INKPHYSICS FLASHCARDS

Quantum phenomena

Year 12 · 29 cards · fronts and backs

Print double-sided, flipping on the long edge, and each answer lands behind its question. Cut along the card borders.

Definitions in mark-scheme wording, the equations that are not on the AQA data sheet, each lesson's check question, and the misconceptions that lose marks. The same cards run on the website with spaced-repetition scheduling, at inkphysics.co.uk/physics/flashcards.

DEFINITION

Define: Work function.

THE PHOTOELECTRIC EFFECT

DEFINITION

Define: Threshold frequency.

THE PHOTOELECTRIC EFFECT

RECALL

State the relationship between threshold frequency and work function.

THE PHOTOELECTRIC EFFECT

DEFINITION

Define: Photon.

THE PHOTOELECTRIC EFFECT

RECALL

State the photoelectric equation.

THE PHOTOELECTRIC EFFECT

DEFINITION

Define: Stopping potential.

THE PHOTOELECTRIC EFFECT

RECALL

State what the gradient of the maximum kinetic energy against frequency graph gives.

THE PHOTOELECTRIC EFFECT

RECALL

State the effect of greater intensity at fixed frequency.

THE PHOTOELECTRIC EFFECT

DEFINITION

The minimum frequency of incident radiation that will release electrons from a surface.

THE PHOTOELECTRIC EFFECT

DEFINITION

The minimum energy needed to release an electron from the surface of a metal.

THE PHOTOELECTRIC EFFECT

DEFINITION

A discrete packet of electromagnetic energy: $E = hf$.

THE PHOTOELECTRIC EFFECT

RECALL

The work function equals the photon energy at the threshold frequency: $\varphi = hf_0$.

THE PHOTOELECTRIC EFFECT

DEFINITION

The minimum potential difference that reduces the photoelectric current to zero: $eV_s = E_k(max)$.

THE PHOTOELECTRIC EFFECT

RECALL

$hf = \varphi + E_k(max)$: the photon energy pays the work function and the rest is the maximum kinetic energy.

THE PHOTOELECTRIC EFFECT

RECALL

More photons arrive per second, so more electrons are emitted per second with the same maximum kinetic energy.

THE PHOTOELECTRIC EFFECT

RECALL

The Planck constant h, the same for every metal.

THE PHOTOELECTRIC EFFECT

SPOT THE ERROR

Say what is wrong with this claim:

Brighter light gives the electrons more energy.

THE PHOTOELECTRIC EFFECT

DEFINITION

Define: The electronvolt.

COLLISIONS OF ELECTRONS WITH ATOMS

RECALL

State the value of one electronvolt.

COLLISIONS OF ELECTRONS WITH ATOMS

DEFINITION

Define: Excitation.

COLLISIONS OF ELECTRONS WITH ATOMS

DEFINITION

Define: Ionisation.

COLLISIONS OF ELECTRONS WITH ATOMS

DEFINITION

Define: Ionisation energy.

COLLISIONS OF ELECTRONS WITH ATOMS

RECALL

Explain what happens in a collision offering less than the first excitation energy.

COLLISIONS OF ELECTRONS WITH ATOMS

RECALL

State the role of the phosphor coating in a fluorescent tube.

COLLISIONS OF ELECTRONS WITH ATOMS

DEFINITION

The energy gained by an electron accelerated through a potential difference of one volt.

COLLISIONS OF ELECTRONS WITH ATOMS

SPOT THE ERROR

Brightness sets only how many photons arrive, not the energy of each. One electron absorbs one photon of energy E = hf, so below the threshold frequency no electrons escape however bright the light.

THE PHOTOELECTRIC EFFECT

DEFINITION

An atomic electron gaining exactly the energy needed to jump to a higher energy level.

COLLISIONS OF ELECTRONS WITH ATOMS

RECALL

1 eV = 1.60×10^{-19} J.

COLLISIONS OF ELECTRONS WITH ATOMS

DEFINITION

The minimum energy needed to remove an electron completely from an atom in its ground state.

COLLISIONS OF ELECTRONS WITH ATOMS

DEFINITION

An electron gaining enough energy to leave the atom entirely, forming an ion.

