



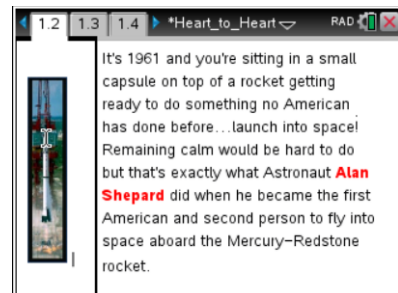
Open the TI-Nspire document *Heart to Heart.tns*.

Have you ever been scared? What about nervous while giving a speech or meeting someone new? What did your heart do? Did you even notice? This activity will give you opportunities to explore how the heart works and what happens to the heart while in space.



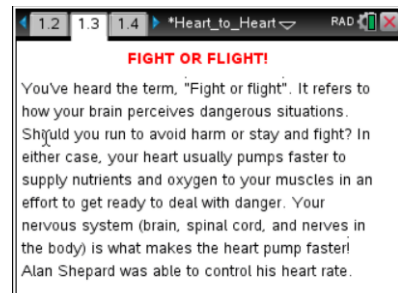
Move to page 1.2

1. Page 1.2 describes the historic launch, in 1961, of the first American in space, Alan Shepard. Imagine sitting on top of the Mercury-Redstone rocket waiting through the countdown knowing that there is no turning back. How would your heart rate change?



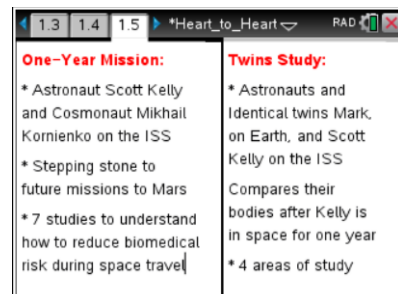
Move to page 1.3 – 1.4

2. Read through pages 1.3 to 1.4 as they describe why the heart rate changes during times of stress.



Move to pages 1.5.

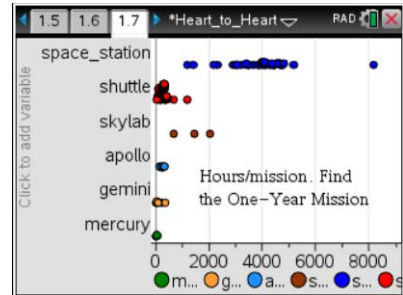
3. This page discusses the One-Year Mission and Twins Study which are two research projects happening aboard the International Space Station. They are both intended to determine health changes while spending extended time in microgravity. The Twins Study is a comparison between physiological changes that may occur between identical twin brothers Mark and Scott Kelly.





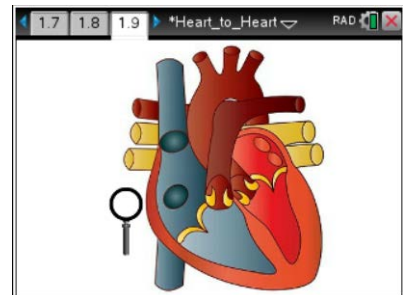
Move to pages 1.6 – 1.7.

4. Review the graph on page 1.7. The graph shows a dot for each manned mission in the history of NASA for the Mercury, Gemini, Apollo, Skylab, Space Shuttle, and International Space Station missions. They are measured in number of hours. Identify which dot represents astronaut Scott Kelly's historic year-long mission.



Move to pages 1.8 – 1.10.

5. These pages explain the basic parts of the cardiovascular system such as the heart and vessels. Examine the image on page 1.9 and determine which vessels are arteries and which are veins.



Move to pages 1.11 – 1.12.

6. Blood has multiple components. It includes white blood cells, red blood cells, and platelets. Blood also exists in two states; oxygenated (with oxygen) and deoxygenated (without oxygen).

Blood - liquid connective tissue made up of platelets and two types of cells.

- White blood cells aka leukocytes** - fight pathogens (foreign invaders - bacteria and viruses).
- Red blood cells aka erythrocytes** - transports oxygen and nutrients to cells and removes carbon dioxide and waste away from cells.
- Platelets** - pieces of cells that clump together in damaged areas and form a plug that reduces blood loss.

Move to page 1.13.

