



PHYSICS

BOOKS - MTG PHYSICS (BENGALI ENGLISH)

QUESTION PAPER 2010

Physics

1. A circular disc rolls down on an inclined plane without slipping. What fraction of its

total energy is translation ?



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2. An infinite number of charges, each equal to q , are placed along the x -axis at $x = 1, x = 2, x = 4, x = 8$ and so on. What is the potential at $x = 0$ due to this set of charges ?



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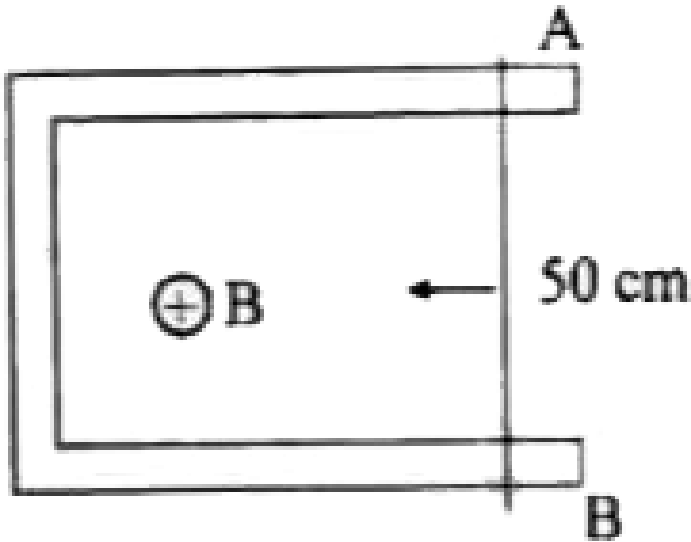
3. A liquid flows through two capillary tubes A and B connected in series. The length and radius of B are twice those of a. What is the ratio of the pressure difference across A to that across B ?



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4. A 50 cm long conductor AB moves with a speed 4 m/s in a magnetic field $B = 0.01 \text{ Wb/m}^2$ as shown. Find the e.m.f generated

and power delivered if resistance of the circuit is 0.1Ω



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5. An electron is moving with a velocity $(2\hat{i} + 2\hat{j})$ m/s in an electric field of intensity

$\vec{E} = \hat{i} + 2\hat{j} - 8\hat{k}$ Volt/m and a magnetic field of $\vec{B} = (2\hat{j} + 3\hat{k})$ tesla. Find the magnitude of force on the electron.



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6. Experimental investigations show that the intensity of solar radiation is maximum for a wavelength 480 nm in the visible region. Estimate the surface temperature of sun. Given Wein's constant $b = 2.88 \times 10^{-3}$ mK

A. 4000 K

B. 6000 K

C. 8000 K

D. $10^6 K$

Answer:



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7. The temperature of an ideal gas is increased from 120 K to 480 K. If at 120 K, the root mean square speed of gas molecules is v , then at 480 K it will be

A. $4v$

B. $2v$

C. $\frac{v}{2}$

D. $\frac{v}{4}$

Answer:



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8. Two mirrors at an angle θ° produce 5 images of a point. The number of images produced when θ is decreased to $\theta - 30^\circ$ is

A. 9

B. 10

C. 11

D. 12

Answer:



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9. The radius of the light circle observed by a fish at a depth of 12 meter is (refractive index of water = $4/3$)

A. a) $36\sqrt{7}$

B. b) $36 / \sqrt{7}$

C. c) $36\sqrt{5}$

D. d) $4\sqrt{5}$

Answer:



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10. In Young's double slit experiment, the fringe width is β . If the entire arrangement is

placed in a liquid of refractive index n , the fringe width becomes :

A. $n\beta$

B. $\frac{\beta}{n + 1}$

C. $\frac{\beta}{n - 1}$

D. $\frac{\beta}{n}$

Answer:



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11. A plano-convex lens ($f = 20$ cm) is silvered at plane surface. Now focal length will be

A. 20 cm

B. 40 cm

C. 30 cm

D. 10 cm

Answer:



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12. The light beams of intensities in the ratio of 9:1 are allowed to interfere. What will be the ratio of the intensities of maxima and minima?

