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**Example #18**

Some informations are given for a body moving in a straight line. The body starts its motion at  $t=0$ .

**Information I :** The velocity of a body at the end of 4s is 16 m/s

**Information II :** The velocity of a body at the end of 12s is 48 m/s

**Information III :** The velocity of a body at the end of 22s is 88 m/s

The body is certainly moving with

- (A) Uniform velocity (B) Uniform speed  
(C) Uniform acceleration (D) Data insufficient for generalization

**Solution****Ans. (D)**

$$\text{Here average acceleration} = \frac{16-0}{4-0} = \frac{48-16}{12-4} = \frac{88-48}{22-12} = 4$$

But we can't say certainly that body have uniform acceleration.

**Example #19**

A large number of particles are moving each with speed  $v$  having directions of motion randomly distributed. What is the average relative velocity between any two particles averaged over all the pairs?

- (A)  $v$  (B)  $(\pi/4)v$  (C)  $(4/\pi)v$  (D) Zero

**Solution :****Ans. (C)**

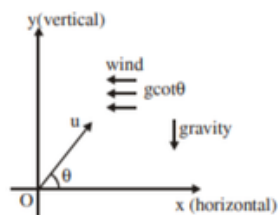
Relative velocity,  $v_r = |\vec{v}_1 - \vec{v}_2|$  where  $v_1 = v_2 = v$

If angle between them be  $\theta$ , then  $v_r = \sqrt{v^2 + v^2 - 2v^2 \cos \theta} = \sqrt{2v^2(1 - \cos \theta)} = 2v \sin\left(\frac{\theta}{2}\right)$

$$\text{Hence, average relative velocity } \bar{v}_r = \frac{\int_0^{2\pi} 2v \sin\left(\frac{\theta}{2}\right) d\theta}{\int_0^{2\pi} d\theta} = \frac{4v}{\pi}$$

**Example #20**

A ball is projected as shown in figure. The ball will return to point :



- (A) O (B) left to point O (C) right to point O (D) none of these

**Solution :****Ans. (A)**

Here  $\frac{a_x}{a_y} = \frac{g \cot \theta}{g} = \frac{1}{\tan \theta} = \frac{u_x}{u_y} \Rightarrow$  Initial velocity & acceleration are opposite to each other.

$\Rightarrow$  Ball will return to point O.

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