IN WHAT WAYS DO OBJECTS MOVE?

BIG IDEA 12: MOTION OF OBJECTS

BENCHMARKS AND TASK ANALYSES

SC.1.P.12.1 Demonstrate and describe the various ways that objects can move, such as in a straight line, zigzag, back-and-forth, round-and-round, fast, and slow.
The student
- moves objects in various ways such as in a straight line, zigzag, back and forth, round and round, fast and slow.
- describes the motions they have observed.

SC.1.N.1.1 Raise questions about the natural world, investigate them in teams through free exploration, and generate appropriate explanations based on those explorations.
The student:
- raises questions about the natural world.
- explores questions about the natural world with a team of students through free exploration and generates appropriate explanations for what was observed.

SC.1.N.1.2 Using the five senses as tools, make careful observations, describe objects in terms of number, shape, texture, size, weight, color, and motion, and compare their observations with others.
The student:
- uses the five senses as tools to:
  - make careful observations.
  - describe objects in terms of number, shape, texture, size, weight, color, and motion.
  - compare own observations with observations of others.

SC.1.N.1.3 Keep records as appropriate - such as pictorial and written records - of investigations conducted.
The student:
- keeps records, such as student-drawn illustrations, science notebooks, or digital media, of investigations conducted.

KEY QUESTION

In what ways do objects move?

TEACHER BACKGROUND INFORMATION

An unbalanced force is a push or pull that makes something changes its motion. A force is a push or pull that makes something start moving, stop moving, or change direction. If an object is not moving, a push or pull will set it in motion. If the object is moving, a push or pull will change its speed or direction. The same object will move different distances depending on the strength of the force on a given surface. It takes more force to move a given object a long distance rather than a short distance on a given surface. (Realize that friction is a force acting on an object moving in everyday situations. If the frictional force is changed, the amount of force required for a given distance also changes.)

SAFETY

Always follow OCPS science safety guidelines.

TEACHING TIPS

The objects available in this lesson must represent movements of straight, round and round and back and forth such as a pinwheel, ball, globe, yoyo, football, plastic drinking cup, plastic bowl, plastic drink bottle, drinking straw, domino, counter, linking cube, marble, plastic bouncing ball, kernel of corn, spinning top, balance, toy rocking horse, etc.

<u>MATERIALS</u>

<u>Per group</u>

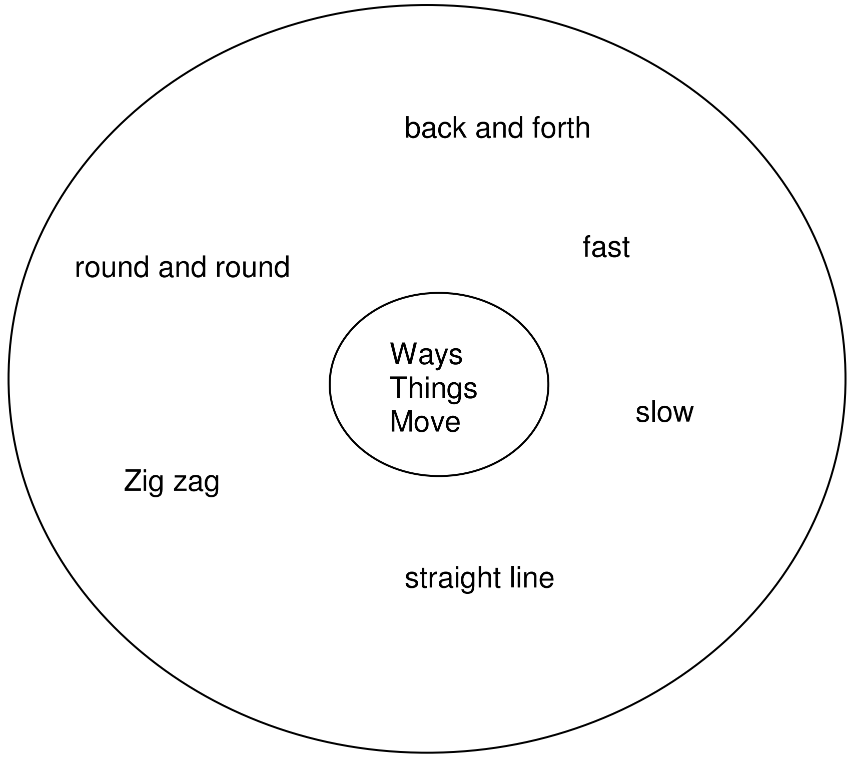
a variety of 7-10 small objects per group (see Teaching Tips)

<u>Per student</u>

science notebook and pencil

<u>ENGAGE</u>

1. Use a variety of materials and move them across a table and ask the students to describe how each of the objects move. (examples: thread spool, golf ball, wooden cone, pine cone, etc.)
2. Ask students to list the different ways in which they moved.
3. Create a Circle Map on the board of their ideas.



