Atomic structure: teacher guidance

**These Knowledge check worksheets**provide a series of questions to assess learners’ knowledge and understanding of this topic at the end of a period of teaching or as revision. They are available at Foundation and Higher level and as fully editable versions so you can adapt them to suit learners’ needs. Use for individual student work in class or at home. Find the full set of answers below.

Also available to assess this topic:

* **Review my learning** **worksheets**: available with three levels of scaffolded support to help build confidence in every learner. Use before, during or after teaching the relevant topic, to understand progress and identify misconceptions, **rsc.li/44igB7V**.
* **Stretch and challenge worksheets** ask learners to apply their knowledge to an unfamiliar context, helping them develop their skills and prepare for examination, **https://rsc.li/3RpZ4Wq**.

Answers

Foundation

1. (a) An atom consists of a nucleus surrounded by **electrons** in shells. The nucleus of most atoms contains **protons/neutrons** and **neutrons/protons**.

All atoms of the same element have the same numbers of **protons/electrons** and **electrons/protons**. [3 marks]

(b) atomic number $=$ 4 [1 mark]

(c) mass number $=$ 9 [1 mark]

(c) $$ [1 mark]

(d) [1 mark per correct row: 2 marks]

|  |  |  |
| --- | --- | --- |
| **Sub-atomic particle** | **Relative mass** | **Relative charge** |
| proton | 1 | +1 |
| neutron | **1** | **0** |
| electron | **very small/0** | **‒1** |

(e) An atom of beryllium has equal numbers of positive charges (protons) and negative charges (electrons). [1 mark]

1. (a) Most of the mass is in the nucleus. [1 mark]

(b) **B.** $1 × 10^{–10} m$ [1 mark]

1. (a) **B.** $number of neutrons = mass number – atomic number$ [1 mark]

(b) [1 mark per correct row: 3 marks]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Atom** | **Atomic number** | **Mass number** | **Number of protons** | **Number of neutrons** | **Number of electrons** |
| aluminium | 13 | 27 | 13 | **14** | **13** |
| phosphorus | 15 | 31 | **15** | 16 | **15** |
| scandium | 21 | 45 | **21** | **24** | 21 |

1. (a) Isotopes of an element have the same number of **protons/electrons** [1] and **electons/protons** [1], but different numbers of **neutrons** [1].They have the same **atomic** [1] number but different **mass** [1] numbers. [5 marks]

(b) i. carbon-13 $$ [1 mark]

 ii. carbon-14 $$ [1 mark]

(c) i. 18 neutrons [1 mark]

 ii. 20 neutrons [1 mark]

 [Total: 24 marks]

Higher

1. (a) atomic number is 4 [1 mark]

(b) mass number is 9 [1 mark]

(c) in the nucleus [1 mark]

(d) i. four [1 mark]

 ii. four [1 mark]

 iii. five [1 mark]

(e) $$ [1 mark]

(f) **C.** 0.112 nm [1 mark]

1. (a) number of neutrons = mass number – atomic number [1 mark]

(b) [1 mark per correct row: 4 marks]

|  |  |  |  |
| --- | --- | --- | --- |
| **Atom or ion** | **Number of protons** | **Number of neutrons** | **Number of electrons** |
| $$$$ | **13** | **14** | **13** |
| $$$$ | **21** | **24** | **21** |
| $$+ | **19** | **20** | **18** |
| $$3– | **15** | **16** | **18** |

1. (a) Isotopes are atoms of the same element that have the same atomic number, [1] but different mass numbers [1].

**OR**

Isotopes are atoms of the same element that have the same number of protons,[1] but different numbers of neutrons [1]. [2 marks]

(b) i. $ $ [1 mark]

 ii. $$[1 mark]

 iii. $$ [1 mark]

(c) The electrical charge is determined by the number of positive (protons) and negative (electrons) sub-atomic particles [1]. Isotopes of an
element have equal numbers of positive and negative charges [1].

[2 marks]

(d) The relative atomic mass of an element is the (weighted or taking abundance into account) average of all isotopes [1]. The relative atomic mass of 12.011 takes carbon-13 and carbon-14 into account [1]. [2 marks]

(e) $l$ is more common. [1 mark]

1. (a) Atomic models changed as new sub-atomic particles were
discovered. [1 mark]

(b)

|  |  |
| --- | --- |
| **Scientist** | **Contribution to atomic structure model** |
| John Dalton | **identified atoms as discrete spheres.** |
| **J J Thomson** | discovered the negatively charged electrons and reasoned that they were in a positive field. |
| Ernest Rutherford | **discovered that the positive charge was concentrated in a central nucleus.** |
| **Niels Bohr** | discovered that electrons orbit the central nucleus in shells/energy levels. |

[4 marks]

 [Total: 28 marks]