



# Physics

## 6. Waves 1

# Revisiting Booklet

Name:

# Waves

## Topics:

1. Transverse and longitudinal waves
2. Properties of waves
3. Required practical activity 8: Measuring frequency and wavelength
4. Reflection of waves (physics only)
5. Required practical activity 9 (physics only): Reflection and Refraction
6. Sound waves (physics only) (HT only)
7. Waves for detection and exploration (physics only) (HT only)
8. Types of electromagnetic waves
9. Properties of electromagnetic waves
10. Required practical activity 10: Infra red
11. Properties of electromagnetic waves
12. Uses and applications of electromagnetic waves
13. Lenses (physics only)
14. Visible light (physics only)
15. Emission and absorption of infrared radiation (physics only)
16. Perfect black bodies and radiation

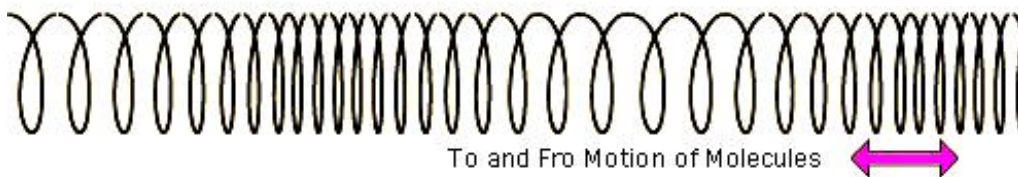
# Transverse and Longitudinal Waves

Draw a graph to represent a transverse wave, label:

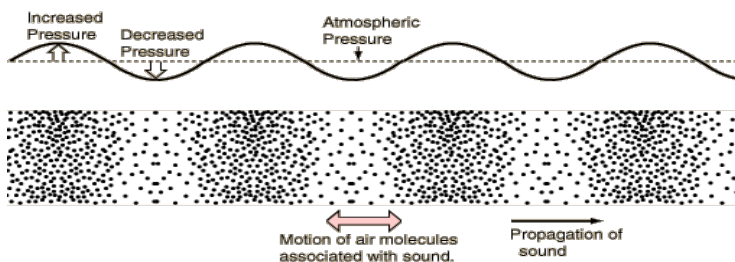
- peak
  - trough
  - Amplitude
  - Wavelength
- 

Now match up the word to its definition:

- |               |   |
|---------------|---|
| 1. Trough     | A. Number of waves produced in each second            |
| 2. Crest      | B. The peak of a wave                                 |
| 3. Amplitude  | C. Distance from one crest to the next                |
| 4. Wavelength | D. The lowest point of a wave                         |
| 5. Frequency  | E. The height of a wave from the middle to the crest. |



1. Label on the diagram where compression and rarefaction occur.
2. Label on the diagram a wavelength.
3. What is the direction of vibration compared to the direction of the wave?



For the above diagram, label on the diagram where compression and rarefaction occur.

# Properties of Waves

Use the formula below to answer the questions. You MUST show your working out.

$$\text{wave speed (v)} = \text{frequency (f)} \times \text{wavelength (\lambda)}$$

1. What is the equation to find the frequency of a wave?
2. What is the equation to find the wavelength of a wave?

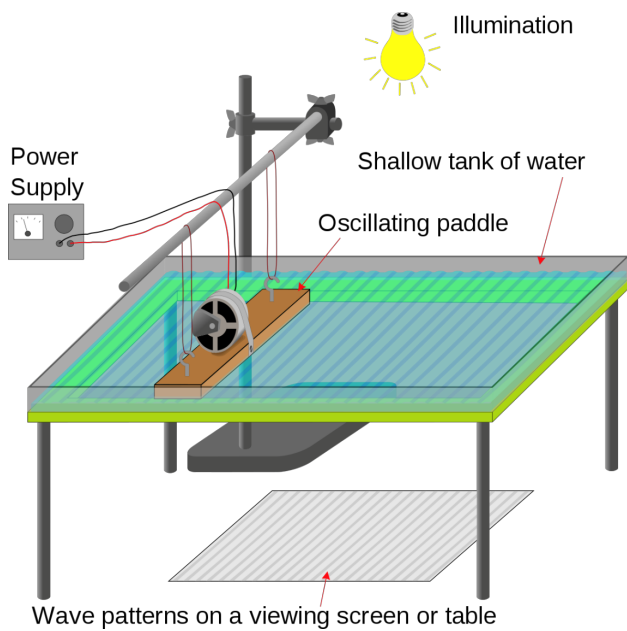
Calculate the following: (3-4 Grade)

