

National Testing Agency

Question Paper Name :	B TECH 16th March 2021 Shift 2
Subject Name :	B TECH
Creation Date :	2021-03-16 21:03:26
Duration :	180
Number of Questions :	90
Total Marks :	300
Display Marks:	Yes

B TECH

Group Number :	1
Group Id :	86435126
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 :	864351151
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 :	864351151
Question Shuffling Allowed :	Yes

Question Number : 1 Question Id : 8643512251 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Two identical antennas mounted on identical towers are separated from each other by a distance of 45 km. What should nearly be the minimum height of receiving antenna to receive the signals in line of sight ?

(Assume radius of earth is 6400 km)

Options :

8643516751. 79.1 m

8643516752. 39.55 m

8643516753. 158.2 m

8643516754. 19.77 m

Question Number : 2 Question Id : 8643512252 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The de-Broglie wavelength associated with an electron and a proton were calculated by accelerating them through same potential of 100 V. What should nearly be the ratio of their wavelengths ? ($m_p = 1.00727u$ $m_e = 0.00055u$)

Options :

8643516755. 43 : 1

8643516756. 1860 : 1

8643516757. 41.4 : 1

8643516758. $(1860)^2 : 1$

Question Number : 3 Question Id : 8643512253 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The refractive index of a converging lens is 1.4. What will be the focal length of this lens if it is placed in a medium of same refractive index ? Assume the radii of curvature of the faces of lens are R_1 and R_2 respectively.

Options :

8643516759. Zero

8643516760. 1

8643516761. Infinite

8643516762. $\frac{R_1 R_2}{R_1 - R_2}$

Question Number : 4 Question Id : 8643512254 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Red light differs from blue light as they have :

Options :

8643516763. Same frequencies and same wavelengths

8643516764. Different frequencies and different wavelengths

8643516765. Same frequencies and different wavelengths

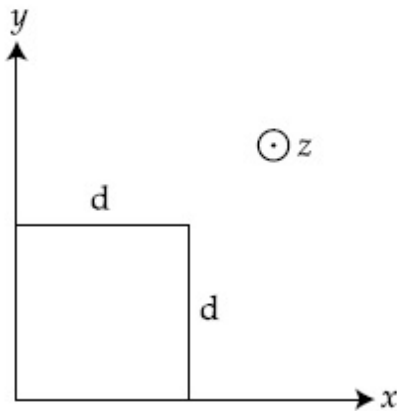
8643516766. Different frequencies and same wavelengths

Question Number : 5 Question Id : 8643512255 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The magnetic field in a region is given by $\vec{B} = B_0 \left(\frac{x}{a}\right) \hat{k}$. A square loop of side d is placed with its edges along the x and y axes. The loop is moved with a constant velocity $\vec{v} = v_0 \hat{i}$.

The emf induced in the loop is :



Options :

8643516767. $\frac{B_0 v_0 d}{2a}$

8643516768. $\frac{B_0 v_0 d^2}{a}$

8643516769. $\frac{B_0 v_0^2 d}{2a}$

8643516770. $\frac{B_0 v_0 d^2}{2a}$

Question Number : 6 Question Id : 8643512256 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Amplitude of a mass-spring system, which is executing simple harmonic motion decreases with time. If mass = 500g, Decay constant = 20 g/s then how much time is required for the amplitude of the system to drop to half of its initial value ?

($\ln 2 = 0.693$)

Options :

8643516771. 34.65 s

8643516772. 15.01 s

8643516773. 0.034 s

8643516774. 17.32 s

Question Number : 7 Question Id : 8643512257 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Calculate the value of mean free path (λ) for oxygen molecules at temperature 27°C and pressure 1.01×10^5 Pa. Assume the molecular diameter 0.3 nm and the gas is ideal. ($k = 1.38 \times 10^{-23} \text{ JK}^{-1}$)

Options :

8643516775. 32 nm

8643516776. 58 nm

8643516777. 86 nm

8643516778. 102 nm

Question Number : 8 Question Id : 8643512258 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

What will be the nature of flow of water from a circular tap, when its flow rate increased from 0.18 L/min to 0.48 L/min ? The radius of the tap and viscosity of water are 0.5 cm and 10^{-3} Pa s, respectively.

