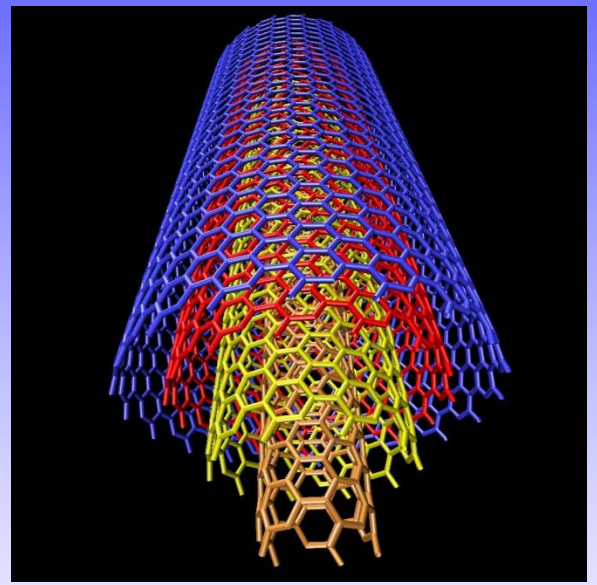
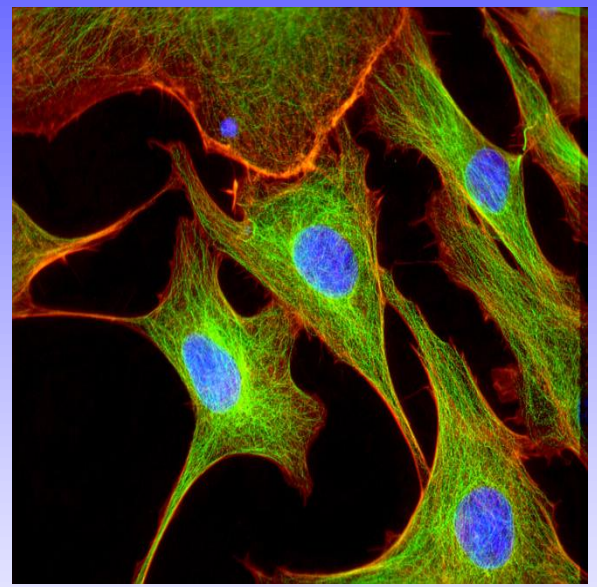
States of Matter





Auburn Mountainview

Karl Steffin, 2001

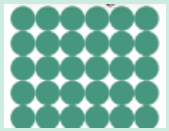
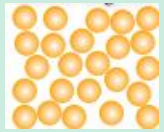
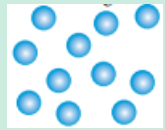
7/29/2026

By end of this lesson, I can…

- **A.1 Create and/or evaluate models that illustrate how the motion and arrangement of particles differ among solids, liquids, and gases.**
- **A.2 Describe how the properties of solids, liquids, and gases are related to particle arrangement.**
- **A.3 Create and/or evaluate models that illustrate how changes in temperature influence the motion of particles in solids, liquids, and gases.**
- **B.1 Justify the choice of equipment used to make a measurement, based on precision.**
- **B.2 Record measured values to the proper experimental precision.**
- **C.1 Create and/or evaluate particulate and graphical models representing the density of pure substances.**
- **C.2 Explain the relationship between the density and the arrangement of particles within a pure substance.**
- **C.3 Perform calculations relating to the density of pure substances.**

