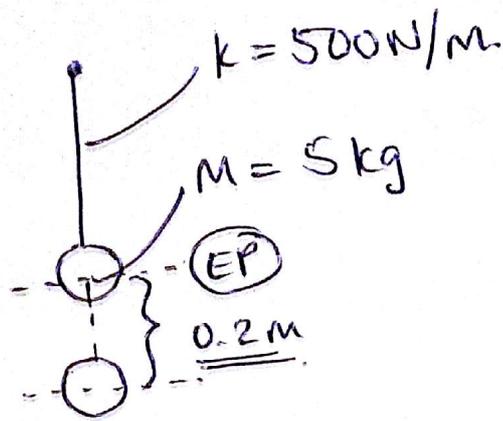


2008

Q6 (a)



(i) We need to find EP.

$$F_{\text{up}} = F_{\text{down}}$$

$$\rightarrow F_{\text{up}} = -k(x) \quad \leftarrow \text{we don't have natural length info!}$$

$$\rightarrow F_{\text{down}} = mg$$

$$\therefore mg = kx$$

$$\therefore 5g = 500x$$

$$x = \frac{5(9.8)}{500} = \frac{49}{500}$$

(ii) Now pull a further distance x .

$$F = F_{\text{down}} - F_{\text{up}}$$

$$= mg - k\left(\frac{49}{500} + x\right)$$

$$\therefore F = 5(9.8) - 500\left(\frac{49}{500} + x\right)$$

$$F = 49 - 49 - 500x.$$

$$F = -500x.$$

$$ma = -500x$$

$$a = \frac{-500}{5}x$$

$$\boxed{a = -100x} \quad \therefore \text{SHM}$$

~~$$\omega = 2\pi$$~~

$$\omega^2 = 100$$

$$\boxed{\omega = 10} \text{ rad/s.}$$

(iii) released at extreme position,

$$\therefore x = A \cos \omega t.$$

$$x = 0.2 \cos(10t)$$

$$\text{@ } 0.1 \text{ s : } x = 0.2 \cos 1.$$

$$x = 0.1081 \text{ m.}$$

$$v^2 = \omega^2 (A^2 - x^2).$$

$$v^2 = 100 (0.04 - 0.1081^2)$$

$$v^2 = 2.8323$$

$$v = \boxed{1.68 \text{ m s}^{-1}}$$

$$a = \omega^2 r = 100(0.1081)$$
$$= \boxed{10.81 \text{ m/s}^2}$$