

## **CLIL LESSONS - PHYSICS**

**MOST OF YOU ARE THINKING:**

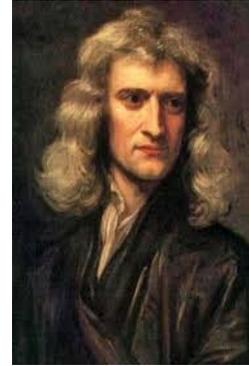
**“WHAT A BORING THING TO DO...  
A PHYSICS LESSON!”**

**But this is more than a physics lesson...**

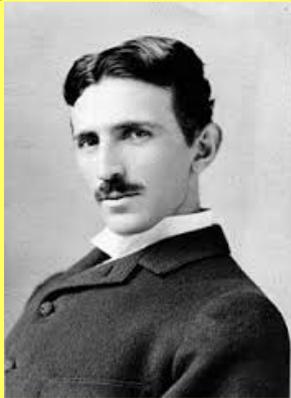
# Students have to split in 5 teams...



**GALILEO  
TEAM**



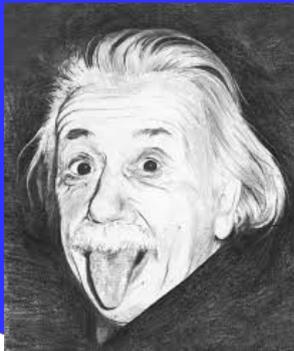
**NEWTON  
TEAM**



**TESLA  
TEAM**



**CURIE  
TEAM**



**EINSTEIN  
TEAM**

...And each team chooses a leader

**This is more than a physics lesson...**

**THIS IS A COMPETITION!!**

**AN AMAZING PRIZE WILL BE AWARDED  
TO THE WINNING TEAM**

**NOT EVERYONE CAN WIN BUT  
EVERYONE CAN HAVE FUN**

**...**

***because physics is amazing***



## What's a CLIL lesson?

# **C**ontent and **L**anguage **i**ntegrated **L**earning

It is a kind of lesson in which pupils learn a subject through the medium of a foreign language

Even if their English is not very good, subject teachers do the clil lesson.

The important thing is not to be perfect, but to be able to communicate

CLIL LESSONS  
PHYSICS

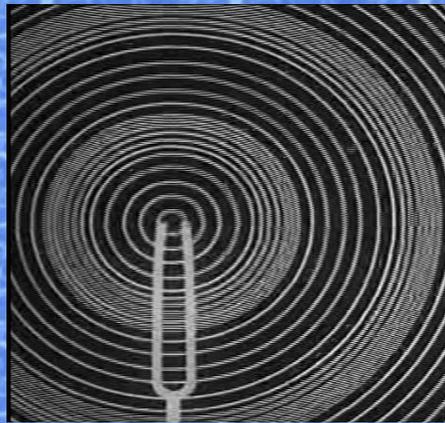
# WAVES

Pina Tontodonato

# Waves are everywhere



A.



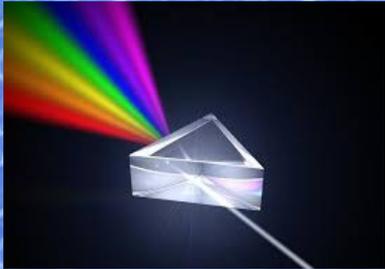
b.



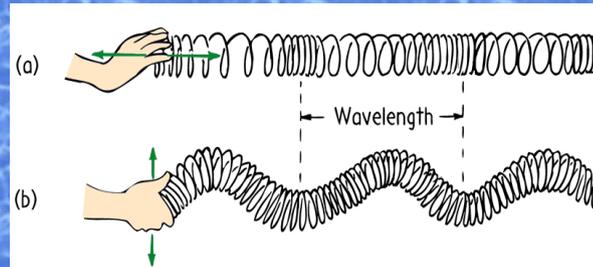
c.



d.



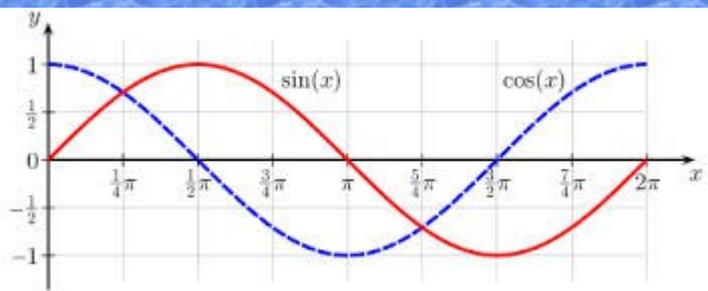
e.



f.



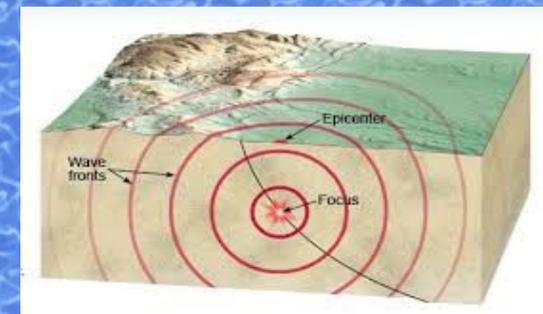
g.



h.



i.



l.

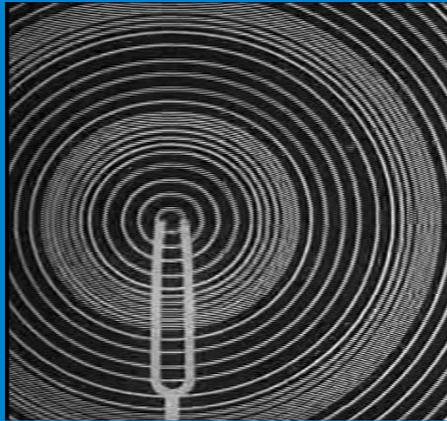
## **ACTIVITY 1: Match figures and associated waves**

**2 points if all answers are correct**  
**1 point if more than 50% is correct**  
**0 point if less than 50% is correct**

# ACTIVITY 1: Match figures and associated waves



A.



