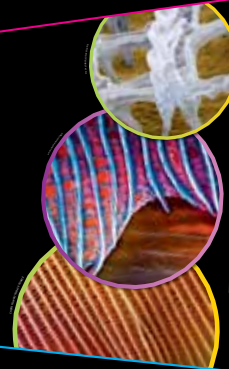


MYSTERIES OF THE UNSEEN WORLD

ZOOM IN!

Discover what a butterfly's wing looks like up close.

Some things are too small to see with the unaided eye. We can zoom in with a microscope. These tools magnify, or make objects look much bigger. These microscopes can make things look like what they really are.



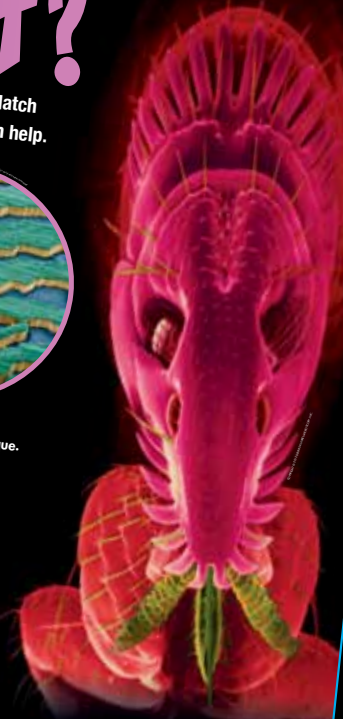
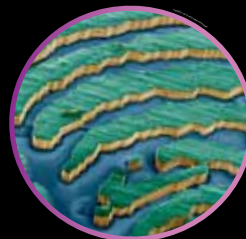
Magnified 41,600 times: You can see a tiny section of a scale's structure.

Magnified 8,300 times: You can see the structure between each ridge. It looks like a ladder.

Magnified 2,680 times: You can see ridges on a scale.

WHAT IS IT?

Objects look very different when you zoom in. Match each close-up with its whole object. The clues can help.



CLUE: This is super sticky.

CLUE: Each one of these is unique.



CLUE: Something uses this to drink nectar.

CLUE: This is totally sweet.

CLUE: This can make your pet very itchy.

NATIONAL GEOGRAPHIC Explorer



PRESENTED BY LOCKHEED MARTIN



Poster: Mysteries of the Unseen World

Activate Prior Knowledge

The Powers of Magnification

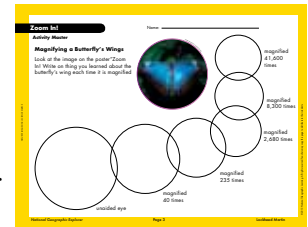
1. Prior to this activity, make 25 cards each with one lower-case letter *a*. Using the Book Antiqua typeface or a similar serif font, make five of the *a*'s in 5-point type size, five in 50-point, and five in 500-point type size. Separate the cards into piles based on type size.
2. Divide the class into five groups. Give each group a copy of the 5-point letter *a*. Tell them to examine the object closely and identify as many details as possible. Invite each group to share its discoveries.
3. Repeat this process with the 50-point *a* and then the 500-point *a*. What details can students see in the 50-point *a* that they couldn't see in the 5-point *a*? What did they notice in the largest *a* that they did not notice in either of the smaller versions? (Some students may not have been able to identify the letter in 5-point type. If they could, they likely just noticed that it's a lower-case letter *a*. In 50-point type, they should notice most details of the letter. In 500-point type, they may notice the letter's fuzzy edges, which are the result of the ink printing on the paper.)
4. Discuss with students how magnifying something, or making it larger, helped them learn more about it. Invite students to share other experiences they have had with magnification.

Zoom In!

Magnifying a Butterfly's Wings

1. Invite a few volunteers to describe what a butterfly's wings look like. Then ask students to imagine that they were something tiny, like a flea, that could get really close to the butterfly. Would its wings look the same to them? Brainstorm ideas about how the wings would look different from this new perspective.
2. Tell students that they don't have to turn into a flea to get a closer look at a butterfly's wings. They can use a magnifier, such as a hand lens or a microscope. Discuss what each of these scientific tools does.

3. Display the poster "Zoom In!" Help students make the connection between the levels of magnification. Starting with the image of the entire butterfly, explain that each image moving away from the butterfly shows a higher magnification. This means that the new details they see are a result of getting closer and even going into the structure of the wing.
4. Give each student a copy of the Activity Master. Have students record one thing they learned about the butterfly's wing with each increase in magnification.
5. Invite students to share their results. Ask students what they might see if there were more circles on this poster. (cells within the scales or parts of the cells) What would they need to see these things? (a more powerful magnifier, such as a scanning electron microscope)



Activity Master,
page T3

Common Core Grade-Level Differentiation

Grades 2-3:

- Complete the Activity Master as a class. Have students explain how a microscope can help scientists gather data and answer questions about the natural world.

