
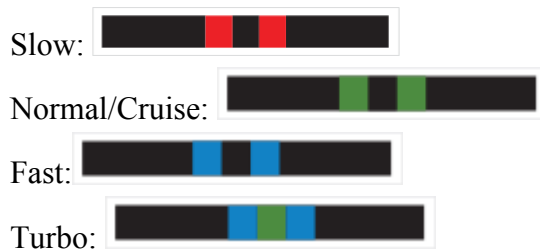


States of Matter with Ozobots		Grade 2 Matter and Energy	
Lesson Plan	Coding Tool	Ozobots	
	Cross-curricular		
Big Ideas <ul style="list-style-type: none"> The particle theory of matter Properties of liquids and solids derive from the behaviour of particles 	Specific Expectations <ul style="list-style-type: none"> investigate the properties of liquids and solids 		
Description Students program Ozobots to act like particles inside of different states of matter.			
Materials <ul style="list-style-type: none"> Ozobot robots Markers Paper 	Computational Thinking Skills <ul style="list-style-type: none"> Robots 		

Introduction

The different states of matter get their properties from the behaviour of particles (atoms and molecules) that make them up. Solids are solid—able to keep their shape and resist forces—because the particles within them cannot move very far or (generally) very fast). Liquids only flow because their particles can move freely within the material. In gasses the particles move even further from one another, not being bound at all. This behaviour can be simulated with Ozobots.

Ozobots are small, line-following robots that can be programmed by driving over dashes of colour. By default, they always follow black lines. Different patterns of primary colours will change the Ozobots behaviour: for example,  (red black red) instructs the Ozobot to drive slowly, until it gets another speed code. Your Ozobots should have come with a quick-reference guide including all of the colour codes. In this activity, the codes most likely to be of use are the speed changes.



If the class has not used Ozobots before (or at least not recently) be sure to allow sufficient time to demonstrate the robot: draw a line for it to follow in black marker, and demonstrate how the coloured codes can be used to program the robot by changing its speed. (There are other codes, of course, which may be relevant to more advanced classes, but for most the speed codes will suffice for this activity.)

Action

Ask each group (or student) to simulate the behaviour of a single particle of matter in each state you wish to consider (solid/liquid/gas or just solid and liquid). Each group should be provided with black and coloured markers, several pieces of paper, and an Ozobot for this activity. Remind your students to label each sheet with their names and which state of matter it means to represent.

Consolidation/Extension

- Lead your students in a discussion if they think that it makes sense to talk about a 'liquid' or 'solid' that only has one particle in it.
- If you have sheets of newsprint, have the students collaborate and put all their ozobots on one sheet.
- You can challenge students to produce a single page that shows all 3 states of matter over time, where the Ozobot begins as a particle in a solid, which then melts, and after some period as a liquid evaporates and becomes a gas (if desired).

Assessment

Assess students on how well the path they make for their ozobot reflects previous discussion of the particle theory of matter.

- Sheets meant to simulate solids should have small, tight paths, not taking up much of the path. If a speed code is used, it should be 'slow'.
- Sheets meant to simulate liquids should have longer, more ranging paths, but still not taking up the entire sheet. A 'fast' or 'cruise' speed code might be used, to show that the material is hotter, having melted.
- Sheets meant to simulate gasses should have wild paths that cover the entire page. 'Fast' or 'turbo' speed codes might be used, to show that the material is hot indeed, having evaporated.

Additional Resources

<https://ozobot.com/create/color-codes>