Secondary Teacher’s Notes And Class Exercises
GETTING STARTED

Vision is one of our five basic senses (hearing, touch, smell and taste are the others) through which we experience the world.

Our “vision” system is made up of our eyes and brain. The performance of this system is far better than any machine ever invented. We can see an immense range of colour and detail, and images and colours are updated constantly so that we have seamless vision with no “break in the action” as we turn our heads or look around.

Good vision is very important to our daily life. Many things we take for granted – just moving around, recognising friends, reading or playing sport - are difficult or impossible with poor vision. Many things in modern life would be vastly different if good vision was not standard. Imagine traffic, school, computing, or television, without good vision.

In Australia, if you have poor vision then you can visit an optometrist directly or be referred to an ophthalmologist and get treatment or correction so that you can see well again. However many people in the world don’t have access to the eye care they need, which means they go through life with poor vision. This drastically reduces their chance at education, employment and a wide range of activities. ICEE Sunnies for Sight Day raises money to give sight to these people.

Questions:

How would the world be different if we didn’t have good vision?
If you had vision problems what could and couldn’t you do?
How would vision problems make you feel?
What could you do to overcome the problems?
## STRUCTURE OF THE EYE

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*For eye structure diagrams refer to Appendix 1.*

### Exercises: Our eyes

Ask the students to form into pairs. Each student examines their partner’s eyes – what do they notice?

How many parts of the eye can they name?

Get them to draw their partner’s eye and label the parts.

Get them to watch the pupil when their partner closes their eyes for a few seconds and then opens them – they will be able to see the pupil get smaller in response to the light.

Ask them to look at their partner’s eye from the side. Can they see the curve of the eyeball and the cornea?
Blind spot
Every eye has a “blind spot”. This is the spot where the retina is joined to the optic nerve. It has no “photoreceptors” (light sensitive cells) so it is not sensitive to light. So if a ray of light comes through the lens of your eye and is focused on this area, the brain receives no information.

Exercise: Blind spot
To experience your blind spot, hold the paper out at arms length and look at the illustration below. Cover your right eye and stare at the circle on the right with your left eye. Then, slowly bring the illustration closer. As you bring it towards your eyes (Do not look at the star), there should be a point where the star disappears from the picture. That is your blind spot!
HOW WE SEE

Our eyes are our body’s most highly developed sensory organs. A larger part of our brain is dedicated to the function of eyesight than those of hearing, touch, smell and taste combined.

Vision

In order for us to see, light rays reflected from an object first pass through the clear front of the eye (the cornea), where they are partially focused. These light rays then pass through the pupil, and are further focused by the lens onto the retina. The retina is responsible for detecting the light from these images and then causing electrical impulses to be sent to the brain along the optic nerve. The brain then processes those impulses and gives information about what we are seeing.

We can see up close and far away as our eyes focus the rays of light correctly onto the retina.

As we look up close and far away muscles around the lens inside the eyes pull the lens to make it change shape in order to focus the rays of light correctly onto the retina. This ability is called “accommodation”. 
The retina

The retina contains different types of photoreceptors (light sensitive cells) - rod cells and cone cells. In the human eye, there are many more rod cells in the retina than there are cone cells. Rod cells are very sensitive to low levels of light, while cone cells are very sensitive to different colours and allow good vision in bright light conditions.

Since rod cells predominate in the periphery (edge) of your retina, your peripheral vision is more light sensitive, enabling you to see dimmer objects in your peripheral vision. If, for example, you see a dim star in your peripheral vision, it may ‘disappear’ when you look at it directly since you are then moving the image onto the cone-rich central vision which is less light sensitive.

Human eyes can distinguish millions of different colours. They are also sensitive enough to light that in ideal conditions a candle burning in the dark can be detected more than 5 km away.

In animals, the number of rod cells and cone cells in their eyes is related to the animal’s instincts and habits. For example, birds such as hawks have more cone cells than do humans. This lets them see small animals from a long distance away, allowing them to hunt for food. Eagles and hawks can see 8 times better than humans – a golden eagle can see a rabbit from 2 km away. Nocturnal animals have more rod cells to allow them better night vision.

