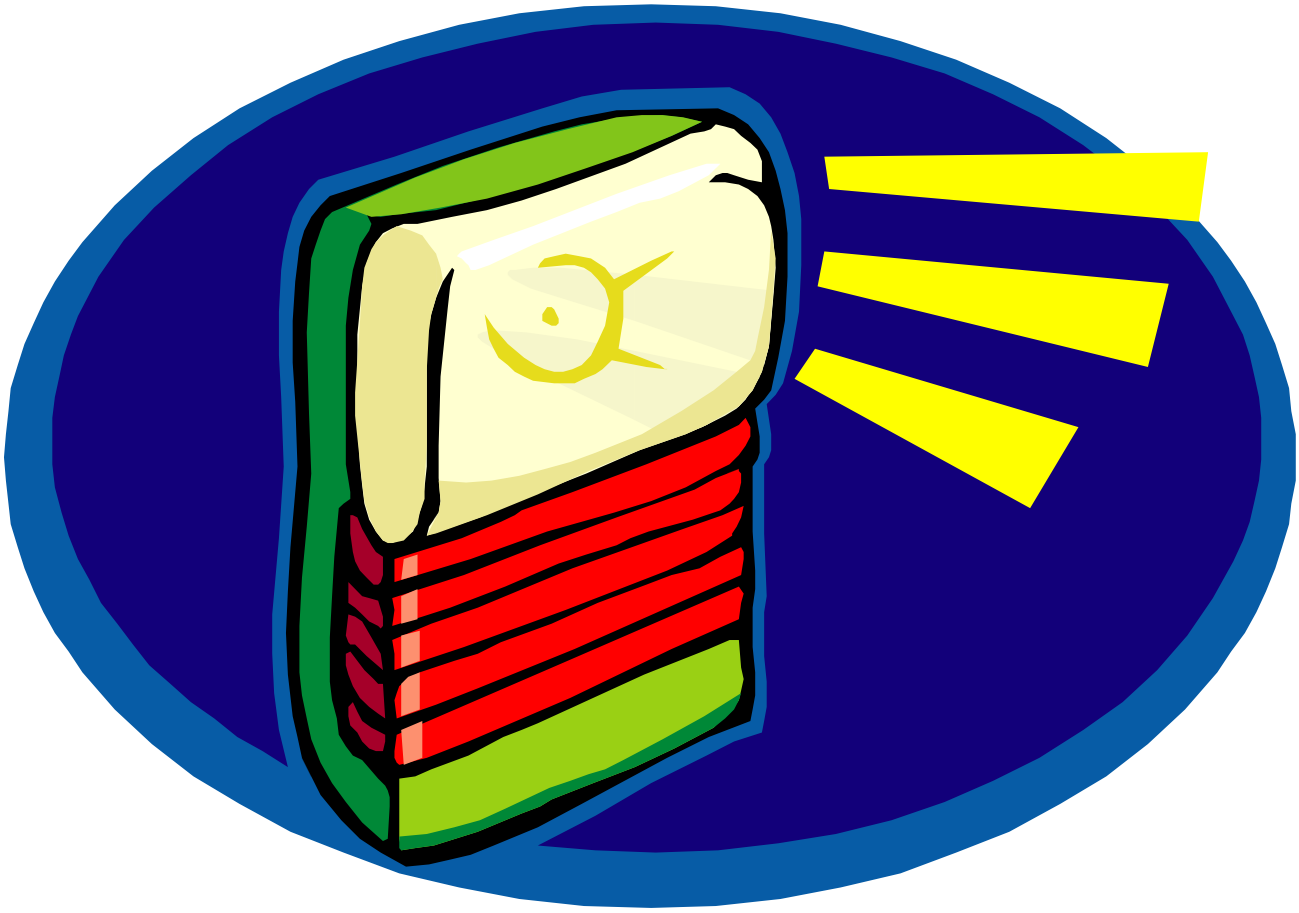
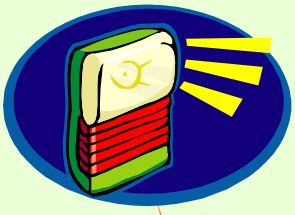
5-14 Science

Light and Sight



Experiment Guide

Activity 1 - How Light Travels



discuss **write**

- Can you describe how **light** moves?

These pictures will help you:

- Write down your answer in your notebook.

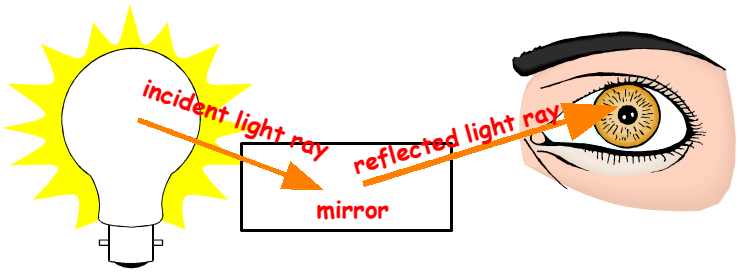
discuss **write** **experiment**

- How can you use a **window** and a short **bunsen burner tube** to prove your answer?
- Write down your ideas.
- Ask your teacher if you can try out your ideas. (You might be given a "help sheet").
- Write down/draw what you find.