1. The frequency of the waves is 0.2 Hz and the length of each wave is estimated at 0.15 m. What is the wave speed?
2. The frequency of the waves is 0.4 Hz and the length of each wave is estimated at 0.15 m. What is the wave speed?
3. The frequency of the waves is 1.5 Hz and the length of each wave is estimated at 2 m. What is the wave speed?
4. The frequency of the waves is 30 Hz and the length of each wave is estimated at 0.2 m. What is the wave speed?

Calculate the following: (5-7 Grade)

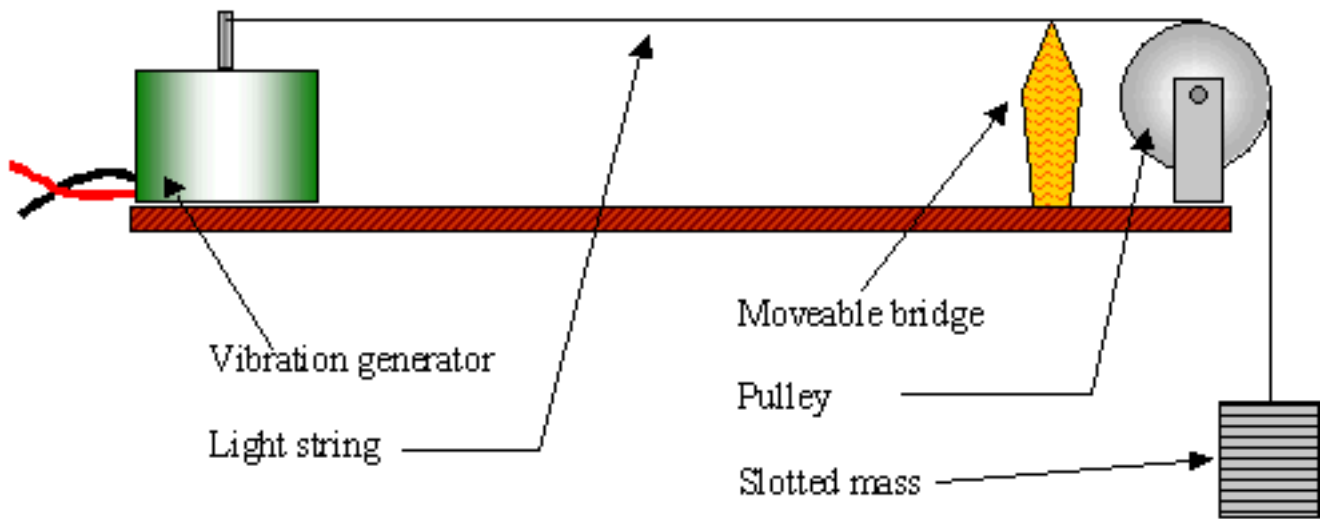
1. The speed of a wave with a frequency of 10kHz and a wavelength of 2m
2. The speed of a wave with a wavelength of 50cm and a frequency of 4kHz
3. The frequency of a wave travelling at 500m/s with a wavelength of 25m
4. The speed of a radio wave with a wavelength of 3000m and a frequency of 100kHz

# Required practical: Measuring frequency and wavelength



## Method

1. Set up the ripple tank with a large sheet of white card or paper on the floor under the tank.
2. Pour water to a depth of about 5 mm into the tank.
3. Adjust the height of the wooden rod so that it just touches the surface of the water.
4. Switch on both the overhead lamp and the electric motor.
5. Adjust the speed of the motor so that low frequency water waves are produced.
6. Adjust the height of the lamp so that the pattern can be clearly seen on the card on the floor.
7. Place a metre ruler at right angles to the waves shown in the pattern on the card. Measure across as many waves as possible then divide that length by the number of waves. This gives the wavelength of the waves.
8. Count the number of waves passing a point in the pattern over a given time (say 10 seconds). Then divide the number of waves counted by 10. This gives the frequency of the waves.
9. Calculate the speed of the waves using the equation:  
$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$



