

Chapter Thirteen Science: Motion, Work, and Machines Study Guide

Lesson Four

Gravitational Potential Energy-anytime an object is raised above the ground the potential energy it gains
-the greater the height and weight the more gravitational potential energy

| Forms of Energy | Examples of Source |
|-----------------|--------------------------------|
| Atomic | radioactive material |
| Chemical | food |
| Electrical | household outlet |
| Light | the Sun |
| Mechanical | moving parts in a machine |
| Sound | vibrations of a stereo speaker |
| Thermal (heat) | hot water in a radiator |

How do batteries work?

- change chemical energy into electricity
- electrons are made to flow through a circuit attached to the battery. When the electrons return to the battery, they cause further chemical reactions to take place.

Dry-cell batteries-used only once and then must be discarded
-should be removed immediately

Lead-acid batteries-designed so that they can be recharged.

Work-applying force to an object to move it through a distance
-amount of work is calculated by multiplying the distance by the force
-when work is done to an object energy is added to it (creates heat)
Work = force x distance

Energy may change form but can not be created or destroyed.

Law of Conservation of Energy-the requirement that the total energy of the universe remains constant

Lesson Five

Machine-a simple device that makes it easier for us to do work.

Simple Machines-machines with few, if any moving parts (example - hammer)
-may change direction of force
-increase strength of an applied force

Effort Force-the force that you apply to a simple machine

Resistance Force-the force against which the machine acts

Output Force-force the machine applies to an object in response to or effort force

Kinds of Simple Machines

- 1)Lever
- 2)Pulley
- 3)Wheel and Axle
- 4)Inclined Plane
- 5)Screw
- 6)Wedge

Levers-have a rigid bar that rests on a pivot point of some kind. The pivot point is called the fulcrum. The

side of the bar on which a person applies an effort force is called the effort arm. The side of the bar on which the lever produces an output force is called the resistance arm.

-position of fulcrum, effort force, and output force can be different

-three classes of levers

1) First-class lever-fulcrum lies between the effort force and the output force

-can produce an output force greater than the effort force

2) Second-class lever-don't change the direction of the effort force but do produce an output force greater than the effort force.

-examples include a wheelbarrow, nutcracker, bottle opener, and a paper cutter

3) Third-class lever-do not change the direction of the effort force. Produce an output force that is less than the effort force

-multiplies the distance of your effort (example - fishing rod)

Mechanical Advantage-a number that tells us how much the machine should multiply our effort.

Pulleys-ropes fit in grooves of wheels, ropes move and turn the wheels.

-can be either fixed or movable

1) Fixed-the wheel itself is attached to a fixed support. Does not multiply the effort force, only changes the direction of the effort force. Pulling down on a rope can be lifting an object straight up by hand.

easier than

2) Movable-pulley is attached to the object and moves with it. Movable pulley multiplies the effort force by two. The movable pulley does not change the direction of effort.

Pulley Systems-several pulleys acting together.

Wheel and Axle-machine consists of a wheel that applies the effort force and a smaller axle that produces the output force. The mechanical advantage of the wheel and axle is the length of the effort arm divided by the length of the resistance arm.

Lesson Six

Inclined Plane-a straight, slanted surface. Has no moving parts, but makes work easier because they multiply the effort force.

$MA = \text{output force} / \text{input force}$

Screw-simple machine that multiplies effort. Is created by wrapping an inclined plane around a central bar. The spiral ridges are the threads of the screw. The distance from thread to thread is called the pitch.

-Screws with a larger pitch tends to have lower mechanical advantages

Wedge-can change the direction of an effort and increase its strength. May have one or two slanted surfaces. (examples include knife blades, ax heads, chisels, and other cutting tools)

Compound Machine-a device that is a combination of two or more simple machines

Scissors-contains two first-class levers and wedges

Screwdriver-screwdriver itself is a wheel and axle and the screw is an inclined plane

Efficiency-amount of useful work a machine can do with a quantity

$\text{Efficiency} = \text{work done by machine} / \text{work put into machine}$