



Royal Academy
of Engineering

THIS IS
ENGINEERING

ENGINEERING IN THE MOVIES OVER THE RAINBOW

STEM

Science, Technology and Maths Focus



INTRODUCTION

Colour and lighting effects are part of the cinematic experience, creating the atmosphere and mood to set a scene. Do you think this could be achieved in the early days of black and white silent movies?

The first colour movies were not actually filmed in colour. These early movies were shot with black and white film and multiple colour filters were superimposed after print to create the colours. This worked to a certain extent but lacked realism.

Technological advances were developing by the time the **WIZARD OF OZ** was released in 1939. This movie was revolutionary in its use of vivid Technicolour, a process of colour cinematography that used three different colours to produce a print. The **WIZARD OF OZ** is widely considered to be one of the greatest films in American history.



World History Archive / Alamy Stock Photo

OVERVIEW

Experiment with prisms and 3D cinema glasses to explain some of the interesting properties of light and their cinematic application.

CHALLENGE

- Teams of two
- 120 minutes
- 3 KS3
- Developing

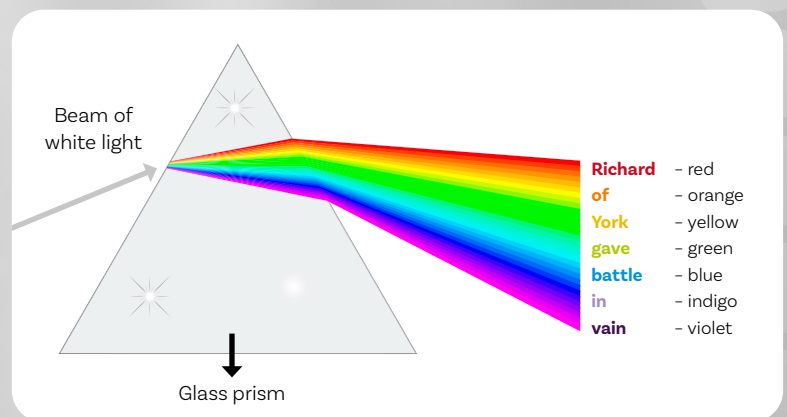
MATERIALS

- Prism
- Ray box
- Red and green acetate filter
- White card
- 3D glasses

PRISMS

The 'rainbow' in science is known as the spectrum.

This is caused by white light from the sun hitting raindrops, which splits up (disperses) the light into many colours to create a rainbow effect. Use the mnemonic methods on the right to remember all seven colours.

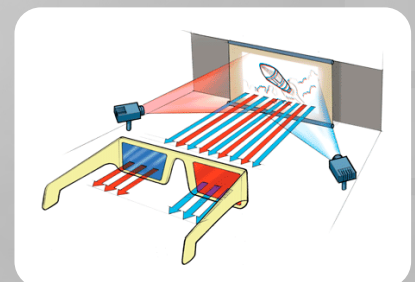


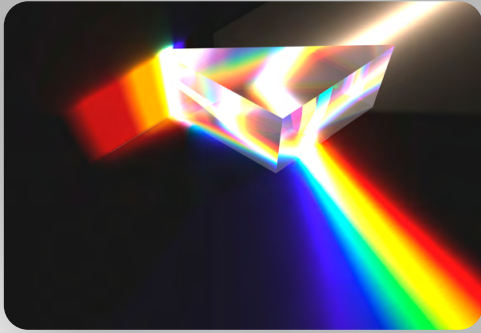
3D GLASSES

Have you ever wondered why you sometimes wear 3D glasses in the cinema?

It's so that you can feed different images into your eyes. The cinema screen projects two images and the glasses cause one of the images to enter one eye and the other to enter the other eye. Your brain does the rest and creates the illusion of a 3D scene.

During this challenge, you will construct your own 3D glasses from white card and red and cyan acetate.





EXERCISE

Recreate Sir Isaac Newton's experiment.

This effect uses a prism and a ray of white light to demonstrate the split into bands of colour. If the science department does not have a ray box, one can be made with a shoebox, touch, tape and pair of scissors.

