Grade 2

Cluster 3: Position and Motion

Overview

The study of position and motion helps children develop a sense of space as well as an understanding of the relationship between stationary and moving objects, including themselves. Through observations and the use of specific vocabulary, students develop their ability to describe the position and motion of objects and recognize the effects of pushes and pulls on the motion of an object. In exploring motion, students investigate inclined planes, and wheels and axles as types of simple machines. They determine how these simple machines make it easier to move things and how friction affects the motion of objects.

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
Students will...	
2-3-01 Use appropriate vocabulary related to their investigations of position and motion. Include: position, stationary, above, between, near, far from, next to, below, in front of, behind, to the right/left, perspective, motion, push, pull, friction, slope, inclined plane, wheel, axle, rotate, clockwise, counterclockwise. GLO: C6, D4	➢ Introduce, explain, use, and reinforce vocabulary throughout this cluster. ➢ **Picture Dictionary** Have students develop a picture dictionary of terms used during this cluster. Students should draw and label each term on separate sheets of paper. At the end of the cluster, students arrange the sheets in alphabetical order and bind them in book form.
2-3-02 Explore and describe the position of a stationary object with reference to themselves, to other objects, or to a specific area. Include: above, between, near, far from, next to, below, in front of, behind, to the right/left. GLO: D4 **2-3-03** Explore and describe changes in the position of an object in relation to its original position, themselves, or another object. GLO: D4 **2-3-04** Explore and describe the position of an object viewed from a perspective different from one's own. GLO: D4 **2-3-05** Explore and describe how changing the position of one's own body affects perspective with reference to a stationary object. GLO: D4, E3	➢ **Identifying Points of Reference** How can directions be given so that everyone in the classroom can locate a certain object? With students, brainstorm and list specific terms of reference in the class to describe location (e.g., near the door, below the teacher's desk, between the windows). Post these where students can easily refer to them. ➢ **Where Is It?** Have the students identify the location of specific objects in relation to another object in the classroom by asking questions such as "Where is the pencil sharpener?" Encourage students to use the points of reference provided above, as well as others, to provide responses that would help someone in the classroom to locate the named objects. For example, "The pencil sharpener is below the light switch that is on the wall next to the door." ➢ **Body Reference Points** Introduce the idea that each student's body can be used as a reference point or a reference frame. Descriptions could include statements such as: is in front of Ahmad; is between Cari and Saul; or is one metre to my left. Name specific objects in the classroom and have students use their classmates' and their own bodies as reference points to describe location. Have students describe the location of the same objects using fixed or stationary objects in the classroom as references. Compare the two types of descriptions. Have students recognize that, unlike the environmental reference objects that are fixed, a person's body is not. When people move, their reference frames change.
2-0-4g. Verbalize questions, ideas, and intentions during classroom activities. GLO: C6 **2-0-5e**. Record observations using written language, drawings, and, with guidance, charts. (ELA 4.1.2, 4.2.5) GLO: C2, C6	

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TEACHER NOTES	SUGGESTIONS FOR ASSESSMENT
It is important for students to learn to describe the relative position of stationary or moving objects using reference objects. Reference objects are typically things that are easy to locate and identify. It is also important that students develop abilities to see and locate stationary objects and objects in motion from a point of view different from their own.	**Interview (2-3-02 to 2-3-05)** Before the interview, collect several small toys/objects (e.g., block, doll house, bear, etc.) to be used as reference points. 1. Using a reference point, move a toy to various positions and have the student describe its location. Ask: Where is the (bear)? The student uses ❑ above ❑ between ❑ near to ❑ far from ❑ next to ❑ below ❑ in front of ❑ behind ❑ to the right ❑ to the left 2. Have the student describe the position of the toy after moving it from its original position, using a reference point and themselves. Ask: Where is the bear now? The student ❑ describes position using reference point ❑ describes position using himself/herself as reference point 3. Use 3 different toys (bears). Have students describe the locations of each toy based on each of the other toy's perspectives. Example: bear 1 bear 2 bear 3 Where is bear 2? (Behind bear 1, in front of bear 3, to the right of bear 1, to the left of bear 3.) Comments: _____ _____.

