A-level Physics Exam Questions – Eduqas

# Question 1 – Waves [10 marks]

(a) State what is meant by the term 'coherent sources'. [2]

(b) Describe how a double slit experiment can be used to demonstrate the wave nature of light. [3]

(c) In a double slit experiment, the slit separation is 0.25 mm and the screen is 1.2 m away. A laser of wavelength 632.8 nm is used. Calculate the fringe spacing observed on the screen. [5]

# Question 2 – Waves [10 marks]

(a) Explain the principle of superposition of waves. [2]

(b) Two sound waves of the same frequency and amplitude travel in opposite directions along a string. Describe and explain the pattern formed on the string. [3]

(c) The wavelength of the waves is 0.50 m. Calculate the distance between adjacent nodes. [5]

# Question 3 – Photoelectric Effect [10 marks]

(a) State the photoelectric equation and define each term. [3]

(b) Describe one experiment that supports the particle nature of light. [3]

(c) A metal surface has a work function of 2.3 eV. Calculate the maximum kinetic energy of an emitted electron when light of frequency 8.0 × 10^14 Hz is incident. (Planck constant h = 6.63 × 10⁻³⁴ J·s, 1 eV = 1.60 × 10⁻¹⁹ J) [4]

# Question 4 – Photoelectric Effect [10 marks]

(a) Define the term 'threshold frequency' in the context of the photoelectric effect. [2]

(b) Ultraviolet light causes electrons to be emitted from a zinc plate but red light does not. Explain why in terms of photon energy. [3]

(c) Calculate the threshold frequency for a metal with a work function of 3.5 eV. [5]

# Answers and Mark Scheme

## Question 1

(a) Coherent sources have a constant phase difference and the same frequency. [2]

(b) The light from the slits acts as two coherent sources. The interference pattern formed on the screen is evidence of constructive and destructive interference, demonstrating wave behaviour. [3]

(c) Fringe spacing = (wavelength × distance to screen) / slit separation = (632.8e-9 × 1.2) / 0.25e-3 = 3.03 mm [5]

## Question 2

(a) The principle of superposition states that when two or more waves meet, the resultant displacement is the vector sum of the individual displacements. [2]

(b) A stationary wave is formed with nodes (no displacement) and antinodes (maximum displacement). This occurs due to constructive and destructive interference. [3]

(c) Distance between nodes = wavelength / 2 = 0.50 / 2 = 0.25 m [5]

## Question 3

(a) E = hf = φ + KEmax, where E is energy of photon, h is Planck’s constant, f is frequency, φ is work function, and KEmax is max kinetic energy of emitted electron. [3]

(b) Millikan’s experiment (or similar) shows that electrons are emitted instantaneously and only if the frequency of light exceeds a threshold, inconsistent with wave theory. [3]

(c) E = hf = 6.63e-34 × 8.0e14 = 5.304e-19 J = 3.315 eV, KEmax = 3.315 - 2.3 = 1.015 eV [4]

## Question 4

(a) The minimum frequency of light that can cause photoemission from a material. [2]

(b) Red light photons have lower energy than UV photons. If their energy is less than the work function, no electrons are emitted. [3]

(c) Threshold frequency = φ / h = (3.5 × 1.6e-19) / 6.63e-34 = 8.45 × 10^14 Hz [5]