Activity 2 - Reflection of Light

We **see** objects when they **give out** light rays (like a **light bulb**) or when light rays **bounce** off them. The light rays go into our **eyes**.

When light rays **bounce** off an object, we say they **reflect** off the object.



Light ray reflecting off a flat mirror into eye

discuss **write** **experiment**

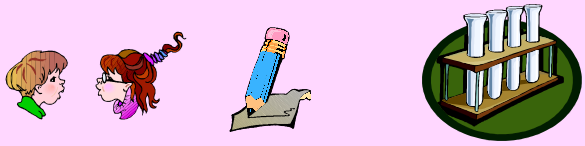
Collect a **ray box**, **power supply** and **plane** (**flat**) **mirror**.

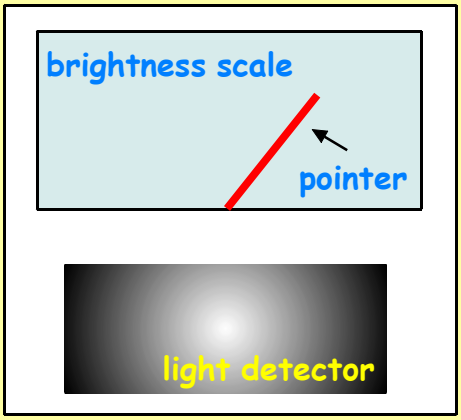
Your teacher will show you how to connect the **ray box** and **power supply** and how to use them safely.

- Do you think there is any connection between the angle at which the **incident light ray** hits the mirror and the angle at which the **reflected light ray** leaves the mirror?
- How could you find out?
- Write down your ideas.
- Ask your teacher if you can try out your ideas.
(You might be given a "help sheet").
- Do your experiment and write down/draw what you find.

Activity 3 - Light Meter

discuss write experiment





Collect a **light meter**.

Your teacher will show you how to use it correctly.

- Draw and label your **light meter**.
- Write down your answers to these questions:

1) What happens to the **pointer** of the **light meter** when **light** hits the meter?

2) What must the **pointer** have if it is able to **move**?

3) Where do you think this comes from?

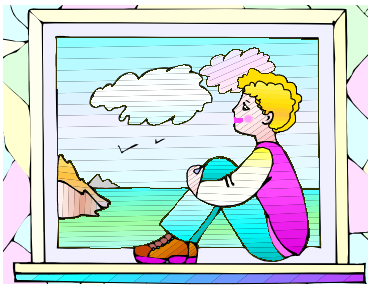
4) What do you think **light** carries from one place to another?

Activity 4 - Transparent, Translucent and Opaque

Transparent objects

You can **see through** transparent objects. Light rays pass through them easily.

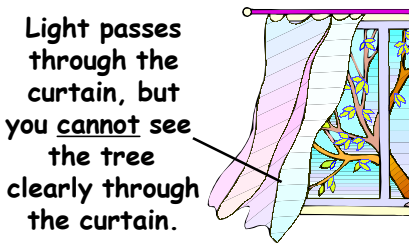
For example: glass windows.



Translucent objects

Light passes through translucent objects - but it is difficult to see anything clearly through the object.

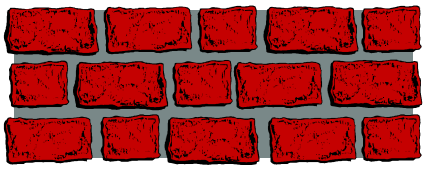
For example: nylon curtains.



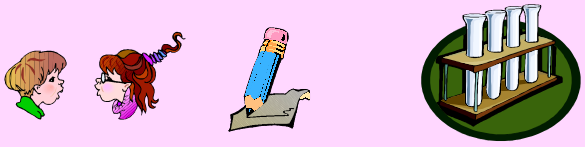
Opaque objects

You cannot **see through** opaque objects. Light rays can't pass through them at all. The object blocks the light rays.

For example: brick walls.



discuss write experiment



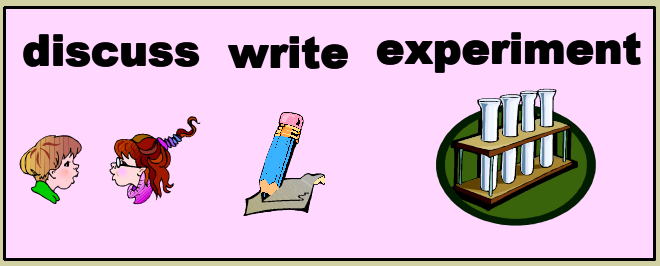
Collect a **ray box, power supply**, **light meter** and sheets of **different material**.

- How could you use the apparatus to find out how well a material lets light pass through it?
- How could you compare different materials "**fairly**"?
- Write down your ideas.
- Ask your teacher if you can try out your ideas.

(You might be given a "help sheet").

