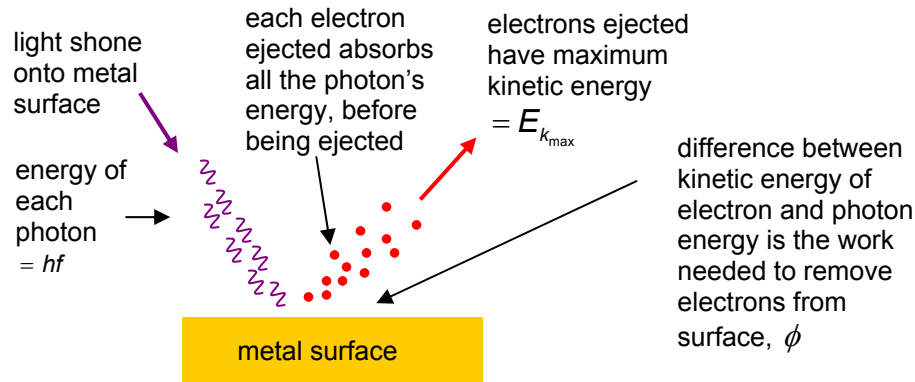


## Topic 12 – Quantum Physics and Nuclear Physics

### The Photoelectric Effect



This is the effect whereby if [ ] is shone onto a metal surface, [ ] (called photoelectrons) are emitted.

- electrons are only emitted if the light is [ ] a certain frequency, called the [ ] frequency (ultra-violet light is needed for some metals)
- the value of this threshold frequency depends on the [ ] being used

and, assuming the frequency of the light is above threshold frequency:

- the number of photoelectrons emitted depends on the [ ] of the light
- the photoelectrons emitted have a range of kinetic energies, up to a certain maximum value (and this maximum kinetic energy depends on the [ ] used and the [ ] of light).

This is explained by the fact that free electrons each require a certain amount of energy to escape from the surface of the metal.

- the minimum energy required to release an electron from a certain metal is called the work [ ] ( $\phi$ ) of the metal

Further, it is necessary to consider that the light hitting the metal behaves as [ ], rather than continuous waves.

- if light behaved as a wave then, even at low frequency the light would eventually provide enough energy to release an electron. This is not the case

So the energy comes from a particle of light. When a "light particle" – called a [ ] – hits an electron, it gives up all of its energy to the electron

- the energy of each photon depends on the [ ] of the light

Each [ ] has energy given by the equation:  $E = hf$

- $E$  is energy, in joules,  $h$  is Planck's constant,  $6.63 \times 10^{-34} \text{ Js}$  and  $f$  is the frequency of the light