1. Pinwheel

Science
- Energy
- Forces
- Friction
- Rotation

Design and Technology
- Assembling components
- Combining materials
- Evaluating
- Properties of materials

Vocabulary
- Area
- Friction
- Rotation
- Speeding up
- Wind force

Other Materials Required
- Cardstock
- Fan
- Paper
- Ruler
- Scissors

Connect

On their way home from school Sam and Sara passed a group of children running around playing with pinwheels. It looked like great fun and Sam and Sara would both really like one.
Once back home, Sam and Sara wanted to try out different ideas for the best wing design, for example big wide wings and small narrow wings.
Sara has built a beautiful pinwheel with tiny wings but no matter how much Sam blows it only turns slowly.

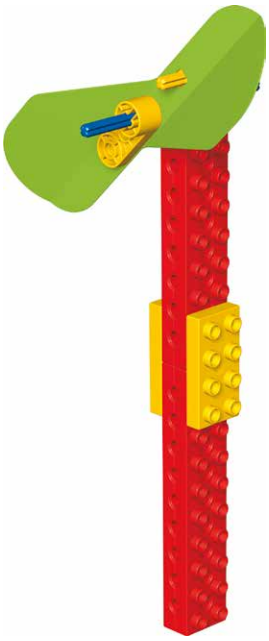
Can you help Sam and Sara build a pinwheel with wings that will turn faster?
Let's find out!

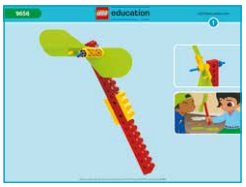
Construct

Build the pinwheel using building instructions no. 1

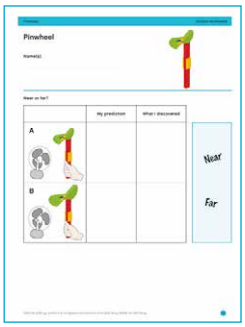
- The wings should be bent at the same angle
- The wings should spin freely
- If they don't turn, there is too much friction from the blue gear rubbing on the red beam. Try moving the wings forward slightly on the blue axle

Warning!
Fans are potentially dangerous. Make sure that students handle them with great care!





Contemplate



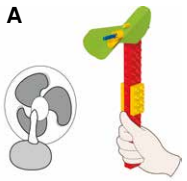
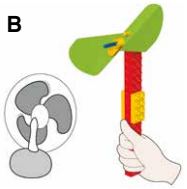
Near or far?

Point the pinwheel at the centre of the fan and begin moving it slowly towards the fan, but be careful to not get too close. Find out which of the pinwheel wings starts turning furthest from the fan.

First predict which of the pinwheels will only start turning near the fan and which will start turning far from the fan.
Write down your predictions using the words on the worksheet

Next, test how far from the fan the pinwheels will start turning.
Write down your findings using the words on the worksheet.

The force of the wind turns the pinwheel. The wind turns the wings, creating energy – just like a wind turbine or windmill.

	My Prediction	What I Discovered
A 		Near
B 		Far

Have the students reflect on their tests by asking questions such as:

- What did you predict would happen and why?
- Describe what happened.
- How did you make it into a fair test?
  Was the pinwheel held at the same angle every time? Did you adjust/change the speed at which the fan blows? Were the wings bent at the same angle?
- Describe how the model works.
- What do you believe to be important things to think about in making a good pinwheel?
  Maybe the size of the wings or how many there are, or their shape – or perhaps the speed of the wind…

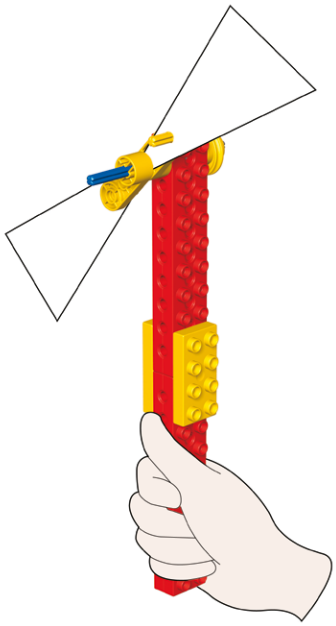
Tip:
Use a ruler to accurately measure the distance between the fan and the pinwheel.

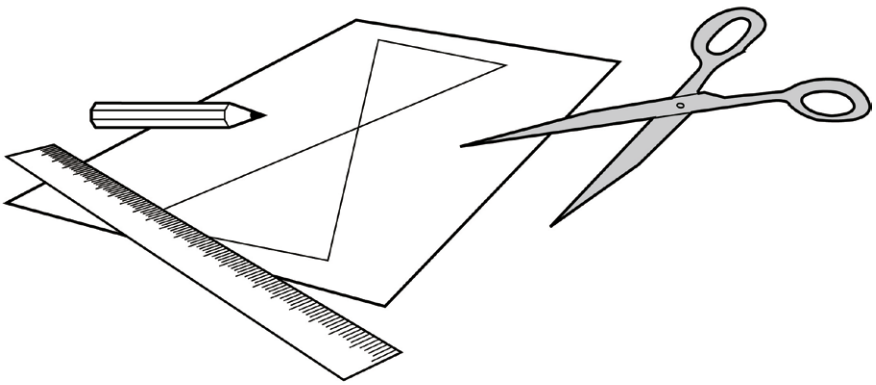
Continue

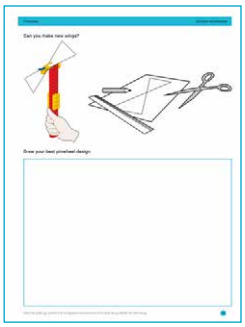
Can you make new wings for your pinwheel?

Give your imagination wings and design your very own pinwheel wings!

Design wings of different shapes and test how they work. Consider which materials would be best. Then make them beautiful and colourful. *On the worksheet, draw your best pinwheel design.*







Pinwheel

Class: _____ **Date:** _____

Performance and Learning Targets Linked to the Activity and the Eight Next Generation Science Practices Observe the suggested student behaviors while working with the activity. Either use the suggested Emerging (E), Developing (D), Proficient (P), Accomplished (A) proficiency level descriptions or use one relevant to your context.	**Name(s):**													
Student Performance Targets Linked to the Activity To what degree can the student…?														
Adequately build the pinwheel model with help or independently using the building instructions (1, 2, 3, 6)														
Use the model to demonstrate understanding of terms and make predictions about force and motion (1, 3, 5)														
Meet or exceed expectations in the design of the pinwheel based on directions of activity (E.g. Wings are bent at same angle. Wings spin freely) (2)														
Make changes or create a new model design in order to create a more advanced model based on tests and data (2, 3, 4, 6)														
Use pinwheel worksheets to record and analyze data collected from the model investigation (3, 4, 5)														
Selected Student Learning Targets Linked to the Practices To what degree can the student…?														
Ask simple to advanced questions based upon observations to make predictions (1, 3)														
Demonstrate ability to use fair testing of models and make adjustments based upon data (3, 4, 6)														
Communicate the meaning of the findings with others (E.g. orally, in drawing or writing) (4, 8)														
Follow a plan to define, carry out, test, evaluate and share a design task (2, 3, 4, 5, 6, 7, 8)														
Compare solutions with other groups and listen to the ideas of others (6, 7, 8)														
Optional Student Learning Targets														
Lesson Observational Notes:														