A. 3:1

B. 4:1

C. 25:9

D. 81:1

Answer:



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13. If x_1 be the size of the magnified image and x_2 the size of the diminished image in Lens Displacement Method, then the size of the object is :

A. $\sqrt{x_1 x_2}$

B. $x_1 x_2$

C. $x_1^2 x_2$

D. $x_1 x_2^2$

Answer:



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14. A point charge $+q$ is placed at the centre of a cube of side L . The electric flux emerging from the cube is

A. $\frac{q}{\epsilon_0}$

B. zero

C. $\frac{6qL^2}{\epsilon_0}$

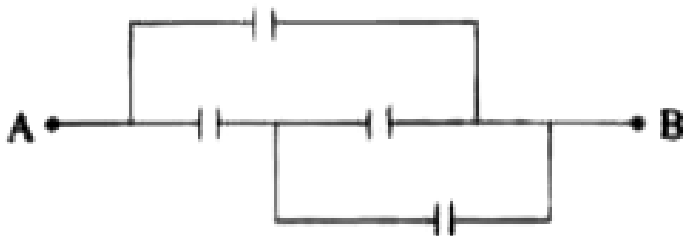
D. $\frac{q}{6L^2\epsilon_0}$

Answer:



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15. In the figure below, the capacitance of each capacitor is $3\mu F$. The effective capacitance between A and B is



A. $3/4\mu F$

B. $3\mu F$

C. $6\mu F$

D. $5\mu F$

Answer:



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16. n identical droplets are charged to v volt each. If they coalesce to form a single large drop, then its potential will be:

A. $n^{2/3}v$

B. $n^{1/3}v$

C. nv

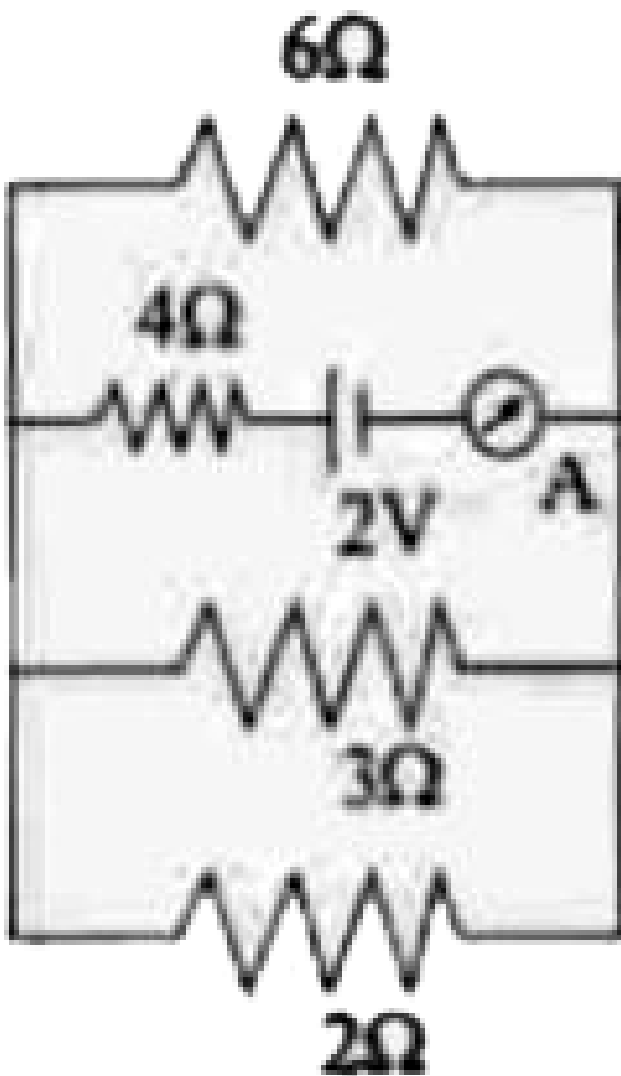
D. v/n

Answer:



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17. The reading on the ammeter in the following figure will be



A. 0.8 A

B. 0.6 A

C. 0.4 A

D. 0.2 A

Answer:



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18. A wire of resistance R is elongated n -fold to make a new uniform wire. The resistance of new wire

A. nR

B. $n^2 R$

C. $2nR$

D. $2n^2 R$

Answer:



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19. The ratio of magnetic field and magnetic moment at the centre of a current carrying circular loop is x . When both the current and radius is doubled the ratio will be

A. $x/8$

B. $x/4$

C. $x/2$

D. $2x$

Answer:



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20. The current through a coil of self inductance $L = 2\text{mH}$ is given by $I = t^2 e^{-t}$ at

time t . How long it will take to make the e.m.f zero?

A. 1s

B. 2s

C. 3s

D. 4s

Answer:



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21. The magnetic flux across a loop of resistance 10Ω is given by $\phi = 5t^2 - 4t + 1$ induced in the loop after 0.2 sec ?

A. 0.4 A

B. 0.2 A

C. 0.04 A

D. 0.02 A

Answer:



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22. The decimal equivalent of the binary number $(11010.101)_2$ is

A. 9.625

B. 25.265

C. 26.625

D. 26.265

Answer:



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23. In a common emitter configuration, a transistor has $\beta = 50$ and input resistance $1k\Omega$. If the peak value of a.c. input is 0.01 V then the peak value of collector current is

A. $0.01\mu A$

B. $0.25\mu A$

C. $100\mu A$

D. $500\mu A$

Answer:



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24. Half-life of a radioactive substance is 20 minute. The time between 20% and 80% decay will be

A. 20 min

B. 30 min

C. 40 min

D. 25 min

Answer:



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25. The energy released by the fission of one uranium atom is 200 MeV. The number of fissions per second required to produce 3.2 W of power is (Take $1\text{eV} = 1.6 \times 10^{-19}\text{J}$)

A. 10^7

B. 10^{10}

C. 10^{15}

D. 10^{11}

Answer:



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26. A body is projected with a speed u m/s at an angle β with the horizontal. The kinetic energy at the highest point is $\frac{3}{4}$ th of the initial kinetic energy. The value of β is :

A. 30°

B. 45°

C. 60°

D. 120°

Answer:



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27. A ball is projected horizontally with a velocity of 5 m/s from the top of a building 19.6 m high. How long will the ball take to hit the ground?

A. $\sqrt{2}S$

B. $2S$

C. $\sqrt{3}S$

D. 3S

Answer:



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28. A stone falls freely from rest and the total distance covered by it in the last second of its motion equals the distance covered by it in the first three seconds of its motion. The stone remains in the air for

A. 6 S

B. 5 S

C. 7 S

D. 4 S

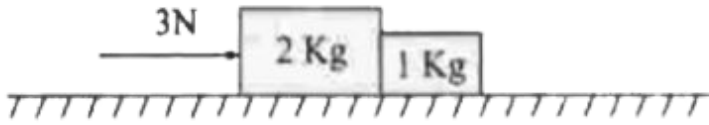
Answer:



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29. Two blocks of 2 kg and 1kg are in contact on a frictionless table. If a force of 3N is applied on 2kg block, then the force of contact

between the two blocks will be



A. 0 N

B. 1 N

C. 2 N

D. 3 N

Answer:



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30. If momentum is increased by 20%, then kinetic energy increases by

A. 48 %

B. 44 %

C. 40 %

D. 36 %

Answer:



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31. A boy of mass 40 kg is climbing a vertical pole at a constant speed. If the coefficient of friction between his palms and the pole is 0.8 and $g = 10\text{ m/s}^2$, the horizontal force that he is applying on the pole is

A. 300 N

B. 400 N

C. 500 N

D. 600 N

Answer:



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32. The value of λ for which the two vectors

$$\hat{a} = 5\hat{i} + \lambda\hat{j} + \hat{k} \text{ and } \hat{b} = \hat{i} - 2\hat{j} + \hat{k} \quad \text{are}$$

perpendicular to each other is

A. 2

B. -2

C. 3

D. -3

Answer:



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33. If $\vec{a} + \vec{b} = \vec{c}$ and $a + b = c$ then the angle included between \vec{a} and \vec{b} is

A. 90°

B. 180°

C. 120°

D. Zero

Answer:



34. The height vertically above the earth's surface at which the acceleration due to gravity becomes 1% of its value at the surface is (R is the radius of the earth)

A. $8R$

B. $9R$

C. $10R$

D. $20R$

Answer:



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35. The change in the gravitational potential energy when a body of mass m is raised to a height nR above the surface of the earth is (here R is the radius of the earth)

A. $\left(\frac{n}{n+1}\right)mgR$

B. $\left(\frac{n}{n-1}\right)mgR$

C. $nmgR$

D. $\frac{mgR}{n}$

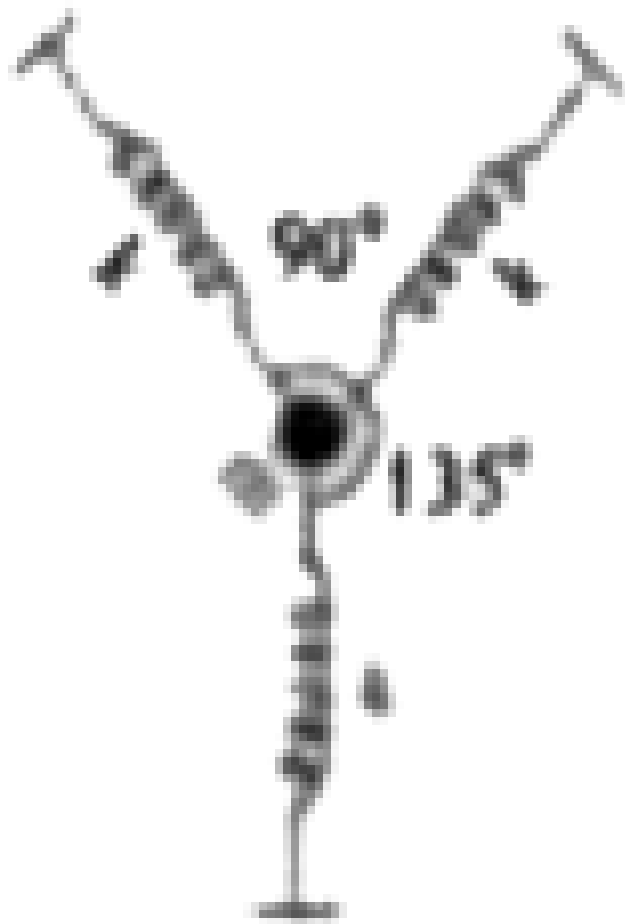
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36. A particle of mass m is attached to three identical massless springs of spring constant ' k ' as shown in the figure. The time period of

vertical oscillation of the particle is



A. $2\pi \sqrt{m/k}$

B. $2\pi \sqrt{\frac{m}{2k}}$

C. $2\pi\sqrt{\frac{m}{3k}}$

D. $\pi\sqrt{m/k}$

Answer:



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37. A spring of force constant k is cut into three equal parts. The force constant of each part would be

A. $\frac{k}{3}$

B. 3k

C. k

D. 2k

Answer:



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38. A body floats in water with 40% of its volume outside water. When the same body floats in oil, 60% of its volume remains outside oil. The relative density of the oil is