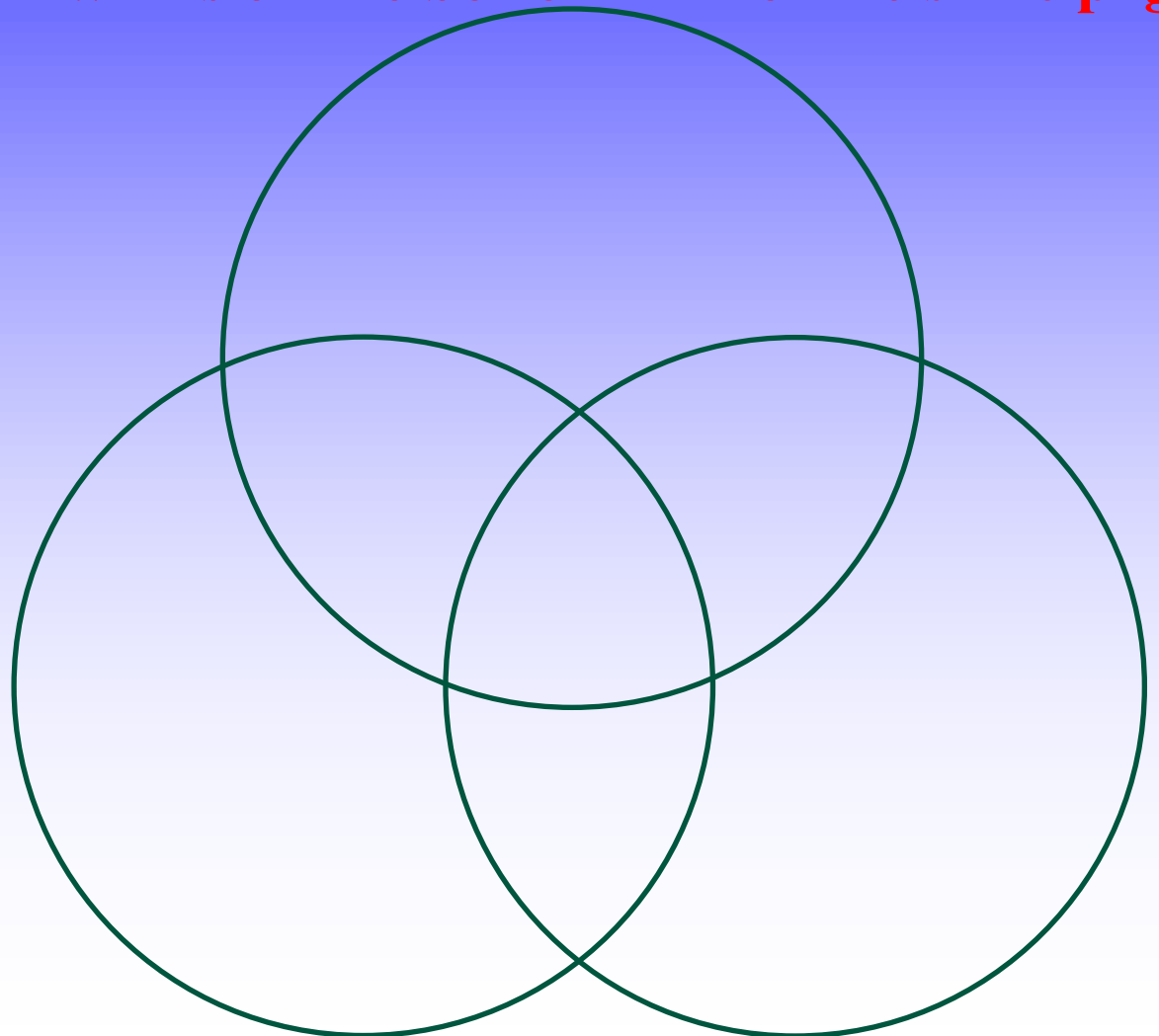
States of Matter

Write this table on the top half of a new page.

Solid or Liquid or Gas?		
Fills any container you put it in	Flows from one container to another	Has mass
Takes the shape of the container	Has a fixed shape	Particles are spaced very close together
Often feels hard to the touch	Particles are spaced somewhat close together	Particles are spaced far apart
Does not flow	Particles are arranged in an organized way	Particles are arranged randomly
		