- Write down/draw what you find.

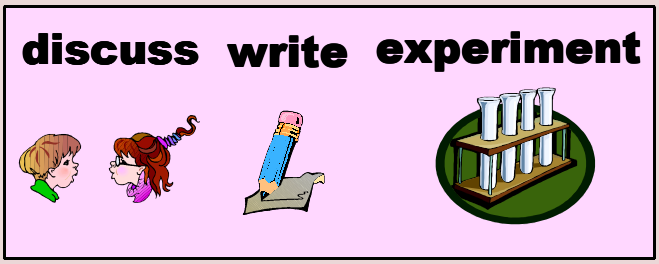
Activity 5 - Brightness of Light and Distance



Collect a **ray box, power supply**, **light meter** and **measuring tape/stick**.

- How could you use the apparatus to find out how the **brightness** of **light** from a **lamp** changes as you move **further away** from the lamp?
- Write down your ideas.
- Ask your teacher if you can try out your ideas. (You might be given a "help sheet").
- Write down/draw what you find.

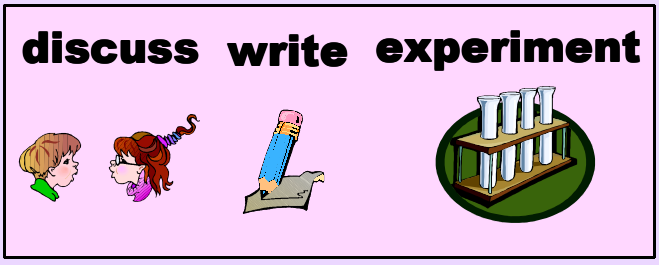
Activity 6 - Changing the Direction of Light



Collect a **ray box**, **power supply** and a **rectangular glass block**.

- How could you investigate whether the **direction** of light changes when it is passed through a **rectangular glass block**?
- Write down your ideas.
- Ask your teacher if you can carry out your ideas.
(You might be given a "help sheet").
- Write down/draw what you find.

Activity 7 - Light and Triangular Prisms

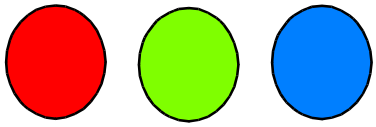


Collect a **ray box**, **power supply**, **colour ray box filter** and a **triangular glass prism**.

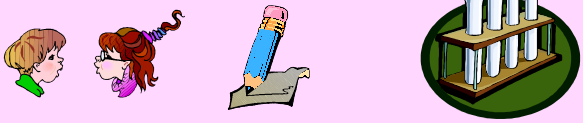
- How could you investigate what happens when **coloured light** and **white light** is passed through a **triangular glass prism**?
- Write down your ideas.
- Ask your teacher if you can carry out your ideas.
(You might be given a "help sheet").
- Write down/draw what you find.

Activity 8 - Mixing Coloured Lights

The 3 **primary colours** for mixing light are **red**, **green** and **blue** - By mixing different amounts of these colours together, we can get all the possible colours of light.



discuss write experiment



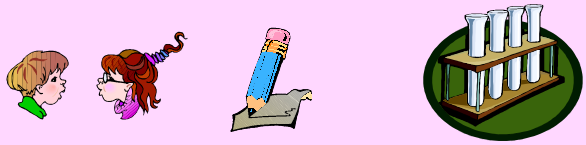
Collect a **ray box**, **power supply**, **3 colour ray box filters** (**red, green and blue**) and a **sheet of white paper** to act as a **screen**.

Look at the **mirrors** and **opening** at the back of the **ray box**.

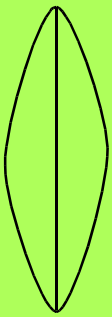
- How could you investigate what happens when you mix the **different colours of light** (**2 at a time,** then **all 3 together**)?
- Write down your ideas.
- Ask your teacher if you can carry out your ideas. (You might be given a "help sheet").
- Write down/draw what you find.

Activity 9 - Convex and Concave Lenses

discuss write experiment



Collect a **ray box**, **power supply**, a **convex lens** and a **concave lens**.



convex lens

- How could you find out what happens when you pass **3 light rays** through each of these lens shapes?
- Write down your ideas.

Ask your teacher if you can carry out your ideas.
(You might be given a "help sheet").

- Write down/draw what you find.

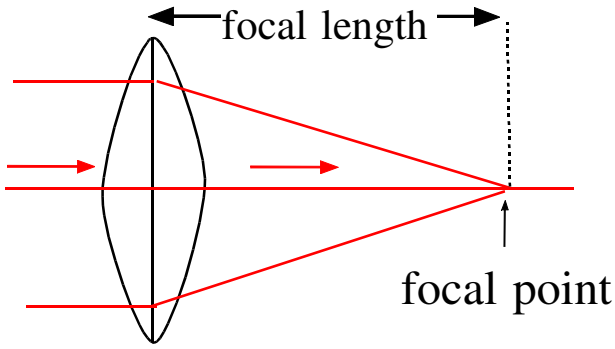
concave lens

Activity 10 - Focal Length of a Convex Lens

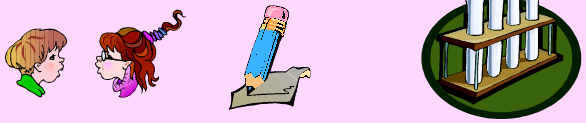
When rays of light pass through a convex lens, the lens makes the rays **focus** (**come together**) at a **point** called the **focal point**.

