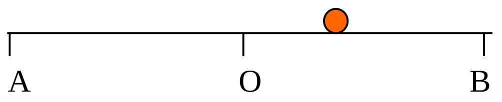
AL Physics MC Answers

Year:1985

Question Number:4,8,15,16,17,18,29,44

1985MC (4)

SHM on a line AOB



	Displacement	Velocity	Acceleration
B	→	0	←
B to O	→	←	←
O	0	←	0
O to A	←	←	→
A	←	0	→
A to O	←	→	→
O	0	→	0
O to B	→	→	←

(A) It is wrong, a and v can be in the same direction (e.g. B to O)

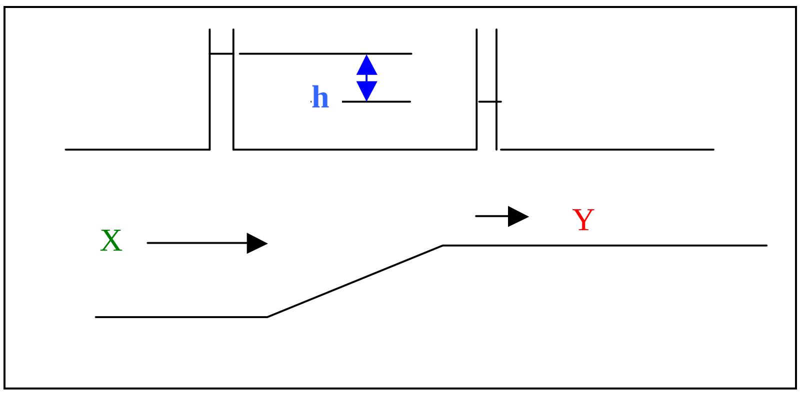
(B) Max acceleration = $\omega^2 A$, so max accel is proportional to the square of frequency.

(C) At the center of oscillation, x = 0, a = 0 and v is maximum (so KE is max)

(D) PE is proportional to x^2. When x increases, PE increases, acceleration increases (in magnitude)

(E) $a \propto -x$. So, in magnitude, a increases with x.

1985 MC (8)



Equation of continuity $A_X V_X = A_Y V_Y$ … … … … ….(1)

Bernoulli's equation $P_X + \rho V_X^2/2 = P_Y + \rho V_Y^2/2$

i.e. $P_X - P_Y = \rho V_Y^2/2 - \rho V_X^2/2$ … … … … ….(2)

Eliminate V_Y (or V_X) from (1) and (2)

$P_X - P_Y = [(A_X/A_Y)^2 - 1]\rho V_X^2/2$ … … … … ….(3)

The manometers record the pressure difference

$$P_X - P_Y = \rho gh \quad \ldots\ \ldots\ \ldots\ \ldots\ \ldots. \ (4)$$

From (3) and (4)

$$\rho gh = [(A_X/A_Y)^2 - 1]\rho V_X{}^2/2$$

$$V_X = \sqrt{\frac{2gh}{(\frac{A_X}{A_Y})^2 - 1}} = \sqrt{\frac{2\times10\times50\times10^{-3}}{(\frac{50}{35})^2 - 1}} = 0.577 ms^{-1}$$

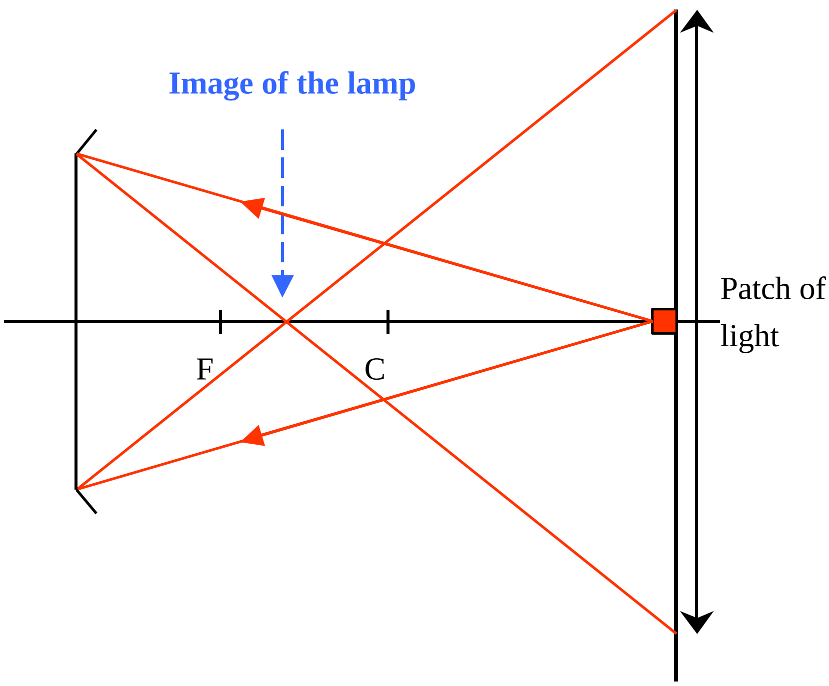
Rate of flow of liquid mass = mass of liquid flow in one second

= ρAV

= $1.00 \times 10^3 \times 50 \times 10^{-6} \times 0.577$

= 2.89×10^{-2} kg s^{-1}

1985MC (15)



Radius of curvature = 12 cm, object distance = 24 cm.

