UNIT 19

Energy and motion

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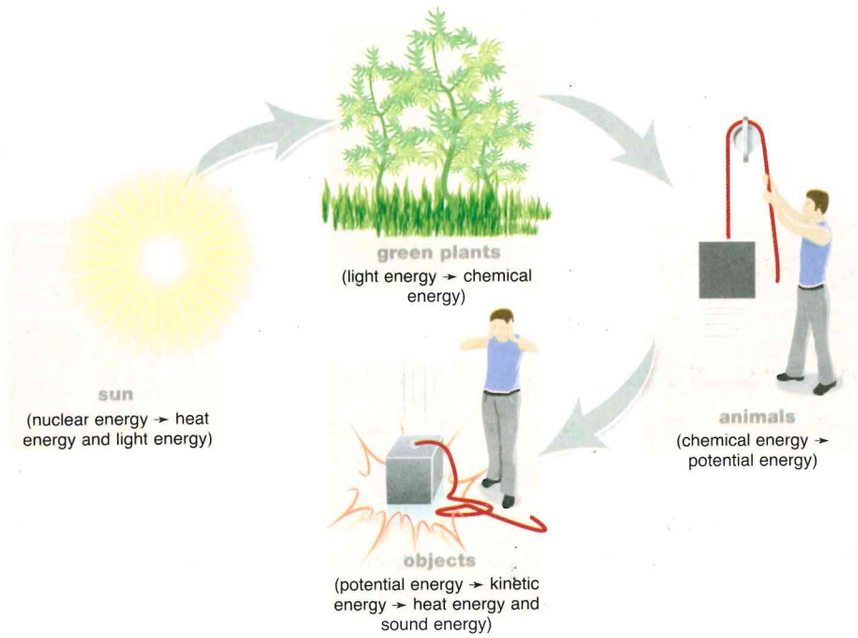
Section 1 *Vocabulary*

A. Read the text and look at the diagram.



Energy cannot be created or destroyed. This is the **Principle of Conservation of Energy**. However, energy can be **converted** from one form to another.

Nuclear energy in the sun is converted into **heat energy** and **light energy** and travels to the Earth.

Green plants convert light energy into **chemical energy** through **photosynthesis**. Animals eat plants and obtain some of their chemical energy.

Humans use the chemical energy to do work. For example, pulling on a rope to raise a load. The load, which is now some meters above the ground, has **potential energy**. In other words, it has **stored** energy which will be released if it falls to the ground.

If the load falls, the potential energy is turned into movement or **kinetic energy**. When the load hits the ground, the kinetic energy is turned into heat energy and **sound energy**.

Although energy cannot be created or destroyed, it can be **wasted**. For example, an electric light bulb is clearly designed to produce light energy. But in a normal light bulb, only 5% of the electrical energy consumed is converted into light energy. The other 95% is wasted as heat energy.

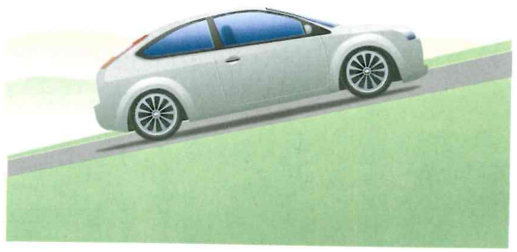
B. Look at the pictures. Write the letter of each picture next to one type of energy conversion.

a 

b 

c 

d 

e 

1. chemical energy to heat energy to kinetic energy: d
2. electrical energy to light energy: c
3. electrical energy to sound energy: b
4. kinetic energy to heat energy: a
5. kinetic energy to potential energy: e

C. How efficient are different types of engines? Read the paragraph and enter the numbers in Table 1 (on page 93). Which is the most efficient?

In the early days of motoring, cars were powered by steam. This was a very inefficient type of engine with only about 7% of the available energy converted into kinetic energy. Next came the internal combustion engine. The diesel version is slightly more energy-efficient than the gasoline version (35% to 30%). Battery-powered vehicles are popular in some countries for short slow trips around town. Their efficiency is high at around 85% conversion of electrical energy into kinetic energy. But remember, the electricity must be produced in the first place, and even the most efficient electricity production (by hydroelectric plants) is only 80% efficient. So overall we should say that the battery-powered car converts energy with an efficiency of 85% × 80% maximum, which means around 68%. Some companies are now experimenting with hydrogen-powered fuel cell cars, which have an efficiency of around 60%.

Power source	Efficiency (%)
Steam	7 %
Internal combustion engine: gasoline	30 %
Internal combustion engine: diesel	35 %
Hydrogen fuel cell	60 %
Battery	68 %

Table 1: Efficiency of some power sources for cars

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Section 2 Reading


stationary car


car accelerating


car hitting parked car

Newton's Laws of Motion

In 1665 the great English scientist, Isaac Newton, formulated three laws which explain why things move or do not move. They are called the Three Laws of Motion.