(Density of water : 10^3 kg/m^3)

Options :

8643516779. Steady flow to unsteady flow

8643516780. Unsteady to steady flow

8643516781. Remains steady flow

8643516782. Remains turbulent flow

Question Number : 9 Question Id : 8643512259 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A charge Q is moving $d\vec{l}$ distance in the magnetic field \vec{B} . Find the value of work done by \vec{B} .

Options :

8643516783. 1

8643516784. Zero

8643516785. Infinite

8643516786. -1

Question Number : 10 Question Id : 8643512260 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Calculate the time interval between 33% decay and 67% decay if half-life of a substance is 20 minutes.

Options :

8643516787. 20 minutes

8643516788. 40 minutes

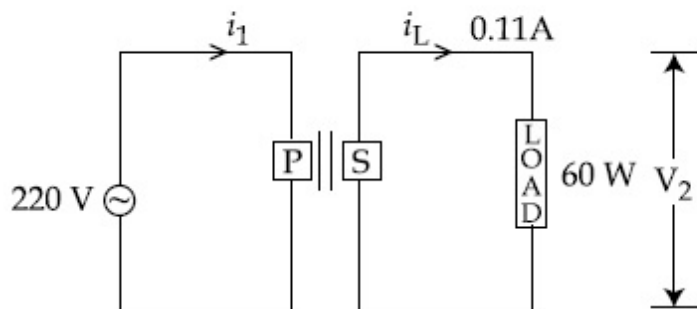
8643516789. 60 minutes

8643516790. 13 minutes

Question Number : 11 Question Id : 8643512261 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

For the given circuit, comment on the type of transformer used.



Options :

8643516791. Step - up transformer

8643516792. Step down transformer

8643516793. Auto transformer

8643516794. Auxilliary transformer

Question Number : 12 Question Id : 8643512262 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The half-life of Au^{198} is 2.7 days. The activity of 1.50 mg of Au^{198} if its atomic weight is 198 g mol^{-1} is, ($N_A = 6 \times 10^{23}/\text{mol}$).

Options :

8643516795. 240 Ci

8643516796. 357 Ci

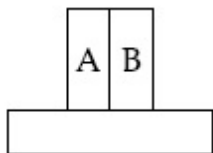
8643516797. 252 Ci

8643516798. 535 Ci

Question Number : 13 Question Id : 8643512263 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A bimetallic strip consists of metals A and B. It is mounted rigidly as shown. The metal A has higher coefficient of expansion compared to that of metal B. When the bimetallic strip is placed in a cold bath, it will :



Options :

8643516799. Bend towards the right

8643516800. Bend towards the left

8643516801. Not bend but shrink

8643516802. Neither bend nor shrink

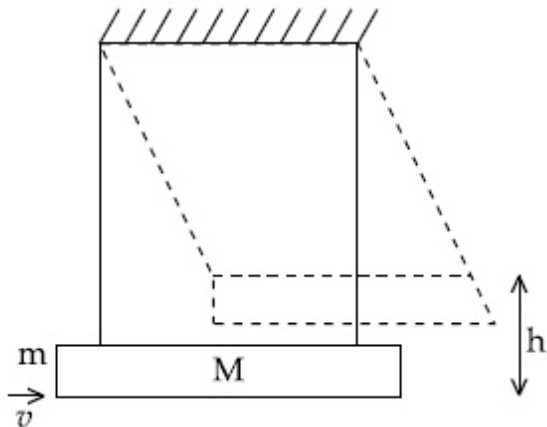
Question Number : 14 Question Id : 8643512264 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A large block of wood of mass $M = 5.99 \text{ kg}$ is hanging from two long massless cords. A bullet of mass $m = 10 \text{ g}$ is fired into the block and gets embedded in it. The (block + bullet) then swing upwards, their centre of mass rising a vertical distance $h = 9.8 \text{ cm}$ before the (block + bullet) pendulum comes momentarily to rest at the end of its arc. The speed of the bullet just before collision is :

(take $g = 9.8 \text{ ms}^{-2}$)



Options :

8643516803. 811.4 m/s

8643516804. 821.4 m/s

8643516805. 831.4 m/s

8643516806. 841.4 m/s

Question Number : 15 Question Id : 8643512265 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Statement I : A cyclist is moving on an unbanked road with a speed of 7 kmh^{-1} and takes a sharp circular turn along a path of radius of 2m without reducing the speed. The static friction coefficient is 0.2. The cyclist will not slip and pass the curve. ($g = 9.8 \text{ m/s}^2$)

Statement II : If the road is banked at an angle of 45° , cyclist can cross the curve of 2m radius with the speed of 18.5 kmh^{-1} without slipping.