The **distance** (**length**) between the **centre of the lens** and the **focal point** is called the **focal length**.

Light rays from an object passing through the lens form a clear **image** (**picture**) of the object on a **screen** placed at the **focal point** - The **image** (**picture**) is **upside down**.



discuss **write** **experiment**



Collect a **convex lens** and a **ruler**.

- Look through the **convex lens** at a **far away object**.
- How can you use a **window**, **ruler** and a **wall** or **white paper screen** to find the **focal length** of the **lens**?
- Write down your ideas.

Ask your teacher if you can try out your ideas.
(You might be given a "help sheet").

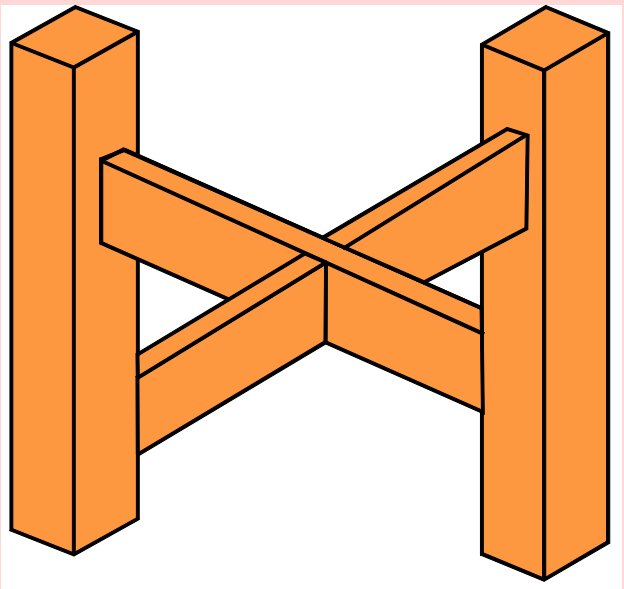
- Write/draw what you find.

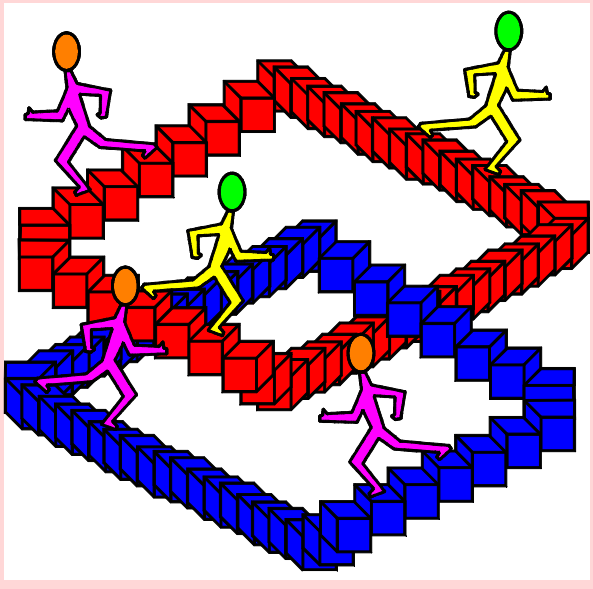
Activity 11 - Optical Illusions

research **write**

Your teacher will help you log on to different **web sites** which will show you some **optical illusions** - Things which **fool your eye and brain**.

- Write down/draw what you find.

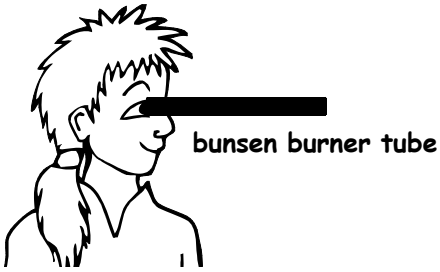


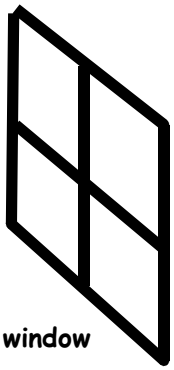


Light and Sight
Experiment Help/Instruction Sheets

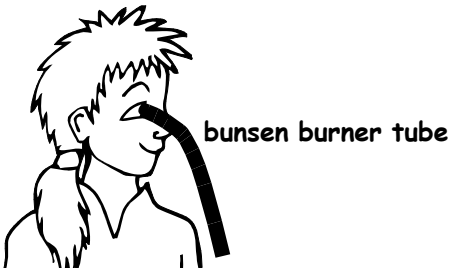
1) How Light Travels

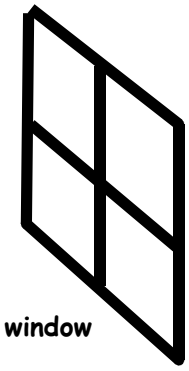
1) Hold a short **bunsen burner tube** level. Look through it at the window.





