

Free Ball

HW

- a) A ball is thrown upward with an initial velocity of 10.0 m/s from the top of a 50.0 m tall building.
- (a) With what velocity will the ball strike the ground?
- (b) How long does it take the ball to strike the ground?

Initial velocity (u) = 10 m/s
Height of building = 50 m
(s) $y = -50.0 \text{ m}$ (displacement)

$$u = 10 \text{ m/s}$$

$$a) v^2 = u^2 - 2gs$$

$$\Rightarrow (10 \text{ m/s})^2 - 2(9.8 \text{ m/s}^2)(-50 \text{ m}) \Rightarrow 1.08 \times 10^3 \text{ m}^2/\text{s}^2$$

$$v^2 = 1.08 \times 10^3 \text{ m}^2/\text{s}^2$$

$$v = \sqrt{1.08 \times 10^3 \text{ m}^2/\text{s}^2} = \pm 32.9 \text{ m/s}$$

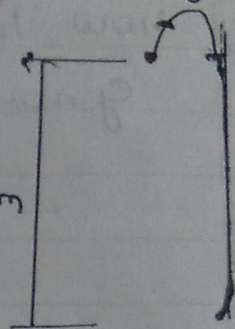
as the object is falling down

v is taken negative $\Rightarrow -32.9 \text{ m/s}$

$$b) v = u - gt$$

$$t = \frac{u - v}{g} = \frac{(10 \text{ m/s}) - (-32.9 \text{ m/s})}{9.8 \text{ m/s}^2} = \frac{42.9 \text{ m/s}}{9.8 \text{ m/s}^2}$$

$$\Rightarrow 4.38 \text{ s}$$



- 2) A Stone is dropped freely in the river from a bridge. It takes 5s to touch the water surface in the river. Calculate
- Height of bridge from water level
 - Distance covered in the last second.

$$i) S = ut + \frac{1}{2}at^2$$

$$h = ut + \frac{1}{2} \times 9.8 \times 5^2 = 9.8 \times \frac{25}{2} = 122.5 \text{ m}$$

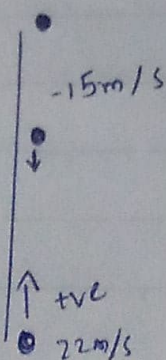
- ii) distance covered in last second is

$$S_t = ut + \frac{a}{2} (2t-1)$$

$$\rightarrow S(5) = 0 + \frac{9.8}{2} (2 \times 5 - 1)$$

$$) S(5) = 0 + \frac{1}{2} \times 9.8 (2 \times 5 - 1) = 44.1 \text{ m}$$

- 3) A tennis ball is struck with a racket, hitting it straight upward at 22 m/s. After how much time will it be falling at 15 m/s



$$a = -g = -10 \text{ m/s}^2$$

$$v = -15 \text{ m/s}, u = 22 \text{ m/s}$$

$$v = u + at$$

$$\rightarrow -15 = 22 - 10t$$

$$\rightarrow t = \frac{22+15}{10} = 3.75$$