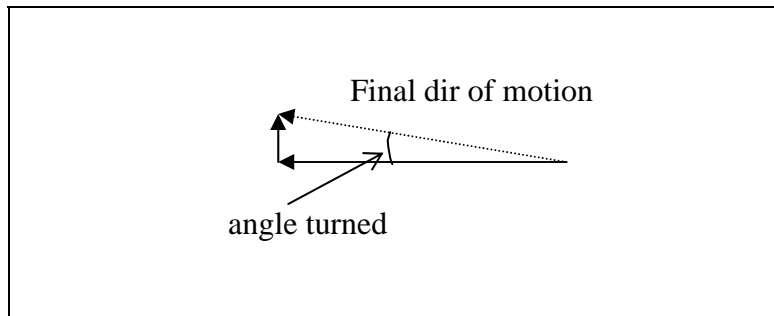


AL Physics MC Answers

Year:1991

Question Number: :4,6,11,15,20,25,27,31,32,35

1991MC (4)

Perpendicular momentum gained = $Ft = 1.0 \times 10^5 \times 5 = 5 \times 10^5 \text{ Ns}$ Perpendicular velocity after the application of the thrust = $5 \times 10^5 / 4 \times 10^4 = 12.5 \text{ ms}^{-1}$.Angle turned = $12.5/1500 = 0.0083 \text{ rad}$.

1991MC (6)

If the cart can complete the circular track safely, the forces acting on it must be adequate in view of the centripetal force required. The condition is satisfied everywhere if it is satisfied at the top. The marginal case is there when at the top the weight of the cart is totally used for centripetal acceleration, i.e.

$$mg = mv^2/R, \text{ where } R \text{ is the radius of the circle.}$$

$$\text{Min KE at the top} = mv^2/2 = mgR/2$$

By conservation of energy,

KE at the bottom

$$\begin{aligned} Mv'^2/2 &= mg(2R) + mv^2/2 \\ &= 5mgR/2 \end{aligned}$$

$$v' = \sqrt{5gR} = \sqrt{5 \times 10 \times 10}$$

1991 MC (11)

Stress and strain are the quantities which are independent of the dimensions of the wire.

Wires made of the same material have the same breaking stress and the breaking strain.

- (1) The breaking strain (= breaking stress/Young's modulus) is unchanged. But extension = strain \times length of the wire. A longer wire has a longer breaking extension.
- (2) Work done = $F_e/2$. Because of the same breaking stress and cross-sectional area, the force to break the wire is the same. e is longer, so W.D. is larger
- (3) The breaking stress is unchanged, i.e. $5.0 \times 10^8 \text{ N m}^{-2}$.

 1991 MC (15)

The force required to separate a pair of atoms from x to $x + \Delta x$ is $k \Delta x$, The area occupied by ONE atom on a plane is x^2 . By definition, **stress = force/area = $k\Delta x/x^2$** .

n molecules per unit area, so $n(x^2) = 1$, $1/x^2 = n$ and **stress = $nk\Delta x$** .

1991 MC (20)

The media is air-film-air

Reflection at the first surface (air to film): π change.

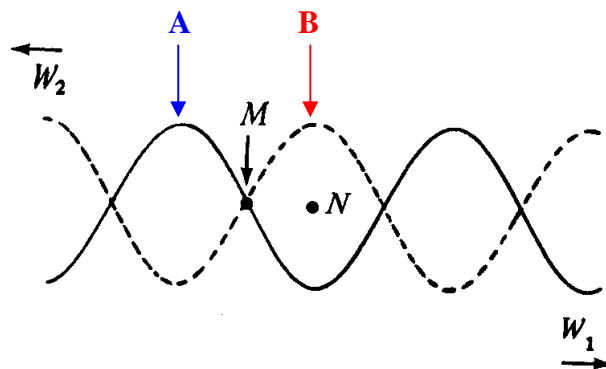
Reflection at the second surface (film to air): no π change

The two reflected rays interferes destructively when

$$2nd = m\lambda$$

$$\text{For } m = 1, d = 600\text{nm}/(2 \times 1.25) = 240 \text{ nm}$$

1991MC (25)

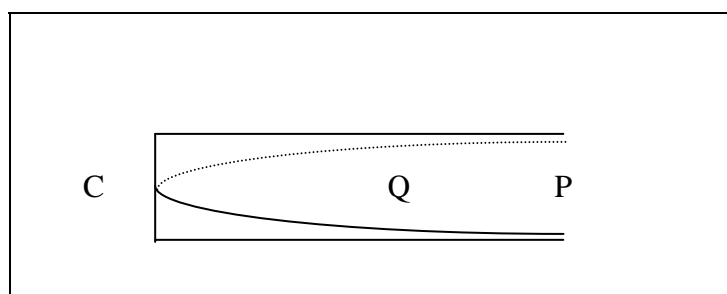


(1) $\lambda = 4MN$

(2) After a quarter of period, the crest A will arrive M and the crest B will arrive M. So at M, the amplitude is $2A$.

