

# CLIL - A MODULE OF PHYSICS IN ENGLISH

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## PIANIFICAZIONE e SCANSIONE DEL MODULO

Il modulo è pensato per un ordine di scuola che prevede due ore di Fisica la settimana e tre ore di Lingua Inglese.

Monte ore di FISICA: 6 ore + 1 ora di compresenza.

Monte ore di LINGUA INGLESE: 4 ore + 1 ora di compresenza.

SETTIMANA	LEZIONE	MATERIA	ORE	ATTIVITÀ
Prima settimana	1	Lingua Inglese (compresenza con Fisica)	1	Warm-up; reading comprehension
Seconda settimana	2	Fisica	2	Presentazione dei testi; lavoro sulla comprensione dei testi
	3	Lingua inglese	1	Brainstorming previous lessons; lavoro sul lessico
Terza settimana	4	Lingua inglese	1	Lavoro sulla written composition
	5	Fisica (compresenza con Lingua Inglese)	1	Checking students writing mistakes; group works on specific task
	6	Fisica	1	PPT presentation
Quarta settimana	7	Lingua inglese	1	Word games
	8	Fisica	2	Test finale

# LEZIONE 1 Lingua inglese (compresenza con Fisica)

*Ove possibile, questa prima lezione prevede la compresenza della docente di LS e della docente di DNL.*

Students are given Text A and Text B about the **role of light to sight** and **the line of sight**.

Students are required to look for nouns, adjectives and verbs connected to **light**.

They work in small groups, decided by the teachers.

## Homework:

Worksheet 1, ex. 1 – text A;

Worksheet 2, ex. 1 – text B

## TEXT A

(Taken from: [www.physicsclassroom.com/Class/refln/u1311a.cfm](http://www.physicsclassroom.com/Class/refln/u1311a.cfm))

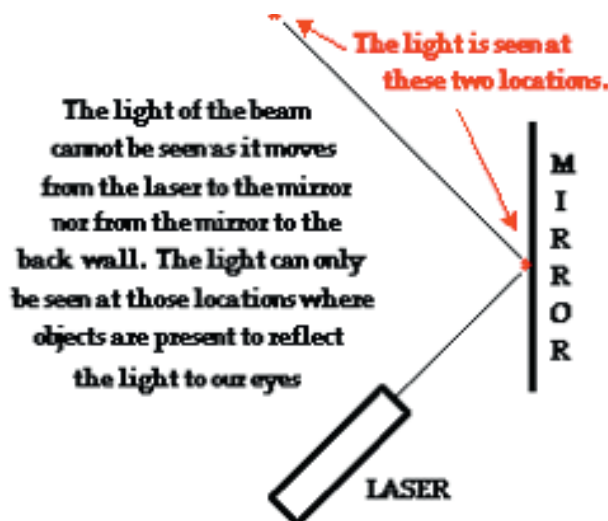
### Reflection and Its Importance. The Role of Light to Sight

The bottom line is: without light, there would be no sight. The visual ability of humans and other animals is the result of the complex interaction of light, eyes and brain. We are able to see because light from an object can move through space and reach our eyes. Once light reaches our eyes, signals are sent to our brain, and our brain deciphers the information in order to detect the appearance, location and movement of the objects we are sighting at. The whole process, as complex as it is, would not be possible if it were not for the presence of light. Without light, there would be no sight.

If you were to turn off the room lights for a moment and then cover all the windows with black construction paper to prevent any entry of light into the room, then you would notice that nothing in the room would be visible. There would be objects present that were capable of being seen. There would be eyes present that would be capable of detecting light from those objects. There would be a brain present that would be capable of deciphering the information sent to it. But there would be no light! The room and everything in it would look black. The appearance of black is merely a sign of the absence of light. When a room full of objects (or a table, a shirt or a sky) looks black, then the objects are not generating nor reflecting light to your eyes. And without light, there would be no sight.