Binocular vision

Why do most animals have two eyes? Each eye captures its own view and the two separate images are sent on to the brain for processing. When the two images arrive simultaneously in the brain, they are united into one picture.

Binocular vision enhances our vision so we can see faint objects. It also allows us to have “depth perception”, where the slight difference between the two images captured by the two eyes is interpreted by the brain to allow us to see the world in three dimensions and to accurately judge the distance to an object. Depth perception is important to precise activities such as catching a ball, pouring water into a cup, reaching out to shake someone’s hand, or threading a needle. Many activities such as sport or driving a car would be difficult or impossible without depth perception.

Some animals, usually prey animals, have their two eyes positioned on opposite sides of their heads. This reduces depth perception but gives them the widest possible field of view, so they can see in all directions and thus keep a lookout for predators. Even without moving their eyes, some birds have a 360 degree field of view.

Other animals, usually hunting animals such as lions or owls, have their two eyes positioned on the front of their heads, thereby reducing field of view in favour of depth perception, so that they can make accurate movements when catching their prey.

Dominant eye

Just as everyone is right or left handed, everyone is right or left “eyed”. Eye “dominance” is the tendency for the brain to prefer visual input from one eye to the other. We have a dominant eye that is primarily relied on for precise positional information. This may be important in sports which require aim such as archery or shooting, where the dominant eye will be used to aim. Approximately two-thirds of the population is right-eye dominant.

The brain

The images that form on the retina are inverted (upside down) due to the way the light is refracted through the eye. The lens inside the eye is convex and flips the image upside down, and that is how it arrives on the retina. Then when the image is transmitted through the optic nerve and into the brain, the brain interprets it into the upright position.

Your brain can be retrained though. In one psychological study, participants were asked to wear inverting lenses - lenses that invert the image before they get to your eye, so that when your eye inverts it, it’s right-side-up. At first, everything appeared upside-down to the participants. But, after a few days, people began to report that everything appeared right-side-up. As a second part of the study, the people were asked to take the glasses off. Because they were now used to the lenses, their normal vision appeared upside-down. Within a day, their vision returned to normal.

Refer to Appendix 4 for diagram
**Exercise: Vision**
Ask the students to hold their hand close to their face and look at it. While holding their hand there ask them to look at something far away like the blackboard or out of the window. They will notice how quickly their eyes adjust the focus so they can see clearly.

Ask the students to cover one eye and try various exercises like shaking hands, placing items in boxes, catching a ball. Now ask the children to repeat these exercises using both eyes. They will learn that it is easier to do these tasks with both eyes.

**Exercise: Dominant eye**
Ask the students to stretch one hand out away from their face and make a circle with their thumb and index finger. Then with both eyes open view a distant object through the opening.

Ask them to slowly bring their hand back to their eyes. The hand will automatically go to the dominant eye.
WHAT CAN GO WRONG

There are a number of things that can go wrong with our eyes, causing poor vision or blindness. There can be a problem either in the eye or in the nerves that connect the eyes to the brain.

Refractive error

Sometimes the problem is simply the way the eye is shaped and how light is focussed through the eye. This is called refractive error, and can usually be corrected with glasses. Refractive errors can be mild, where vision is just a bit blurry, or severe, where vision is so blurry people can’t see anything clearly.

Types of refractive error include:

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<th>People who are shortsighted can see well up close, but not at a distance. People who are shortsighted might have trouble recognising people across the room, seeing the blackboard from the back of the room, or recognising a bus number as it comes down the street. In myopia, rays of light entering the eye from a distant object focus in front of the retina.</th>
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<td>Presbyopia Ageing Vision</td>
<td>Presbyopia is a condition where you can’t focus up close, because the lens inside the eye has hardened and can no longer change shape (or accommodate) to provide close focus. It happens to almost everyone as they age (usually starting at around age 40) – which is why older people need reading glasses.</td>
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Leading causes of avoidable blindness in the world

Around the world there are many causes of blindness. There are an estimated 37 million blind people in the world including 1.5 million blind children. An additional 124 million have vision impairment from eye disease and at least 300 million have blindness or vision impairment due to uncorrected refractive error. Over 90% of the blind people live in developing countries.

That is a staggering 400 million people with vision impairment – 80% of which is avoidable.

