



Virtual Learning

Physics

Power

May 22, 2020

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Objective/Learning Target:

Students will examine the concept of power then use it to solve various problems.

Quick Review #1

An apple hanging from a limb has potential energy because of its height. If it falls, what becomes of this energy just before it hits the ground? When it hits the ground?



Quick Review #1 Answer

As the apple falls the gravitational potential energy is converted to kinetic energy, and just before the apple hits the ground all of the potential will have been converted to kinetic energy. When striking the ground the energy is transferred to the ground as vibrations, heat, and sound. A small amount would return to the apple and make it bounce upward.



Quick Review #2

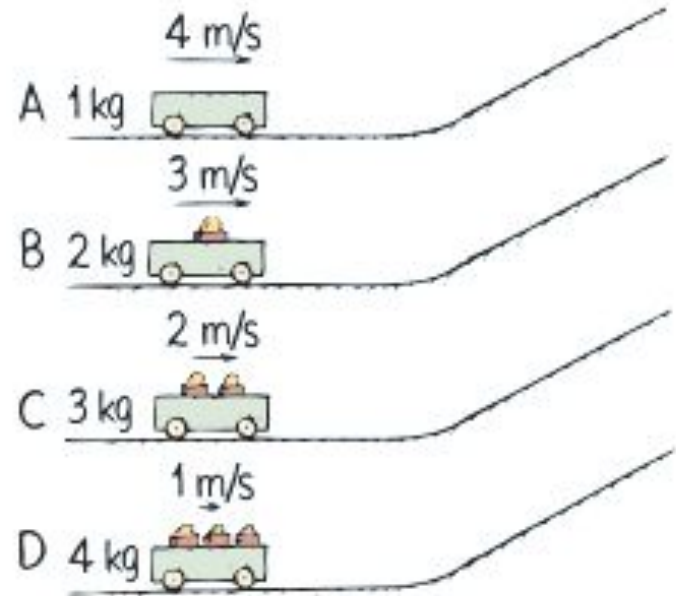
Carts moving along the lab floor run up short inclines. Friction effects are negligible.

a. Rank the carts by kinetic energy before they meet the incline.

b. Rank the carts by how high they go up the incline.

c. Rank the carts by potential energy when they reach the highest point on the incline.

d. Why are your answers different for b and c?



Quick Review #2 Answer

a. $\frac{1}{2} mv^2 \rightarrow A = 8 \text{ J}, \quad B = 9 \text{ J} \quad C = 6 \text{ J} \quad D = 4 \text{ J}$

So... $B > A > C, > D$

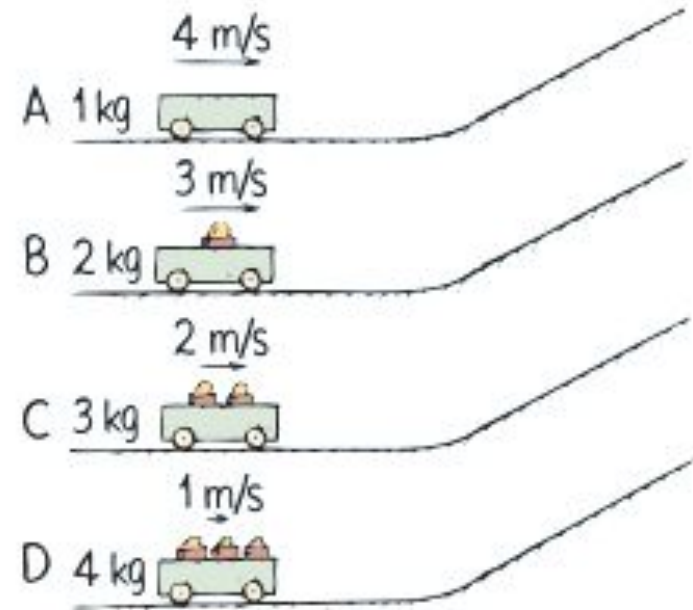
b. $h = KE/mg \rightarrow A = 0.81\text{m}, B = 0.46\text{m}$
 $C = 0.2\text{m}, D = 0.1\text{m}$

So... A, B, C, D

c. $PE_{\text{top}} = KE_{\text{bottom}}$

So... B, A, C, D

d. $PE_{\text{top}} = KE_{\text{bottom}}$

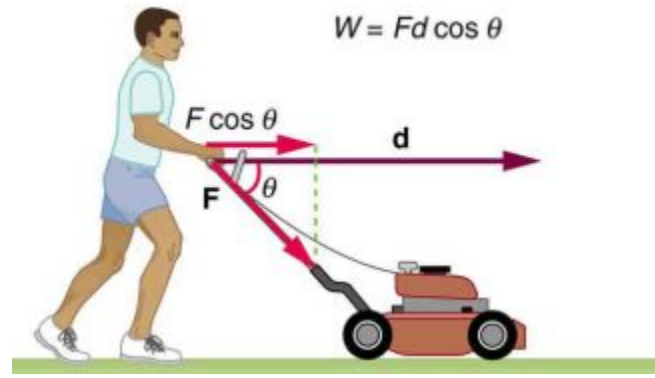


Power

Link: [Power](#)

