

# LIGHT AND SIGHT

Match the idioms below with their definitions

| Idioms                      | Definitions  |
|-----------------------------|--|
| • according to one's lights | • to make a flame, as with a match   |
| • see the light (of day)    | • as one's opinions, information, or standards may direct  |
| • in the light of           | • with knowledge of; considering   |
| • stand in one's own light  | • to make or become light; to make or become bright, cheerful, etc.; informal to begin smoking (a cigar, etc.) |
| • light up                  | • to come into existence; to come to public view; to understand  |
| • strike a light            | • to harm one's reputation by acting unwisely  |

## I. Read the text about light and answer the questions that follow

to propagate - přenášet, šířit (se)

to hold sway - (to be master, to rule) vládnout, kralovat

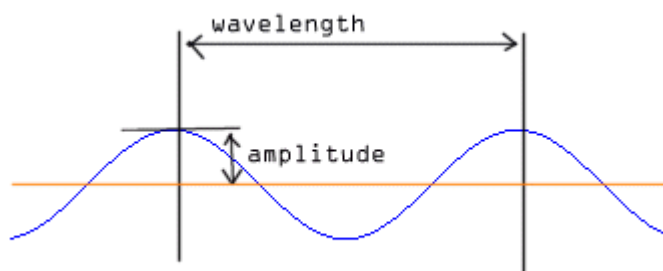
1. What is the dual nature of light?
2. What is the amplitude of the light?
3. What does colour of light depend on in the classical interpretation?
4. Describe photons.
5. What do colour and brightness depend on in the quantum theory of light?

## What is Light?

Light is simply a name for a range of electromagnetic radiation that can be detected by the human eye. What is electromagnetic radiation, then?

Electromagnetic radiation has a dual nature as both particles and waves. One way to look at it is as changing electric and magnetic fields which propagate through space, forming an electromagnetic wave.

This wave has amplitude, which is the brightness of the light, wavelength, which is the color of the light, and an angle at which it is vibrating, called polarization. This was the classical interpretation, crystallized in Maxwell's equations, which held sway until Planck, Einstein and others came along with quantum theory. In terms of the modern quantum theory, electromagnetic radiation consists of particles called photons, which are packets ("quanta") of energy which move at the speed of light.



In this particle view of light, the brightness of the light is the number of photons, the color of the light is the energy contained in each photon, and four numbers (X, Y, Z and T) are the polarization.

Which interpretation is correct? Both of them, actually. It turns out electromagnetic radiation can have both wave-like and particle-like properties as demonstrated in experiments such as the dual slit experiment.

Source: *Discovering Light!* ThinkQuest [cit. 28. 3. 2012]. Available at <[http://library.thinkquest.org/27356/p\\_index.htm](http://library.thinkquest.org/27356/p_index.htm)>

## 2 Refraction of light

Read the text and fill in the gaps with these words.

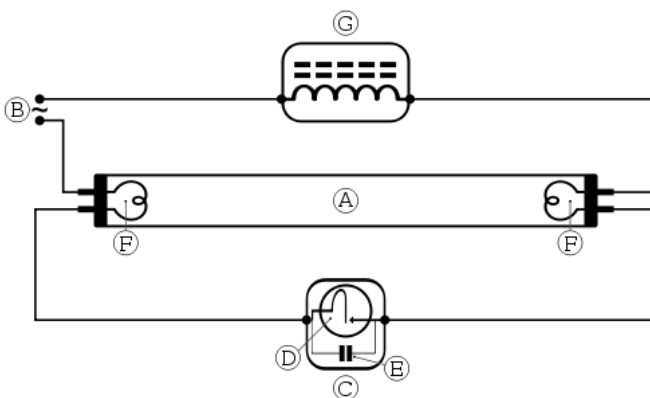
**bend incidence light normal optical effect refracted refraction transparent**

When a pencil is half submerged in a beaker of water, the pencil should appear to bend at the point it enters the water. This 1 \_\_\_\_\_ is due to refraction. When light passes from one 2 \_\_\_\_\_ medium to another, such as from air to water, its speed changes. This change in speed causes the light to 3 \_\_\_\_\_. When light travels from a less dense medium, such as air, to a denser medium, such as glass or water, 4 \_\_\_\_\_ bends towards the normal but when it travels from a denser medium to a less dense medium it bends away from the 5 \_\_\_\_\_. The angle between the incident ray and the normal is called the angle of 6 \_\_\_\_\_ and the angle between the 7 \_\_\_\_\_ ray and the normal is called the angle of 8 \_\_\_\_\_.