Avoidable vision impairment occurs because there is no eye care available, or because the treatment or correction is too expensive. In developing countries, there may be not enough eye care clinics, optometrists or ophthalmologists to meet the needs of the population, particularly in rural areas.

ICEE Sunnies for Sight Day helps to raise funds to giving sight to these people, by providing sustainable eye care services and training local eye care practitioners.
Refractive Error
Refractive Error is an optical defect that affects the ability to focus on images. Most vision impairment is correctable with the use of a pair of glasses or other magnifying device.

Cataract
This means that the lens inside the eye isn’t clear – it is cloudy or opaque. A person with cataract can’t see well - it is like looking through a cloudy window - or it may even mean that the person is blind.

Cataract surgery, where the cloudy lens is removed and replaced with an artificial “intraocular lens”, is very common. Each year in Australia 120,000 cataract operations are performed, and this figure is set to increase with our ageing population.

Cataract is responsible for 48% of world blindness, which represents about 17.6 million people. The development of cataract is usually age related, and protecting your eyes from UV radiation from the sun can help to prevent cataract.

Trachoma
This is an infection of the eye caused by poor hygiene. With repeated infections, the inside of the eyelid becomes scarred, and the eyelashes turn inwards. The lashes rubbing on the front of the eye can damage the cornea, causing blindness.

Trachoma affects about 84 million people of whom about 8 million are visually impaired. It was once endemic in most countries. It is responsible, at present, for more than 3% of the world’s blindness.

Onchocerciasis
River blindness. Onchocerciasis is an eye and skin disease caused by a worm. It is transmitted to humans through the bite of a blackfly. It has been a major cause of blindness in Africa.

Vitamin A deficiency
Children’s eyes need Vitamin A to develop properly, and in many developing countries Vitamin A deficiency is a major cause of blindness.

So, as you may have been told, carrots are actually good for your vision – as carrots are high in Vitamin A.

Other conditions
There are other conditions the students might have heard of, maybe from their parents or grandparents.

Defective colour vision ("Colour blindness")
A condition in which certain colours cannot be distinguished, most commonly due to an inherited condition. Defective Red/Green colour vision is by far the most common form, about 99% of all colour vision problems, and causes problems in distinguishing reds and greens. Some people who have defective Red/Green colour vision also have a decreased sensitivity to red light. (For example a student with this problem would not see red pen on a white board as easily as other students.) Another colour deficiency Blue/Yellow also exists, but is rare. Total colour blindness (seeing in only shades of grey) is extremely rare.

Defective colour vision is much more common in men than in women. Approximately one in 12 men or boys has at least some colour perception problems.

There is no treatment for defective colour vision, nor is it usually the cause of any significant disability. However, it can be very frustrating for individuals affected by it. Having defective colour vision does keep one from performing certain jobs and makes others difficult.

Glaucoma
A condition where the pressure inside the eye is too high. The optometrist does a special test when you have an eye check to make sure you don’t have glaucoma.

Diabetes
Diabetes is an imbalance in blood sugar levels. If it is not well looked after it can lead to "diabetic retinopathy", which is damage to the blood vessels in the retina which can cause vision problems and even blindness.

AMD
Age-related macular degeneration is a condition that affects the macula, the central part of the retina that is responsible for clearest vision. It usually affects older people. It causes a loss of central vision, and an inability to see fine details like small print.
Exercise: Questions
Ask your students to imagine being vision impaired.
What couldn’t they do any more? What would be difficult?
What jobs might be difficult with defective colour vision?
Imagine you live in a developing country.
What problems might you have in getting the eye care you need?
What do “sustainable” eye care services mean?
What goes into making a sustainable service?

Exercise: Blindness
Divide the children into pairs. One child is blindfolded, while the other acts as a guide. Have them do a series of activities - go for a walk, find their bag, put rubbish in the bin, etc.

Children’s Vision
Teachers and carers can play a critical role in the detection of vision problems among children.
The Optometrists Association Australia have developed materials for teachers and parents that provide information about the symptoms of vision problems in children.