CHALLENGE 1

- 1. Twist the prism and observe the effect the wave of light has on the emerging rays of colour.**

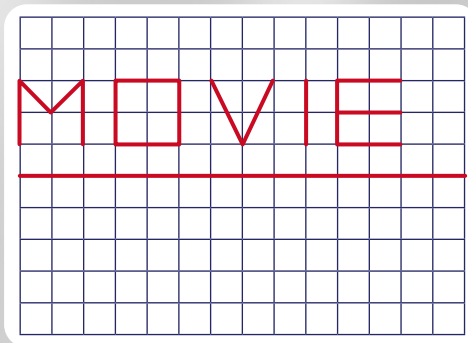
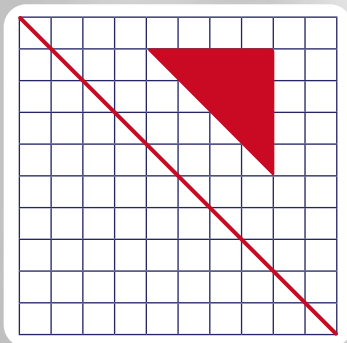
Which colour was bent the most by the prism?

Which colour was bent the least by the prism?

Try placing small pieces of colour filter in the path of the light, before it strikes the prism. What do you observe?

.....

- 2. Reflect the shapes in the mirror lines.**



- 3. Add the missing word in each statement and locate in the word search.**

Material that allows light to pass through. **T.....**

Measure of how much light material allows to pass. **T.....**

Made when light cannot travel through an object. **S....**

Object that gives out light. **L.....**

Material that allows some light to pass through. **T.....**

Light will **R.....** when it meets a different **D.....** material.

S.... OF LIGHT= 300,000,000 metres/second.

Dark materials **A.....** light.

Light Amplification by Stimulated Emission of Radiation. **L....**

Huge ball of gas that gives out heat and light. **S...**

Material that does not allow light to pass through. **O.....**

Shiny materials such as a **M.....** will reflect light.

A line at 90° to a plane surface. **N.....**

Angle of **I.....** = **A.....** of reflection.

Device used to see out of a submarine. **P.....**

R	A	R	I	T	E	R	S	T	A	M	P
E	B	E	S	R	R	E	F	R	P	I	E
F	S	S	H	A	D	O	W	A	E	R	R
L	O	C	A	N	L	A	S	N	R	R	I
T	R	A	N	S	M	I	S	S	I	O	N
E	B	N	O	P	F	L	A	L	S	R	C
F	N	O	P	A	Q	U	E	U	C	D	I
L	A	S	E	R	E	M	A	C	O	E	D
E	Q	T	R	E	N	I	N	E	P	N	E
C	U	A	A	N	A	N	G	N	E	S	N
T	R	R	I	T	Y	O	L	T	R	I	C
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N	O	R	M	A	L	S	P	E	E	Y	Y

