



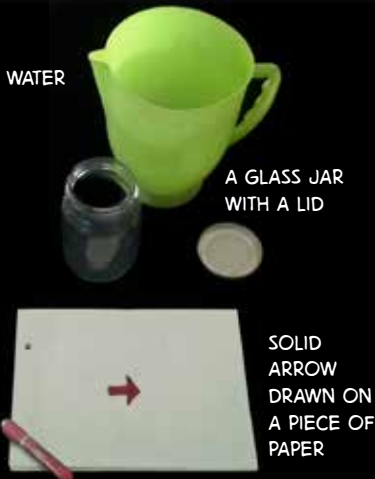
BENDING LIGHT TO HELP US SEE BETTER



ACTIVITY: MAKE YOUR OWN LENS



YOU WILL NEED:



1 PLACE THE EMPTY JAR ON THE TABLE AND STAND THE PICTURE OF THE ARROW ABOUT 15CM BEHIND IT.



2 LOOK THROUGH THE JAR AT THE ARROW. WHICH WAY IS IT POINTING?



3 FILL THE JAR WITH WATER AND SCREW THE LID ON TIGHTLY. STAND IT IN FRONT OF THE ARROW. LOOK THROUGH THE JAR AT THE ARROW. WHAT DO YOU NOTICE?



4 TWIST THE JAR AROUND WHILE LOOKING THROUGH IT AT THE ARROW. WHAT DO YOU NOTICE?



WHAT'S HAPPENING HERE?



WHEN LIGHT PASSES FROM ONE SUBSTANCE INTO A DIFFERENT ONE, ITS SPEED CHANGES. THIS CAUSES THE LIGHT TO BEND. THIS BENDING IS CALLED REFRACTION. IF LIGHT PASSES FROM A LESS OPTICALLY DENSE SUBSTANCE (LIKE AIR) TO A MORE OPTICALLY DENSE SUBSTANCE (LIKE WATER), IT SLOWS DOWN.

ORIGINAL RAY OF LIGHT

ANGLE OF INCIDENCE

90°

ANGLE OF REFRACTION

REFRACTED RAY OF LIGHT

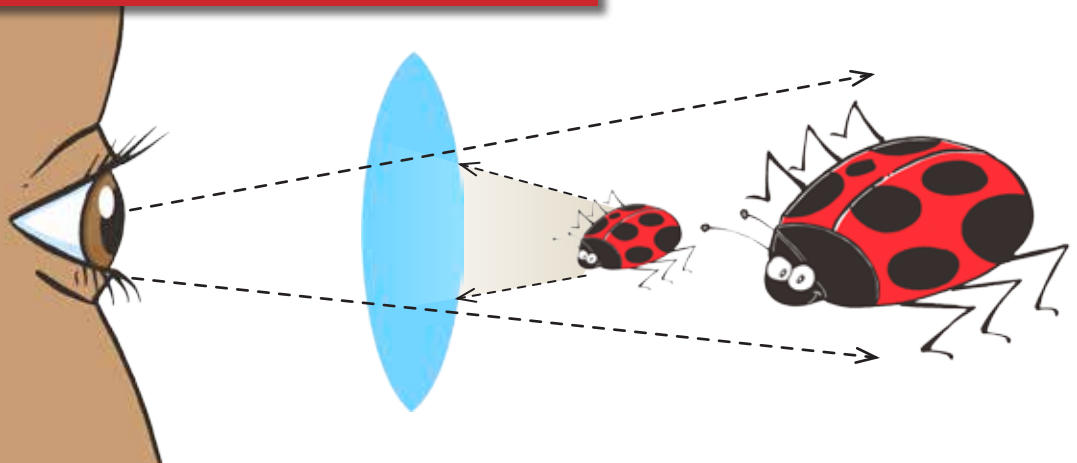
WHEN YOU LOOK AT SOMETHING THROUGH AN EMPTY GLASS, THE LIGHT DOESN'T BEND MUCH, BECAUSE THE GLASS IS FILLED WITH AIR. BUT WHEN YOU FILL THE GLASS WITH WATER, IT BENDS THE LIGHT RAYS SO THAT THEY ENTER YOUR EYE AT A DIFFERENT ANGLE. THIS MAKES THE THING YOU ARE LOOKING AT APPEAR VERY DIFFERENT.