They are available on the
Website: http://www.optometrists.asn.au/kidsvis,
or from the Association:
Telephone: (03) 9663 6833;
Fax: (03) 9663 7478;
E-mail: oaanat@optometrists.asn.au
HOW THINGS GET TREATED

Spectacles and contact lenses

People with refractive error usually correct their vision with spectacles or contact lenses. To see clearly they need spectacles or contact lenses.

We generally take spectacles for granted, however they may be one of the world’s most important inventions. The invention of spectacles enabled people see clearly. Just imagine how the world would be if people could not see clearly.

No visual aids existed at the time of the ancient Egyptians, Greeks, or Romans. In a letter written by a prominent Roman about 100BC he expresses his resignation to old age and his complaint that he could no longer read for himself, having instead to rely on his assistant.

Around 1000AD, the first vision aid was invented. The reading stone, what we know as a magnifying glass, was a glass sphere used by monks that was laid on top of the material to be read to magnify the letters.

Nobody knows who “invented” spectacles, however they first appeared between 1268 and 1289AD. They were made from primitive convex shaped glass or crystal stones, surrounded by frames and connected through a rivet. The wearers, mostly monks and scholars, held the lenses in front of their eyes or balanced them on their nose.

In 1289 di Popozo wrote: “I am so debilitated by age that without the glasses known as spectacles, I would no longer be able to read or write. These have recently been invented for the benefit of poor old people whose sight has become weak”. In 1306 a monk of Pisa delivered a sermon in which he stated: “It is not yet twenty years since the art of making spectacles, one of the most useful arts on earth, was discovered. I, myself, have seen and conversed with the man who made them first”. However the name of the inventor of eyeglasses remains a mystery.

The invention of the printing press in 1452 and the growing availability of books prompted the mass production of inexpensive spectacles that were sold in cities by peddlers.

In 1718, Edward Scarlett, a London optician, designed the first spectacles with handles going over the ears to hold them in place. In 1784, Benjamin Franklin developed bifocal glasses. He was getting old and was having trouble seeing both up-close and at a distance. Getting tired of switching between two types of glasses, he devised a way to have both types of lenses fit into the frame. The distance lens was placed at the top and the up-close lens was placed at the bottom.

Today, if people can’t get spectacles or contact lenses then they will have blurry vision. Unfortunately that is the case in many developing countries, where people may not have access to eye care or may not be able to afford spectacles. Uncorrected refractive error causes poor vision or blindness in at least 300 million people in the world.

Contact lenses

The contact lens story began in 1845, when Sir John Herschel, an English astronomer, discussed whether vision could be corrected by ‘applying in contact with the surface of the eye some transparent animal jelly contained in a spherical capsule of glass, or whether an actual mould of the cornea might not be taken and impressed on some transparent medium.’ However there is no record of any attempt to put his theory into practice.

It was not until 1887-1888 that a device that we would recognise as a contact lens was made. Three people, working independently of each other, came up with blown glass lenses: August Muller in Germany, who made lenses to protect damaged eyes; and Adolf Fick in Germany and Eugene Kalt in France, who made lenses to correct vision.

From these first glass lenses, designs were gradually improved until the development of a plastic suitable for contact lenses – poly-methyl-methacrylate, or PMMA - in the early 1930s. PMMA rapidly replaced glass as the material of choice for contact lens manufacture, and these lenses are still in use today.

However in 1957 came a development which was to bring contact lenses into wide use. Professor Wichterle and Dr Drashoslav Lim, working in the Institute of Chemical Technology of the Czechoslovak Academy of Sciences in Prague, developed a stable transparent gel, hydroxy-ethyl methacrylate (HEMA), and filed patents on the material for a wide range of possible applications, including contact lenses. The first HEMA contact lenses were used in their own eyes in 1957.

The early discoveries by Wichterle and Lim ushered in the rapid development of various soft polymers by manufacturing companies in the 1970s. These developments have continued until now we have a wide range of lenses to choose from. Today, over 100 million people around the world wear contact lenses.
Lenses
To correct myopia you need a concave lens to make the light rays diverge, so that they are focussed on the retina instead of in front of it.
Refer to Appendix 5 for diagram
To correct hyperopia or presbyopia you need a convex lens to make the light rays converge, so that they are focussed on the retina instead of behind it.
Refer to Appendix 6 for diagram

Other treatments
There are many treatments for other eye conditions and diseases, such as antibiotics for infection, or surgery for cataracts.