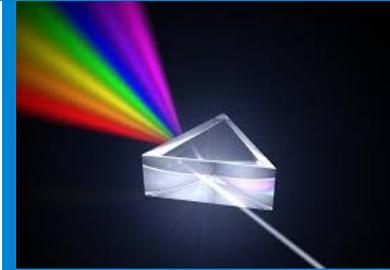
B.



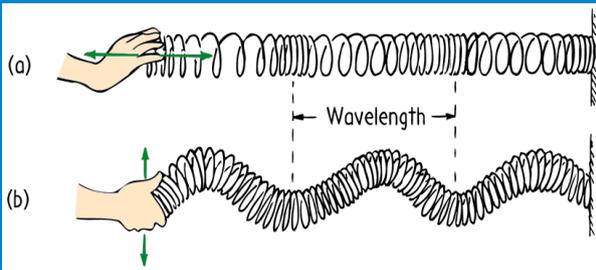
C.



D.



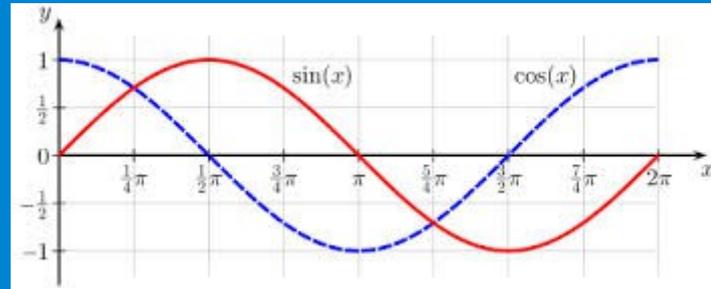
E.



F.



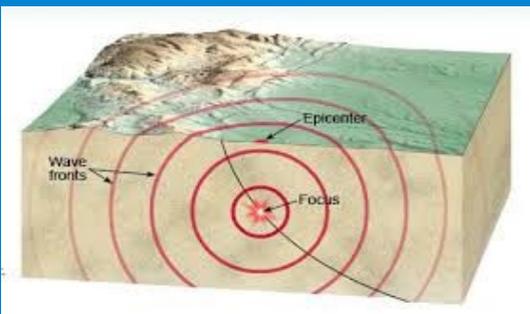
G.



H.



I.



L.

- 1) SLINKY WAVES
- 2) EARTHQUAKE WAVES
- 3) SOUND WAVES
- 4) X RAYS
- 5) STADIUM WAVES

- 6) RADIO WAVES
- 7) VISIBLE LIGHT WAVES
- 8) SINE AND COSINE WAVES
- 9) WATER WAVES
- 10) MICROWAVES

## ACTIVITY 1: SOLUTION

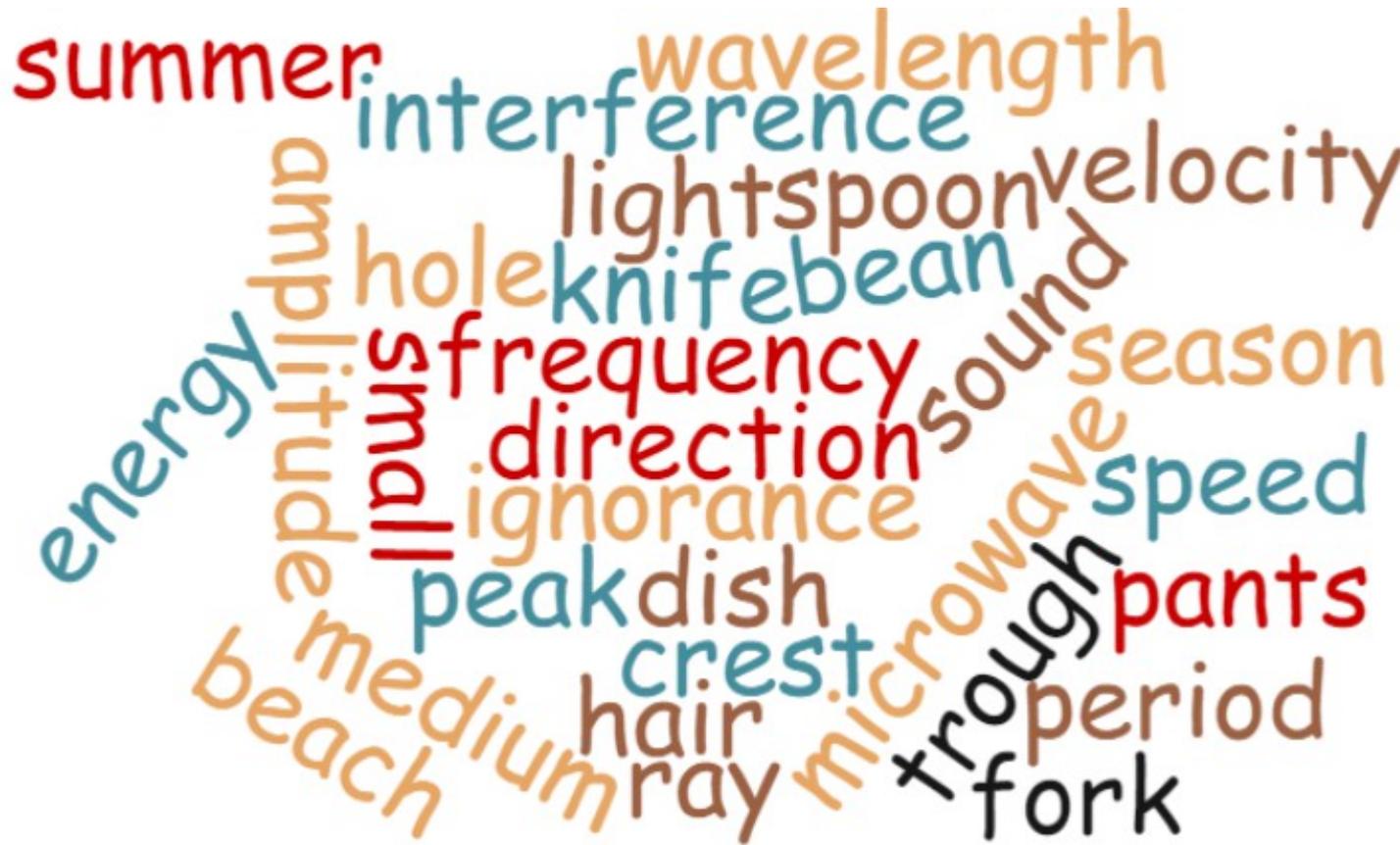
A	9
B	3
C	5
D	10
E	7
F	1
G	6
H	8
I	4
L	2

