# Atomic Structure

GCSE Science • **Combined and Triple** • Grades 3–6

**WORKED SOLUTIONS**

Name: worked example Class: _____ Total: 52 / 52

*Show all your working. Marks are given for correct method as well as the final answer.*

**1.** Name the three sub-atomic particles and give the charge of each. **[3 marks]**

proton: positive
neutron: no charge
electron: negative

**Answer:** proton +1, neutron 0, electron −1

**2.** State where in the atom the protons and neutrons are found. **[1 mark]**

electrons orbit outside it in shells

**Answer:** in the nucleus

**3.** Explain why an atom has no overall charge. **[2 marks]**

the +1 and −1 charges cancel exactly

**Answer:** equal numbers of protons and electrons

**4.** Define the atomic number of an element. **[1 mark]**

it is what makes it that element

**Answer:** the number of protons

**5.** Define the mass number of an atom. **[1 mark]**

electrons are too light to count

**Answer:** protons + neutrons

**6.** Sodium has atomic number 11 and mass number 23. Work out the number of neutrons. **[2 marks]**

23 − 11
= 12 neutrons

**Answer:** 12

**7.** For that sodium atom, write down the number of electrons. **[1 mark]**

neutral atom, so electrons = protons

**Answer:** 11

**8.** A chlorine atom has 17 protons and 18 neutrons. Write down its mass number. **[1 mark]**

17 + 18 = 35

**Answer:** 35

**9.** An ion has 12 protons and 10 electrons. Work out its charge. **[2 marks]**

two more protons than electrons
lost 2 electrons, so 2+

**Answer:** 2+

**10.** Define an isotope. **[2 marks]**

same element, different mass number

**Answer:** same protons, different numbers of neutrons

**11.** Explain why isotopes of an element react in the same way. **[2 marks]**

reactions depend on the OUTER electrons
neutrons do not affect them

**Answer:** they have the same electronic structure

**12.** Chlorine is 75% chlorine-35 and 25% chlorine-37. Work out its relative atomic mass. **[4 marks]**

$(75 \times 35) + (25 \times 37)$
$= 2625 + 925 = 3550$
$3550 \div 100 = 35.5$

**Answer:** 35.5

**13.** Write down the electronic structure of an atom with 11 electrons. **[2 marks]**

fill 2 then 8 then the rest

**Answer:** 2, 8, 1

**14.** Write down the electronic structure of an atom with 17 electrons. **[2 marks]**

$2 + 8 + 7 = 17$

**Answer:** 2, 8, 7

**15.** An element has the electronic structure $2, 8, 2$. Write down which group of the periodic table it is in. **[2 marks]**

the group number is the number of OUTER electrons

**Answer:** group 2

**16.** Explain why the elements in group 0 are unreactive. **[2 marks]**

no need to gain, lose or share electrons

**Answer:** they have a full outer shell

**17.** Explain why reactivity increases down group 1. **[3 marks]**

more shells, so more shielding
weaker attraction to the nucleus
so the outer electron is lost more easily

**Answer:** the outer electron is further from the nucleus

**18.** Explain why reactivity DECREASES down group 7. **[3 marks]**

group 7 atoms GAIN an electron
opposite reasoning to group 1
more shielding means weaker attraction for it

**Answer:** it is harder to gain an electron

**19.** The model of the atom has changed over time.

**(a)** Describe the plum pudding model. **[2 marks]**

a ball of positive charge
with electrons dotted through it

**(b)** Describe what the alpha scattering experiment showed. **[3 marks]**

most alpha particles passed straight through
so the atom is mostly empty space
a few bounced back, so there is a small dense nucleus
which is positively charged

**Answer:** ____ positive ball with electrons in it ; a small dense positive nucleus____

**20.** Magnesium has the symbol $^{24}_{12}Mg$.

**(a)** Write down the numbers of protons, neutrons and electrons. **[3 marks]**

protons = 12 (the bottom number)
neutrons = 24 – 12 = 12
electrons = 12

**(b)** Write down the electronic structure and hence the group. **[3 marks]**

2, 8, 2
2 outer electrons, so group 2

**Answer:** ____ 12, 12, 12 ; 2,8,2 and group 2____

**21.** An atom of an element has 19 protons and 20 neutrons.

**(a)** Work out its mass number. **[1 mark]**

19 + 20 = 39

**(b)** Work out its electronic structure and predict how reactive it is. **[4 marks]**

2, 8, 8, 1
one outer electron, so group 1
very reactive
it loses that one electron easily

**Answer:** ____ 39 ; 2,8,8,1 and very reactive____

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