PHYSICS

BOOKS - NTA MOCK TESTS

JEE MOCK TEST 23

Physics

1. A proton is bombarded on a stationary lithium nucleus. As a result of the collision, two α-particles are produced. If the direction

of motion of the α-particles with the initial direction of motion makes an angles $\cos^{-1}(1/4)$, find the kinetic energy of the striking proton. Given, binding energies per nucleon of Li^7 and He^4 are 5.60 and $7.06MeV$, respectively.

(Assume mass of proton $\approx$ mass of neutron).

A. 17.28 MeV

B. 17.36 MeV

C. 17.58 MeV

D. 17.44 MeV

Answer: A

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2. At a certain place, the angle of dip is 30° and the horizontal component of earth's magnetic field is $50\mu T$. The total magnetic field (in μT) of the earth at this place, is

A. $100\sqrt{3}\mu T$

B. $100\mu T$

C. $\frac{100}{\sqrt{3}}\mu T$

D. $200\mu T$

Answer: C

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3. A battery of 10V is connected to a resistance of 20Ω through a variable resistance R. If the variable resistance R is increased at the rate of $5\Omega \ \ \min^{-1}$, then the amount of charge that passes through the battery in 4 min is

A. $120C$

B. $120 \log_e(2) C$

C. $\frac{120}{\log_e(2)} C$

D. $\frac{60}{\log_e(2)} C$

Answer: B

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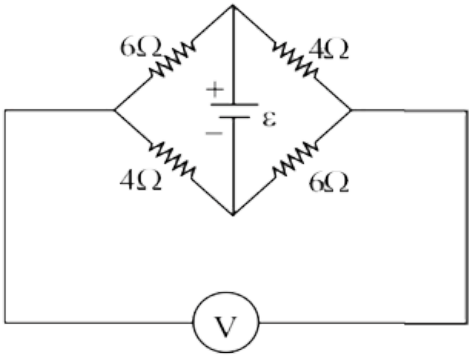
4. In the circuit shown below, the voltmeter is of large resistance. The E.M.F. of the cell is ε.

The reading of the voltmeter is



A. zero

B. $\frac{\varepsilon}{10}$

C. $\frac{\varepsilon}{5}$

D. $\frac{\varepsilon}{2}$

Answer: C

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5. An AC circuit drawing power from a source of angular frequency $50\,\mathrm{rad\,s^{-1}}$ has a power factor of 0.6. In this condition, a resistance of 100Ω is present and the current is lagging behind the voltage. If a capacitor is connected in series, then the required capacitance that will result in a power factor of unity is

A. $30\mu F$

B. $150\mu F$

C. $50\mu F$

D. $200\mu F$

Answer: B

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6. Consider a solid cube made up of insulating material having a uniform volume charge density. Assuming the electrostatic potential to be zero at infinity, the ratio of the potential

at a corner of the cube to that at the centre will be

A. $1:1$

B. $1:2$

C. $1:4$

D. $1:8$

Answer: B

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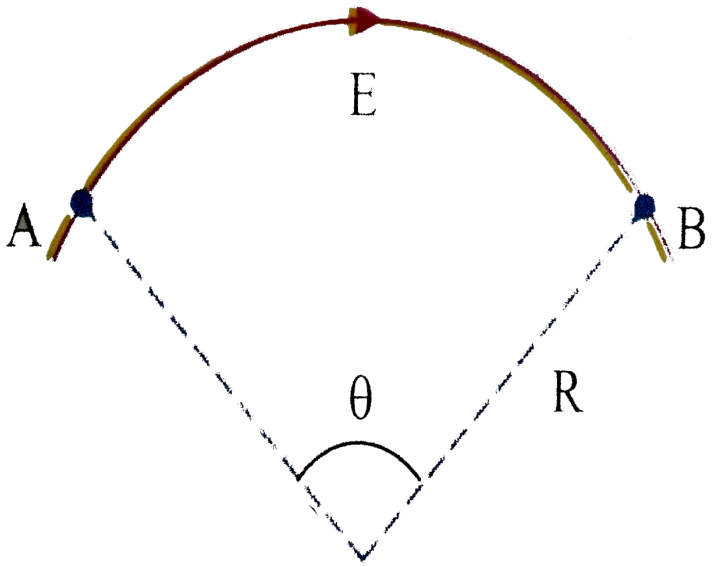
7. Figures shows an electric line of force which curves along a circular arc.The magnitude of electric field intensities is same at all points on this curve and is equal to E.If the potential at A is V ,the potential at B is