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PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
Students will...	
	➢ **Where Is It Now?** Part 1) After describing the position of an object, have a student move to a new location and describe the object's position from this new perspective. Students should use both stationary and body reference points. Part 2) After describing the position of an object, the teacher should change its position and encourage students to describe the change in as many ways as possible. Descriptions should describe the change in the following ways: in relation to its original position (e.g., moved to the right), in relation to themselves (e.g., moved closer to me), and in relation to another object (e.g., moved behind the desk). ➢ **Name that Object Game** **My View:** Have students work in pairs to describe where an object is located in relation to themselves and other objects in the classroom. Have one student provide a description of an object's location. Have the second student (who is sitting beside the first student, facing in the same direction) identify the object. Encourage students to be active listeners as they practise using precise language to describe position. **Your View:** Repeat the activity above, but this time have students sitting facing each other. They must describe an object's location from their partner's perspective.
2-3-06 Describe the motion of various objects and living things. *Examples: spinning, swinging, bouncing, sliding, rolling, jumping...* GLO: D1, D4	➢ **Simon Says** Play a game of "Simon Says…" to explore movement and develop the cluster vocabulary. Example: Simon says jump in place. Simon says spin around. Play this game outdoors or in the gym to encourage movement. ➢ **Picture Sort** Have students sort and classify pictures of animals according to how they move (link to Growth and Changes in Animals, 2-1-12). Example: **Hop/Jump**: kangaroo, frog/toad **Fly**: robin, bat **Walk/Run**: dog, cheetah **Swim**: fish, tadpole
2-0-1a. Ask questions that lead to investigations of living things, objects, and events in the immediate environment. (ELA 1.2.4, 3.1.2, 3.1.3; Math SP-I.1.2) GLO: A1, C2, C5 **2-0-2a**. Access information using a variety of sources. *Examples: elders, simple chapter books, concept books, CD-ROMs, Internet...* (ELA 1.1.2, 3.2.2 Math SP-II.1.2; TFS 2.1.1) GLO: C6 **2-0-2b**. Match information to research needs. (ELA 3.2.3, 3.3.3) GLO: C6, C8 **2-0-4e**. Respond to the ideas and actions of others in building their own understandings. (ELA 1.1.2) GLO: C5, C7	

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TEACHER NOTES	SUGGESTIONS FOR ASSESSMENT
Young children tend to view objects from their own point of view. They need to understand that the position of an object is relative. (It depends upon the reference frame that is used to describe it.) One student's reference frame will result in a different description of an object's position from that of a classmate.	4. Have the students describe the position of an object from their perspective. Then, have them describe its position from the interviewer's perspective. The student describes ❑ own perspective ❑ other perspective Comments: _____ 5. Have the students describe the position of an object. Then have them move to another location and describe the position of the same object. The student ❑ clearly describes the position of the object ❑ uses reference points ❑ uses "direction" or position language ❑ clearly describes the position from the different perspectives

