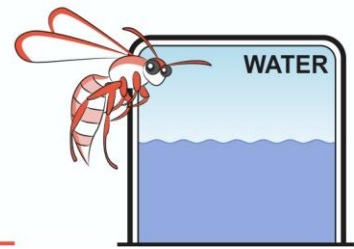


## Meniscus & Parallax - Teacher Notes



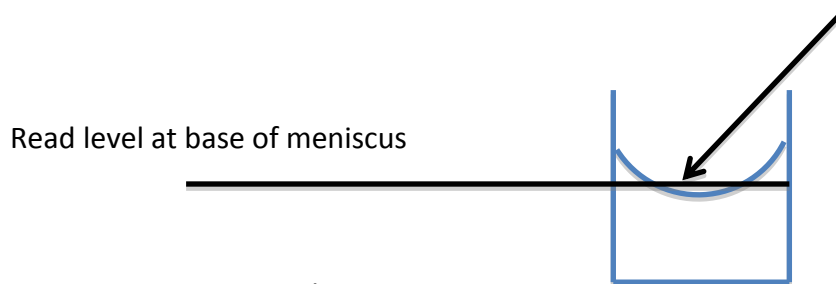
### Measuring accurately

Students often have trouble measuring liquids accurately at first, usually due to one or more of the following errors:

- Meniscus reading error
- Parallax error
- Transfer error
- Unit error

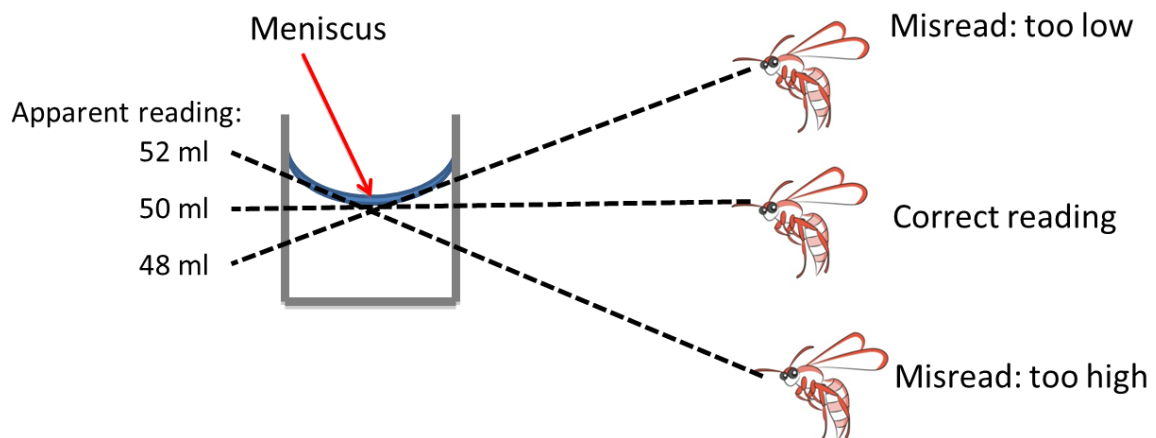
### Meniscus Error

Since water molecules are attracted to the sides of the measuring cylinder and this force decreases with distance from the sides, water has a downward curving surface or **MENISCUS**.

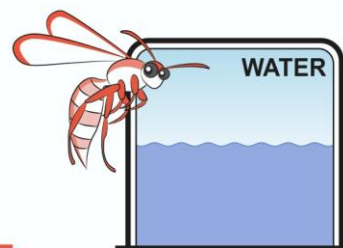


**Interesting Fact:** Liquid mercury is not attracted to glass. As a result its meniscus domes upward.

To avoid meniscus error, students need to take their eyes down to water level and read the level of the base of the curved surface.



## Meniscus & Parallax - Teacher Notes



### Parallax error

To demonstrate how parallax error can cause misreading, conduct this easy, 1-minute experiment:

1. Ask students to look around the room and find an object with an obvious vertical edge (e.g. a door frame or window frame).
2. Students then close one eye and align their index finger with the edge.
3. Without moving their alignment finger, shut the open eye and open the closed eye.
4. The edge will appear to have moved sideways. This is caused by the difference in position of our two eyes. Even that small distance causes parallax error. Students may practise getting correct measurements using beakers, measuring cylinders and pipettes.

### Transfer Error

When decanting or pouring liquid from one container to another, often some droplets of liquid remain adhering to the first container. However, this can cause measurement errors, especially if there are multiple decanting steps. These droplets of water remain in the container due to the forces of cohesion and adhesion (for more on cohesion and adhesion, read the WASP activity on these forces available online). Point out to students that a careful, steady hand and attention to detail are very important in chemistry and physical experiments for reasons like this.

### Unit Error

Students often forget at first to record the volume units after the reading (i.e., they write "25" instead of "25 mL"). However, this can lead to serious errors when working in a team. To highlight why this type of error is a huge problem, consider sharing the story of the 1999 NASA Mars Climate Orbiter, which was destroyed in the Mars atmosphere because some of the engineers calculated the trajectory of the craft in the wrong units!

For more information, visit:

[https://en.wikipedia.org/wiki/Mars\\_Climate\\_Orbiter#Cause\\_of\\_failure](https://en.wikipedia.org/wiki/Mars_Climate_Orbiter#Cause_of_failure)

### Using different measuring containers

Beakers hold large amounts of liquid but only give measurements accurate to 10 or 50mL. Some even only give a maximum reading. Measuring cylinders give more precise measurements but hold less liquid. Transfer pipettes give the most accurate readings (if completely emptied) but only carry a small amount of liquid.

**Note:** Some students need practice to understand conservation of volume. They may misunderstand that in a tall measuring cylinder liquid has a greater volume than when it is poured into a large beaker. Moving the same liquid amongst several different containers will help.