The objects that we see can be placed into one of two categories: luminous objects and illuminated objects. Luminous objects are objects that generate their own light. Illuminated objects are objects that are capable of reflecting light to our eyes. The sun is an example of a luminous object, while the moon is an illuminated object. During the day, the sun generates sufficient light to illuminate objects on Earth. The blue skies, the white clouds, the green grass, the colored leaves of fall, the neighbor's house, and the car approaching the intersection are all seen as a result of light from the sun (the luminous object) reflecting off the illuminated objects and traveling to our eyes. Without the light from the luminous objects, these illuminated objects would not be seen. During the evening when the Earth has rotated to a position where the light from the sun can no longer reach our part of the Earth (due to its inability to bend around the spherical shape of the Earth), objects on Earth appear black (or at least so dark that we could say they are nearly black). In the absence of a porch light or a street light, the neighbor's house can no longer be seen; the grass is no longer green, but rather black; the leaves on the trees are dark; and were it not for the headlights of the car, it would not be seen approaching the intersection. Without luminous objects generating light that propagates through space to illuminate non-luminous objects, those non-luminous objects cannot be seen. Without light, there would be no sight.

A common Physics demonstration involves the directing of a laser beam across the room. With the room lights off, the laser is turned on and its beam is directed towards a plane mirror. The presence of the light beam cannot be detected as it travels towards the mirror. Furthermore, the light beam cannot be detected after reflecting off the mirror and traveling through the air towards a wall in the room. The only locations where the presence of the light beam can be detected are at the location where the light beam strikes the mirror and at the location where the light beam strikes a



At these two locations, a portion of the light in the beam is reflecting off the objects (the mirror and the wall) and traveling towards the students' eyes. And since the detection of objects is dependent upon light traveling from that object to the eye, these are the only two locations where one can detect the light beam. But in between the laser and the mirror, the light beam cannot be detected. There is nothing present in the region between the laser and the mirror that is capable of reflecting the light of the beam to students' eyes.

But then the phenomenal occurred (as it often does in a Physics class). A mister is used to spray water into the air in the region where the light beam is moving. Small suspended droplets of water are capable of reflecting light from the beam to your eye. It is only due to the presence of the suspended water droplets that the light path from the laser to the mirror could be detected. When light from the laser (a luminous object) strikes the suspended water droplets (the illuminated object), the light is reflected to students' eyes. The path of the light beam can now be seen. With light, there can be sight.

But without light, there would be no sight.

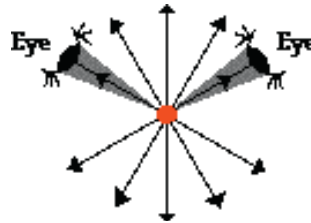
None of us generate light in the visible region of the electromagnetic spectrum. We are not brilliant objects (please take no offense) like the sun; rather, we are illuminated objects like the moon. We make our presence visibly known by reflecting light to the eyes of those who look our way. It is only by reflection that we, as well as most of the other objects in our physical world, can be seen. And if reflected light is so essential to sight, then the very nature of light reflection is a worthy topic of study among students of physics. And in this lesson and the several that follow, we will undertake a study of the way light reflects off objects and travels to our eyes in order to allow us to view them.

## TEXT B

(Taken from: [www.physicsclassroom.com/Class/refln/U13l1b.cfm](http://www.physicsclassroom.com/Class/refln/U13l1b.cfm))

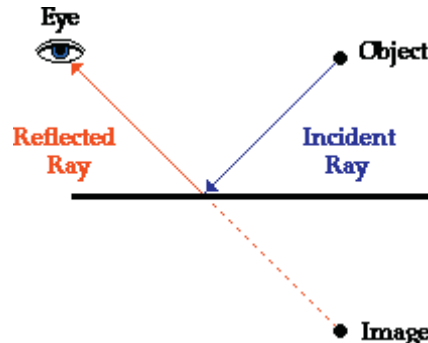
### The Line of Sight

A luminous object emits light in a variety of directions; and an illuminated object reflects light in a variety of directions. Although this light diverges from the object in a variety of directions, your eye only sees the very small diverging cone of rays that is coming towards it. If your eyes were located at a different location, then you would see a different cone of rays. Regardless of the eye location, you will still need to sight along a line in a specific direction in order to view the object.



While simple, this concept of the line of sight is also profound! This very principle of the line of sight will assist us in understanding the formation of images (reflection).

The manner in which light travels to your eye as you view the image of an object in a plane mirror can be summarized as follows.



To view the image of an object in a mirror, you must sight along a line at the image. One of the many rays of light from the object will approach the mirror and reflect along your line of sight to your eye. This ray of light is known as the incident ray. The incident ray (as represented by the blue ray in the diagram) intersects the mirror at the same location where your line of sight intersects the mirror. The light ray then reflects off the mirror and travels to your eye (as represented by the red ray in the diagram); this ray of light is known as the reflected ray.

