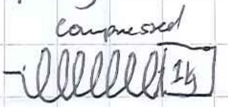
TSOKOS p. 113 #7, 8, 12, 24-27, 34

SL1 HW #12

⑦ Spring w/ $K = 200\ \frac{N}{m}$ is stretched from 3.0 cm → 5.0 cm $\Delta x = 2cm = .02m$

Work done $= \Delta EPE = \frac{1}{2}KX^2 = \frac{1}{2}(200\ \frac{N}{m})(.02m)^2 = \boxed{.04J}$

⑧ Spring w/ $k = 150\ \frac{N}{m}$ is compressed by 4.0 cm



→ $v = ?$ $\Delta EPE = \Delta KE$

$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$ $v^2 = \frac{kx^2}{m} = \frac{(150\ \frac{N}{m})(.04\ m)^2}{1\ kg} = 0.24\ \frac{m^2}{s^2}$

$\boxed{v = 0.49\ m/s}$

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⑫ Toy gun shoots 20.0 g ball w/ compressed spring $(k = 12\ \frac{N}{m})$
Compression = 10.0 cm.

- What speed does ball exit gun? (No friction)

$\Delta EPE = \Delta KE$ $\frac{1}{2}kx^2 = \frac{1}{2}mv^2$

$v^2 = \frac{kx^2}{m} = \frac{(12)(.1)^2}{(.02)} = 6$ $\boxed{v = 2.45\ m/s}$

- What will be exit speed of ball with .05 N of Friction

$\Delta EPE = \Delta KE + Work_{friction}$

Better to write
$\Delta EPE - W_{friction} = \Delta KE$

$\frac{1}{2}kx^2 = \frac{1}{2}mv^2 + F_f \cdot d$

$\frac{1}{2}(12)(0.1)^2 = \frac{1}{2}(.02)v^2 + (.05N)(.10)$

$v^2 = \frac{.06 - .005}{.01} = 5.5$ $\boxed{v = 2.35\ m/s}$

$\Sigma KE_0 \neq \Sigma KE_f$

$\frac{1}{2}(6)(4)^2 + 0 \neq \frac{1}{2}(14)(1.7)^2$

$48J \neq 20.2J$ Kinetic loss of energy = **27.8J**

(24) Mass of 6.0kg moves at 4.0m/s collides w/ 8.0kg at rest and sticks. How much KE is lost?

to find Vf for both, use cons. of momentum:

$m_1v_1 + m_2v_2 = (m_1+m_2)V_f$ ($v_2 = 0$)

$(6)(4) + 0 = (14)V_f \quad V_f = 1.7 m/s$

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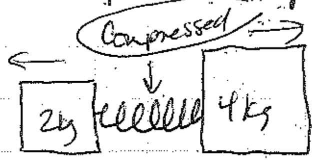
(25) 2 masses compress a spring between them.



$\Sigma p_0 = \Sigma p_f$

$(m_1+m_2)0 = m_1V_{f1} + m_2V_{f2}$

$0 = (2)(-3) + (4)V_{f2}$ $V_{f2} = 1.5 m/s$

When released, the 2kg mass moves w/ $v = 3 m/s$. What was energy stored in spring?

$KE_{02} + KE_{40} + EPE_s = KE_{2f} + KE_{4f}$ or $EPE_s = \Delta KE_2 + \Delta KE_4$

$EPE = \frac{1}{2}(2)(-3)^2 + \frac{1}{2}(4)(1.5)^2 =$ **13.5J**

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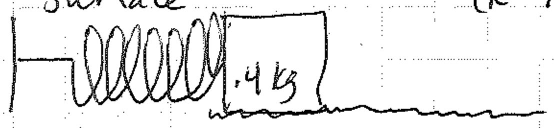
(26) Block compresses a spring while sitting on a rough surface $(K = 120 \frac{N}{m})$ $X = .15m$ (Compressed)



$F_s = 1.2N$ (Static friction)

(a) What speed will block have when spring returns to natural length?

$EPE_s - W_{friction} = \Delta KE_{block}$

$\frac{1}{2}Kx^2 - F_s x d = \frac{1}{2}mV_f^2$

$\frac{1}{2}(120)(.15)^2 - (1.2)(.15) = \frac{1}{2}(0.4)V_f^2$

$1.35 - .18 = 0.2V_f^2 \qquad V_f^2 = \frac{1.17}{0.2}$

$V_f = 2.42 m/s$

No friction

$EPE_s = \Delta KE_{block}$ $1.35 = 0.2 V_f^2$ $V_f = 2.60$ m/s

26 (b) What % is this of the speed it would have had with no friction? $\frac{2.42}{2.60} \times 100$ (93.1%)

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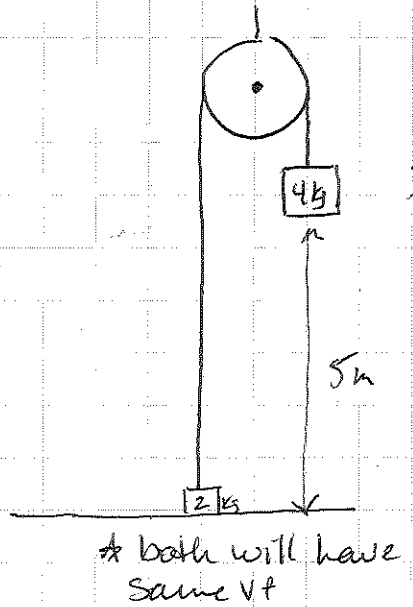
(27) 2 bodies connected by a string. Lighter body is resting on floor with the other being released from h = 5.0 m.



Calculate speeds of 2 bodies just as 4kg mass is about to hit the floor.

$\Sigma E_0 = \Sigma E_f$

$PE_0 + KE_0 = PE_f + KE_f$ (for both masses)

$(4)(10)(5) = (2)(10)(5) + \frac{1}{2}(6)V_f^2$

$200 = 100 + 3V_f^2$

$V_f^2 = \frac{100}{3}$ $V_f = 5.77$ m/s

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(34) Bungee jumper (m = 60 kg) jumps from 24 m bridge. rope = 12 m long (spring or bungee cord) → Hooke's law applies.

(a) k = ? if woman is to reach water.

$PE_g = EPE_s$ $(60\,kg)(10\,m/s^2)(24\,m) = \frac{1}{2}k(12\,m)^2$

$k = 200\ \frac{N}{m}$

(b) Same rope used by heavier man. Why will he hit the water.

F applied is much larger → will create a larger extension.