<u>EXPLORE</u>

1. Distribute a group of 7-10 objects to each group.
2. Ask students, *"When gently pushed, will the objects have the same movement?"*
3. In their science notebooks, have students respond to the question.
4. Have students predict the movement the individual objects will have when they are gently pushed.
5. Have students refer to the movement circle map. (Do not discourage students who predict movements other than those listed on the chart paper. More than likely, his/her prediction will be a synonym for a movement that is listed on the chart paper).
6. Have students test their predictions by gently pushing each object and recording the observed movement.
7. Using the discovered data, students sort the objects.
8. Ask: *Did your prediction match the actual movement?*

<u>EXPLAIN</u>

1. Ask: *Do all the objects have the same movement?*
2. Ask: *Did you notice any patterns in the discoveries?* (For example, students may have noticed that all the objects with curved bottoms moved back and forth).

<u>EXTEND AND APPLY</u>

1. Ask: *If the objects had been pulled, instead of pushed, would the results be the same?*
2. Display a pinwheel, yo-yo, ball, globe and a toy top. Allow students to be scientists and observe what happens when you make each object move.
3. Ask; "How are the object movements the same? How are they different?"

ASSESSMENT

- Discussion
- Vocabulary
- Data collected in the science notebooks
- Students inferences and conclusions

DO ALL TOPS SPIN ALIKE?

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The student:
- keeps records, such as student-drawn illustrations, science notebooks, or digital media, of investigations conducted.

SC.1.N.1.4 Ask "how do you know?" in appropriate situations.
The student:
- asks "how do you know?" in appropriate situations.

KEY QUESTION

Do all tops spin alike?

TEACHER BACKGROUND INFORMATION

Motion is a key characteristic of all matter that can be observed, described, and measured. The motion of objects can be changed by forces.

MATERIALS

Teacher

several examples of toy spinners or tops

Per group

copy of (BLM) Science is ….TOPS!,
various materials for constructing tops (e.g. spools, push pins, nuts and bolts, coasters, recycled CDs, pencil, tag board)

SAFETY

While spinning tops it is recommended that students wear safety goggles.

TEACHING TIPS

- Many students are not familiar with tops. Demonstrate how tops spin by spinning a toy top for the class.
- Do not use tops which require string since they will not be constructed in this activity.

ENGAGE

A. Share examples of toy spinners and tops with the class. Have a group discussion about what a top is and its important parts (disc and spindle) to determine students' prior knowledge of tops and other spinning things.

1. Create a K-W-L chart (a three-column chart with the first column designated for what students Know, the second for what students Want to know or Wonder, and the third for what they Learn).
2. Record what students already KNOW about tops.

EXPLORE

1. Challenge students working in groups of three to use the materials available to design and build a top that spins. Allow each group a prototype and then a revision of its first model. Discuss the changes students made and the effect the changes had on their tops' motion.
2. When each group is finished, give students ample time to examine the tops and demonstrate how they work.
3. Discuss questions students might WONDER about tops. Add these to the K-W-L chart. Model this as a think aloud to get the discussion going by asking one of the following:
   a. *How can we make a top that spins for a long time?*
   b. *What if the spindle of the top is really long?*
   c. *How far above the table should the disc be?*
   d. *What happens if we add more weight?*
4. Have students generate their own questions, then work as a group to design and carry out an experiment to answer those questions.
5. Have students use the BLM *Science Is...TOPS!* to keep track of their investigation and observations.
6. Allow students time to design and experiment, and facilitate interaction within each group.

EXPLAIN

1. Allow each group to present its findings and demonstrate how its top spins to the class. Ask each group to state the question it tried to answer, and then ask the students questions such as: *Did you answer your question? What evidence do you have?*
2. Fill in the K-W-L chart with what students have LEARNED during their investigation.
3. Have students observe and describe the motion of each top.

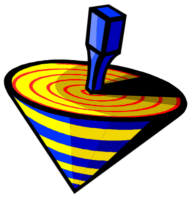
EXTEND AND APPLY

Have students launch a new investigation on the following questions: Does a top always need to be circular to spin? What would happen if a top were oval, triangular, or asymmetrical in shape?

ASSESSMENT

When your investigation of tops is complete, ask the students the following questions:
What are the important parts of a top that make it work?
What trouble did you have making a top?
How does changing one of those parts affect its motion?
How do you know?