The First Law

If an object is not being pushed or pulled, it will remain stationary, or continue to move in a straight line at a constant speed. So a car will not move unless it is pushed by the engine, and it will continue at a steady speed unless the driver presses the accelerator or the brake.

The Second Law

When a force acts upon a stationary object, it will start to move, and a moving object will accelerate or slow down, depending on the direction of the force. So a car will move or speed up if the driver presses the accelerator and slow down or stop if he pushes the brake.

The Third Law

For every action there is an equal and opposite reaction. So if a moving car hits a stationary car, the moving car will be stopped and the stationary car will be moved.

The first law contains an impossible condition: it says "if an object is not being pulled". But all moving objects are pulled back or slowed down by a force called friction. Friction acts on any moving object. It is the result of two surfaces coming into contact. For example, a moving car experiences air resistance – the friction between the car and the air. The car also experiences tire resistance – the friction between the tires and the road. Friction slows moving objects down and causes wear and tear. Tires are worn out by use, for example. But friction also helps us. For example, because of friction we can walk and grip things with our hands.

A Choose the best answer in each case.

1. The first law explains why:
   a. cars slow down unless you press the accelerator
   b. a car on a flat surface doesn't move
   c. there is resistance in the air
   d. cars move in straight lines
2. The second law explains why:
   a. a car slows down when you apply the brake
   b. a car on a flat surface doesn't move
   c. cars move in straight lines
   d. cars sometimes crash
3. The third law explains why:
   a. moving cars sometimes hit stationary cars
   b. a car slows down when you apply the brake
   c. a car on a flat surface doesn't move
   d. a moving car moves a stationary car in an accident
4. Moving objects are always pulled by a force. It is called:
   a. resistance
   b. a brake
   c. an accelerator
   d. friction
5. Friction is:
   a. always a bad thing
   b. always a good thing
   c. sometimes good, sometimes bad
   d. neither good nor bad

B Study the following example sentences.

Showing conditions

If an object is not being pushed, it **will** remain stationary.
When a force acts upon a stationary object, it **will** start to move.
Unless an object is being pushed, it **will** remain stationary.
A car **will** not move **unless** the driver presses the accelerator.
A car **will** continue at a steady pace **unless** the driver presses the brake.

C Circle the correct words and forms of the verbs.

1. If a stationary object is not being pushed or pulled, it (*remains* / *will remain*) stationary.
2. A car will not move unless it (*pushes* / *is pushed*) by the engine.
3. A car will continue to move at a steady speed (*if* / *unless*) the driver presses the accelerator or brake.
4. When a force (*acts* / *will act*) upon a stationary object, it will start to move.
5. A car will move or speed up if the driver (*presses* / *doesn't press*) the accelerator.
6. A car will slow down or stop (*if* / *unless*) the driver pushes the brake.
7. If a moving car hits a stationary car, the moving car (*will stop* / *will be stopped*) and the stationary car will be moved.

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Section 3 Listening

A Listen and complete the summary of the reading text in Section 2. Write one word in each space.

Isaac Newton's Three Laws of _____ explain why things move or do not move. The First Law states that an object will remain _____, or continue to move in a _____ line at a constant speed, if it is not being pushed or pulled. The Second Law states that if a _____ acts upon a stationary object it will start to move, and a moving object will accelerate or slow down. The Third Law states that for every action there is an _____ and opposite reaction.

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B Listen to the lecture. What is it about?

1. Newton's First Law of Motion
2. Newton's Second Law of Motion
3. Newton's Third Law of Motion

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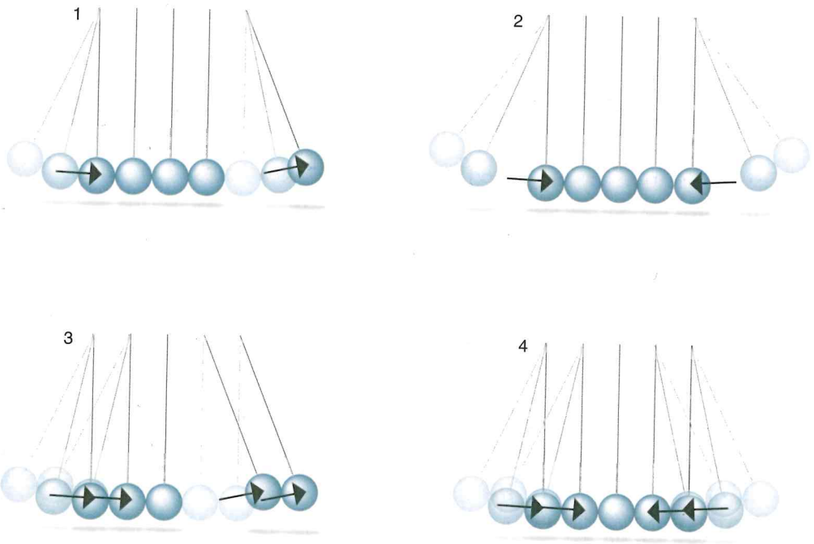
C. Listen again. Check the diagram showing the action that is described.



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