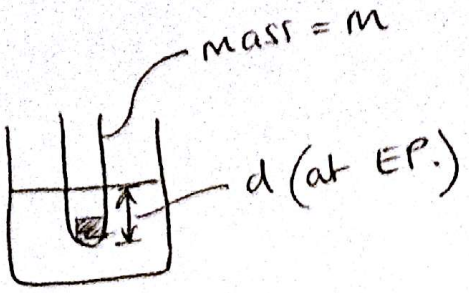
2015

(6) (a).



(i). $F \propto l$ ← submerged length

$\therefore F = kl$

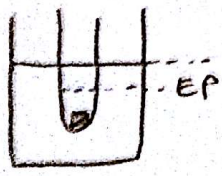
↑ some proportionality constant.

@ EP, forces up = forces down

$\therefore \quad kd = mg$

$$\boxed{k = \frac{mg}{d}}$$

(ii).



resultant force ⇒

$F = F_{down} - F_{up.}$

$F = mg - k(x + d).$

$F = mg - kx - kd.$

$F = mg - kx - mg$

$F = -kx$

$ma = -kx$

$$\boxed{a = \frac{-k}{m}x} \quad \therefore \text{ SHM.}$$

$$\omega^2 = \frac{k}{m}$$

$$\therefore \omega = \sqrt{\frac{k}{m}}$$

$$\therefore T = \frac{2\pi}{\sqrt{k/m}} = \boxed{2\pi\sqrt{\frac{m}{k}}}$$