States of Matter

Draw this on the bottom half of the same page



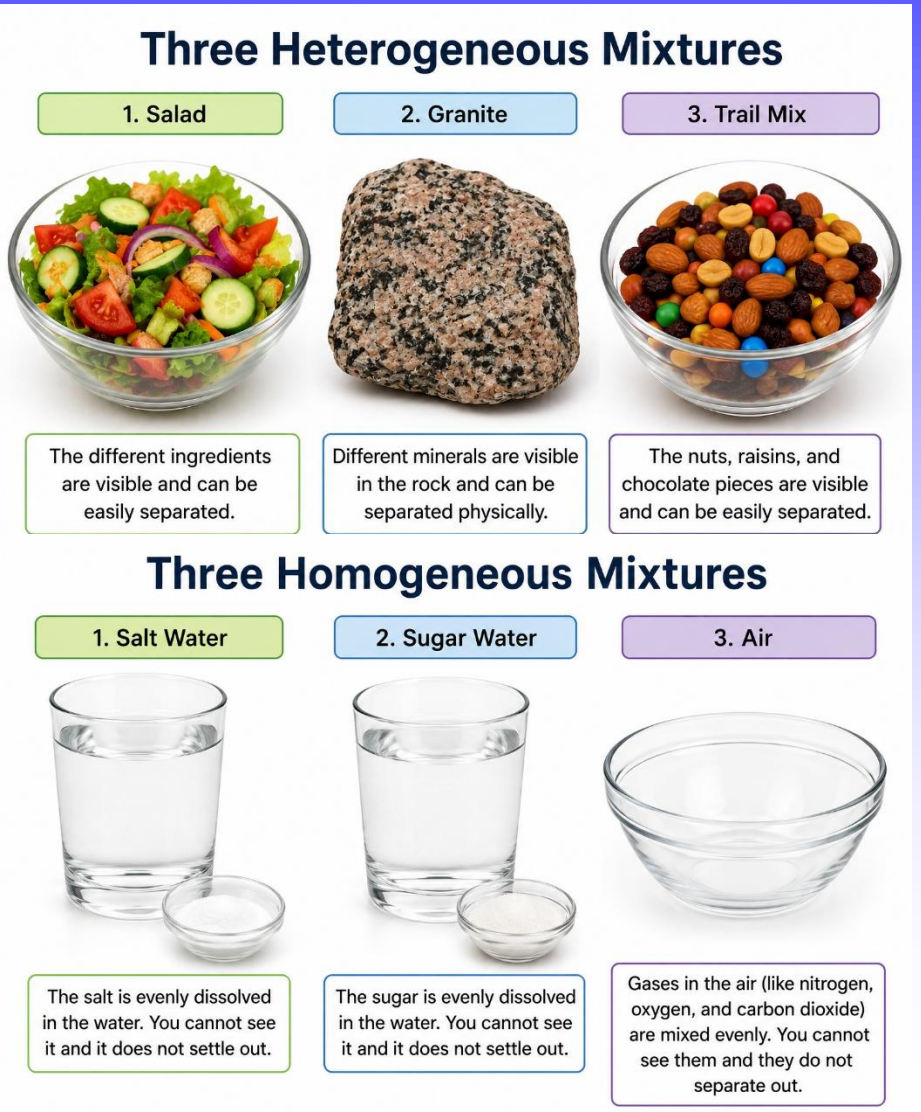
Matter: Pure Substances

- **Elements are atoms with a set number of protons. (Gold)**

or

- **Compounds are two or more different atoms bonded together. (Quartz)**

Matter: Mixtures



- **Homogeneous: Two or more compounds (not bonded) together in equal proportions.**

or

- **Heterogeneous: Two or more compounds or atoms (not bonded) together in unequal proportions.**