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
Students will...	
2-0-4f. Work in a variety of cooperative partnerships and groups. (ELA 5.2.1) GLO: C7 **2-0-6c**. Place materials and objects in a sequence or in groups using one or two attributes, and describe the system used. (Math SP-III.0.2) GLO: C2, C3, C5	➢ **Exploring Objects that Move** Set up a centre with an assortment of simple mechanical toys and objects that can be set in motion. If possible, include the following objects: • wheel and axle systems that rotate around an axis such as toy cars • objects that spin rapidly such as tops, yo-yos, button and string zoomers, and gyroscopes • objects that swing (move back and forth) such as a pendulum • objects that bounce (strike an object and rebound) such as rubber balls • objects that slide (move over a surface while maintaining continuous contact) such as hockey pucks, shuffleboard disks, or curling stones • objects that roll (move along by revolving on an axis or by repeatedly turning over) such as marbles Have the students describe how these objects move.
2-3-07 Recognize that the position and motion of an object can be changed by a push or a pull and the size of the change is related to the strength of the push or pull. GLO: D4 **2-0-4a**. Follow simple directions, and describe the purpose of steps followed. GLO: C2 **2-0-5d**. Estimate and measure length using standard units. (Math SS-I.1.2) GLO: C2, C3, C5 **2-0-5e**. Record observations using written language, drawings, and, with guidance, charts. (ELA 4.1.2, 4.2.5) GLO: C2, C6 **2-0-9c**. Take the time to repeat a measurement or observation for greater precision or detail.GLO: C5	➢ **Investigating Changes in Position and Motion** Have students work in small groups to investigate how pushes and pulls affect the position and motion of objects. Provide students with several different objects such as toy trucks, hockey pucks, shuffleboard rocks, or pull toys. Have students move each object using different amounts of relative force (push it hard, or push it lightly) for each trial. Have students measure the distance the object travelled each time (e.g., mark off distances on the floor, count floor tiles) and record their information in a chart such as the one below. **Toy Car** **Strength of push** — **Distance travelled** light push _____ medium push _____ hard push _____ Use the following questions to reflect on the investigation: • What did you discover about changing the position and motion of an object? (The size of the change is related to the strength of the push or pull.) • How might this information be helpful? (Curlers need to know how hard to throw a rock depending on the situation, hockey/ringette players need to know where the puck/ring needs to go and how hard to shoot it.) Have students record in their science journals their understanding of how the position and motion of objects are changed in relation to pushes and pulls.

TEACHER NOTES	SUGGESTIONS FOR ASSESSMENT
	Learning Log Entry: Exploring Objects that Move Have students summarize what they learned about how different toys/objects move by completing the following: Toys and objects move in different ways. At the centre, I learned that _____ _____. Look for ❑ rotate ❑ bounce ❑ spin ❑ slide ❑ swing ❑ roll ❑ other
It is not important for students to accurately measure the strength of a push or the distance travelled. However, they should be provided with enough experiences to realize that the strength of the push has a direct effect on the size of the change in position. Discussions of **pushes and pulls** develop into an understanding of the concept of **force**. While students are not expected to use the term force at this grade, encourage proper usage should students already be using the term.	

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
Students will... **2-3-08** Compare and describe the effects of friction on the motion of objects and humans when travelling across different surfaces. *Examples: wheels of a toy on tile, sandpaper, or foam rubber; shoes on carpet, tile, or ice...* GLO: C2, D4 **2-0-7a**. Propose an answer to the initial question based on their observations. (Math SP-IV.2.2) GLO: A1, A2, C2 **2-0-7d**. Connect new experiences, ideas, and information with prior knowledge and experiences. (ELA 1.2.1, 2.1.2) GLO: A2 **2-0-8a**. Recognize that learning can come from careful observations and investigations. (ELA 3.3.4) GLO: A1, A2, C2	➢ **How Well Does It Move?** Set up several centres in which students explore friction and motion. At each centre, provide students with a variety of surfaces such as tiles, sandpaper, foam rubber, and carpet. Centres 2 and 3 require ramps. Have students record their observations at each centre. **Centre 1:** Objects with wheels **Centre 2:** Objects that slide **Centre 3:** Objects that roll When students have had the opportunity to work at each centre, have them reflect on the learning experiences, using the following discussion questions: • On which surface(s) does the object move the easiest? • On which surface(s) does the object have the most difficulty moving? • Are there any surfaces that do not seem to make a difference to the movement of the object? • Why do certain surfaces affect the motion of objects? ➢ **Practical Examples of Friction** With students, brainstorm and list examples of how friction is important in daily life. Examples include: sand is put on ice to make it easier for walking, curlers use a “slider” on their shoes to allow easier movement on ice, athletic shoes have special textures to prevent slipping, etc.

