



How Big Is It?

Investigating size and scale using the metric system.

Try this!

1. Arrange the scale cards in a line across the top of your table, from smallest to biggest.
2. Make additional rows of object cards, placing them under the scale card that **best** fits the measurement of each object.

CA Science Content Standards

Grade 2, Standard 4b – express measurements in metric system units

Grade 4, Standard 6b – estimate the length of objects

Grade 7, Standard 1 – cell biology

Grade 7, Standard 2 – genetics

Grade 7, Standard 6 – physical principles in living systems

Grade 7, Standard 7b – collect information

Next Generation Science Standards

Scientific and Engineering Practices – Using mathematics, informational computer technology and computational thinking; Engaging in argument from evidence; Obtaining, evaluating and communicating information

Crosscutting concept – Scale, proportion, and quantity

Materials

- Set of scale cards
- Set of object cards

Notes to the presenter

You can do this activity with different sets of object cards. The first page of object cards includes more commonly known objects. The second page includes additional, more challenging objects. You can also select objects that are relevant to the scale your students are learning about (larger than one meter, smaller than 1 meter, microscopic objects, etc.)

See also this interactive animation on The Scale of the Universe to help students visualize objects at various scales: <http://htwins.net/scale2/>

For a biological focus, see also this interactive comparison of objects smaller than 1 mm, www.cellsalive.com/howbig.htm, and this comparison of cells, viruses, and biological molecules, <http://learn.genetics.utah.edu/content/begin/cells/scale/>

Extensions

These cards can be used in various ways. To address the focus on argumentation in the Common Core on Science Literacy, some teachers have had students compare and defend their object placements. Some have also distributed one object card per student and had the students arrange themselves in a line of ascending size by discussing their objects with each other. Other teachers have used the cards in a Pokemon-like trading game where larger (or smaller) objects are more “powerful”.

Credits

The Center for Probing the Nanoscale (CPN) at Stanford University is supported by the NSF under award PHY-0830228. For more information and other activities, visit <http://cpn.stanford.edu>.

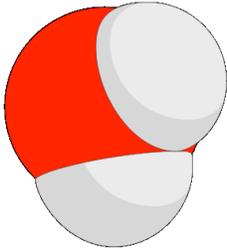
Image Sources

Water molecule: http://kinialohaguy.files.wordpress.com/2009/05/water_molecule.png
Carbon nanotube: <http://www.ewels.info/img/science/nanotubes/tube.angled.jpg>
Virus: <http://www.drugdevelopment-technology.com/projects/fludase/images/1-influenza.jpg>
Candle: <http://www.clker.com/clipart-10942.html>
Bacterium: <http://www.ou.edu/class/pheidole/General%20Bacteria.jpg>
Red blood cells: <http://health-pictures.com/blood/images/red-blood-cell.gif&imgrefurl=http://health-pictures.com/blood/red-blood-cell.htm>
Human hair: http://commons.wikimedia.org/wiki/File:Human_hair_SEM.svg
Penny: www.faqs.org/photo-dict/phrase/749/penny.html
Quarter: <http://www.hung-truong.com/blog/wp-content/uploads/2007/10/quarter.jpg>
Envelope: http://www.clker.com/cliparts/e/3/4/7/11949844071868980516addressed_envelope_with_stamp_01.svg.hi.png
5-year-old child: http://www.dallasnews.com/sharedcontent/dws/img/v3/09-23-2007.NTR_0923Dora.GJD27VKDF.1.jpg
Bus: <http://www.athenstransit.com/our-services/the-bus.html>
Soccer player: <http://www.outdoorfunstore.com/sports/IMAGES/Soccer1.JPG>
"Walking Away": <http://www.laurenmessef.com/wp-content/uploads/walking-away.gif>
Airplane: <http://www.dennisholmesdesigns.com/siteimages/airplane.png>
Interstate sign: [commons.wikimedia.org/wiki/File:I-25_\(big\).svg](http://commons.wikimedia.org/wiki/File:I-25_(big).svg)
Cesium atom: <http://www.saburchill.com/chemistry/visual/atoms/055.html>
DNA double helix: <http://www.ec.gc.ca/EnviroZine/images/DNA.jpg>
ATP molecule: http://www3.ntu.edu.sg/home/CXGuo/Energy%20Harnessing_files/main_files/image001.jpg
Transistor symbol: <http://www.freeclipartnow.com/d/40997-2/IEC-NPN-Transistor-Symbol.jpg>
DVD: <http://upload.wikimedia.org/wikipedia/commons/thumb/3/30/DVD.png/250px-DVD.png>
Merino sheep: www.pelage.co.nz/fibres.htm
Dust mite: http://upload.wikimedia.org/wikipedia/commons/thumb/e/eb/House_Dust_Mite.jpg/250px-House_Dust_Mite.jpg
Amoeba: <http://www.arthursclipart.org/biologya/biology/amoeba%25202.gif>
Wedding ring: http://goldprice.org/gold-jewellery/uploaded_images/gold-wedding-ring-780063.jpg
Electrical outlet:
http://www.homefurnish.com/CMS400Min_dev/uploadedImages/homeimprovement/electrical/iStock_000001058487Small_175.jpg
Basketball player: http://www.shutterstock.com/s/_basketball_player_vector/search.html
House: <http://www.fotosearch.com/bthumb/ART/ART194/SUB055.jpg>
Train: <http://files.songbirdnest.com/wp-content/uploads/2008/03/caltrain.png>
Empire State Building: <http://www.newyorkminiaturemodel.com/Buildings/images/Empire%20State%20building.jpg.jpg>
Mt. Everest: <http://ghoomghaam.com/images-articles/mountain-everest.jpg>
Outer space cartoon: http://comps.fotosearch.com/comp/IMZ/IMZ001/outer-space-b_~ski0050.jpg

