Name: _____ DISC: _____ Score: _____ / 20

Instructions:
- Do your own work.
- Answer the questions below in the space provided.
- ***You must show all of your work to received credit for these problems***
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers

Q1	Q2	Q3	Q4
5	10	5	5

SPEED OF LIGHT	$c = 3 \times 10^8 m/s$
h	$6.626 \times 10^{-34} Js$
$\hbar$	$1.0546 \times 10^{-34} Js$
ELECTRON MASS	$m_e = 9.1 \times 10^{-31} kg$
hc	$1240\ eV\ nm$
MOMENTUM	$p = h/\lambda$
PHOTON ENERGY	$E = hc/\lambda$
PARTICLE ENERGY	$E = p^2/2m$
UNCERTAINTY PRINCIPLE	$\Delta x \Delta p \geq \hbar/2$

1. For the electron and photon listed in the table fill in the remaining quantities:

Table (5 pts.):

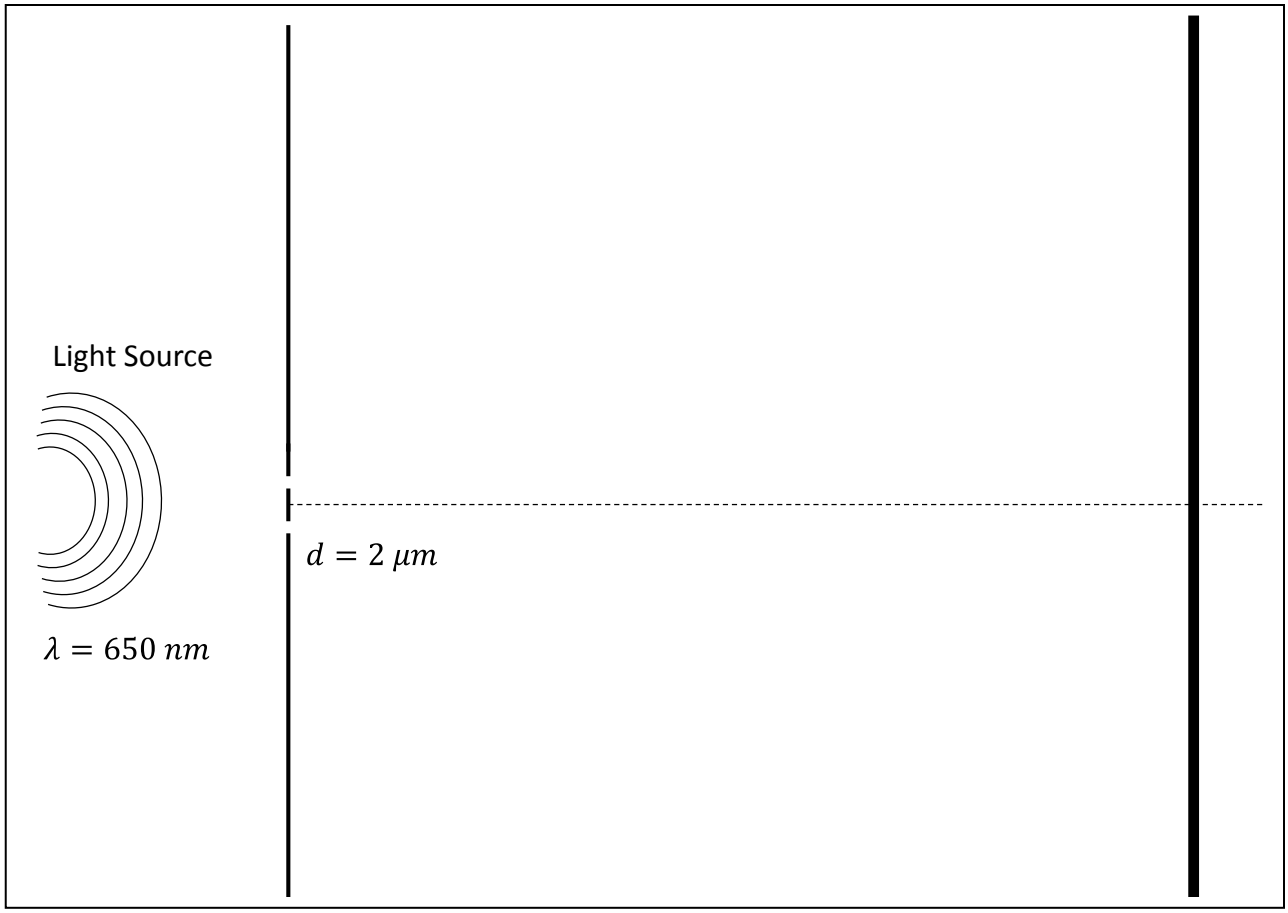
ENERGY	WAVELENGTH λ	MOMENTUM p	POSITION UNCERTAINTY
photon: $E = 5\ eV$			
electron: $E = 5 \pm 0.1\ eV$			

2. Remembering that the energy levels of a hydrogen-like atom can be calculated: $E_n = -13.6\ eV \left(\frac{Z^2}{n^2}\right)$, where n is an integer, and $Z = 1$ for hydrogen. Calculate the following properties of the photon needed to make the following transitions in hydrogen:

Table (10 pts.):

TRANSITION	WAVELENGTH λ	ENERGY E
$n = 1 \rightarrow n = 3$		
$n = 1 \rightarrow n = 2$		
$n = 4 \rightarrow n = 5$		
$n = 2 \rightarrow n = 3$		
$n = 3 \rightarrow n = 4$		

3. A beam of red light $\lambda = 650\ nm$ impinges a screen with two slits spaced $d = 2\ \mu m$ apart.



Sketch (1 pts.):
Table (4 pts.):

a) On the diagram sketch the interference pattern you expect from two-slit interference.

b) Fill in the following table for the interference minima ($d \sin\theta = \left(m + \frac{1}{2}\right)\lambda$):

Minimum	Angle	Position
$m = 1$		
$m = 2$		
$m = 3$		
$m = 4$		