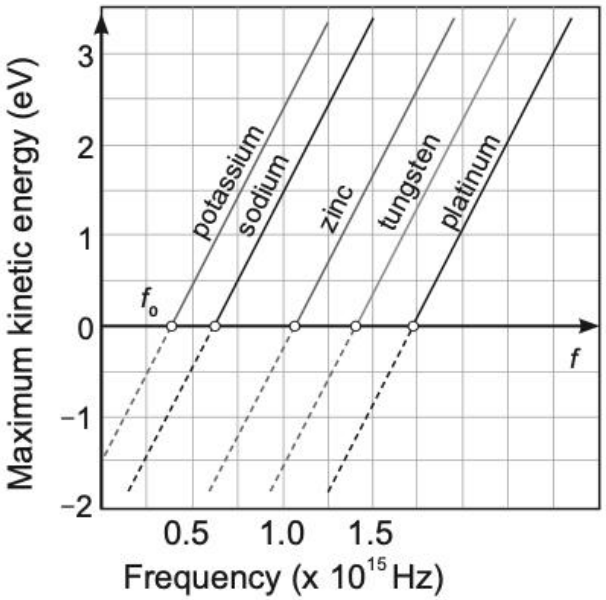
Question 13 **(13 marks)**

The photoelectric effect uses light to liberate electrons from metals. The graph of the maximum kinetic energy of these liberated electrons from different metals plotted against the frequency of the incident light is shown below.



(a) Estimate the threshold frequency for potassium from the graph above. (2 marks)

Answer _____ Hz

Each metal has a work function that describes the minimum amount of energy required to liberate an electron from the surface of that metal.

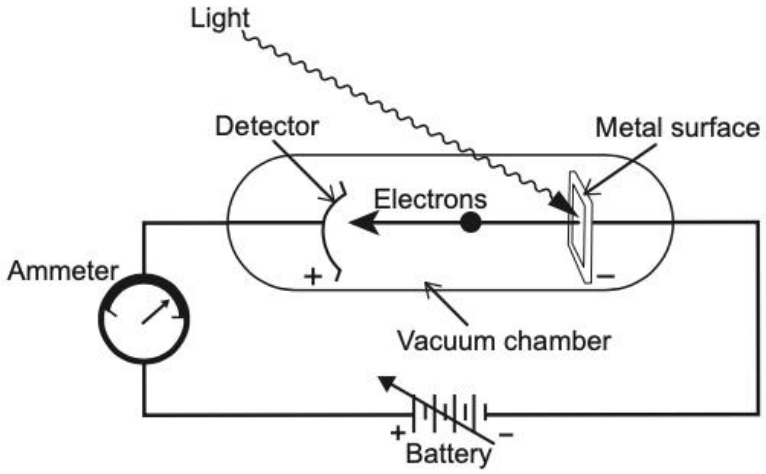
(b) Estimate the work function for potassium from the graph above. (2 marks)

Answer _____ eV

(c) Using your value from part (b), estimate the maximum velocity of a liberated electron if light with a frequency of 1.20×10^{15} Hz shines on a potassium metal plate. Give your answer to two significant figures. (6 marks)

Answer _____ m s^{-1}

The diagram below shows how the kinetic energy of the liberated electrons is measured. The ammeter measures the photocurrent and the battery can reverse and vary the potential difference between the metal plate and the detector. The potential is increased until the ammeter reads zero.



(d) Below is a graph of photocurrent versus potential difference. On this graph, draw the resulting curve when light of the same frequency but lower power is shone on the same metal. (3 marks)