

55. Human Heart is a Pump

Classroom Activity: Understanding the function of the human heart.

Grade(s): 5

Strand (s): Understanding Life Systems

This task addresses the following overall expectations:

- investigate the structure and function of the major organs of various human body systems;
- demonstrate an understanding of the structure and function of human body systems and interactions within and between systems.

and the following specific expectations:

- design and build a model to demonstrate how organs or components of body systems in the human body work and interact with other components;
- use appropriate science and technology vocabulary, including circulation, respiration, digestion, organs, and nutrients, in oral and written communication;
- use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes;
- identify major systems in the human body and describe their roles and interrelationships;
- describe the basic structure and function of major organs in the respiratory, circulatory, and digestive systems.

Assessment Categories:

- Knowledge and Understanding
- Communication
- Application

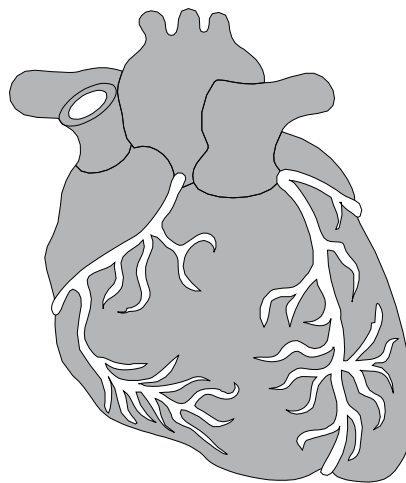
Cross-discipline connections: Language

Type of Activity: Classroom/science lab

Preparation: 3 hours

Obtain a video of how the Human heart functions.

Collect all the pieces and assemble the pump and test it.



Materials/Resources for teachers:

Model of Human Heart (optional)

Video of human heart function

Flask with spigot at bottom (could use milk carton with modified spigot at bottom)

One meter of flexible hose to fit snugly over the spigot

One bucket to drain water into

Food colouring

Clamp to pinch hose

One 50 mm check valve

One Rubber stopper to fit top of flask

Materials/Resources for students:

Volunteer one student to be timekeeper

Activity Description: (approx. 1 hour)

The model of the human heart provides a good visual of the 4 sectors of the heart. The hinged flaps in the model allow the internal valves to be displayed. The video should explain how the blood flow travels in one direction, much like the check valve allows flow in one direction.

Set up the flask with the tube and mark the side of the flask with a piece of masking tape. Use the clamp to

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pinch the hose, but place the clamp about 5 cm downstream of the spigot. Pour clean water into the flask to the bottom of the masking tape. Pour some food colouring in the water in the flask. Notice that the colour does not penetrate beyond the spigot. At a closer look, you will notice air is trapped between the spigot and the clamp. Have your volunteer timekeeper determine the amount of time required to drain the coloured water into a pail.

For more advanced grades, you could explain the equation of $\text{Flow} = \text{Area} \times \text{Velocity}$.

Repeat the draw down, but place a stopper in the top. You should find the draw down time is the same. Repeat a third time, but while the water is draining, place your finger over the hole in the stopper. You should notice that the water stops draining from the flask. The stoppage resembles a blood clot in an artery. You have also demonstrated a control volume with the flow in and flow out. Keeping in mind that water is heavier than air, ask the students why the lack of airflow prevented the water from draining out the bottom. Ask the students what they would expect if the flask were a plastic bag.

Repeat drawdown test (with or without stopper), but this time hold the outlet of the hose higher than the level in the flask. The water goes to equilibrium, much like the blood in your body when you are sleeping. For high school grades, you could explain Bernoulli's equation. Ask the students why a doctor asks you to lie down for 5 minutes before your blood pressure is taken.

The health of the heart is dependent on the air you breathe, food consumed and beverages consumed. That includes the presence or lack of cigarette smoke. You can also talk about air pollution and how engineered systems such as HVAC or simple dust masks prevent particulate matter from entering the lungs.

Tips: To obtain a model of the human heart and a video, contact your local College or Heart and Stroke Foundation or Red Cross offices.