

Chapter 9: Mars Image Inquiry

Student Worksheet

Objective:

Learn about the surface of Mars through the images of the Rover and the Mars Reconnaissance Orbiter.

Engage:

Look at the image in Figure 1 below. What do you think it is? What would you guess is the scale of the image? Write your thoughts below. Do not turn the page until you're done.

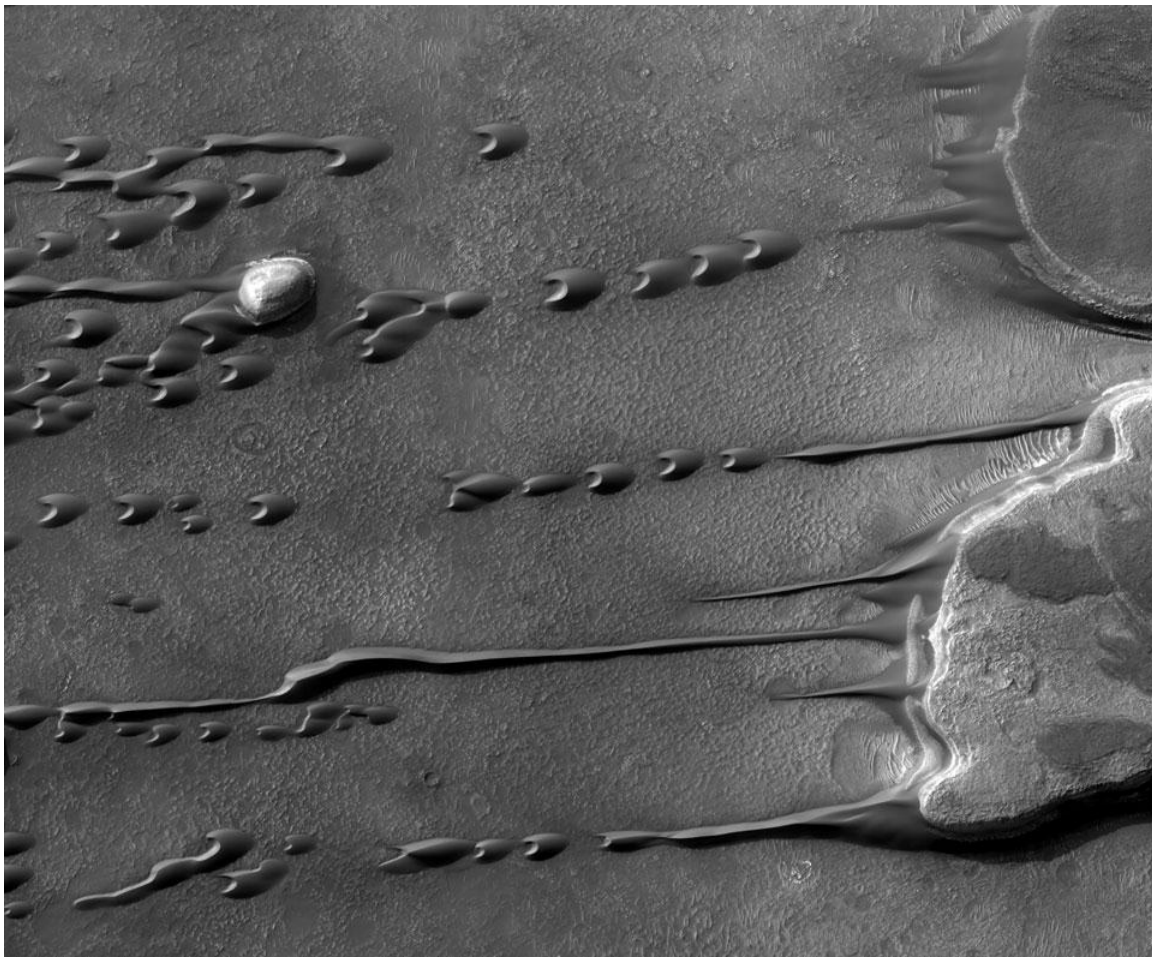


Figure 1

NASA/HiRISE/MRO/LPL

Introduction:

The image you saw in Figure 1 above showed sand dunes—called *barchans*—pushed across Mars by strong winds. These dunes that appear as drops of liquid can move intact across the land. Similar dunes are found on Earth. Notice the flat-topped Mesa on the right side and a pale dome-topped hill on the left.

