PHYC10160 – homework guidance

Typically 20% grade for each of five criteria.

A solution typically follows the following flow, but not always. Sometimes definitions are most naturally given next to a law. Sometimes a law is most naturally stated next to some stepped working. But, the following criteria are met for a good solution to a typical question.

(1) DEFINITIONS

Variables used are defined. Advised is to use a diagram for this.

Ideally a simple and clear physical diagram is at the start of the answer to summarize the question/problem and to define variables by marking them on the diagram. Great works of art are not necessary.

By whatever means though, variables used in the solution should be defined.

International standard constants (Euler's Number, *e*, Planck's constant, *h*, Speed of light, *c*, etc.) do not need to be defined in the solution.

For example the law describing the energy of a photon is as follows with definitions:

$$E_{ph} = hv$$

Energy of a photon is E_{ph}

Frequency of a photon is v

(2) **LAWS**

State laws before their use, consistent with definitions in (1).

For example, gaining a full grade with definitions and stating laws (and a step in working), the frequency of a photon generated from an atomic transition between two energy states E_a and E_b is given by:

Energy of a photon is E_{ph}

Frequency of a photon is v

Energy at level a is E_a

Energy at level b is E_b

$$E_{ph} = E_a - E_b$$

$$E_{ph} = hv$$

$$v = \frac{E_{ph}}{h} = \frac{E_a - E_b}{h}$$

Writing the relationship without stating the laws used or stepping the working, such as the following, does not gain a full grade:

Energy of a photon is E_{ph}

Frequency of a photon is v

Energy at level a is E_a

Energy at level b is E_b

$$v = \frac{E_a - E_b}{h}$$

(3) **STEPPED WORKING**

In which the method and approach is clear to the reader.

Lay out the work will all steps between the laws being stated and the final answer.

(4) **UNITS**

Anywhere in the solution, where a physical quantity is written in numbers there should be accompanying units.

The following gains a full grade, because it is physically correct at each step.
It is quicker to write than including units with each value as they are inserted into the equation, however it is less robust and flexible for this, because it relies on using suitable SI units throughout.

Energy of a photon is E_{ph}

Frequency of a photon, v = 2.00 x 10^{15} Hz

$$E_{ph} = hv$$

$$E_{ph} = (6.63 \times 10^{-34} \times 2.00 \times 10^{15})\ \text{J}$$

$$E_{ph} = 13.26 \times 10^{-19}\ \text{J}$$

The following does not gain a full grade. Why?

Energy of a photon is E_{ph}

Frequency of a photon, $v = 2 \times 10^{15}$ Hz

$\text{h} = 6.63 \times 10^{-34}\ \text{m}^2\ \text{kg s}^{-1}$

$$E_{ph} = hv = \left(6.63 \times 10^{-34}\right)\left(2 \times 10^{15}\right) = 13.26 \times 10^{-19}$$

Errors are: a) not including units with physical values and; b) the question (if summarized correctly here) defines the frequency to one significant figure only, and as such, the answer can only be stated to one significant figure (see (5) 'Numerically Correct')

Likewise for both reasons, the following does not gain a full grade, even though the unit is included in the final answer:

Energy of a photon is E_{ph}

Frequency of a photon, $v = 2 \times 10^{15}$ Hz

$\text{h} = 6.63 \times 10^{-34}\ \text{m}^2\ \text{kg s}^{-1}$

$$E_{ph} = hv = \left(6.63 \times 10^{-34}\right)\left(2 \times 10^{15}\right) = 13.26 \times 10^{-19}\ \text{J}$$

(5) **NUMERICALLY CORRECT**

The solution is numerically correct in each step, as well as in the final answer (with units).

Significant figures and decimal places are appropriate in the context of the variables (accuracy) provided in the question. In particular, significant figures/decimal places are not added inappropriately (see above examples in (4)).

It is fine to use an arbitrary number of significant figures/decimal places on the calculator, but, the answer from a calculator needs to be written in the context of the accuracy asked for or the accuracy of variables given in the question.

If wanting a reminder on how to handle significant figures and decimal places for an equation, see the Wiley text, the early chapters.