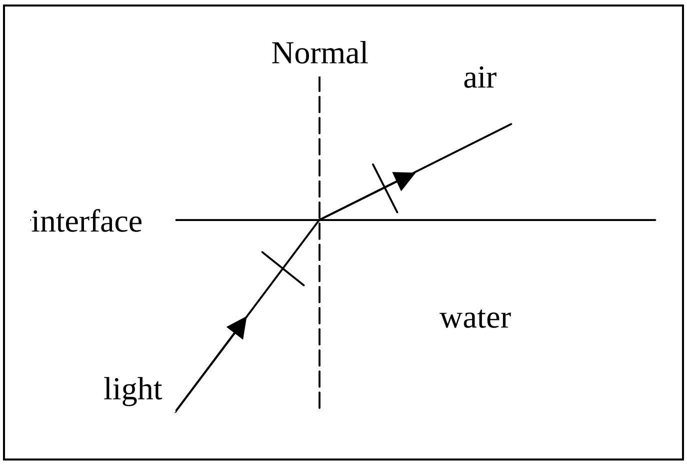
The object is placed beyond the center of curvature (2F), so the image of the lamp will be formed between F and C. After reflection by the concave mirror, any rays emitted from the lamp will be converged to the image of the lamp. After convergence, the rays will continue their paths and so diverge outwards. The rays shine on the wall and thus form a patch of light on it. The mirror is circular, so the patch of light is circular. The patch of light is larger than the size of the mirror because the image-wall distance is greater than the image-mirror distance (see the above figure).

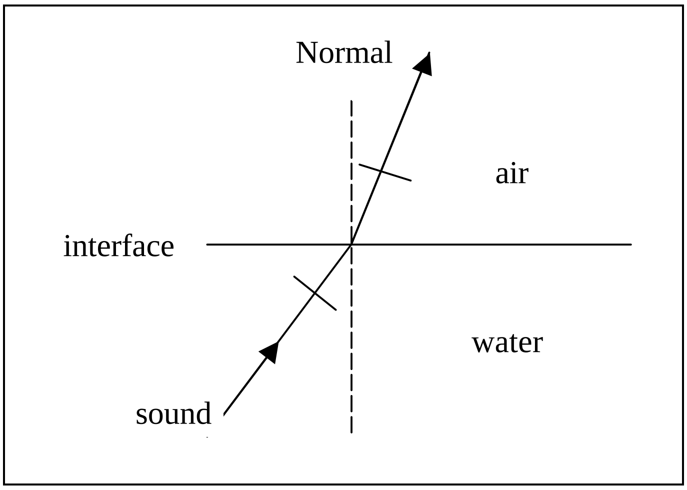
1985MC(16)

The time between two loud sounds is 2.5 cm x 0.2mscm^{-1} = 0.5 ms

Beat frequency = 1/0.5 ms = 2000 Hz

1985MC(17)



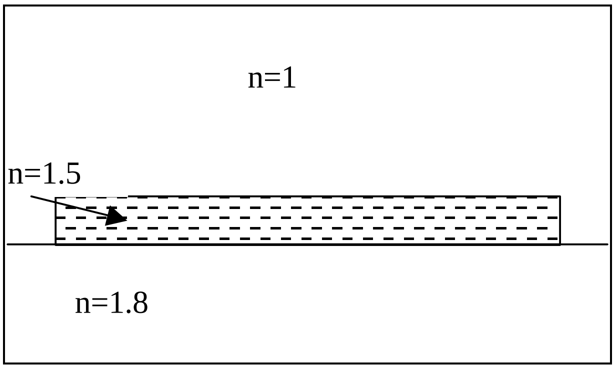


Refraction occurs because the speed of the wave changes when it across an interface. A light beam goes from water into air, it will bend away from the normal because its speed in air is greater than that in water.

The situation is completely different if the wave is a sound wave, not a beam of light.

Ultrasound travels faster in water than in air. So when a beam of ultrasound goes to air from water, it will bend towards the normal (just like a beam of light goes to water from air).

1985MC (18)



Reflection at to the upper surface : π change

Reflection at the lower surface: π change

Destructive interference occurs when 2nd =(m+1/2) λ, where m = 0, 1, 2, 3, ...

n = 1.5, λ = 200 nm

When m = 0, λ = 4nd = 1200 nm

When m = 1, λ = 400 nm (answer).

1985MC (29)

Emf of inductor $e = -L\frac{dI}{dt}$. The minus sign is introduced because of Lenz's law

First stage: the current increases linearly. So ε is constant. X is positive w.r.t. Y(ground) because such an induced emf will oppose the increasing current.

Second stage: the current decreases linearly. ε is constant and X is negative w.r.t. Y(ground)

1985MC(44)

Let ε be the emf and r be the internal resistance of the battery

(1) The electrical power delivered by the battery = εI

(cf. The power used in the external circuit = $\varepsilon I - I^2 r$)

(2) Electrical energy = εQ

[(1) and (2) comes from the definition of emf:

The electromotive force of a source (a battery, generator, etc.) is the energy (chemical, mechanical, etc.) converted into electrical energy when unit charge passes through it

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(3) The terminal p.d is ε -Ir. When the circuit is open, the current is zero, so terminal p.d. = ε. (When the battery draws a current, terminal p.d. < ε)
