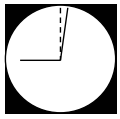
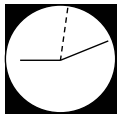
[62 minute lesson] **Australia Public Release Lesson 5 Lesson Graph [8th grade]**


1½ minutes

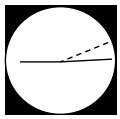
Science Organization: Students arrange themselves at the front of the classroom

The teacher instructs students to come to the front of the room and "huddle." They gather in front of the counter where the teacher is situated.


10 minutes

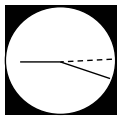
Whole-Class Seatwork: Class discusses the natural state of an object

The teacher starts the "huddle" by passing out today's handouts. He asks students, "What is the natural state of an object or body?" and encourages them to ask him questions to clarify what he means. The teacher elaborates by sliding a couple of masses across the table, asking if they would keep going or come to rest. He also asks about the motion of other objects (e.g., a tossed ball, a fired bullet, a rocket in space). He surveys the class asking, "Who's in agreement on this that things that are moving have got to have a force behind them to keep them moving? Who thinks that's right?" The discussion leads into issues about friction and gravity. The teacher directs students' attention to one of the handouts that was distributed. The handout begins with a riddle, "Galileo thought about it, Newton formalized it while we are all affected by it and all experience it even if we are not aware of it in scientific terms. WHAT is IT?" Other clues follow and students figure out that they are talking about friction.


3 minutes

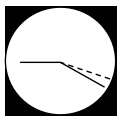
Whole-Class Seatwork: Class discusses friction

The teacher asks the class, "Is friction important to us?" The class talks about some examples and identifies friction as a force. The teacher then revisits the earlier notion that things that are moving need a force to keep them moving. He asks, "Who's still comfortable with that?"


3½ minutes

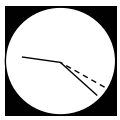
Whole-Class Practical Work: Teacher demonstrates force and motion

To help students understand the different forces on a moving object, he slides a mass across the table. He asks the class, (1) is there is a force to start the mass moving? and (2) is there a force to stop it from moving? They engage in a discussion about force and differentiate energy from force.


3 minutes

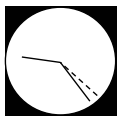
Whole-Class Seatwork: Class goes over handout about friction

The teacher returns to the issue of friction. He asks students the first two questions on the handout, "What is friction?" and "What determines how big it is?" He engages students in a discussion of when they may want to have maximum friction and when they may want to have minimum friction. Students respond by offering real-world scenarios.


2 minutes

Whole-Class Practical Work: Teacher demonstrates factors that influence motion

The teacher performs two demonstrations to guide students in thinking about moving objects. He slides a mass across the table, then asks what would happen if the surface of the table was ice or sandpaper. Students respond accordingly. The teacher then pushes a trolley across the table. He adds weight to the trolley then pushes it again, asking students for their observations. The teacher then describes a parallel scenario with a student pulling a sled with a friend inside and then adding more friends. They conclude that more force will need to be exerted for the trolley or sled to move (the same distance).


2 minutes

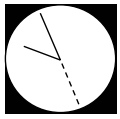
Whole-Class Seatwork: Class goes over instructions for practical activities

The teacher tells the class that these "are the ideas that we're going to test." He returns to the handout and asks the students to read the questions: (1) How do we measure it? (2) What determines how big it is? (3) Does it exist in a vacuum? and (4) Does it exist without gravity? Students prepare for their practical activity by following the instructions under each question.


2½ minutes

Whole-Class Practical Work: Teacher demonstrates the materials for today's activities

The teacher shows students the materials they will be using for their investigations about force. He goes over the first question, highlighting the fact that there are two parts. He states, "the first one is how much force does it take to get it [block of wood] started? And the other is how much force does it keep- take to keep it moving?" He elicits students' ideas by asking if the forces would be the same. The teacher moves a wood block with a spring balance to demonstrate the forces, but does not give them the answer. He tells them they will find out in their investigation.


28½ minutes

Independent Practical Work: Students work in groups of two, three, or four on activities

Students begin the activity by gathering the materials (e.g., spring balances, friction blocks, scissors, string, etc.). They follow the handout that instructs them to measure force under different conditions. For example, one question asks students to measure and record the force needed to maintain a constant speed (using a wood block and a spring balance). In another question, students are asked to add weights to their blocks and then measure and record the force needed to maintain a constant speed. The handout instructs students to conduct multiple trials; it also has related questions such as, "Why is it a good technique to take several measurements?" Students record their values and write their responses on the handout.

3 minutes

Science Organization: Students put materials away

The teacher announces there are only a few minutes remaining in the class period. They will continue with this activity tomorrow. Students put away their materials.

3 minutes

Whole-Class Seatwork: Class talks about initial results from practical work

Class goes over some initial results from today's activities. They discuss the difference in force to get the block started versus the force to keep the block moving. They also briefly go over the factors of having different surfaces and adding weights to the blocks. It is now lunchtime and students prepare to leave.