

Orbitals, configurations and ionisation energy patterns

Chemistry grades 11-12 (A Level · IB · Class 11-12) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test covers configurations, ionisation energy and successive data. Answer every question, show your working and write units. You may use a periodic table and a calculator. The total is 20 marks.

Level: Chemistry grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** A Level 3.1.1, IB S1.3

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Configurations of nickel (2 marks)

Nickel has atomic number 28.

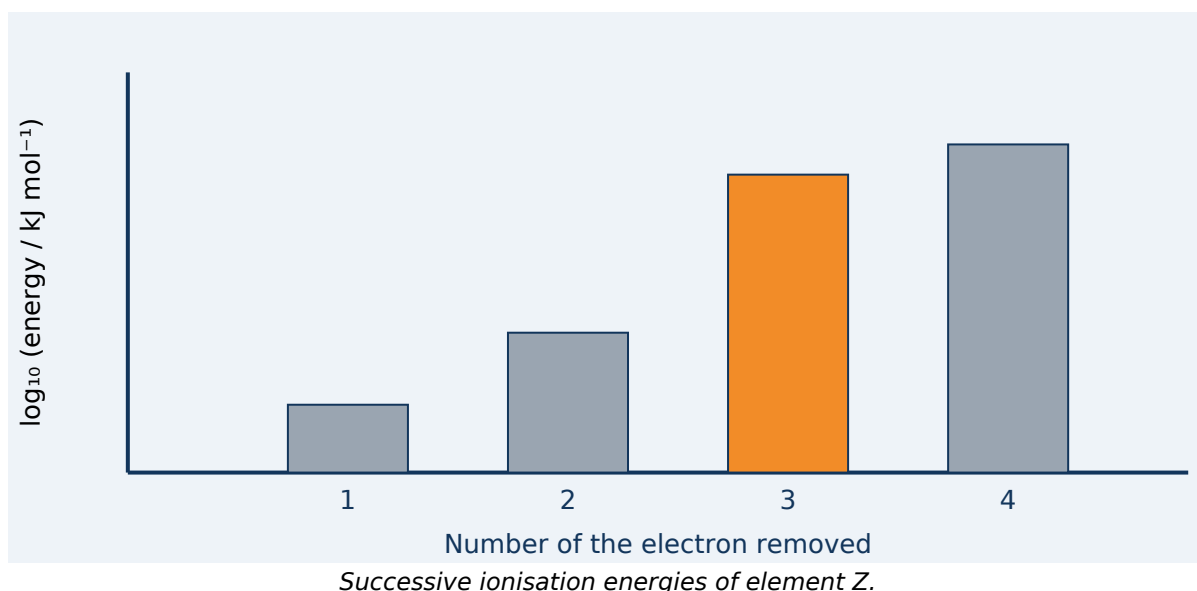
- Write the shorthand configuration of a nickel atom. (1 mark)
- Write the configuration of Ni^{2+} . (1 mark)

Question 2 Defining ionisation energy (2 marks)

Define the first ionisation energy of aluminium and write the equation for it, with state symbols. (2 marks)

Question 3 Reading the graph (4 marks)

The bar chart shows successive ionisation energies of element Z.



- State the group of Z. (1 mark)
- Write the formula of the ion Z forms. (1 mark)
- Explain the large increase between electrons 2 and 3. (2 marks)

Question 4 Neon and argon (3 marks)

The first ionisation energy of neon is 2081 kJ mol^{-1} and that of argon is 1521 kJ mol^{-1} . Explain why argon is lower. (3 marks)

Question 5 Energy for lithium (2 marks)

The first ionisation energy of lithium is 520 kJ mol^{-1} . Calculate the energy needed to ionise 0.0500 mol of gaseous lithium atoms. (2 marks)

Question 6 Carbon in boxes (2 marks)

Carbon has the configuration $1s^2 2s^2 2p^2$. State how many unpaired electrons it has and name the rule that decides how the 2p electrons are arranged. (2 marks)

Question 7 Phosphorus and sulfur (2 marks)

Phosphorus has a first ionisation energy of 1012 kJ mol^{-1} and sulfur 1000 kJ mol^{-1} . Explain why sulfur is slightly lower. (2 marks)

Question 8 Chromium (3 marks)

State the ground-state configuration of chromium ($Z = 24$) and explain why it is not $[\text{Ar}] 3d^4 4s^2$. (3 marks)