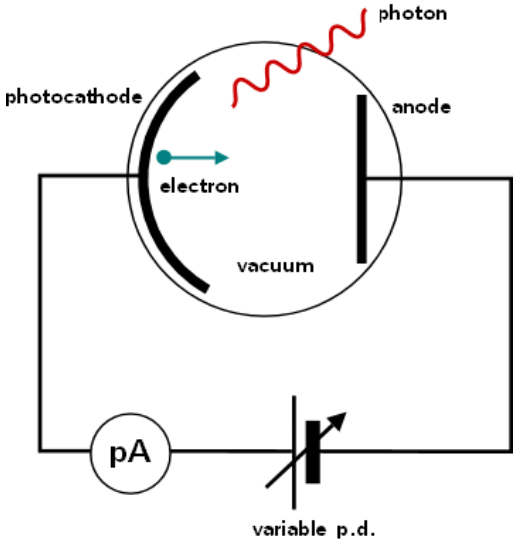
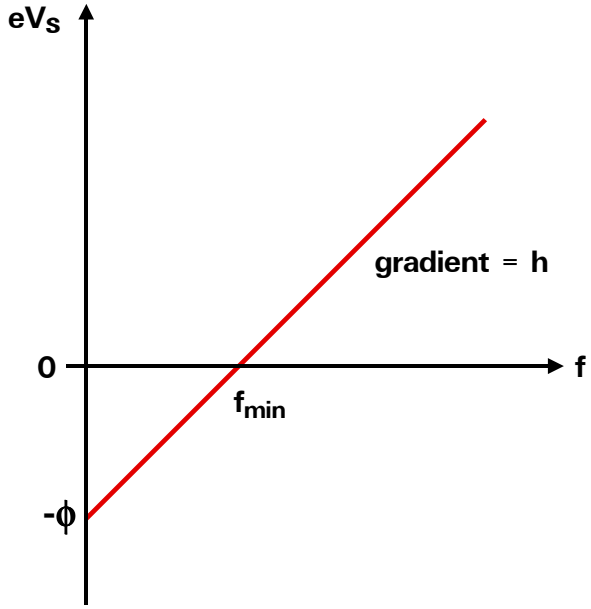
3.2 Millikan's Photoelectric Experiment

The American Nobel prize winning experimental physicist Robert Millikan performed the experiment which would prove Einstein's explanation correct. His apparatus, although far more sophisticated, was similar in essence to that shown in the diagram.
With the cathode made positive and the anode negative, the emitted photoelectrons face a potential hill and, as the reverse p.d. is increased, fewer and fewer of them reach the anode. At a critical p.d. known as the stopping p.d. (V_s) the electron current falls to zero and the maximum kinetic energy lost by the electrons can be calculated from e x V_s. Einstein's equation can then be written as:



$$eV_s = hf - \emptyset$$

This has the form of a straight line graph equation. If eV_s is plotted on the y-axis and f on the x-axis, the resulting graph should be a straight line with a gradient equal to Planck's constant, h, and an intercept on the x-axis equal to the threshold frequency, f_{min}.



Light at the threshold frequency has just enough energy to release electrons from the metal but they emerge with zero kinetic energy, hence

$$hf_{min} = \emptyset$$