**2 points if all answers are correct**  
**1 point if more than 50% is correct**  
**0 point if less than 50% is correct**





## ACTIVITY 2 (Glossary): solution



**2 points if the team writes at least 15 correct words**  
**1 points if the team writes at least 10 correct words**  
**0 points if the team writes less than 10 correct words**

wavelength
period
amplitude
disturbance
vibrations
energy
ray
velocity
speed
trough
crest
peak
direction
frequency
microwave
light
sound
interference

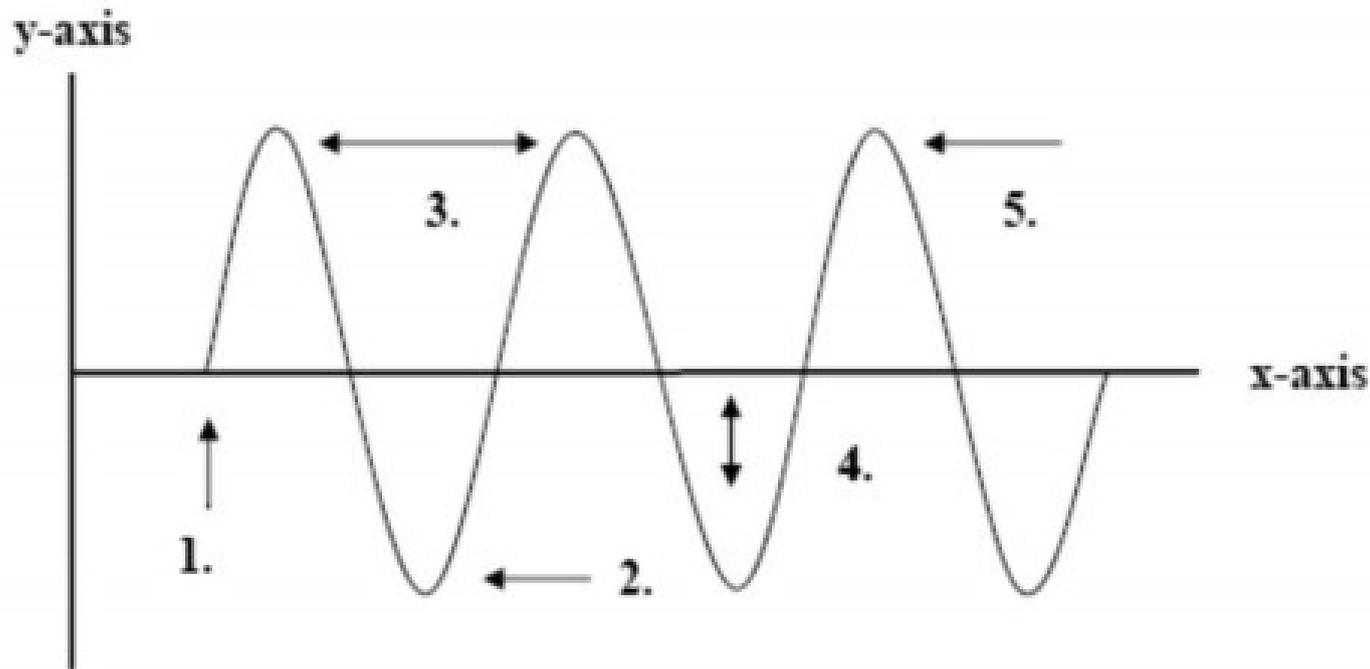
## **ACTIVITY 3 (Glossary): Fill in the gaps**

**2 points if all answers are correct**  
**0 points if there are mistakes**

## ACTIVITY 3 (Glossary): Anatomy of a wave worksheet

In the diagram below, identify the parts of a wave by using the provided definitions.