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

Options :

8643516807. Both statement I and statement II are true

8643516808. Both statement I and statement II are false

8643516809. Statement I is correct and statement II is incorrect

8643516810. Statement I is incorrect and statement II is correct

Question Number : 16 Question Id : 8643512266 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A mosquito is moving with a velocity $\vec{v} = 0.5 t^2 \hat{i} + 3t \hat{j} + 9 \hat{k} \text{ m/s}$ and accelerating in uniform conditions. What will be the direction of mosquito after 2 s ?

Options :

8643516811. $\tan^{-1}\left(\frac{5}{2}\right)$ from x -axis

8643516812. $\tan^{-1}\left(\frac{5}{2}\right)$ from y -axis

8643516813. $\tan^{-1}\left(\frac{2}{3}\right)$ from x -axis

8643516814. $\tan^{-1}\left(\frac{2}{3}\right)$ from y -axis

Question Number : 17 Question Id : 8643512267 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

In order to determine the Young's Modulus of a wire of radius 0.2 cm (measured using a scale of least count = 0.001 cm) and length 1m (measured using a scale of least count = 1 mm), a weight of mass 1 kg (measured using a scale of least count = 1 g) was hanged to get the elongation of 0.5 cm (measured using a scale of least count 0.001 cm). What will be the fractional error in the value of Young's Modulus determined by this experiment ?

Options :

8643516815. 1.4 %

8643516816. 0.9%

8643516817. 0.14%

8643516818. 9%

Question Number : 18 Question Id : 8643512268 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A resistor develops 500 J of thermal energy in 20 s when a current of 1.5A is passed through it. If the current is increased from 1.5 A to 3 A, what will be the energy developed in 20 s.

Options :

8643516819. 500 J

8643516820. 1000 J

8643516821. 1500 J

8643516822. 2000 J

Question Number : 19 Question Id : 8643512269 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Find out the surface charge density at the intersection of point $x=3$ m plane and x -axis, in the region of uniform line charge of 8 nC/m lying along the z -axis in free space.

Options :

8643516823. 47.88 C/m

8643516824. 0.07 nC m^{-2}

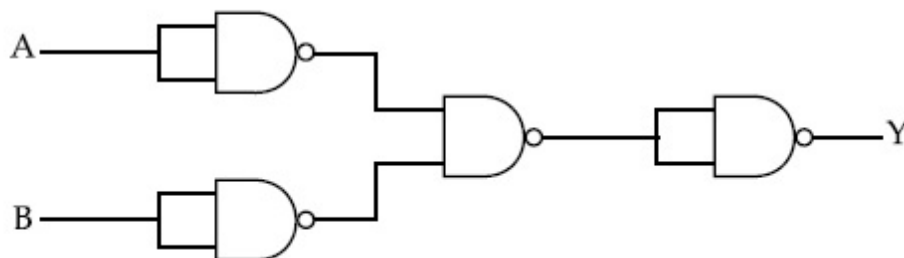
8643516825. 0.424 nC m^{-2}

8643516826. 4.0 nC m^{-2}

Question Number : 20 Question Id : 8643512270 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The following logic gate is equivalent to :



Options :

8643516827. AND Gate

8643516828. NAND Gate

8643516829. OR Gate

8643516830. NOR Gate

Physics Section B

Section Id :	864351152
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 :	864351152
Question Shuffling Allowed :	Yes

Question Number : 21 Question Id : 8643512271 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

If one wants to remove all the mass of the earth to infinity in order to break it up completely.