7. Check on the simulation on page 1.13. Attempt to move blood through the heart by pressing the correct chamber button in the correct order.

When the right ventricle contracts, blood travels out to the lungs through the pulmonary artery

contract right atrium

contract right ventricle

contract left atrium

contract left ventricle

Test yourself...



Questions related to pages 1.1 – 1.13

Q1. What is the function of the atria?

Q2. What is the difference between the right and left ventricles?

Q3. What other body system is responsible for changing the pace of the heart?

- A. The nervous system
- B. The integumentary system
- C. The digestive system
- D. None of the above

Q4. Why does blood move from the right ventricle into the lungs?



Q5. What is the function of the heart valves?

Q6. What would happen if one of the valves didn't work correctly?

Q7. Describe the differences between leukocytes and erythrocytes?

Q8. Blood exists in two states; oxygenated and deoxygenated. Which side of the heart receives and distributes oxygenated blood? Describe the function of each chamber.



Move to page 2.1 – 2.6

- 8. These pages offer students a glimpse into the life of Dr. Natacha Chough, a flight surgeon working for NASA. She is a medical doctor that works with astronauts before, during, and after missions into space. Dr. Chough describes her career choice and why it has been so rewarding for her.

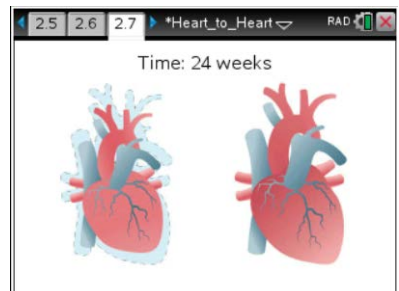


Questions related to pages 2.1 – 2.6

- Q9. What is the role of a flight surgeon?
 - A. True – Without math and science, Dr. Chough wouldn't know much about how the human body or how to treat patients
 - B. False – Dr. Chough doesn't need math and science to be a flight surgeon
- Q10. Math and science are critical for doing the job of a flight surgeon?
 - A. True – Without math and science, Dr. Chough wouldn't know much about how the human body or how to treat patients
 - B. False – Dr. Chough doesn't need math and science to be a flight surgeon
- Q11. Would you want to have a doctor that did very well in their math and science courses or would you be okay with lower grades? Why?

Move to pages 2.7 -- 2.9.

- 9. Did you know the heart is always changing? It changes based on the amount of work it needs to perform to keep the body functioning properly. In microgravity, it doesn't have to work as hard. In fact, if the astronaut doesn't do a lot of exercise, their heart will both shrink and change shape! Check out the animation to see what could happen to your heart while in microgravity!



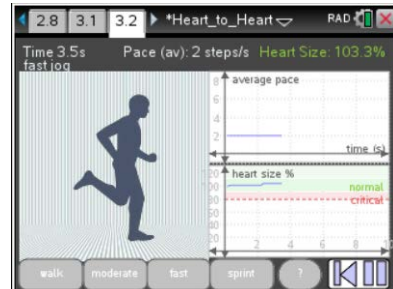


Questions related to 2.7 – 2.8

- Q12. Why would the heart change shape to become more spherical in space?
- Q13. If astronauts did not exercise while in space, would their heart shrink at a constant rate?
- A. Yes, if astronauts don't exercise their heart would shrink at a constant rate
 - B. No, their hearts would shrink more quickly at first and then slow down over time
 - C. Yes, in fact, if they don't exercise their heart could shrink to nothing
 - D. No, their hearts would shrink slowly at first but would shrink faster and faster over time.

Move to page 3.1 to 3.2.

10. You will now run through a simulation that requires you to "exercise" to keep your avatar's heart healthy enough to complete the mission when they arrive on Mars after a six month journey (in only 10 seconds!).



Questions related to 3.1 to 3.2

- Q14. Because Martian gravity is only 38% that of Earth's, why should astronauts worry about exercising while they are on a trip to Mars?
- Q15. Would exercising on a treadmill in microgravity be the same as running on Earth? Explain your answer.



Heart to Heart

Student Activity



Name _____

Class _____

For more information about NASA's One-Year Mission and Twins Study check out the links below:

<https://www.nasa.gov/1ym>

<https://www.nasa.gov/twins-study>