NO H.W Due Friday

Read 6.8 - 6.10

Exam

Grade calculator online

Redo exam during discussion section to earn back some points

Find mistake in exam & explain why.

$\frac{1}{2}$ point for each answer

+6 for fixing mistake → +16 points

Review (Quick)

Kinetic Energy $K = \frac{1}{2}mv^2$

Potential Energy

Gravitational $U = mgh$

Spring $U = \frac{1}{2}kx^2$

Total $E = K + U$

If only conservative forces

$E_i = E_f$

Energy conserved (mechanical)

A motorcycle rider leaps across a canyon with an initial speed of 38.0 m/s from a height of 70.0 m. He lands at a height of 35.0 m what is his final velocity? (magnitude)

$E_f = E_i$ $\quad E_i = E_f$

$\frac{1}{2}mv_f^2 + mgh_f = \frac{1}{2}mv_i^2 + mgh_i$

$\frac{1}{2}v_f^2 = \frac{1}{2}v_i^2 + gh_i - gh_f$

$v_f = \sqrt{v_i^2 + 2g(h_i - h_f)}$

$= \sqrt{(38\,m/s)^2 + 2 \cdot 9.8\,m/s^2 (70m - 35m)}$

$= 46.2\,m/s$

Interactive Question

Two marbles, one twice as heavy as the other, are dropped to the ground from the roof of a building. Just before hitting the ground, the heavier marble has

A) as much kinetic energy as the lighter one.
B) twice as much kinetic energy as the lighter one.
C) half as much kinetic energy as the lighter one.
D) four times as much kinetic energy as the lighter one.
E) impossible to tell.

ex) A 70 kg person bungee jumps off a 50 m bridge with his ankles attached to a 15 m rope. Assume that he is 2.0 m tall and he just stops at the edge. What is the spring constant of the cord?

$$E_f = E_i$$

$$\tfrac{1}{2}mv_f^2 + mgh_f + \tfrac{1}{2}kx_f^2 = \tfrac{1}{2}mv_i^2 + mgh_i + \tfrac{1}{2}kx_i^2$$

$$\tfrac{1}{2}kx_f^2 = mgh_i$$

$$k = \frac{2mgh_i}{x_f^2}$$

$-h_f = 0$

$x_i = 0$

$v_i = 0$

$v_f = 0$

$$k = \frac{2\cdot(70\text{ kg})(9.8\text{ m/s}^2)(50\text{ m})}{(33\text{ m})^2}$$

50 m

15

2 m

$50\text{ m} - 15\text{ m} - 2\text{ m} = 33\text{ m}$

$$k = 63\text{ N/m}$$

SO FAR Neglected friction

If no friction → Total mechanical energy conserved

Total Energy is always conserved

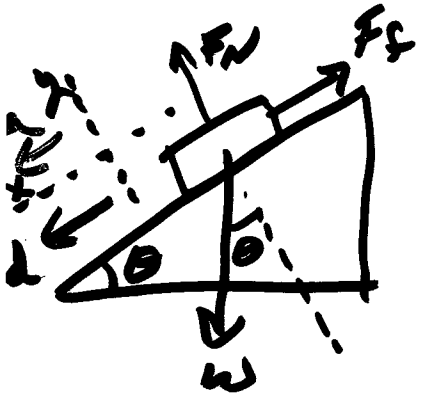
Can lose mechanical energy
Transferred to other types of energy
heat, sound ...

If we have friction

Total mechanical energy decrease
Total Energy remains same

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

ex) A 58 kg skier is coasting down a slope of 25°. A frictional force of 70 N opposes her motion. Near the top her speed is 3.6 m/s. What is her speed at a point 57 m downhill?



$$W_{net} = F_{net}\, d \cos\theta$$

$$x: \; -f_f + w\sin\theta = ma$$

$$-70\,N + (58\,kg)(9.8\,m/s^2)\sin 25^\circ$$

$$= \underline{170\,N} \quad F_{net}$$

$$W_{net} = (170\,N)(57\,m)\cos 0 = 9700\,J$$

$$W_{net} = K_f - K_i$$

$$K_f = 9700\,J + K_i$$

$$= 9700\,J + \tfrac{1}{2}mv_i^2$$

$$= 9700\,J + \tfrac{1}{2}(58\,kg)(3.6\,m/s)^2 =$$

$$\boxed{10{,}100\,J = K_f}$$

$$\frac{1}{2} m v_f^2 = 10,100\ J$$

$$v_f = \sqrt{(2 \cdot 10,100\ J)/58\ kg}$$

$$\boxed{v_f = 19\ m/s}$$