Questions
How many people in the class wear glasses or contact lenses?
Who else do you know that wears glasses or contact lenses?
How would the world be different if glasses had not been invented?
**KEEP YOUR EYES HEALTHY**

You only have one set of eyes, so it’s important you look after them. You should:

**Eat well.**

Eyes need good nutrition to develop properly, and to stay healthy. For example, Vitamin A deficiency can cause blindness in children, and vitamins in vegetables and fruit can help to keep your cornea and retina healthy.

**Not smoke.**

Not smoking will also help to keep your eyes healthy. Tobacco smoke is composed of as many as 4,000 active compounds, most of them toxic and potentially damaging to the eye. Smoking can cause or worsen several eye disorders, particularly cataract and age-related macular degeneration (AMD), and may lead to blindness.

**Have regular eye examinations.**

Just like going to the dentist regularly to make sure that our teeth are healthy, we need to check regularly to make sure that our eyes are healthy and working properly. You should go to an optometrist to have your eyes and vision checked every 2-5 years, and more often if you wear glasses or have another eye problem.

**Protect your eyes.**

*Sunglasses:*

While most of us are aware of the damage that ultraviolet light can do to the skin, medical evidence shows that our eyes can also be harmed. UV radiation from the sun absorbed by the eye can contribute to a number of serious eye disorders and diseases, including cataract, pterygium, cancer of the skin around the eye, corneal degenerative changes, and age-related macular degeneration.

It is important that you wear good quality sunglasses and a hat when you are outdoors. Slip! Slop! Slap! and Slide! on your sunnies.

Since UV radiation is reflected off surfaces such as snow, water and sand, the risk is particularly high on the beach, while boating, or in snowy mountain areas. The risk is greatest during the mid-day hours, from 10 am to 3 pm, and during the summer months.

Protection should start with very young children and become part of their routine. UV exposure at an early age can be the most damaging in the long-term as the human eye is still developing through childhood and adolescence. Solar radiation damage to the eye may be cumulative and may increase the risk of developing an ocular disorder later in life.

Sunglass design is also important. All sunglasses sold in Australia are required to conform to an Australian Standard, AS 1067, which specifies how much UV protection must be provided. Sunglasses may be labeled as "General purpose sunglasses", which are suitable for most applications, or as "Specific-purpose sunglasses", which provide a higher level of protection, and are suitable for people who have a particularly high exposure to UV radiation.

Wrap around glasses are important to prevent light coming in from the side. Light coming into the eye from the side is focussed sideways through the eye, onto a spot on the white part of the eye near the nose. The UV concentration is this spot can be 20 times stronger than the normal exposure of ‘head-on’ light, thus significantly increasing the potential and rate of UV damage. In many older Australians this causes a “pterygium”, which is a fleshy growth over the conjunctiva (white part) of the eye. In mild cases pterygium can cause irritation, and in severe cases it can affect vision and may require surgical removal. It is seen most commonly in people who work outdoors in the sun and wind, and its prevalence is related to the amount of UV exposure.

The sun: Sunlight is very bright, and looking directly at the sun can be painful, and potentially hazardous. While glancing at the sun only causes your eyes to be dazzled, looking for any period of time is dangerous. For normal unprotected eyes, around 30 seconds of direct exposure is enough to cause permanent impairment of vision. Looking directly at the sun delivers about 4 milliwatts of sunlight to the retina, and potentially causes permanent damage.

Looking at the sun during an eclipse is even more hazardous. Normally, the sun’s brightness will make you blink or look away quickly before damage can be done. During an eclipse however, the brightness is reduced, so you think you can look for a longer period. However the radiation remains high, and you can easily receive enough to cause damage.
Safety goggles: Having your eye badly hit or pierced can cause vision impairment. It is also important to stop your cornea (the clear front of your eye) being damaged. The cornea in some ways is just like other parts of your body - if it is cut then it will cause an opaque scar, which can interfere with vision.

It is therefore important to protect your eyes from accidents. Don’t play carelessly with things that can hurt the eyes.

Exercise your eyes.

