2017 Ph H1 Q9

Section: Particles and Waves

Topic: Forces on Charged Particles

Brief summary of the question

A clean zinc plate is illuminated. The radiation is replaced by higher frequency light at the same irradiance. Predict the changes in: (i) maximum kinetic energy of emitted photoelectrons (ii) number of photoelectrons per second

Worked solution

Photon energy: E = hf. Higher f ⇒ higher energy per photon.

Photoelectric equation: K_max = hf - ϕ. ϕ is constant for the metal. If f increases, K_max increases.

Irradiance is fixed (same power per area). Each photon now has more energy, so fewer photons arrive per second. Fewer photons ⇒ fewer electrons emitted per second.

Final answer

D — K_max increases; number per second decreases.

Revision tips

- **At constant irradiance: ↑ f ⇒ ↑ K_max, ↓ photon rate.**
- **↑ Irradiance changes the rate, not K_max.**
- **↑ Frequency changes K_max, not the brightness.**