Teacher Notes

If students have not used the term **friction** in their discussions, introduce it and model its use as a way to talk about the resistance to motion between two surfaces.

Suggestions for Assessment

Paper and Pencil Task: How Well Does It Move?

Student directions: The entranceway of the school has a very slippery floor. The teacher is worried about students falling and hurting themselves. What could be done to make this area safer? Explain your answer.

Look for

- ❑ a surface that will increase friction
- ❑ use of the term "friction" in the explanation

PRESCRIBED LEARNING OUTCOMES

Students will...

2-3-09 Explore and describe the effects of changing the slope of an inclined plane on the downward motion of an object and the effort needed to push or pull an object upward.

GLO: C2, D4

2-0-4a. Follow simple directions, and describe the purpose of steps followed. GLO: C2

2-0-5a. Make, with guidance, observations that are relevant to a specific question. GLO: A1, A2, C2

2-0-7a. Propose an answer to the initial question based on their observations. (Math SP-IV.2.2) GLO: A1, A2, C2

SUGGESTIONS FOR INSTRUCTION

➢ **Investigating the Effect of Incline on Motion, Part 1**

Have students work in small groups to determine how changing the slope of an inclined plane affects the downward motion of objects. Test a variety of objects for each slope. Have students release the object at the top of the slope and measure the distance travelled using standard measurements, e.g., decimetres, metres. Include objects that move in different ways. Have students record their observations in a chart like the following:

Distance Travelled

Object	1st Slope (least steep)	2nd Slope	3rd Slope (steepest)
toy car	_____	_____	_____
ping pong ball	_____	_____	_____
pencil	_____	_____	_____
roller skate	_____	_____	_____

Ask the following question:

- How does the slope affect an object's downward motion? (The steeper the slope, the farther the object will travel.)

➢ **Investigating the Effect of Incline on Motion, Part 2**

Have groups of students use the toy car or roller skate and the three slopes from the previous learning experience to explore how easy or difficult it is to have the object travel up the different slopes. Have students test the slopes by releasing the car or skate from the base with enough push (force) to get the object to travel to the top of the slope. Following the tests, have students order the slopes according to the effort needed to push the object to the top.

Ask students the following question:

- How does the slope affect the effort needed to push an object to the top? (The steeper the slope, the harder the push needed.)

Have students use Blackline Master 1: Scientific Inquiry Recording Sheet: Grades 1 and 2

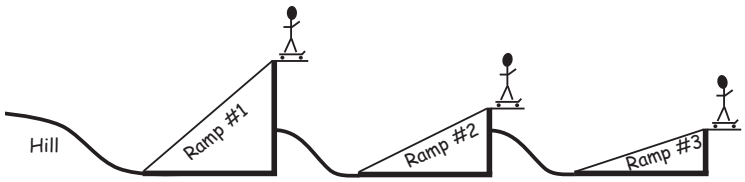
Teacher Notes

An **inclined plane** is a slanting surface that connects one level to a higher level. The slanting surface (slope) can be gradual or steep.

Suggestions for Assessment

Paper and Pencil Task: Inclined Planes

Ping wants to use his skateboard to reach the top of a hill. He has a choice of three ramps from which he can begin. Which should he use, and why?



Look for

- ❑ ramp #1
- ❑ ramp #1 is steeper and Ping would travel farther.

What else could Ping do to make sure he gets to the top?

