



Colour My World

YEAR 5
PHYSICAL SCIENCES



QGC

FUTUREMAKERS



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Future Makers

Future Makers is an innovative partnership between Queensland Museum Network and Shell's QGC business aiming to increase awareness and understanding of the value of science, technology, engineering and maths (STEM) education and skills in Queensland.

This partnership aims to engage and inspire people with the wonder of science, and increase the participation and performance of students in STEM-related subjects and careers — creating a highly capable workforce for the future.

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ENGAGE – EXPLORE – EXPLAIN – EVALUATE

Colour My World

Teacher Resource

In this activity, students investigate how they can use light and colour to change the way things look. Students firstly explore how they can split, mix and block light in a teacher-led demonstration. They then use their knowledge and understanding of light and colour to create a coloured shadows light show inspired by a Queensland Museum Network exhibition.

Light and Colour Demonstration

Materials required to complete the demonstration include:

- White wall or white board
- Dolphin torch
- 5 x CDs
- 1 x Red LED coloured light
1 x Green LED coloured light
1 x Blue LED coloured light

Please note, we only recommend using coloured cellophane to cover LED torches; the heat produced by other torches will melt the cellophane, which can result in a health and safety hazard.

- Sheets of coloured perspex or cellophane
Various colours should be provided to allow for experimentation.
- Circles of white and black cardboard, various sizes, adhered to a stick
- Objects, such as a stand or blu-tak, to hold up the board and/or perspex/cellophane sheets in front of the wall or board

Detailed step-by-step instructions can be seen below. It is recommended that you use these instructions to guide your students through the activity.

1. Gather students around a white wall, ensuring all can see the demonstration. Alternatively, set up the white board in a location where all students can see the demonstration. Turn off the lights in the classroom.
2. Shine the torch onto the wall/board. Ask students: What colour does the wall/board look?
3. Inform students that you have some objects that can change the colour of the wall/board.

Pass the objects (CDs) around to students. As the objects are passed around, ask students to discuss in pairs or threes: What do you notice about the object? How might this object change the colour of the wall/board? Why do you think this? These questions could be written on the whiteboard or pieces of butchers paper for students to refer to during this time. Ask students to return the objects. Students share their thoughts with the class. Responses and predictions could also be recorded on the white board or pieces of butchers paper.

4. Position a CD in front of the wall/board, holding the CD so that its reflective surface faces the wall/board. Shine the torch onto the reflective surface of the CD. Ask students: What do you see? Student responses may include a rainbow and the colours they see. Students may even like to count the number of different colours they see. You may need to adjust the angle of the CD and/or torch to see this effect.
5. Move the CD away from the torch. Inform students that white light is made up of each of these colours. Move the CD back in front of the torch. Inform students this object, a CD, separates white light into its component colours: red, orange, yellow, green, blue and violet.
6. Inform students that they are going to be mixing colours to see what types of different colours they can make on the wall/board. Ask students: Has anyone enjoyed mixing different colours before? What are your favourite colour combinations/mixes?

Inform students that they can also mix colours together using light from torches and that this will give completely different results to mixing colours with paint. Show students available objects, including coloured lights, sheets of coloured perspex/cellophane and circles of black and white cardboard. Ask the students to suggest which objects they would like to investigate and how they would like to investigate the objects (i.e. the object's position in relation to the torch, wall/board and any other objects already in use).

The following questions can be used to guide this investigation process. It is recommended that you repeat this process three to four times, investigating the effects of a new object each time. Ensure students make predictions about how each object will change the colour of the wall/board before use, share observations when the object is in use and discuss results using scientific knowledge and understanding.

- What could we do first?
 - Let's make a prediction. What colour will the wall/board be when we shine this light/place this coloured sheet in front of the wall/board?
 - What colour is the wall/board now?
 - What else could we do? Could we add something or take something away?
 - What do you notice now? Why do you think this has happened?
7. Remove all previously used objects away from the wall/board. Show students the red, green and blue coloured lights. Ask students: What do you think will happen if we shine these three lights on to the wall/board? Shine the lights on to the wall/board and compare predictions with results.
 8. Facilitate a think-pair-share discussion with students. What surprised students the most? What did students learn during the demonstration? What might students like to explore further?

Coloured Shadows

Materials required to complete the design challenge will vary. At the very least, each student group will require access to one red, one green and one blue coloured light. Such lights can be sourced from educational suppliers or can be made by covering individual torches with red, green and blue lighting gels.

