NO Reading assignment

H.W Due tonight

solutions available

work out H.W yourself!!

Exam II Monday 7:30 A.M

HERE

DAYLIGHT SAVINGS TIME

Sunday: spring Forward

Gravity

Work done in a gravitational field does not depend on path taken.

=> Gravitational potential energy is always the same at the same height regardless of path taken

If work done is independent of path taken → conservative force

Spring, gravity → conservative

Friction → not conservative

$W_{net} = \Delta K = W_c + W_{nc}$

we found earlier $W_c = -\Delta U$ (gravity)

$\Delta K = -\Delta U + W_{nc}$

$W_{nc} = \Delta K + \Delta U$

If we only have conservative forces $W_{nc} = 0$

$\Rightarrow \Delta K + \Delta U = 0$

$\frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 + U_f - U_i = 0$

$\frac{1}{2} m v_f^2 + U_f - \left(\frac{1}{2} m v_i^2 + U_i\right) = 0$

Total energy = kinetic + potential

$E_f = K_f + U_f \qquad E_i = K_i + U_i$

$E_f - E_i = 0 \Rightarrow E_f = E_i$

Energy is conserved (mechanical)

Energy Review

Potential (U)

Gravity: mgh

Spring: $\frac{1}{2}kx^2$ ($F=kx$)

K = spring constant

Kinetic (K)

$\frac{1}{2}mv^2$

$W_{net} = F_{net} d \cos\theta = K_f - K_i$

$W_c = -\Delta U$

conservative forces — work done independent of path taken

non-conservative forces — i.e. friction

$W_{NC} = \Delta K + \Delta U$

if only conservative forces

$\Delta K + \Delta U = 0$

Energy conserved (mechanical)

Potential Energy

Potential of an object to do work

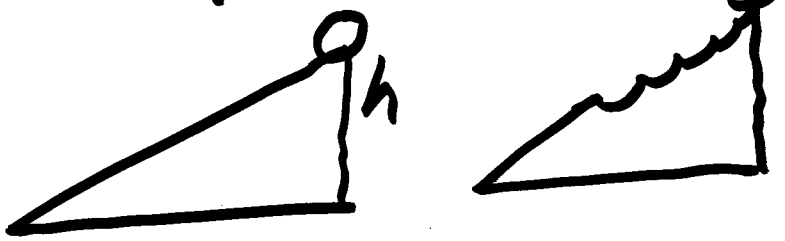
→ spring

→ Gravity

For Gravity

→ No absolute scale for potential energy. Something that is higher has a higher potential energy than something that is lower

ex) A child and sled of mass = 50kg slide down a <u>frictionless</u> hill. If sled starts from rest and has a speed of 3.00 m/s at bottom, how high is the hill?



conservation of Energy

$E_i = E_f$

$E_i = \frac{1}{2}mv_i^2 + u_i$

$E_f = \frac{1}{2}mv_f^2 + u_f$

$v_i = 0$

$u_i = mgh$

$v_f = 3\,m/s$

$u_f = 0$ defined ($h=0$)

$E_i \qquad E_f$

$$0 + mgh = \frac{1}{2}mv_f^2 + 0$$

$$h = \frac{v_f^2}{2g} = \frac{(3\,m/s)^2}{2 \cdot 9.8\,m/s^2} = .46\,m$$

ex) A 0.5 kg block is used to compress a spring with spring constant 80.0 N/m a distance of 0.02 m. When spring released, what is final speed of block?

$E_f = E_i$

$$\frac{1}{2}mv_f^2 + U_f = \frac{1}{2}mv_i^2 + U_i$$

$v_i = 0 \qquad v_f = ?$

$U_i = \frac{1}{2}kx^2 \qquad U_f = 0$

$$\frac{1}{2}mv_f^2 + 0 = 0 + \frac{1}{2}kx^2$$

$$\cancel{\frac{1}{2}}mv_f^2 = \cancel{\frac{1}{2}}kx^2$$

$$v_f = \sqrt{\frac{kx^2}{m}}$$

$$v_f = \sqrt{\frac{80\,N/m \cdot (.02\,m)^2}{.5\,kg}}$$

$$\boxed{.25\,m/s}$$

ex) A 1.2 kg object is dropped from a height of 10.0 m onto a spring with spring constant 500 N/m. How far does spring compress?

$E_i = E_f$

$v_i = 0$

$v_f = 0$

$h = 0$

$$\frac{1}{2}mv_i^2 + U_i = \frac{1}{2}mv_f^2 + U_f$$

$$0 + mgh = 0 + \frac{1}{2}kx^2$$

Gravity = 0 + spring

$$x^2 = \frac{2mgh}{k}$$

$$x = \sqrt{\frac{2 \cdot 1.2\,kg \cdot 9.8\,m/s^2 \cdot 10\,m}{500\,N/m}}$$

$$\boxed{= .68\,m}$$

$K_i = 0$ $E_i = E_f$

$U_i = mgh$

minimum h to make it around loop

$K_f = \frac{1}{2}mv^2$

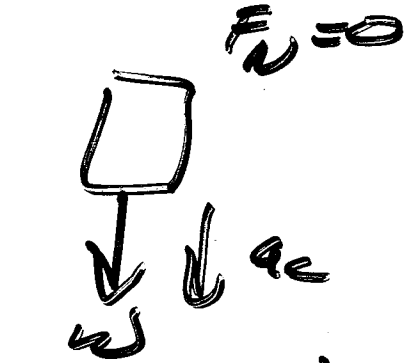
$U_f = mg2r$

$E_i = E_f$

$$mgh = \frac{1}{2}mv^2 + mg2r$$

$$\cancel{m}gh = \frac{1}{2}\cancel{m}gr + \cancel{m}g2r$$

$$\boxed{h = 2.5r}$$



$$mg = \frac{mv^2}{r}$$

$$v^2 = gr$$

Interactive Question

In which system is there a decrease in potential energy?

A) A boy stretches a spring.
B) A child slides down a sliding board.
C) A crate rests at the bottom of an inclined plane.
D) A car ascends up a steep hill.
E) More than one of the above

Exam II (Monday)

16 Questions (1 Free)

Dominated by chp 4+5
(chp 6 small part) 1 work
1 Kinetic Energy

calculational + concept Questions

some algebra, but I tried to limit it.

FREE Body diagrams

FORCES

$\Sigma \vec{F} = m\vec{a}$

Newton's 3 laws

centripetal acceleration

work

⋮

Satellites in orbit

inclined planes

sliding cars

starts at 7:30 A.M HERE