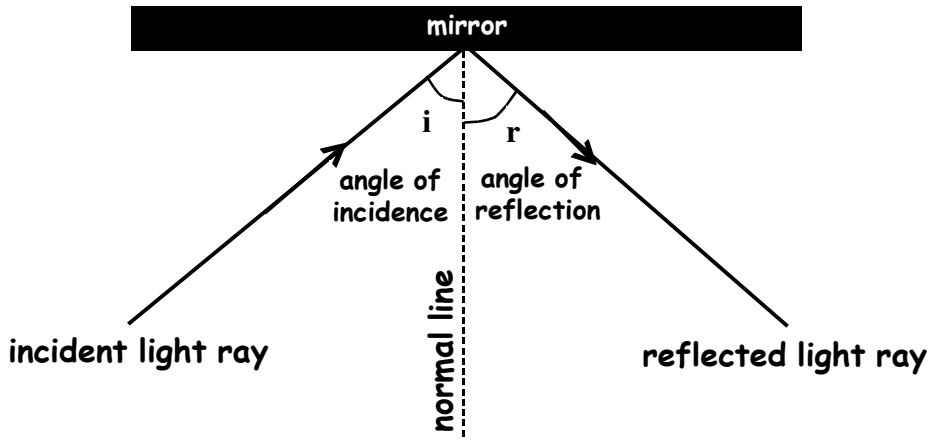
2) Hold the short **bunsen burner tube** loosely, so that it bends downwards. Look through it now.





3) Write/draw what you find.

2) Reflection of Light



When a **light ray** hits a **plane** (**flat**) **mirror**, the **ray** is **reflected**.

Where the **ray** hits the **mirror**, we draw a **dashed line** across (at **90º** to) the **mirror** - We call this **line** the **normal line**.

We can then measure the **angles i** and **r** with a **protractor**.

You will use a **ray diagram** like this:

1) Copy the table.

2) Collect a **ray diagram sheet**.

3) Put a **plane** (**flat**) **mirror** on the sheet on the **horizontal line**.

4) Shine a light ray along **line A**. Draw in the **reflected ray**. Measure **angle r** on the **protractor** and write it in your table.

5) Do the same for lines **B**, **C**, **D** and **E**.

6) Write/draw what you find.

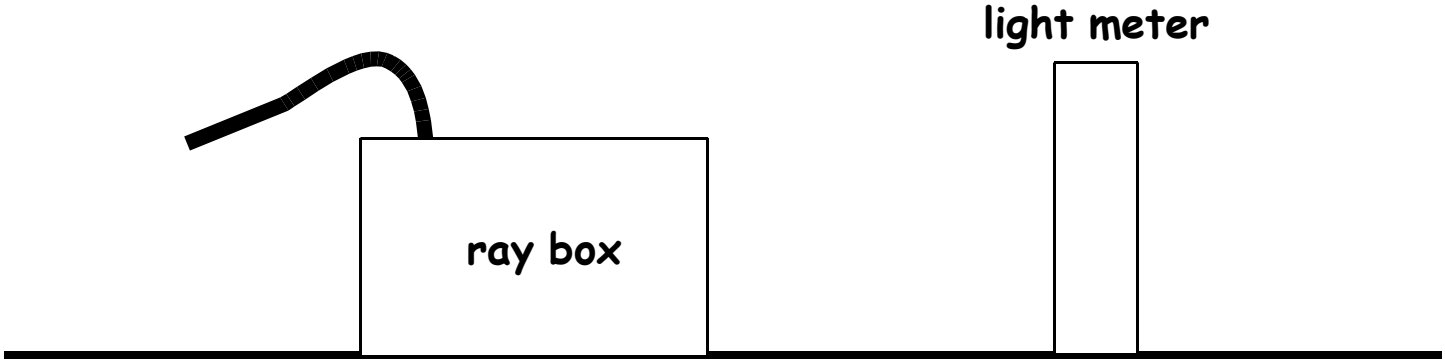
ray	i (angle of incidence)	r (angle of reflection)
A	10º	
B	20º	
C	30º	
D	40º	
E	50º	

4) Transparent, Translucent and Opaque

1) Copy this table:

material	light meter reading

2) Set up this apparatus. Do not have any **slit plate** in the **ray box**. Make sure the **ray box** and **light meter** are **in line**. The **light detector** on the **meter** must face the **ray box**.



2) Move the **light meter** back and forward until the **pointer** reaches the biggest number on the scale (**30**).

3) Hold 1 **sheet of material** (paper, tissue paper, paper towel, metal foil, etc) over the **light detector** on the **light meter** - Don't get your fingers or any other part of your body in the way of the light.

4) Read the **brightness** of **light** reaching the **light meter**. Put your reading in your table.

5) Repeat for other materials - You must keep **exactly the same distance** between the **ray box** and the **light meter** each time.

