

Professor Brainstorm's Upside Down Reflections

About this Activity (Information for Parents and Teachers)

This experiment investigates what happens when light reflects off a curved surface.

This experiment is designed for children aged from 7 to 11 years (Years 3 to 6).

What you Need

All you need for this experiment is a large shiny metal serving spoon (as shown in the pictures below).



Upside Down Reflections

- Hold the spoon with the back of the spoon towards you. You should be able to see your reflection in the spoon - although you may notice that your reflection is a bit distorted. (See photo below left.)
- Move the spoon closer to your face - and then further away. What happens to your reflection? (Answer: Your reflection gets bigger as you move the spoon towards your face, and smaller as you move it away.)
- Now turn the spoon around so that you are looking into the bowl of the spoon. What has happened to your reflection? It is upside down! (See photo below right.)
- Keeping the bowl of the spoon towards you, move the spoon closer - until it is almost covering one of your eyes. Suddenly you will see a huge magnified eye looking back at you. (It may help if you close your other eye.) And now the reflection is the right way up. (if you tilt the spoon a little you will see that your eye-brow is above your eye - where it should be!)



Now try this ...

You will need to find a curved (concave) mirror to do this part of the experiment. Shaving mirrors and make-up mirrors are often concave mirrors. (You will be able to feel with your fingers whether or not the mirror is concave. A concave mirror feels like it has a slight dip in the middle.)

Warning - these types of mirrors are usually made of glass - and will break if they are dropped. So always ask an adult first before handling these mirrors.

Place the concave mirror on a table (or some other flat surface where it will not fall).

- Put your face close to the mirror - so that your nose is about 10cm away from the mirror. You should be able to see your reflection in the mirror (as in the photo on the right.)



- Slowly move your head away from the mirror - but not too far. Do not move more than about 50cm from the mirror. Keep watching your reflection as you move away. Do you notice anything strange happening to your reflection. (In a 'normal' flat mirror as you move away from the mirror your reflection gets gradually smaller. But in this case your reflection gets larger as you move further away. See photo on the left.)
- Now move even further away from the mirror. Your reflection becomes more and more distorted - and then disappears altogether. But keep moving back until you are about 2 metres from the mirror. Can you see your reflection? Are you upside down?

How does it work?

Curved mirrors produce distorted reflections. You may have been to a 'Hall of Mirrors', where they have large curved mirrors - which make you look very strange!

In this experiment we have been investigating two specific types of curved mirror:

- Convex mirrors. These are ones which bulge out in the middle. The back of the serving spoon forms a convex mirror.
- Concave mirrors. These are ones which form a dip in the middle. The bowl of the spoon and the make-up or shaving mirrors are examples of concave mirror.

In a convex mirror the reflections are always the right way up. But in a concave mirror it is a bit more complicated.

When you are close to a concave mirror, your reflection is the right way up - and it is magnified. (The magnification is why concave mirrors are useful for shaving or putting on make-up.)

But if you move further away from a concave mirror, your reflection turns upside down.

The distance that you have to move away from the mirror before this happens depends on the curvature of the mirror. Shaving mirrors and make-up mirrors are only slightly concave - so you don't usually see the upside down reflection until you are at least 1 metre away from the mirror.

However the serving spoon is much more curved. So your reflection in the concave side of a serving spoon is almost always upside down. You can only see your reflection the right way up if you hold the spoon just a few centimetres away from your eye.