Physics 121
Homework Solutions
Chapter 1

Q3. The accuracy of your answer depends on the accuracy of the measurements used to calculate it, not on the number of digits present at the end of the calculation. If the measurements are only good to 10%, listing digits that imply an uncertainty less than that is not appropriate.

Q5. Units matter! 5m is a very different answer than 5cm or 5 km.

Q7. 8.32 cm. The 2 in the calculation is exact; there is no uncertainty in it. The only other measurement (the 4.16 cm) has 3 significant figures, so that's what your final answer should have.

P2. (a) 3 (b) 4 (the zero counts because it's on the right. If we only had 3 significant figures, we'd write 81.6) (c) 3 (d) 1 (e) 2 (f) 4 (g) 2

P3. (a) 1.156×10^0 (or just 1.156) (b) 2.18×10^1 (c) 6.8×10^{-3} (d) 2.7365×10^1 (e) 2.19×10^{-1} (f) 4.44×10^2

P4. (a) 86900 (b) 9100 (c) 0.88 (d) 476 (e) 0.0000362

P5. We assume that the uncertainty is ±0.01, so the % uncertainty is 0.01/1.57, or **0.6%.**

P6. 0.25/3.76 = 0.06648… which we round to 0.07. So the uncertainty is **7%**.

P9. **1.7** . The 0.082×10^{-1} has two significant figures, so that's what the answer should have.

P11. The formula for volume of a sphere is $V = 4/3*pi*r^3$. The 4/3 and the pi are exact, so they don't contribute to the uncertainty. The uncertainty in r is 0.09/2.86, or 3%. Lets find the value of r^3 for 2.86 as well as the high and low values for r (2.86 + 0.09, and 2.86 – 0.09)
$2.86^3 = 23.4$
$2.95^3 = 25.7$
$2.77^3 = 21.3$
The high and low values are 2.1 and 2.3 away from the middle value of 23.4. So our uncertainty is about 2.3/23.4, or about **10%**.

P13. (a) 1 megavolt (b) 2 micrometers (c) 6 kilodays (d) 1.8 kilobucks (e) 8 nanopieces

P15. 93×10^6 miles*(1609 meters / 1 mile) = 149637×10^6 meters, but let's not forget significant figures. This becomes **1.5×10^{11} meters**, or **150 gigameters**.

P19. (a) 1.80 m + 1.425 m + 0.534 m = 3.759…but how many sig figs? The least accurate measurement is the 1.80m, so there is an uncertainty of ±0.01. That means we should round to **3.76**.

P22. (a) You could look this up in the front cover, or work it out: distance traveled = $(2.998 \times 10^8$ m/s)*(1 year), which requires some unit conversion. Expanded, this looks like:

$(2.998 \times 10^8$ m/s)*(1 year)*(365 days/1 year)*(24 hr / 1 day)*(60 min/1 hr)*(60 sec/1 min)

Now cancel all appropriate units, leaving only meters. **9.461×10^{15} m**.

(b) 9.461×10^{15} m * (1 AU / 1.50×10^8 km) * (1 km /10^3 m) = **6.3×10^4 AU**.

(c) Light travels 6.3×10^4 AU in 1 year, so we convert:

(6.3×10^4 AU/yr)*(1 yr /365 days)*(1 day /24 hr) = **7.2 AU/hr**.

P27. A football field is about 100m long and roughly 40m wide (an estimate! I didn't look this up.) So the mower will make about 10 trips across the field in 1 hour (1km/hr converts to 1000 m/hr). Each pass is 0.5m wide, so 10 trips covers 5m of the width of my field. I need to cover 40m of width, so I need to repeat that 8 times, which will take **8 hours**. (Your estimates may vary a bit, but not too much)