Lesson 3.1 - Properties of Matter

Overview

During this lesson, students will gain understanding of how an object is described by its properties and why/how the properties change. They will create a SAM system to capture the change in properties when heating an ice cube.

Key Information

Level 3: (Ages 10-11) US Grades 4-5

Time: 45/90 minutes

Warm-Up	5 minutes
Mini-lesson	10 minutes
Worked Example	7 minutes
Challenge 1	7 minutes
Challenge 1 - Debug	5 minutes
Challenge 2	7 minutes
Tidy Up / Exit Ticket	4 minutes

Lesson Topics

- **Physical Science**
  - Measurements of a variety of properties can be used to identify materials
- **Scientific Thinking**
  - Asking relevant questions and using different types of scientific enquiries to answer them setting up simple practical enquiries
- **Art and Design**
  - Explore and use mechanisms, devices and materials for imaginative activity that leads to original and creative outcomes
- **Design and Technology**
  - Generate, develop, model and communicate ideas through talking, drawing and mock-ups
- **Computing**
  - Inputs, outputs, abstraction, debugging

Learning Objectives

- ***As a result of this lesson, students will be able to***
  - Identify and describe different properties of an object
  - Identify the difference between materials in particular; solid, liquid and gas
  - Identify when a material/object properties have been changed if they are reversible or irreversible
  - Observe the change in properties of an object
  - Create a SAM system to capture the change of properties in an object

Materials

- Bag
- Marshmallows
- Stick
- Paper
- Chocolate

Materials continue on Page 2

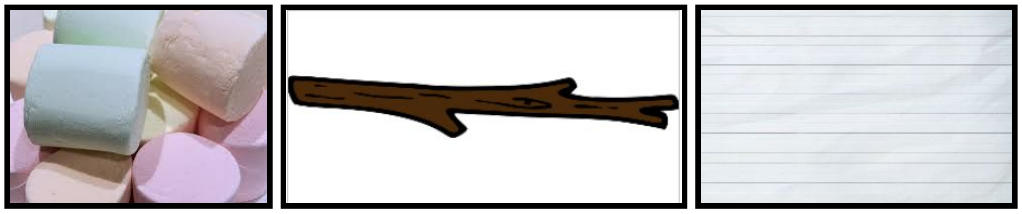
- Saucepan
- Spoon
- Hob/Refrigerator
- Plate
- Ice cubes

Warm Up – Let's Play 'Guess the object' — 5 minutes

Can we identify an object by touch?

Objective: Identify and describe what you can feel.

Procedures: Teacher asks students to close their eyes and, using a feely bag, ask students to reach inside and guess the object and describe what they can feel; *is it smooth, stiff, soft, hard?* etc. The aim is for students to understand that we can get an idea of what something is by its feel, as all objects have different properties.



Sample photo ideas: Marshmallows, a stick, paper

Link forward: Link to mini lesson looking at object properties. In particular; solid, liquid and gas.

Mini-lesson — 10 minutes

What properties do we use to identify an object?

Objective: Identify the difference between materials in particular; solid, liquid and gas and Identify, when the properties of a material/object have been changed, if they are reversible or irreversible.

Procedure: Introduce that all objects are made up of tiny particles called 'matter' and an object can be described based on the 'matter' within an object like; hard or soft, hot or cold. Look at how an object's properties can be changed and these can be reversible or irreversible.

Keywords

- Solid
- Liquid
- Matter
- Gas

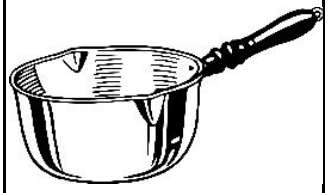
Let's Discuss: *What are the three possible states of matter of an object? Can an object change its properties back and forth? In your workbooks or with a partner, record, discuss, or share an example of an object that can change its material properties; for example a popsicle and whether it is reversible or irreversible.*

Link forward: Link to creating a SAM system to photograph the stages of the change in properties of a material

Worked Example

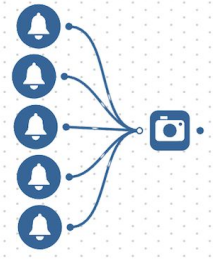
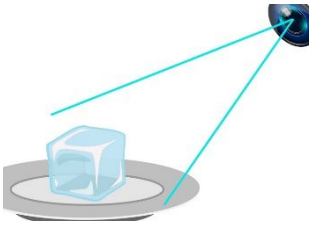
7 minutes