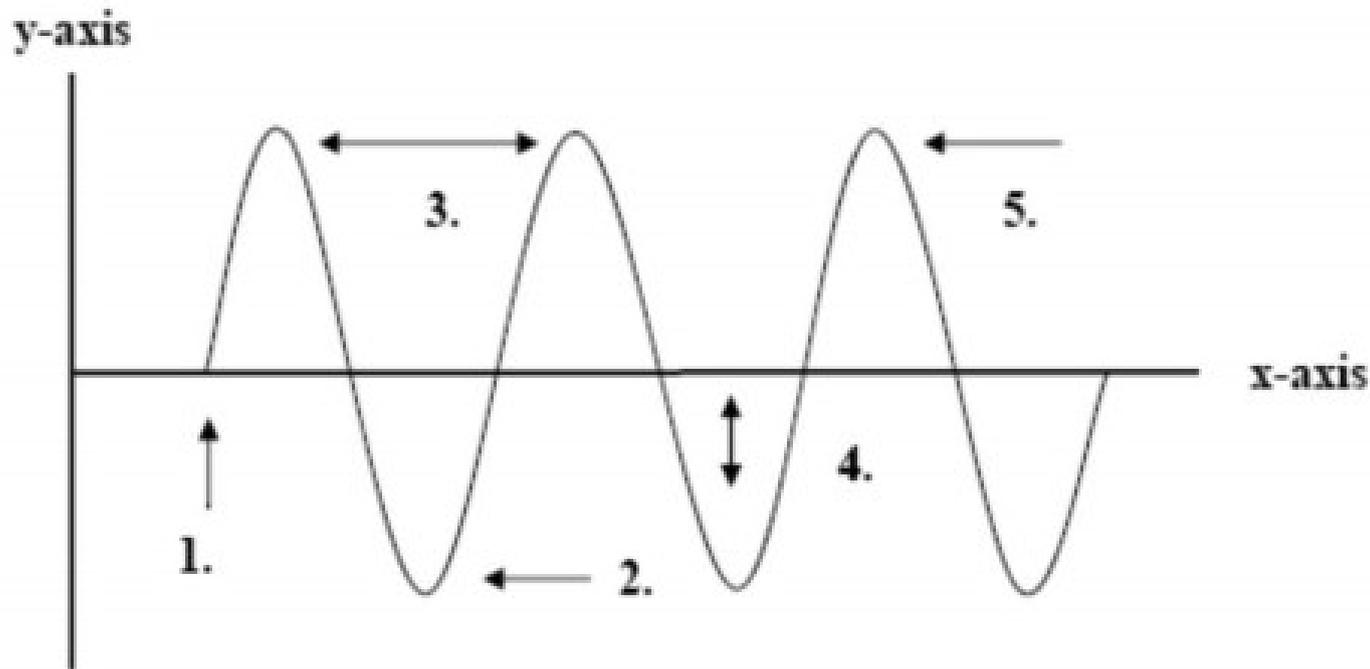
- # \_\_\_\_ = **crest**            The highest point of the wave above the line of origin.
- # \_\_\_\_ = **trough**            The lowest point of the wave below the line of origin.
- # \_\_\_\_ = **line of origin**    Signifies the original position of the medium.
- # \_\_\_\_ = **wavelength**      The distance between two consecutive crests.
- # \_\_\_\_ = **amplitude**        The distance from the line of origin to a crest or trough of a wave.



## ACTIVITY 3 (Glossary): Solution

In the diagram below, identify the parts of a wave by using the provided definitions.

- # 5 = **crest**      The highest point of the wave above the line of origin.
- # 2 = **trough**      The lowest point of the wave below the line of origin.
- # 1 = **line of origin**      Signifies the original position of the medium.
- # 3 = **wavelength**      The distance between two consecutive crests.
- # 4 = **amplitude**      The distance from the line of origin to a crest or trough of a wave.



**2 points if all answers are correct**  
**0 point if there are mistakes**

# ACTIVITY 4 (specific glossary): match terms, pictures and definitions

A

propagation direction

B

amplitude

C

crest

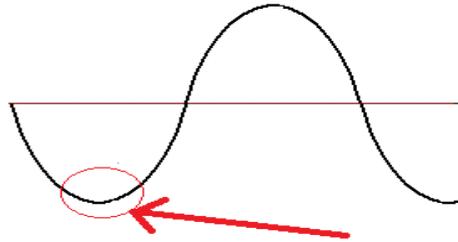
D

wavelength

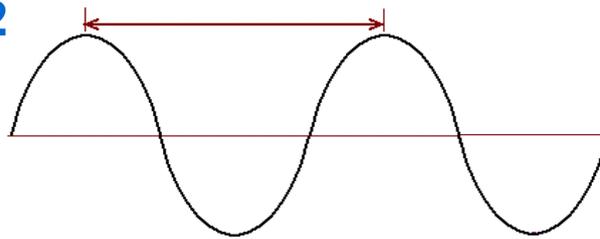
E

trough

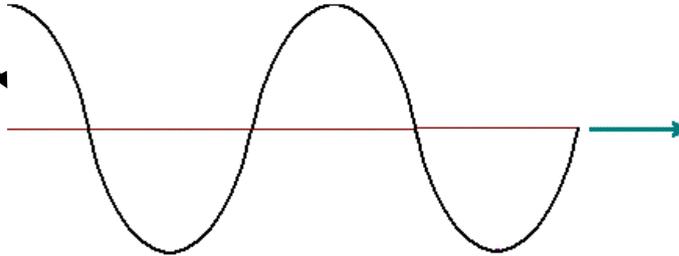
1



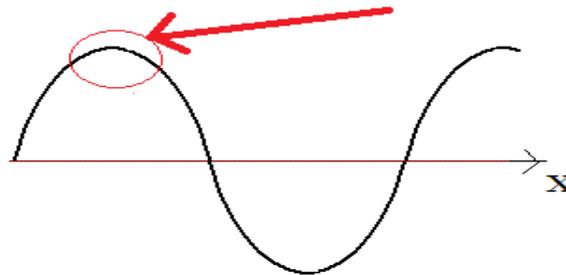
2



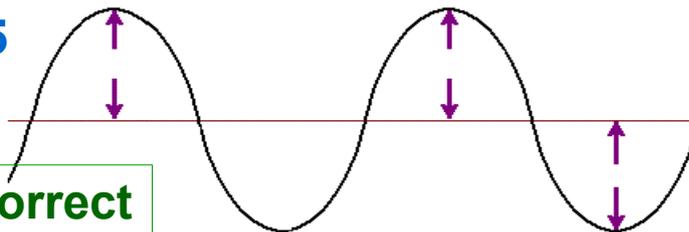
3



4



5



$\alpha$

the distance from crest to crest or from trough to trough.

$\beta$

The straight line which represents the direction of propagation of the wave.

$\gamma$

The lowest point or point on the medium that exhibits the maximum amount of negative displacement from the rest position.

$\epsilon$

the maximum amount of displacement of a particle on the medium from its rest position.

$\delta$

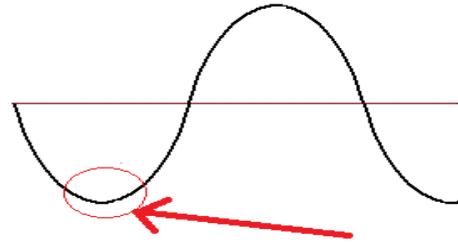
PEAK or the point on the medium that exhibits the maximum amount of positive displacement from the rest position.