A. $V - ER\theta$

B. $V - 2ER \sin. \frac{\theta}{2}$

C. $V + ER\theta$

D. $V + 2ER \sin. \frac{\theta}{2}$

Answer: A

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8. The main scale of a vernier callipers reads $10mm$ in 10 divisions. Ten divisions of vernier scale coincide with nine divisions of the main scale. When the two jaws of the callipers touch

each other, the fifth division of the vernier coincides with 9 main scale divisions and zero of the vernier is to the right of zero of main scale, when a cylinder is tightly placed between the two jaws, the zero of the vernier scale lies slightly to the left of $3.2cm$ and the fourth vernier division coincides with a main scale division. Find diameter of the cylinder.

A. 3.19 cm

B. 3.14 cm

C. 3.04 cm

D. None of these

Answer: A

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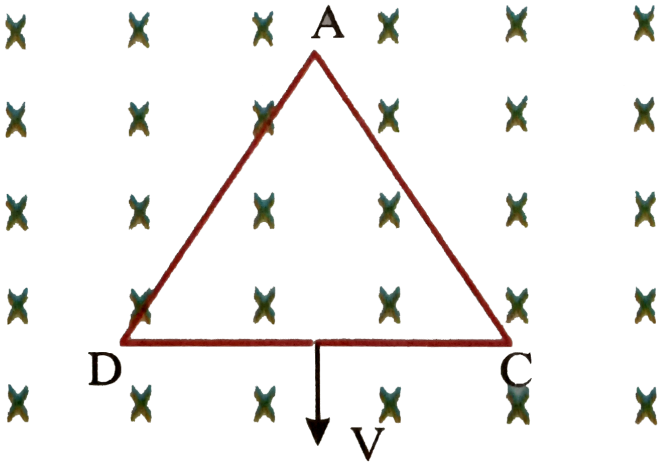
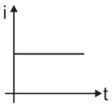
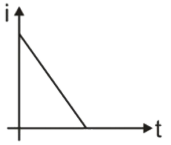
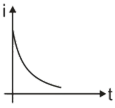
9. An equilateral triangular loop ADC having some resistance is pulled with a constant velocity v out of a uniform magnetic field directed inot the paper. At time $t = 0$, side DC of the loop at is at edge of the magnetic field.

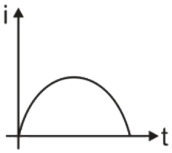


The induced current (i) versus time (t) graph will be as

A. 

B. 

C. 

D. 

Answer: B

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10. The kinetic energy of a particle executing SHM is 16J. When it is in its mean position. If the amplitude of oscillation is 25cm and the mass of the particle is 5.12 kg, the time period of its oscillation in second is

A. $20\pi s$

B. $2\pi s$

C. $\pi / 5 s$

D. $5\pi s$

Answer: C

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11. The energy that should be added to an electron to reduce its de-Broglie wavelength from 1 nm to 0.5 nm is

A. four times the initial energy

B. equal to the initial energy

C. twice the initial energy

D. thrice the initial energy

Answer: D

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12. A U - tube having a horizontal arm of length 20 cm, has a uniform cross - sectional area $1cm^2$. It is filled with water of volume 60

cc. The volume of a liquid of density $4\,\mathrm{g\,cc}^{-1}$ required to be poured in one arm of the U - tube so that no water is left in the horizontal arm of the tube is $\left(\text{take g} \quad = 9.8ms^{-2}\right)$

