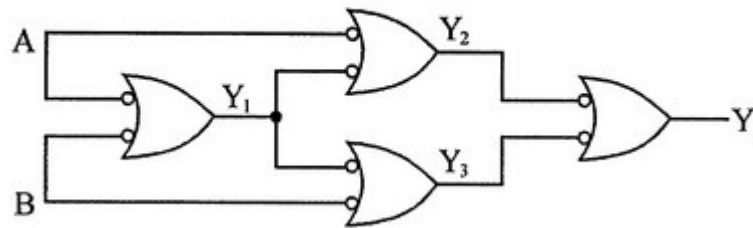
Options :

6760334111. $-50\,cm$

6760334112. $+50\,cm$

6760334113. $+100\,cm$

6760334114. $+25\,cm$

Question Number : 17 Question Id : 6760331367 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Identify the resulting gate for the following circuit.

Options :

6760334115. OR Gate

6760334116. Exclusive-OR gate

6760334117. NOR gate

6760334118. AND gate

Question Number : 18 Question Id : 6760331368 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

A radioactive isotope has a half life of T years. After how much time is its activity reduced to 6.25% of its original activity ?

Options :

6760334119. 2 T years

6760334120. 4 T years

6760334121. 1.5 T years

6760334122. 1 T year

Question Number : 19 Question Id : 6760331369 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Given below are two statements : one is labeled as Assertion A and the other is labeled as Reason R.

Assertion A : Communication techniques which are using much higher frequencies like TV signal broadcast, can not be received beyond the line-of-sight.

Reason R : Radio waves used for radio broadcast which are in the below critical frequency range, receive reflection from the ionosphere and can be received by the receiving antenna.

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

Options :

6760334123. Both **A** and **R** are true and **R** is the correct explanation of **A**.

6760334124. Both **A** and **R** are true but **R** is NOT the correct explanation of **A**.

6760334125. **A** is true but **R** is false.

6760334126. **A** is false but **R** is true.

Question Number : 20 Question Id : 6760331370 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A block of mass 4.0 kg is pulled up on a smooth incline of angle 30° with the horizontal. If the block moves with an acceleration of 1.0 m/s^2, the power delivered by the pulling force at a time 3.0 s after the motion starts is

Options :

6760334127. 70.8 W

6760334128. 35.4 W

6760334129. 65.4 W

6760334130. 85.4 W

Physics Section B

Section Id :   67603392

Section Number :   2

Section type :   Online

Question Number : 21 Question Id : 6760331371 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

_____ $\times 10^{-10}$ J (joule) energy is contained in a 120 m length of a laser beam operating at 4mW.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 22 Question Id : 6760331372 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The magnetic flux linked with a coil at any instant 't' is given by

$\phi = 5t^3 - 100t + 300$ (SI unit). The emf induced in the coil at t = 2 s is _____ V.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Question Number : 23 Question Id : 6760331373 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The ratio of shortest wavelength to the largest wavelength in Brackett series of atomic spectra for hydrogen atom is $x : 25$, where 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 :

100

Question Number : 24 Question Id : 6760331374 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A train left the station at uniform acceleration of 2 m/s². A man behind the train at a distance of 5 m is running with a constant speed of 6 m/s to catch the train. The time to catch the train will be _____ s.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 25 Question Id : 6760331375 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A sample undergoing beta decay, reduced to $\frac{1}{16}^{th}$ of its initial mass in 48 years. Its half life period is _____ years.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 26 Question Id : 6760331376 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Two particles of equal mass '*m*' go round a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle is $\sqrt{\frac{1}{x} \cdot \frac{Gm}{R}}$ where x is _____ .

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 27 Question Id : 6760331377 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

In Young's double slit experiment, 58 fringes are observed in the field of view when a light of wavelength 6000 $\overset{\circ}{A}$ was used. Number of fringes that can be viewed, if another light of wavelength 4000 $\overset{\circ}{A}$ is used are _____.

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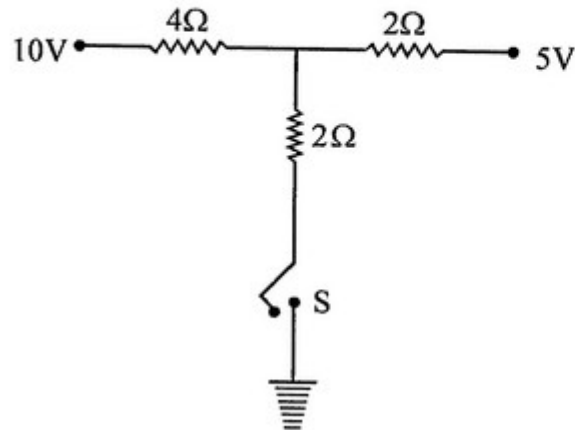**Answers Type :** Equal
Text Areas : PlainText
Possible Answers :

100

Question Number : 28 Question Id : 6760331378 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

As the switch S is closed in the circuit shown in figure, current passed through it is _____A.

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

Question Number : 29 Question Id : 6760331379 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

The electric potential at point $(x, 0, 0)$ is $V = \left(\dfrac{1000}{x} + \dfrac{1500}{x^2} + \dfrac{500}{x^3}\right)$ volt.

The electric field strength at a point $x = 1\ m$ is _____ $\hat{i}\ V/m$.

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

100

Question Number : 30 Question Id : 6760331380 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

A body of mass 20 kg is placed at a latitude of 45° on earth of radius R and angular speed ω. The change in weight of the body (if earth stops rotating)

is $x R\omega^2$. 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 :

100