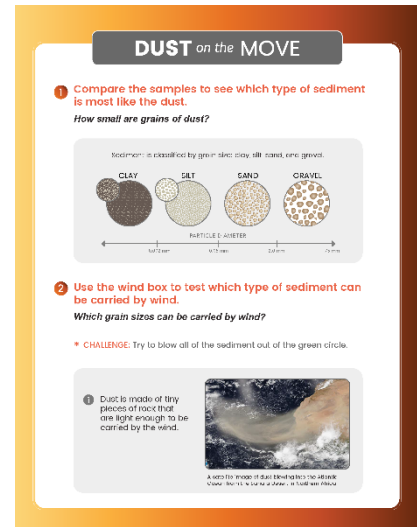


DUST *on the* MOVE

Dust on the Move

The *Dust on the Move* activity is a hands-on experience to help visitors learn what atmospheric dust is by considering how grains of dust compare in size to other common sediments and to explore how dust disperses from source regions across the surface of the Earth. There are two parts to the activity. First, samples of dust, clay, silt, fine and coarse sand, and gravel are examined in test tubes and under magnification. Then there is a wind box where visitors use a handheld fan to test which grain sizes can be transported by wind.

Both parts of the activity can be displayed together on a single tabletop or on a large activity cart. *Dust on the Move* is best for individuals or small groups that can rotate between examining the samples with the microscope and interacting with the wind box. Allow 5-10 minutes to complete both activities, depending on the level of engagement.



Required Materials

- Dust on the Move sign
 - pdf file available at scied.ucar.edu/atmospheric-dust-climate
- Tabletop sign holder
- Test tube rack with six sediment samples in closed-top test tubes
- 10-gallon glass tank with lid
- Handheld fan and USB charging cable (second fan as backup)
- Wind funnel for fan
- Rubber bands (2)
- Container of sediment (fine sand, coarse sand, gravel)
- Digital handheld microscope & accessories
- Wheel of samples (dust, clay, silt, fine sand, coarse sand, and gravel)
- Laptop or iPad/tablet to view microscope images

Instructions for Setup

- Ensure that the fan battery is charged via the USB charging cable. A second fan is provided as a backup.
- Attach the wind funnel (clear plastic 2L bottle top) to the hooks on the back of the fan using the provided rubber bands. Hook a rubber band around the mouth of the funnel and then stretch around to hook on the back of the fan. Repeat for the other side. (photo 1)



Photo 1

Instructions for Setup continued

- Empty the sediment from the provided container into the tank. Gently shake the tank to distribute the sediment across the bottom of the tank. Make sure there is sediment inside the area of the green circle that is attached to the tank bottom. (photo 2)
- Secure the microscope on the included stand and place it in the middle of the round sediment samples tray (wheel of samples). Adjust the stand so that the microscope touches the top of the sample containers. (photo 3)
- Connect the microscope to your laptop or device (see instructions for pairing the microscope with your laptop or device below) and use the focus adjustment knob to focus the image on your device's screen. Don't forget to remove the lens cover from the microscope!
- Place the test tube rack with sediment tubes near the wheel of samples. *Note: You may want to attach the test tubes to the rack with wire cabling to ensure that visitors don't accidentally remove them from the display.*
- Display the *Dust on the Move* sign, in the sign holder, near the tank and wheel of samples.



Photo 2



Photo 3

Using the Digital Microscope

The microscope must be paired with a laptop or wifi enabled device to display the images. If using a laptop, connect the microscope directly to a USB port. If using a tablet or smartphone, you will need to connect the microscope to the Wifi Magic Box, which will send the images to your device via local network wifi. You will likely need to install an app on your laptop or device to display the microscope images. The exact setup instructions depend on the device you are connecting. Refer to the [Juision General Microscope website](#) for the most updated instructions for pairing the microscope with your device.

If you have trouble pairing your device to the microscope, reference the Juision General Microscope website or the booklet included in the packaging for troubleshooting.

Included equipment: microscope with removable lens cover, adjustable stand, Wifi Magic Box, Micro USB cable, and storage case

Use with Mac: Plug the microscope into your laptop's USB port and operate using the Pluggable Digital Viewer application.

- To install *Pluggable Digital Viewer* on your Mac, follow the instructions from the Juision General Microscope website: <https://jiusion.com/art/microscope>.
- From the Pluggable Digital Viewer, select the settings icon and choose the UVC PC Camera from the Device dropdown menu (if your laptop has a built-in camera, it will likely be selected by default)

Use with iPhone or iPad: Plug the microscope into the Wifi Magic Box and operate using the HD Wifi app on your device.

- Install HD Wifi from the Apple app store onto your device
- Connect the microscope to the Wifi Magic Box and press the power button on the magic box (the microscope light should turn on).
- Ensure that the magic box is charged in advance or connected to a power source via the USB cable.
- In the settings menu on your iPhone or iPad, select the magic box as your wifi network.
- The wifi magic box functions as a local network. You must connect your iPad or iPhone to this local network for the microscope to work with your device.
- Open up the HD Wifi app on your device. You may have to give the app access to your camera, but the microscope should now display on your device.
- Be sure to keep your device in close proximity to the microscope and magic box so that you don't lose connection.



