

13 Energy

Worksheet A: ENERGY EQUATIONS

Name _____

Inquiry Physics

In the previous investigation, you were introduced to the ideas of work. You found that work was the product of a force moved through a distance when the force and distance were parallel and in the same direction. Now we present a new idea: *energy is the property of a system that enables it to do work*. Since its energy enables a system to do work, energy and work are equivalent. Therefore they are both measured in newton•meters or joules. This is a **think** investigation. You will be thinking about hypothetical situations and answering questions about them.

1. Figure 1 shows a 98.0 N box which is resting on a horizontal surface. The box is to be lifted until its center of gravity moves from point A to point B. That distance is 10.0 m. How much work will be done in lifting the box? (Show your equation as well as the numerical answer in your calculation.)

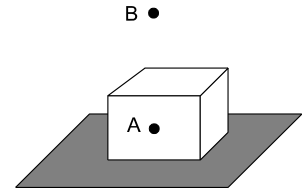


Figure 1

2. Your previous science courses should have introduced you to the idea of the conservation of energy. State that principle:

3. You know that work and energy are equivalent. How much energy does the box have at point B that it did not have when resting on the horizontal surface?

4. The box will now be dropped. How does the **form** of the energy change? (Remember your answer to #2.)

5. What effects might the energy have on the horizontal surface and the box?

6. You have found that the box has the ability to do work when it is at point B. Think of a single word that means "**has the ability to**". This word is often used in sentences such as: "That student will likely do well in college. She has great _____." What is the word?

7. The class will discuss an equation that will **always** permit you to compute the type of energy you just named. Write the equation below:

8. The type of energy you just named is sometimes called **the energy of position**. Why would it be called that?

9. When force is exerted to lift a box, that force is acting against what phenomenon of nature?

10. Add that name before the name of the energy type you invented in question 6. Now you have a complete name for this type of energy. Write the complete name below.

11. Figure 2 shows a 98.0 N box resting on a horizontal surface. How much work is done in raising the box until its center of gravity moves from point A to point B? (Use the equation from question 7 to solve this. Be careful about which distance you plug into the formula! Show **all** of your work and the numerical answer.)

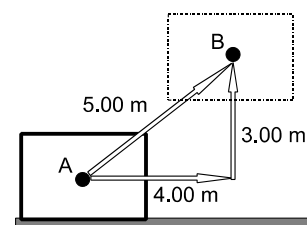


Figure 2

12. Note which of the three distances shown you had to use to solve for the work done. Explain **why** you used that distance to solve for the work done, rather than using another of the distances.

13. Consider the box in **Figure 3** as it **falls** from B to A.

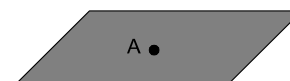
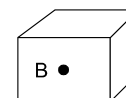


Figure 3

- a. What is the initial velocity of the box if it is released from rest? (Numerical answer.)
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- b. Find an equation involving only v_f , d , and a for the velocity of the box just before it struck the surface. (Use your answer from part a to help you.)
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- c. What is the numerical acceleration with which the box moves toward the surface?
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14. Now you will be guided on how to rewrite the gravitational potential energy equation to find a new energy equation for the box in Figure 3 just before it strikes the floor.

- (a) **Work** = **Fd** and **Work** = **PE** so **PE** = _____.
- (b) Newton's Second Law states that **F** = _____.
- (c) Combining (a) and (b) shows that **PE** = _____.
- (d) Rearranging the answer to **question 13 part b** shows that **d** = _____.
- (e) Substituting the result of (d) into (c) yields **PE** = _____.
- (f) Your answer to **question 13 part c** shows that in this case **a** = **g**.
- (g) Simplify equation (e) into its simplest possible form. **PE** = _____.

The final result from question 14 gives us a new equation for energy. This is NOT an equation for the static energy of an object above a surface any more (it really isn't "PE"). Instead, it is an equation for the energy of motion.

15. What is a word in Physics which means "motion"?
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16. Now write an equation for this energy of motion.
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