

3.1 The Periodic Table & Periodic Trends

Question Paper

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| Course | DP IB Chemistry |
| Section | 3. Periodicity |
| Topic | 3.1 The Periodic Table & Periodic Trends |
| Difficulty | Hard |

Time allowed: 60
Score: /43
Percentage: /100

Question 1a

- a)
This question refers to the elements in the first three periods of the Periodic Table.
Select an element from the first three periods that fits each of the following descriptions.
- i)
The element with the highest first ionisation energy [1]
- ii)
The element that forms a 1- ion with the same electron configuration as helium [1]
- iii)
An element which forms a compound with hydrogen in which the element has an oxidation number of -4 [1]

[3 marks]

Question 1b

- b)
This question is about the elements which have atomic numbers 33 to 37.
The first ionisation energies of these elements are shown in the table below.

| Element | As | Se | Br | Kr | Rb |
|---|-----|-----|------|------|-----|
| Ionisation energy value in kJ mol^{-1} | 947 | 941 | 1340 | 1351 | 403 |

- i)
Suggest the formulae of the hydrides of arsenic and selenium [2]
- ii)
Explain why the first ionisation energy of rubidium is lower than that of krypton [2]
- iii)
State which of the elements, arsenic to rubidium, has atoms with the smallest atomic radius [1]

[5 marks]

Question 1c

c)

The first 3 elements of Period 3 show a general increase in melting point.

Explain this trend in melting point across these Period 3 elements.

[3 marks]

Question 1d

d)

This question is about hydrogen, the element with the atomic number $Z = 1$.

Hydrogen can be placed in several different positions in periodic tables. One is immediately above lithium in Group 1 as shown in section 6 of the data booklet. Another is in the centre of the first row.

Evaluate the position of hydrogen when it is placed immediately above lithium and state **one** reason in favour and **two** against.

[3]

[3 marks]

Question 2a

a)

This question is about Period 4 of the Periodic Table.

State and explain which of K^+ and Ca^{2+} is the smaller ion.

[2]

[2 marks]

Question 2b

b)

Write the electron configuration for a Ca^+ ion.

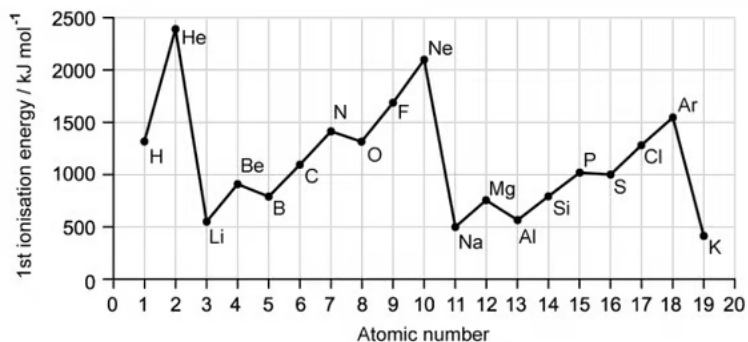
[1]

[1 mark]

Question 2c

c)

The first ionisation energies of the elements H to K are shown below.



State and explain the trend in first ionisation energies shown by the elements with the atomic numbers 2, 10 and 18.

[4]

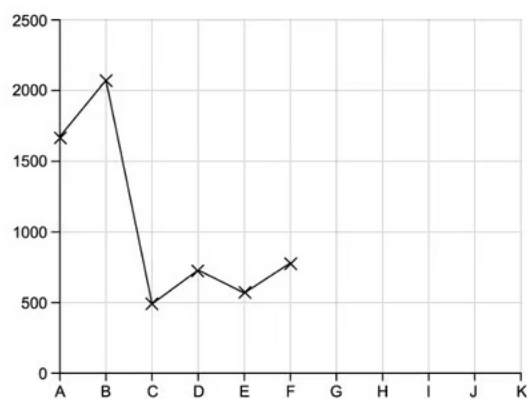
[4 marks]

Question 3a

a)

Electrons in atoms occupy orbitals.

The figure below shows the first ionisation energies for six consecutive elements labelled **A-F**.



Complete the graph of the first ionisation energies for the next five elements.

[3]

[3 marks]

Question 3b

b)

Explain why the value of the first ionisation energy for D is greater than for C.

[2]

[2 marks]

Question 3c

c)

The sequence of the first three elements in the Periodic Table is hydrogen, helium and then lithium.

Explain why the first ionisation energy of hydrogen is less than that of helium but greater than that of lithium.

[4]

[4 marks]

Question 4a

a)

First ionisation energies decrease down groups in the Periodic Table.

Explain this trend and the effect on the reactivity of groups containing metals.

[3]

[3 marks]

Question 4b

b)

The ionisation energy values show a general increase across period 4 from gallium to krypton.

State and explain how selenium deviates from this trend.

[3]

[3 marks]

Question 4c

c)

Give one other element from period 2 or 3 which also deviates from this general trend, similar to selenium.

[1]

[1 mark]

Question 4d

d)

State and explain the trends in electronegativity down group 2 and across period 3.

[6]

[6 marks]



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