

Year: 1983

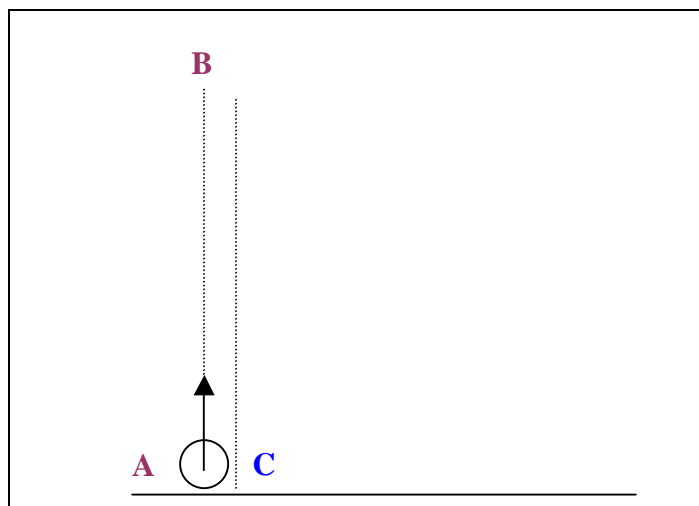
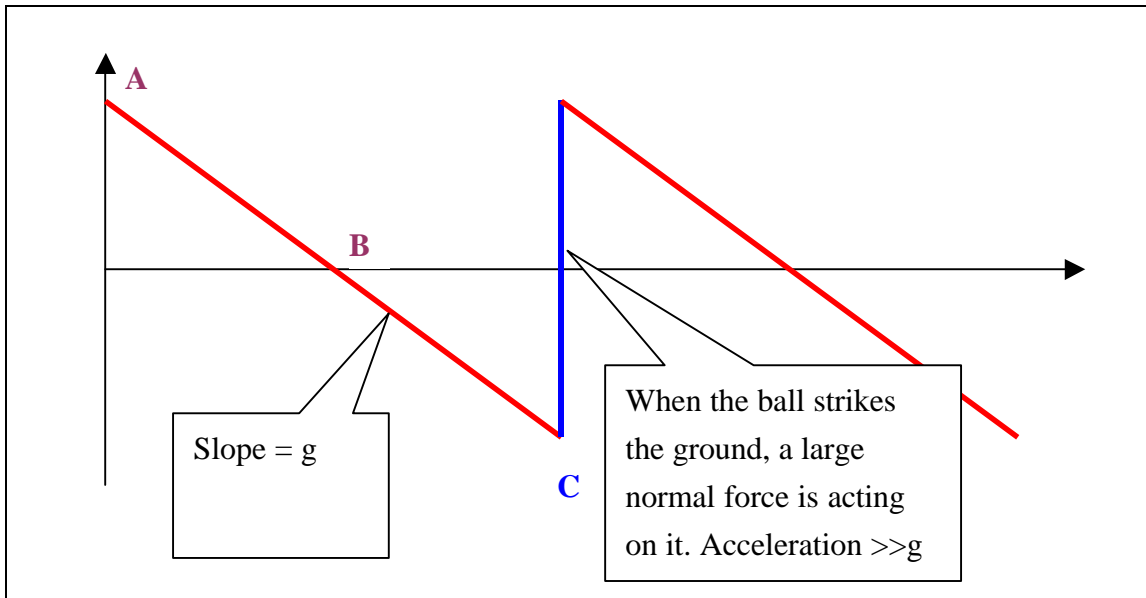
Question Number: 1,2,7,10,22,23,25,39

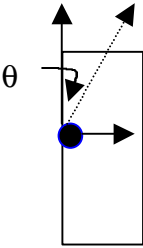
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1983MC (1)

$$v = u + gt$$

So the v-t graph is a straight line





In one second, the ship moves to the north by 1.73 m.  
At the same time, the man walks to the east by 1 m.  
So his motion is N-W with the angle  
 $\theta = \tan^{-1}(1/1.73) = 30^\circ$   
His dir. Is N30°E.

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1983MC (7)

From Y to Z,

Vertical motion:  $y = gt^2/2$      $t = \sqrt{2 \times 2/10} = 0.632s$

Horizontal motion;  $x = u_x t$  ,     $u_x = 3/0.632 = 4.74 \text{ ms}^{-1}$

From X to Y

$mgh = mu_x^2/2$      $h = 4.74^2/(2 \times 10) = 1.125 \text{ m}$

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1983MC (10)

**Total momentum must be conserved:** D and E are impossible.

Total KE after collision is equal (elastic) or less than (inelastic) that before collision: A is impossible

B or C ???

X is behind Y, so it cannot move faster than Y. C is impossible

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1983 MC(22)

By symmetry, current through X = current through Y = I

Current through the  $8\Omega$  resistor = 2I

Loop around X and the  $8\Omega$  resistor

$10V = I(4\Omega) + 2I(8\Omega)$

$I = 0.5 \text{ A}$

Current through the  $8\Omega$  resistor = 1 A

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Wheatstone bridge -- not examined today.

No current through G, so

current thru'  $40\Omega$  = current thru'  $50\Omega$  and

$$\text{pd across } R = \text{p.d. across the } 40\Omega \quad \dots \dots \dots (1)$$

$$\text{p.d. across } 50 \Omega = 2 \text{ V} \quad \dots \dots \dots (2)$$

From (2), current thru'  $50 \Omega = 0.04 \text{ A}$

From (1),  $(0.4 - 0.04)R = 0.04(40)$

$$R = 4.4 \Omega$$

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1983 MC (25)

In a motor,  $V - \epsilon = IR$ , where  $\epsilon$  is the back emf, which is proportional to speed.

At the beginning,  $\omega = 0$ , so  $\epsilon = 0$ , so the current should be the largest. However, **the inductance of the armature coil prevents a sudden rise of the current**. It needs a certain time for the current to rise to the peak. When the coil gains speed, the back emf increases with time, so the current drops. A steady current finally flows in the coil to produce a torque to do the work against the load or friction.

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1983 MC (39)

Some facts about standing waves in a pipe

- (1) At notes- molecules do not vibrate
- (2) We hear a sound coming from a closed pipe → energy comes out.
- (3) "closed pipe"----a pipe with one end closed and one end open.



In the fundamental mode, the maximum amplitude of oscillation occurs at the open end, not at the middle.