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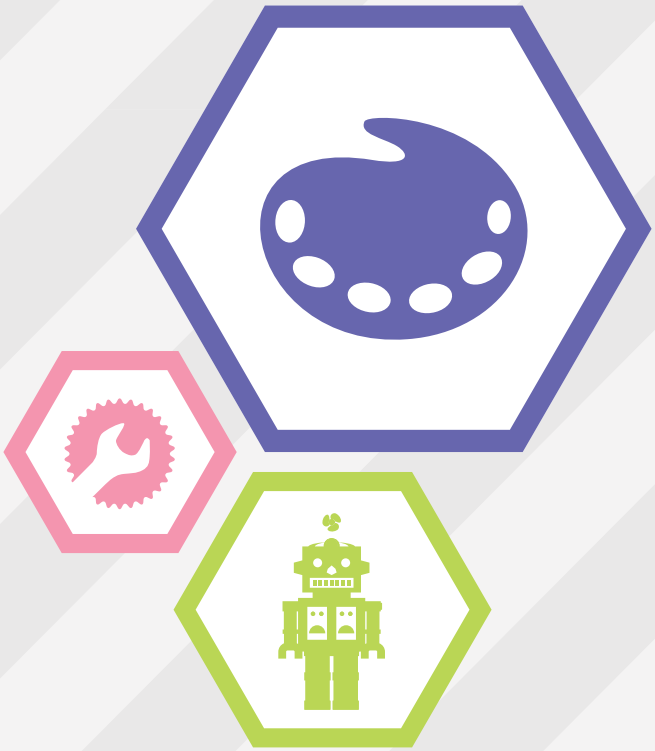
MAKEIT

WORKSHOP PLAN



national science week 2015

THE COLOUR WHITE

We see millions of colours every day, but how does the white light from an LED or the yellowish light of the sun make that possible?

AGE GROUP
5+ (some cutting with scissors)

METHOD
Group activity
(14:1 participant to facilitator ratio recommended)

LEVEL
Introductory

DURATION
25 minutes

KEY LEARNINGS
Light from a source forms shadows and can be absorbed, reflected and refracted. (Yr5:ACSSU080)
Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena. (Yr5:ACSHE081)

Version 1.0
12 August 2015

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THE COLOUR WHITE

INCLUDED IN THIS WORKSHOP PLAN

> Materials and equipment list
> Preparation suggestions
> Recommendations: General advice and opportunities for further learning
> Full 25 minute workshop outline

APPENDIX

> Spinner Template
> Materials Suppliers List

MATERIALS AND EQUIPMENT

- ☐ Spinner template on A4 card (1 per participant)
- ☐ Cotton twine (0.75m - 1m per participant)
- ☐ 3 small torches (shared between the group)
- ☐ Baking paper (1 A4 sheet)
- ☐ Red, blue and green cellophane (1 A4 sheet)
- ☐ Ruler (1 per participant)
- ☐ Scissors (1 per participant)
- ☐ Coloured felt pens
- ☐ Sticky tape
- ☐ White surface (card or paper is OK)
- ☐ SPINNER TEMPLATE (appendix)
- ☐ MATERIALS SUPPLIERS LIST (appendix)

Required, but not included in pre-packed kits:

- *Ruler*
- *Scissors*
- *Sticky tape*
- *Coloured felt pens*
- *White surface/card*

PREPARATION

> The facilitator should prepare for this workshop by making their own spinner using the instructions and materials provided. Experiment with getting the spinner to work – putting your fingers through the loop, holding it tight enough to make the disc stand up, and rolling the disc towards you to start a twist in the twine before gently pulling your hands apart. When the twine becomes an open loop, relax your hands and let the momentum of the spinner twist the twine in the opposite direction. As the spinner slows down, begin to apply pressure gently and increasing pressure outwards to increase the spin. Repeat rhythmically to build speed.

> Have a small object at hand (eg. an eraser, a matchbox, a bulldog clip) to make shadows with the coloured light from the torches. Participants can be encouraged to guess what colour shadows they will see with individual colours, and different combinations.

> The coloured light works best in a darkened room, but if this is not available, then it is possible to use a large cardboard box to make a darkened viewing area. Consider how participants will observe the effects if using a box – crowding may be an issue.

> Have a rubbish bin ready for the cardboard waste.

RECOMMENDATIONS

GENERAL ADVICE

Depending on the age and skill levels of the participants, it would be ideal to have a couple of extra copies of the template at hand if cutting errors make completion impossible. The spinner works best if adjacent colours are contrasting and a variety of colours are used.