2 points if all answers are correct  
0 points if there are mistakes

# ACTIVITY 4 (specific glossary): SOLUTION

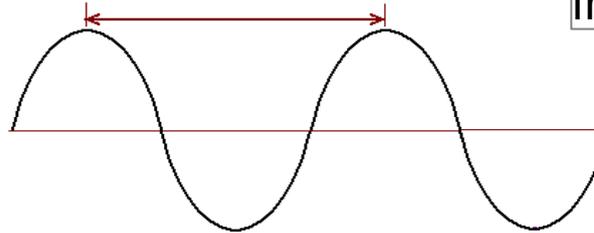
A	3	$\beta$
B	5	$\epsilon$
C	4	$\delta$
D	2	$\alpha$
E	1	$\gamma$

trough



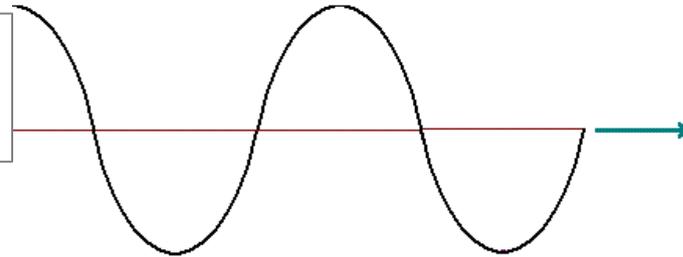
The lowest point or point on the medium that exhibits the maximum amount of negative displacement from the rest position.

wavelength



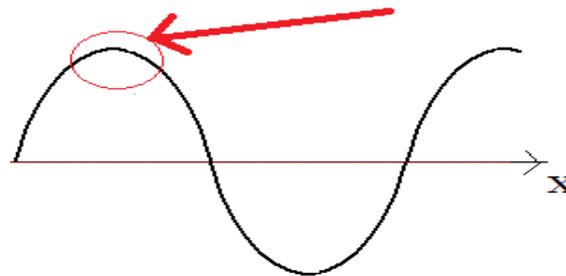
the distance from crest to crest or from trough to trough.

propagation direction



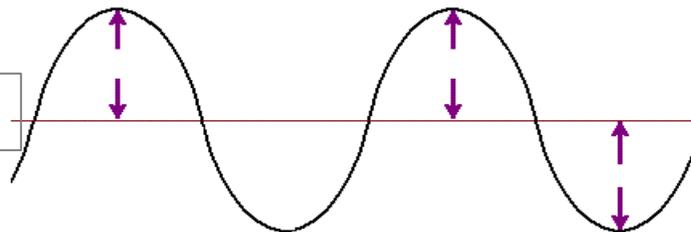
The straight line which represents the direction of propagation of the wave.

crest



PEAK or the point on the medium that exhibits the maximum amount of positive displacement from the rest position.

amplitude



the maximum amount of displacement of a particle on the medium from its rest position.

**2 points if all answers are correct**  
**0 points if there are mistakes**

## **ACTIVITY 5 (glossary): Fill in the gaps**

**2 points if all answers are correct**  
**0 point if there are mistakes**

## ACTIVITY 5 (glossary): Fill in the gaps

**Oscillation:** the act of regularly [1]\_\_\_\_\_ from one position to another and back to the original position

**Energy:** The [2]\_\_\_\_\_ to do work.

**Physical quantity:** is a physical [3]\_\_\_\_\_ of a phenomenon, body, or substance, that can be quantified by measurement. For instances: Mass, Time, Volume.

**Speed:** the speed of an object is the magnitude of its [4]\_\_\_\_\_ (the rate of change of its position).

**Matter:** physical or corporeal substance in general, whether solid, [5]\_\_\_\_\_ or gaseous.

**Vacuum:** emptiness of space. A space from which most or all of the [6]\_\_\_\_\_ has been removed.

**Medium:** in physics, a material through with waves [7]\_\_\_\_\_

Words to be used:

A)Matter - B) velocity – C) propagate -  
D)capacity - E)property – F)moving – G)liquid

## ACTIVITY 5 (glossary): solution

**Oscillation:** the act of regularly [1]\_moving\_\_ from one position to another and back to the original position

**Energy:** The [2]\_capacity\_\_ to do work.

**Physical quantity:** is a physical [3]\_property\_\_ of a phenomenon, body, or substance, that can be quantified by measurement. For instances: Mass, Time, Volume.

**Speed:** the speed of an object is the magnitude of its [4]\_velocity\_\_ (the rate of change of its position).

**Matter:** physical or corporeal substance in general, whether solid, [5]\_liquid\_\_ or gaseous.

**Vacuum:** emptiness of space. A space from which most or all of the [6]\_matter\_\_ has been removed.

**Medium:** in physics, a material through which waves [7]\_propagate\_\_

**2 points if all answers are correct**  
**0 point if there are mistakes**

1	F
2	D
3	E
4	B
5	G
6	A
7	C

## Activity 6: **WALKING DICTATION**

**6 points to the 1° team**  
**4 points to the 2° team**  
**3 points to the 3° team**  
**2 points to the 4° team**  
**1 point to the 5° team**

# Activity 6: **WALKING DICTATION**

The teacher cut a text into sentences and split the class into groups.

Each group must have one or more runners and a writer.

The first runner has to TO WALK (AND NOT TO RUN) and read the first sentence. Runners are not allowed to touch the paper, take the paper back to the group or shout the sentence across the room. They have to come back and repeat the sentence to the writer.

Spelling words out is fine. MOBILE PHONES are not allowed.

The runners can only whisper to their partners and not speak in a normal voice.

Any voice above a whisper and the game is over for that team.

The writer of the group writes down the sentence as it is dictated, if the runner forgets part of the sentence they are allowed to go back to the paper and re-read it.

The group can then elect another runner and a writer and they have to find another sentence.

Once the sentences have been written correctly (max 3 mistakes allowed), the group then has to put the sentences in the correct order.

