



1 minute



2½ minutes



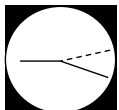
4 minutes



5 minutes



1 minute



4 minutes



20 minutes

Whole-Class Seatwork: Class reviews previous lesson

The lesson starts with a formalized greeting where all the students bow to the teacher. The teacher begins a discussion about water in the air, a topic they have been previously studying. He asks students what is dew point and they respond with a definition, "the temperature at which condensation takes place when the air is cooled."

Whole-Class Seatwork: Class develops new content about cloud formation

The teacher introduces today's objectives. He states, "Today, relating to this [dew point]...we are going to study about how clouds form." He elicits students' ideas about cloud formation, asking the class where clouds are formed. They brainstorm ideas and the teacher writes their responses on the chalkboard (e.g., dirt, sea, sky, mountain). They discuss and clarify some of these ideas.

Whole-Class Practical Work: Teacher demonstrates air compression and expansion

The teacher announces that the class will be making clouds experimentally. Before doing so, he shows them a vacuum chamber with a balloon inside. He asks students for a prediction of what would happen to the balloon when air is taken out of the chamber (i.e., shrinks, stays the same, inflates, or bursts). He demonstrates this and the balloon inflates. This is because the air in the chamber gets thinner, or expands in volume. When he lets air back into the chamber, students see that the balloon shrinks (deflates). The teacher then describes to the class that he wants them to create this state of expansion using the instruments provided.

Whole-Class Practical Work: Teacher demonstrates materials

The teacher shows the class the instruments they will be using for their practical activity. He demonstrates the procedures, going over the different conditions: (1) pump with smoke, (2) pump without smoke, (3) syringe with smoke, and (4) syringe without smoke.

Science Organization: Teacher assigns students into groups

The teacher combines groups so that each group now has six or seven students. The teacher instructs them to spend about five minutes on each instrument and then rotate.

Independent Seatwork: Students answer worksheet question

The teacher passes out a worksheet that describes the compression and expansion activity. He instructs students to write their names and answer question one. The question is, "Where are the clouds formed? And why do you think so?" He asks them to think in their own words and write a response within two minutes. Then they will start the activity.

Independent Practical Work: Students work on air compression and expansion activity

Students work in groups of six or seven on their practical activity. They rotate through four different stations where they experiment with different instruments, pushing and pulling pistons attached to chambers. They spend about five minutes with each instrument. In each case, students are to observe the effects of air compression and air expansion in the chambers. Two of the stations involve students lighting an incense stick to produce smoke, which represents a cloud. The teacher walks around to the different groups and facilitates. He makes observations of their procedures, for example, telling some groups that they have too much smoke. He also asks students questions about their observations, for example, asking them what happened to the air when the piston is pulled.



13½ minutes

Whole-Class Seatwork: Class talks about results

The teacher has the four conditions written on the chalkboard and asks students for their observations. He writes the results on the chalkboard in different colors (i.e., white and yellow chalk). They discuss.

- Syringe with smoke
 - pull piston → air expands → becomes white
 - push piston → air compresses → white disappears
- Syringe without smoke
 - Whether you pull the piston or push the piston, there is no change
- Pump with smoke
 - Remove the cap → air expands → becomes white
- Pump without smoke
 - Remove the cap → there is no change → becomes a little bit white

The teacher asks the class to interpret the results, asking "When we look at all four of these experiments, can we say that it becomes white when there is smoke or it becomes white when there is no smoke?" The class concludes that when there is smoke, there is white in the chamber. The teacher identifies the "white" as being clouds, announcing that clouds are essentially formed along the same principle. He returns to the earlier demonstration of the vacuum chamber and balloon, reminding the class that when air gets thinner it expands. The class realizes that the air in the atmosphere is thinner so air expands and the temperature decreases. When the temperature goes down, it reaches the dew point. The teacher adds, "It reaches to the state in which it cannot stay as water vapor in the air anymore, it reaches to the state in which it cannot exist as water vapor anymore, then it condenses and becomes clouds which we can see with our eyes." The teacher attempts to talk about cloud formation a bit more, asking students about dust and other particles in the air with which water molecules could attach. However, the bell rings and the discussion is cut short. The teacher tells the class they will complete the summary in the next lesson. He instructs students to fill out the "self evaluation" section of their worksheets.



1 minute



1½ minutes

Independent Seatwork: Students work on worksheet assignment

Students fill out the "self evaluation" section of their worksheets. They do not have time to summarize the activities, which they are told by the teacher to complete in the next class.

Science Organization: Students prepare to leave

Students bow to the teacher and thank him. They return the instruments and are dismissed.