

Quantum physics · supported focus

Supported focus · HL

Supported scope

- Supported HL focus. First assessment 2025; full Physics guide acquired (84 PDF pages). Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

Quantum · 1.1

Reasoning

Bright low-frequency light can fail to eject electrons while dim higher-frequency light succeeds. Photon energy depends on frequency, not intensity alone. Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

Quantum · 2.1

Reasoning

A photon has energy proportional to frequency. The work function is the minimum energy needed to release an electron from a surface. Above threshold, excess photon energy can become electron kinetic energy. photon: A quantum of electromagnetic radiation; work function: Minimum surface energy needed to release an electron.

Quantum · 3.1

Reasoning

Use photon energy = Planck constant $\times$ frequency. Maximum kinetic energy = photon energy - work function. Increasing intensity at fixed frequency increases photon arrival rate, not individual photon energy. Read axes carefully on a stopping-potential or kinetic-energy graph. Identify threshold frequency from the zero-energy intercept. State the metal and experimental conditions because work function is material-specific.

Quantum · 4.1

Reasoning

State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution. Known: photon energy is 5.0 electronvolts and work function is 2.0 electronvolts. Maximum kinetic energy = photon energy - work function = $5.0 - 2.0 = 3.0$ electronvolts. A 1.5 electronvolt photon cannot cause emission from that surface in this model.

Quantum · 4.2

Reasoning

Photon energy is 4.8 eV and work function 2.1 eV. Find maximum kinetic energy. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

Quantum · 5.1

Reasoning

Electrons do not accumulate many sub-threshold photons in the elementary single-photon model. Do not confuse photon number with photon energy. Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Quantum · 5.2

Reasoning

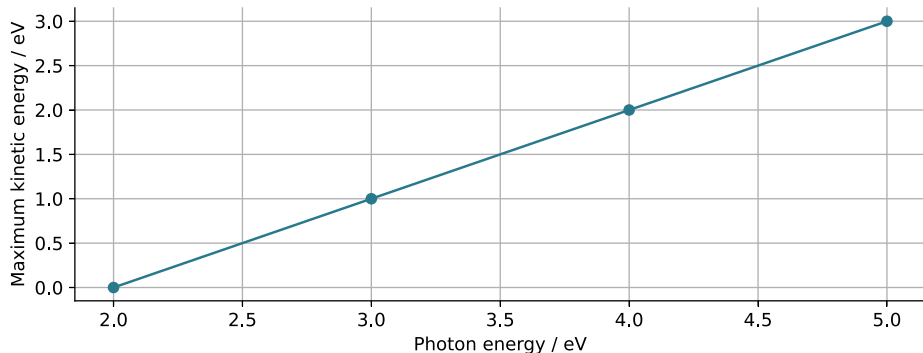
Doubling light intensity doubles each photon energy at fixed frequency. This claim is false: Electrons do not accumulate many sub-threshold photons in the elementary single-photon model. Do not confuse photon number with photon energy.

Quantum · 5.3

Reasoning

Photons and the photoelectric effect: Use photon energy = Planck constant $\times$ frequency. Maximum kinetic energy = photon energy - work function. Increasing intensity at fixed frequency increases photon arrival rate, not individual photon energy.

Quantum · diagram



- Original teaching diagram: Photons and the photoelectric effect
- Use the labels and the stated model together.

Quantum · original transfer

Your turn

A surface has work function 2.5 eV. Compare 2.0 and 4.0 eV photons and predict what doubling intensity changes in the one-photon model.

Quantum · transfer reasoning

Method and interpretation

2.0 eV cannot cause emission; 4.0 eV gives maximum kinetic energy 1.5 eV. Above threshold, greater intensity supplies more photons, not more energy per photon. It does not raise K_{max} .

Check yourself

- Explain photon using the stated model.
- Explain work function using the stated model.
- Change one value in the original transfer; explain which assumption still matters.