Changing Matter

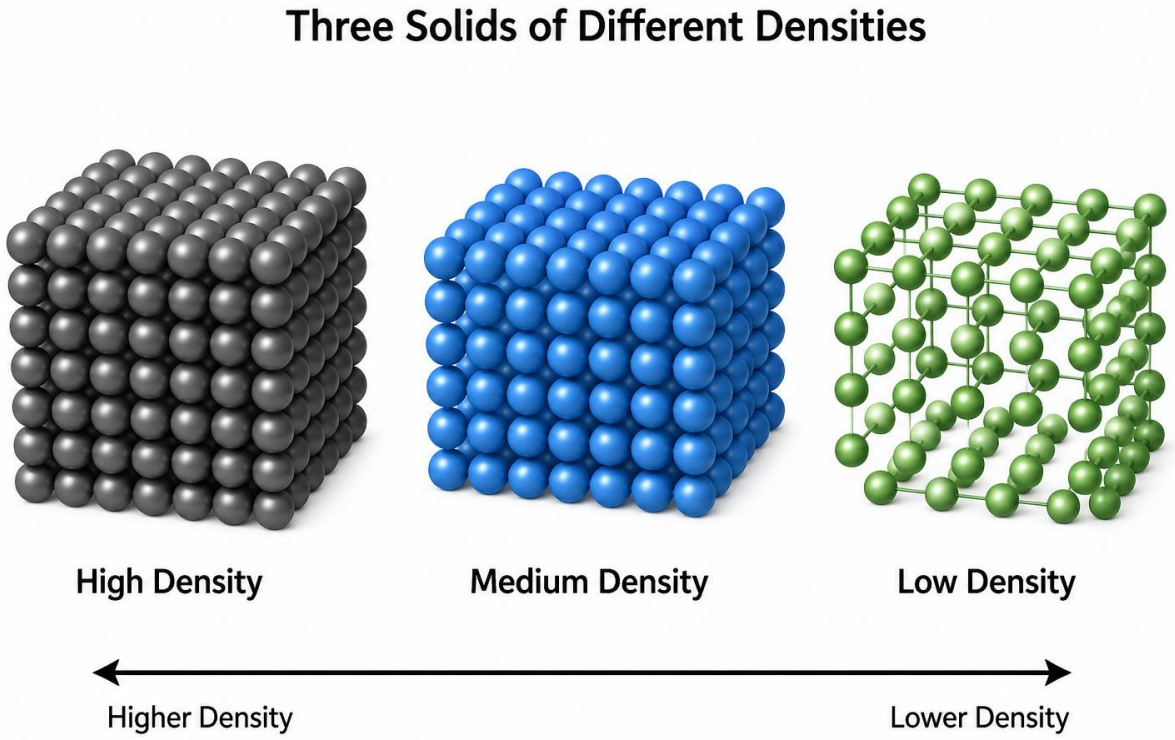
- **Physical: DO NOT alter the identity.**
  - **Phase Changes (Increasing/Decreasing Energy)**
  - **Magnetic (Temporary addition or removal)**
  - **Shape Changes (Molding, Drawing, Pounding)**
  - **Mixing/Crystallizing (Salt + Water, Carbon→ Diamond)**
  - **Breaking (Tear, Crush, Bend)**
- **Chemical: Alter the identity.**
  - **Oxidization/Reduction (Rust, Tarnish, Burn)**
  - **Cooking (Denaturing Proteins)**
  - **Organic (Photosynthesis, Ripening, Rotting)**
  - **Reacting (Synthesize, Decompose, Replace)**