AIR
WATER



HOW DOES A MAGNIFYING GLASS WORK?

A MAGNIFYING GLASS IS AN EXAMPLE OF A LENS. LIGHT RAYS FROM THE OBJECT ARE BENT BY THE LENS AND ENTER YOUR EYE. YOUR EYE FOLLOWS THE LIGHT RAYS BACK TO WHERE THEY **APPEAR** TO BE COMING FROM. THAT IS WHY THE IMAGE LOOKS MUCH LARGER THAN THE OBJECT.



LENSES IN YOUR EYES

YOUR EYES HAVE LENSES IN THEM TO FOCUS LIGHT ONTO YOUR RETINA, WHICH IS AT THE BACK OF YOUR EYE.

RETINA

LENS

LIGHT

LIGHT



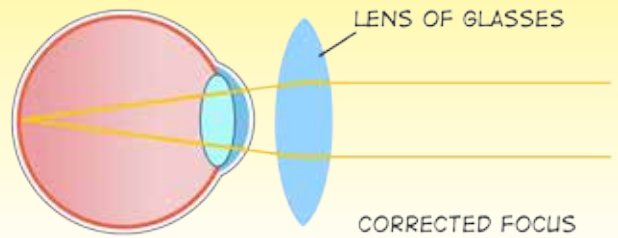
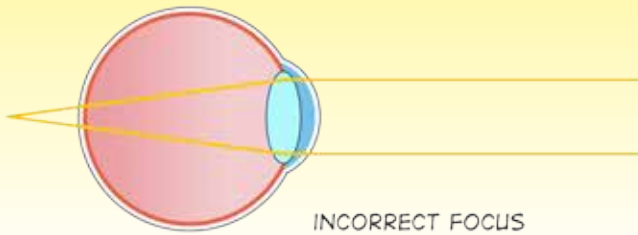
HOW DO GLASSES HELP YOU TO SEE BETTER?

LENSES BEND LIGHT IN DIFFERENT WAYS, DEPENDING ON THE SHAPE OF THE LENS.

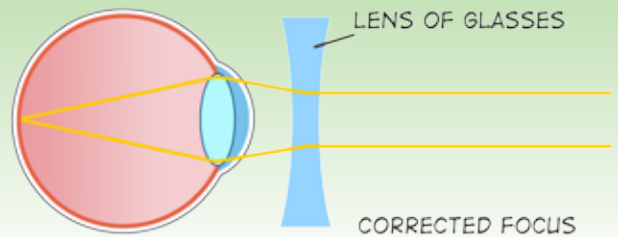
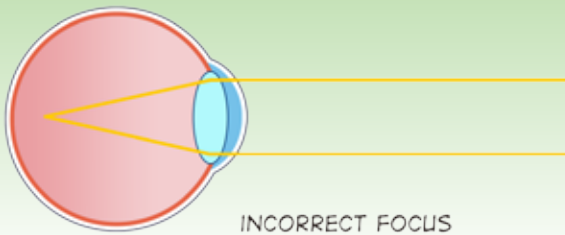


SOME PEOPLES' EYES DO NOT FOCUS LIGHT IN THE CORRECT PLACE FOR THEM TO SEE CLEARLY. IF THEY WEAR GLASSES MADE WITH THE CORRECT SHAPE OF LENS, THIS HELPS TO FOCUS THE LIGHT CORRECTLY SO THAT THEY CAN SEE A CLEAR IMAGE.

FAR-SIGHTED



NEAR-SIGHTED



LENSES IN SCIENCE

LENSES ARE ALSO USED IN SCIENTIFIC INSTRUMENTS SUCH AS MICROSCOPES AND TELESCOPES.



