PHYSICS

BOOKS - BITSAT GUIDE

SOLVED PAPER 2017

Part I Physics

1. If temperature of black body increases from $300K$ to $900K$, then the rate of energy radiation increases by

A. 81

B. 3

C. 9

D. 2

Answer: a

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2. A whistle of frequency 500 Hz tied to the end of a string of length 1.2 m revolves at 400 rev / min . A listener standing some distance away in the

plane of rotation of whistle hears frequencies in the range (speed of sound = 340 m / s)

A. 436 to 574

B. 426 to 586

C. 426 to 574

D. . 436 to 586

Answer: d

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3. The focal lengths of convex lens for red and blue light are 100 cm and 96.8 cm respectively. The dispersive power of material of lens is

A. 0.968

B. 0.98

C. 0.0325

D. 0.325

Answer: c

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4. Two metal pieces having a potential difference of $800V$ are $0.02m$ apart horizontally. A particle of mass $1.96 \times 10^{-15} kg$ is suspended in equilibrium between the plates. If the e is the elementary charge, then charge on the particle is

A. 2e

B. 3e

C. 6e

D. 8e

Answer: b

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5. At what angle to the horizontal should an object be projected so that the maximum height reached is equal to the horizontal range.

A. $\tan^{-1}(2)$

B. $\tan^{-1}(4)$

C. $\tan^{-1}\left(\frac{2}{3}\right)$

D. $\tan^{-1}(3)$

Answer: b

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6. A body of mass 1kg is executing simple harmonic motion. Its displacement y(cm) at t seconds is given by $y = 6\sin(100t + \pi/4)$. Its maximum kinetic energy is

A. 6 J

B. 18 J

C. 24 J

D. 36 J

Answer: b

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7. A positive charge q is projected in magnetic field of width $\frac{mv}{\sqrt{2}qB}$ with velocity v . Then, the time taken by charged particle to emerge from the magnetic field is

A. $\frac{m}{\sqrt{2}qB}$

B. $\frac{\pi m}{4qB}$

C. $\frac{\pi m}{2qB}$

D. $\frac{n\pi}{\sqrt{2}\cdot qB}$

Answer: b

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8. In Young's double-slit experiment, the slits are $2mm$ apart and are illuminated by photons of two wavelengths $\lambda_1 = 12000\text{Å}$ and $\lambda_2 = 10000\text{Å}$. At what minimum distance from the common central bright fringe on the screen $2m$ from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other?

A. 8 mm

B. 6 mm

C. 4 mm

D. 3 mm

Answer: b

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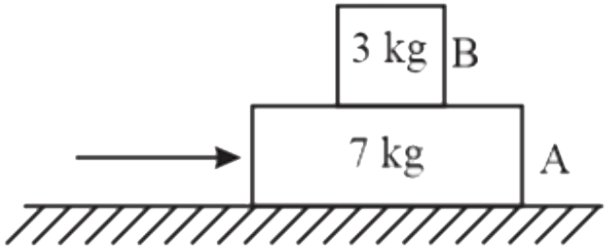
9. Two blocks A and B are placed one over the other on a smooth horizontal surface. The maximum horizontal force that can be applied on the lower block A, so that A and B move without separation is 49N. The coefficient of friction

between A and B is (take g = $9.8ms^{-2}$)



A. 0.2

B. 0.3

C. 0.5

D. 0.8

Answer: c

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10. An aeroplane is flying in a horizontal direction with a velocityu and at a height of 2000 m. When it is vertically below a point A on the ground a food packet is released from it. The packet strikes the ground at point B. If AB = 3 km and g =10 m/s^2 , then the value of u is

A. 54 km/h

B. 540 km/h

C. 150 km/h

D. 300 km/h

Answer: b

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11. A conducting circular loop is placed in a uniform magnetic field, $B = 0.025T$ with its plane perpendicular to the loop. The radius of the loop is made to shrink at a constant rate of $1mms^{-1}$. The induced emf when the radius is $2cm$ is

