

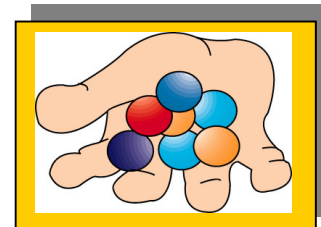
Cosmic Chemistry: Cosmogony

Doppler Effect—Are You Coming or Going?

STUDENT ACTIVITY

PART 1

1. Divide yourselves into teams or otherwise follow the instructions of the teacher. The steps in this activity are written as if you have been divided up into teams of three members. Each team should select a “source” person, a “timer/recorder,” and a “receiver.”
2. Your teacher will provide a track along which you will roll spherical objects, such as marbles. Designate the top end of the track as the “source.”
3. Obtain approximately 20 marbles and a stopwatch from your teacher.
4. The “source” person should now place the marbles on the track at even, roughly one-second intervals. Try to be consistent as possible. The stationary “receiver” collects the marbles as they arrive at the end of the track, announcing the arrival of the first and last marbles. The “timer/recorder” measures and records the time of arrival of the first and last marbles at the end of the track. Record the time on the Reporting/Data Sheet and calculate the frequency of the rolling marbles.
5. Now gather up the marbles and repeat the process. However, this time, as soon as the first marble arrives at the end of the track, the “receiver” should slowly (take baby steps) begin to walk toward the source, collecting from the track all the marbles that pass by him/her for a 10-second period. The timer/recorder should call out the time. Count the marbles and record the results on the Reporting/Data Sheet. Now calculate a frequency for the marbles, as collected by the moving “receiver.”
6. Gather up the marbles again and repeat the process. This time, however, the “receiver” should position himself/herself near the source. As soon as one marble has passed by, the receiver should slowly walk (baby steps again) down the track collecting from the track all the marbles that pass by him/her for a 10-second period. Again, the timer/recorder should call out the time. Count the marbles and record the results on the Reporting/Data Sheet. Now calculate a frequency for the marbles, as collected by the moving “receiver.”
7. Hand in the team’s Reporting/Data Sheet to the teacher.



PART 2

1. Follow your teacher’s instructions.

PART 3

1. Read the student text again, paying particular attention to the section on electromagnetic radiation.
2. Obtain from your teacher a copy of the handout called “Spectral Data.”
3. Use the information on the handout as you answer the questions posed on Part 3 of the Student Reporting/Data Sheet.
4. When you have completed your work, turn in the Student Reporting/Data Sheet to the teacher.