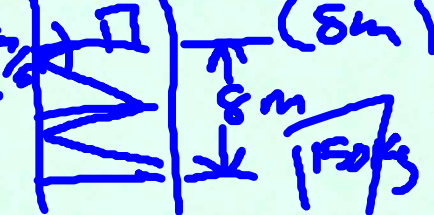


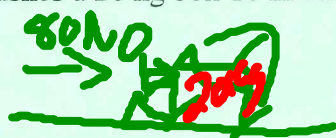
WORK-ENERGY PROBLEM WORKSHEET

- 2d 1. The third floor of a house is 8 m above street level. How much work is needed to move a 150 kg refrigerator to the third floor?

$$W = F \Delta s = W \Delta s = m g \Delta s = (150 \text{ kg}) (9.8 \text{ m/s}^2) (8 \text{ m})$$


2. If Stan does 176 J of work lifting himself 0.30 m, what is Stan's mass?

- 1st 3. Lee pushes a 20 kg box 10 m across the floor with a horizontal force of 80 N. How much work does Lee do?



$$W = F \Delta s = (80 \text{ N}) (10 \text{ m}) = 800 \text{ Nm} = 800 \text{ J}$$

4. Sau-Lan, with a mass of 52 kg, rides the up escalator at Ocean Park in Hong Kong, the world's longest. If the escalator has a length of 227 m and angle of 31° , calculate the work done by the escalator to lift Sau-Lan.

done

5. A librarian lifts a 2.2 kg book from the floor to a height of 1.25 m; carries the book 8.0 m to the stacks, and places the book on a shelf 0.35 m above the floor. How much work is done on the book?

done

6. A horizontal force of 805 N is needed to drag a crate across the floor with a constant speed. If the rope used to drag the crate makes an angle of 32° with the floor:

- a. Calculate the force applied along the rope.

$$W = F \Delta s \cos \theta$$

- b. Calculate the work done to pull the crate a distance of 22m.

done

- c. If the job is done in 8 seconds, how much power is developed?

done

7. Mary weighs 505 N. If she walks down a flight of stairs to a level 5.5 m below, what is the change in her potential energy?

P.E. \downarrow P.E.

$$\Delta P.E. = mgh = Wh = (505 \text{ N}) (5.5 \text{ m})$$

$\Delta P.E. = -$

8. Toni has a mass of 45 kg and is moving with a speed of 10 m/s.

- a. Calculate her kinetic energy.

$$K.E. = \frac{1}{2} m v^2 = \frac{1}{2} (45 \text{ kg}) (10 \text{ m/s})^2 = 2,250 \text{ J}$$

- b. If Toni's speed changes to 5 m/s, what is her kinetic energy? Compare to part a answer.

$$K.E. = \frac{1}{2} m v^2$$

$\rightarrow \frac{1}{4}$ as much

9. 1000 g of copper pellets ($c = .092 \text{ cal/g}^\circ\text{C}$) are continually dropped in a 1 m-long PVC tube 200 times. Calculate the temperature rise ($^\circ\text{C}$) in the pellets due to the work done on them.

$$P.E. = mgh = (1 \text{ kg})(9.8 \text{ m/s}^2)(200 \text{ m}) = 1960 \text{ J} \cdot \frac{1 \text{ cal}}{4.18 \text{ J}} = 468 \text{ cal}$$

$$Q = cm\Delta T \quad \text{so} \quad \Delta T = \frac{Q}{cm} = \frac{468 \text{ cal}}{(.092 \text{ cal/g}^\circ\text{C})(1000 \text{ g})} = 5.08^\circ\text{C}$$

10. An experimental train with a mass of $2.5 \times 10^4 \text{ kg}$ is powered by a jet engine with a thrust of $5.0 \times 10^5 \text{ N}$ over a track length of 509 m.

a. Calculate the work done on the train.

$$W = F\Delta s = (5.0 \times 10^5 \text{ N})(509 \text{ m}) = 25.45 \times 10^7 \text{ J}$$

b. Calculate the final velocity of the train (assume no friction).

$$K.E. = \frac{1}{2}mv^2 = W \quad v = \sqrt{\frac{2W}{m}} = \sqrt{\frac{2(25.45 \times 10^7 \text{ J})}{2.5 \times 10^4 \text{ kg}}} = 1.41 \times 10^3 \text{ m/s}$$

11. A 20 kg rock is on the edge of a 100 m tall vertical cliff

a. What is the rock's potential energy relative to the base of the cliff?

$$P.E. = mgh = (20 \text{ kg})(9.8 \text{ m/s}^2)(100 \text{ m}) = 1.96 \times 10^4 \text{ J}$$

b. If the rock falls off the cliff, what is its speed just before it strikes the ground?

$$v = \sqrt{2gh} = 44.3 \text{ m/s}$$

12. A bow hunter places a 60 g arrow on the bowstring and exerts an average force of 180 N to pull the bowstring back 0.45 m.

a. How much work has she done?

b. If the bow is 80% efficient, at what speed does the arrow leave the bow?

c. If fired vertically into the air, what height would the arrow achieve (assume 80% efficiency)?

13. A 3.0 kg gun, resting on a frictionless surface, fires a 12 g bullet with a muzzle velocity of 410 m/s.

a. Calculate the momenta of the bullet and gun after firing. Is momentum conserved?

b. Calculate the kinetic energy of the bullet and gun after firing. Is mechanical energy conserved?

14. A superball has a coefficient of restitution of 0.78. If it is dropped from a height of 2 m above the floor, to what height will it rebound?

15. If you could convert matter to energy with 1% efficiency, how much energy would 1 g of water produce?