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: 9]