

A-Level Physics

Name: _____ Score: _____

1. Which phrases belong in the two-mark definition of a photon? Select **all** that apply.

- ☐ of energy
- ☐ that travels more slowly in glass
- ☐ of electromagnetic radiation
- ☐ a quantum, or discrete packet

Tick every correct option.

2. Below the threshold frequency, shining a brighter light on the metal:

- ☐ emits faster electrons
- ☐ emits more electrons
- ☐ melts the metal
- ☐ still emits no electrons

3. Light shows its wave nature in interference, and its particle nature in:

- ☐ shadows
- ☐ the photoelectric effect
- ☐ reflection
- ☐ refraction

4. Electrons in an atom can only occupy certain _____ energy levels.

5. The energy of a photon is:

- ☐ $\frac{h}{f}$
- ☐ hf
- ☐ $\frac{f}{h}$
- ☐ hf^2

6. The minimum energy needed to free an electron from the surface is the _____ function.

7. The de Broglie wavelength of a particle is:

☐ $\frac{h}{f}$

☐ $\frac{p}{h}$

☐ hp

☐ $\frac{h}{p}$

8. Atomic energy levels are written as negative, with 0 for a just-free electron.

☐ True ☐ False

9. Higher-frequency photons carry more energy.

☐ True ☐ False

10. Light of 400 nm (photon energy 3.1 eV) falls on these metals. Which emit photoelectrons? Select **all** that apply.

☐ caesium, work function 2.1 eV

☐ sodium, work function 2.3 eV

☐ platinum, work function 5.6 eV

☐ zinc, work function 4.3 eV

Tick every correct option.

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1. of energy; of electromagnetic radiation; a quantum, or discrete packet

"A particle of light" alone scores one at best. Both the quantum idea and the electromagnetic radiation must appear.

2. still emits no electrons

Each photon is below Φ , so no single photon can free an electron – brightness cannot help.

3. the photoelectric effect

The photoelectric effect needs photons (particles); interference and diffraction need waves.

4. discrete

The levels are discrete (quantised) – an electron cannot have an energy in between them.

5. hf

$E = hf = \frac{hc}{\lambda}$ – proportional to frequency.

6. work

The work function $\Phi = hf_0$ – the least energy to release a surface electron.

7. $\frac{h}{p}$

$\lambda = \frac{h}{p}$ – wavelength is Planck's constant over momentum.

8. True

The most tightly bound (ground) state is the most negative; energy rises toward 0 as the electron is freed.

9. True

$E = hf$, so energy rises with frequency – a γ -ray photon carries far more than a radio one.

10. caesium, work function 2.1 eV; sodium, work function 2.3 eV

Emission needs $hf \geq$ work function. Zinc and platinum emit nothing at this wavelength however intense the light; zinc needs below 290 nm, in the ultraviolet.