Method

1. Set up the equipment as above, with 1 meter between the vibration generator & wooden block (moveable bridge)
2. Switch on the vibration generator. The string (or elasticated cord) should start to vibrate.
3. Adjust the vibration generator until a clear wave pattern can be seen. The waves should look like they are stationary.
4. The frequency is the frequency of the power supply:
5. Calculate the speed of the wave using the equation:  

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$
6. Repeat at different lengths, for example 0.9m, 0.8m, 0.7m, 0.6m

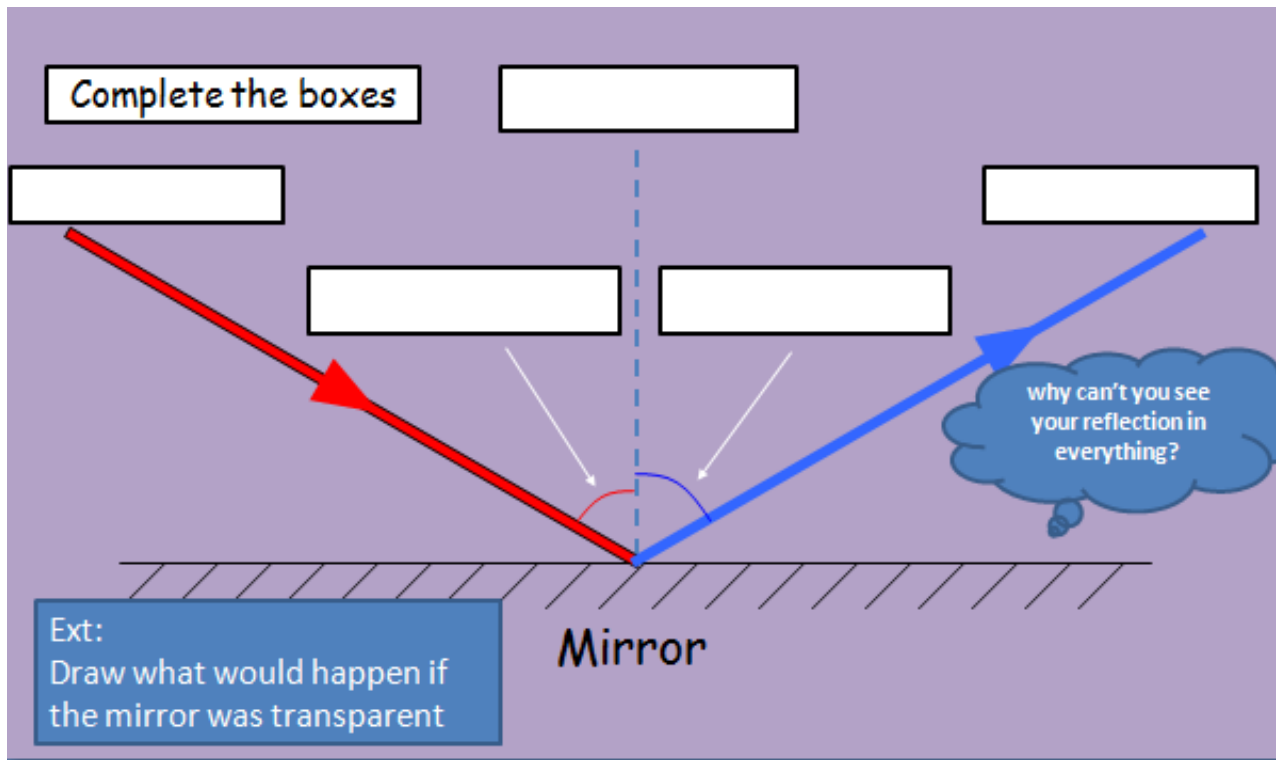
Evaluate each method for working out the speed of a wave:

You will need to read through the methods a couple of times to help with this.

	Ripple tank	Vibration generator
How is the wavelength measured?		
What is the difficulty in measuring the wavelength this way?		
How reliable is wavelength measured?		
How is the frequency measured?		
What is the difficulty in measuring the frequency in this way?		
How reliable is the frequency measured?		