When the sentences have been ordered, the team hands in the sequence to the teacher.

The first team handing the correct sequence wins.

## ACTIVITY 6: WALKING DICTATION

### Albert Einstein e Leopold Infeld, What is a wave? (The Evolution of Physics)

*(A): The wind, passing over a field of grain, sets up a wave which spreads out across the whole field. Here again we must distinguish between the motion of the wave and the motion of the separate plants, which undergo only small oscillations.*

*(B): The essentially new thing here is that for the first time we consider the motion of something which is not matter, but energy propagated through matter.*

*(C): The particles constituting the medium perform only small vibrations, but the whole motion is that of a progressive wave.*

*(D): There are two quite different motions involved, that of the rumor, Washington to New York, and that of the persons who spread the rumor.*

*(E): A bit of gossip starting in Washington reaches New York very quickly, even though not a single individual who takes part in spreading it travels between these two cities.*

## ACTIVITY 6: Solution

***Albert Einstein e Leopold Infeld, What is a wave?***

***(The Evolution of Physics)***

1	E
2	D
3	A
4	C
5	B

*« A bit of gossip starting in Washington reaches New York very quickly, even though not a single individual who takes part in spreading it travels between these two cities. There are two quite different motions involved, that of the rumor, Washington to New York, and that of the persons who spread the rumor. The wind, passing over a field of grain, sets up a wave which spreads out across the whole field. Here again we must distinguish between the motion of the wave and the motion of the separate plants, which undergo only small oscillations. The particles constituting the medium perform only small vibrations, but the whole motion is that of a progressive wave. The essentially new thing here is that for the first time we consider the motion of something which is not matter, but energy propagated through matter. »*

## ACTIVITY 7: fill in the gaps with the words in the list

### What's a wave?

In physics, a wave is a disturbance or oscillation (of a physical quantity) that travels through [1]... or space, accompanied by a transfer of energy.

A wave is a disturbance that carries energy from [2]... to place.

Wave motion [3]... energy from one point to another, often with no permanent displacement of the particles of the medium.

In other words, there is no associated[4] ... transport.

*A [5]... does NOT carry matter with it!*

*It just moves the matter as it goes [6]... it*

#### WORDS TO BE USED:

a) Mass – b) place – c) through – d) matter – e) transfers – f) wave

**2 points if all answers are correct**  
**0 point if there are mistakes**

## ACTIVITY 7: solution

**2 points if all answers are correct**  
**0 point if there are mistakes**

1	d
2	b
3	e
4	a
5	f
6	c

## What's a wave?

In physics, a wave is a disturbance or oscillation (of a physical quantity) that travels through [1] **matter** or space, accompanied by a transfer of energy.

A wave is a disturbance that carries energy from [2] **place**. to place.

Wave motion [3] **transfers** energy from one point to another, often with no permanent displacement of the particles of the medium.

In other words, there is no associated [4] **mass** transport.

*A [5] **wave** does NOT carry matter with it!*

*It just moves the matter as it goes [6] **through** it*

# Jigsaw activity 7



## THE JIGSAW CLASSROOM

The Jigsaw Classroom is a cooperative learning technique that reduces racial conflict among school children, promotes better learning, improves student motivation, and increases enjoyment of the learning experience.

A lecture about the waves types and features has been divided in 5 parts  
(text A- text B- text C – text D – text E)

Within each team, the teacher assigns each student a letter (A-B-C-D-E)

All students A form a new group (group A) and work together to learn text A

The same for the students B, C, D and E.

At the end of this step, each students will come back to his original team and he will explain the text to his mates (but they can't have the text).

At the end of the session, the teacher gives a quiz on the material.

## **Text A**

### **Wave Types**

#### **Mechanical waves:**

They propagate **through a medium**, and the substance of the medium is deformed.

The deformation reverses itself because of restoring forces.

*For example, in slinky waves the restoring force is due to the elastic force.*

*Other Examples of mechanical waves: sound waves, earthquake waves, water waves...*

## ***Text B***

### ***Wave Types:*** **Non mechanical waves**

**Non mechanical waves do not require a medium, they can either propagate through a medium or through a vacuum.**

The most common are the **Electromagnetic waves**: they consist of periodic oscillations of electric and magnetic fields.

They include radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, X-rays and gamma rays.

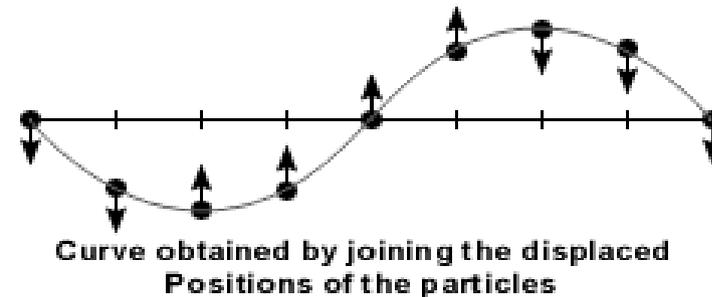
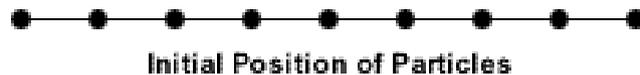
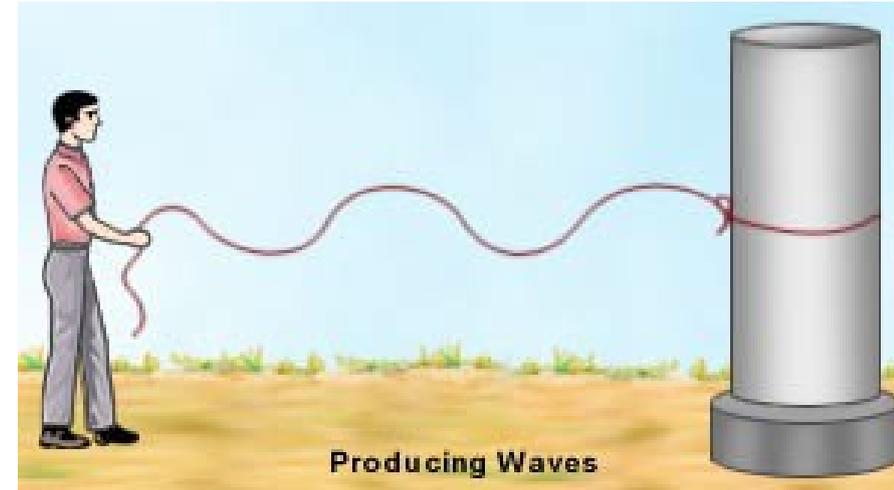
Also gravitational waves can travel through a vacuum, for this reason they are non mechanical waves.