A. 60 cc

B. 45 cc

C. 50 cc

D. 35 cc

Answer: D

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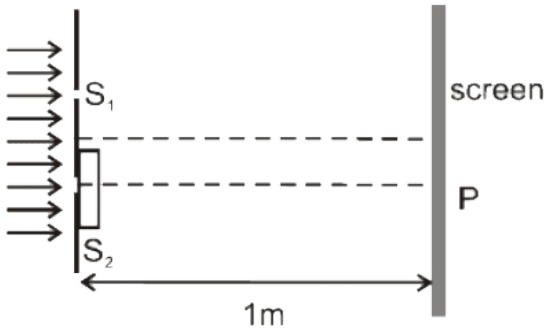
13. In standard Young's double - slit experiment, visible light $\lambda \in (350nm, 750nm)$ is used in both the slits. Distance between the slits is 2 mm, and the distance of the screen from the slits is 1 m. A thin glass slab $(\mu = 1.5)$ of thickness $6\mu m$ is placed in front of slit S_2. Which among the following wavelength is missing at point P, which is directly in front of slit S_2? (Neglect dispersion

of light)



A. 400 nm

B. 500 nm

C. 600 nm

D. 700 nm

Answer: A

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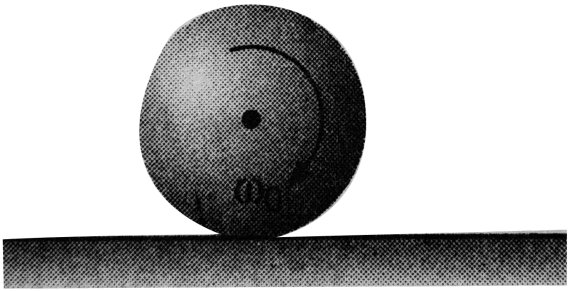

14.

solid sphere of radius r is gently placed on a rough horizontal ground with an initial angular speed ω_0 and no linear velocity. If the coefficient of friction is μ, find the time t when the slipping stops. in addition state the linear

velocity v and angular velocity ω at the end of slipping

A. $\frac{2}{7}\frac{r\omega_0}{\mu g}$

B. $\frac{3}{7}\frac{r\omega A_0}{\mu g}$

C. $\frac{3}{7}\frac{r\omega_0}{\mu g}$

D. $\frac{r\omega_0}{\mu g}$

Answer: A

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15. A piece of copper and another of germanium are cooled from room temperature to 77 K, the resistance of -

A. each of them increases

B. each of them decreases

C. copper decreases and of germanium increases

D. copper increases and of germanium decreases

Answer: C

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16. Which among the following statements is correct regarding the dependence of voltage gain of an amplifier on the frequency of the signal?

A. does not depend upon frequency of the signal

B. increases with frequency of the signal

C. decreases with frequency of the signal

D. initially constant and then decreases with frequency of the signal

Answer: D

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17. If P, Q and R are physical quantities, having different dimensions, which of the following combination can never be a meaningful quantity?

A. $\frac{PQ - Q^2}{R}$

B. $(PQ - R)$

C. $\frac{PQ}{R}$

D. $\left(\frac{PR - Q^2}{R}\right)$

Answer: A

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18. Assuming that the human pupil has a radius of 0.25 cm and a comfortable viewing distance of 25 cm. The minimum separation

between two point object that the human eye can resolve for the light of wavelength 500 nm is

A. $300\mu m$

B. $1\mu m$

C. $30\mu m$

D. $100\mu m$

Answer: C

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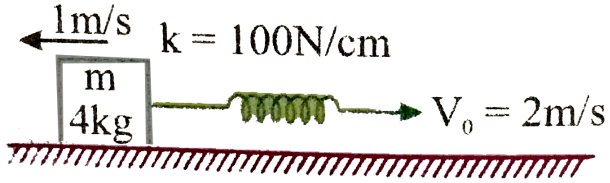
19. The spring block system lies on a smooth horizontal surface. The free end of the spring is being pulled towards right with constant speed $v_0 = 2m/s$. At $t = 0\,\text{sec}$, the spring of constant $k = 100N/cm$ is unstretched and the block has a speed $1m/s$ to left. The maximum extension of the spring is.



