FREE REVISION PACK

# Photoelectric Effect

AQA A-level Physics · 7407 / 7408 · Specification 3.2.2.1

Easy Medium Hard **Multiple choice · past-paper questions**

| 7 | 7 | ≈ 10 min |
|---|---|---|
| QUESTIONS | TOTAL MARKS | SUGGESTED TIME* |

## Contents


| Q | LEVEL | FOCUS | SOURCE | MARKS |
|---|---|---|---|---|
| 1 | Easy | Maximum kinetic energy from a wavelength | AQA June 2018 · A-level Paper 1 · Q14 | 1 mark |
| 2 | Easy | Kinetic energy of the emitted electrons | AQA June 2019 · AS Paper 2 · Q11 | 1 mark |
| 3 | Easy | Gradient of $E_k$ against 1/λ | AQA June 2018 · AS Paper 2 · Q9 | 1 mark |
| 4 | Medium | Doubling the power of the light | AQA June 2017 · AS Paper 2 · Q20 | 1 mark |
| 5 | Medium | Raising the frequency at a fixed photon rate | AQA June 2023 · AS Paper 2 · Q13 | 1 mark |
| 6 | Medium | The Planck constant from an $E_{k(max)}$–f graph | AQA June 2025 · A-level Paper 1 · Q30 | 1 mark |
| 7 | Hard | Raising the frequency at a fixed rate of energy | AQA June 2024 · A-level Paper 1 · Q10 | 1 mark |


**Key ideas to have ready**

- Each electron absorbs one photon. $hf = \varphi + E_{k(max)}$, where φ is the work function.
- No electrons are emitted below the threshold frequency $f_0 = \varphi / h$, however intense the light.
- Increasing the **frequency** raises $E_{k(max)}$. Increasing the **number of photons per second** raises the number of electrons per second (the current), not their energy.
- A graph of $E_{k(max)}$ against f is a straight line with gradient h, f-intercept $f_0$ and $E_k$-intercept $-\varphi$. The stopping potential gives $E_{k(max)} = eV_s$.

**How to use this pack**

1. The questions are grouped into levels (Easy, Medium and Hard). Work through them in order, and check your answers at the end of each level before moving on.
2. Every question is multiple choice with one correct answer. Write down your working anyway; that is how you find mistakes.
3. The separate mark scheme uses the same numbers and explains every answer.

Levels are based on how students did in AQA's examiner reports where that information exists, plus our own difficulty rating. *About 1.5 minutes per question.

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## Easy

Definitions and one-step ideas. Most students get these right.

Questions 1–3

Only **one** answer per question is allowed. For each question, completely fill in the circle alongside the appropriate answer.

AQA June 2018 · A-level Paper 1 · Q14

**1** Photons of wavelength $290\ \text{nm}$ are incident on a metal plate. The work function of the metal is $4.1\ \text{eV}$

What is the maximum kinetic energy of the emitted electrons?

**[1 mark]**

**A** $0.19\ \text{eV}$ ⬭

**B** $4.3\ \text{eV}$ ⬭

**C** $6.9\ \text{eV}$ ⬭

**D** $8.4\ \text{eV}$ ⬭

AQA June 2019 · AS Paper 2 · Q11

**2** Photons of energy $1.0 \times 10^{-18}\ \text{J}$ are incident on a metal surface and cause the emission of electrons from the metal surface.

Which statement about the emitted electrons is correct?

**[1 mark]**

**A** They each have a kinetic energy of $1.0 \times 10^{-18}\ \text{J}$. ⬭

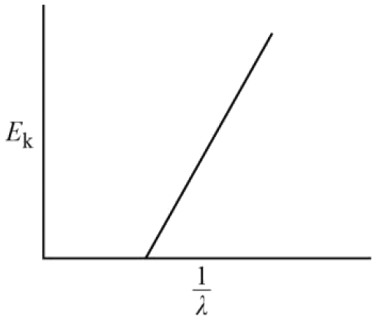
**B** They each have a kinetic energy that is a multiple of $1.0 \times 10^{-18}\ \text{J}$. ⬭

**C** Their mean kinetic energy is $1.0 \times 10^{-18}\ \text{J}$. ⬭

**D** The kinetic energy of each must be less than $1.0 \times 10^{-18}\ \text{J}$. ⬭

AQA June 2018 · AS Paper 2 · Q9

**3** The graph shows how the maximum kinetic energy $E_k$ of photoelectrons emitted from a metal surface varies with the reciprocal of the wavelength $\lambda$ of the incident radiation.