Your eyes should be able to focus up close and far away. If you only look at things that are up close (like books or computer screens), your eyes can change so that you can no longer see far away. If you are reading or working on a computer you should take regular “eye breaks”, (for a few minutes every half hour at least). Look out the window, or go outside and play or go for a walk. Recent studies show that the chance of becoming myopic (short-sighted) is lower for children who do more sport and outdoor activities.

Questions:
Who in the class has had an eye examination?
Who regularly wears sunglasses?
Who needs to wear safety goggles or special eye protection?

Exercise:
Ask the students to write and act out short plays about eye safety and how to protect their eyes.

POSSIBLE RESEARCH AND EXTENSION TOPICS
More detailed investigations can be done on various aspects of vision and eye care. Possible topics could include:

- The history and development of spectacles
- The history and development of contact lenses
- Looking at a particular eye condition in detail (refractive error, cataract, diabetes)
- Interview a person with glasses or contact lenses - ask why they wear them, what they have difficulty with, what they need to do to care for their eyes and spectacles/lenses
- Eye care challenges in a developing country
- Eye care in rural and remote areas in Australia
- An eye care delivery project in a developing country
- What does Australia do to improve international eye care?

You may also wish to invite a local optometrist to your school to perform simple vision screening or to give a talk.

Books to read:
The Story of My Life, by Helen Keller and James Berger
The World I Live In, by Helen Keller and Roger Shattuck
ESSAY QUESTIONS (to come)
Secondary Class Handouts
GETTING STARTED
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For eye structure diagrams refer to Appendix 1
HOW WE SEE

In order for us to see:
1. Light passes through and is focussed by the cornea (clear front of the eye)
2. Then it passes through the pupil
3. Then it gets further focussed by the lens
4. Then it falls on the retina (the back of the eye)
5. This causes electrical impulses to travel along the optic nerve to the brain
6. Where the brain interprets the image
As we look up close and far away the muscles around the lens inside the eye pull the lens to make it change shape in order to focus the rays of light correctly onto the retina. This ability is called “accommodation”.

The retina contains different types of cells – rod cells and cone cells. Rod cells are very sensitive to low levels of light, while cone cells are very sensitive to different colours and allow us to see well in bright light conditions. Human eyes can distinguish millions of different colours. Different animals have proportions of rod and cone cells depending on their habits – birds such as hawks have more cone cells to enable them to see prey from far away (a golden eagle can see a rabbit from 2 km away) and nocturnal animals have more rod cells so they can see at night.

**WHAT CAN GO WRONG**

Sometimes things go wrong with eyes. There are many different conditions that can cause poor vision or blindness. For example:

- **Refractive error** (there are several types of refractive error, the most common being shortsightedness or myopia; and longsightedness or hyperopia): means that the eye is the wrong shape and light does not focus correctly on the retina. People with refractive error need to wear glasses or contact lenses to see clearly.

<table>
<thead>
<tr>
<th>Type of Refractive Error</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myopia</td>
<td>Shortsightedness. People who are shortsighted can see well up close, but not at a distance. People who are shortsighted might have trouble recognising people across the room, seeing the blackboard from the back of the room, or recognising a bus number as it comes down the street. In myopia, rays of light entering the eye from a distant object focus in front of the retina.</td>
</tr>
<tr>
<td>Hyperopia</td>
<td>Longsightedness. People who are longsighted can usually see well at a distance but not up close. People who are longsighted might have trouble reading or working on a computer. In hyperopia, rays of light entering the eye from a close object focus behind the retina.</td>
</tr>
<tr>
<td>Presbyopia</td>
<td>“Old sight”. Presbyopia is a condition where you can’t focus up close, because the lens inside the eye has hardened and can no longer change shape (or accommodate) to provide close focus. It happens to almost everyone as they age (usually starting at around age 40) – which is why older people need reading glasses.</td>
</tr>
</tbody>
</table>
• **Cataract:** means the lens inside the eye isn’t clear so light can’t get through it. People with cataracts need an operation where the cloudy lens is removed and replaced with a new, clear plastic lens.

Around the world there are around 37 million blind people, and 124 million people with vision impairment. In addition, over 250 million have blindness or vision impairment due to uncorrected refractive error (they don’t have the glasses they need).

