

13C Charles' Law

What is the relationship between the volume and temperature of a gas?

Jacques Charles (1746–1823) determined the relationship between temperature and volume for an enclosed gas. In this simple investigation, you will measure the volume of air in a balloon, heat the system, and observe and collect temperature and volume data as the system cools. From this data, you will be able to derive Charles' Law.

Materials

- Balloon
- Plunger assembly
- Displacement tank
- Tray or dish pan
- Ice
- Temperature probe
- Data Collector

1 Thinking about temperature and volume

- If you inflate a balloon and leave it on a sunny windowsill, what do you think will happen to the balloon?
- Make a hypothesis about the relationship between volume and temperature of an enclosed gas. (Hint: When temperature increases, what do you think happens to the volume?)

2 Setting up the experiment

- To begin making the plunger assembly, use the weights base that comes with the equipment kit. Remove all the steel weights (you won't need these).
- Cut a styrofoam cup so that it is 12 cm high and then make a small hole in the side of the cup.
- Poke a hole in the bottom of the cup using one of the posts and leave the cup attached to the weights base as shown in the photo. You will use this plunger assembly to submerge the balloon in the displacement tank.
- Blow up a balloon but don't tie it. Allow it to deflate. Repeat this process three times. This will stretch the balloon so it is easier to use in experiment.
- Blow up the balloon with enough air that it will fit easily in the displacement tank. It should *not* fit snugly (approximately 12-cm in diameter).

