

## Numbers in Biology

### Reading numbers and measurements:

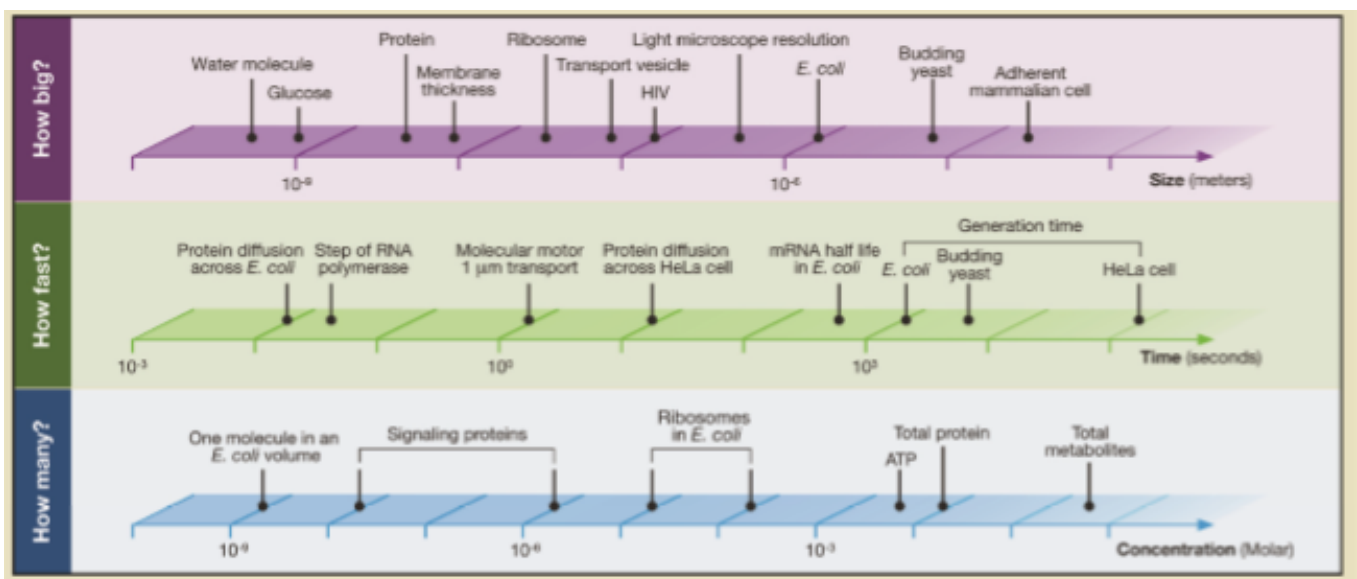
31%                      k<sup>3</sup>                      y<sup>2</sup>                      -70°F                      x


1,203.4                      10°C                      3a<sup>4</sup>                      :

3.14                      0.631                      =                      30.7°                      0.002

6.7x10<sup>-9</sup>km                      2376.69                      0.735μm                      42.9 kmh<sup>-1</sup>

**How Many Carbon Atoms Are in a Cell?** A cell with a volume of 1 μm<sup>3</sup> and a density of about 1 g/ml has a total mass of 10<sup>-12</sup> grams. From the formula C<sub>4</sub>H<sub>7</sub>O<sub>2</sub>N and the weights of the elements, we derive a carbon content of about  $12 \times 4 / (12 \times 4 + 7 \times 2 + 16 \times 2 + 14) = 48/101$  or about one half of the dry mass. With 30% dry mass (70% water), we obtain ~10<sup>-13</sup> gm of carbon. Next we transformed the number of molecules using Avogadro's constant:  $6 \times 10^{23} \times 10^{-13} / 12 = 5 \times 10^9$  carbon atoms per cell. To verify this, we have done the calculation in a different way: assuming there are about 3 × 10<sup>6</sup> proteins, each one consisting of about 300 amino acids, we get a total of ?10<sup>9</sup> amino acids. An amino acid has about five carbon atoms, so we arrive at a similar value. Both estimates depend linearly on the cell volume, which can vary significantly based on growth conditions.



11  34 Listen and answer questions 1–10.

**Questions 1–3**

Complete the table. Write **NO MORE THAN THREE WORDS AND/OR A NUMBER** for each answer

Animal	Brought by	Reason
1 .....	settlers	for food
fox	settlers	2 .....
cane toad	3 .....	to kill beetles

**Questions 4 and 5**

Complete the flowchart below.

Write **NO MORE THAN TWO WORDS AND/OR A NUMBER** for each answer.

**Beetles' effect on sugar cane**

Beetle lays eggs

Eggs become grubs

Grubs eat the 4 .....

Sugar cane 5 .....



**Questions 6–10**

Choose the correct letter, **A**, **B** or **C**.

- 6 The cane toad originated in  
**A** Central America.  
**B** Hawaii.  
**C** Australia.
- 7 In Australia, the toads  
**A** grew extremely large.  
**B** multiplied in number.  
**C** ate the cane beetles.
- 8 The farmers' plan failed because  
**A** there were too many beetles.  
**B** their own research was faulty.  
**C** they believed the reports they read.
- 9 The sugar cane industry  
**A** thrives today.  
**B** has died out in some areas.  
**C** survives alongside the beetle.
- 10 The second lesson to be learned from this story is that  
**A** the environment is constantly at risk.  
**B** first-hand research is not always necessary.  
**C** caution is necessary when dealing with nature.

**Questions 1–3**

Complete the summary. Write **NO MORE THAN TWO WORDS AND/OR A NUMBER** for each answer.

**ROVER ROBOT**

The robot does the same work as a 1 ..... . Some people think it looks like a 2 ..... on wheels. It is quite small, weighing only 16.5 kg and it moves relatively slowly, with a maximum speed of 3 ..... km an hour.

**Questions 4–7**

Label the diagram of the rover robot.

Write **NO MORE THAN THREE WORDS** for each answer.



**Questions 8–10**

Answer the questions below.

Write **NO MORE THAN THREE WORDS AND/OR A NUMBER** for each answer.

- 8 How long does it take the radio signal to travel from Earth to Mars? .....
- 9 What stops the scientists from steering the rover in real time? .....
- 10 What do scientists believe Mars has, which is similar to Earth? .....