Detailed step-by-step instructions can be seen below. It is recommended that you use these instructions to guide your students through the activity.

Before introducing the design challenge, you and your students may like to explore how different cultures and professions use light and colour. For instance, students could view puppet theatre plays produced by Asian cultures, such as Wayang from Java, Indonesia or Chinese shadow puppetry, and discuss how light and colour have been used to engage and entertain audiences. Students could also investigate the use of lighting in the theatre, and how colour and light in this setting can help to create atmosphere or tell a story.

1. Introduce students to the design challenge:

Create a light show inspired by a Queensland Museum Network exhibition. Your light show must use only red, green and blue lights, and feature six different coloured shadows!

To better suit your classroom context, you may like to change the source of students' inspiration to support a cross-curriculum priority or other subject area learning.

2. Share or negotiate any specific challenge requirements, restrictions or criteria for success with students. These may include:

- Size of student groups (three to four students per group)
- Student roles
- Materials to complete the challenge
- Time limit to complete the challenge

3. Divide students into groups, ensuring each student knows their individual role if assigned. Provide students with time to complete *Part 1: Coloured Shadows Design Challenge*. Additional information regarding specific aspects of the design challenge can be found below.

Investigate

Students identify the different coloured shadows they can make using a red, green and blue light. Ensure students use correct terminology when describing the secondary colours of light: *magenta* rather than *pink* and *cyan* rather than *light blue*. During this time, you may also like to inform students that the primary colours of light are red, green and blue. Our eyes can only detect red, green and blue light. All other colours we see, including cyan, magenta and yellow, are a mixture of these three primary colours.

Create and Test

Students explain why they observe different coloured shadows when they hold various objects in front of a red, green and blue light. While student wording may be different, an accurate explanation should include the following information:

- The three primary colours of light are red, green and blue. When red, green and blue lights are combined, we see white light.
- Light travels in straight lines. Light can be blocked to create shadows.
- In this investigation, there are three lights. Each light is in a different position. When an object blocks one or more of these lights, multiple shadows are created.
- A shadow against a white wall shows as a different colour depending on which colour of light has been blocked. If the red light source is blocked, the green and blue light will still reach the wall. When mixed, these two colours make cyan and so we see a cyan shadow. This is the same for the other light sources. When the green light source is blocked, the blue and red light will still reach the wall. When mixed, these two colours make magenta and so we see a magenta shadow. When the blue light source is blocked, the green and red light will still reach the wall. When mixed, these two colours make yellow and so we see a yellow shadow.

After completing the design challenge, students reflect on and evaluate their final design and experiences:

- What knowledge/understandings helped you make decisions about your light show?
 - Are there any further changes you could make to improve the light show?
 - What were the main challenges you experienced during the design process? How did you overcome these?
 - What have you learnt about colour and light/the design process from this activity?
 - How could you apply this knowledge and understanding to your learning in other contexts?
 - What more would you like to know about colour and light?
4. Students complete *Part 2: Coloured Shadows Show*. You may wish to negotiate the duration of the coloured shadow show with students before they start this activity. Students present their coloured shadow shows to the class.

Curriculum Links

Science

YEAR 5

Science Understanding

Light from a source forms shadows and can be absorbed, reflected and refracted (ACSSU080)

Science as a Human Endeavour

Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE081)

Science Inquiry Skills

With guidance, pose clarifying questions and make predictions about scientific investigations (ACSI231)

Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSI086)

Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate (ACSI087)

Compare data with predictions and use as evidence in developing explanations (ACSI218)

Reflect on and suggest improvements to scientific investigations (ACSI091)

Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts (ACSI093)

Design and Technologies

YEAR 5 & 6

Design and Technologies: Knowledge and Understanding

Investigate characteristics and properties of a range of materials, systems, components, tools and equipment and evaluate the impact of their use (ACTDEK023)

Design and Technologies: Processes and Production Skills

Critique needs or opportunities for designing, and investigate materials, components, tools, equipment and processes to achieve intended designed solutions (ACTDEP024)

Generate, develop and communicate design ideas and processes for audiences using appropriate technical terms and graphical representation techniques (ACTDEP025)

Select appropriate materials, components, tools, equipment and techniques and apply safe procedures to make designed solutions (ACTDEP026)

Negotiate criteria for success that include sustainability to evaluate design ideas, processes and solutions (ACTDEP027)

English

YEAR 5

Language

Understand how texts vary in purpose, structure and topic as well as the degree of formality (ACELA1504)

