

### Why Cells Are Small: Surface Area to Volume Ratios

The cells you've looked at in biology have all been with the use of a microscope: they've all been very, very small. Why? You've learned about osmosis and diffusion. This is how cells get almost everything they need: nutrients, ions, water, etc, and how they get rid of wastes

1. If a cell has a high concentration of waste that it wants to get rid of, which do you predict will be able to get rid of the waste sooner – a smaller cell or a large one? Explain your answer.

---



---

2. Chemical reactions in a cell cause heat, which can have a negative effect on the operation of enzymes in a cell. Would a larger cell or a smaller cell more easily release heat? Explain why.

---

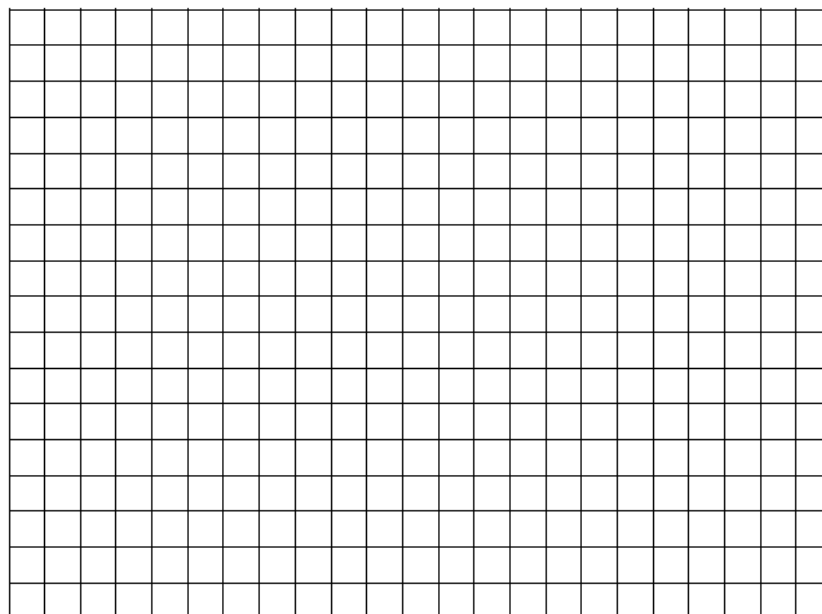


---

In an experiment a scientist wanted to see how quickly heat would diffuse from different cells. She used potatoes and cut 3 different sized models. The models were 2 cm<sup>3</sup>, 4 cm<sup>3</sup>, and 8 cm<sup>3</sup>. She warmed the potatoes to 60 °C and measured the change in temperature every 2 minutes for 20 minutes.

	TEMPERATURE (EVERY 2 MIN)									
	2 min	4min	6min	8min	10 min	12 min	14 min	16 min	18 min	20 min
2 cm <sup>3</sup>	53	47	40	33	27	22	18	18	18	18
4 cm <sup>3</sup>	57	54	50	47	44	40	37	33	30	27
8 cm <sup>3</sup>	58	56	54	52	49	46	44	42	39	37

Graph the data



3. What is the dependent variable? \_\_\_\_\_
4. What is the independent variable? \_\_\_\_\_
5. Which sized potato cooled off fastest? \_\_\_\_\_
6. Consider a mouse and an elephant. If both were left in the cold overnight, which would be in danger of freezing to death? Why?

\_\_\_\_\_

---

7. Fill in the blanks using the words **large** or **small**:
- a) As multicellular organisms grow and develop, their individual cells undergo cell division in order to remain \_\_\_\_\_.
- b) This means the whole organism can grow \_\_\_\_\_, but the total cell surface area of the organism grows \_\_\_\_\_ too.
- c) If the volume of an individual cell becomes \_\_\_\_\_, the cell will not be able to diffuse substances fast enough to survive.
8. Is a multicellular organism more likely to grow large because their cells are growing, or because they make more cells due to cell division? Explain your answer in terms of cell size.

\_\_\_\_\_

\_\_\_\_\_