Home Physics Waves & Particles Quantum Essential Pre-Uni Physics D9.5

Essential Pre-Uni Physics D9.5

A Level

Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

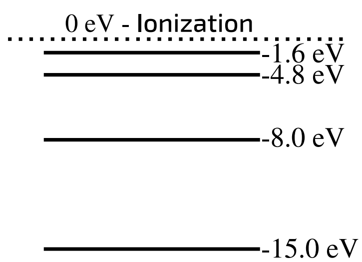

Figure 1: Energy level diagram of the atom this question is concerned with.

Part A Ground state

A $10\,\mathrm{eV}$ photon passes through this atom when it is in the ground state. How much energy is the atom likely to absorb from the photon? Give your answer in electron volts.

Part B First excited state

Repeat the question if the atom starts in the $-8.0\,\mathrm{eV}$ state. You should give a different answer to Part A if at all possible.

Part C Incident electron

For the situation where a $10\,\mathrm{eV}$ **electron** passes through the atom when it is in its ground state, how much energy is the atom likely to absorb from the **electron**? You should have a different answer to Part A.

Essential Pre-Uni Physics J1.9

GCSE C C C A Level P P P

Complete the nuclear equation. Don't forget the neutrino / antineutrino if it is a beta decay! A periodic table is available here, however you shouldn't need it.

$^{23}_{13}\mathrm{Al} \rightarrow \quad \ldots$ (Beta+ decay)

- $^{23}_{13}\mathrm{Mg} \quad + \quad ^{0}_{1}\mathrm{e} \quad + \quad ^{0}_{0}\nu$
- $^{23}_{12}\mathrm{Mg} \quad + \quad ^{0}_{1}\mathrm{e} \quad + \quad ^{0}_{0}\nu$
- $^{23}_{12}\mathrm{Mg} \quad + \quad ^{0}_{1}\mathrm{e} + \quad ^{0}_{0}\overline{\nu}$

Essential Pre-Uni Physics D7.2

A Level

Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

A laser diode requires $3.2\ \mathrm{V}$ across it to make it work. This means that its photons will have an energy of $3.2\ \mathrm{eV}$. Calculate the wavelength of the light emitted.

Essential Pre-Uni Physics D9.3

A Level

Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

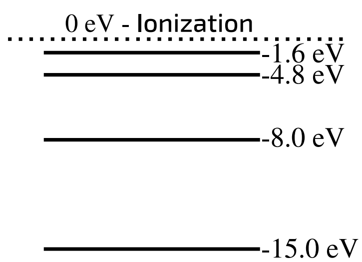

Figure 1: Energy level diagram of the atom this question is concerned with.

If the atom is in the $-1.6\,\mathrm{eV}$ state, and the electron descends to the ground state in three separate stages, what is the wavelength of the least energetic photon emitted?

Essential Pre-Uni Physics D7.7

A Level

C C C

Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

Caution - when working with particles, do not use $c = f\lambda$. Question D7.9 shows you why.

Part A Momentum from KE

Calculate the momentum of an electron if its kinetic energy is $10\,\mathrm{keV}$.

Part B Momentum from wavelength

An electron's wavelength is $3.0 \times 10^{-7}\,\mathrm{m}$. What is its momentum?

Essential Pre-Uni Physics D9.1

A Level

Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

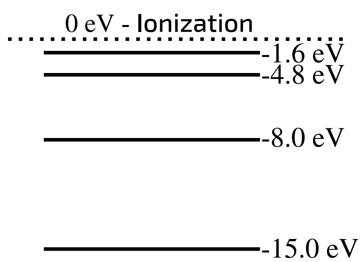

Figure 1: Energy level diagram of the atom this question is concerned with.

How much energy (in eV) is needed to ionize the atom if it is in its ground state?

Essential Pre-Uni Physics D6.4

A Level

Useful physical constants can be found in the hint tabs.

Part A Maximum speed of photoelectrons

Calculate the maximum speed of the photoelectrons emitted when a material with an 8.4×10^{-20} J work function is illuminated by light of frequency 7.0×10^{14} Hz.

Part B Minimum speed of photoelectrons

What is the minimum speed of the photoelectrons emitted?

Essential Pre-Uni Physics D6.5

A Level

A graph of stopping potential (y) against frequency of light (x) is plotted for zinc, and also for aluminium. Without knowing more information, answer the following questions:

Part A Linear graphs?

a) Are the lines straight or not?

- No
- Yes

Part B Sign of the y-intercepts

b) Are the y-intercepts positive, negative or zero?

- Zero
- Positive
- Negative

Part C Sign of the gradients

c) Are the gradients positive, negative or zero?

- Negative
- Zero
- Positive

Part D Comparing the gradients

d) Are the gradients of the two lines the same or different?

- Different
- Same

Part E Comparing the y-intercepts

e) Are the y-intercepts of the two lines the same or different?

- Different
- Same

Part F The x-intercept

f) What is the significance of the x-intercept?

- It is the work function of the material.
- It is the frequency of the incident light.
- It is the threshold frequency.

Part G Common gradient or intercept

g) If you answered `same' to parts (d) or (e), write down the value of the common gradient or intercept.

- Common gradient = $-he$

  Intercept not common

- Common gradient = $\frac{h}{e}$

  Intercept not common

- Common gradient = h

  Intercept not common

- Gradient not common

  Common intercept = $\frac{\mathrm{e}}{\mathrm{h}}$

- Common gradient = $\frac{h}{e}$

  Common intercept = h

- Gradient not common

  Common intercept = $\frac{\text{work function}}{\text{electric charge}}$

isaac Physics. You work it out.

Essential Pre-Uni Physics J1.2

GCSE C C C A Level P P P

Complete the nuclear equation. Don't forget the neutrino / antineutrino if it is a beta decay! A periodic table is available here, however you shouldn't need it.

$^{3}_{1}\mathrm{H} \rightarrow \quad \ldots$ (Beta– decay)

- $^{3}_{2}\mathrm{He} \quad + \quad ^{0}_{-1}\mathrm{e} \quad + \quad ^{0}_{1}\overline{v}$
- $^{3}_{0}\mathrm{He} \quad + \quad ^{0}_{1}\mathrm{e} \quad + \quad ^{0}_{0}v$
- $^{3}_{2}\mathrm{He} \quad + \quad ^{0}_{-1}\mathrm{e} \quad + \quad ^{0}_{0}\overline{v}$

Physics. You work it out.

Essential Pre-Uni Physics J1.1

GCSE C C C A Level P P P

Complete the nuclear equation. Don't forget the neutrino / antineutrino if it is a beta decay! A periodic table is available here, however you shouldn't need it.

$$^{241}_{95}\mathrm{Am} \rightarrow \quad \dots \quad \text{(Alpha decay)}$$

- \quad\ce{^{241}_{94}Np}\quad+\quad{^{0}_{1} \text{e}}\quad+\quad^{0}_{0}\nu
- $^{241}_{96}\mathrm{Np} \quad + \quad ^{0}_{-1}\mathrm{e} \quad + \quad ^{0}_{0}\overline{\nu}$
- $^{237}_{93}\mathrm{Np} \quad + \quad ^{4}_{2}\mathrm{He}$