## Text C

### Wave Types: Transverse waves

Waves in which the particles of the medium move at right angles to the direction of the wave.

*observe the figures: particles oscillate along a direction perpendicular to the propagation*



*Think about a "stadium wave:" the people are moving up and down, but the wave is going around the stadium.*

Parts of transverse waves:

**Crest:** the highest point of the wave

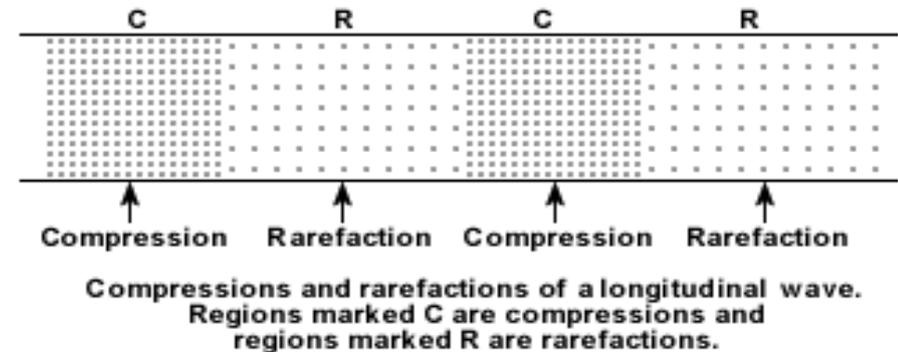
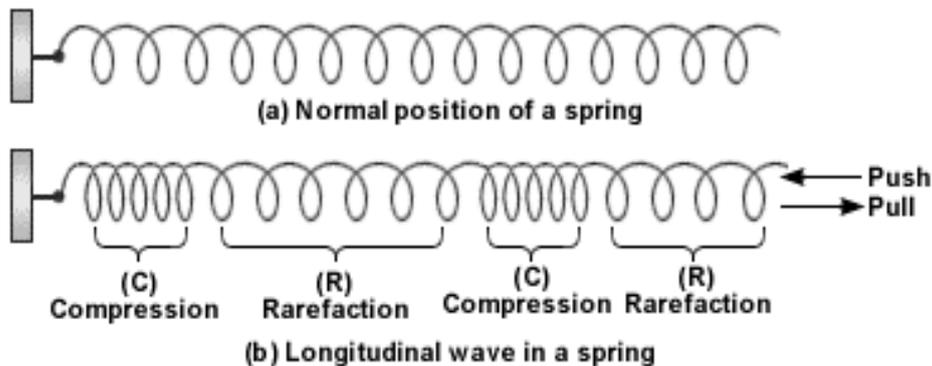
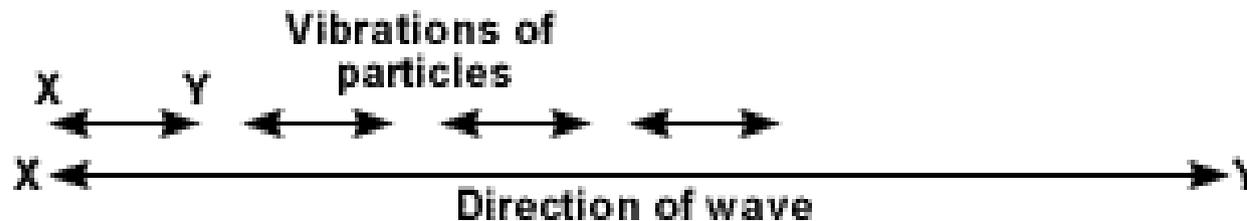
**Trough:** the lowest point of the wave

## Text D

### Wave Types: Longitudinal waves

**Longitudinal waves are also called compressional waves.**

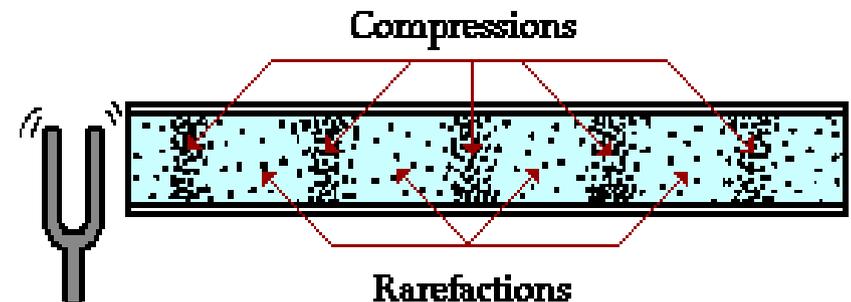
They are waves where the particles of the medium move back and forth in the same direction as the wave. Longitudinal waves occur when the oscillations are parallel to the direction of propagation.