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width of a water molecule



diameter of a carbon nanotube



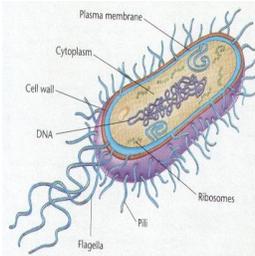
diameter of a flu virus



wavelength of visible light



width of a bacterium



diameter of a red blood cell



thickness of a human hair



thickness of a penny



diameter of a quarter



width of a standard envelope



height of a typical 5-year-old child



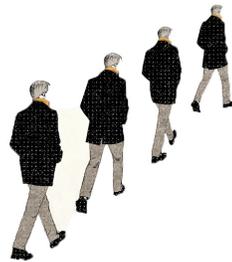
length of a standard city bus



length of a soccer field



distance walked in 20 minutes



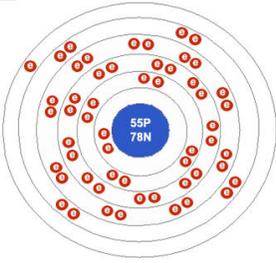
cruising altitude of an airplane



distance a car can travel on a freeway in 1 hour



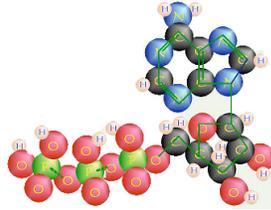
diameter of a cesium atom



diameter of a DNA double helix



length of an ATP molecule



width of a transistor in a computer chip



width of a single bit on a DVD



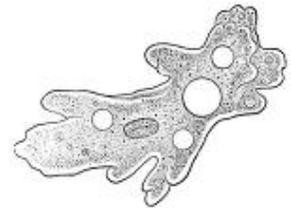
diameter of a strand of Merino wool



length of a dust mite



length of a typical amoeba



width of a wedding ring



width of an electrical outlet cover



height of a typical pro basketball player



height of a 2-story house



length of a 5-car train



3x the height of the Empire State Building



height of Mt. Everest



altitude of official start of "outer space"



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$$10^{-10} \text{ m}$$

(1 angstrom)

$$10^{-9} \text{ m}$$

(1 nanometer)

$$10^{-8} \text{ m}$$

(10 nanometers)

$$10^{-7} \text{ m}$$

(100 nanometers)

$$10^{-6} \text{ m}$$

(1 micrometer)

$$10^{-5} \text{ m}$$

(10 micrometers)

$$10^{-4} \text{ m}$$

(100 micrometers)

$$10^{-3} \text{ m}$$

(1 millimeter)

$$10^{-2} \text{ m}$$

(1 centimeter)

$$10^{-1} \text{ m}$$

(1 decimeter)

$$10^0 \text{ m}$$

(1 meter)

$$10^1 \text{ m}$$

(10 meters)

$$10^2 \text{ m}$$

(100 meters)

$$10^3 \text{ m}$$

(1 kilometer)

$$10^4 \text{ m}$$

(10 kilometers)

$$10^5 \text{ m}$$

(100 kilometers)

0.0000000001 m (1 angstrom)	0.000000001 m (1 nanometer)	0.00000001 m (10 nanometers)	0.0000001 m (100 nanometers)
0.000001 m (1 micrometer)	0.00001 m (10 micrometers)	0.0001 m (100 micrometers)	0.001 m (1 millimeter)
0.01 m (1 centimeter)	0.1 m (1 decimeter)	1.0 m (1 meter)	10.0 m (10 meters)
100.0 m (100 meters)	1000.0 m (1 kilometer)	10000.0 m (10 kilometers)	100000.0 m (100 kilometers)