Look for

- ❑ push off hard when he starts

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
Students will...	
2-3-10 Identify how humans use inclined planes to make motion easier. *Examples: staircase, playground slide, wheelchair ramp, ramp on a moving van...* GLO: B1, D4 **2-0-4h**. Follow given safety procedures and rules. GLO: C1 **2-0-5e**. Record observations using written language, drawings, and, with guidance, charts. (ELA 4.1.2, 4.2.5) GLO: C2, C6 **2-0-7d**. Connect new experiences, ideas, and information with prior knowledge and experiences. (ELA 1.2.1, 2.1.2) GLO: A2	➢ **Investigating How Humans Use the Inclined Plane** Use a heavy object (that can be tied to a rope) and an inclined plane that is safe and sturdy enough to allow a student to walk on it while pulling a heavy object (a wheelchair ramp works well). The slope should not be higher than the vertical distance a student can lift the heavy object off the floor (chest height, perhaps). Ask students to lift an object off the floor to the indicated height. Discuss whether they found it easy or hard to do. Then, have them use an inclined plane to pull the object up to an equivalent vertical height. Discuss how this compares with lifting the object. Which method required more effort? ➢ **Science Journals** Have students use labelled diagrams and text to explain how inclined planes help humans move heavy objects. ➢ **Partner Brainstorming** Have students work in pairs to identify examples of inclined planes in their community such as a toboggan slide, playground slide, ski hill, wheelchair ramp, etc. Have students share their partners' lists and compile a class list.
2-3-11 Explore toys to determine how wheels and axles interact and move. GLO: C2, D4 **2-3-12** Recognize that the wheels of a vehicle rotate clockwise or counterclockwise depending on the direction of motion of the vehicle. GLO: D4 **2-3-13** Identify how humans use the wheel and axle to make movement easier. *Examples: moving dolly, wheelbarrow, cart, wagon...* GLO: B1, D4 (continued)	➢ **Picture Glossaries** Have students use toy cars or trucks to explore the movement of wheels and axles. Have them sketch and label their observations. Ensure that students observe the following: • the interaction of the wheel and axle • the movement of the wheels on the driver's side when the car is pushed forward • the movement of the wheels from the passenger's side when the car is pushed forward • the movement of the wheels from the driver's side when the car is pushed backward and • the movement of the wheels from the passenger's side when the car is pushed backward. ➢ **Wheels and Axles in the Environment** Part 1) Have students repeat the task of pulling a heavy object up an inclined plane (wheelchair ramp). This time, challenge them to think of how rollers could help make their job easier. Use simple rollers to move the object up the ramp. Discuss how this made the job easier and identify any problems they had (keeping the rollers (continued)

TEACHER NOTES	SUGGESTIONS FOR ASSESSMENT
An **inclined plane** is a an example of a **simple machine**. Simple machines help to make work easier.	**Science Journal Entry** Provide students with the following scenario: A child wants to move a heavy box up the stairs. What is the easiest way to get the box up the stairs? Use labelled diagrams and words in your answer. Look for ❑ a ramp (inclined plane) ❑ explanation that less effort is needed when you use a ramp (The work is easier.)
The **wheel and axle** is one type of **simple machine**. The wheel is connected to the axle. When the wheel is turned the axle is also turned. When the axle is turned the wheels are turned. One complete turn of the wheel causes one complete turn of the axle. When the toy is pushed forward, the wheel and axle, when viewed from the driver's side of the vehicle, turn in a counterclockwise direction. When the same forward movement of the vehicle is viewed from the passenger's side, the wheel and axle turn in a clockwise direction. When the toy is pushed backward, the wheel and axle, when viewed from the driver's side of the vehicle, move in a clockwise direction. When viewed from the passenger's side of the vehicle, the wheel and axle move in a counterclockwise direction.	