## 3 Fluorescent lamps

Read the text and underline the correct words.

The fluorescent lamp is a sealed 1 (cylindrical / circular) glass tube that contains mercury at 2 (high / low) pressure and electrodes at either ends of the tube. Sometimes a small amount of inert gas, such as 3 (boron / argon), is placed in the tube. A phosphor powder coats the inside of the glass. When the lamp is turned on, the current flows through the electrical circuit to the electrodes, which shoot 4 (protons / electrons) into the mercury vapour causing it to emit a bluish light and 5 (extraviolet/ ultraviolet) radiation. We are unable to see ultraviolet radiation but when it hits the phosphor powder coating the glass tube, it causes the coating to emit 6 (visible/violet) light. These lamps do not produce much heat incandescent light bulbs glow because the 7 (filament/element) is heated to a very high temperature. So a lot of energy is wasted as heat. Therefore 8 (luminous / fluorescent) lamps are more economical than conventional 9 (candescent / incandescent) light bulbs, even though the initial installation cost of the fluorescent lamp is 10 (lower / higher).



# B Working with sentences

## 4 Real and apparent depth

Match the beginning and endings of the sentences.

| Beginnings   | Endings   |
|--|---|
| 1. When observing an object in water from  | a. a back into the denser medium as though it had been                |
| 2. This optical effect   | b. reflected, b is also due to refraction.                            |
| 3. An observer sees the object when light rays leave the object and travel               | c. above it seems closer to the surface than it actually is.          |
| 4. However, as the light rays leave the water and enter the air, they are bent           | d. to the surface of the water and enter the observer's eyes,         |
| 5. This means that although the eye receives the light rays from the object, they appear | e. 'total internal reflection',                                       |
| 6. The angle of refraction is so large that all of the ray has been refracted            | f. away from the normal.  |
| 7. This is called  | g. to have come from a point above the location of the actual object. |

1 \_\_\_\_ 2 \_\_\_\_ 3 \_\_\_\_ 4 \_\_\_\_ 5 \_\_\_\_ 6 \_\_\_\_ 7 \_\_\_\_

# C Working with texts

## 5 How does light travel?

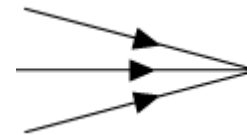
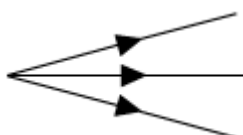
Read the text and then fill in the gaps on the diagram with suitable words.

Light travels in a straight line, which is why we cannot see around corners. In diagrams light is generally represented as straight lines with arrowheads pointing in the direction in which the light travels. A single ray of light cannot be seen but when they come together they become visible. These lines are called rays and a collection of equally spaced rays is called a beam of light. There are different types of beams. Rays which do not meet are known as a parallel beam of light. Those rays which start from a source and spread out from this point are called a diverging beam and rays which come together to a point are known as a converging beam.



A single ray of light a \_\_\_\_\_ but when they come together to form beams they become b \_\_\_\_\_.

### Types of beam



c \_\_\_\_\_

of light

d \_\_\_\_\_

– rays spreading out of the source

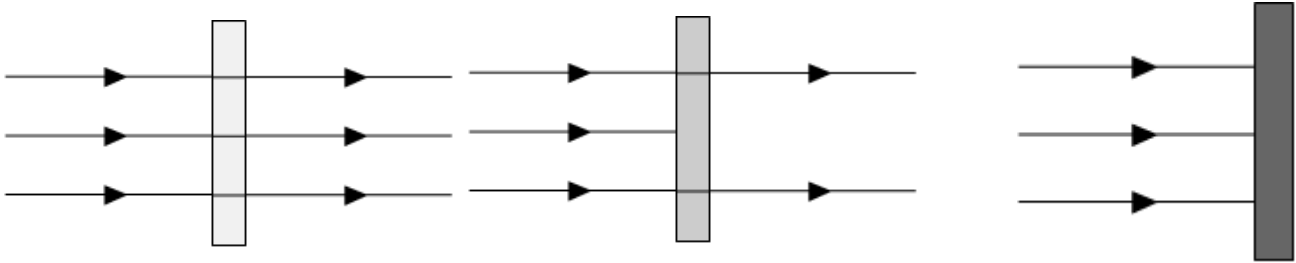
e \_\_\_\_\_

– rays coming together

## 6 The effect of different types of material on light

Read the text and then fill in the gaps on the diagram.