(3) AT N, the two waves arriving are always antiphase (opposite, e.g. one is crest, the other is trough; one is $+2$, the other is -2 , and so on). Point N is a displacement node (cf M is displacement antinode)

1991MC (27)



In a stationary wave, all points between two nodes are vibrating in phase

Particles Q and P are vibrating in phase. The phase difference is 0

1991MC(32)

- (1) Correct. By symmetry, the p.d's. across L_1 and L_2 are both 6 V. So they glow with the same brightness
- (2) Correct. The operating voltage of L_2 is 6 V
- (3) Incorrect. When S is opened, L_1 will take a voltage less than 6 V (because a parallel combination of 5Ω and something must be less than 5Ω ; in series, V is proportional to resistance)

1991MC (31)



No matter the sphere is hollow or solid, all the charges will reside at its outermost surface

Outside (A to B): All charges are concentrated at the center

$$E = \frac{Q}{4\pi\epsilon_0 r^2} \quad \text{and} \quad V = \frac{Q}{4\pi\epsilon_0 r}$$

Inside: $E = 0$ and $V = \text{constant}$ $\left[E = -\frac{dV}{dr} \right]$

What is the value of the constant V?

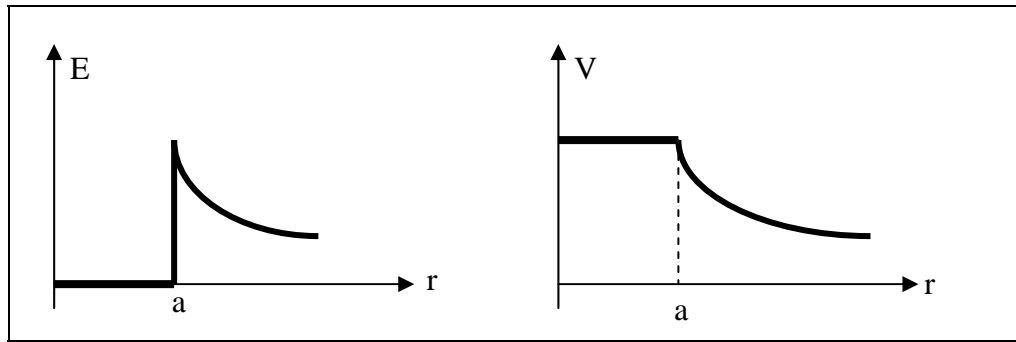
Suppose a charge is brought from infinity to C, the route is infinity to A and then to C. The electric field on the path A to C is zero, so no work is done.

$$WD(\infty \rightarrow C) = WD(\infty \rightarrow A)$$

Potential at C is defined as the work done against the electrostatic force in bringing unit charge from infinity to C.

So Potential at C = potential at A.

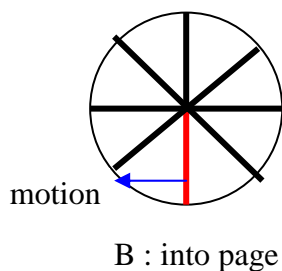
The potential at all points inside a hollow (or solid) conducting sphere is equal to the potential at the surface of the sphere.



B is incorrect because $E = \frac{dV}{dr} \neq 0$ inside the sphere. **In electrostatics, the electric field inside a metal should be zero. Otherwise, the electric field will push the electron electrons to move. Internal currents appear, so it is not electrostatic.**

1991MC (35)

It is a disc generator.



The field is pointing into page.

Consider the red wire, its motion is to the left, so the induced current through it is downward

The potential at the center is negative.

Similar cases happen to other wires (they are effectively joined in parallel).

The current flows from the rim to the center via an external circuit.

Quantitatively, $\varepsilon = Br(\omega r/2)$, where r is the radius and ω is the angular speed of rotation