# Reflection of waves (physics only)

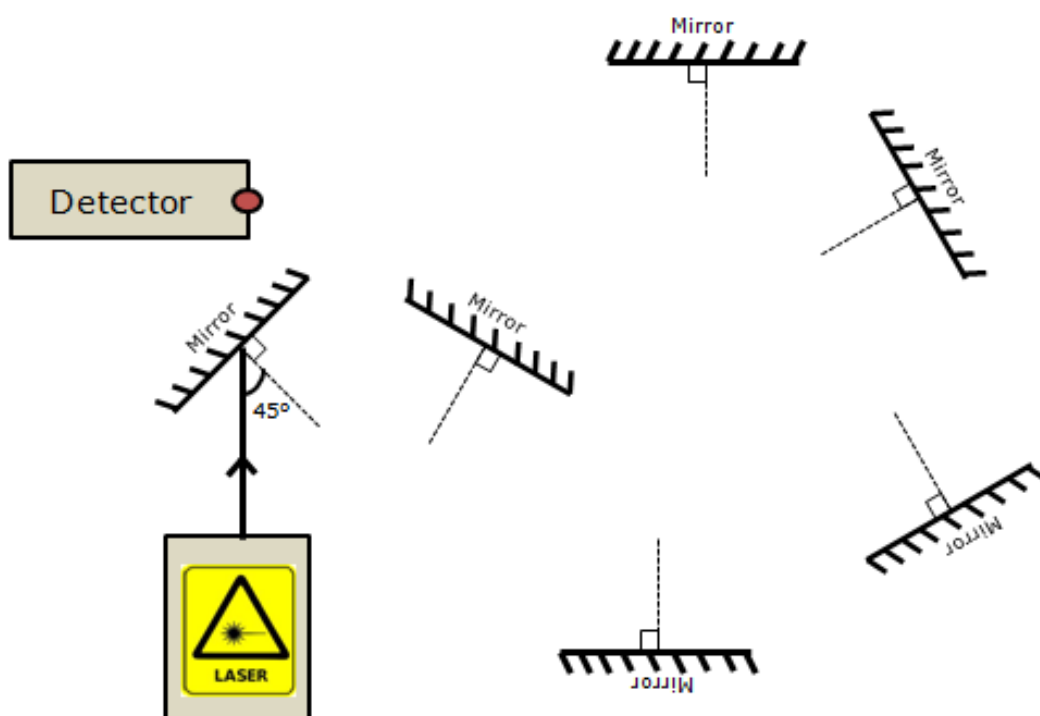
## What is the law of reflection?



## Mirror maze

Can you work out the reflections and show the path of the laser light to the detector?

- Not all mirrors are used.
- Write on the angles of incidence and reflection
- Use arrows to show the direction of the laser light.



## **Required practical activity 9 (physics only): Reflection and Refraction**

1. Using a diagram Explain the difference between refraction and reflection.
2. Draw a diagram to show the relationship between the incident and reflected ray.
3. Describe and explain using a diagram the path of light through a glass block in terms of the speed of light.



# Sound waves (physics only) (HT only)

1

This table shows the speed of sound in water, wood and air at room temperature.

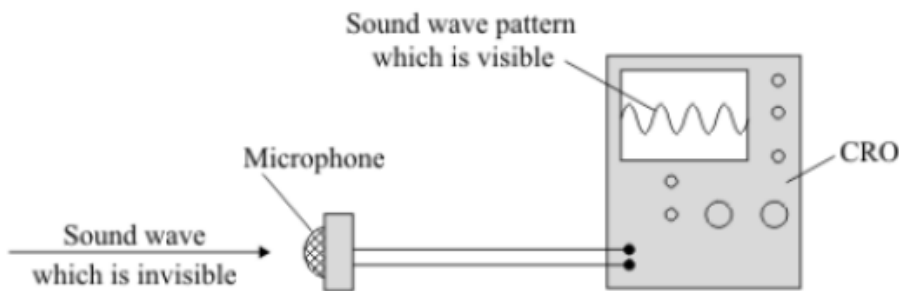
Medium	Speed of sound (m/s)
wood	4120
water	1497
air	344

- a) In which of the three media does sound travel most slowly? .....
- b) Based on the data, does sound travel faster through a liquid or a solid? .....