Observe in the diagram above that the image is positioned directly across the mirror along a line that runs from the object, perpendicular to the mirror. The distance from the mirror to the object (known as the object distance) is equal to the distance from the mirror to the image (known as the image distance). For all plane mirrors, this equality holds true:

$$\text{Object distance} = \text{Image distance}$$

## Worksheet 1 – Fisica

**Homework: Esercizio 1.** Dal testo *The role of Light to Sight*, create un mini glossario completando la tabella sottostante.

TERMINE IN INGLESE	DEFINIZIONE

**Lezione 2: Esercizio 2.** Scrivete tre semplici frasi in lingua inglese usando alcuni tra i termini riportati nella tabella precedente.

1. ....
2. ....
3. ....

## Worksheet 2 – Fisica

**Homework: Esercizio 1.** Dal testo *The line of Sight*, create un mini glossario completando la tabella sottostante.

TERMINE IN INGLESE	DEFINIZIONE

**Lezione 2: Esercizio 2.** Scrivete tre semplici frasi in lingua inglese usando alcuni tra i termini riportati nella tabella precedente.

1. ....
2. ....
3. ....

# LEZIONE 2 Fisica

**First hour:** students have to complete worksheets 1 and 2, ex. 2. Then, the correction of the worksheets is done together in class. After that students are given text C, which is about “reflection from a plane mirror and diffusion”.

**Second hour:** the teacher explains the three texts (possibly in English), and starts the discussion (both in Italian and in English).

Students are required to work on worksheet 3. Each exercise is corrected in class.

TEXT C from: DOUBLE AWARD SCIENCE PHYSICS HIGHER, by B. Arnold, ed. Letts

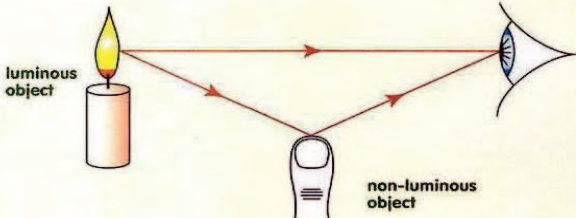
WAVES

## REFLECTION AND REFRACTION

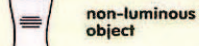
**Examiner's Top Tip**  
Angles are always measured between the ray and the normal. A normal is a line at 90° to the surface.

### SEEING OBJECTS

- We see **luminous objects** such as fires, light bulbs and stars because some of the light they **emit** enters our eyes.
- We see **non-luminous objects** because some of the light they **reflect** enters our eyes.



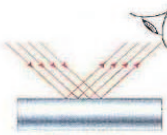
luminous object



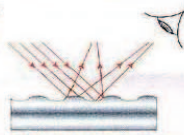
non-luminous object

**Examiner's Top Tip**  
Always put arrowheads on rays. If the ray changes direction, put one arrowhead on the ray before the change and one after.

### PLANE AND DIFFUSION REFLECTION

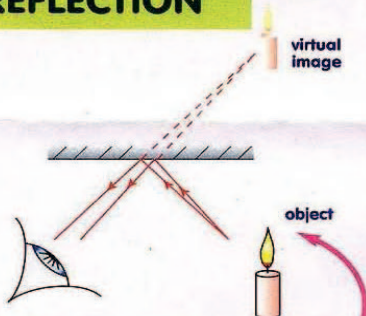


shiny surface



matt or rough surface

- All the rays are reflected in the same direction. Lots of light enters our eyes so the surface looks **shiny or glossy**.
- Because the light is **scattered**, only a little of it enters our eyes so the surface appears **dull or matt**.




virtual image

object

**THE IMAGE CREATED BY A PLANE MIRROR**  
The image of an object is:

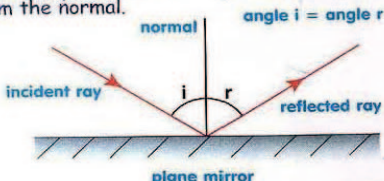
- **upright**
- the **same size** as the object
- the **same distance** behind the mirror as the object is in front
- **laterally inverted**, i.e. the left is seen on the left and the right is seen on the right
- a **virtual image**, i.e. it cannot be formed on a screen placed behind the mirror.