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
Students will...	
2-0-4g. Verbalize questions, ideas, and intentions during classroom activities. GLO: C6 **2-0-4h**. Follow given safety procedures and rules. GLO: C1 **2-0-7e**. Describe, in a variety of ways, what was done and what was observed. *Examples: concrete materials, captioned drawings, oral language...* (ELA 4.1.2, 4.2.5) GLO: C6 **2-0-9a**. Willingly consider other people's views. GLO: C5, C7	in place). Repeat the procedure using a device with wheels (a cart) and compare this with their results using the rollers. Part 2) Have students work in small groups to draw or find pictures of machines/tools with wheels. Have students glue the pictures on chart paper and record how each example makes work easier for humans. **Picture of machine/tool** (wheelbarrow) — **How it helps** helps carry things such as dirt from place to place ➢ **Gallery Walk** Post the charts and use a Gallery Walk (Brownlie and Close, 1992) to facilitate the sharing of information. (Note: Gallery Walk is discussed in *ELA, Strategies* pp. 202-203.)
2-3-14 Use the design process to construct a vehicle with wheels and axles that meets given criteria. GLO: C3, D4 **2-0-1c**. Identify practical problems to solve in the immediate environment. GLO: C3 **2-0-3a**. Brainstorm, with the class, possible solutions to a practical problem; and in small groups, reach consensus on a solution to implement. (ELA 1.2.3, 2.2.2) GLO: C3, C7 **2-0-3b**. Create, with the class, a plan to solve a problem or meet a need. *Examples: identify simple steps to follow, prepare a drawing of the object to be constructed...* (ELA 1.2.3) GLO: C3, C7 **2-0-3c**. Develop, as a class, limited criteria to evaluate an object or device based on its function and aesthetics. GLO: C3, C7 **2-0-3d**. Identify tools and materials to be used, and explain their choices. GLO: C2, C3, C4 **2-0-4b**. Construct an object or device to solve a problem or meet a need. GLO: C3 **2-0-4c**. Test an object or device with respect to pre-determined criteria. GLO: C3 **2-0-4d**. Identify and make improvements to an object or device with respect to pre-determined criteria. GLO: C3 **2-0-7b**. Propose a solution to the initial problem. GLO: C3 **2-0-7c**. Identify new problems that arise. GLO: C3 **2-0-8b**. Recognize that tools are developed in response to human needs. GLO: A3, B2	➢ **Design Project: A Vehicle with Wheels and Axles** Use literature to help set the context for the design task. For example, identify a practical problem in a story that involves a character having to transport something from one place to another, or who needs to travel from one place to another. Sample criteria for the creation of a vehicle include • contains 4 wheels, 2 axles • seating space for at least the driver • space for cargo (4 blocks) • sturdy (doesn't fall apart under the load) • able to travel in a straight line down a ramp when released from the top Students can make vehicles from a variety of ready-made objects including cereal boxes, pop cans, or milk cartons.

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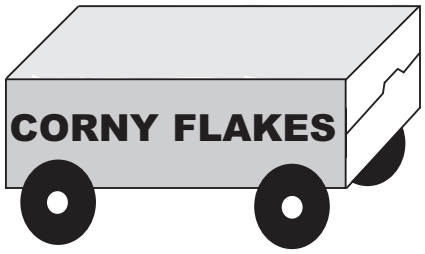
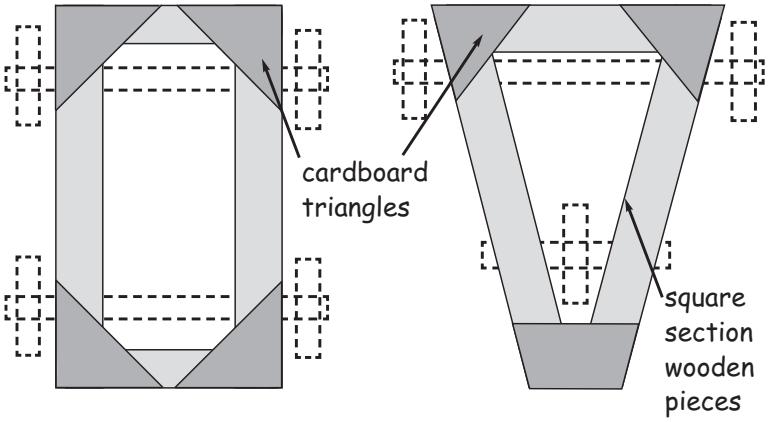
TEACHER NOTES	SUGGESTIONS FOR ASSESSMENT
Have students use Blackline Master 3: Design Process Recording Sheet: Grades 1 and 2.	**Design Process Checklist: Vehicles** The student ❑ understands the problem ❑ contributes to brainstorming ❑ contributes to the creation of a plan ❑ develops criteria with the class ❑ selects appropriate materials and tools ❑ constructs vehicle with wheels and axles ❑ uses tools and materials safely ❑ tests vehicle based on criteria ❑ suggests and makes improvements to the vehicle **Student Self-Assessment of the Construction and/or Process** 1. One problem I had was _____ _____. 2. I did well on _____ _____. 3. One thing I would suggest to another student_____ _____. 4. I would like to learn more about _____ _____. 5. I could improve it by _____ _____ _____.