2 marks

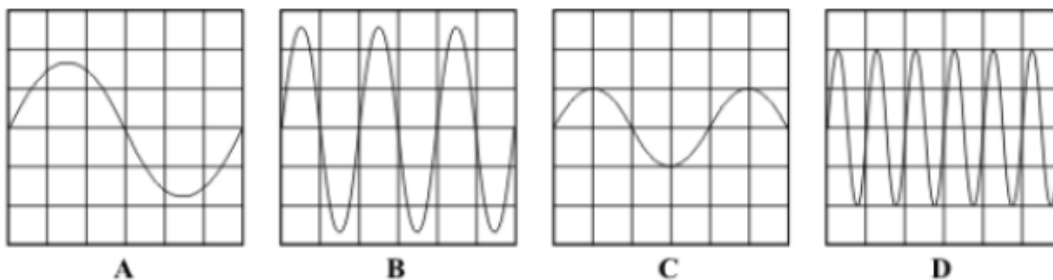
2

A microphone and a cathode ray oscilloscope (CRO) can be used to show the pattern of a sound wave.



Four sound wave patterns, **A**, **B**, **C** and **D**, are shown.

They are all drawn to the same scale.



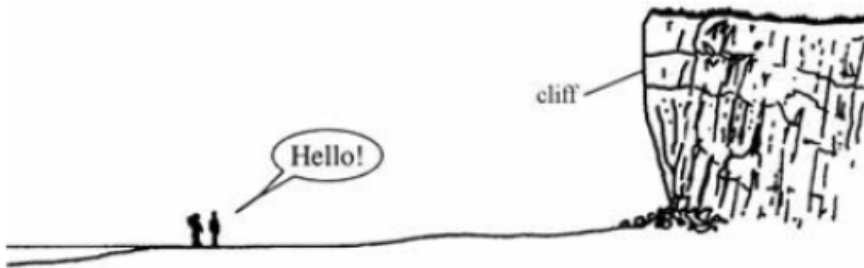
- (a) Which **one** of the patterns has the smallest amplitude? .....
- (b) Which **one** of the patterns has the lowest frequency? .....

(Total 2 marks)

3

Two friends are standing on a beach.

When they shout they can hear themselves a second later.



Explain, as fully as you can, why this happens.  
(You may answer on the diagram if you want to.)

.....

.....

(Total 2 marks)

4

(a) This information is from a science magazine.

<p>Electronic systems can be used to produce ultrasonic waves. These waves have a frequency higher than the upper limit for hearing in humans.</p>
--

Complete the sentence by choosing the correct number from the box.

20	2000	20 000	200 000
----	------	--------	---------

The upper limit for hearing in humans is a frequency of ..... Hz.

(1)

(b) An electronic system produces ultrasound with a frequency of 500 kHz.

What does the symbol kHz stand for?

.....

(1)

2 marks

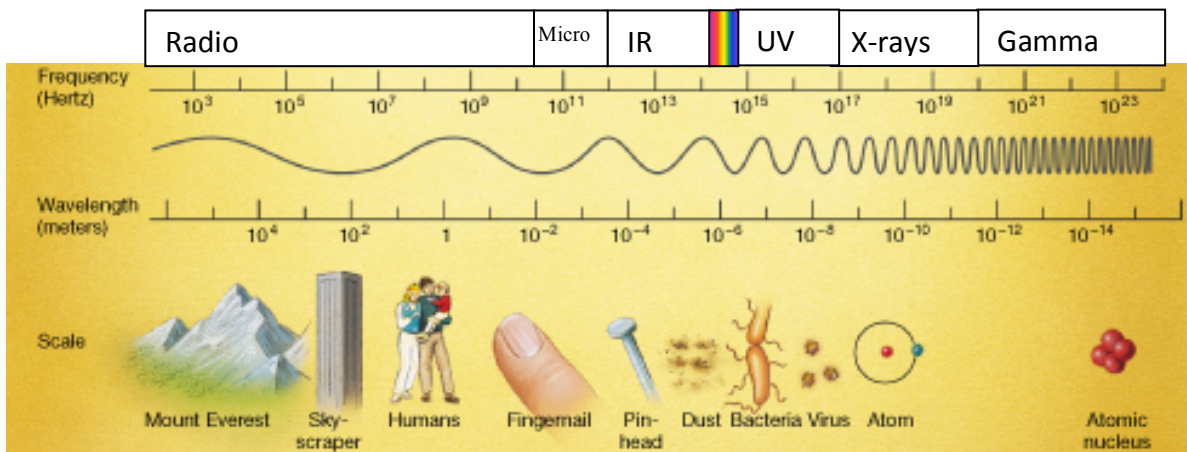
## Waves for detection and exploration (physics only) (HT only)

