

2.1 PreTest: Precision, Scientific Notation, Vectors, Kinematics Intro

1. Round each value to three significant figures.

- (a) 0.003297 m *0.00330* (c) 5.9998 s *6.00*
(b) 93.085 kg *93.1* (d) 12,450 N *12,500*

2. Write each number in proper scientific notation ($1 \leq a < 10$).

- (a) 0.00045 = *4.5×10^{-4}* (c) 602,000,000 = *6.02×10^8*
(b) 38,200 = *3.82×10^4* (d) 0.00875 = *8.75×10^{-3}*

3. Express in standard (long) form.

- (a) 6.07×10^{-4} *0.000607* (b) 1.002×10^5 *100200*

4. Perform each operation and give the answer to 3 significant figures.

- (a) $(3.2 \times 10^3) + (7.5 \times 10^2)$ *$= 3,950$ 3.95×10^3* (c) $\frac{4.5 \times 10^5}{9.0 \times 10^2} = 500$
(b) $(6.40 \times 10^{-2}) \times (2.5 \times 10^3)$ *160*

5. A board's width is measured as 12.4 ± 0.2 cm.

(a) What is the range of possible values?

*$12.6 - 12.2$ cm
 12.2 to 12.6 cm*

(b) What is the percent uncertainty? (show work)

*$\frac{0.2}{12.4} = 1.61$
 $\approx 1.61\% \approx 2\%$*

6. A mass is measured as 0.815 kg with an uncertainty of ± 0.005 kg.

(a) Calculate the percent uncertainty. $\frac{0.005}{0.815} = 0.0061349 \dots \approx 0.61\%$

(b) Which measurement (the board or this mass) is more precise? Explain briefly.

Unit Conversions

7. Convert each value. Show one line of work using unit factors.

(a) 2.35 m to cm

$$235 \text{ cm}$$

(d) 0.650 kg to g

$$650 \text{ g}$$

(b) 7.20 km to m

$$7200$$

(e) 4.20×10^3 g to kg

$$4.20 \text{ kg}$$

(c) 18.0 in to cm

(1 in = 2.54 cm)

$$18.0 \text{ in} \cdot \frac{2.54 \text{ cm}}{1 \text{ in}} = 45.72 \text{ cm} \approx 45.7 \text{ cm}$$

(f) 15.5 lb to kg

$$15.5 \text{ lb}$$

(1 lb = 0.454 kg)

$$= 7.037 \text{ kg} \approx 7.04 \text{ kg}$$

8. Convert each speed.

(a) 55.0 mi/h to m/s

$$55.0 \frac{\text{mi}}{\text{hr}} \cdot \frac{1609 \text{ m}}{1 \text{ mile}} \cdot \frac{1 \text{ hr}}{3600 \text{ s}} = \frac{88495}{3600} = 24.58 \text{ m/s} \approx 24.6$$

(1 mi = 1609 m)

(b) 4.20 m/s to km/h

$$4.20 \text{ m/s} \cdot \frac{1 \text{ km}}{1000} \cdot \frac{3600 \text{ s}}{1 \text{ h}} = 15.12 \text{ km/h} \approx 15.1$$

(c) A car moves at 22.5 m/s. How long does it take to travel 1.00 km?

$$1.00 \text{ km} = 1000 \text{ m}$$

$$t = \frac{d}{s} = \frac{1000}{22.5} = 44.4 \text{ s.}$$

Order of Magnitude Estimation

9. Choose the best order of magnitude.

- (a) Mass of a textbook: A) 10^{-3} kg B) 10^{-1} kg C) 10^0 kg D) 10^2 kg

A book weighs a couple pounds

- (b) Length of a classroom: A) 10^{-2} m B) 10^0 m C) 10^1 m D) 10^3 m

A large classroom might be 30 ft. long

- (c) Time for light to cross 10 m: A) 10^{-8} s B) 10^{-6} s C) 10^{-3} s D) 10^0 s

Light travels 300,000,000 m/s

One-Dimensional Motion and Vectors

10. A student walks along a straight hallway (forward is +). Start $x_0 = 2.0$ m.

- (a) To $x = 7.5$ m, find displacement Δx .