Avoidable vision impairment occurs often because there is no eyecare available, or because the treatment or correction is too expensive. In developing countries, there may be not enough eyecare clinics, optometrists or ophthalmologists to meet the needs of the population, particularly in rural areas.

Sunnies for Sight Day helps to raise funds to “Give Sight” to these people, by providing sustainable eyecare services and trained local eyecare practitioners.

Sustainable means that the services will keep going using local resources and systems, rather than relying on outside organisations to provide services or funds.

**HOW THINGS GET TREATED**

Just like medicines and treatments when you’re sick, there are various treatments and corrections when you have poor vision or an eye disease. e.g. glasses, contact lenses, surgery, antibiotics.

Glasses may be one of the world’s most important inventions. “Magnifying glasses” first appeared around 1000AD and were used by monks to read. They were glass spheres that were laid on top of writing to magnify the letters. Nobody knows who “invented” spectacles, but they appeared between 1268 and 1289AD. The invention of the printing press in 1452 and the spread of reading prompted the mass production of spectacles.

**Lenses**

To correct myopia you need a concave lens to make the light rays diverge, so that they are focussed on the retina instead of in front of it.

To correct hyperopia or presbyopia you need a convex lens to make the light rays converge, so that they are focussed on the retina instead of behind it.
WHAT’S GOOD FOR YOUR EYES?

**Keep Your Eyes Looking Good!**

You only have one set of eyes, so it’s important you look after them. You should:

- **Eat well.** Eyes need good nutrition to develop properly, and to stay healthy. For example, Vitamin A deficiency can cause blindness in children, and vitamins in vegetables and fruit can help to keep your cornea and retina healthy.

- **Not smoke.** Tobacco smoke is composed of as many as 4,000 compounds, many of them toxic to the eye. Smoking can cause or worsen several eye disorders including cataract and age-related macular degeneration, and may lead to blindness.

- **Have regular eye examinations.** Just like going to the dentist to make sure that our teeth are healthy, we need to check regularly to make sure that our eyes are healthy and working properly. You should go to an optometrist to have your eyes checked every 2-5 years, and more often if you wear glasses or have another eye problem.

- **Protect your eyes.** Too much UV radiation (from sunlight) can damage your eyes, so it is important that you wear good quality sunglasses or a hat when you are outdoors. Since UV radiation is reflected off surfaces such as snow, water and sand, the risk is particularly high on the beach, while boating, or in snowy mountain areas. The risk is greatest during the mid-day hours, from 10 am to 3 pm, and during the summer months. You should never look straight into the sun for any period of time. For normal unprotected eyes, around 30 seconds of direct exposure is enough to cause permanent impairment of vision.

- **If your eye is hit or pierced it can cause vision impairment.** Don’t play carelessly with things that can hurt the eyes. There are also some activities where you should take special care of your eyes. For example, carpenters wear safety glasses to stop any pieces of wood or dust going into their eyes.

- **Exercise your eyes.** Your eyes should be able to focus up close and far away. If you only look at things that are up close (like books or computer screens), your eyes can change so that you can no longer see far away. If you are reading or working on a computer you should take regular “eye breaks”, (for a few minutes every half hour at least). Look out the window, or go outside and play or go for a walk. Recent studies show that the chance of becoming myopic (short-sighted) is lower for children who do more sport and outdoor activities.
Secondary Class
Fun & Games
Knowing your Vision

Using a pencil draw a line linking the word with the correct definition

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyelids</td>
<td>The coloured part of the eye. It is usually blue, brown, grey or green.</td>
</tr>
<tr>
<td>Cornea</td>
<td>Two folds of skin at the top and bottom of your eye. They close over your eyes when you blink or sleep.</td>
</tr>
<tr>
<td>Eyelashes</td>
<td>A jelly-like ball that sits in a sack behind the pupil. It changes shape to focus the light passing through your eye so that you can see clearly.</td>
</tr>
<tr>
<td>Pupil</td>
<td>A row of hair growing on your eyelids. They help to protect the eyes, especially from things in the air like flying insects and dust.</td>
</tr>
<tr>
<td>Retina</td>
<td>The clear front of the eye.</td>
</tr>
<tr>
<td>Iris</td>
<td>The back of your eye. It receives the light passing through the pupil and lens and transmits the images to your brain.</td>
</tr>
<tr>
<td>Lens</td>
<td>The round black hole in the centre of your eye. It lets light into your eye so that you can see.</td>
</tr>
<tr>
<td>Vitreous</td>
<td>The watery liquid that keeps your eyes moist.</td>
</tr>
<tr>
<td>Optic nerve</td>
<td>The jelly like material inside the eyeball.</td>
</tr>
<tr>
<td>Tears</td>
<td>The nerve that carries information from the back of the eye to the brain.</td>
</tr>
</tbody>
</table>
Find a Word