A. $2\pi\mu V$

B. $\pi\mu V$

C. $\frac{\pi}{2}\mu V$

D. $2\mu V$

Answer: b

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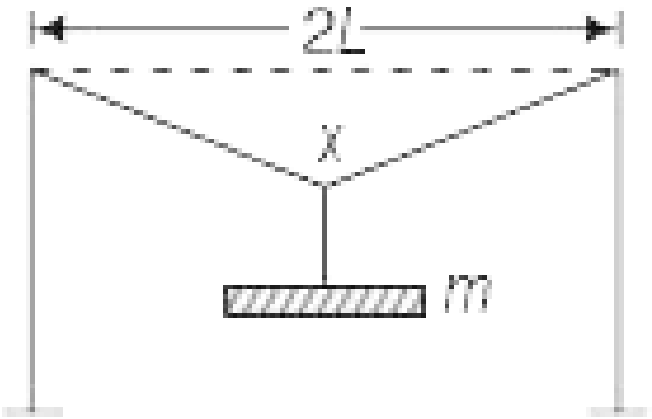
12. A mild steel wire of length 2L and cross-sectional area A is stretched, well with in the elastic limit, horizontally between two pillars as shown in figure. A mass m is suspended from the

mid-point of the wire strain in the wire is



A. $\frac{x^2}{2L^2}$

B. $\frac{x}{L}$

C. $\frac{x^2}{L}$

D. $\frac{x^2}{2L}$

Answer: a

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13. The resistance of a wire at $20^\circ C$ is 20Ω and at $500^\circ C$ is 60Ω. At which temperature its resistance will be 25Ω?

A. $50^\circ C$

B. $60^\circ C$

C. $70^\circ C$

D. $80^\circ C$

Answer: d

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14. The de-Broglie wavelength of proton $\left(\text{ charge} = 1.6 \times 10^{-19} C, \text{mass} = 1.6 \times 10^{-27} Kg\right)$ accelerated through a potential difference of 1kV is

A. $600 Å$

B. $0.9 \times 10^{-12} m$

C. $7 Å$

D. 0.9 nm

Answer: b

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15. An iceberg of density $900kg/m^3$ is floating in water of density $1000kg/m^3$. The percentage of volume of ice cube outside the water is

A. $20\ \%$

B. $35\ \%$

C. $10\ \%$

D. $11\ \%$

Answer: c

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16. The total energy of an electron in the first excited state of hydrogen is about $-3.4eV$. Its kinetic energy in this state is:

A. $-3.4eV$

B. $-6.8eV$

C. $6.8eV$

D. $3.4eV$

Answer: d

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17. A common emitter amplifier has a voltage gain of 50, an input impedance of 100Ω and an output impedance of 200 Ω. The power gain of the amplifier is :-

A. 500

B. 1000

C. 1250

D. 50

Answer: c

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18. The horizontal range and maximum height attained by a projectile are R and H respectively. If a constant horizontal acceleration $a = \frac{g}{4}$ is is imparted to the projectile due to wind, then its horizontal range and maximum height will be

A. $(R + H), \frac{H}{2}$

B. $\left(R + \frac{H}{2}\right), 2H$

C. $(R + 2H), H$

D. $(R + H), H$

Answer: d

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19. A balloon is filled at $27^\circ C$ and 1 atm pressure by $500m^3$ He. At-$3^\circ C$ and 0.5 atm pressures, the volume of He-gas contained in balloon will be

A. $700m^3$

B. $900m^3$

C. $1000m^3$

D. $500m^3$

Answer: b

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20. The ratio of intensity at the centre of a bright fringe to the intensity at a point distant one-fourth of the distance between two successive bright fringes will be

A. 4

B. 3

C. 2

D. 1

Answer: c

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21. A rectangular block of mass m and area of cross-section A floats in a liquid of density ρ. If it is given a small vertical displacement from equilibrium, it undergoes oscillation with a time period T. Then