NOTE: Attached to this activity is a set of 8 Mars images. Beginning on the next page, you will enter into an inquiry about what is pictured in each image.

Procedure:

1. Review the 8 images labeled Figures A-H. For each figure write what you think is pictured. Record your guesses about the scale and contents of each image in **Table 1** on the next page.
2. On the board, your instructor will write a list of the titles for the pictures. Try to match each title to one of the figures A-H. Feel free to refine or change your guesses about scale and contents.

Table 1

	Your Guesses about Scale and Contents	Title Matching Guess
Figure A		
Figure B		
Figure C		
Figure D		
Figure E		
Figure F		
Figure G		
Figure H		

3. Complete **Table 2** on the next page by matching captions with the images. In the right-hand column, write the letter of the figure you think matches the caption.

Table 2 Caption Matching

Caption	Letter
<p>This is an image of a small piece of Martian soil. The image has a diameter of 4 cm. It shows a small pit from where the Rover Curiosity took a soil sample. Initially scientists were worried that the shiny piece in the center of the image broke off the rover itself, but testing has indicated the shiny piece is native to Mars. This image was taken by the Mars Hand Lens Imager (MAHLI) camera on Curiosity's arm.</p>	
<p>This image shows about 1 kilometer of Mars. The dark streaks look almost like trees. In fact the dark sand on Mars is typically covered by the pinker, frostier sand in the winter; but as Spring comes, melting occurs on the cold surface of Mars. The dark sand is actually moving downhill from the tops of dunes. The picture was taken in April 2008 near the north pole of Mars.</p>	
<p>This image shows large sand dunes on the floor of Proctor Crater on Mars. The picture was taken by a camera on board the Mars Reconnaissance Orbiter. The dunes likely formed more recently than the lighter rock forms they appear to cover, and are thought to slowly shift in response to pervasive winds. The dunes are a result of the high winds and sandy surface composition on Mars.</p>	
<p>In the Martian summers the solid CO₂ at the poles sublimates directly into gas. The circular landmarks in the center of the image are about 60 meters in diameter.</p>	
<p>Mysterious streaks, perhaps caused by high winds, force dark sand to flow down slopes. This image was taken by the Mars Reconnaissance Orbiter near Acheron Fossae, a 700 km long trough.</p>	
<p>Volcanic vent in the plains east of Pavonis Mons.</p>	
<p>The hole appears to be the opening to a cavern 35 meters in diameter. The shadow in the opening indicates the hole is about 20 meters deep. This hole was discovered by accident in photos taken from the Mars Reconnaissance Orbiter. These holes are very interesting for future investigation because the interiors are protected from the harsh surface conditions on Mars.</p>	
<p>The rover, Opportunity, found these unusually shaped spheres while exploring a place named Kirkwood near the rim of Mars' Endeavour Crater. The picture shows sphere shaped objects only about 3 millimeters in diameter. Some are broken, others are smooth. Early in Opportunity rover's mission it found similar looking objects dubbed blueberries, but these spheres differ in content and density. The blueberries had greater iron content. The formation of these spheres remains unknown.</p>	

Conclusion:

1. Which photos did the Mars Reconnaissance Orbiter take? Which did the Rovers take?
2. Suppose the photos were transmitted back to Earth at the speed of light. How long would they take to arrive? Use the data tables in Appendix A of your textbook for needed information.
3. It took approximately 8 months for the Curiosity Rover to get to Mars. About how fast was it travelling?
4. If you were going to do research on Mars based on one of the photos you saw, what would it be? Why?

Extend:

- Do some further investigation of barchans. Document your findings.
- Investigate the current missions to Mars, both on the surface of the planet and in orbit.
- What is the future for unmanned missions to Mars?