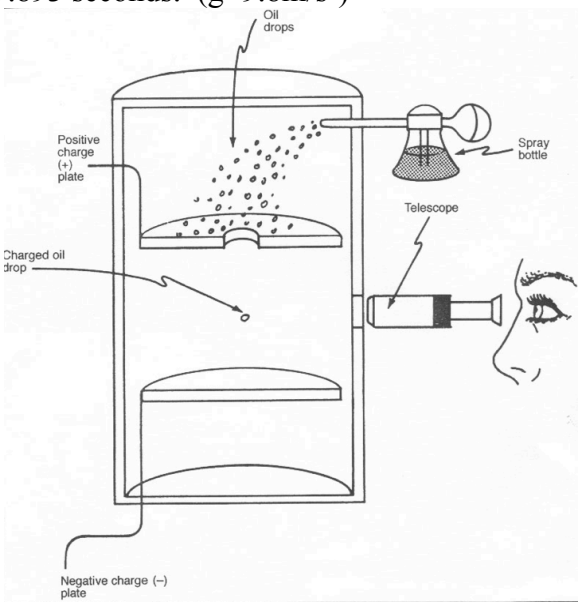
Notes: $c=3x10^{8}m/s$ = *1 lightyear/year, 1 nanometer=* 10^{-9} *meters,* $h=6.626x10^{-34}J*s = 4.136x10^{-15}eV*s$, $m_e c^2=0.511$ *MeV,* $1eV=1.602x10^{-19}$ J, $e=1.602x10^{-19}$ C, hc=1240 eV*nm, 1u=931.49 MeV, $\hbar=1.055x10^{-34}$ J*s= $h/(2\pi)$, $g=9.8m/s^2$, $R=1.0974x10^{7}m^{-1}$

There are 10 points in tota and 3 questionsl.
Remember to write your quiz code # and your name on the front of your blue book, student ID number is not needed.

----------Please write clearly. Show your work for all problems.----------

1. In Millikan's oil drop experiment, an oil droplet is observed to fall 0.010 meters in 40 seconds when the electric field is off. The mass of the oil droplet is $1.670x10^{-14}$ kg. The electric field is then turned on with strength $3.000x10^{5}$V/m and an oil droplet is seen to rise 0.010 meters in 37.893 seconds. ($g=9.8m/s^2$)



a. (2 points) What is the charge on the oil droplet in Coulombs?
b. (1 point) Since the charge of an electron is $1.602x10^{-19}$ C, how many electrons are on the droplet contributing to this charge?

2. In the hydrogen atom according to Bohr,
a. (2 points) what is the energy of the photon that could cause an electronic transmission from the n=4 state to the n=5 state in eV?
b. (2 points) The electron then drops from the n=5 state to a lower state. What is the shortest possible wavelength of the photon emitted when this occurs in nm ($1nm=10^{-9}m$)?

3. A an object of mass 1kg moves with a speed of 3 m/s. The speed is measured with an uncertainty of 3% (meaning that $\Delta v=0.03v$, $\hbar=1.055\text{x}10^{-34}$ J*s, $h=6.626\text{x}10^{-34}$ J*s).

a. (1 point) What is the minimum uncertainty in its position in meters?

b. (1 point) If the object is now an electron with mass $m_e=9.109\text{x}10^{-31}$ kg moving at the same speed with the same uncertainty, what is the minimum uncertainty in the electron's position in meters?

c. (1 point) What is the electron's De Broglie wavelength in meters?