

**Section C.1: Significant Digits****Significant digits**

The digits in a number that represents actual measurements and therefore have meaning are called *significant digits*.

Significant digits:

- Nonzero digits.
- Zeros that follow a nonzero digit and lie to the right of the decimal point:
  
- Zeros between nonzero digits or other significant zeros:

Not significant digits:

- Zeros to the left of the first nonzero digit:
  
- Zeros to the right of the last nonzero digit but before the decimal point:

**Ex.1**

- 132 pounds has 3 significant digits and implies a measurement to the nearest pound.
- 132.00 pounds has 5 significant digits and implies a measurement to the nearest hundredth of a pound.
- $2 \times 10^2$  students has 1 significant digit and implies a measurement to the nearest hundred students.
- $2.00 \times 10^2$  students has 3 significant digits and implies exactly 200 students.

**Ex.2** Counting significant digits.

State the number of significant digits and the implied meaning of the following numbers:

- (1) a time of 11.90 seconds;
- (2) a length of 0.000067 meter;
- (3) a population reported as 240,000;
- (4) a population reported as  $2.40 \times 10^5$ .

**Section C.2: Rounding****Significant digits**

The basic process of rounding numbers takes two steps:

- **Step 1:** Decide which decimal place (for example, tens, ones, tenths or hundredths) is the smallest that should be kept.
- **Step 2:** Look at the number in the nearest place to the *right* (for example, if rounding the tenths, look at hundredths). If the value in the next place is *less than 5* round *down*, if it is 5 or *greater than 5*, round *up*.

**Ex.3**

- 382.2593 rounded to the nearest thousandth is 382.259.
- 382.2593 rounded to the nearest hundredth is 382.26.
- 382.2593 rounded to the nearest tenth is 382.3.
- 382.2593 rounded to the nearest one is 382.
- 382.2593 rounded to the nearest ten is 380.
- 382.2593 rounded to the nearest hundred is 400.

Ex.4 Rounding with significant digits.

For each of the following operations, give your answer with the specified number of significant digits:

- (1)  $7.7 \text{ mm} \times 9.92 \text{ mm}$ ; give your answer with 2 significant digits;
- (2)  $240,000 \times 72,106$ ; give your answer with 4 significant digits.

### Section C.3: Understanding Errors

#### Types of Error: Random and Systematic

Types of error: random error and systematic error

There are two types of error:

Significant digits:

- *Random errors* occur because of random and inherently unpredictable events in the measurement process. We can minimize the effect of random errors by making many measurements and averaging them.
- *Systematic errors* occur when there is a problem in the measurement system that affect all measurements in the same way, such as making them all too low or too high by the same amount. If we discover a systematic error, we can go back and adjust the affected measurements.