Grades 4-5:

- Have students complete the Activity Master in small groups. Tell students to think about what they learned by looking at the magnified images of a butterfly's wing. Have them write three questions. Then have them write answers for their questions, citing evidence in the images.

Grades 6-8:

- Have students complete the Activity Master with a partner. Then have them examine the images again, this time going from the highest magnification to the lowest. Ask students to pinpoint where in each preceding image they would find the information shown in the next highest magnification.

Mysteries of the Unseen World

Learn about the movie, and access educational resources at: <http://mysteriesunseenworld.com>.

Poster: Mysteries of the Unseen World

What Is It?

Taking a Closer Look

1. To complete this activity, you will need a hand lens, a sheet of plain white paper, and colored pencils for each student. You will also need an assortment of items such as leaves, flower petals, bits of bark, etc. Microscopes, if available, can also be used.
2. Display the poster “What Is It?” Challenge students to match each close-up with the original object. Can they make any matches without reading the clues?
3. Then tell students that they will create their own matching game. Give each student an object, a hand lens, and a sheet of plain white paper. Give students five minutes to examine their object with the hand lens, draw a close-up, and write one clue.
4. Collect the items from students. Also collect students’ drawings. Number them sequentially.
5. Have each student take out a piece of paper and number it up to the number of items that were inspected. Then divide the class into groups of four. Give each group four drawings. Challenge students to identify each item, writing their answers on the correct lines of their papers.
6. Have groups switch drawings until they have had one attempt to identify each object.
7. Arrange the drawings numerically at the front of the room. Have each student place the object he or she drew in front of the corresponding drawing. Tell students to use these results to check their responses.
8. Did any groups correctly identify all objects? Which items were the most difficult to identify? Were there any objects they could not identify without the clues?
9. If you have classroom microscopes, select one or two of the objects and have students examine them with this increased magnification. Have volunteers draw each. Then place the new drawings next to the originals of those objects. Discuss how increasing the magnification changes what students see.

Common Core Grade-Level Differentiation

Grades 2-3:

- Using an ink pad, have students make copies of their fingerprints. Have them compare their own fingerprints with the close-up on the poster. What does the magnified image show that the ink stamp does not? (raised ridges, uneven edges, etc.)

Grades 4-5:

- Ask students: *Why is a sneaker fastener so sticky?* Have them examine the close-up on the poster to gather data that helps them answer the question.

Grades 6-8:

- Have students design and conduct an investigation to learn what the cells of one of the objects on the “What Is It?” poster looks like at various scales.

Wrapping It Up

Putting Magnification to Good Use

1. Have volunteers identify their favorite magnified image on either poster. Challenge them to explain why they liked that particular image. Did it look funny? Was it gross? Did they just find it interesting?
2. Point out to students that they created a game out of magnification, but magnifying objects also can be extremely useful. Many people couldn’t do their jobs without the ability to take a closer look. Tell them that they will explore jobs that use magnification.
3. Assign each student a partner. Have pairs conduct research to identify one professional application for magnification. Tell them to record the profession in which people use magnification, what tool they use, how it helps them, and why they need these tools to do their jobs. (For example: doctors, surgeons, and scientists use microscopes to see cells, tissues, etc. more closely; astronomers use telescopes to see stars; photographers and videographers use telescopic lenses to capture close-up images.)
4. When students are finished, have them present their findings to the class. Explore the range of career options in which magnification plays a role.

Activity Master

Magnifying a Butterfly's Wings

Look at the images on the "Zoom In!" side of the poster. Write one thing you learned about the butterfly's wing each time it's magnified.



Name: _____

magnified
41,600
times

magnified
8,300 times

magnified
2,680 times

magnified
235 times

magnified
40 times

unaided eye

Name: _____

Activity Master

Magnifying a Butterfly's Wings

Look at the images on the "Zoom In!" side of the poster. Write one thing you learned about the butterfly's wing each time it's magnified.



Students may note the color, texture, or structure seen in the image.

magnified
41,600
times

Students may note the color, texture, or structure seen in the image.

magnified
8,300 times

Answers will vary

Students may note how the scales attach to the wing, how they overlap, or differences in color in parts of the wing.

magnified
2,680 times

Students may note how the scales attach to the wing, how they overlap, or differences in color in parts of the wing.

magnified
235 times

Students may note the size, shape, or color of the butterfly's wing.

Students may note the shape of the scales, how they overlap, or the shading in between them.

magnified
40 times

unaided eye