Use with PC or Android: You can use multiple apps to connect the microscope to your PC or Android device. In some cases, you might be able to use the microscope without installing additional software. To learn about the recommended apps and instructions for pairing with the microscope, visit the Juision General Microscope website: <https://jiusion.com/art/microscope>.

Facilitation Instructions

Sediment samples: How small are grains of dust?

- Allow visitors to examine each of the six sediment samples with the microscope. Prompt them to notice differences in grain size and consider which sediment is most similar to the dust sample. Encourage visitors to hold the test tubes and compare the different samples to one another.

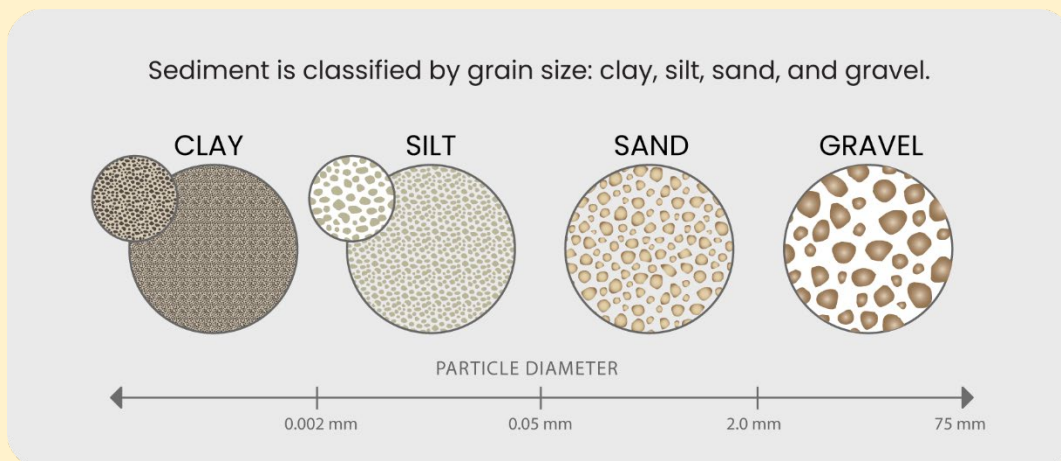
- Question prompts:
 - *What do you notice about each of the samples?*
 - *How are the samples different from each other? (Notice differences in color, texture, grain size, or particle shape)*
 - *Compare the different samples. Which one is most like the dust?*
 - *How is dust similar to/different from the other samples?*

What's in the test tubes?

Dust	The dust samples used in the activity were collected in the field from either China or Argentina. Some samples were mechanically separated from a source rock substrate in the lab.
Gravel	This gravel is crushed stone made of unconsolidated rock fragments, not from any particular location.
Coarse sand	The coarse sand is a loose aggregate of silica with 0.5-1.0mm grain size, not from any particular location.
Fine sand	This sand is commercial or utility-grade with 0.075-0.425mm grain size, not from any particular location.
Red sand <i>in the wind box only</i>	This is a type of fine sand sourced from Moab, Utah. Sand is formed naturally from the erosion of rock material.
Silt	This silt loam is sourced from Nephi, Utah. Silt is a dust-like sediment formed by erosion due to water or ice with a grain size of 0.008-0.0625 mm.
Clay	This clay is sourced from Aurora, Utah. A loose, slippery material, clay forms from the erosion of rocks that contain feldspar and has a grain size of less than four micrometers (μm).

Sediment classification

Dust is a mixture of fine particles of varying composition, including metal oxides, carbonates, and clay, that are lofted into the atmosphere. The exact mineral composition of dust varies depending on the source region. The DUST PIRE project studied dust from China, including the North Tibetan Plateau. Also called aeolian dust, these aerosol-sized particles come from dry regions with high winds. Dust is most similar to silt in terms of grain size. Grain size is measured by finding the diameter of the grain. The smaller the grain size, the easier the wind can transport the sediment.



Wind box: Which grain sizes can be carried by the wind?

- Invite visitors to use the wind box to test which sediment sizes are easiest to move with air. The air from the fan represents wind. Three sediments with different grain sizes (gravel, coarse sand, fine sand) are in the tank.
 - Demonstrate reaching through the opening in the tank lid to operate the fan.
Note: do not allow visitors to remove the fan from inside the tank through the lid as this may damage the air funnel.
 - Tell visitors that they can change the fan's speed to replicate low/high wind.
- Question prompts:
 - *(Before starting) Which of the sediments do you think will be most affected by the wind? Why?*
 - *How will changing the wind speed affect the movement of the particles?*
 - *Why are the red sand particles so much easier to move with the wind?*
 - *(After testing) Do you think dust particles are light enough to be carried thousands of miles across the Earth by the wind? Why or why not?*



What to Expect

Visitors should notice that the fine sand moves easily, the coarse sand moves when you concentrate the wind directly on it (but still not as much as the fine sand), and the gravel barely moves. They should conclude that smaller grain sizes will transport more easily by wind.

Dust, which is smaller than sand, would be moved by wind more easily than these larger and heavier grains. You may wish to explain that this wind box doesn't include dust because it is too easily blown and escapes the box.