Phys106, II-Semester 2018/19, Tutorial 6, Fri 15.2.

Work in teams of three. Do "Stages" in the order below. When all teams finished a stage, make sure all students at your table understand the solution and agree on one by using the board (in Studio-Air).

This is a mid-sem exam preparation / revision tutorial.

For this tutorial, you may find the following list of physical constants convenient:

- $h = 6.62607004 \times 10^{-34}$ J s
- $\hbar = 1.054571800 \times 10^{-34}$ J s
- $e = 1.60217662 \times 10^{-19}$ C
- $c = 2.99792458 \times 10^{8}$ m/s

Stage 1

(i) For each week lecture note material, decide what are the most important points and paraphrase these in one or two sentences.

(ii) Discuss your selection with others on the table.

(iii) On each table collect two main questions on lecture notes, unclear to the largest number of people, and ask a TA/myself about them.

Stage 2

(i) For all past tutorials/assignments/quizzes, make a list of things that you have questions about. Try to sort those out on the table.

(ii) On each table collect two main questions on tutorials/assignments/quizzes, unclear to the largest number of people, and ask a TA/myself about them.

Stage 3

(i) For questions and answers in this course, it is frequently important to convert between different units for the same type of quantity. Make sure you understand how to convert between: eV, KeV, MeV, J and m, nm, $\mathring{A}$. Make sure every answer for a physical quantity that you write has the right units.

(ii) Units also frequently offer a useful test of an equation that you derived or remembered. You can check the units on both sides and see if they work out. If they don't, the equation must be wrong.
Example: $F = ma$, where F is a force, a is an acceleration and m a mass. We (should) know, mass has unit kg and acceleration m/s^2. Force is a bit more tricky, let's say we remember $W = \int dx F(x)$ (work is the integral over force). Since work is an energy, units of force must be J/m. If we cannot remember what J is made of, lets remember $E_{kin} = 0.5mv^2$ for kinetic energy. Now we know we must haver $J = kg(m/s)^2$. Overall, units on both sides are $[kg(m/s)^2]/m = (kg)(m/s^2)$. This works out. Now suppose some-one tried to sell you the equation $F = ma^2$. You can do the same unit test again, to discover that it cannot be right.

For the following list of equations, do this unit check to show if they an be right or wrong (ignore your knowledge of how they have to be).

- $F = ma^2$
- $\omega k = V$, ω is a frequency, k is a wave-number, V a velocity.
- $\frac{\partial^2}{\partial x^2} y(x,t) = \frac{1}{V^2} \frac{\partial^2}{\partial t^2} y(x,t)$, y is a rope displacement in meters, x is position, t is time, V is a velocity.
- $\lambda' - \lambda = \frac{hm}{c}[1 - \cos(\phi)]$, m mass, c speed of light, λ wavelengths.
- $E_{therm} = \frac{h\nu}{e^{\nu/(hk_B T)} - 1}$, where E_{therm} is the thermal energy, ν a frequency, T a temperature

(iii) If you were too fast and reach this, please find some additional exercise questions in the text book.