What is the gradient of this graph?

**[1 mark]**

**A** $c$ ⬭

**B** $h$ ⬭

**C** $hc$ ⬭

**D** $\frac{h}{c}$ ⬭

## Medium

Two or three steps. Roughly a third to a half of students get these right.

Questions 4–6

AQA June 2017 · AS Paper 2 · Q20

**4** When light of a certain frequency greater than the threshold frequency of a metal is directed at the metal, photoelectrons are emitted from the surface.
The power of the light incident on the metal surface is doubled.

Which row shows the effect on the maximum kinetic energy and the number of photoelectrons emitted per second?

**[1 mark]**

| | Maximum kinetic energy | Number of photoelectrons emitted per second | |
|---|---|---|---|
| **A** | remains unchanged | remains unchanged | ⬭ |
| **B** | doubles | remains unchanged | ⬭ |
| **C** | remains unchanged | doubles | ⬭ |
| **D** | doubles | doubles | ⬭ |

AQA June 2023 · AS Paper 2 · Q13

**5** Monochromatic light of frequency $f$ is incident on a metal surface in a vacuum.
Photoelectrons are emitted from the surface.

The photoelectric current $I$ is measured.

The magnitude of the stopping potential $V_s$ is then measured.

$f$ is increased without changing the rate at which photons arrive at the metal surface.

What are the new measurements of the photoelectric current and the magnitude of the stopping potential?

**[1 mark]**

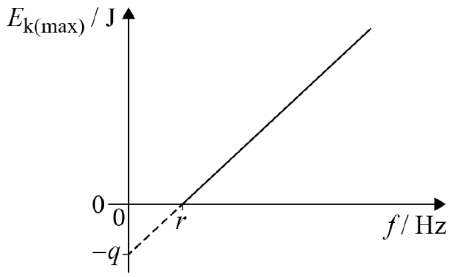
| | Photoelectric current | Magnitude of the stopping potential | |
|---|---|---|---|
| **A** | $I$ | $V_s$ | ⬭ |
| **B** | $I$ | $> V_s$ | ⬭ |
| **C** | $> I$ | $V_s$ | ⬭ |
| **D** | $> I$ | $> V_s$ | ⬭ |

AQA June 2025 · A-level Paper 1 · Q30

**6** In a photoelectric experiment, the maximum kinetic energy $E_{k(max)}$ of the emitted electrons and the frequency $f$ of the incident radiation are measured.

A graph of the variation of $E_{k(max)}$ with $f$ has:

- a gradient $p$
- an intercept $-q$ on the $E_{k(max)}$ axis
- an intercept $r$ on the $f$ axis.




What is the value of the Planck constant?

**[1 mark]**

**A** $\frac{p}{r}$ ⬭

**B** $\frac{r}{p}$ ⬭

**C** $\frac{r}{q}$ ⬭

**D** $\frac{q}{r}$ ⬭

**Hard** Several steps, often with a trap built in. Fewer than 3 in 10 students get these right. **Question 7**

AQA June 2024 · A-level Paper 1 · Q10

**7** Monochromatic light is incident on a metal surface in a vacuum and photoelectrons are emitted from the surface. The photoelectric current $I$ is the rate of flow of charge from the surface.
The maximum kinetic energy of the photoelectrons is $E_{k(max)}$.
$E_{k(max)}$ and $I$ are measured.

The frequency of the light is then increased. There is no change to the rate at which energy is incident on the surface.

What happens to $E_{k(max)}$ and $I$ when the frequency is increased?

**[1 mark]**

| | $E_{k(max)}$ | $I$ | |
|---|---|---|---|
| **A** | increases | decreases | ⬭ |
| **B** | increases | no change | ⬭ |
| **C** | no change | no change | ⬭ |
| **D** | no change | decreases | ⬭ |

**End of questions.** Check your answers with the matching mark scheme. More free packs and 1-to-1 tuition:
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