MICROSCOPES FOCUS LIGHT TO ALLOW US TO SEE THINGS THAT ARE TOO SMALL TO SEE WITH OUR EYES.

Photo: commons.wikimedia.org - GcG(jawp)

TELESCOPES ENABLE US TO SEE OBJECTS THAT ARE VERY FAR AWAY.

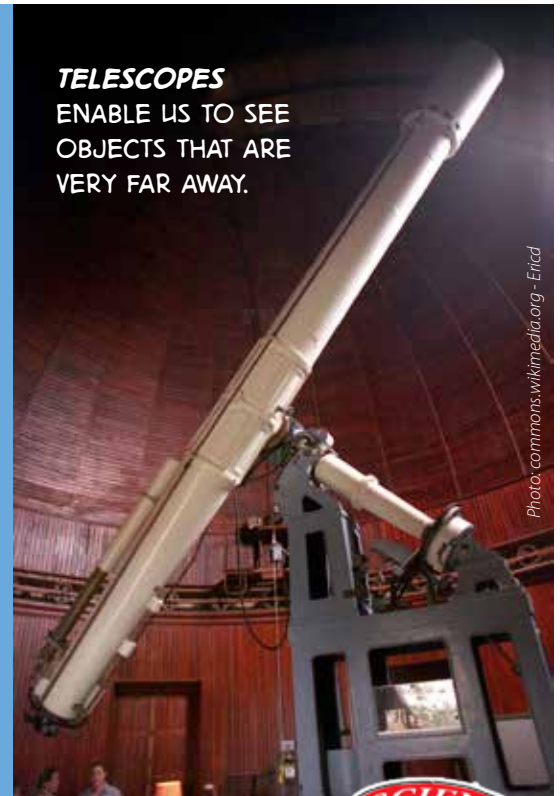


Photo: commons.wikimedia.org - Ericd

Knowledge is NCAH!



CAREERS:

- OPTOMETRIST
- MICROSCOPE ENGINEER
- OPTOMETRIC TECHNICIAN



Dr Patience Mthunzi holds a PhD in Physics in the area of Biophotonics. She is currently a senior scientist researcher at the National Laser Centre (NLC). She has won many prestigious awards for her research, where she explores biological cells using an *optical tweezer*. This instrument uses the principle of refraction of laser light to trap a tiny biological particle so that it can be studied.

CURRICULUM LINKS

- GRADE 8: **ENERGY & CHANGE** (VISIBLE LIGHT)
- GRADE 11: **WAVES, SOUND & LIGHT** (GEOMETRICAL OPTICS)

PUZZLE YOUR MIND!!!

IF A SUBSTANCE CAUSES THE LIGHT TO SPEED UP OR SLOW DOWN MORE, IT WILL REFRACT (BEND) MORE. THE **REFRACTIVE INDEX** TELLS US HOW MUCH THE LIGHT WILL BEND FOR DIFFERENT SUBSTANCES. THIS TABLE SHOWS THE SPEED OF LIGHT IN DIFFERENT SUBSTANCES.

Substance	Refractive index	Speed of light in substance	Angle of refraction if angle of incidence is 20°
Air	1.00	300 000 000 m/s	20°
Water		226 000 000 m/s	
Glass		200 000 000 m/s	13.2°
Diamond		125 000 000 m/s	

COMPLETE THE TABLE BY PLACING EACH PIECE OF INFORMATION BELOW IN THE CORRECT SPACE:

REFRACTIVE INDEX: 2.4 1.33 1.5 ANGLE OF REFRACTION: 8.2° 14.9°

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School: _____ Name: _____

Telephone number: _____ Email address: _____

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Visit www.sciencespaza.org, email info@sciencespaza.org, sms or WhatsApp us on 076 173 7130 or write to us at PO Box 22106, Mayor's Walk, 3208

This Science Spaza resource was produced for the National Science Week celebrations of the International Year of Light. National Science Week is an initiative of the Department of Science and Technology, implemented by the South African Agency for Science and Technology Advancement (SAASTA), a business unit of the National Research Foundation. For more information visit www.saasta.ac.za



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