# 12.1 Electrons in Atoms

## Question Paper

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|---|---|
| Course | DP IB Chemistry |
| Section | 12. Atomic Structure (HL only) |
| Topic | 12.1 Electrons in Atoms |
| Difficulty | Hard |

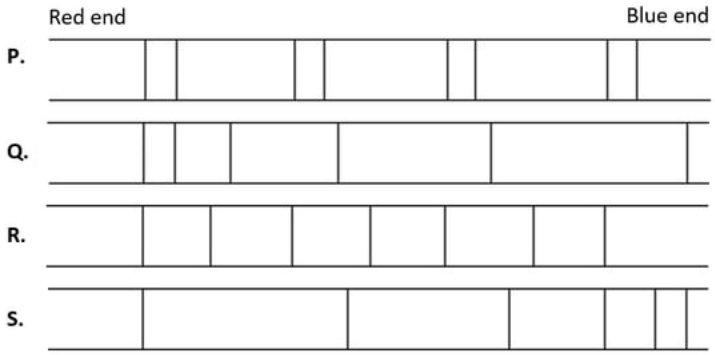
**Time allowed:** 10

**Score:** /5

**Percentage:** /100

## Question 1

Which statement is true about the spectra shown?




A. All the lines in R have the same energy

B. Q and S could represent line emission spectra

C. Only S could represent a line emission spectrum for hydrogen

D. P indicates the element has 4 pairs of electrons at different energy levels

**[1 mark]**

## Question 2

The energy absorbed at the limit of convergence for helium is $19.6 \times 10^{-18}$ J per atom.

Which calculation would be used to calculate the wavelength, in m, for this electron transition?

($c = 3.00 \times 10^{8}$ ms$^{-1}$, $h = 6.63 \times 10^{-34}$ Js)

A. $\lambda = \frac{19.6 \times 10^{-18} \times 3.00 \times 10^{8}}{6.63 \times 10^{-34}}$

B. $\lambda = \frac{3.00 \times 10^{8} \times 6.63 \times 10^{-34}}{19.6 \times 10^{-18}}$

C. $\lambda = \frac{19.6 \times 10^{-18} \times 6.63 \times 10^{-34}}{3.00 \times 10^{8}}$

D. $\lambda = \frac{3.00 \times 10^{8}}{19.6 \times 10^{-18} \times 6.63 \times 10^{-34}}$

**[1 mark]**

## Question 3

The first ionisation energies (in kJ $mol^{-1}$) of five successive elements are:

$$2081, 496, 738, 578, 787$$

What could these elements be?

A. First five elements in a period

B. Second to the sixth elements in a period

C. Last four elements of one period and the first one of the next period

D. Last element of one period and the first four elements of the next period

**[1 mark]**

## Question 4

A period 3 element forms an oxide $M_2O_3$.

Which represents the first four successive ionisation energies of M?

| | Ionisation energy / kJmol$^{-1}$ | | | |
|---|---|---|---|---|
| | **First** | **Second** | **Third** | **Fourth** |
| **A.** | 496 | 4560 | 6940 | 9540 |
| **B.** | 578 | 1820 | 2740 | 11600 |
| **C.** | 1012 | 1907 | 2914 | 4964 |
| **D.** | 736 | 1450 | 7740 | 10500 |

**[1 mark]**

## Question 5

Between which ionisation energies of silicon will there be the greatest difference?

A. Between the second and fourth ionisation energies

B. Between the first and third ionisation energies

C. Between the fourth and fifth ionisation energies

D. Between the fifth and sixth ionisation energies

**[1 mark]**