#### Parts of longitudinal waves:

**Compression:** where the particles are close together

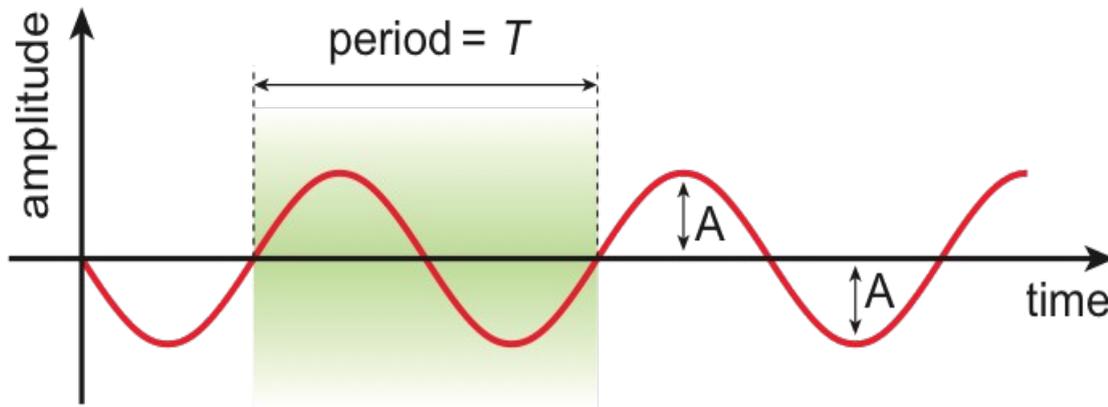
**Rarefaction:** where the particles are spread apart



## Text E

### Wave properties: frequency and period

A wave can be described as a function of time by observing the change in displacement of a single point on the wave. As the wave passes, the point under observation oscillates.



The period  $T$  [s] is the time required for one complete cycle (one oscillation).

**Period (T):** The period of a wave is the time for a particle on a medium to make one complete vibrational cycle.

**Frequency (f):** How many waves go past a point in one second. The number of oscillations occurring in one second. The unit of measurement is hertz (Hz). The higher the frequency, the more energy in the wave.

If 10 waves go past in 1 second, the frequency is 10 Hz

Frequency  $f$  is related to the period  $T$  by:  $f = \frac{1}{T}$

## **ACTIVITY 8: Match terms and definitions**

**6 points if all answers are correct**

**3 points if more than 50% is correct**

**0 point if less than 50% is correct**

## ACTIVITY 8: Match terms and definitions

1) mechanical wave;

2) period;

3) rarefaction;

4) transverse wave;

5) trough;

6) wave;

7) wavelength;

8) amplitude;

9) compression;

10) compressional (longitudinal) wave;

11) crest;

12) electromagnetic waves;

13) energy;

14) frequency;

A) the maximum amount of displacement of a particle on the medium from its rest position.

B) When the particles of a longitudinal wave are far apart.

C) The lowest point on a transverse wave.

D) A disturbance that carries energy from one place to another.

E) A wave in which the medium moves back and forth in the same direction as the wave.

F) the point on the medium that exhibits the maximum amount of positive displacement from the rest position.

G) periodic oscillations of electric and magnetic fields.

H) the time for a particle on a medium to make one complete vibrational cycle.

I) The capacity to do work.

L) The number of oscillations occurring in one second. Measured in hertz (Hz).

M) A wave that requires a medium to travel.

N) A wave in which the particles of the medium move at right angles to the direction of the wave.

O) When the particles of a longitudinal wave are close together.

P) the length of one spatial repetition (known as a wave cycle), or the distance from crest to crest or from trough to trough.

## ACTIVITY 8: solution

**amplitude:** The amplitude of a wave refers to the maximum amount of displacement of a particle on the medium from its rest position.

- **compression:** When the particles of a longitudinal wave are close together.
- **compressional (longitudinal) wave:** A wave in which the medium moves back and forth in the same direction as the wave.
- **crest:** The crest of a wave is the point on the medium that exhibits the maximum amount of positive displacement from the rest position.
- **electromagnetic waves:** they consist of periodic oscillations of electric and magnetic fields. Also called an EM wave.
- **energy:** The capacity to do work.
- **frequency:** The number of oscillations occurring in one second. Measured in hertz (Hz).
- **mechanical wave:** A wave that requires a medium to travel.
- **period:** is the time for a particle on a medium to make one complete vibrational cycle.
- **rarefaction :** When the particles of a longitudinal wave are far apart..
- **transverse wave:** A wave in which the particles of the medium move at right angles to the direction of the wave.
- **trough:** The lowest point on a transverse wave.
- **wave:** A disturbance that carries energy from one place to another.
- **Wavelength:** the length of one spatial repetition (known as a wave cycle), or the distance from crest to crest or from trough to trough.

1	M	8	A
2	H	9	O
3	B	10	E
4	N	11	F
5	C	12	G
6	D	13	E
7	P	14	L

**6 points if all answers are correct**

**3 points if more than 50% is correct**

**0 point if less than 50% is correct**

# ANSWER SHEET – SOLUTION

Act. 2: Fill in the empty column with the words in the cloud related (in physics) to waves

wavelength
period
amplitude
disturbance
vibrations
energy
ray
velocity
speed
trough
crest
peak
direction
frequency
microwave
light
sound
interference

## ACTIVITY 1:

Match figures and associated waves

A	9
B	3
C	5
D	10
E	7
F	1
G	6
H	8
I	4
L	2

## ACT. 3: Fill in the gaps

# 5 = crest  
 # 2 = trough  
 # 1 = line of origin  
 # 3 = wavelength  
 # 4 = amplitude

## ACT. 4: match terms, pictures and definitions

A	3	$\beta$
B	5	$\varepsilon$
C	4	$\delta$
D	2	$\alpha$
E	1	$\gamma$

## ACT. 5: Fill in the gaps

1	F
2	D
3	E
4	B
5	G
6	A
7	C

## ACT. 6: walking dictation

1	E
2	D
3	A
4	C
5	B

## ACT. 7: Fill in the gaps

1	d
2	b
3	e
4	a
5	f
6	c

## ACT. 8: Fill in the gaps

1	M	8	A
2	H	9	O
3	B	10	E
4	N	11	F
5	C	12	G
6	D	13	E
7	P	14	L

## Modern physics

Every elementary particle or quantic entity exhibits the properties of not only particles, but also waves.

According to quantum mechanics, electrons, protons and neutrons can be described as waves.

**We are made of protons, neutrons and electrons**

**Protons, neutrons and electrons are waves**

**We are made of waves**