A. $T \propto \sqrt{\rho}$

B. $T \propto \frac{1}{\sqrt{A}}$

C. $T \propto \frac{1}{\sqrt{\rho}}$

D. $T \propto \frac{1}{\sqrt{m}}$

Answer: b

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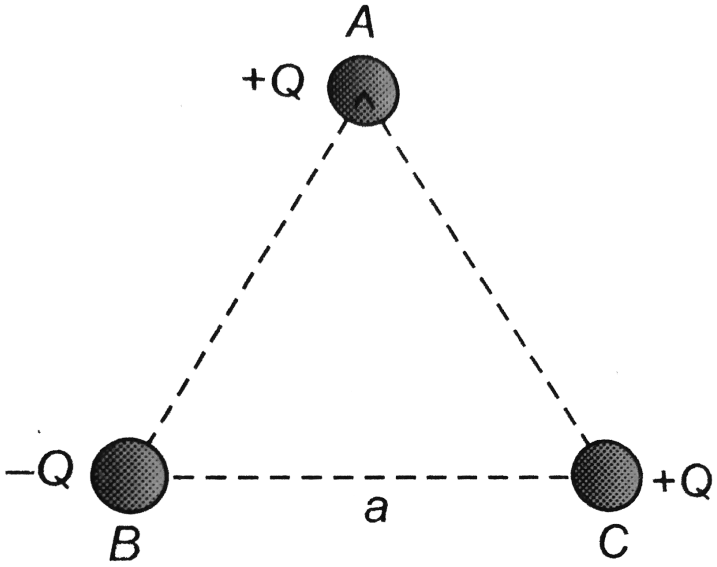
22. Three charges are placed at the vertices of an equilateral trianlge of side a as shown in the following figure. The force experienced by the charge placed at the vertex A in a direction

normal to BC is



A. $\frac{Q^2}{4\pi\varepsilon_0 a^2}$

B. $-\frac{Q^2}{4\pi\varepsilon_0 a^2}$

C. zero

D. $\frac{Q^2}{2\pi\varepsilon_0 a^2}$

Answer: c

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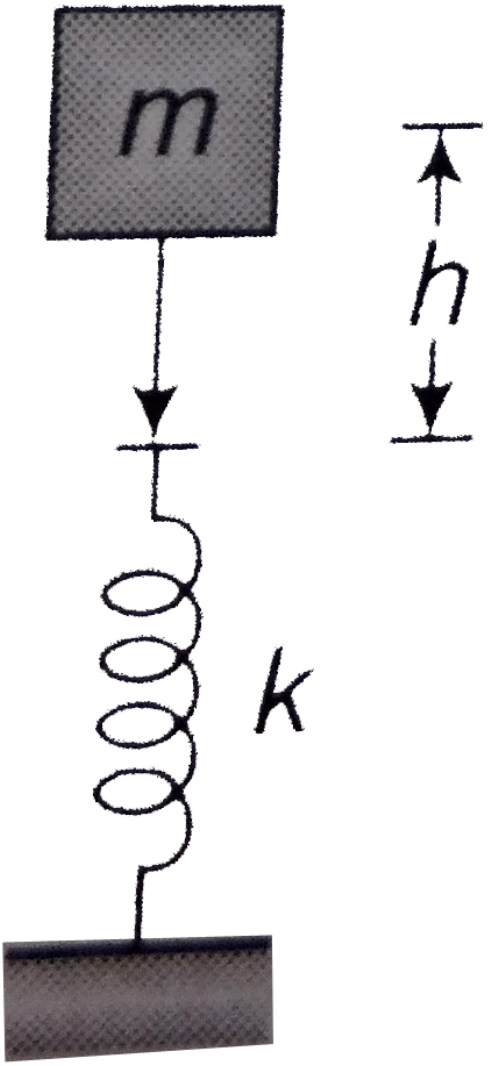
23. A body of mass m falls from a height h onto the pan of a spring balance. The masses of the pan and spring are negligible. The force constant of the spring is k. The body sticks to the pan and oscillates simple harmonically. The amplitude of

oscillation is



A. $\frac{mg}{k}$

B. $\frac{mg}{k}\sqrt{1+\frac{2hk}{mg}}$

C. $\frac{mg}{k}+\frac{mg}{k}\sqrt{\frac{1+2hk}{mg}}$

D. None of these

Answer: b

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24. The activity of a radioactive sample is measures as N_0 counts per minute at $t=0$ and N_0/e counts per minute at $t=5\ \text{min}$. The time

(in minute) at which the activity reduces to half its value is.