Opaque materials and objects block the passage of light, that is, they do not allow any light to pass through them. So it is impossible to see through them to objects on the opposite side. However, not all materials are opaque. Transparent materials allow light to pass through completely. As a result it is easy to see things clearly on the other side of a transparent object. Clear glass and plastic wrap are examples of materials that are transparent. Translucent materials on the other hand only allow some light to pass through them, so it is difficult to see objects on the other side clearly. Examples of materials that are translucent are tracing paper, grease paper and frosted glass.



a \_\_\_\_\_ materials allow light to pass through b \_\_\_\_\_, making it c \_\_\_\_\_ to see through them.

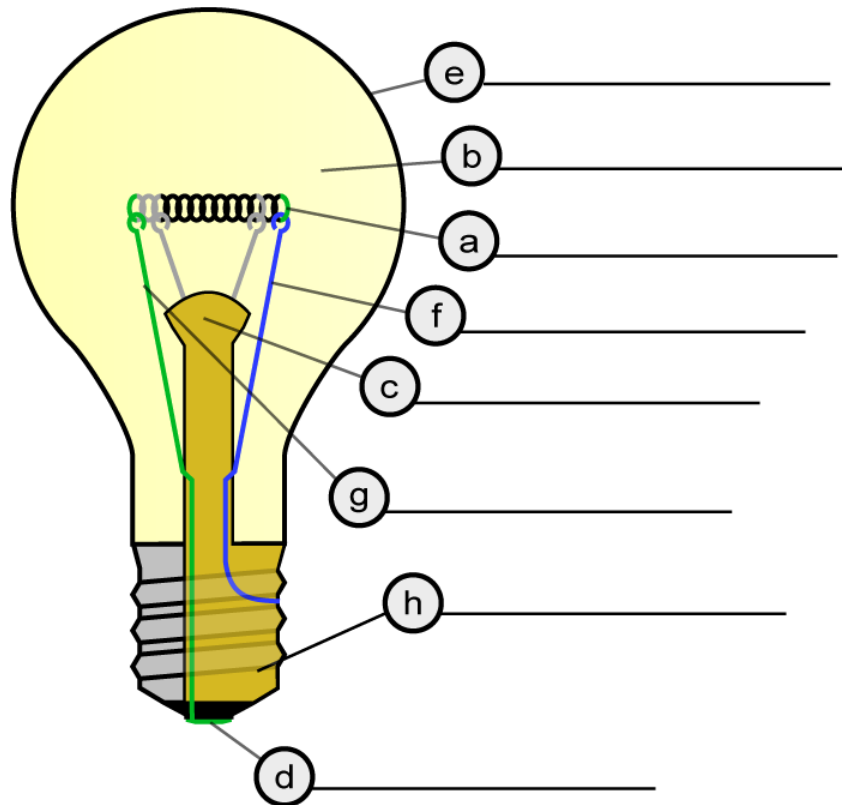
d \_\_\_\_\_ objects only allow e \_\_\_\_\_ to pass through, making it f \_\_\_\_\_ to see through them clearly.

g \_\_\_\_\_ objects h \_\_\_\_\_ allow i \_\_\_\_\_ to pass through, making it j \_\_\_\_\_ to see through them.

## 7 The filament lamp

Read the text and label the diagram.

A filament lamp is an incandescent source of light, that is, it gives off light because it is very hot. The filament light bulb has a very thin tungsten filament coil, which is connected to electrical foot contacts via two stiff pieces of support wire. The support wires are enclosed in insulation at the base of the glass mount. The filament is enclosed in a glass case or bulb filled with an inert gas such as argon, and is fixed on a glass mount so that it sits in the middle of the bulb. When the bulb is connected to a power supply, an electric current passes through the tungsten filament. This makes the filament heat up to 2500 °C, at which point the tungsten glows white hot and emits light and heat. The heat is wasted energy since it produces no illumination. At these high temperatures the metal tends to evaporate and become condensed on the sides of the bulb, gradually darkening it. The inert gas in the bulb slows down this process and prevents oxidation of the tungsten which would happen if air was used to fill the bulb. Some bulbs have a screw thread to allow them to be securely fixed into a lamp.