FURTHER LEARNING

Further learning could come from considering why mixing coloured paints produces a muddy grey, rather than white (reflected colours, from pigments, appear because the pigments absorb all colours except the one reflected). Mixing enough pigments means that eventually all the colours in white light will be absorbed, and the mixture looks dark. Stage effects using coloured lights and shadows could be illustrated.

WORKSHOP OUTLINE

00:00 INTRODUCTION

Introduce yourself, welcome participants and cover any housekeeping.

Ask participants if they have ever seen a rainbow, and explain that this shows that sunlight contains all the colours we see (and some we can't). Begin with the demonstration, and get some participants to assist in cutting up the cellophane and black paper.

00:05 COMBINING COLOURS

Cut 3 squares of baking paper a bit larger than the end of the torch, and a similar sized piece of each of the three colours of cellophane.

Place one coloured piece of cellophane over each torch, and sticky tape it in place, making three torches that each shine a different colour.

Place a piece of baking paper over the cellophane on each torch, and sticky tape it in place.

This helps to diffuse the light.

In a darkened room (or other dark space), shine the torches onto a white surface (a piece of paper will do) to demonstrate that they produce a single colour.

Now shine two torches simultaneously on the same spot, and observe what happens when the light combines.

Try different combinations of colours, and finally all 3 (a white spot should result), showing that white light is made up of different colours combined.

An additional activity would be to place a small object in front of the white surface, and shine different coloured light onto it. This time, look at the shadows.

00:15

MAKE A COLOUR SPINNER

Hand out spinner templates, and ask participants to cut them to make a circle.

Each section is then coloured in with a different colour. Doubling up is OK, but make sure adjacent segments are different.

Colour in the whole template, ensure you don't leve any white space.

Use a pen or sharp pencil to punch two holes at the spots marked, about 5 – 10 mm each side of the centre of the circle. The holes need to be big enough for the twine to pass through.

Cut a piece of twine about a metre long for each participant. When doubled, the twine should stretch loosely between outstretched hands.

Smaller pieces may be better for younger groups.

Thread the twine through the holes, and tie the ends. Keep the knot at a distance from the spinner, so it can move freely.

Put a finger of each hand through the ends of the loop, and twist it a bit.

Try rolling the spinner towards you along the table or floor as you hold the string.

Now pull your hands apart gently, and the twist will make the spinner rotate.

Relax the tension when the loop opens to allow the momentum of the spinner to wind the twine in the opposite direction. As the spinner begins to slow, apply outward pressure again, and repeat the process as the spinner builds speed.

Look at the spinner as it rotates – you should see it turn white when spinning rapidly, and may catch a glimpse of the colours as it slows down.

Explanation: When you look at the spinner, light is reflected into your eyes, and you see the colours that are not absorbed by the pigments. Different cells in the eye respond to different coloured light, and the brain has learned to interpret this as seeing particular colours.

Continued...

When the spinner is rotating rapidly, different colours are reflected into your eyes so fast that all the different receptor cells are responding at the same time, and the brain interprets this as the colour white. This explains how we see white as a colour, even though it is actually made up of light of all the colours of the rainbow.