A. $\log_e \frac{2}{5}$

B. $\frac{5}{\log_e 2}$

C. $5 \log_{10} 2$

D. $5 \log_e 2$

Answer: d

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25. A plano-convex lens fits exactly into a plano-concave lens. Their plane surfaces are parallel to each other. If the lenses are made of different material of refractive indices μ_1 and μ_2 and R is the radius of curvature of the curved surface of the lenses, then focal length of the combination is

A. $\frac{R}{2(\mu_1 + \mu_2)}$

B. $\frac{R}{2(\mu_1 - \mu_2)}$

C. $\frac{R}{(\mu_1 - \mu_2)}$

D. $\frac{2R}{\mu_1 = \mu_2}$

Answer: c

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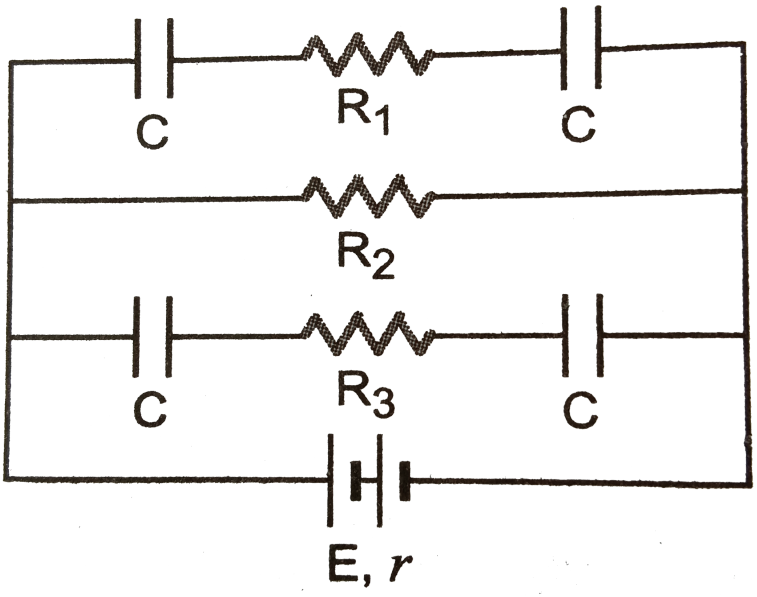
26. In Fig, $E = 5$ volt , $r = 1\Omega, R_2 = 4\Omega, R_1 = R_3 = 1\Omega$ and $C = 3\mu F$. Then the numbercal value of the charge on each plate of the capacitor is



A. $24\mu C$

B. $12\mu C$

C. $6\mu C$

D. $3\mu C$

Answer: c

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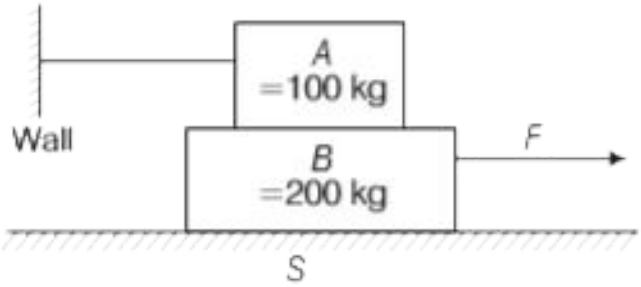
27. A block A of mass 100 kg rests on another block B of mass 200 kg and is tied to a wall as shown in the figure. The coefficient of friction

between A and B is 0.2 and that between B and ground is 0.3. The minimum force required to move the block B is $\left(g = 10ms^{-2}\right)$