6) Write/draw what you find.

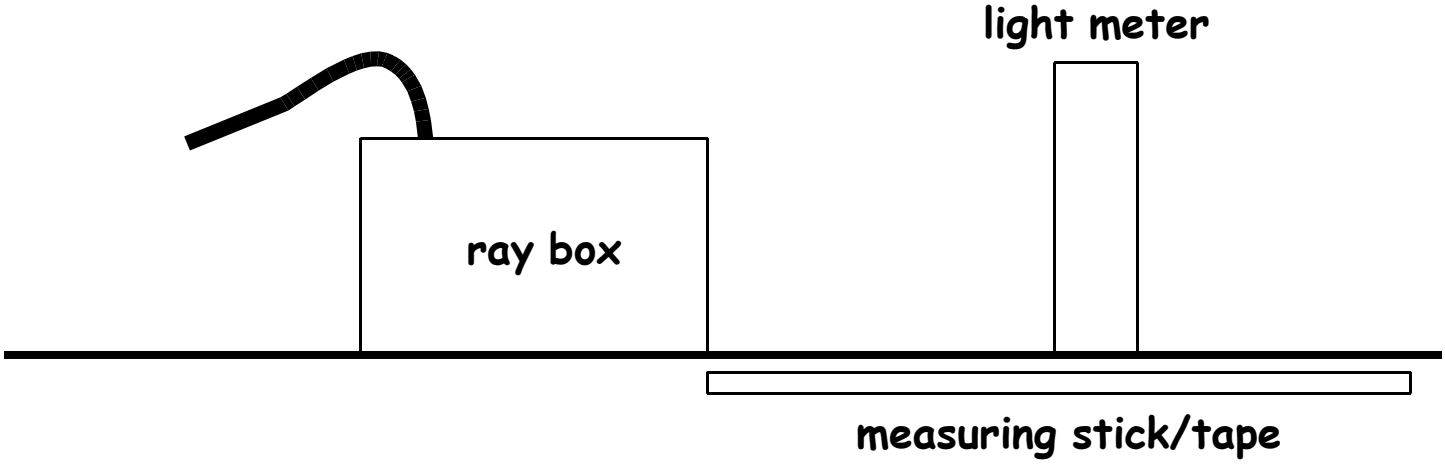
7) You could present your results in a **bar graph**.

5) Brightness of Light and Distance

1) Copy this table:

light meter reading (Brightness of Light)	distance between ray box and light meter/ cm
30	
10	
5	
3	
2	

2) Set up this apparatus. Do not have any **slit plate** in the **ray box**. Make sure the **ray box** and **light meter** are **in line**. The **light detector** on the **meter** must face the **ray box**.



3) Move the **light meter** back and forward until the **pointer** reaches the biggest number on the scale (**30**).

4) Measure the **distance between the ray box and light meter**. Put your **distance reading** in your table.

5) Move the **light meter** back until the pointer reaches the next **brightness number** in your table. Measure the **distance between the ray box and light meter**. Put your **distance reading** in your table.

6) Repeat for the other **brightness numbers** - You may have to measure quite a distance away from the **ray box**.

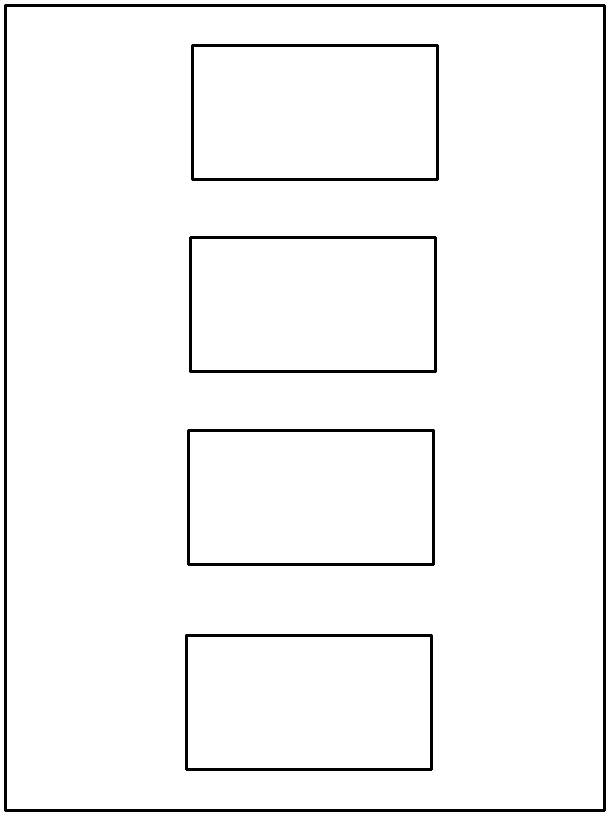
7) Write/draw what you find.

8) You could present your results in a **line graph**.

6) Changing the Direction of Light - Refraction

1) Collect a **rectangular glass block**.

