

CHAPTER 5- ENERGY AND POWER

ACTIVITY 1: Exercise Bicycle Efficiency

Activity Objective: Measure the energy necessary to operate a bicycle

Chapter 1 Definition: Energy is defined as the ability to do work. Physics defines energy as a property of objects which can be transferred to other objects or converted into different forms. The ability of a system to perform work is another, but it is misrepresentative because energy is not necessarily available to do work. Yet, there are other definitions of energy, depending on the framework, such as thermal energy, radiant energy, electromagnetic, nuclear, etc. The great thing about energy is that it can be converted from one form to another. The First Law of Thermodynamics states that matter and energy can neither be created nor destroyed; it can only change from one state to another.

REVIEW VIDEOS: Energy and power difference Rating:

<https://www.youtube.com/watch?v=WzF8p5E1gsY>

Difference between kinetic and potential energy <https://www.youtube.com/watch?v=x-Is8oOr7yg>

Mechanical Power Rating: <https://www.youtube.com/watch?v=XcG3s5UOiUM>

Materials: Chapter 5, paper, computer, printer. Internet Access, bicycle (average bike, at least three speeds, preferably good quality and in good condition); Measuring instruments for torque, gear sizes, weight, etc.; slightly (5°) inclined 2000 ft. long testing area; research materials, brake pedal effort gauge

Procedure:

1. Examine a bicycle's crankshaft and front and back gear cassettes, taking note of the different sizes of gears, how they are turned, and how the different sizes affect the amount of energy used vs. speed.

2. Measure the drive wheel radius and gears using diameters and decide which gears you will use for step number 5.

3. Mount a brake pedal effort gauge on one of the bicycle pedals.

4. Examine the comparable parts of a car (driveshaft), taking note of the different pieces, how they operate, and different ways to affect them.

5. On a slightly five degree inclined plane, measure the amount of torque (work) expended to move the bike 2,000 ft. up that slope.

6. Test the torque amount using several different gear combinations, one per run to see if the amount of energy expended increases or decreases.

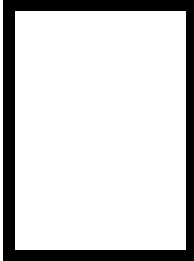
7. Record the energy expended to move the bike the distance: Write an essay as to why you think the bike expended the amount energy that it did and whether you think that it expended a lot of energy for its size and function.

8. Look for ways to make the bicycle more efficient: body design, frame design, materials (weight), or gearing.



RUBRIC

| 4 World-Class Learner | 3 Proficient Learner | 2 Developing Learner | 1 Emergent Learner |
|---|--|---|---|
| Learner at this level has gone beyond mastery of knowledge, skills, & attitudes described in project. World-class learner consistently exhibits high-quality performance. | Learner at this level has had opportunities to apply knowledge, skills, & attitudes of component of project. Proficient learner has mastered essential attributes, thus proving mastery. | Learner at this level has been exposed to & had opportunity to apply knowledge, skills, & attitudes of project. Developing learner may have only a few essential attributes to master before mastery. | Learner at this level may or may not have been exposed to knowledge, skills, & attitudes required by academic standards of the project. |



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