Find the words from the list in the table below.

cornea  eye  eyelashes  iris  lenses  looking  retina  sight
spectacles  sunglasses  vision

corpora  eye  eyelid  lenses  pupil  retina  sight
sunglasses  vision

S  U  N  G  L  A  S  S  S  E  S
P  A  V  P  U  P  I  L  Y  E
E  P  L  E  V  L  G  E  X  H
C  R  Y  K  I  O  H  Y  M  S
T  E  A  R  S  O  T  E  L  A
A  T  E  M  I  K  P  L  E  L
C  I  N  J  O  I  R  I  N  E
L  N  R  X  N  N  O  D  S  Y
E  A  O  A  D  G  S  S  E  E
S  I  C  F  B  I  R  I  S  T
Ebbinghaus Illusion: Which red flower centre is bigger? (The right one? The left one? Actually they are the same size.).

Why: Our perception is influenced by any surrounding objects, in this case the white spheres. Since the overall shape of the flower on the right is bigger, some assume the centre is also bigger. Others may see the left centre as being larger because it is bigger than the surrounding spheres.
Optical Illusions

Fraser’s Spiral: Also known as the twisted-cord illusion. It looks as if this is a spiral, but in fact it’s a series of circles.

Why: A regular line pattern (the circles) is combined with misaligned parts (the chequered pattern underneath). The black and white lines that make up each circle are slightly curved towards the center of the whole figure. Our eyes try to follow this direction and, helped by the chequered pattern, they ‘jump’ to the next inner (smaller) circle - a jump we fail to detect, so the circles appear as a spiral.
Crossword

ACROSS
4. Sight
5. A way to correct vision
9. What we see with

DOWN
1. The round black hole in the eye
2. What you wear to protect your eyes from bright light
3. A way to correct vision
6. Cover of the eye
7. The liquid on the surface of the eye
8. Coloured part of the eye
ACROSS
3. The round black hole in the eye
6. Coloured part of the eye
7. The back of the eye
8. Cover of the eye
9. The liquid on the surface of the eye
10. A way to correct vision

DOWN
1. A way to correct vision
2. Sight
4. What you wear to protect your eyes from bright light
5. Clear front of the eye
11. What you see with
Crossword

ACROSS
2. Sight
3. The liquid on the surface of the eye
5. The round black hole in the eye
6. A way to correct vision
8. Coloured part of the eye
9. Cover of the eye

DOWN
1. What you wear to protect your eyes from bright light
4. A way to correct vision
7. What we see with
Other Student Activities

**Blindfold a Friend:** One friend is blindfolded and the other is the guide. The guide has to successfully get them and their blindfolded partner through a pre-planned route around the classroom or school yard. Each pair is timed and the fastest duo wins. This is a powerful tool to demonstrate the difficulty of living with poor vision.

**Blindfold an Instructor:** One friend is blindfolded and the other is the instructor. The instructor has to successfully navigate the blindfolded friend through a pre-planned route around the classroom or school yard using only verbal directions. This is a powerful tool to demonstrate the difficulty of living with poor vision.

**Paper Plate Face:** Hold a paper plate on top of your head and try to draw smiling face. This can demonstrate to students how hard it is to do a simple task when you are unable to see.
The brain

The eye: Cross section of the eyeball showing image of externally seen pear appearing on the retina
Lenses (Concave)

Concave (minus) lens is used to diverge parallel light and brings the incident light to a focus on the retina.
Lenses (Convex)

Convex (plus) lens is used to converge parallel light and bring the incident light to a focus on the retina.