

# Physics 151 Practic Exam #1 Sol<sup>n</sup>s

1) The volume of the cylinder is  $\pi R^2 L = 5 \times 10^5 \text{ m}^3$   
 The mass of the water is  $\frac{1 \text{ g}}{1 \text{ cm}^3} \times \left(\frac{100 \text{ cm}}{\text{m}}\right)^3 \times 5 \times 10^5 \text{ m}^3$   
 $= 5 \times 10^{11} \text{ g} = 5 \times 10^8 \text{ kg}$

2)  $\Delta x = v_0 t + \frac{1}{2} a t^2$   
 $v = v_0 + a t$

We know  $\Delta x$ ,  $t$ , and  $v$  but not  $a$ , nor  $v_0$   
 lets ~~the~~ solve for  $a$  and substitute

$$v - v_0 = a t$$

$$\frac{v - v_0}{t} = a$$

$$\Delta x = v_0 t + \frac{1}{2} \left(\frac{v - v_0}{t}\right) t^2 = \frac{v_0 t + v t}{2}$$

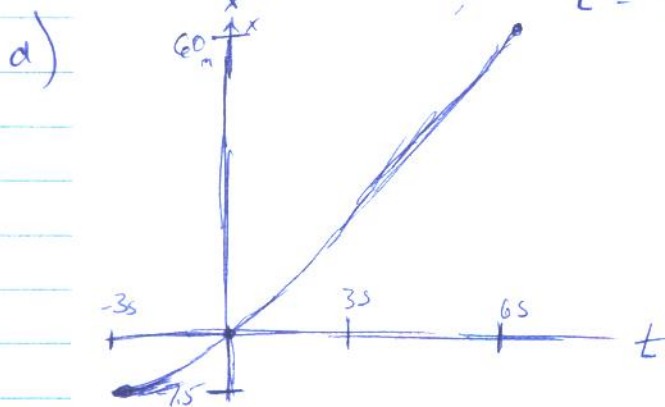
Solving for  $v_0$  we find

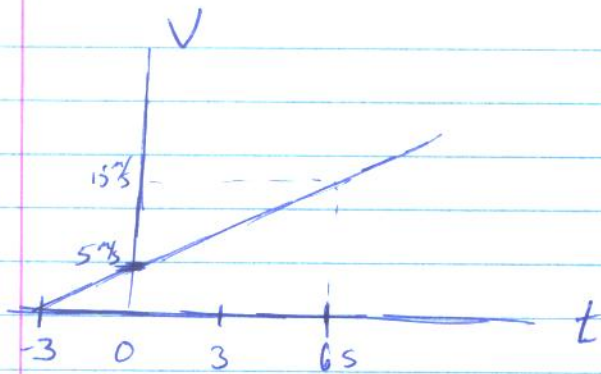
a)  $v_0 = \frac{2 \Delta x}{t} - v = 5 \text{ m/s}$

which means that

b)  $a = \frac{15 \text{ m/s} - 5 \text{ m/s}}{6 \text{ s}} = \frac{5}{3} \text{ m/s}^2$

c) The velocity was zero at  
 $v = v_0 + a t = 0$   
 $5 \text{ m/s} + \frac{5}{3} t = 0$   
 $t = -3 \text{ s}$





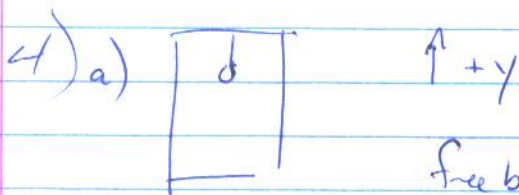
3) If  $t$  is measured in seconds and  $x$  is measured in meters

a)  $D$  has units  $\Rightarrow m/s$

b) The velocity  $\frac{dx}{dt} = \frac{D}{2\sqrt{t}}$

c) The acceleration  $\frac{dv}{dt} = -\frac{D}{4t^{3/2}}$

d) for positive  $t$  the molecule is slowing down, because the acceleration is negative.



free body diagram for the lamp



$$\vec{a} = \frac{\sum \vec{F}}{m} = \frac{T \hat{j} - mg \hat{j}}{m}$$

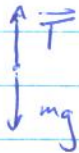
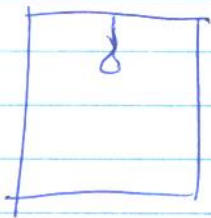
$$m\vec{a} = T \hat{j} - mg \hat{j}$$

$$m(\vec{a} + g \hat{j}) = T \hat{j}$$

The accel is  $+2.4 m/s^2 \hat{j}$  so

$$m = \frac{T}{g + 2.4 m/s^2} = \frac{89 N}{9.8 m/s + 2.4 m/s} = 0.3 kg$$

b)



$$a = 2.4 \hat{j} \text{ m/s}^2$$

This is exactly the same situation as before, so  $\vec{T} = 89 \text{ N} \hat{j}$