

A-Level Physics

Name: _____ Score: _____

1. The energy of a photon is:

☐ hf

☐ $\frac{h}{f}$

☐ hf^2

☐ $\frac{f}{h}$

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

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

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

☐ the photoelectric effect☐ refraction☐ reflection☐ shadows

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

5. A photon has energy 3.2×10^{-19} J. What is this in eV? ($1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$)

_____ eV

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

7. The de Broglie wavelength of a particle is:

☐ $\frac{h}{p}$

☐ hp

☐ $\frac{p}{h}$

☐ $\frac{h}{f}$

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. A 5.0 eV photon hits a metal with work function 2.0 eV. What is the maximum KE of the photoelectron?

_____ eV

A-Level Physics

1. hf

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

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. **2 eV**

$$\frac{3.2 \times 10^{-19}}{1.6 \times 10^{-19}} = 2.0 \text{ eV.}$$

6. **work**

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

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

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

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. **3 eV**

$$\text{Max KE} = hf - \Phi = 5.0 - 2.0 = 3.0 \text{ eV.}$$