Literacy

Plan, draft and publish imaginative, informative and persuasive print and multimodal texts, choosing text structures, language features, images and sound appropriate to purpose and audience (ACELY1704)

Re-read and edit student's own and others' work using agreed criteria for text structures and language features (ACELY1705)

General Capabilities

Literacy

Comprehending texts through listening, reading and viewing

Composing texts through speaking, writing and creating

Information and Communication Technology

Investigating with ICT

Creating with ICT

Critical and Creative Thinking

Inquiring: Identifying, exploring and organising information and ideas

Generating ideas, possibilities and actions

Reflecting on thinking and processes

Analysing, synthesising and evaluating reasoning and procedures

Personal and Social Capability

Social management

Colour My World

Student Activity

Part 1: Coloured Shadows Design Challenge

Lighting, colour and shadow effects are commonly used in theatre and film. These effects are carefully considered by lighting designers, and are deliberately selected to engage and entertain audiences, create atmosphere or help tell a story.

Task:

Create a light show inspired by a Queensland Museum Network exhibition. Your light show must use only red, green and blue lights, and feature six different coloured shadows!


You must:

- **Investigate** how you can use red, green and blue lights to create different colours and coloured shadows.
- **Design** a light show stage that uses red, green and blue lights to create different colours and coloured shadows.
- **Create** your light show stage.
- **Test** your light show stage. Move different opaque, translucent and transparent objects in front of the lights and observe the effects.
- **Refine** your light show stage so that you can see at least six different coloured shadows when you move an object in front of the lights.
- **Collaborate** in teams of three or four.
- **Evaluate** your light show stage. Does it allow you to present a light show where we can see different colours and coloured shadows? You may also be required to evaluate social interactions and your ability to work effectively in a team.



Investigate

Describe how you created different colours and coloured shadows using the red, green and blue lights.

A large, empty rectangular box with a thin black border, intended for students to write their descriptions of how they created different colors and colored shadows using red, green, and blue lights.

Design

Design a stage for your light show. How will you arrange the lights so that you can see different colours and coloured shadows? What materials will you need to construct the stage? Draw a labelled diagram of your light show stage below.

Describe how the light show stage works. Explain how you decided on the position of your lights.

Create and Test

Create your light show stage.

Test your light show stage. Describe what happens when you place an object in between the screen and lights, and then move the object towards and away from the light source. Record the object/s used and your observations below.

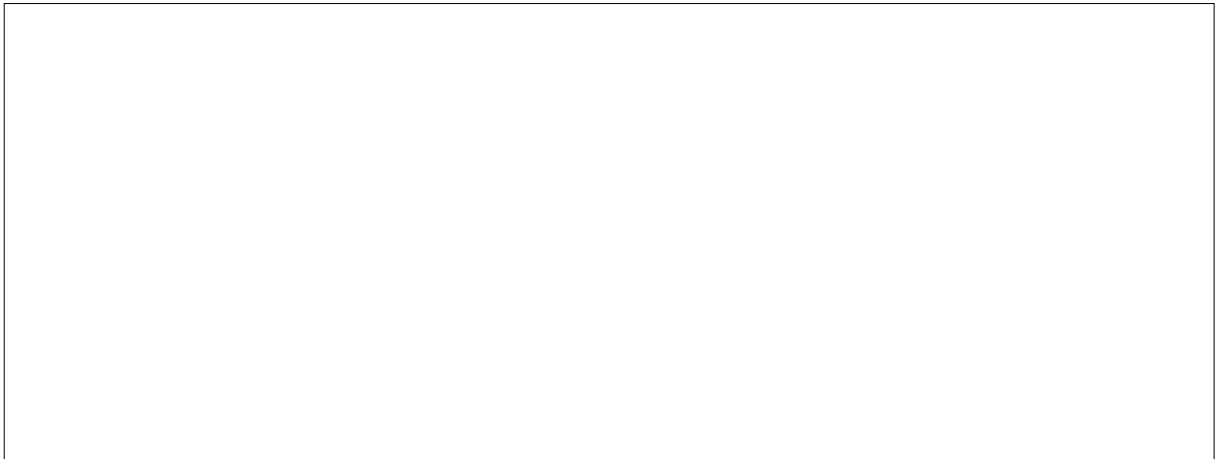
Describe what happens when you move an opaque, translucent and transparent object in front of the lights. Record the object used and your observations below.