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### REFLECTION FROM A PLANE MIRROR

- When a ray of light strikes a plane mirror it is reflected so that the **angle of incidence** is equal to the **angle of reflection**. The angles are always measured from the normal.



normal

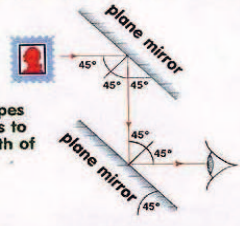
angle  $i = \text{angle } r$

incident ray

reflected ray

plane mirror

**SIMPLE PERISCOPE**



plane mirror

plane mirror

Simple periscopes use two mirrors to change the path of a ray of light.

REFLECTION AND REFR

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# Worksheet 3 – Fisica

**Activity 1.** The table below contains words that have been divided in two parts. Find the pieces that fit together and write them on the lines below.

mir	ection	ra	al	y
refl	tual	ror	vir	rse
re	ima	reve	gla	lig
in	ss	ht	ge	vert

.....

.....

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**Activity 2.** Find the following words hidden in the crossword puzzle. The words are left to right, right to left, diagonally... Then discover and write the hidden sentence:

.....

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REFLECT, VIRTUAL, REAL, LIGHT, MIRROR, PLAIN, IMAGE, RIGHT, LEFT, DOWN, LOOK, FUN, RAY

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T	W	I	T	C	E	L	F	E	R
H	T	L	P	L	A	I	N	H	L
G	O	A	U	U	T	G	L	E	O
I	I	E	T	G	H	H	F	R	O
R	O	R	R	I	M	T	U	A	K
T	I	M	A	G	E	N	N	Y	O
V	N	W	O	D	S	I	G	H	T

**Activity 3.** Connect nouns and adjectives. Then give examples like «I have a big plane mirror», «The sun is a luminous object»...

	LUMINOUS	BIG	WHITE	VIRTUAL	HEAVY	PLANE	REFLECTED
IMAGE							
MIRROR							
LIGHT							
RAY							
OBJECT							

.....

.....

# LEZIONE 3 Lingua inglese

Using the previous texts, students are required to work in groups on worksheet 4. They have 15 minutes. In the second part of the lesson students are given worksheet 5 and they do Exercise 1.

## Worksheet 4 – Lingua inglese

**Exercise 1. Answer the following questions.**

1. What is a luminous object?

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.....  
.....

2. Which is the relationship between the angle of incidence and the angle of reflection?

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.....

3. Can you describe the image that is created by a plane mirror?

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**Exercise 2. Decide if the following statements are true or false.**

		TRUE	FALSE
1.	A light bulb is a luminous object.		
2.	A non-luminous object can't be seen.		
3.	A shiny surface reflects all the rays in different directions.		
4.	A virtual image is an image created by a plane mirror.		
5.	A reflected ray is emitted by a luminous object.		
6.	The angle of incident is not always equal to the angle of reflection.		

**Exercise 3. Correct the false statements of the previous exercise.**

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# Worksheet 5 – Lingua inglese

Exercise 1. Fill in the table with your ideas, according to their importance.

1. IMPORTANT	2. QUITE IMPORTANT	3. VERY IMPORTANT
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.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
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.....	.....	.....
.....	.....	.....
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.....	.....	.....

Exercise 2. Write about 120-150 words on “Light and reflection”.

Use the following writing frame to help you.

*Writing frame:*

- Paragraph 1 (introduction):      What is light?
- Paragraph 2 (background):      Where does light come from?  
  What is a ray of light?
- Paragraph 3 (current situation):      How is a ray of light present in everyday life? Give examples.
- Paragraph 4 (conclusion):      Give your opinion about...  
  Give a reason for your opinion.

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## LEZIONE 4 Lingua inglese

From Worksheet 5, ex. 2, students write a guided composition on “Light and Reflection”, which is given to the teacher at the end of the lesson.

# LEZIONE 5 Fisica (compresenza con Lingua inglese)

The two teachers have corrected together (language and content) students' compositions (worksheet 5) before this lesson.

In class they discuss the mistakes with each group in turn, and explain the corrections either in Italian or in English. While doing this checking with the single group, the other groups are working on the following tasks.

## TASK GROUP 1

**Date:** ..... **Class:** .....

**Students:** .....; .....; .....; .....

Your class must create a Power Point presentation. The class is divided into six groups.

