

MisConceptual Questions

[List all answers that are valid.]

- The laws of physics
 - are permanent and unalterable.
 - are part of nature and are waiting to be discovered.
 - can change, but only because of evidence that convinces the community of physicists.
 - apply to physics but not necessarily to chemistry or other fields.
 - were basically complete by 1900, and have undergone only minor revisions since.
 - are accepted by all major world countries, and cannot be changed without international treaties.
- How should we write the result of the following calculation, being careful about significant figures?
 $(3.84 \text{ s})(37 \text{ m/s}) + (5.3 \text{ s})(14.1 \text{ m/s}) =$
 - 200 m.
 - 210 m.
 - 216.81 m.
 - 217 m.
 - 220 m.
- Four students use different instruments to measure the length of the same pen. Which measurement implies the greatest precision?
 - 160.0 mm.
 - 16.0 cm.
 - 0.160 m.
 - 0.00016 km.
 - Need more information.
- The number 0.0078 has how many significant figures?
 - 1.
 - 2.
 - 3.
 - 4.

- How many significant figures does $1.362 + 25.2$ have?
 - 2.
 - 3.
 - 4.
 - 5.
- Accuracy represents
 - repeatability of a measurement, using a given instrument.
 - how close a measurement is to the true value.
 - an ideal number of measurements to make.
 - how poorly an instrument is operating.
- Precision represents
 - repeatability of a measurement, using a given instrument.
 - how close a measurement is to the true value.
 - an ideal number of measurements to make.
 - how poorly an instrument is operating.
- To convert from ft^2 to yd^2 , you should
 - multiply by 3.
 - multiply by $1/3$.
 - multiply by 9.
 - multiply by $1/9$.
 - multiply by 6.
 - multiply by $1/6$.
- Which is *not* true about an order-of-magnitude estimation?
 - It gives you a rough idea of the answer.
 - It can be done by keeping only one significant figure.
 - It can be used to check if an exact calculation is reasonable.
 - It may require making some reasonable assumptions in order to calculate the answer.
 - It will always be accurate to at least two significant figures.
- $[L^2]$ represents the dimensions for which of the following?
 - cm^2 .
 - square feet.
 - m^2 .
 - All of the above.

Problems

[The Problems at the end of each Chapter are ranked I, II, or III according to estimated difficulty, with (I) Problems being easiest. Level III are meant as challenges for the best students. The Problems are arranged by Section, meaning that the reader should have read up to and including that Section, but not only that Section—Problems often depend on earlier material. Next is a set of “General Problems” not arranged by Section and not ranked.]

1–3 Measurement, Uncertainty, Significant Figures

(Note: In Problems, assume a number like 6.4 is accurate to ± 0.1 ; and 950 is accurate to 2 significant figures (± 10) unless 950 is said to be “precisely” or “very nearly” 950, in which case assume 950 ± 1 .)

- (I) How many significant figures do each of the following numbers have: (a) 777, (b) 81.60, (c) 7.03, (d) 0.03, (e) 0.0086, (f) 6465, and (g) 8700?
- (I) Write the following numbers in powers of 10 notation: (a) 5.859, (b) 21.8, (c) 0.0068, (d) 328.65, (e) 0.219, (f) 444.
- (I) Write out the following numbers in full with the correct number of zeros: (a) 8.69×10^5 , (b) 9.1×10^3 , (c) 2.5×10^{-1} , (d) 4.76×10^2 , and (e) 3.62×10^{-5} .
- (II) What is the percent uncertainty in the measurement $3.25 \pm 0.35 \text{ m}$?
- (II) Time intervals measured with a physical stopwatch typically have an uncertainty of about 0.2 s, due to human reaction time at the start and stop moments. What is the percent uncertainty of a hand-timed measurement of (a) 4.5 s, (b) 45 s, (c) 4.5 min?

- (II) Add $(9.2 \times 10^3 \text{ s}) + (6.3 \times 10^4 \text{ s}) + (0.008 \times 10^6 \text{ s})$.
- (II) Multiply $4.079 \times 10^2 \text{ m}$ by $0.057 \times 10^{-1} \text{ m}$, taking into account significant figures.
- (II) What, approximately, is the percent uncertainty for a measurement given as 1.27 m^2 ?
- (II) For small angles θ , the numerical value of $\sin \theta$ is approximately the same as the numerical value of $\tan \theta$. Find the largest angle for which sine and tangent agree to within two significant figures.
- (II) A report stated that “a survey of 215 students found that 37.2% had bought a sugar-rich soft drink the day before.” (a) How many students bought a soft drink? (b) What is wrong with the original statement?
- (II) A watch manufacturer claims that its watches gain or lose no more than 9 seconds in a year. How accurate are these watches, expressed as a percentage?
- (III) What is the area, and its approximate uncertainty, of a circle of radius $5.1 \times 10^4 \text{ cm}$?
- (III) What, roughly, is the percent uncertainty in the volume of a spherical beach ball of radius $r = 0.64 \pm 0.04 \text{ m}$?

1–4 and 1–5 Units, Standards, SI, Converting Units

- (I) Write the following as full (decimal) numbers without prefixes on the units: (a) 286.6 mm, (b) $74 \mu\text{V}$, (c) 430 mg, (d) 47.2 ps, (e) 22.5 nm, (f) 2.50 gigavolts.