



Life Support Team Instructions

Overview

You need six people on the life support team. Here is what your team does:

1. Monitor and calculate the vital signs of astronauts. You'll use online Macromedia® Flash® tools, proportions, and cross-multiplication.
2. Graph data and predict how astronauts will perform.
3. Report the astronauts' vital signs and then advise the mission commander about whether the astronauts should rest or work.
4. Prepare respiration rate data for the task control team.

Team Tasks

Two team members monitor each astronaut. Each of you fills one of the following roles for your astronaut:

Cardiology Specialist

- Monitor the heart rate of your astronaut. You'll use a heart rate monitor, proportions, and cross-multiplication.
- Graph your astronaut's heart rate. Then you predict when your astronaut's heart rate will hit the critical threshold.
- Enter heart rate data into the computer.

Respiration Specialist

- Monitors your astronaut's respiration rate. You'll use a respiration monitor, proportions, and cross-multiplication.
- Graph your astronaut's respiration rate. Then you predict when your astronaut's respiration rate will hit the critical threshold.
- Enter respiration rate data into the computer.
- Fill out a report form with respiration rate data for the task control team.

Mission Preparation

1. Go to this web site:
www3.cet.edu/flashcom/satellite

Select "Life Support: (Your Astronaut's Name)" from the dropdown menu. The mission commander will give you the password to log in.

2. The mission commander will start the heart rate and respiration rate monitors for each astronaut.

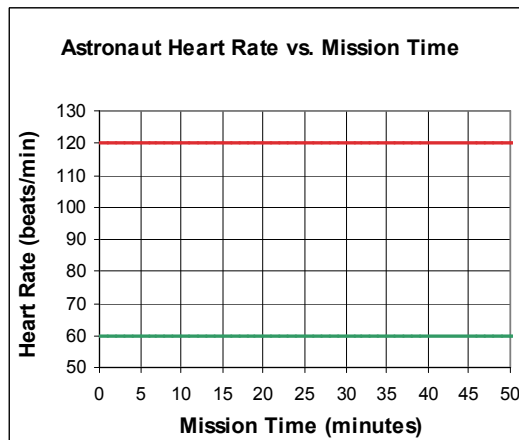
3. Click on the record button on your monitor to collect heart and respiration rate data. Directions for using the monitors are included below. Use proportions and calculate your astronaut's heart and respiration rates.
4. Each specialist graphs his or her data on the graphing worksheet and the large (11x17) wall graphs heart rate and respiration rate data. On the large wall graphs use a different color for each astronaut.
5. On your monitor fill in the blanks with the required information to send to the mission commander. Talk to the other specialist and decide if your astronaut's vital signs are increasing or decreasing. Then together, predict when your astronaut will reach the critical threshold. Next send your data and predictions to the mission commander through the computer.
6. Record the respiration rate on your report form. (Each of you needs your own set of report forms.) Tear off the report form and send it to the task control team via your communication officer.

Note: If your astronaut is close to reaching the critical threshold for heart or respiration rate, you must order your astronaut to rest.

Critical Thresholds for Astronauts

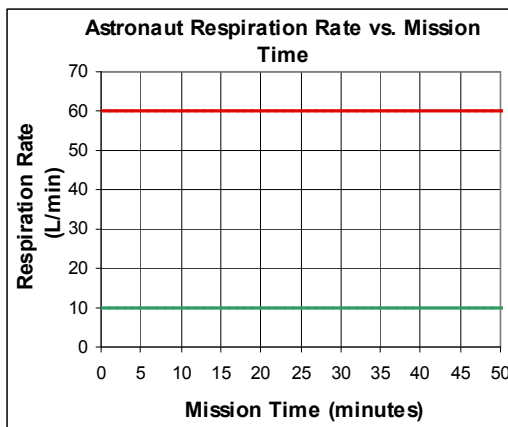
Heart Rate Critical Threshold

Each astronaut's heart rate should never rise above 120 beats per minute. That is the critical threshold for an astronaut's heart rate during an extravehicular activity (EVA). The astronaut will use his or her oxygen supply too quickly at this rate. If it looks as if the astronaut will soon reach either heart or respiration rate critical threshold, order the astronaut to rest. Return the astronaut to work once both rates return to the lower threshold.



Respiration Rate Critical Threshold

The astronaut's respiration rate should never rise above 60 liters of oxygen per minute. That is the critical threshold for an astronaut's respiration rate during an EVA. The astronaut will use his or her oxygen supply too quickly at this rate. If it looks as if the astronaut will soon reach critical threshold, order the astronaut to rest. Return the astronaut to work once both rates return to the lower threshold.



Prepare two large wall graphs like the ones shown here to record your astronaut's heart and respiration rate data. Use a red line for the critical threshold and a green line for the lower threshold. Use these graphs to predict when your astronaut will need to rest.

Heart and Respiration Rate Monitors

To calculate your astronaut's heart and respiration rates, first collect data using two monitors.

Astronaut Bob Vaughn Mission time: 2:03 min sec Record 1:21

Click on the record button to record heart and respiration data. Then follow the steps below to calculate the rates for your astronaut.

Calculating the Heart Rate

1. Click on the time tool under the cardio output monitor. Click in front of the first heartbeat you want to record. Then click again at the end of the

10th heartbeat. The box to the right of the time tool displays the amount of time it took for 10 heartbeats.

2. In fraction form use the heart rate you recorded as the first part of your proportion.

$$\frac{10 \text{ beats}}{7.4 \text{ sec}} = \frac{X \text{ beats}}{60 \text{ sec}}$$
3. Cross-multiply the proportion and solve for X beats.
4. Graph your answer on the graphing worksheet and the wall graph. Use the graphs to predict when your astronaut will reach the critical threshold.
5. Enter your information on the computer. Send it and the respiration data to the mission commander.
6. Take a reading every five minutes.

Calculating the Respiration Rate

1. Click on the time tool under the respiration output monitor. Click in front of the first respiration wave you want to record. Then click again at the end of the fifth respiration wave. The box to the right of the time tool displays the amount of time it took for five respirations.

2. Next, click on the volume tool under the respiration output monitor. Click on the first liters box you selected with the time tool. Then click again on the last box you selected to get the total amount of oxygen used. If you use the volume tool correctly, the volume boxes will be highlighted in pink, and the total volume will appear in the white box beside the volume tool.

- Use the total volume, recorded by the volume tool, over the time you recorded as the first part of your proportion.

$$\frac{6.31 \text{ L}}{18.2 \text{ sec}} = \frac{X \text{ L}}{60 \text{ sec}}$$

- Cross-multiply the proportion and solve for X liters.
- Graph your answer on your graphing worksheet and on the large wall graphs. Use the graphs to predict when your astronaut will reach the critical threshold.
- Enter your information on your computer. Send it and the heart rate data to the mission commander.
- Meet with the cardiology specialist and together fill out the report form for the task control team. Send the form to the task control team through your communications officer.
- Take a reading every five minutes.