A. 900 N

B. 200 N

C. 1100 N

D. 700 N

Answer: c

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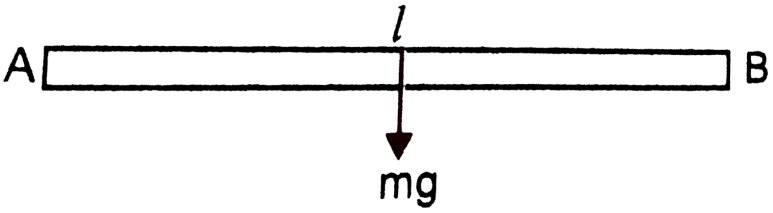
28. A unifrom rod of length l and mass m is free to rotate in a vertical plane about A, Fig. The rod initially in horizontal position is released. The initial angular acceleration of the rod is $\left(MI \text{of rod about} A \text{is} \frac{ml^2}{3}\right)$



A. $\frac{3g}{2l}$

B. $\frac{2l}{3g}$

C. $\frac{3g}{2l^2}$

D. $\mathrm{mg}\frac{l}{2}$

Answer: a

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29. Monochromatic radiation of wavelength λ is incident on a hydrogen sample in ground state. Hydrogen atoms absorb a fraction of light and subsequently emit radiations of six different wavelength . Find the wavelength λ.

A. 97 . 5 nm

B. 121 .6 nm

C. 110.3 nm

D. 45 .2 nm

Answer: a

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30. A coil in the shape of an equilateral triangle of side l is suspended between the pole pieces of permanent magnet. Such that $\overrightarrow{B}$ is in plane of the

coil. If due to a current I in the triangle, a torque τ acts on it, the side l of the triangel is:

A. $2\frac{\left(\frac{\tau}{\sqrt{3}Bi}\right)^1}{2}$

B. $\frac{2}{\sqrt{3}}\left(\frac{\tau}{Bi}\right)$

C. $2\frac{\left(\frac{\tau}{Bi}\right)^1}{2}$

D. $\frac{1}{\sqrt{3}}\left(\frac{\tau}{Bi}\right)$

Answer: a

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31. Work done in increasing the size of a soap bubble from a radius of 3cm to 5cm is nearly (Surface tension of soap solution $= 0.03Nm^{-1}$)

A. $0.2\pi mJ$

B. $2\pi mJ$

C. $0.4mJ$

D. $4\pi mJ$

Answer: d

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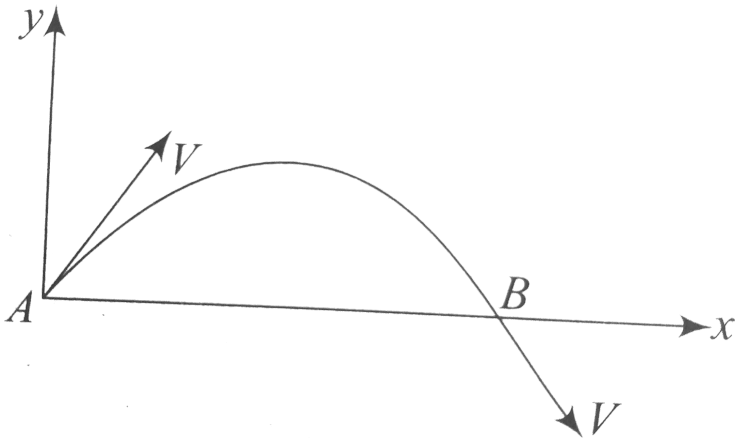
32. The velocity of a projectile at the initial point A is $\left(2\hat{i}+3\hat{j}\right)m/s$. Its velocity (in m/s) at point B is



A. $-2\hat{i}-3\hat{j}$

B. $-2\hat{i}+3\hat{j}$

C. $2\hat{i}-3\hat{j}$

D. $2\hat{i}+3\hat{j}$

Answer: c

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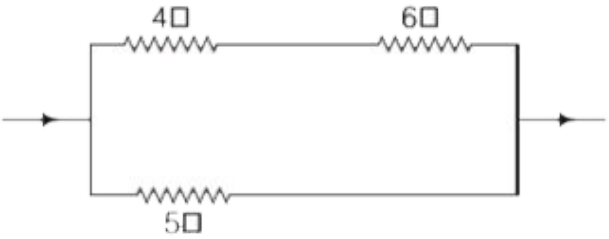
33. In the circuit shown , the heat produced in 5Ω resistot is $10\text{cal}s^{-1}$ .The heat produced per sec in 4Ω resistor will be