PRESCRIBED LEARNING OUTCOMES
Students will...

SUGGESTIONS FOR INSTRUCTION



Vehicles can also be constructed from square section wood.



Vehicle Bodies

The body (chassis) of the constructed vehicles can be rectangular, triangular, t-shaped, etc. Cardboard triangles (purchased or home-made) provide an effective and sturdy method of joining the wooden pieces.

Wheels

There are many materials that can be used for making wheels: jar lids, cardboard disks, thread spools, thick wooden dowelling, etc. Reinforce thin wheels to prevent wobbling (Kraft stick, thick cardboard, etc.).

All wheels must be attached to the axle. The axle must be attached to the body (or chassis) of the vehicle. Axles can be made from thin wooden dowelling or even pencils. An axle holder is required to allow the axle to turn.

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TEACHER NOTES

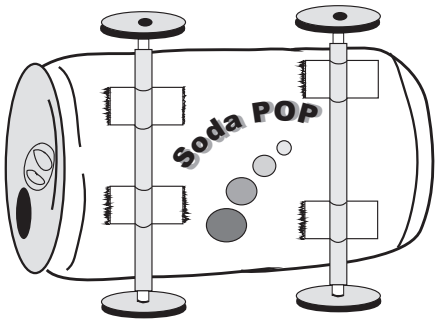
Square section wood is a common design construction material for students. It is similar to wooden dowelling, but is square (1 cm x 1 cm).

SUGGESTIONS FOR ASSESSMENT

PRESCRIBED LEARNING OUTCOMES

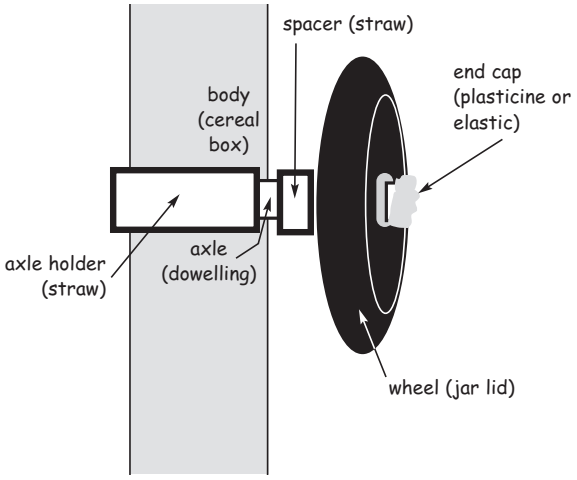
Students will...

SUGGESTIONS FOR INSTRUCTION



Axle Holders

The simplest type of axle holder is a tube, such as a straw, taped to the bottom of the body of the vehicle. The placement of the axle holder is important to the smooth and straight-line movement of the vehicle. Axle holders need to be parallel to the front and rear chassis of the vehicle and each other. Spacers (small pieces of plastic straw) can be used between the wheel and the body of the vehicle to allow the wheels to move freely. If the axle does not fit tightly on the wheels, a cap may be needed to prevent the wheel from falling off. Caps can be made from plasticine, rubber bands, washers, beads, etc.



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SUGGESTIONS FOR ASSESSMENT

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