

10 (a) State an experimental phenomenon that provides evidence for:

- (i) the particulate nature of electromagnetic radiation

..... [1]

- (ii) the wave nature of matter.

..... [1]

(b) A particle of matter moves with momentum p .

- (i) State the equation that gives the effective wavelength λ of the particle. State the name of any other symbols used.

[2]

- (ii) State the name given to the wavelength of the moving particle.

..... [1]

(c) Electrons are accelerated from rest through a potential difference (p.d.) of 4.8 kV.

- (i) Show that the final speed of the electrons is $4.1 \times 10^7 \text{ m s}^{-1}$.

[2]

- (ii) Calculate the effective wavelength of a beam of electrons moving at the speed in (c)(i).

wavelength = m [2]

[Total: 21]