

Circulation System:  
The River of Life  
Student Worksheet

Name \_\_\_\_\_

Class \_\_\_\_\_

**Background**

Blood is a body part that is often overlooked because it is made up, in large part, of liquid. This liquid portion of the blood is plasma, while the solid portion is the various blood cells. What relationship exists between the body mass and blood volume of a human?

The table below shows how body mass (in kilograms) and blood volume (in liters) are related.

Mass (kg)	Blood Volume (L)
30	2.5
40	3.4
50	4.3
60	5.2
70	6.1
80	7.0
90	7.9
100	8.8
110	9.7
120	10.6

It should be clear from the above data, and our own understanding, that the volume of blood increases with body mass. More mass means more veins, arteries, and capillaries to move the nutrients and waste to and from the cells.

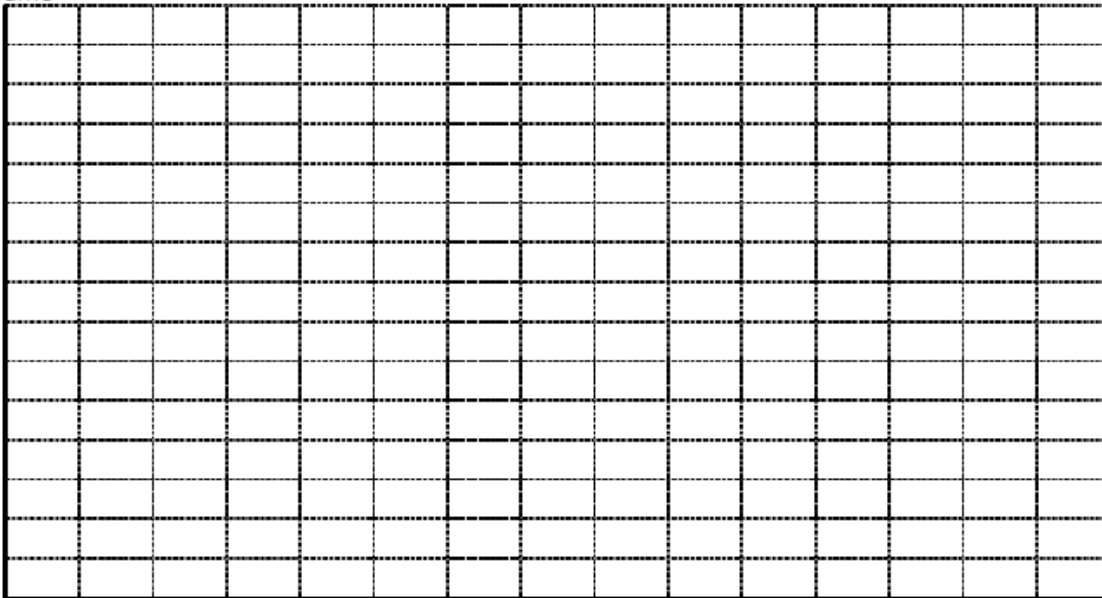
(Adapted from Jeff Lukens and Bob Tower 2001: Activity 11 The River of Life in Explorations: Biology with the TI-83 Plus Texas Instruments p. 97–105)

### Data Analysis

1. According to the data table, what type of relationship could exist between the amount of blood (L) in the body and the mass (kg) of a person?
2. Which variable would be the independent variable,  $x$ ?
3. Plot the values for the mass of a person and volume of blood.

Title \_\_\_\_\_

Axis name



Axes name

4. Draw a line of best fit for the graph.
5. Record the coordinates of two points on the line of best fit.
6. Mark the points as  $A$  and  $B$  on the graph.

Point  $A$  =

Point  $B$  =

- Using points *A* and *B*, calculate the slope of the line.
- What is the formula for determining the volume of blood a person has given his/her mass?
- How much blood would a person with a mass of 73 kg have?
- How much blood would a 4.1 kg newborn have?
- Estimate the mass of a person who has 5.5 L of blood in her body.
- Estimate the mass of a person who has 7.3 L of blood in his body.

13. If this same mass/volume relationship were true for all other mammals, how many liters of blood would there be in a horse that had a mass of 500 kg?
14. Nathan decided to donate blood at the blood bank. He can donate 0.5 L of blood. If his mass is 67 kg, calculate the percentage of his blood he donated.
15. If you donated 0.5 L of blood, what percentage of your blood did you donate?
16. Dehydration is a danger to your health. If 52% of blood is water, what is the volume of water circulating in the blood vessels of a 40 kg child? How much water is circulating in your blood?

17. Sodium is an abundant ion in the bloodstream. Normally, there are about 2,400 mg of sodium in one liter of blood. Approximately how much sodium flows through the bloodstream of a 66 kg person? Express your answer in both milligrams and grams.

One of the most important functions of the blood is to transport oxygen to all of your cells. The cells that do this are called erythrocytes, or red blood cells. Red blood cells are by far the most numerous cells in the blood, averaging about  $4.5 \times 10^6$  cells per microliter (1,000 microliters = 1 milliliter).

18. How many microliters are there in 1 *liter*?

19. Calculate the number of erythrocytes in your blood vessels.

Leukocytes, or white blood cells, are another type of blood cell in your body. On average, human blood contains about  $7.0 \times 10^3$  leukocytes per microliter.

20. Calculate the approximate number of leukocytes in your bloodstream.

21. Why does the number of white blood cells tend to fluctuate a lot more than the number of red blood cells?

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