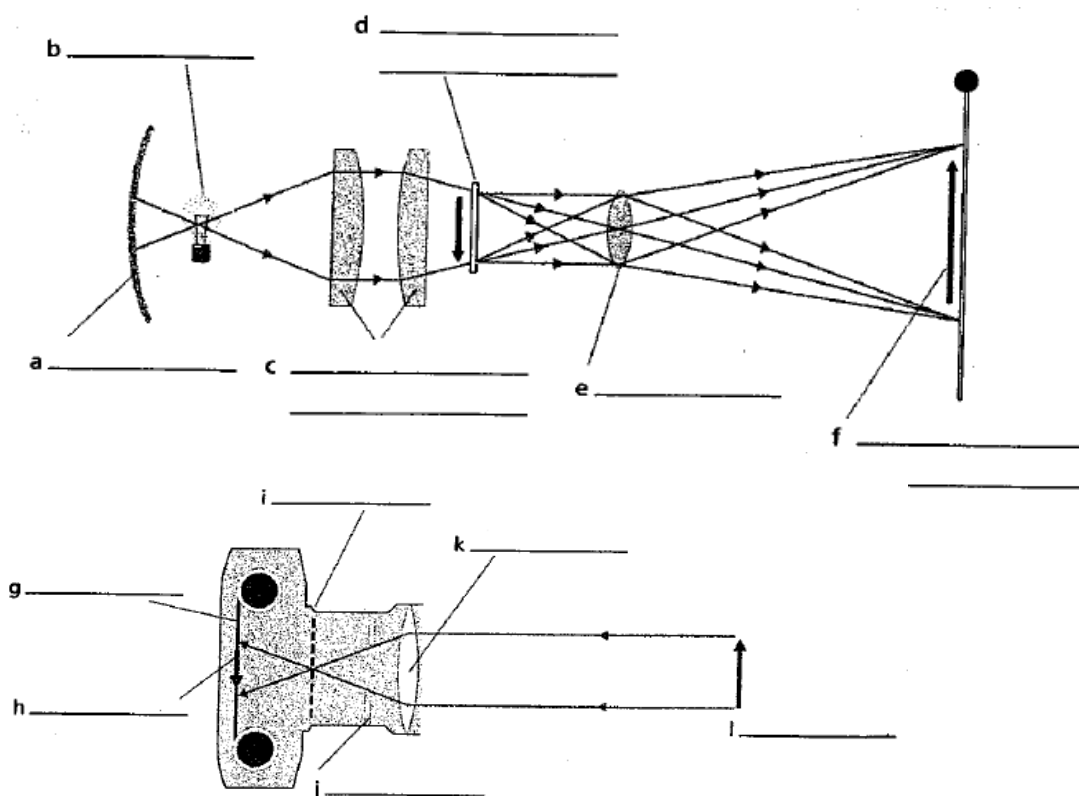


## 8 Slide projector and camera

Read the text and label the diagram with these words.

**concave mirror condensing lenses convex lens (2×) diaphragm film image  
image inverted right way up light source object shutters slide inserted upside down**

A slide projector uses an internal light source to illuminate a transparent slide. Light from the light source is collected by a large, double lens called the condensing lens, which then makes the light rays converge towards the slide. The slide is placed upside down in front of the light source and at a suitable distance behind the convex lens. The light passes through the transparency of the slide and then through the lens which refracts the light rays and converges them onto a screen, to give a large inverted image. However, the image will occur right side up if the slide (object) was placed in the projector upside down. A camera is basically a lightproof box, which contains a light-sensitive film behind a convex lens. When a photograph is taken, a shutter behind the diaphragm and lens opens and closes quickly. During the brief period that the shutter is open, light enters the camera from the object. The lens first converges the light rays causing them to cross and so produce a small inverted image on the light-sensitive film. The film is later developed into a permanent picture. The illustration shows how an image is formed on the film inside a camera.



Ex 2–8; source: „Science“; Keith Kelly; 2007

## IX Watch the video and then answer the questions below

(source: [www.voutube.com](http://www.voutube.com))

1. What are rods and cones, as referred to in the recording?
2. What is cornea?
3. How is the shape of the lens controlled?
4. When does the ciliary body contract?
5. Where are rods and cones located?
6. What is the light energy turned into in rods and cones?
7. What is the function of the optic nerve?