Directions:

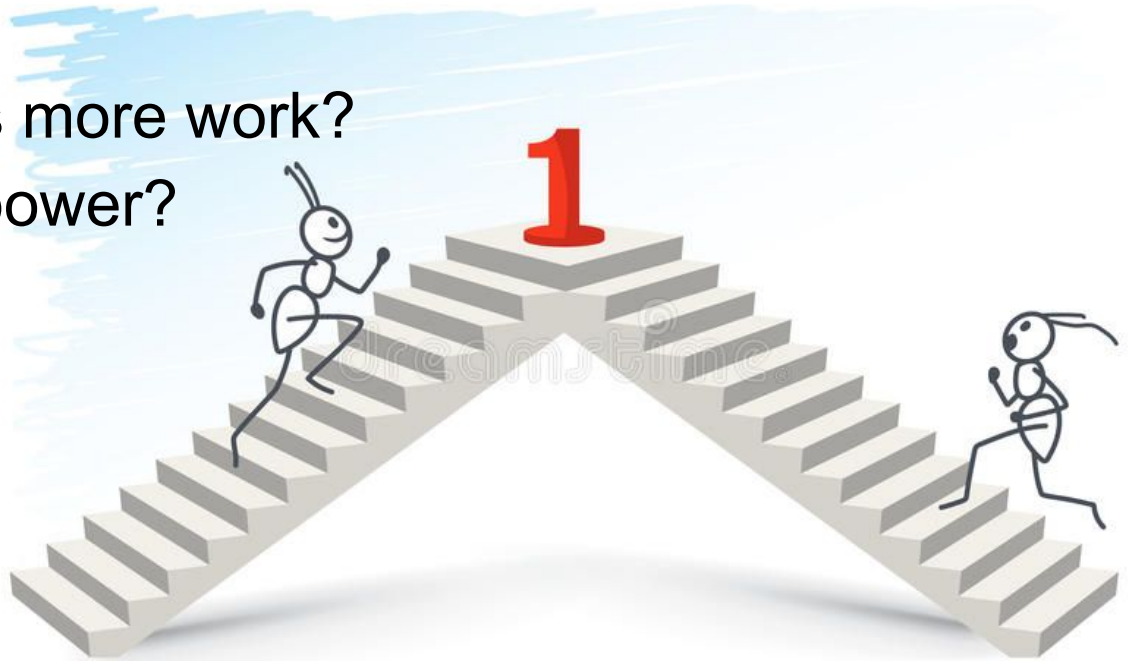
- Read through Power.
- Work through any examples on a separate piece of paper before you scroll down to the solution.
- On a separate piece of paper complete the practice problems on the following slides.
- Check your answers.
- For additional practice check out the conceptual questions and the problems and exercises in the table of contents for the online text linked above.



Practice Problem #1

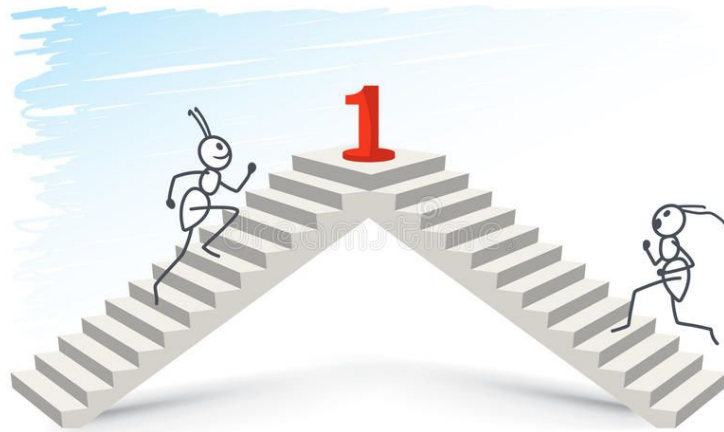
Two people who weigh the same climb a flight of stairs. The first person climbs the stairs in 30 s, and the second person climbs them in 40 s.

- a. Which person does more work?
- b. Which uses more power?



Practice Problem #1 Answer

- a. Both do the same amount of work. They lifted their body weight the height of the stairs. Same amount of force through the same distance.
- b. The person that climbed the stairs in the lesser amount of time expended more power. The same work done in less time.