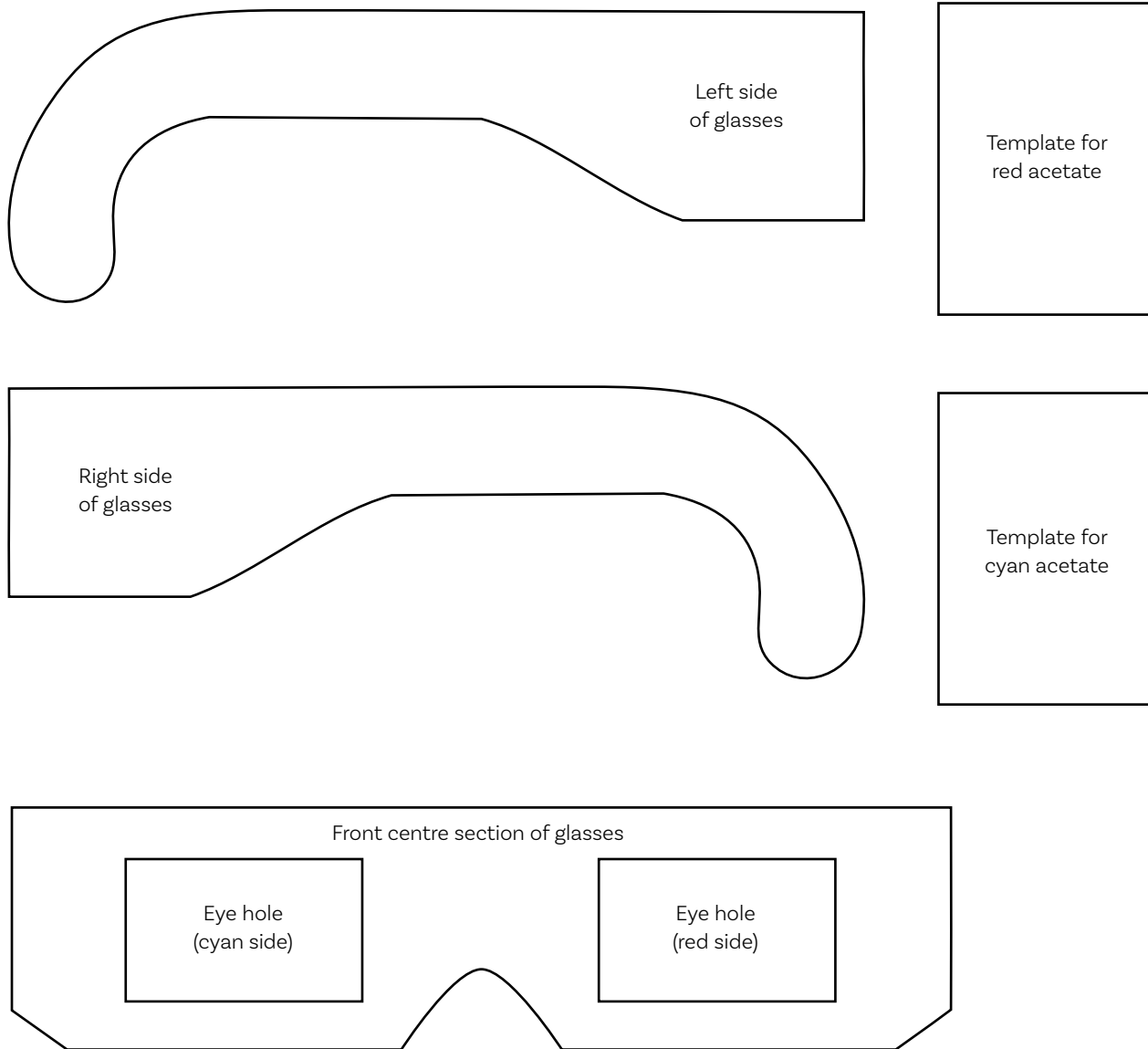
4. Instructions for constructing your own 3D glasses

- Cut out the 3D glasses from the template (next page) including the eye holes.
- Tape the sides to the centre section to form the glasses template.
- Cut a square of red and green acetate using the template.
- Tape the red acetate to the back of the left eyehole and tape the green acetate to the back of the right.
- Fold the sides of the eye glasses to fit the face.
- Now watch a 3D film such as Toy Story 3D trailer at <https://www.youtube.com/watch?v=2wYyI3xxhkl>
- Do you notice anything different?

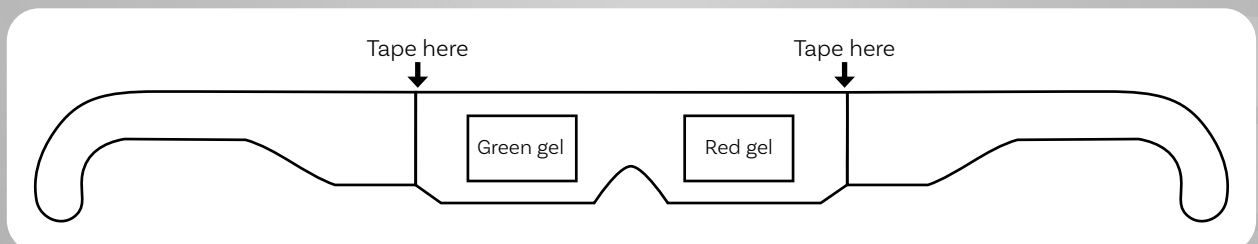


3D GLASSES TEMPLATE

A. Cut out the 3 eyeglass sections (including the eye holes) and the two acetate templates



B. Tape the sides to the centre section, as per the diagram below (shows front of glasses)





Royal Academy of Engineering

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