Quantum physics

Cambridge International AS & A Level Physics

> *Unlike IGCSE, 9702 gives you a data sheet: it is page 2 of Papers 1, 2 and 4, with more formulae on page 3 of Paper 4. Everything marked GIVEN is printed for you; everything else you must recall. Compiled by GioPhysics from the published syllabus. This is an independent study aid, not a Cambridge document; the official syllabus is the authority.*

22.1 Energy and momentum of a photon

A LEVEL

Photon energy

$$E = hf$$

$E = hc / \lambda$

- E — photon energy (J)
- h — Planck constant (J s)
- f — frequency (Hz)

A LEVEL

Photon momentum

$$p = E / c$$

- p — momentum (kg m s^{-1})
- E — photon energy (J)
- c — speed of light (m s^{-1})

22.2 Photoelectric effect

A LEVEL

Photoelectric equation

$$hf = \Phi + \tfrac{1}{2}mv^2max$$

- hf — photon energy (J)
- Φ — work function (J)
- $\tfrac{1}{2}mv^2max$ — maximum kinetic energy of the electron (J)

22.3 Wave–particle duality

A LEVEL

de Broglie wavelength

$$\lambda = h / p$$

- λ — de Broglie wavelength (m)
- h — Planck constant (J s)
- p — momentum (kg m s^{-1})

22.4 Energy levels in atoms and line spectra

A LEVEL

Transition between energy levels

$$hf = E_1 - E_2$$

- E_1, E_2 — the two energy levels (J)
- f — frequency of the emitted photon (Hz)