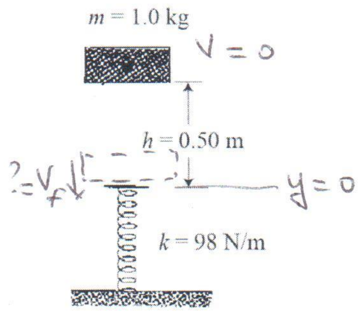
QUIZ#7- CHAPTER 8
DATE: 28/10/19

Name: Key Id#: Sect.#:

A block, of mass 1.0 kg, initially at rest, falls from a height of $h = 0.50$ m, on a vertical spring as shown in the figure. The spring constant is $k = 98$ N/m.



(a) Calculate the speed of the block just before hitting the spring.

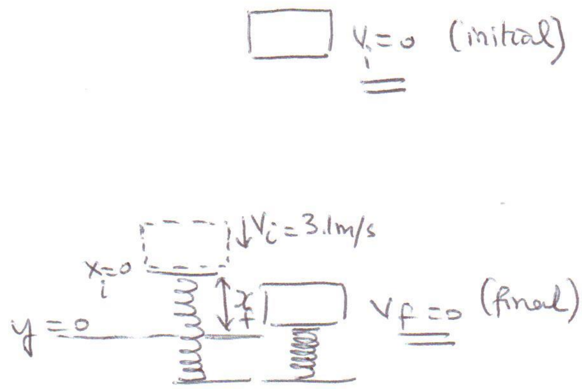
$$\Delta K + \Delta U_g = 0$$

$$\left(\frac{1}{2} m v_f^2 - 0\right) + mg(0 - h) = 0$$

$$\frac{1}{2} m v_f^2 = mgh \qquad v = \sqrt{2gh} = \sqrt{2 \times 9.8 \times 0.5}$$

$$\boxed{V_f = 3.13 \text{ m/s}}$$

(b) Calculate the maximum compression of the spring?



$$\Delta K^{\,0} + \Delta U_g + \Delta U_s = 0$$

$$mg[0 - (h + x)] + \frac{1}{2} k x^2 - 0 = 0$$

$$\frac{1}{2} k x^2 - mgx - mgh = 0$$

$$49 x^2 - 9.8 x - 4.9 = 0$$

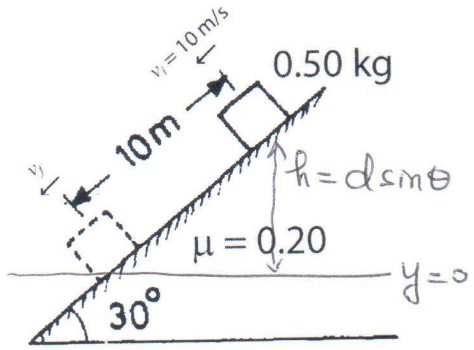
$$x = \frac{9.8 \pm \sqrt{9.8^2 - 4 \times 49 \times 4.9}}{98} = \frac{9.8 \pm 32.5}{98}$$

take ⊕ solution $x = \frac{9.8 + 32.5}{98} = \boxed{0.43 \text{ m}}$

QUIZ#7- CHAPTER 8
DATE: 28/10/19

Name: Key Id#: Sect.#:

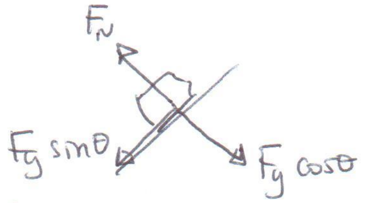
1. The figure shows a block, of mass 0.5 kg moving down an inclined rough plane of angle 30°. Calculate v_f.



$$\Delta K + \Delta U_g = W_f$$

$$\left(\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2\right) + mg(0-h) = -\mu_k f_k d$$

$$h = d\sin\theta \qquad f_k = \mu_k mg\cos\theta$$



$$F_N = F_g\cos\theta = mg\cos\theta$$

$$\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 - mgd\sin\theta = -\mu_k mgd\cos\theta$$

$$v_f = \sqrt{v_i^2 + 2(gd\sin\theta - \mu_k gd\cos\theta)} = \sqrt{10^2 + 2(9.8\times10\sin30° - 0.2\times9.8\times10\times\cos30°)}$$

$$\boxed{v_f = 12.8\ m/s}$$

2. A single conservative force is acting on a 10.0-kg body. If the work done on the body by this force is 60.0 J, find the change in its potential energy.

$$\Delta U = -W = -60\ J$$

You can solve the first question using Chapters 2+5!

$$mg\sin\theta = 0.5\times9.8\times0.5 = 2.45N \qquad F_{net} = 2.45 - 0.85 = 1.6N$$

$$\mu_k mg\cos\theta = 0.85N \qquad v_f = 12.8\ m/s$$

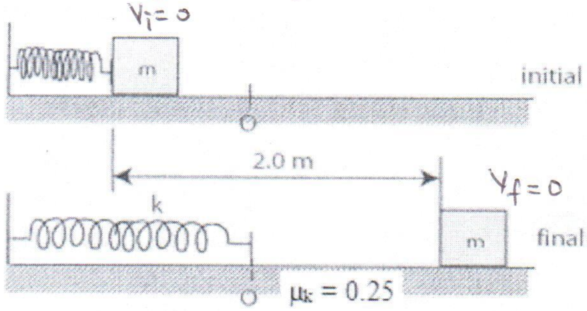
$$v_f^2 = v_0^2 + 2a\Delta x \qquad a = 3.2\ m/s^2$$

$$a = \frac{F}{m} = \frac{1.6}{0.5} \qquad \boxed{v_f = 12.8\ m/s}$$

QUIZ#7- CHAPTER 8
DATE: 28/10/19

Name: Key Id#: Sect.#:

1. A spring of k = 100 N/m is fixed at one end to the wall. A 5.00-kg block is pushed against the spring on a horizontal rough surface with a coefficient of kinetic friction $\mu_k = 0.250$. When the block is released from rest it travels a distance of 2.00 m before coming to full stop, as shown in the figure.



(a) How far was the spring compressed before being released?

$$\Delta K^{\,0} + \Delta U_s = W_f$$

$$\frac{1}{2}k(0 - x^2) = -f_k d \qquad f_k = \mu_k F_N = \mu_k m g$$

$$-\frac{1}{2}kx^2 = -\mu_k m g d$$

$$x = \sqrt{\frac{2\mu_k m g d}{k}} = \sqrt{\frac{2 \times 0.25 \times 5 \times 9.8 \times 2}{100}}$$

$$\boxed{x = 0.7\ m}$$

(b) What was the speed of the block just when it leaves the spring in its relaxed position?

$$\Delta K + \Delta U_s = W_f$$

$$\left(\frac{1}{2}m v_f^2 - 0\right) + \frac{1}{2}k(0 - x^2) = -\mu_k m g x$$

$$\frac{1}{2}m v_f^2 = \frac{1}{2}kx^2 - \mu_k m g x$$

$$v_f = \sqrt{\frac{kx^2}{m} - 2\mu_k g x} = \sqrt{\frac{100 \times 0.7^2}{5} - 2 \times 0.25 \times 9.8 \times 0.7}$$

$$v_f = \sqrt{9.8 - 3.43} = \boxed{2.5\ m/s}$$