Practice Problem # 2

A student with a mass of 80.0 kg runs up three flights of stairs in 12 s. The student has gone vertical distance of 8.0 m. What is the student's power?



Practice Problem # 2 Answer

$$\text{Power} = \frac{\text{work}}{\text{time}} = \frac{Fd}{t}$$

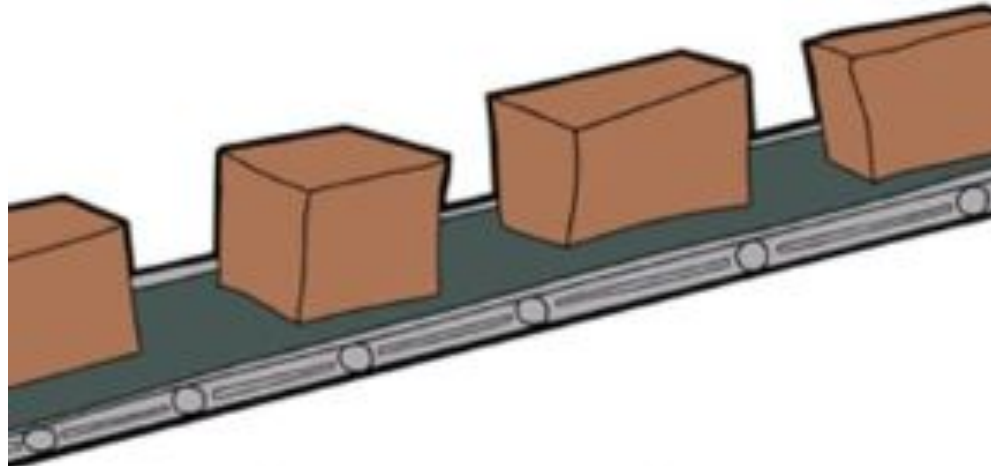
$$= \frac{(80.0 \text{ kg} \times 9.8 \text{ m/s}^2) \times 8.0 \text{ m}}{12 \text{ s}}$$

$$= 520 \text{ watts}$$



Practice Problem #3

A 12.0 meter long conveyor belt, inclined at 30.0° , is used to transport cases of printer paper from the production floor to the cargo bay to be loaded on delivery trucks. Each ream has a mass of 2.15 kg and there are 10 reams per case. Determine the useful power of the conveyor if it delivers 15 cases per minute.

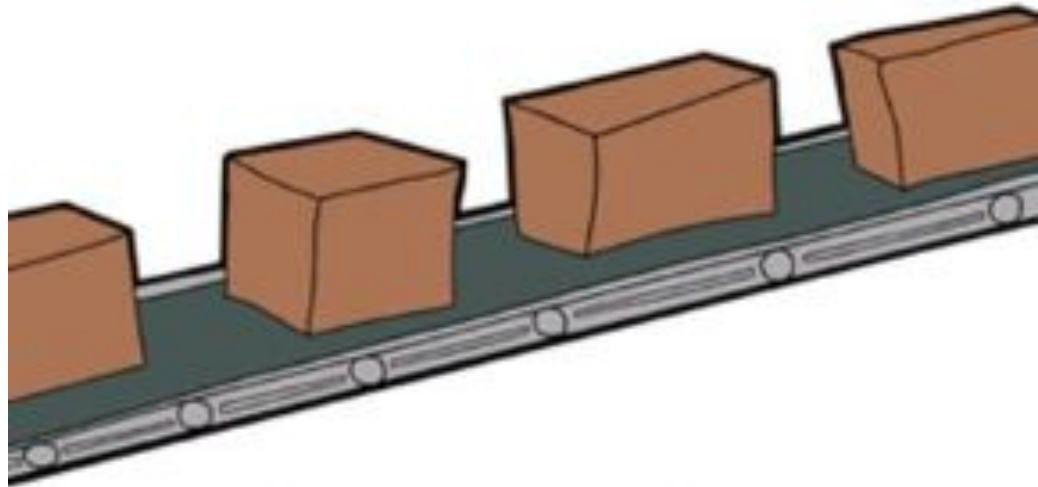


Practice Problem #3 Answer

$$\text{Power} = \frac{\text{work}}{\text{time}} = \frac{Fd}{t}$$

$$= \frac{(2.15 \text{ kg/ream})(9.8 \text{ m/s}^2)(10 \text{ reams/case})(15 \text{ cases}) \times 12.0 \text{ m} \times \sin 30^\circ}{60 \text{ sec}}$$

$$= \frac{1935 \text{ J}}{60 \text{ s}} = 316 \text{ watts}$$



Additional Practice

For additional practice check out the conceptual questions and the problems and exercises in the table of contents from the online text linked above.