(A) 2 cm (B) 4 cm (C) 6 cm

A. 2 cm

B. 4 cm

C. 6 cm

D. 8 cm

Answer:

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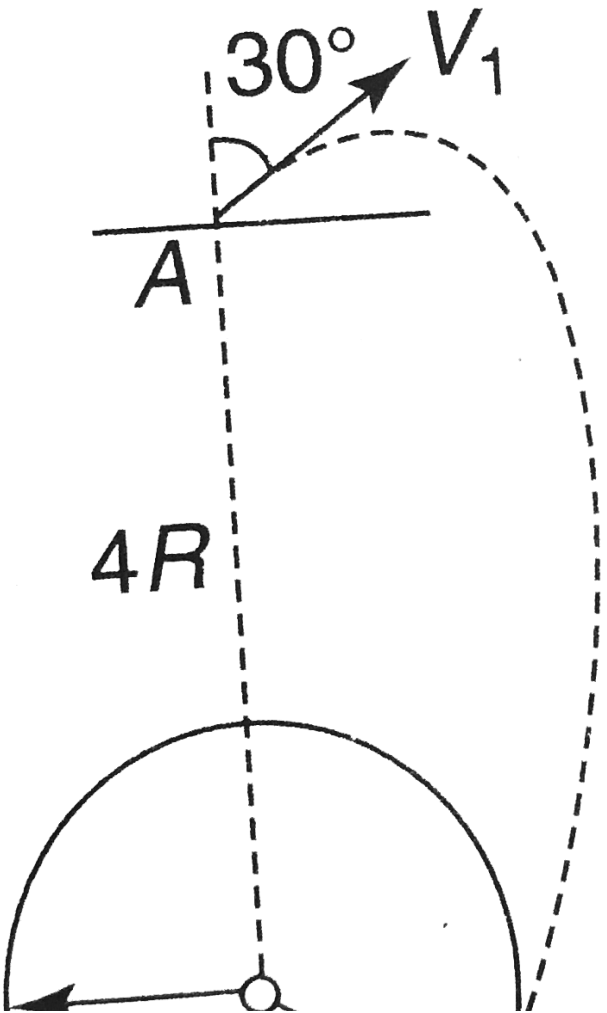
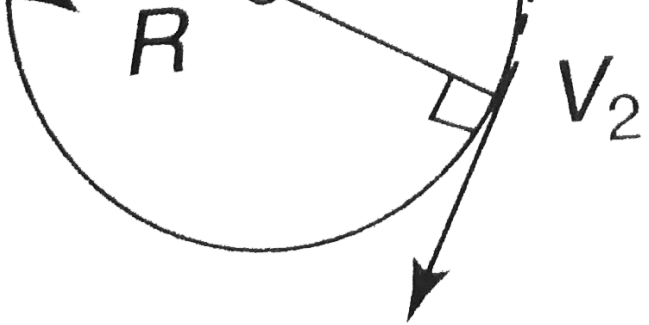
20. A particle is projected from point A, that is at a distance $4R$ form the centre of the earth, with speed V_1 in a direction making 30° with the line joining the centre of the earth and point A, as shown. Consider gravitational

interaction only between these two. (Use $\frac{GM}{R} = 6.4 \times 10^7 m^2/s^2$). The speed V_1 if particle pasess grazing the surface of the earth is





A. $4\sqrt{2}\mathrm{km\ s^{-1}}$

B. $3\sqrt{2}\mathrm{km\ s^{-1}}$

C. $6\sqrt{2}\mathrm{km\ s^{-1}}$

D. $5\sqrt{2}\mathrm{km\ s^{-1}}$

Answer: A

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21. A hill is $500m$ high. Supplies are to be across the hill using a canon that can hurl packets at a speed of $125m/s$ over the hill . The canon is located at a distance of $800m$ from the foot to hill and can be viewed on the ground at a speed of 2 m//s , so that its distance from the hill can be adjusted. What is the shortest time (in second) in which a packet can reach on the ground across the hill ? $g = 10m/s^2$.