Your group must create these slides:

### SLIDE 1 Title

Suggestion: nice, colourful, interesting title.

### SLIDE 2 Map about light and sight

Suggestion: you can use the maps made by your classmates.

Write here the steps:

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## TASK GROUP 2

**Date:** ..... **Class:** .....

**Students:** .....; .....; .....; .....

Your class must create a Power Point presentation. The class is divided into six groups.

Your group must create these slides:

### SLIDE 3 The role of light to sight

Suggestion: choose and write some important sentences from text B.

### SLIDE 4 The role of light to sight

Suggestion: choose and write other important sentences from text B.

If you need more slides, you can create them. You can also add pictures.

Write here the steps:

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### TASK GROUP 3

Date: ..... Class: .....

Students: .....; .....; .....; .....

Your class must create a Power Point presentation. The class is divided into six groups.  
Your group must create these slides:

**SLIDE 5 The line of sight**

Suggestion: choose and write some important sentences from text C.

**SLIDE 6 The line of sight**

Suggestion: choose and write other important sentences from text C.

If you need more slides, you can create them. You can also add pictures.

Write here the steps:

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### TASK GROUP 4

Date: ..... Class: .....

Students: .....; .....; .....; .....

Your class must create a Power Point presentation. The class is divided into six groups.  
Your group must create these slides:

**SLIDE 7 The characteristics of the image created by a plane mirror**

Suggestion: choose and write some important sentences from text A.

**SLIDE 8 The characteristics of the image created by a plane mirror**

Suggestion: choose and write some important sentences from text A.

If you need more slides, you can create them. You can also add pictures.

Write here the steps:

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## TASK GROUP 5

Date: ..... Class: .....

Students: .....; .....; .....; .....

Your class must create a Power Point presentation. The class is divided into six groups.  
Your group must create these slides:

### **SLIDE 9 The reflection from a plane mirror**

Suggestion: choose and write some important sentences from text A.

### **SLIDE 10 The reflection from a plane mirror**

Suggestion: choose and write other important sentences from text A.

If you need more slides, you can create them. You can also add pictures.

Write here the steps:

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## TASK GROUP 6

Date: ..... Class: .....

Students: .....; .....; .....; .....

Your class must create a Power Point presentation. The class is divided into six groups.  
Your group must create these slides:

### **SLIDE 11 Plane diffusion**

Suggestion: choose and write some important sentences from text A.

### **SLIDE 12 Plane diffusion**

Suggestion: choose and write other important sentences from text A.

If you need more slides, you can create them. You can also add pictures.

Write here the steps:

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## LEZIONE 6 Fisica

Students work on their Power Point Presentation about light and sight.  
The slides are sent to the teacher at the end of the lesson.

## LEZIONE 7 Lingua inglese

The teacher give the students some word games in order to memorize the new vocabulary. The ones presented to the students have been constructed using the website [www.discoveryeducation.com](http://www.discoveryeducation.com).

The students have 20-30 minutes and they work in pairs. Check students answers at the end of the lesson.  
(Taken from: <http://puzzlemaker.discoveryeducation.com>)

### Activity 1. Word search with a hidden message.

After finding all the words listed below the puzzle, copy the remaining letters in the given spaces and the hidden message will be revealed.

### Reflection and his importance

N	W	S	S	E	I	K	S	W	I
T	I	H	C	D	O	U	T	H	L
I	G	A	H	I	U	T	T	I	H
S	S	A	R	G	S	O	E	T	P
R	E	W	O	B	U	Y	L	E	L
A	B	S	E	N	C	E	H	C	A
L	U	M	I	N	O	U	S	P	N
W	I	N	D	O	W	S	L	D	E
B	E	N	R	O	R	R	I	M	O
S	I	G	G	R	E	E	N	H	T

