12.1 Electrons in Atoms

Question Paper

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

Time allowed: 20

Score: /14

Percentage: /100

Question 1a

a)
An element Y has the following first six ionisation energies in kJ mol^{-1}. These are shown in the table below.

	1st	2nd	3rd	4th	5th	6th
Ionisation energy (kJ mol^{-1})	577	1820	2740	11600	14800	18400

State what group of the Periodic Table this element belongs to.

[1]

[1 mark]

Question 1b

b)
State what can be determined from the frequency of the convergence limit in a hydrogen emission spectrum.

[1]

[1 mark]

Question 1c

c)
Hydrogen spectral data give the frequency of 3.30×10^{15} Hz for its convergence limit.

Calculate the ionisation energy, in J, for a single atom of hydrogen using Sections 1 and 2 of the Data Booklet.

[1]

[1 mark]

Question 1d

d)
Calculate the wavelength, in m, for the electron transition corresponding to the frequency in part (c) using Section 1 of the Data Booklet.

[1 mark]

Question 2a

a)

State which element in Period 2 will have the highest first ionisation energy value.

[1]

[1 mark]

Question 2b

b)

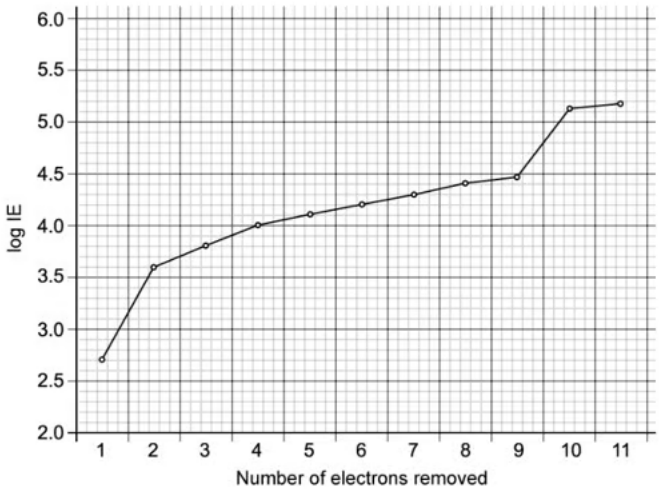
Write an equation, including state symbols, for the third ionisation energy of beryllium.

[1 mark]

Question 2c

c)

The successive ionisation energies of an element, X, are shown below.



State how many shells element X has.

[1]

[1 mark]

Question 2d

d)

Deduce which group element X is in.

[1]

[1 mark]

Question 3a

a)
State the general trend in first ionisation energies across Period 3.

[1]

[1 mark]

Question 3b

b)
The first ionisation energy of aluminium is lower than magnesium. Write the full electron configurations of aluminium and magnesium.

[2]

[2 marks]

Question 3c

c)
Using the electron configurations from part (b), explain why the first ionisation energy of aluminium is lower than magnesium.

[2]

[2 marks]

Question 3d

d)
Write the equation, including state symbols, for the second ionisation energy of aluminium.

[1]

[1 mark]