

## JAF02 Unit 5 Light

### A) READING

#### *Reflecting on Light*

Most of what we know about the world comes to us through our ability to “see“ with our eyes, our telescopes, and our microscopes. But how do we see? Sight is not something that reaches out *from* our eyes. You see this page, for example, because light, reflecting from the sun or an electric light, travels from the paper to your eyes.

Sometimes we see light as it comes from a direct source, such as the sun, fire, lightning, or a light bulb. The rest of the time we see light as it is reflected off objects.

Light travels at high speed. It must have been a great leap in the intuition of scientists to realize that light actually travels at a speed of 186 000 miles per second. It travels slightly faster in a vacuum and slower in other transparent materials such as water or diamonds. It takes light less than one minute to travel from the earth to the moon and about 15 minutes to go from the earth to the sun.

In 1678 the Dutch scientist Christian Huygens was the first to propose that light travels in waves. Since then the work of Albert Einstein and James Maxwell has revealed that light actually consists of particles known as photons and travels in electromagnetic waves. Light seems to travel in straight lines. If you shine a flashlight in the dark, for example, the beam of light appears to be straight. In contrast, sound waves travel in every direction. We can hear people on the other side of a wall but cannot see them.

In certain situations light diverges from a straight path. When it falls on an object, most is either absorbed (in the case of an opaque object such as wood or metal) or passes through (in the case of a transparent object such as water or glass). The remainder of the light is reflected. It is reflected light that changes direction. When light is reflected off a smooth surface, it changes direction in a regular way, that is, the angle that is reflected equals the angle at which it strikes the surface. If the surface is rough, light is reflected in many directions.

Certain silver compounds (like silver bromide) reflect almost all the light that falls on them and are accordingly used for mirrors. The image that is reflected in a flat mirror is identical to the original object, even in size, except that the image is reversed. This is because light on a flat surface changes direction.

When light passes from one transparent medium to another, it changes speed and direction. This process, called refraction, explains the apparent shortening of a person’s legs or the bending of a stick in water.

Light is a form of energy that can be transformed into heat. You can prove this by using a magnifying glass to concentrate the sun’s rays on a piece of paper and burn a hole in it. It is this light energy from the sun that warms the earth and enables living things to grow. Plants get light energy directly from the sun. Animals get it from the plants they eat.

### Task 1 Making Inferences

Indicate whether each of the following statements is stated in the passage (S), implied (I), or neither stated nor implied (N). Do not indicate whether the statement is true or false.

1. The speed of light is 186,000 miles per second.
2. Light travels slower through glass than through air.
3. Light travels faster than sound.
4. Moonlight is reflected light.
5. Light travels faster through water than sound does.
6. Scientists did not always know that light travels.
7. Light travels in the same way as sound.
8. Light travels at different speeds in different substances.
9. Sound waves do not travel in straight lines.
10. Most of the sound we hear is reflected.
11. An opaque object reflects more light than a transparent one.
12. A flat mirror reflects a reversed object.
13. Light energy can be converted to heat energy.

(Zimmerman, F. *English for Science*. Prentice Hall Regents, 1989)

### Task 2 Vocabulary

Scan the text again and find the words with similar meaning to the phrases below:

- a) ability to see
- b) a sudden large change or increase in sth.
- c) to suggest an idea for people to think about
- d) to separate and go in different directions
- e) having a surface that is not even or regular
- f) to turn something the opposite way around
- g) that seems to be real or true but may not be
- h) narrow lines of light, heat or other energy

### Task 3 Bending Light

Complete the text.

If you have ever half-submerged a straight stick into water, you have probably noticed that the stick \_\_\_\_\_ bent at the point it enters the water. This optical effect is due to \_\_\_\_\_. As light passes from one transparent \_\_\_\_\_ to another, it changes speed, and bends. How much this happens depends on the \_\_\_\_\_ of the mediums and the \_\_\_\_\_ between the light ray and the line perpendicular (normal) to the surface separating the two mediums (medium/medium \_\_\_\_\_). Each medium has a different refractive index. The angle between the light ray and the normal as it \_\_\_\_\_ a medium is called the **angle of incidence**. The angle between the light ray and the normal as it \_\_\_\_\_ a medium is called the **angle of refraction**.

(Source: <http://interactagram.com/physics/optics/refraction/>)

## B) Vocabulary: Collocations

Which verbs does the noun *light* collocate with?

e.g. fluorescent      artificial      beam of      travels

### LIGHT

## C) Grammar: Passive Voice

**Task 1** Identify passive structures in the above text.

**Task 2** Now rewrite the sentences using the passive voice so that you emphasise the action and not the vague agent *they* or *someone*. Retain the time reference and tense that the original sentence expresses.

- a) They have cancelled some popular courses.
- b) They wrote an in-depth report on their research.
- c) They will revise the budget within the next few months.
- d) Someone should have audited the accounts long ago.
- e) They passed new tax laws last year.
- f) Someone is questioning the suspect right now.
- g) Someone is fixing my computer.

## D) Faster than the speed of light

**Task 1** Use the phrases below to describe the experiment conducted at CERN in 2011:

to record neutrinos

to raise the alarming possibility of time travel

to change our view of the fundamental laws of nature

to disprove Albert Einstein's theory of special relativity

to cast doubt on the findings

to conduct a separate study on the same beam of neutrinos

to monitor how much energy the neutrinos had when they arrived

a bad connection between a GPS unit and a computer to blame

(adapted from <http://www.telegraph.co.uk/science/science-news/9100009/Scientists-did-not-break-speed-of-light-it-was-a-faulty-wire.html>)

**Task 2** Watch the spokesman describing the findings at the time of investigation. Summarise his main points.

<http://www.telegraph.co.uk/science/science-news/9100009/Scientists-did-not-break-speed-of-light-it-was-a-faulty-wire.html>