Fields

- A **Field** is a physical quantity that has certain value at any point of physical space (x,y,z), and time, t. In other words, it's a function defined in physical space & time.

- A field can be vector or scalar, but there are also other types.

- Electric field **E**, and Newtonian gravity **g**, are examples of vector fields.

- Electric force acting on a charge q:

$$\vec{F}_{elect} = q\vec{E}$$

here electric field does not depend on the charge q itself, but depends on other charges in space.

- Gravitational force:

$$\vec{F}_{grav} = m\vec{g}$$

Mass m is the gravitational charge, g is the local gravity field. g is also an acceleration of a freely falling object, but of course it does not have to have the familiar value of 9.8 m/s^2, as on the surface of Earth.

Problem The figure shows an outline of the famous oil drop experiment by Millikan and Fletcher that was done at the University of Chicago in 1909-1913. The goal was to find the magnitude of electron's electric charge. In the experiment, tiny oil droplets were trapped between two electrodes. The masses of the droplets were measured by observing their motion under gravity, in the presence of air. After that, the electric field was switch on and tuned to the value at which it balances the gravity. Due to the X-rays, the charge on the oil was occasionally changing, so the field had to be changed too, to preserve the balance.

Let's say, you observe an oil droplet of mass $m=10^{-14}$ kg. Find the charge of an "electron", if the droplet could be balanced at the following values of the electric field (in N/C): 102 , 122.5 , 136 ,153 , 175.

By the way, don't try to google the result. The **e** you are supposed to calculate from these data, is not real.