



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 a second row of object cards, placing the object card next to the scale card that **best** fits the measurement of the 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

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.)

This interactive website helps 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
- See also this comparison of cells, viruses, and biological molecules: <http://learn.genetics.utah.edu/content/begin/cells/scale/>

Extensions

These cards can be used for a variety of other activities. Some teachers have combined several sets to make a deck of cards, and used the deck to play “poker”. They can also be used 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-0425897. For more information and other activities, visit <http://cpn.stanford.edu>.

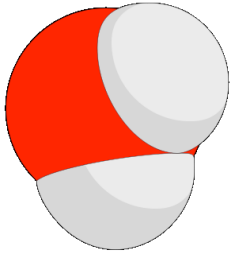
Image Sources

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
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.laurennessef.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



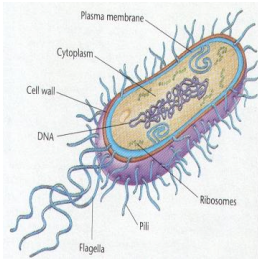
diameter of a flu virus



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



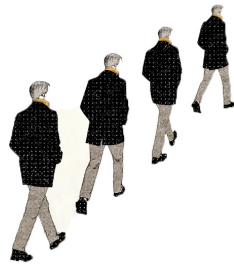
length of a standard city bus



length of a soccer field



distance walked in 20 minutes



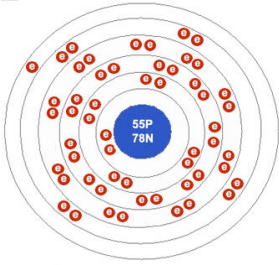
cruising altitude of an airplane



distance a car can travel on a freeway in 1 hour



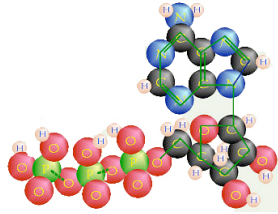
diameter of a cesium atom



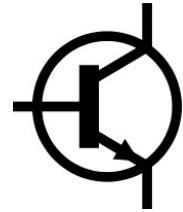
diameter of a DNA double helix



length of an ATP molecule



width of a transistor in a computer chip



width of a single bit on a DVD



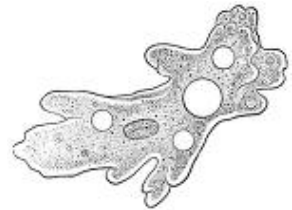
diameter of a strand of Merino wool



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"



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

(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)