The amount of energy that needs to be supplied will be $\frac{x}{5} \frac{GM^2}{R}$ where x is _____

(Round off to the Nearest Integer)

(M is the mass of earth, R is the radius of earth, G is the gravitational constant)

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 : 8643512272 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A swimmer can swim with velocity of 12 km/h in still water. Water flowing in a river has velocity 6 km/h. The direction with respect to the direction of flow of river water he should swim in order to reach the point on the other bank just opposite to his starting point is _____°. (Round off to the Nearest Integer)

(Find the angle in degrees)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 23 Question Id : 8643512273 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A body of mass 2 kg moves under a force of $(2\hat{i} + 3\hat{j} + 5\hat{k})$ N. It starts from rest and was at

the origin initially. After 4 s, its new coordinates are (8, b, 20). The value of b is _____.

(Round off to the Nearest Integer)

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 : 8643512274 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A force $\vec{F} = 4\hat{i} + 3\hat{j} + 4\hat{k}$ is applied on an intersection point of $x = 2$ plane and x -axis. The

magnitude of torque of this force about a point (2, 3, 4) is _____.

(Round off to the Nearest Integer)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

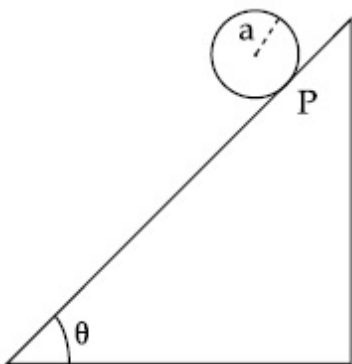
Question Number : 25 Question Id : 8643512275 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A solid disc of radius 'a' and mass 'm' rolls down without slipping on an inclined plane making an angle θ with the horizontal. The acceleration of the disc will be $\frac{2}{b} g \sin\theta$ where b is _____. (Round off to the Nearest Integer)

(g = acceleration due to gravity

θ = angle as shown in figure)



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 : 8643512276 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

For an ideal heat engine, the temperature of the source is 127°C . In order to have 60% efficiency the temperature of the sink should be _____ $^\circ\text{C}$. (Round off to the Nearest Integer)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

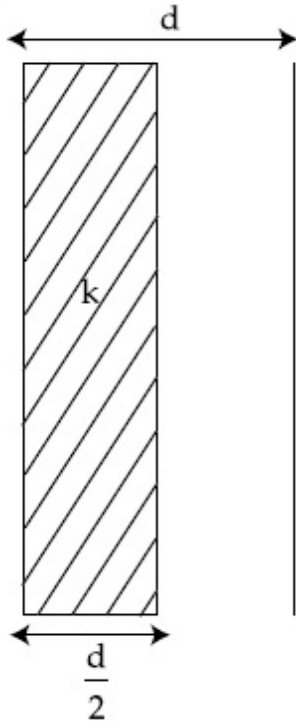
Possible Answers :

100

Question Number : 27 Question Id : 8643512277 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

In a parallel plate capacitor set up, the plate area of capacitor is 2 m^2 and the plates are separated by 1 m . If the space between the plates are filled with a dielectric material of thickness 0.5 m and area 2 m^2 (see fig) the capacitance of the set-up will be _____ ϵ_0 . (Dielectric constant of the material = 3.2) (Round off to the Nearest Integer)



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 : 8643512278 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The energy dissipated by a resistor is 10 mJ in 1 s when an electric current of 2 mA flows through it. The resistance is _____ Ω . (Round off to the Nearest Integer)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 29 Question Id : 8643512279 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A deviation of 2° is produced in the yellow ray when prism of crown and flint glass are achromatically combined. Taking dispersive powers of crown and flint glass as 0.02 and 0.03 respectively and refractive index for yellow light for these glasses are 1.5 and 1.6 respectively. The refracting angles for crown glass prism will be _____ $^\circ$ (in degree). (Round off to the Nearest Integer)

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 : 8643512280 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A closed organ pipe of length L and an open organ pipe contain gases of densities ρ_1 and ρ_2 respectively. The compressibility of gases are equal in both the pipes. Both the pipes are vibrating in their first overtone with same frequency. The length of the open pipe is $\frac{x}{3} L \sqrt{\frac{\rho_1}{\rho_2}}$ where x is _____. (Round off to the Nearest Integer)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100