$$\Delta x = 7.5 - 2.0 = +5.5 \text{ m}$$

- (b) From $x = 7.5$ m back to $x = 4.0$ m, find Δx .

$$\Delta = 4.0 - 7.5 = -3.5 \text{ m}$$

- (c) Total displacement from start to finish.

$$d = \cancel{+5.5} + \cancel{-3.5} = 2.0 \text{ m} = 4.0 - 2.0 = 2.0 \text{ m}$$

displacement 2.0

11. A cart moves from $x_1 = 1.2$ m at $t_1 = 0.0$ s to $x_2 = 5.8$ m at $t_2 = 3.0$ s. (2 sig figs)

- (a) Find displacement.

$$d = |5.8 - 1.2| = 4.6 \text{ m}$$

- (b) Find average velocity v_{avg} .

$$\bar{v} = \frac{\Delta x}{\Delta t} = \frac{5.8 - 1.2}{3.0 - 0} = 1.5\bar{3} \approx +1.5 \text{ m/s}$$

- (c) State the units for v_{avg} .

meters per second

12. A cyclist rides east, then west:

EAST Positive

- (a) From $x = 0$ m to $x = 30$ m in 12 s.

$$\bar{v} = \frac{\Delta x}{\Delta t} = \frac{30 - 0}{12} = 2.5 \text{ m/s}$$

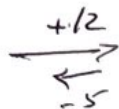
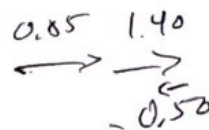
- (b) Then back to $x = 18$ m at $t = 20$ s.

$$\bar{v} = \frac{18 - 30}{20 - 12} = -1.5 \text{ m/s}$$

- (c) Find each displacement, total displacement, and total distance traveled.

$$30, -12; \text{ total } +18 \text{ m}; \text{ distance} = |30| + |-12| = 42 \text{ m}$$

13. One-dimensional vector additions (east is +).



(a) $\Delta x_1 = +12 \text{ m}$, $\Delta x_2 = -5 \text{ m}$

$$\Delta x = +12 - 5 = +7 \text{ m}$$

(b) $+0.85 \text{ km}$, $+1.40 \text{ km}$, -0.50 km

$$\Delta x = 0.85 + 1.40 - 0.50 = +1.75 \text{ km}$$

Why is distance not always equal to displacement?

Because when direction changes, the displacement can offset itself but distance increases

14. A car travels at 88 km/h . The driver looks away for 1.6 s .

2 sig figs

(a) Convert 88 km/h to m/s .

$$88 \frac{\text{km}}{\text{hr}} \cdot \frac{1000 \text{ m}}{1 \text{ km}} \cdot \frac{1 \text{ hr}}{3600 \text{ s}} = 24.4 \text{ m/s} \approx 24 \text{ m/s}$$

(b) How far does the car move in 1.6 s ?

$$24.4 \frac{\text{m}}{\text{s}} \cdot 1.6 \text{ s} = 39.0 \text{ m} \approx 39 \text{ m}$$

(or $38.4 \approx 38 \text{ m}$)

15. A cart starts from rest and accelerates at 0.80 m/s^2 .

(a) Find its speed after 5.0 s .

$$v = 0.80 \frac{\text{m}}{\text{s}^2} \cdot 5 \text{ s} = 4.0 \text{ m/s}$$

(b) Interpret physically what 0.80 m/s^2 means.

Its speed increases 0.8 m/s each second

(c) If displacement is 10.0 m , find average velocity.

$$\bar{v} = \frac{\text{displacement}}{t} = \frac{10 \text{ m}}{5 \text{ s}} = 2 \text{ m/s}$$

16. A drone flies north at 12.0 m/s for 45.0 s .

(a) Convert 12.0 m/s to km/h .

$$12.0 \frac{\text{m}}{\text{s}} \cdot \frac{1 \text{ km}}{1000 \text{ m}} \cdot \frac{3600 \text{ s}}{1 \text{ hr}} = 43.2 \text{ km/h}$$

(b) Find distance traveled.

$$d = 12.0 \text{ m/s} \cdot 45.0 \text{ s} = 540 \text{ m}$$

(c) If south is negative, what sign would you assign to this displacement?

positive