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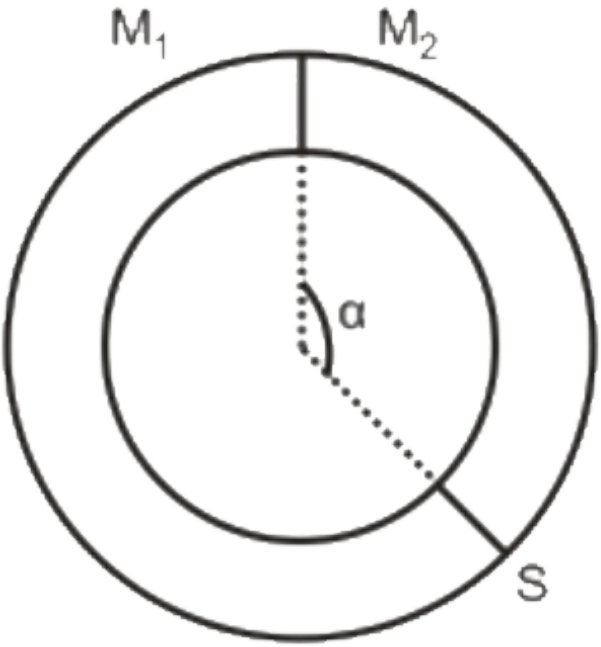
22. A ring - shaped tube contains two ideal gases with equal masses and relative molar masses $M_1 = 32 \text{ and } M_2 = 28$. The gases are separated by one fixed partition and another movable stopper S which can move freely without friction inside the ring . What is the value of the angel α (in degree) at equilibrium

?



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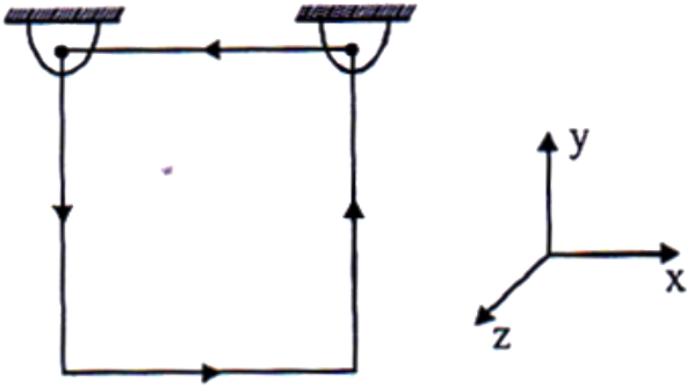
23. A current - carrying uniform square frame is suspended from hinged support as shown

in the diagram such that it can freely rotate about its upper side. The length and mass of each side of the frame are 2 m and 4 kg respectively. A uniform magnetic field $\vec{B} = \left(3\hat{i} + 4\hat{j}\right)$ is applied. When the wireframe is rotated to 45° from vertical and released it remains in equilibrium. What is the magnitude of current (in A) in the wire frame ?



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24. A plane is in level flight at a constant speed such that the speed of the air below the wings is $144\,\mathrm{km\,h^{-1}}$ and above the wing is $180\,\mathrm{km\,h^{-1}}$. If each of its wings has an area of $25\,\mathrm{m^2}$, then the mass (in kg) of the plane is $\left[\rho_{\text{air}} = 1\,\mathrm{kg\,m^{-3}}, g = 10 ms^{-2}\right]$

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25. An thin rod of negligible mass and area of cross - section $4 \times 10^{-6} m^2$, suspended vertically from one end, has a length of 0.5 m at $100^\circ C$. The rod is cooled to $0^\circ C$ but prevented from contracting by attaching a mass at the lower end. The value of this mass is (in Kg)

(Given, coefficient of linear expansion is $10^{-5^\circ} C^{-1}$, Young's modulus is $Y = 10^{11} Nm^{-2}$ and $g = 10 ms^{-2}$)

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