12.1 Electrons in Atoms

Mark Schemes
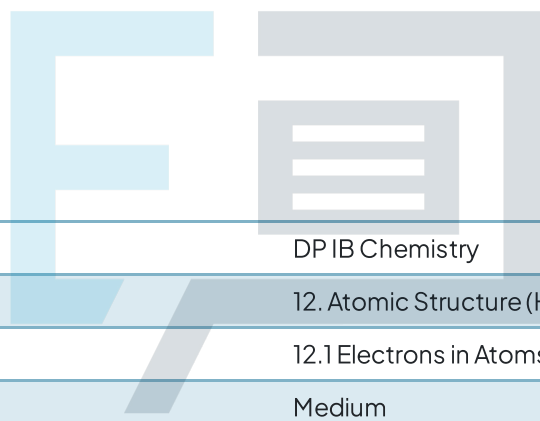
Course	DP IB Chemistry
Section	12. Atomic Structure (HL only)
Topic	12.1 Electrons in Atoms
Difficulty	Medium

To be used by all students preparing for DP IB Chemistry HL
Students of other boards may also find this useful

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The correct answer is **C** because:

- $E = h\nu$

- We also know $\nu = \dfrac{c}{\lambda}$

- Hence we can write $E = \dfrac{hc}{\lambda}$

- Remember to divide by 1000 to get your answer in kJ

- We must also remember to convert 550 from nanometres into metres by multiplying by 10^9

- $E = \dfrac{6.626 \times 10^{-34} \times 2.988 \times 10^8}{550 \times 10^{-9} \times 1000}$

A is incorrect as	the calculation hasn't included the division by 1000 to get the answer in kJ
B is incorrect as	the calculation hasn't converted the 550 nm into metres
D is incorrect as	the equation for ν has been incorrectly substituted into the energy equation

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The correct answer is **B** because:

- The largest jump is between the 2nd and 3rd electrons being removed
- This tells us that the 3rd electron is being removed from new shell
- Hence there are 2 electrons in the outer shell of **Y** so **Y** will lose 2 electrons to form the **Y^{2+}** ion

A is incorrect as	this would correspond to the largest jump being between the 1st and 2nd electrons removed
C is incorrect as	this would correspond to the largest jump being between the 3rd and 4th electrons removed
D is incorrect as	this would correspond to the largest jump being between the 4th and 5th electrons removed

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The correct answer is **A** because:

- The largest jump in successive ionisation energies is between the 1st and 2nd
- This tells us that the 2nd electron is being removed from a new shell
- We know the unknown element must therefore have 1 electron in its outer shell corresponding to a group 1 element

B is incorrect as	group 2 elements have the largest jump between their 2nd and 3rd ionisation energies
C is incorrect as	group 3 elements have the largest jump between their 3rd and 4th ionisation energies
D is incorrect as	group 4 elements have the largest jump between their 4th and 5th ionisation energies

Exam Papers Practice

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The correct answer is **D** because:

- The large decrease in ionisation energy after X suggest the element following X is in a different period
- This is because there is an extra shell increasing the amount of electron shielding so the outer shell electron is removed more easily
- For the element following X to be in a different period X must be in group 18

A is incorrect as	the element in group 3 would be the 3rd element after the large drop in the graph
B is incorrect as	the element in group 10 would be the 10th element after the large drop in the graph
C is incorrect as	the element in group 5 would be the 5th element after the large drop in the graph

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The correct answer is **A** because:

- In an emission spectrum the ionisation energy corresponds to to a transition between from the ground state to $n=\infty$
- This is known as the limit of convergence of the spectrum
- Beyond this the electron can have any energy, so is no longer under the influence of the nucleus: the electron is outside the atom

B is incorrect as	the arrow is in the wrong direction for ionisation
C is incorrect as	the transition is not from the ground state
D is incorrect as	the transition is not from the ground state and the arrow is in the wrong direction