

## Lesson 2.1 - Night Light

### Overview

During this lesson, students will gain an understanding of how light helps us see and how an object has a purpose when it is designed and built. These concepts are combined to develop a SAM system that has a clear purpose of a nightlight.

### Key Information

Level 2: (Ages 9-10) US Grades 3 or 4

Time: 45/90 minutes

<a href="#">Warm-Up</a>	5 minutes
<a href="#">Mini-lesson</a>	10 minutes
<a href="#">Worked Example</a>	7 minutes
<a href="#">Challenge 1</a>	7 minutes
<a href="#">Challenge 1 - Debug</a>	5 minutes
<a href="#">Challenge 2</a>	7 minutes
<a href="#">Tidy Up / Exit Ticket</a>	4 minutes

### Lesson Topics

- **Computing**
  - Inputs, outputs, modifiers, debugging
- **Scientific Thinking**
  - Asking relevant questions and using different types of scientific enquiries to answer them setting up simple practical enquiries
  - Trial and error combined with calibration and adjustment
- **Math**
  - Duration of events and measurement of time (seconds)
- **Art and Design**
  - Use a range of materials creatively to design and make products
- **Design and Technology**
  - Generate, develop, model and communicate ideas through talking, drawing and mock-ups
- **English Language Arts**
  - Use information gained from the illustrations and words in a print or digital text
  - Oral presentation

### Learning Objectives

- **As a result of this lesson, students will be able to**
  - Understand the purpose of a nightlight
  - Identify sources of manmade light and the purpose for building mechanisms
  - Build, debug and make the system to power a nightlight
  - Make a finished nightlight that conforms to the agreed criteria

### Materials

- Colander
- Plasticine
- SAM Labs' Kit
- SAM Labs' Student Workbook

### Warm Up – Identifying and fulfilling criteria

5 minutes

*Which of these do you think is the best nightlight?*

**Objective:** To observe the differences in nightlight designs and understand criteria for a successfully designed nightlight.

**Procedures:** All types of lighting have a purpose beyond mere illumination. For example; street lights should be bright and reliable, lights in a bathroom should be bright and resistant to moisture, energy consumption is a requirement for all forms of lighting.

There are always criteria beyond mere illumination. To be fit for purpose, a nightlight should fulfill the following design criteria; dim, not too expensive, safe.

The teacher asks the students to look at the pictures. Can they identify which of the nightlights is

- Dim, cheap but dangerous?
- Dim, safe but expensive?
- Safe, too bright and expensive?



10c



\$100



\$100

**Sample photo ideas:** A candle, an elegant night light, an ordinary table lamp

**Link forward:** Link to designing a nightlight that fulfils the necessary criteria.

### Mini-lesson:

10 minutes

*Manmade light*

**Objective:** Identify types of manmade light and the purpose for they are is used

**Procedures:** Introduce the concept that light bounces off all objects and that light enters our eyes which is how we see. Look at different types of manmade light and how they have a specific purpose. Explain that the purpose of a nightlight is not to illuminate so much as to provide a comfortable ambience, conducive to sleep. Elicit or explain the considerations that are important to nightlight design and the concept of direct or indirect light. The teacher elicits different type of light, eg: lights in a classroom, street lighting, overhead lights, shaded lights.

#### Key Words

- Purpose
- Reflection
- Design
- Feature


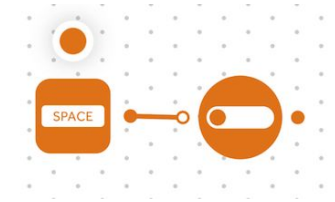
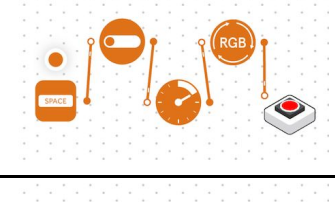

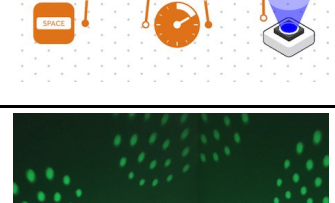
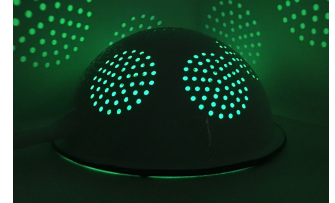
**Let's Discuss:** *How does light enter our eyes? In your workbooks or with a partner, record, discuss, or share an example of an object that uses a light and what the purpose of that object is.*

**Link forward:** Link to students designing a system can be used as a nightlight

### Worked Example

7 minutes



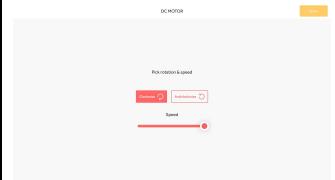
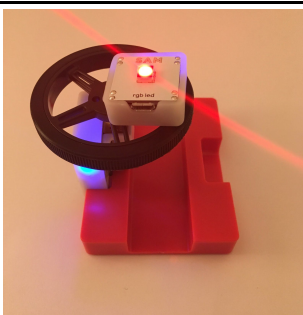
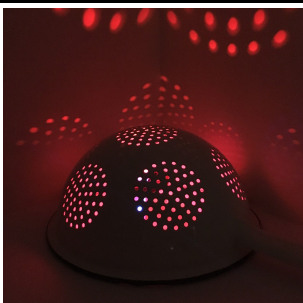
Design a SAM system to project light

