

Physics 9 Homework: Measurement, Units, and Intro to Motion

Name: _____

Date: _____

1. Rounding to 3 significant figures

a) 0.003297 m

Answer: _____

b) 93.085 kg

Answer: _____

c) 5.9998 s

Answer: _____

d) 12,450 N

Answer: _____

2. Scientific notation (write each in the form $a \times 10^n$ with $1 \leq a < 10$)

a) 0.000 45

b) 38,200

c) 6.07×10^{-4} (write in standard/long form)

d) 1.002×10^5 (write in standard/long form)

3. Operations in scientific notation

Carry out the operation and give the answer to *3 significant figures*.

a) $(3.2 \times 10^3) + (7.5 \times 10^2) =$ _____

b) $(6.40 \times 10^{-2}) \times (2.5 \times 10^3) =$ _____

c) $\frac{4.5 \times 10^5}{9.0 \times 10^2} =$ _____

4. Percent uncertainty / percent precision

A length is measured as $12.4 \text{ cm} \pm 0.2 \text{ cm}$.

a) What is the range of possible values? _____

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

A mass is quoted as 0.815 kg and the instrument is reliable to $\pm 0.005 \text{ kg}$. c) Percent uncertainty for the mass = _____

5. Unit conversions: length

Show your factor(s). Keep 3 sig figs.

a) Convert 2.35 m to cm . _____

b) Convert 7.20 km to m . _____

c) Convert 18.0 in to cm . (Use $1 \text{ in} = 2.54 \text{ cm}$ exactly.) _____

6. Unit conversions: mass

- a) Convert 0.650 kg to g. _____
- b) Convert 4.20×10^3 g to kg. _____
- c) A backpack has a mass of 15.5 lb. Using $1 \text{ lb} = 0.454 \text{ kg}$, find its mass in kg to 3 sig figs.

7. Unit conversions: speed

- a) Convert 55.0 mi/h to m/s. (Use $1 \text{ mi} = 1609 \text{ m}$ and $1 \text{ h} = 3600 \text{ s}$)
- b) A runner moves at 4.20 m/s. What is this speed in km/h? _____
- c) A car moves at 22.5 m/s. How many seconds does it take to travel 1.00 km at this speed?

8. Order-of-magnitude quick check (circle one)

- 1) The mass of a textbook is closest to A) 10^{-3} kg B) 10^{-1} kg C) 10^0 kg D) 10^2 kg
- 2) The length of a classroom is closest to A) 10^{-2} m B) 10^0 m C) 10^1 m D) 10^3 m
- 3) The time for light to cross a classroom ($\sim 10 \text{ m}$) is closest to A) 10^{-8} s B) 10^{-6} s C) 10^{-3} s D) 10^0 s

9. One-dimensional displacement

A student walks along a straight hallway. Take forward (to the right) as +. He starts at $x_0 = 2.0 \text{ m}$.

- a) He walks to $x = 7.5 \text{ m}$. What is his displacement Δx ? _____
- b) From $x = 7.5 \text{ m}$ he walks back to $x = 4.0 \text{ m}$. What is his displacement for this part?

- c) What is his *total* displacement from the start at 2.0 m to the end at 4.0 m? _____

10. Average velocity from position–time

A cart is at $x_1 = 1.2 \text{ m}$ at $t_1 = 0.0 \text{ s}$ and later is at $x_2 = 5.8 \text{ m}$ at $t_2 = 3.0 \text{ s}$.

- a) Find the displacement. _____
- b) Find the average velocity v_{avg} during this interval. _____
- c) Write the units for v_{avg} clearly. _____

11. Motion with a direction change

A cyclist rides east at constant speed. She is at $x = 0 \text{ m}$ at $t = 0 \text{ s}$. After 12 s she is at $x = 30 \text{ m}$. She then turns around and rides west and is at $x = 18 \text{ m}$ at $t = 20 \text{ s}$.

- a) Displacement from $t = 0$ to $t = 12$ s: _____
- b) Average velocity from $t = 0$ to $t = 12$ s: _____
- c) Displacement from $t = 12$ s to $t = 20$ s: _____
- d) Total displacement from $t = 0$ to $t = 20$ s: _____
- e) Total distance traveled from $t = 0$ to $t = 20$ s: _____

12. Simple “one-dimensional vector” additions

Treat right/east as $+$ and left/west as $-$.

- a) $\Delta x_1 = +12$ m and $\Delta x_2 = -5$ m. Net displacement = _____
- b) A car drives $+0.85$ km, then $+1.40$ km, then -0.50 km. Net displacement (in km) = _____
- c) Explain in one sentence why distance traveled is not always equal to displacement.

13. Short application, like the textbook but with new numbers

A car travels at 88 km/h along a straight road. The driver looks down at the radio for 1.6 s.

- a) Convert 88 km/h to m/s. _____
- b) How far does the car travel in 1.6 s at this speed? Give 3 sig figs. _____
- c) Why is it important to keep track of units in every step?

14. Intro acceleration (very simple)

A cart starts from rest and speeds up in a straight line with a constant acceleration of 0.80 m/s².

- a) What is its speed after 5.0 s? (Use $v = v_0 + at$.) _____
- b) In words, what does the number 0.80 m/s² tell you about the motion?
- c) If the cart’s displacement in that time was 10.0 m, what was its average velocity? _____

15. Mixed practice (convert + compute)

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

- a) Convert 12.0 m/s to km/h. _____
- b) How far (in m) does it travel in 45.0 s? _____
- c) If we choose south as the negative direction, what sign should we give to the displacement you found in part (b)? Explain.