Ultrasound	Seismic Waves
<p>What is ultrasound?</p> <p>What are the properties of ultrasound?</p> <p>What can ultrasound be used for?</p>	<p>What are seismic waves?</p> <p>What are P waves?</p> <p>What are S waves?</p> <p>How can seismic waves be useful?</p>

# Types of Electromagnetic Waves

Use your notes/textbook to complete the table

Type of Wave	Penetration	Uses	Hazards



## **Required practical activity: Infra-red**

**Draw a diagram to show how a:**

**1) Black, matt surface absorbs and emits infrared radiation**

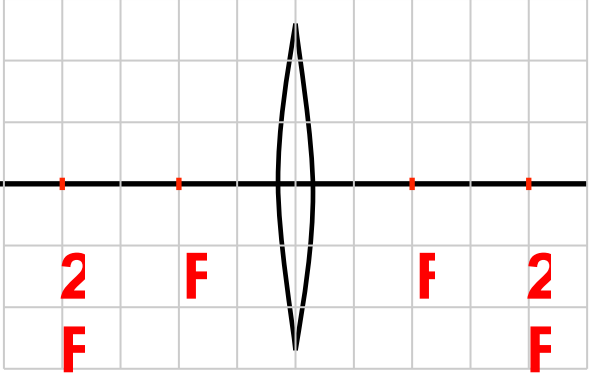
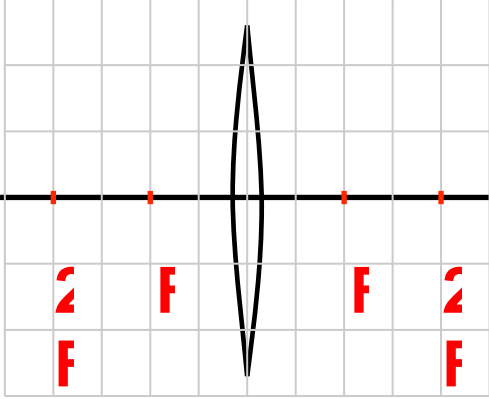
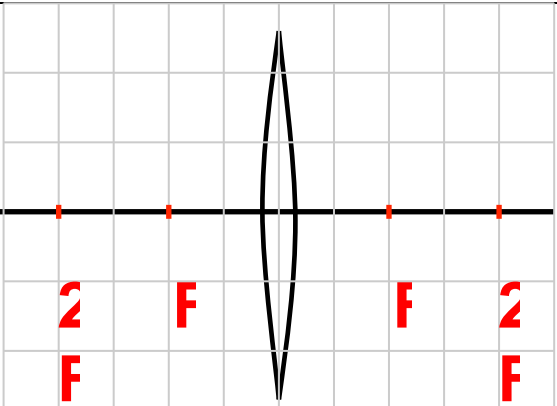
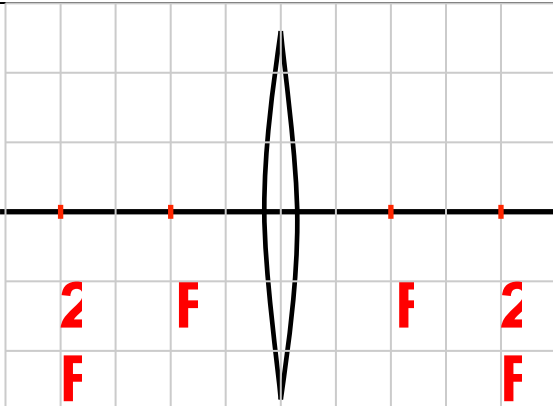
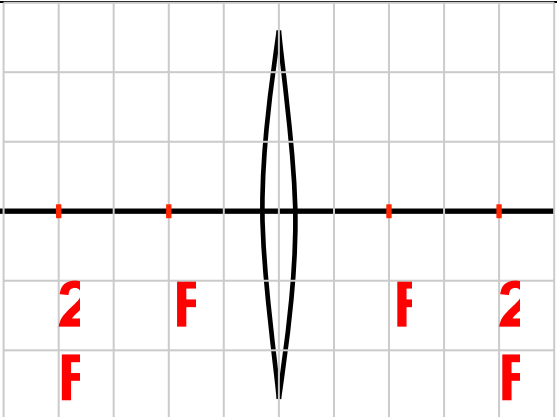
**2) How a white, shiny surface absorbs and emits infrared radiation**