A. 1 cal

B. 2 cal

C. 3 cal

D. 4 cal

Answer: b

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34. An α - particle after passing through a potential difference of V volts collides with a nucleus . If the atomic number of the nucleus is Z then the distance of closest approach of α – particle to the nucleus will be

A. $14.4.\ \frac{Z}{V}$

B. $14.4\frac{Z}{V}m$

C. $14.4\frac{V}{Z}m$

D. $14.4\frac{V}{Z}$

Answer: a

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35. Two simple pendulum of length $5m$ and $20m$ respectively are given small displacement in time direction at the same time. They will again in the

plane when the pendulum of shorter length has completed oscillation.

A. 5

B. 1

C. 2

D. 3

Answer: c

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36. A parallel plate capacitor with air between the plates has capacitance of $9pF$. The separation between its plates is 'd'. The space between the plates is now filled with two dielectrics. One of the dielectrics has dielectric constant $k_1 = 3$ and thickness $\frac{d}{3}$ while the other one has dielectric constant $k_2 = 6$ and thickness $\frac{2d}{3}$. Capacitance of the capacitor is now

A. 1.8 pF

B. 45 pF

C. 40.5 pF

D. 20.25pF

Answer: c

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37. A particle moving along x-axis has acceleration f, at time t, given by $f = f_0\left(1 - \frac{t}{T}\right)$, where f_0 and T are constant.

The particle at $t = 0$ has zero velocity. In the time interval between $t = 0$ and the instant when $f = 0$, the particle's velocity (v_x) is :

A. $f_0 T$

B. $\frac{1}{2} f_0 T^2$

C. $f_0 T^2$

D. $\frac{1}{2} f_0 T$

Answer: d

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38. A geostationary satellite orbits around the earth in a circular orbit of radius 36,000 km. then the time period of a spy satellite orbiting a few

hundred km (600 km) above the earth's surface (R=6400 km) will approximately be

A. $\frac{1}{2}$ n

B. 1 n

C. 2 h

D. 4 h

Answer: c

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39. A tranverse wave propagating on a stretched string of linear density 3×10^{-4} kg per m is represented by the equation

$$y = 0.2 \sin(1.5x + 60t)$$

Where , x is in metre and t is in second. The tension in the string (in newton) is

A. 0.24

B. 0.48

C. 1.20

D. 1.80

Answer: b

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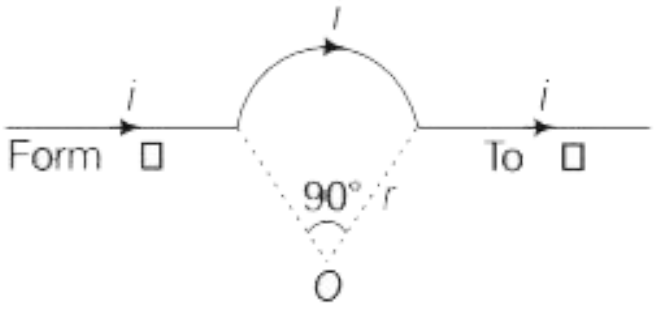
40. What is the magnetic field at the centre of arc in the figure below?



A. $\frac{\mu_0}{4\pi} \cdot \frac{2i}{r}[\sqrt{2}+\pi]$

B. $\frac{\mu_0}{4\pi} \cdot \frac{2i}{r}\left[\sqrt{2}+\frac{\pi}{4}\right]$

C. $\frac{\mu_0}{4\pi} \cdot \frac{i}{r}[\sqrt{2}+\pi]$

D. $\frac{\mu_0}{4\pi} \cdot \frac{i}{r}\left[\sqrt{2}+\frac{\pi}{4}\right]$

Answer: b

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