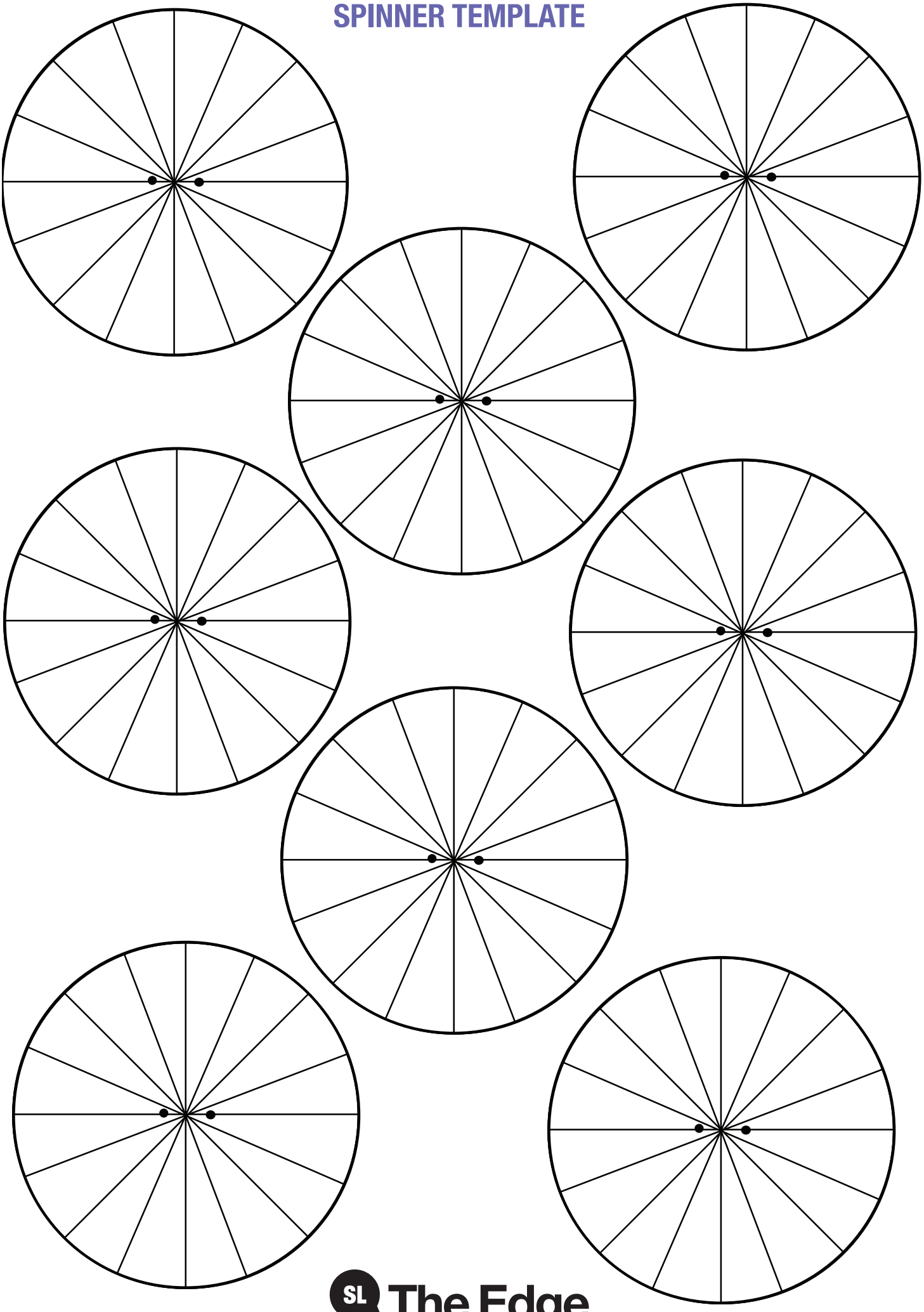
00:25 **THE END**

APPENDIX

SPINNER TEMPLATE

MATERIALS SUPPLIERS LIST

SPINNER TEMPLATE



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THE COLOUR WHITE MATERIALS SUPPLIERS

MATERIAL	QTY	SUPPLIER	COST	LINK
A3 card for template	100 (A3)	Officeworks	$10.98 + $5.95 shipping <$55	http://www.officeworks.com.au/shop/officeworks/p/quill-a4-board-200gsm-white-50-pack-qubxlawe
Cotton twine (10m per kit)	80m	Staples	$2.75 +$5.50 shipping <$55	http://www.staples.com.au/main-catalogue-search?Ntt=cotton+string&submit=Search&searchtrigger=globalsearch
Torches (3 per kit)	1	Bunnings Arlec 9 LED (with batteries)	$5.46	http://www.bunnings.com.au/arlec-9-led-watchman-metal-torch-with-batteries_p4410346
	3	SupaCheap Auto 9 LED (batteries included)	$15.98 (3 pack)	http://www.supercheapauto.com.au/online-store/products/Ridge-Ryder-9-LED-Aluminium-Torch-3-Pack.aspx?pid=353092#Recommendations
Cellophane (3 sheets per kit)	25	Staples (5 sheetsx5 colours)	$22.85 + $5.50 shipping <$55	http://www.staples.com.au

ABOUT THIS LIST

We've put this list of suppliers together to help make the planning and preparation process a little easier. We don't receive any kick-backs or benefits from sharing this list with you.

If you've downloaded this workshop plan from edgeqld.org.au then you'll require all the materials and equipment listed at the beginning of this document (and above).

If you've received this workshop plan through the National Science Week kits distributed by your public library, then all the above materials are supplied in the kit.

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Author/Developer

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The Edge, State Library of Queensland
for National Science Week 2015
www.scienceweek.net.au

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Tell us what you think, and what you'd change.

Take the 2 minute questionnaire:

goo.gl/yBV2uw

This Inspiring Australia initiative is supported by the Australian Government as part of National Science Week.

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