A. 0.9

B. 1.2

C. 1.5

D. 1.8

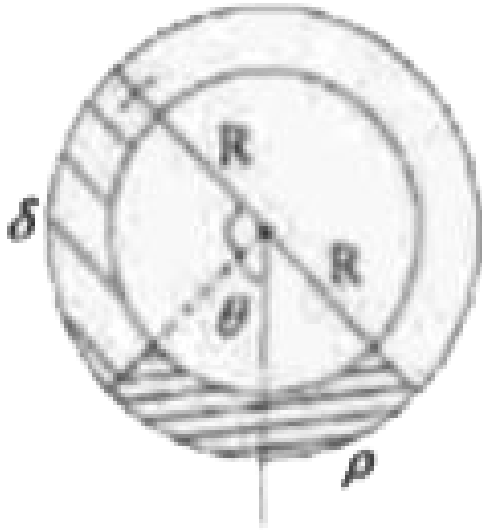
Answer:



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39. A uniform long tube is bent into a circle of radius R and it lies in a vertical plane. Two liquids of same volume but densities ρ and δ

fill half the tube. The angle θ is



A. $\tan^{-1} \left(\frac{\rho - \delta}{\rho - \delta} \right)$

B. $\tan^{-1} \rho / \delta$

C. $\tan^{-1} \delta / \rho$

D. $\tan^{-1} \frac{\rho + \delta}{\rho - \delta}$

Answer:



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40. Two solid spheres of same metal but of mass M and $8M$ fall simultaneously on a viscous liquid and their terminal velocities are v and nv then value of n is

A. 16

B. 8

C. 4

D. 2

Answer:



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41. A particle is executing linear simple harmonic motion of amplitude A . At what displacement is the energy of the particle half potential and half kinetic ?

A. $\frac{A}{4}$

B. $\frac{A}{2}$

C. $\frac{A}{\sqrt{2}}$

D. $\frac{A}{\sqrt{3}}$

Answer:



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42. The equation of a progressive wave is

$$y = 4 \sin(4\pi t - 0.04x + \pi/3)$$
 where x is in

meter and The velocity of the wave is

A. $100\pi m / s$

B. $50\pi m / s$

C. $25\pi m / s$

D. $\pi m / s$

Answer:



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43. A longitudinal wave is represented by $x = x_0 \sin 2\pi(nt - x/\lambda)$. The maximum

particle velocity will be four times the wave velocity if :

A. $\lambda = \frac{\pi x_0}{4}$

B. $\lambda = 2\pi x_0$

C. $\lambda = \frac{\pi x_0}{2}$

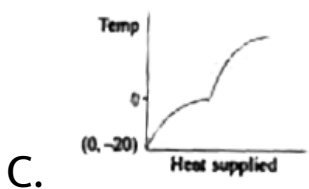
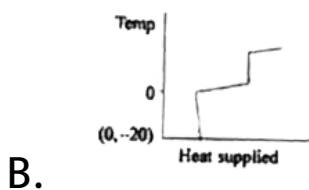
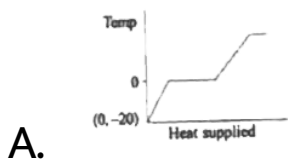
D. $\lambda = 4\pi x_0$

Answer:

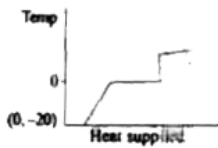


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44. A block of ice at temperature -20°C is slowly heated and converted to steam at 100°C . Which of the following diagram is most appropriate?



D.



Answer:



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45. Two black bodies at temperatures $327^{\circ}C$ and $427^{\circ}C$ are kept in an evacuated chamber at $27^{\circ}C$. The ratio of their rates of loss of heat are :

A. $(6/7)$

B. $(6/7)^2$

C. $(6/7)^3$

D. $\frac{243}{464}$

Answer:



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