

Read textbook pages 700-701 – The Meaning of Work and answer

1. The everyday meaning of the word “work” is different than its meaning in science. Keeping that in mind, what is Work?
2. If you pull an object horizontally, what part of your force does work?
3. Figure 2: Force, Motion, and Work – Why doesn’t the girl do work when she carries her suitcase rather than pulling it?
4. Is work done on a stack of newspapers if you lift them from the floor to a table?
5. Is work done on a stack of newspapers if you hold them in front of you and carry them across the room at a constant velocity?
6. In order for work to be done on an object, what must happen to the object?
7. In which of the following situations is work being done: rolling a bowling ball, pushing on a tree for ten minutes, kicking a football?

Read textbook pages 702-703 – Calculating Work and answer

1. What is the formula to calculate work?
2. Figure 3: Amount of Work – work. You do more work when you lift a heavier plant the same distance. Why does it take more work to lift the heavier plant?
3. What is a joule?
4. How can you determine the amount of work done on an object?
5. Is more work done when a force of 2 N moves an object 3 m or when a force of 3 N moves an object 2 m? Explain.
6. Which involves more work—lifting a full backpack 1 meter from the ground, or lifting an empty backpack 1 meter from the ground?
7. Which involves more work—lifting the full backpack 1 centimeter from the ground or lifting the same backpack 1 meter from the ground?
8. What are the two factors that determine how much work is involved in moving an object?

Work Problems:

1. How much work is done on a 75 N bowling ball when you carry it horizontally across a 10m wide room?
2. How much work is done when a force of 1N moves a book 2m?
3. You must exert a force of 4.5 N on a book to slide it across a table. If you do 2.7J of work in the process, how far have you moved the book?
4. A child pulls a sled up a snow-covered hill. In the process, the child does 405 J of work on the sled. If she walks a distance of 15 m up the hill, how large a force does she exert on the sled?
5. 55, 000J of work is done to move a rock 25m. How much force was applied?
6. You and 3 friends apply a combined force of 489.5N to push a piano. The amount of work done is 1762.2J. What distance did the piano move?
7. If it took a bulldozer 567.6 joules of work to push a mound of dirt 30.5 meters, how much force did the bulldozer have to apply?
8. A frontend loader needed to apply 137 Newtons of force to lift a rock. A total of 223 joules of work was done. How far was the rock lifted?
9. A young boy applied a force of 2,550 Newtons on his St. Bernard dog who is sitting on the boy's tennis shoes. He was unable to move the dog. How much work did he do trying to push the dog?

1. WORK:

- a. Define *work*:
- b. Work can also be defined as a transfer of _____.
- c. In order for work to be done, force and displacement must be in the _____ direction.
- d. Give one example in which work is done:
- e. Give one example in which work is not done:
- f. For the following 3 scenarios, explain why work *is* or *is not* done:
 - A woman preparing for a trip lifts her suitcase from the floor to the bed so that she may pack more easily.
 - A man spends 5 minutes thinking about the most efficient way to decorate his roof with Christmas lights.
 - A student carries his book bag down the hallway.
- g. Identify which of the pairs in each scenario illustrates *more* work being done:
 - _____ A boy helps a teacher by lifting a 200-N box of books 1.5 meters from the floor to the desktop.
 - _____ The same boy lifts a 500-N box of books the same height.
Explain your choice:
 - _____ A girl throws a 1-kg softball with a force of 50 Newtons a distance of 25 meters.
 - _____ The same girl throws the softball with the same force a distance of 17 meters.
Explain your choice:
- h. The formula for calculating work is _____, and the unit for work is the _____

Read textbook pages 703-705 – Power and answer

1. What is Power? How are power and work related?
2. Figure 4: Work and Power Will the blower or the rake do the same amount of work in less time?
3. What are some things you would describe as powerful?
4. What characteristic do all of these things share?
5. The term power has a different meaning in science than it does in everyday use. In science, power is the rate at which work is done. Keeping this in mind, what is a rate?
6. How does the amount of time it takes to lift a stack of books affect the amount of work involved?
7. How does the time it takes to lift a stack of books affect the power involved?
8. Math Sample problem: Write each step of the sample problem, and then using the same steps, answer:
 - a. A motor exerts a force of 12,000 N to lift an elevator 8.0 m in 6.0 seconds. What is the power of the motor?
 - b. A crane lifts an 8,000-N beam 75 m to the top of a building in 30 seconds. What is the crane’s power?

Calculating Power:

1. Your family is moving to a new apartment. While lifting a box 1.5 m straight up to put it on a truck, you exert an upward force of 200 N for 1.0 s. How much power is required to do this?
 2. You lift a book from the floor to a bookshelf 1.0 m above the ground. How much power is used if the upward force is 15.0 N and you do the work in 2.0 s?
 3. You apply a horizontal force of 10.0 N to pull a wheeled suitcase at a constant speed of 0.5 m/s across flat ground. How much power is used? (Hint: The suitcase moves 0.5 m/s. Consider how much work the force does each second and how work is related to power.)
 4. In which of the following cases is work being done on an object?
 - a. pushing against a locked door
 - b. suspending a heavy weight with a strong chain
 - c. pulling a trailer up a hill
 - d. carrying a box down a corridor
 5. A tractor exerts a force of 20,000 newtons to move a trailer 8 meters. How much work was done on the trailer?
 - a. 2,500 J
 - b. 4,000 J
 - c. 20,000 J
 - d. 160,000 J
 6. A car exerts a force of 500 newtons to pull a boat 100 meters in 10 seconds. How much power does the car use?
 - a. 5000 W
 - b. 6000 W
 - c. 50 W
 - d. 1000 W
 7. One horsepower is a unit of power equal to
 - a. 0.746 W.
 - b. 1.0 W.
 - c. 746 W.
 - d. 2,000 W.
 8. The power of a light bulb that converts electrical energy at a rate of 100 joules per second is
 - a. 50 watts.
 - b. 200 watts.
 - c. 100 watts.
 - d. 40 watts
2. **POWER:**
 - a. Define *power*:
 - b. How are power and work related?
 - c. Identify which of the pairs in each scenario illustrates *less* power being generated:
 - _____ A woman pushes a cart with 95 N of force 3 m in 10 seconds.
 - _____ A man pushes a cart with 95 N of force 3 m in 13 seconds.
Explain your choice:
 - _____ A 340-N student climbs the stairs in 14 seconds.
 - _____ A 420-N student climbs the stairs in 14 seconds.
Explain your choice:
 - d. The relationship between power, force and velocity is _____