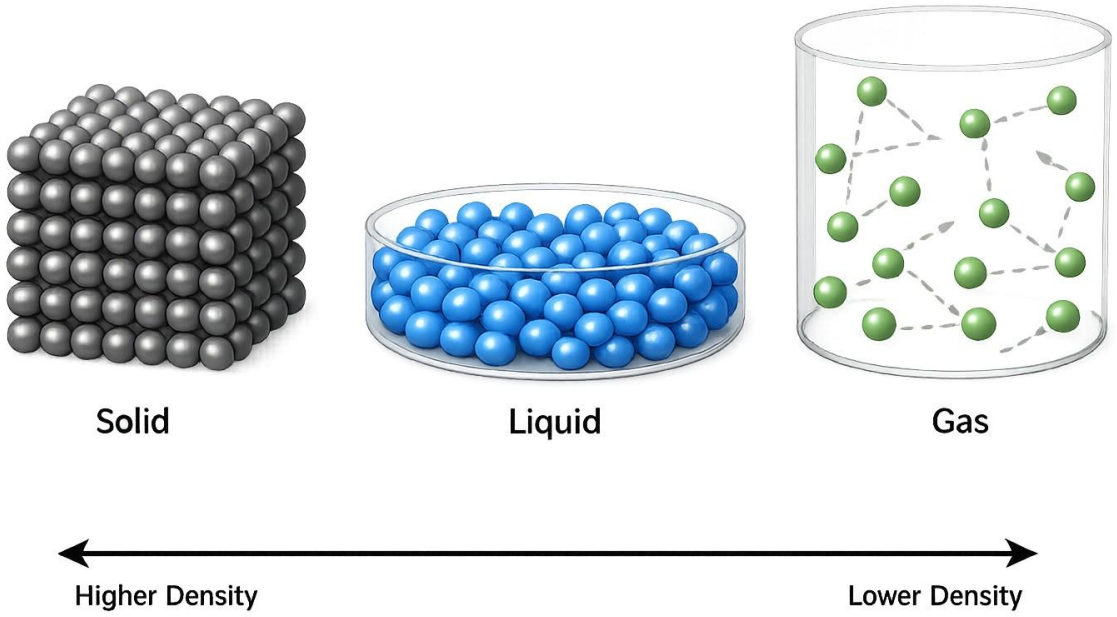
Mass and Density

- **Mass: quantity of matter in an object (kg)**
- **Volume: quantity of space that matter occupies (m^3)**
- **Density: the relationship between mass and volume of an object (kg/m^3)**

For any substance $D = \frac{m}{V}$.

Particle look at Density





Density Example

- **What mass of water is needed to fill an Olympic size pool (50-m x 25-m, 3.0-m deep)?**

$$D = \frac{m}{V}$$

$$V = l \cdot w \cdot h$$
$$V = 50 - m \cdot 25 - m \cdot 3 - m$$
$$V = 3750 - m^3$$

D= 1000-kg/m^3
m= ?
V= 3750-m^3
l= 50-m
w= 25-m
h= 3-m

$$1000 - \frac{kg}{m^3} = \frac{m}{3750 - m^3}$$

$$m = 3,750,000 - kg$$

m = 3.8 x 10^6-kg

Density Example Ratios

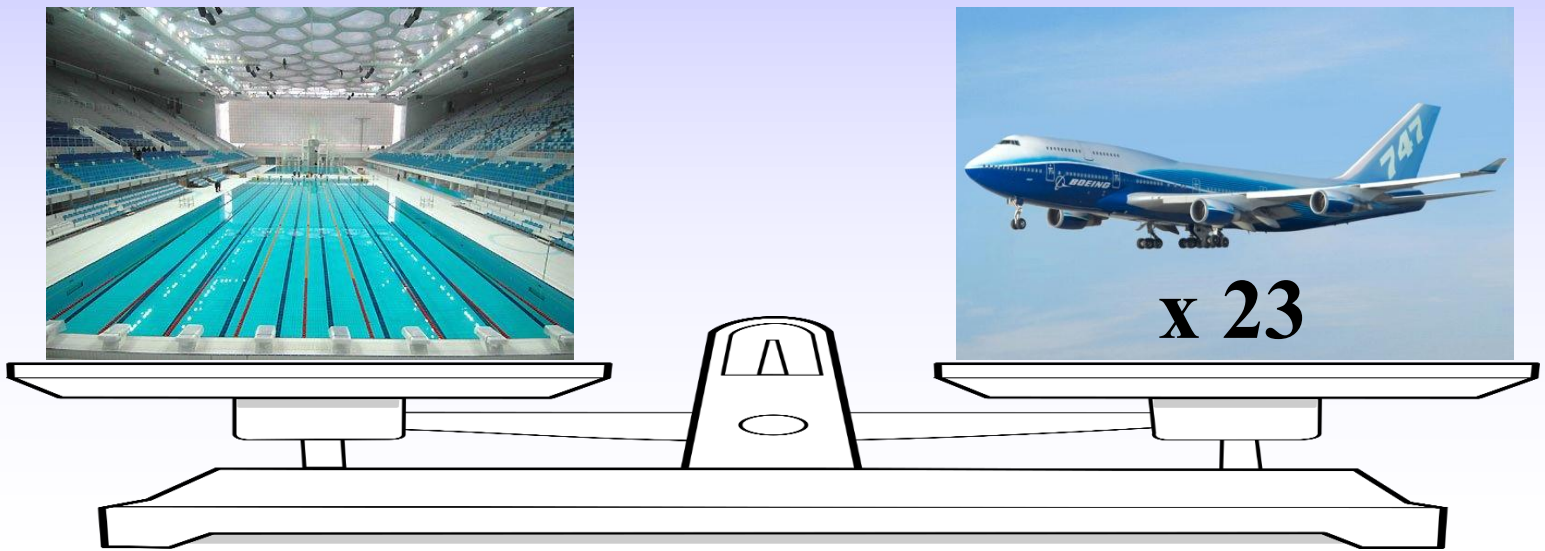
- Comparisons (ratios) can bridge the gap between very big and very small numbers.
- Compare the mass of the pools water to the mass of a Boeing 747 (162400-kg).