a) Opaque

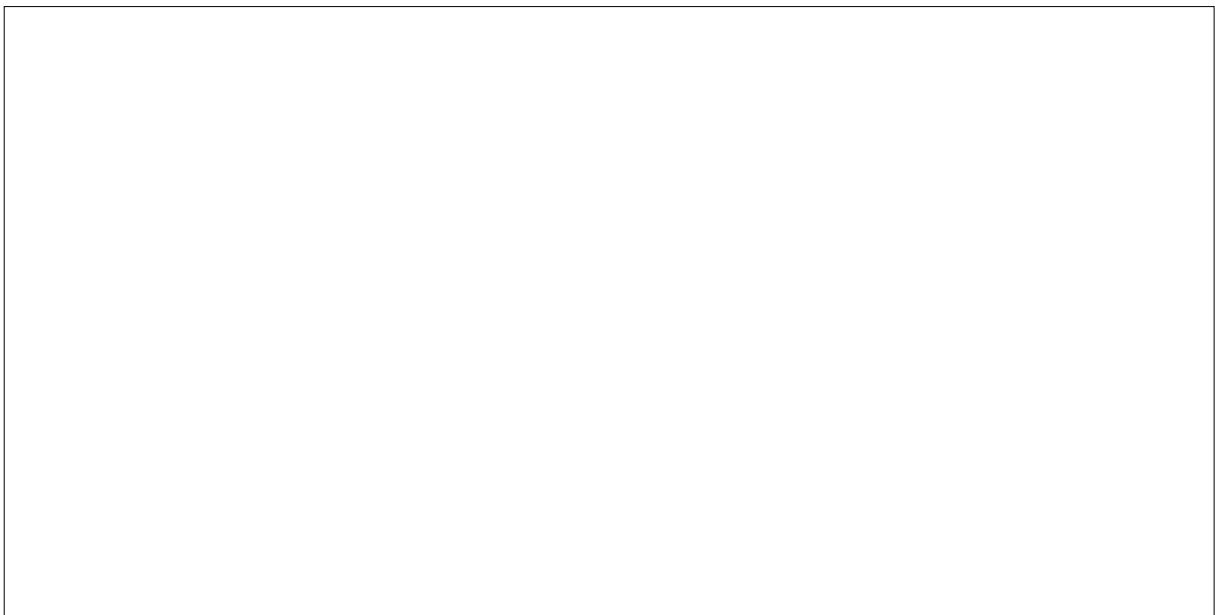
b) Translucent



c) Transparent



Explain your observations using your scientific understanding of light.



Refine

Refine your light show stage so that you can see at least six different coloured shadows when you move an object in front of the lights. Describe how you achieved this effect.



Evaluate

Reflect on your actions with your team or class after you have completed the design challenge. You might like to think about the following questions to assist with your reflection:

- What scientific knowledge helped you make decisions about your light show?
- What aspects of your light show are you very satisfied with and why?
- Describe any further changes you could make to improve the light show.
- What were the main challenges you experienced during the design process? How did you overcome these challenges?
- What have you learnt about colour and light/the design process from this activity?
- How could you apply this knowledge and understanding to your learning in other contexts?
- What more would we like to know about colour and light?

Part 2: Coloured Shadows Show

Create a coloured shadows show inspired by a Queensland Museum Network exhibition.

You may visit the closest Museum or research the exhibitions at [Queensland Museum](#), [The Workshops Rail Museum](#), [Cobb+Co Museum](#) or [Museum of Tropical Queensland](#).

The exhibition that will provide inspiration for our coloured shadows show is:

Brainstorm any initial ideas you may have for a story. Select your best idea, and then complete the narrative story map to describe how your coloured shadows show will unfold.

Orientation	
	Materials Required
	Lighting Effects

Complication	
	Materials Required
	Lighting Effects

Series of Events	
	Materials Required
	Lighting Effects

Resolution	
	Materials Required
	Lighting Effects

Explain how you used different visual and lighting effects to tell your story, including moving objects closer and further from the light source, and the use of opaque, transparent and translucent objects.

Present your coloured shadows light show to the class. You may even like to film your coloured shadows light show to share with your school or family.

Coloured Shadows at *SparkLab, Sciencentre*



Children creating coloured shadows at the Coloured Shadows exhibit at *SparkLab, Sciencentre*.

Visit [SparkLab, Sciencentre](#) to create a number of coloured shadows on the white light wall.

What colours are your shadows?

How do your shadows change when you move side to side, or towards or away from the lights?

How can you make your shadows the same size as a friend or caregiver?

Find out the answers to these questions and pose your own in this interactive space!