**3322 Fall 2021 – Quick Problems Meeting 2**

1. For a monotonic gas (e.g., Argon), one measure of the average speed of the atoms is the root mean square speed [a concept you should have encountered in the PC I class]. The value is given by vrms = [3kBT/m]1/2 where m here is the atomic mass. [Hint: The value you should obtain for m as used in this equation is very, very small! Also, make sure you use SI units. What is the SI unit for mass?] (a) Determine the m value to use for Helium and use this in the above formula to determine (b) the root mean square speed of Helium at 20.0 oC. [Take care that you used the correct units for temperature, T]. (c) Calculate the de Broglie wavelength for Helium at a temperature of 20.0 oC. [Section 1 & 2]. **Answers Only.**

[2 + 3 + 5 = 10 points]

2. The following data were observed in an experiment on the photoelectric effect observed with potassium:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1019 × Kinetic Energy of Electron (J) | 4.490 | 3.090 | 1.890 | 1.340 | 0.7000 | 0.3110 |
| Wavelength (nm) | 250.0 | 300.0 | 350.0 | 400.0 | 450.0 | 500.0 |

(a) Evaluate these data graphically by making a plot using Excel software. Be sure you include all the required elements for this graph (e.g., the title – y-axis vs. x-axis is the convention used **{do not reverse these},** the axes with units, the tic marks for each axis). What should be plotted on the x-axis and on the y-axis? [See the lecture notes for a hint if that is needed]. Be careful of what you use for the y-axis. Please also see the note below. Provide on the graph for a linear fit to the data, the equation for the line of best-fit and the R2-value. For both the equation and the R2-value, use Scientific Notation to make sure there are a sufficient number of significant figures in your parameters in the equation for your line of best fit. In doing so, you should be able to obtain decent values for the following: (b) the Work function in units of J and in eV [given by what in the Photoelectric Effect equation?] {1 J ≡ 6.2415090741018 eV}and (c) Planck’s constant [given by what in the Photoelectric Effect equation?]. (d) Compare your answer for Q2 (b) with the Literature value for the Work function parameter (in eV) supplying the Reference for the literature value. (You will need to look up the answer in the literature for (c); i.e., make sure you supply the literature Reference for the work function of potassium). [Section 1].

[12 + 4 + 2 + 2 = 20 points]

[Note: The values for the Kinetic Energy that you should use in this determination are very small – each of the values listed in the cells for Kinetic Energy in the Table need to be multiplied by the factor of 10–19. To give the Kinetic Energy of the electron. This is a conventional way of presenting the data in a Table without having to include ×10−19 for each of the Kinetic Energy values in the individual cells].

[Total = 30 points]