COLLISIONS OF ELECTRONS WITH ATOMS

RECALL

It absorbs the ultraviolet photons emitted by de-exciting mercury atoms and re-emits the energy as visible light.

COLLISIONS OF ELECTRONS WITH ATOMS

RECALL

The collision is elastic: the atom absorbs nothing and the electron keeps its kinetic energy.

COLLISIONS OF ELECTRONS WITH ATOMS

SPOT THE ERROR

Say what is wrong with this claim:

Any collision can nudge an atom just a little.

COLLISIONS OF ELECTRONS WITH ATOMS

DEFINITION

Define: Ground state.

ENERGY LEVELS AND PHOTON EMISSION

RECALL

State the photon emission equation.

ENERGY LEVELS AND PHOTON EMISSION

RECALL

Explain why energy levels are negative.

ENERGY LEVELS AND PHOTON EMISSION

RECALL

Explain why line spectra show that energy levels are discrete.

ENERGY LEVELS AND PHOTON EMISSION

RECALL

State which transition gives the longest wavelength.

ENERGY LEVELS AND PHOTON EMISSION

SPOT THE ERROR

Say what is wrong with this claim:

An atom can emit any colour it likes.

ENERGY LEVELS AND PHOTON EMISSION

DEFINITION

Define: De Broglie wavelength.

WAVE-PARTICLE DUALITY

DEFINITION

The lowest energy level of an atom, in which its electrons normally sit.

ENERGY LEVELS AND PHOTON EMISSION

SPOT THE ERROR

An atom cannot absorb just any amount of energy: its energy levels are discrete, so it accepts only the exact energy of a gap between levels; anything less leaves it unchanged.

COLLISIONS OF ELECTRONS WITH ATOMS

RECALL

Zero is set at ionisation, and a bound electron has less energy than a free one.

ENERGY LEVELS AND PHOTON EMISSION

RECALL

$hf = E_1 - E_2$: the photon carries exactly the difference between the two levels.

ENERGY LEVELS AND PHOTON EMISSION

RECALL

The transition with the smallest energy gap, since $\lambda = hc/\Delta E$.

ENERGY LEVELS AND PHOTON EMISSION

RECALL

Sharp lines mean only certain photon energies are emitted, and each equals a gap between two fixed levels.

ENERGY LEVELS AND PHOTON EMISSION

DEFINITION

The wavelength associated with a moving particle: $\lambda = h/p$, where p is the particle's momentum.

WAVE-PARTICLE DUALITY

SPOT THE ERROR

An atom cannot emit any colour: each emitted photon's energy hf must equal the gap between two discrete energy levels, so only certain wavelengths appear, giving a line spectrum.

ENERGY LEVELS AND PHOTON EMISSION

RECALL

State the evidence that particles have wave properties.

WAVE-PARTICLE DUALITY

RECALL

State the evidence that light has particle properties.

WAVE-PARTICLE DUALITY

RECALL

State the condition for significant diffraction of a particle beam.

WAVE-PARTICLE DUALITY

RECALL

State the effect of faster electrons on a diffraction pattern.

WAVE-PARTICLE DUALITY

SPOT THE ERROR

Say what is wrong with this claim:

Light is a wave, and electrons are particles.

WAVE-PARTICLE DUALITY

RECALL

The photoelectric effect: each emitted electron has absorbed a single photon.

WAVE-PARTICLE DUALITY

RECALL

Electron diffraction: a beam of electrons passed through a thin crystal produces a pattern of rings.

WAVE-PARTICLE DUALITY

RECALL

Greater momentum means a shorter de Broglie wavelength, so the rings shrink towards the centre.

WAVE-PARTICLE DUALITY

RECALL

The de Broglie wavelength must be comparable to the size of the gap or spacing.

WAVE-PARTICLE DUALITY

SPOT THE ERROR

Neither label is complete: light also arrives as photons, and electrons also diffract. All matter and radiation show both wave and particle behaviour; the experiment decides which appears, with wavelength $\lambda = h/p$.

WAVE-PARTICLE DUALITY