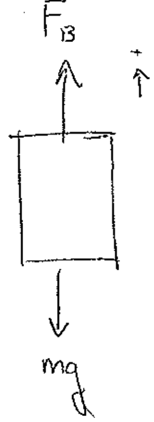
(3) A)



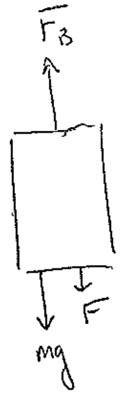
$$\sum F_y = F_B - mg = \cancel{0}\; m(0)$$

$\Longrightarrow \cancel{mg}$ $\quad (1000\,kg/m^3)\,(0.04\,m^2)(0.6\,m)(10\,m/s^2) = 240N$

$$\Longrightarrow mg = F_B = \rho_w V_w g = \cancel{\rho_w (\pi)}\,($$

↳ *Since the bouyancy force is the weight of the displaced water.*

B)



$$\sum F_y = F_B - mg - F = m(0)$$

$$\Longrightarrow F = F_B - mg = (1000\,kg/m^3)(0.04\,m^2)(0.7\,m)(10\,m/s^2) - 240N = 40N \text{ down!}$$

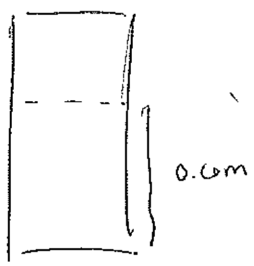
c) *Once again:*

$$\sum F_y = F_B - mg - F = m(0)$$

$$\Longrightarrow F = F_B - mg = (1000\,kg/m^3)(0.04\,m^2)(0.8\,m)(10\,m/s^2) - 240N = 80N$$

So we need <u>40N</u> *in addition to part B.! this seems linear to me!*

D) Lets take a look at the bouancy force as a function of how much is submerged.



$$F_B = (1000\,kg/m^3)(0.04\,m^2)(10\,m/s^2)h = \underbrace{(400\,N/k)}_{\text{identify this as k}}h$$

$$\omega = \sqrt{k/m} = \sqrt{\frac{400\,N/m}{24\,kg}} = \boxed{4.08\,rad/sec}$$

E) For a damped oscillator, the equation is:

$$y(t) = Ae^{-bt/2m}\cos(\omega t - \phi), \quad A = -2\,cm$$

but since it starts from rest, $\phi = 0$, so we're left with:

$$y(t) = Ae^{-bt/2m}\cos(\omega t)$$

Now, at the top of the cycle, $t = \frac{T}{2} = \frac{2\pi}{2\omega} = \boxed{\frac{\pi}{\omega}}$

$$y(\pi/\omega) = A\left(e^{-b\pi/2m\omega}\right)\left(\cos\left(\frac{\pi}{\omega}\omega\right)\right) = -Ae^{-b\pi/2m\omega} = 1.8\,cm$$

$$\Longrightarrow e^{-b\pi/2m\omega} = \frac{-1.8\,cm}{A} = 0.9$$

$$\Longrightarrow \frac{-b\pi}{2m\omega} = \ln(0.9) = -0.1054$$

$$\Longrightarrow b = \frac{(0.1054)(2m\omega)}{\pi} = \frac{(0.1054)(2)(24\,kg)(4.08\,Hz)}{\pi} = \boxed{6.57\,kg/sec}$$