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Subject - Mechanics

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Topic - Assignment No - 2

## Assignment No.2

(82) A ballon going up with a constant velocity droped a stone which takes 4 seconds to reach the ground. The moment this stone strikes the ground, another stove is dropped from the ballon and this one takes 5 seconds to reach the ground. with what velocity is the ballon rising? From what height is the second stone dropped?

Ans: (8.829 m/s, 78.48m)

Ans→ Free body diagram



$S_1$  4sec     $S_2$  5sec

stone1          stone2
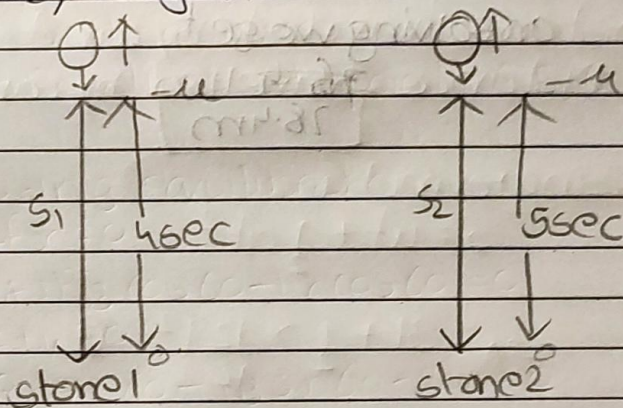
from the diagram

$$S_1 = -4u + \frac{1}{2} \cdot 9.8 \times (4)^2 \qquad \Big\} \ (S = (ut + \frac{1}{2}at^2)$$

$$\& \ S_2 = -5u + \frac{1}{2} \times 9.8 \times (5)^2 \Big\}$$

but $S_2 - S_1$ is the distance travelled by ballon in 4sec

$\Rightarrow$

let

$\alpha = S_2 - S_1$

$= u + 44.1$

$\Rightarrow \alpha = 4u + 0$

$\Rightarrow 4u = -u + 44.1$

$5u = 44.1$

$u = 8.82$

$\therefore \boxed{u = 8.82 \, m/s}$

Now $S_1 \cdot S_2 = -5(8.82) + \frac{1}{2}(9.8)(8.82)^2$

on solving we get

$\boxed{\cancel{76.4} \; 78.4m}$

**Q1)** Two cars moving in same direction are 150m apart, car A being ahed of car B. At this instance, velocity of A is 3m/s & constant acceleration of 1·2m/s² while the velocity of car B is 30m/s and its uniform retardation is 0·6m/s². How many times do the cars cross each other? Find when and where they cross, with respect to the given position of A.

**Ans⟶** Soln: Let

Distance travelled by car A = $S_A$
& Distance travelled by car B = $S_B$

Using formula.
$$S = ut + \frac{1}{2}at^2$$

$$S_A = 3t + \frac{1}{2} \times \frac{12}{10}t^2 \quad -①$$

$$S_B = 30t + \frac{1}{2} \times \frac{6}{10}t^2 \quad -②$$

Car B will over car A when
$$S_B = S_A + 150$$

Putting the values in ① & ②

$$S_A = 3t + \frac{1}{2} \times \frac{3}{5}t^2$$

⟹

$$S_A + 150 = 30t + \frac{1}{2} \times \frac{6^3}{10} t^2$$

$$3t + \frac{3t^2}{5} + 150 = 30t + \frac{3}{10} t^2$$

so from the given equations

$t_1 = \cancel{76} \ 7.363, \ at \ 54.62 \ from A$

$t_2 = 22.63 \ , \ at \ 375.37m \ from B$