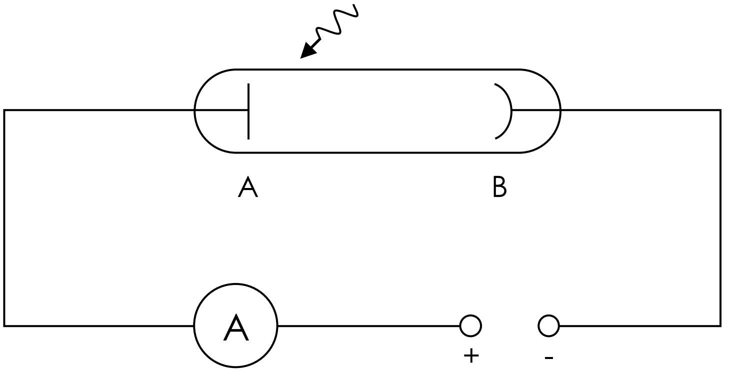
15th May – Part 1

1. A vacuum photocell can be used to investigate the photoelectric effect. EM waves above the threshold frequency are shone onto a metal surface at A and photoelectrons are emitted. These travel across to a collector plate at B.

   A PD is applied across A and B, with B negative with respect to A. As this PD is gradually increased from zero, then at a value V_s (called the stopping voltage) the current recorded on the ammeter decreases to zero. This happens when the PD is large enough that the electrical work done in stopping an electron is equal to KE_{max}. This is equal to the charge on an electron multiplied by V_s between A and B ($KE_{max} = eV_s$).



   The frequency, f, of the EM waves is changed and the stopping voltage, V_s, recorded.

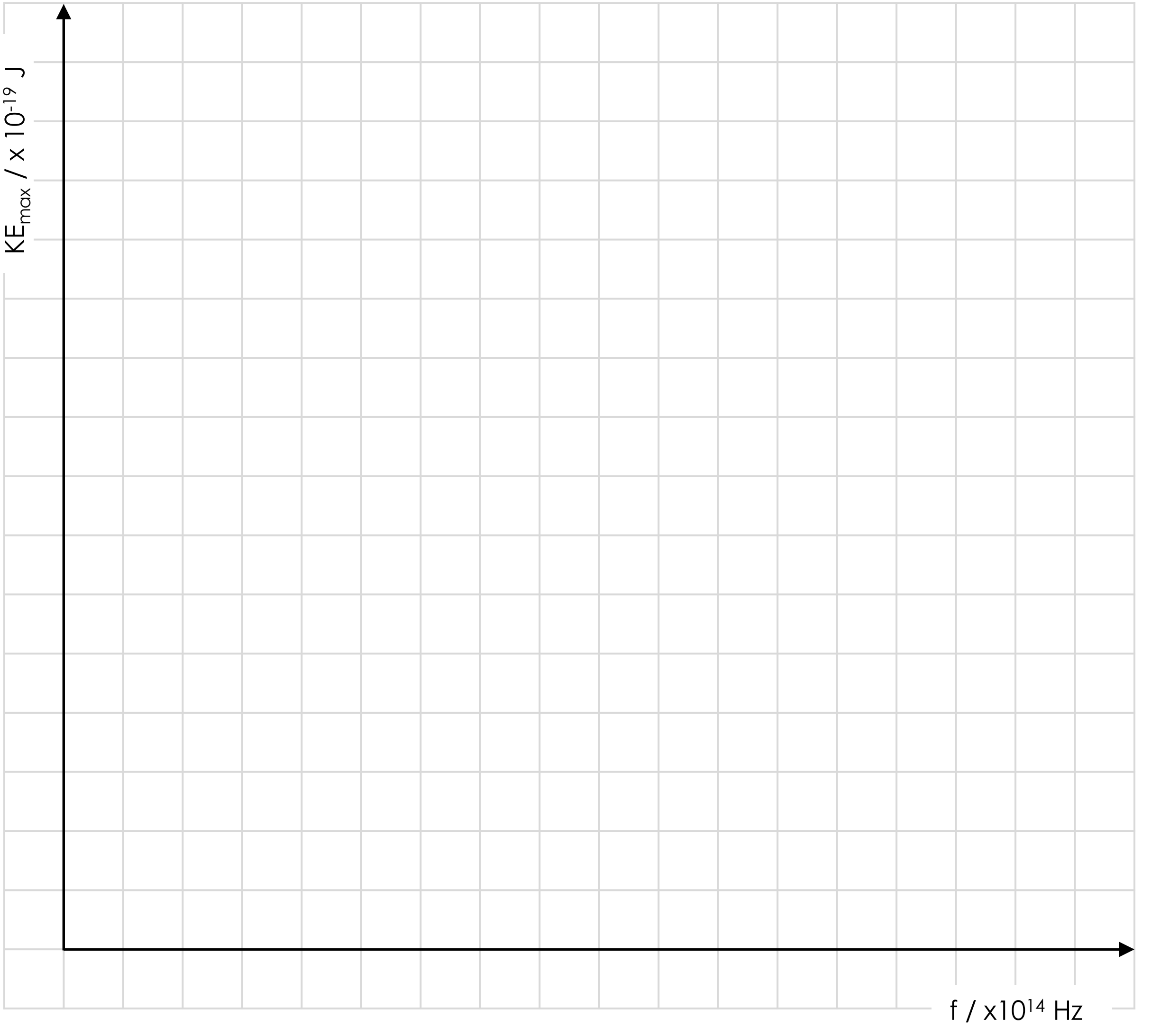
   a. Complete values for the **maximum kinetic energy** KE_{max} in the table below

f / x 10^{14} Hz	V_s / V	KE_{max} / x 10^{-19} J
7.0	0.53	0.85
8.5	1.25	2.00
10.0	1.75	
12.0	2.50	
13.5	3.19	
15.0	3.75	

15th May – Part 2

1

1. b. Use values from your table to **plot** a graph showing maximum kinetic energy, KE_{max}, against frequency, f



c. Calculate the **gradient** of your graph (this should be equal to the Planck constant)

d. Use the intercept on the frequency axis (x-axis) to calculate the **work function** for the metal used for plate A in **electronvolts**

16th May

1 2 3

1. A student with mass 60 kg runs up a ramp 10 m long at 30° to the horizontal in 6.0 s. They then do 4 pull-ups, raising their body 0.50 m each time, in a total time of 10 seconds.

   Calculate the **ratio** of their leg power to arm power.

2. The EMF of a battery is 6.0 V. When the battery provides a current of 1.4 A, its terminal PD drops to 4.1 V. Calculate the **internal resistance** of the battery.

3. A uniform beam of length 4.0 m and mass 48 kg hangs on two wires A and B. Wire A is 1.0 m from the centre and wire B is 1.5 m from the centre.

   Calculate the **tension** in each wire.