# Properties of electromagnetic waves

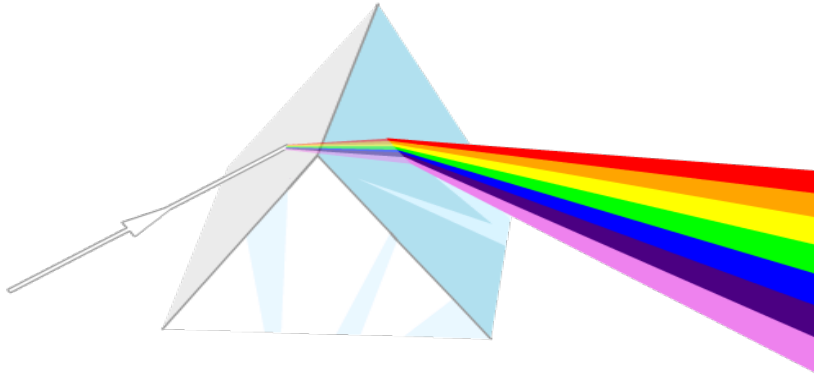
Complete the table!

Radiation Type	Uses	Dangers
Gamma rays	Treating cancer / sterilization	
X-rays	Medical	
Ultra violet	Sun beds	
Visible light	Sight	
Infrared	Remote controls / heat transfer	
Microwaves	Satellite communications / cooking	
Radio waves	Communications	

# Lenses (Physics Only)

<p>When Object is Over 2F away from lens</p> 	<p>When an object is at 2F away from lens</p> 
<p>Description:</p>	<p>Description:</p>
<p>When an object is between 2F and F from the lens</p> 	<p>When an object is at F distance from the lens</p> 
<p>Description</p>	<p>Description</p>
<p>When the lens is closer to the lens than F</p> 	<p>Questions:</p> <ol style="list-style-type: none"> <li>1. What is the difference between convex and a concave lens?</li> <li>2. What does F, focal point mean?</li> <li>3. What happens to light when it goes through a lens?</li> </ol>
<p>Description</p>	

## Visible Light (Physics Only)



1. When a ray of light enters glass at an angle it changes \_\_\_\_\_ and therefore changes \_\_\_\_\_. This is called \_\_\_\_\_.
  2. The refractive index is a measure of how much a light ray will \_\_\_\_\_ on passing from one medium to another.
  3. When light passes from one medium to another and the refractive index is high, light bends \_\_\_\_\_.
  4. When light passes from one medium to another and the refractive index is low light bends \_\_\_\_\_.
- EXT: The refractive index is determined by.....

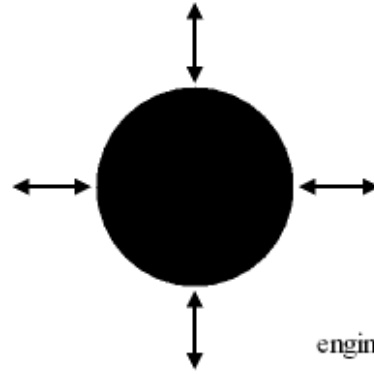
### **Keywords**

refraction, incidence, a lot, a little, speed, direction, medium, refract



# Perfect black bodies and radiation (Physics Only)

1. Define a black body



engineeringtoolbox.com

2. Describe the trend shown by the graph below