Instructions	Workspace	Notes for Teachers
<b>Step 1.</b> Pair and drag these blocks onto the Workspace: <ul style="list-style-type: none"> <li>• Key Press block</li> <li>• Toggle block</li> <li>• Interval block</li> <li>• Cycle Colours block</li> <li>• RGB LED block</li> </ul>		<p>The teacher says, "These blocks will allow us to set up a system to mimic a night light".</p>
<b>Step 2.</b> Connect the output of the Key Press block to the input of the Toggle block.		<p>The Toggle acts as a switch - when the Key Press block is pressed the Toggle will turn on or off.</p>
<b>Step 3.</b> Connect the output of the Toggle block to the Interval block.		<p>The Interval block will activate the Cycle Colors block to change the color of the Light. The default setting for the Interval block is 1 second but can be edited to adjust the output flashing speed.</p>
<b>Step 4.</b> Connect the output of the Interval block to the Cycle Colours block.		<p>Every time the Interval block reaches its set time interval it sends a pulse to the Cycle Color block, which in turn sends a different color to the Light.</p>
<b>Step 5.</b> Connect the output of the Cycle Colours block to the input of the RGB LED block.		<p>The Light will now cycle through red, green and blue</p>
<b>Step 6.</b> Place a colander over the top of the blocks and activate the system.		<p>The colander is important as it reduces the amount of light and makes the nightlight dim. The holes in the colander allow the light to make a pattern on the walls.</p>

### Challenge 1

7 minutes

Make a working night light that changes colour and creates a moving pattern

Instructions	Workspace	Notes for Teachers
<b>Step 1.</b> Turn on and pair: <ul style="list-style-type: none"> <li>DC Motor block</li> </ul>		<p>The motor is going to help our light move and create a moving night light effect.</p>
<b>Step 2.</b> Connect the DC motor block to the output of the toggle block		<p>You will be using the system created in the Worked Example and adding to it by connecting the output of the Toggle block to the input of the DC motor block.</p>
<b>Step 3.</b> Clockwise or Anti-Clockwise		<p>Does the direction of the motor affect the output? The default setting is clockwise and we are used to a clockwise motion - does going against the 'norm' affect the relaxation effect?</p>
<b>Step 4.</b> Connect the DC Motor and Wheel by securing the RGB LED on top of the Wheel.		<p>We suggest you place the motor in the SAM Controller to keep it steady and the position of the light on the wheel needs to be slightly to one side to allow the movement to be seen.</p> <p>Use some plasticine to hold the RGB LED in place on top of the Wheel.</p>
<b>Step 5.</b> Place a colander over the top of the blocks and activate the system again.		<p>This time as the light emits different colours it will revolve giving a moving pattern on the wall and ceiling</p>


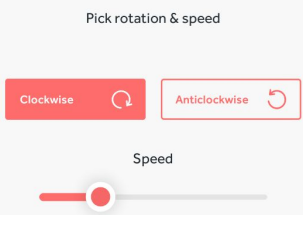
**Checks for understanding:** Why is it important to make the light stay on without having to touch the Sensor? What does RGB stand for?

## Lesson 2.1 - Night Light

### Challenge 1 - Debug it:

5 minutes





The motor goes too fast and the colours change too quickly - how can we slow it down?

Instructions	Workspace	Notes for Teachers
<b>Step 1.</b> Edit the Settings of the Interval block so that the light changes color at a slower rate.		<i>The light flashes but the colours change too quickly and would be better if it flashed slower. Students should use trial and error to set what they feel is the best speed</i>
<b>Step 2.</b> Edit the Settings of the Motor block so that it revolves at a slower speed.		<p><i>Now the pattern on the wall will change at a slower speed and be more relaxing. Students should use trial and error to set what they feel is the best speed.</i></p> <p><i>The speed of the motor is important as we want the nightlight to be relaxing and not mimic a disco ball. We need to adjust the speed of the motor to about half way so the movement of the motor is reduced.</i></p>

### Challenge 2

7 minutes

Make a nightlight that turns on automatically when it goes dark.

Instructions	Workspace	Notes for Teachers
<b>Step 1.</b> Change the Key Press block to the Light Sensor block.		<i>The Light Sensor is extremely useful as we can make events happen depending on brightness.</i>
<b>Step 2.</b> Change the settings of the Light Sensor to 'as a Button'.		<i>The Light Sensor as a button will react specifically to the difference of light and dark. The Sensor can be left as a Sensor and react to light as it decreases and is more sensitive than as a button.</i>
<b>Step 3.</b> When the block is covered (making it dark) the system will turn on.		<i>When it is dark we want the system to turn on thus making the system automatic instead of being switched on manually.</i>
<b>Step 4.</b> Show your nightlight to the rest of the class!		<i>This is a nice opportunity for oral presentations (English Language Arts).</i>
<b>Extension Ideas:</b> <ul style="list-style-type: none"> <li>• <b>Computing/Science</b> <ul style="list-style-type: none"> <li>○ Add a timer to switch nightlight on at your bedtime and off in the morning</li> <li>○ Add a Compare block so that the Sensor will switch on, not only when it is dark, but also when the light goes below a certain level</li> <li>○ Experiment with different Interval settings in order to set a rotate rate for the motor which is most relaxing</li> </ul> </li> </ul>		

## Lesson 2.1 - Night Light

- Experiment with different brightnesses of the Light to see which is the most relaxing
  - Experiment with different covers instead of the colander
- **Science**
  - How do we see in the dark? Look at how minimal light can still enter our eyes to help us see
  - Eyesight and disabilities - how has technology helped people see
- **Geography**
  - Countries of the world and the difference in light - Look at Alaska town Barrow where they don't see the sun for 67 days in winter but have constant sun for 80 days in summer
- **English**
  - Peer assessment reports on each other nightlights

**Checks for understanding:** *Which block is our input that simulates the light? Which block sets the time for changing the colour?*

### Tidy Up / Exit Ticket:

**4 minutes**

*Reinforcing the learning objectives of the lesson, students can reflect on key takeaways by completing and submitting an exit ticket.*