



Mythbusters Chemistry

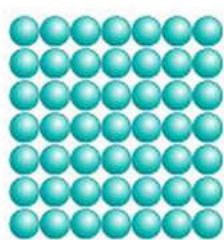
Season 4, Episode 15
"Archimedes' Steam Cannon"

The Myth: It is possible to build a functional cannon using only steam as propulsion.

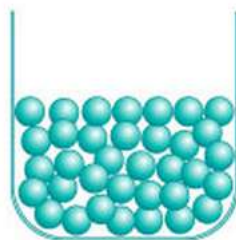
Background Questions:

(Answer before watching the episode!)

1. This diagram shows the change in the motion of the particles within a solid, liquid, and gas. Draw in what the gas particles would look like.



Solid



Liquid



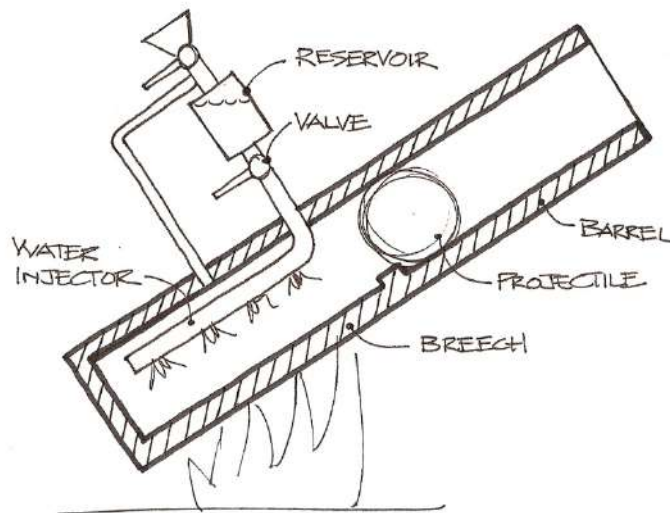
Gas

2. Which of the three states of matter has the most kinetic energy?
3. Assuming each contained the same number of particles, which state of matter would occupy the most volume?
4. In this episode, the Mythbusters try *flash boil* water. This means applying enough heat to instantly boil the water upon contact. If they use a gallon (3,785g) of water at room temperature (25°C), how much energy would be needed to boil the water? The specific heat of water is 4.18g/J°C.
5. Steam has 1700 times more volume than water. What effect will boiling water in the cannon have on the pressure inside the chamber?
 - a. Which of the three gas laws (Boyle's, Charles, or Gay-Lussac's) explains this relationship?

Episode Questions:

(Answer while or after watching the episode.)

1. Use this concept drawing of Archimedes cannon made by MIT to give a brief explanation of how it is supposed to work.



2. The first trial of the cannon fails. What three changes are made to the design?
3. The second and third trials also fail, so the Mythbusters consult with someone with MIT to make additional design changes. List the four changes they make.
4. The concept cannon finally does successfully fire. What happened to the tennis ball?
5. The design of the cannon is changed once again and a new boiler is built to attach to the cannon. Jamie mentions that the walls of the chamber expand slightly as the boiler is heated.
 - a. Which gas law explains the increase in pressure due to the change of liquid water to steam?
(Boyle's | Charles | Gay-Lussac)
 - b. Which gas law explains the increase in pressure due to the higher temperatures inside the boiler?
(Boyle's | Charles | Gay-Lussac)
6. The pressure in the boiler was not building up very quickly, so fiberglass was wrapped around it. Explain why this would make a difference.
7. How far did the cannonball travel after the successful firing?