ABSENCE  
MIRROR

BRAIN  
PHYSICS

CLOUDS  
PLANE

GRASS  
SKIES

GREEN  
WHITE

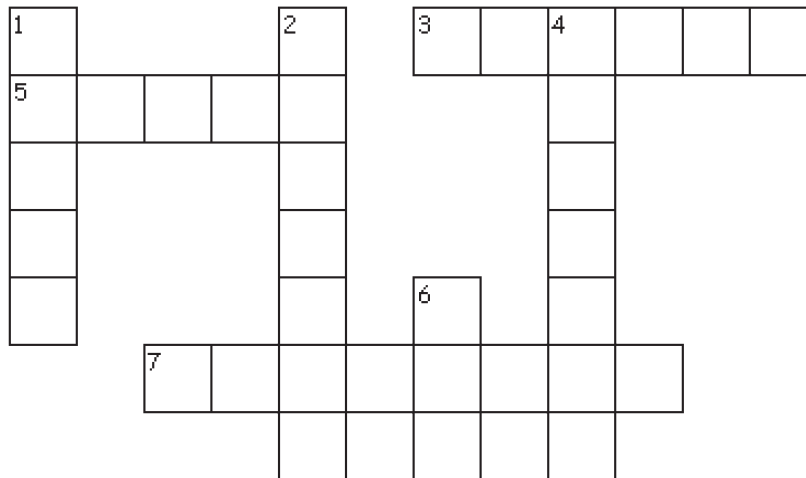
LUMINOUS  
WINDOWS

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## Activity 4. Criss-cross puzzle.

### Light



#### Across

3. A surface capable of reflecting sufficient light to form an image of an object placed in front of it.
5. A reproduction of the form of a person or object.
7. The extent of space between two objects or places; an intervening space.

#### Down

1. The ability to see.
2. The act or an instance of reversing.
4. Send back an image of.
6. A thin line or narrow beam of light or other radiant energy.





**Exercise 3. Reading comprehension: read the text and complete the following exercises.**

**What is light?**

Light is part of the electromagnetic spectrum, the spectrum is the collection of all waves, which include visible light, Microwaves, radio waves (AM, FM, SW), X-Rays, and Gamma Rays. In the late 1600s, important questions were raised, asking if light is made up of particles or waves. *Sir Isaac Newton*, held the theory that light was made up of tiny particles. In 1678, Dutch physicist, *Christiaan Huygens*, believed that light was made up of waves vibrating up and down perpendicular to the direction of the light travels, and therefore formulated a way of visualizing wave propagation. This became known as '*Huygens' Principle*'. Huygens' theory was the successful theory of light wave motion in three dimensions. Huygen suggested that light wave peaks form surfaces like the layers of an onion. In a vacuum, or other uniform mediums, the light waves are spherical, and these wave surfaces advance or spread out as they travel at the speed of light. This theory explains why light shining through a pinhole or slit will spread out rather than going in a straight line. Newton's theory came first, but the theory of Huygens better described early experiments. Huygens' principle lets you predict where a given wavefront will be in the future, if you have the knowledge of where the given wavefront is at the present time. At the time, some of the experiments conducted on light theory, both the wave theory and particle theory, had some unexplained phenomenon. Newton could not explain the phenomenon of light *interference*. This forced Newton's particle theory in favour of the wave theory. This difficulty was due to the unexplained phenomenon of light *Polarisation* – scientists were familiar with the fact that wave motion was parallel to the direction of wave travel, NOT perpendicular to the direction of wave travel, as light does.

(Taken from [www.nightlase.com.au/education/optics/light.htm](http://www.nightlase.com.au/education/optics/light.htm))

**1. Complete, using all the words listed below.**

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resolve – Newton – explained – shining – most – light – formulated – waves – line – theories – advance – particles – speed – spherical – uniform – spreads

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Light theory started to be ..... in the late 1600s. .... and Huygens elaborated the ..... important light ..... According to the first, ..... is made of tiny ....., according to the second it is composed of ..... Huygens' theory ..... some questions that Newton's couldn't ..... According to this second theory, the light waves are ..... in ..... mediums, and these wave surfaces ..... at the ..... of light. This theory explained why light ..... through a pinhole ..... out of rather than proceeding in a straight .....

**2. Match questions and answers.**

**QUESTIONS:** **A.** What is the main difference between Newton's and Huygens' theories? **B.** What is Huygens' principle? **C.** According to Huygens, how can we describe light motion?

**ANSWERS:** **1.** It is a way of visualising wave propagation based on the hypothesis that light is made up of waves vibrating up and down perpendicular to the direction of the light travels. **2.** According to Newton light was made up of tiny particles, while Huygens believed that light was made up of waves. **3.** Light waves are spherical and vibrate up and down perpendicular to the direction of motion. In a uniform medium they travel at the speed of light.

**SOLUTIONS:** .....