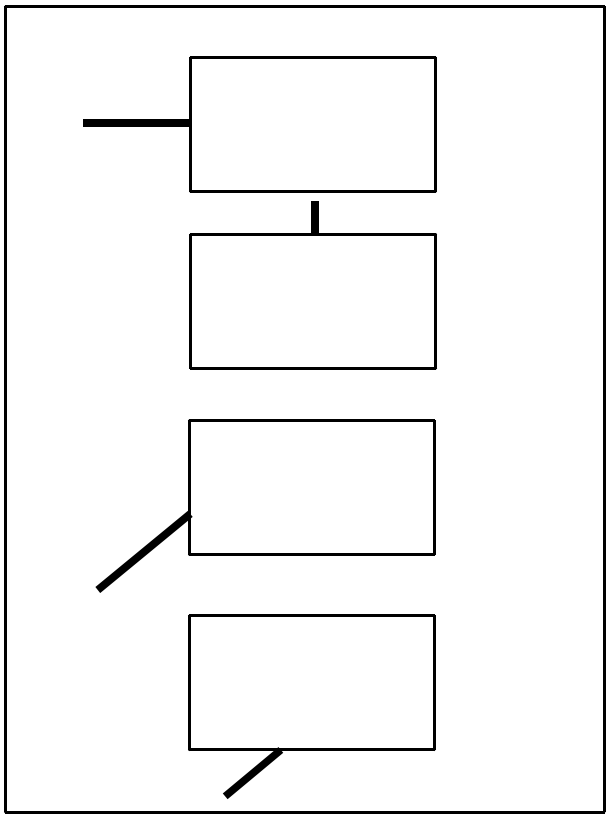
2) On a sheet of **white paper**, draw round the **block** 4 times so your paper looks like this:



3) Put your **glass block** over the top diagram. Shine a **light ray** at the **block** in the direction shown. On the paper, draw the path the **light ray** takes.

4) Repeat for the other diagrams.

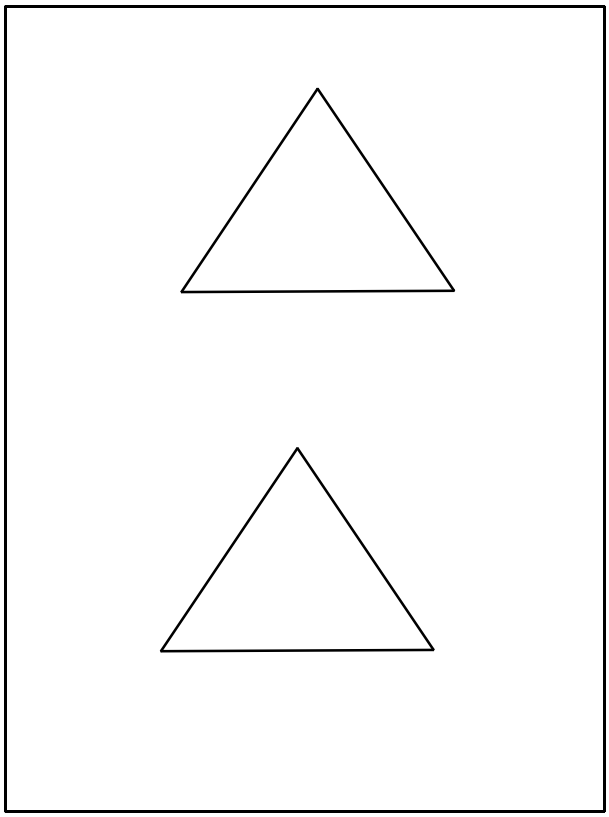
5) Write/draw what you find.



7) Light and Triangular Prisms

1) Collect a **triangular glass prism**.

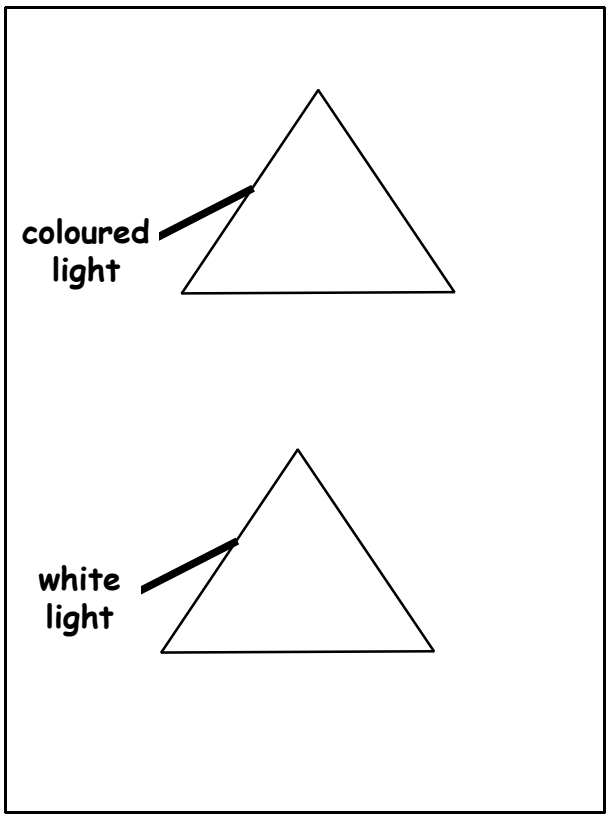
2) On a sheet of **white paper**, draw round the **glass prism** 2 times so your paper looks like this:



3) Put your **glass prism** over the top diagram. Shine a **<u>coloured</u> light ray** at the **block** in the direction shown. On the paper, draw the path the **light ray** takes.