Look at the chocolate and observe the change in its material properties

Instructions	Workspace	Notes for Teachers
Step 1. Gather the equipment • Saucepan • Chocolate		*The reason this is a worked example is that the experiment is not about everyone getting to melt chocolate but about them observing the change and seeing how the properties change.*
Step 2. Observe the chocolate before.		*Teacher says …"Look at the chocolate before and discuss the properties – think about how they would describe it; hard, cold, thick, thin.*
Step 3. Place the chocolate in saucepan and heat.		*This is an opportunity to predict the outcome and discuss what students think will happen to the properties.*
Step 4. Heat the chocolate.		*Teacher says …"Watch the chocolate melt and discuss what happened. How would you now describe the chocolate?"*
Step 5. Predict the outcome.		*What do they think will happen if this is now put in the fridge? Look at the cycle the heating properties have and how it affects a substance*

Challenge 1 — 7 minutes

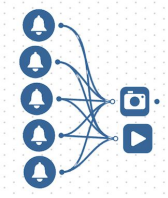
Create a SAM system to capture the change in a material's properties

Instructions	Workspace	Notes for Teachers
Step 1. Drag the blocks to the workspace: • Camera block • Time trigger block x 5		*Teacher says …"Notice the colour of the blocks are different and that is because they are not yet linked together in a system"*
Step 2. Set the Time Trigger blocks		*Teacher says …"Think about when you are going to be ready to start so set the timer to start a few minutes ahead. Each time trigger block needs to be changed to be a minute apart (depending on temperature of room), so you can observe the change"* *If it is a warm day the process will be quicker but a colder day/area will mean the melting will take longer. This offers a discussion before as to what the time should be for the time trigger blocks and pupils to predict and determine from the outcome if their decisions were accurate*
Step 3. Connect the blocks		*Teacher says …"Connect the blocks – all time triggers need to be connected to the camera block"*
Step 4. Put an ice cube on a plate		*Placing the ice cube on a plate means the change can be seen easily and the camera can see too* *To ensure this works quickly it is best to ensure this is done in a warm area, if hot outside this will speed up the process*
Step 5. Place the device		*Teacher says …"Think about the position of the device - Ensure the device is set so the camera is pointed at the area of the plate where the ice cube is. This can be tested by accessing the camera and looking at the position of the plate on the screen"*

Checks for understanding: *Why did the temperature of the room affect the process? How did the ice cube change? What would happen if it was put back in the freezer?*

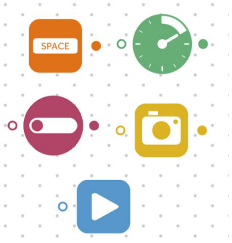
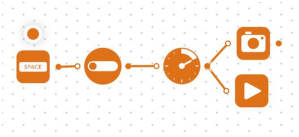
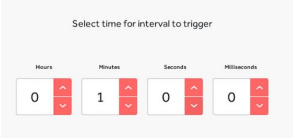
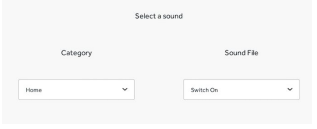
Challenge 1 - Debug it — 5 minutes

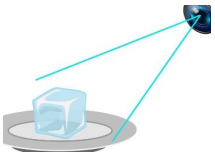
How can we tell if the camera is taking a picture?

Instructions	Workspace	Notes for Teachers
Step 1. Drag a Sound Player onto the Workspace		*Teacher says …"It would be useful to know when the camera is taking a picture to help determine if the timing is correct and amend if necessary. The Time Trigger blocks allow editing when the time has started and the system can be adjusted to the process"*
Step 2. Set the sound		*Teacher says …"Edit the settings of the Sound block so that you have the 'switch on' sound, this will tell you when the camera takes a picture with a click"*
Step 3. Connect all time Trigger blocks to the sound block		*Teacher says …"Ensuring all outputs of the Time Trigger blocks are connected to the Sound block, means the sound will go off every time the camera takes a photo."·*

Challenge 2 — 7 minutes

We need to make a more efficient system

Instructions	Workspace	Notes for Teachers
Step 1. Drag the blocks to the workspace • Key press block • Toggle block • Interval block • Camera block • Sound block		*Teacher says …"We are going to replace the Time Triggers with a more efficient system that will take pictures every minute until the system is switched off."*
Step 2. Connect the blocks		*The output of the Interval needs to be connected to both the Camera and the Sound Player block*
Step 3. Set the interval block		*Edit the settings of the Interval block to 1 minute, discuss whether this is suitable or requires adjustment depending on the temperature of room/location.*
Step 4. Set the Sound Player block		*Edit the settings of the sound block to be Home / Switch On. This will allow the click to happen every time the camera takes a picture*

Step 5. Ice cube on a plate.		*Add another ice cube to the plate and set up the device to see this and activate the system*

Extension Ideas:

- **Science**
  - Why does the temperature of the room affect the speed of the ice cube melting?
  - Position pupils in different locations and observe the difference of change in properties
- **Maths**
  - Set up a timer and compare outcomes in the classroom and other locations
- **English/Science**
  - Use the images to create a report describing how the properties changed and why

Checks for understanding: *How have we made the system more efficient? How did the interval block work here with the camera output?*

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.