What is the motion of a top like?
What else can you think of that moves like a top?



Exploring…..TOPS!

I want to know...

My plan is to...

I learned that...

My top looks like this:

MAKING OBJECTS MOVE

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SC.1.E.5.2 Explore the Law of Gravity by demonstrating that Earth's gravity pulls any object on or near Earth toward it even though nothing is touching the object.
The student:

- explores how objects fall, or are pulled, to the Earth's surface, even when there is nothing touching the object.

SC.1.P.13.1 Demonstrate that the way to change the motion of an object is by applying a push or a pull.
The student:

- changes the motion of an object by applying a push or a pull.

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The student:

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KEY QUESTION

How can you make an object move?

TEACHER BACKGROUND INFORMATION

As part of this lesson, students will make many discoveries about how and why objects move. They will explore and manipulate the motion of objects and the forces required to control that motion (pushing, pulling, throwing, dropping, rolling, and so on). This will help them understand that the position and motion of objects can be changed by pushing or pulling and that the size of the change is related to the strength of the push or pull. This is important because research suggests that students tend to think of force as a property of an object ("an object has force," or "force is within an object") rather than as a relation between objects.
In addition, students tend to distinguish between active objects and objects that support or block or otherwise act passively. Students tend to call the active actions "force" but do not consider passive actions as "forces." Teaching students to integrate the concept of passive support into the broader concept of force is a challenging task even at the high-school level. Therefore, students should have many additional opportunities to view, describe, and discuss the movement of objects and to identify the forces behind them.

MATERIALS

Per student

marble (or other small sphere)
science notebook and pencil

Per group
ping-pong or other balls
assorted materials—string, glue, tape, drinking straws, cardboard, yardsticks, scrap wood, rubber bands, etc.
various kinds of cardboard tubes (from paper towels, aluminum foil, wrapping paper, toilet tissue, etc.) Cut most of the tubes in half lengthwise; leave some intact.
blocks
marbles or small balls
masking tape

SAFETY
Make sure that all balls are accounted for so that no one will slip on a ball on the floor. Keep all balls out of mouths.

TEACHING TIPS
Designate specific areas of the room and floor area for each group so that they may work uninterrupted.

ENGAGE
1. Give every student a marble and ask them to make it move on their desk.
2. Ask: *What did you do to make the marble move?* (push or drop)
3. Discuss the movement of rolling objects, ask:
    - *What kinds of objects can roll? What do these objects have in common?*
    - *How can you start an object rolling?* (push, pull, or drop)
    - *If you hold something above the ground and let go, which way does it go? (*down*) Does it ever go up when you let go? (*no*)*
    - *How can you stop an object from rolling?*
4. Ask: *Can you think of a way to make something roll in an exact path? (build a track) What other things move on a track?*

EXPLORE
1. Tell students that they will try to build their own track for the ping-pong ball, marble, or toy car using cardboard tubes and masking tape.
2. Have students work in pairs or small groups.
3. Give each group a ping-pong ball, marble, or toy car and a selection of cardboard tubes. Ask students, *"How could you make the objects move using the cardboard tubes and masking tape?" "Where do you think the object will go?"*
4. Write down students' answers on a large sheet of paper or a blackboard at the front of the room.
5. Now have students test their ideas. Students will create a track that will be used to stop the ball as close to an exact position as possible. Provide students with a measurable distance for which to aim, so that they can test and adjust their structures as needed.
6. Again, encourage students to record their observations and results in their student notebook.
7. Ask students to consider these questions:
    - *How can you build the track to slow the ball down?*
    - *Speed it up?*
    - *Make it go further?*
    - *Make it go a shorter distance?*
    - *Turn a corner*

EXPLAIN

1. Discuss results and answers to questions.
2. Ask: *In what ways did your objects move?*
3. Ask: *How did you get your object to begin moving?*
4. Guide students to discuss reasons some balls traveled farther or faster than other.
5. Introduce the concept of acceleration in relation to the angle of tracks in the discussions.

EXTEND AND APPLY

Consider posing other challenges, such as:

- Build the fastest track possible.
- Build the slowest track possible.
- Build a track that will allow the ball or car to dip down to a lower point and then go to a slightly higher point.

ASSESSMENT

Ask students to complete this assignment:

- Draw a picture of the structure you built. Explain what it does and how it works, using words and/or pictures.
- Draw a picture to show what you could do to the structure to make the ball (or car) go faster.
- Draw a picture to show what you could do to the structure to make the ball (or car) go slower.