4) Put your **glass prism** over the bottom diagram. Shine a **<u>white</u> light ray** at the **block** in the direction shown. On the paper, draw the path the **light ray** takes. Hold a sheet of white paper up and down, and put it in the way of the light coming out of the prism.

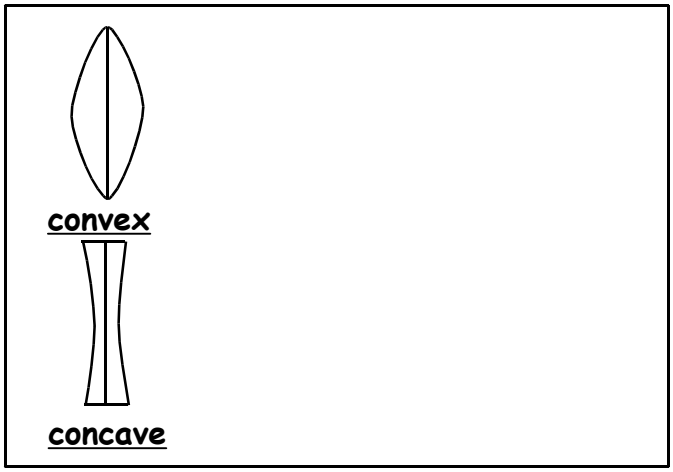
5) Write/draw what you find out.



10) Convex and Concave Lenses

1) Collect a **convex glass block** and a **concave glass block**.

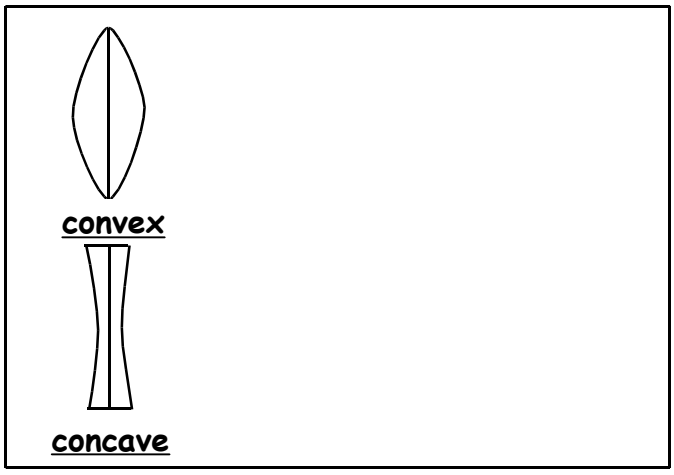
2) On a sheet of **white paper**, draw round both **glass blocks** so your paper looks like this:



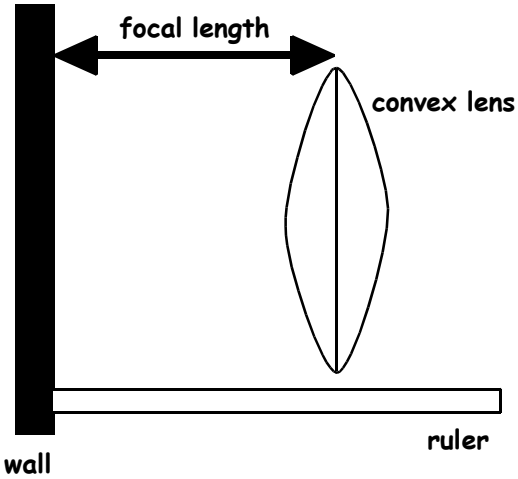
3) Put your **convex glass block** over the top diagram. Shine **3 light rays** at the **block** in the direction shown. On the paper, draw the path the **light rays** takes.

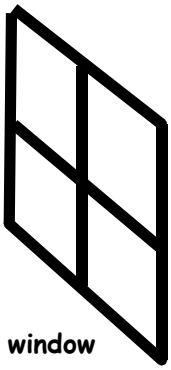
4) Put your **concave glass block** over the top diagram. Shine **3 light rays** at the **block** in the direction shown. On the paper, draw the path the **light rays** takes.

5) Write/draw what you find.



11) Focal Length of a Convex Lens





1) If the wall is **dark coloured**, stick a sheet of **white paper** on it at **window height**.

2) Hold the **convex lens** close to the **wall** at **window height**. Move the **lens back and forward** until you see a **sharp**/**clear image** (**picture**) of the **window** on the **wall**.

3) Hold the **lens** steady in this position and use a **ruler** to measure the **distance between the wall and the centre of the lens** - This is the **focal length** of the **lens**.

4) Write/draw what you find.