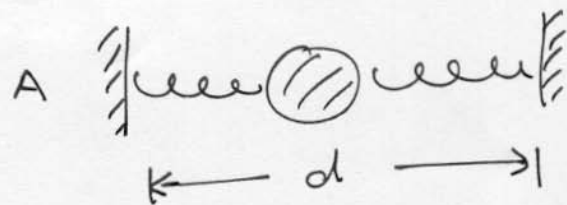


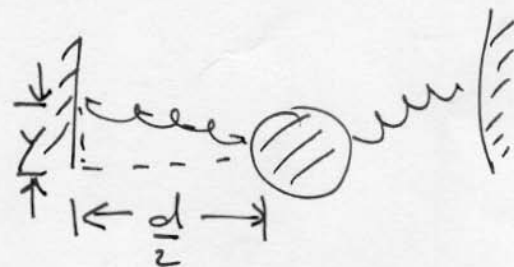
Midterm 2

Problem 1

$$E_A = \frac{1}{2} k \left(\frac{d}{2} - l_0 \right)^2 \times 2$$
$$= k \left(\frac{d}{2} - l_0 \right)^2$$



$$E_B = \frac{1}{2} k \left(\sqrt{\left(\frac{d}{2} \right)^2 + y^2} - l_0 \right)^2 \times 2$$
$$- mgh$$



$$E_A = E_B$$

$$\Rightarrow k \left(\frac{d}{2} - l_0 \right)^2 = k \left(\sqrt{\left(\frac{d}{2} \right)^2 + y^2} - l_0 \right)^2 - mg y$$

$$k \left(\frac{d^2}{4} - 2 d l_0 + l_0^2 \right) = k \left(\frac{d^2}{4} + y^2 - 2 l_0 \sqrt{\frac{d^2}{4} + y^2} + l_0^2 \right) - mg y$$

$$k l_0 \left(\sqrt{d^2 + 4 y^2} - d \right) = mg y$$

$$k = \frac{mg y}{l_0 \left(\sqrt{d^2 + 4 y^2} - d \right)} = 84.6 \text{ N/m}$$