$m_{pool} = 3.75 \times 10^6$-kg
$m_{747} = 1.62 \times 10^5$-kg

$$R = \frac{m_{pool}}{m_{747}}$$

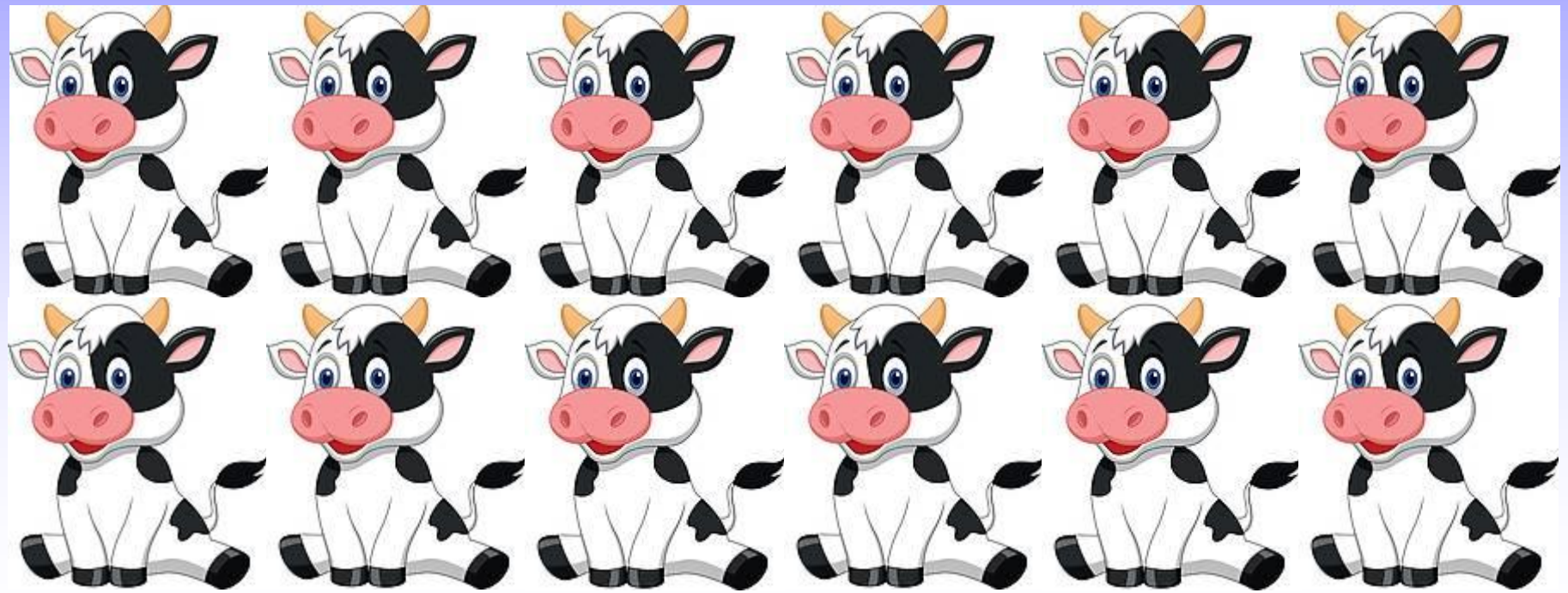
$$R = \frac{3,750,000 - kg}{162,400 - kg}$$

$$R = 23$$



Self Check

- **I measure that there are 15 cows on this page… do an Error Analysis (EA).**



Leave space under question to solve in class

Self Check

- **What percentage of the animals have feathers?**

Leave Space under question to solve in class