# MARK SCHEME

# GCSE

## CHEMISTRY

## AQA - COMBINED SCIENCE

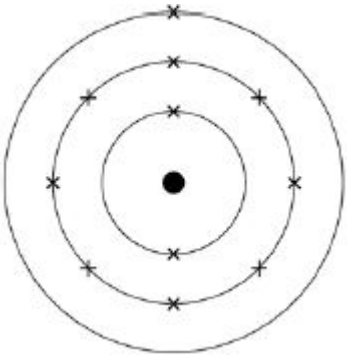
---

## C1 - TEST 6

### ATOMIC STRUCTURE AND THE PERIODIC TABLE

### Advanced

**1.** (a)



*allow dot, cross, or e to show electrons*

**1**

(b) any **two** from:

- use tongs / tweezers to handle metal
- use a (safety) screen
- use a small piece of metal
- use a large volume of water
- keep a safe distance between teacher / students and apparatus

*ignore store metal under oil*

**2**

(c) $OH^-$

**1**

(d) as diameter increases, reactivity increases

**1**

(because as diameter increases) outer electron is further from the nucleus

*allow (because as diameter increases) outer shell is further from nucleus*

**1**

(so) outer electron is less attracted to the nucleus

*allow (so there is) increased shielding*

**1**

(so) outer electron is lost (more) easily

**1**

**[8]**

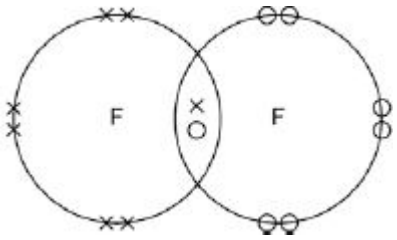
**2.** (a) g

*do **not** accept upper case (G)*

*do **not** accept gas*

**1**

(b)




*one shared pair anywhere in overlap between two circles **or** on intersection*

**1**

*6 other electrons on each atom*

**1**

*allow dots **or** crosses **or** mixture for all marks*

*ignore any inner shell electrons*

(c) 18

**1**

(d) $AlBr_3$

**1**

**2** Al + 3 $Br_2$ (⟶ 2 $AlBr_2$)

**1**

*allow **1** mark for balancing their equation with an incorrect product*

(e) chlorine is a smaller atom
**or** has fewer energy levels
**or** outer shell closer to nucleus

*ignore chlorine has fewer electrons*

**1**

chlorine has less shielding
**or**
has the greater attraction between the nucleus and the outer shell **or** incoming electron

**1**

therefore chlorine can gain an electron (into the outer shell) more easily

**1**

*if no other marks awarded allow **1** mark for correct trend in reactivity in Group 7*

*do **not** accept reference to incorrect particles e.g. chloride atom*

***max 2** if outer shell / level not mentioned*
*'it' refers to chlorine*
*allow converse reasons for bromine being less reactive*

**[9]**

**3.** (a) most alpha particles went straight through, suggesting lots of empty space

**1**

a few alpha particles bounced back, suggesting small central nucleus

1

with all the positive charge

1

the plum pudding model does not explain the results because it shows the whole atom as a ball of positive charge with no empty space

1

(b) the figures show that the radius of an atom is 10 000 times bigger than the nucleus

1

consistent with the nuclear model, which says that the atom has a tiny nucleus at the centre of the atom

1

(c) all hydrogen atoms have just one proton (in the nucleus)

1

some hydrogen atoms also have one neutron

1

protons and neutrons have the same relative mass so mass number of these atoms is 2

1

(d) neutrons are not attracted or repelled by a positive nucleus

1

so the neutrons would all pass through the foil

1

**[11]**

**4.** (a) because they form hydroxides

1

that give alkaline solutions (in water)

1

(b) the atoms have more electron shells (as move down the group)

1

so the electron in the outer shell is further away from the nucleus

1

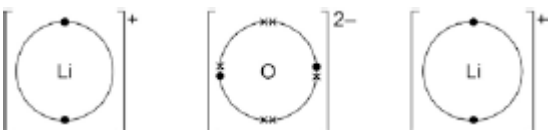
which reduces the attraction to the nucleus

1

so the electron is lost more easily from the atom

1

(c)




*electronic structure of lithium drawn correctly*

1

*electronic structure of oxygen drawn correctly*

1

*correct charge on ions ($Li^+$ and $O^{2-}$)*

1

*correct number of each ion (2 lithium, 1 oxygen)*

1

**[10]**

**5.** (a) electron
proton
neutron

*this order only*
*all 3 correct = **2** marks*
*1 or 2 correct = **1** mark*

2

(b) **A** = electron has less mass so is deflected more
**or**
electron deflected towards positive because it is negatively charged

1

**B** = neutron because the neutron's path does not change as not charged

1

**C** = proton <u>and</u> proton has greater mass (accept heavier) so is deflected less (than electron)
**or**
proton is deflected towards negative because it is positively charged

1

this is because the lower plate is negative
**or**
upper plate is positive

1

(c) $\frac{23}{6.02 \times 10^{23}}$

1

$3.82 \times 10^{-23}$

*answer to 3 significant figures*

1

(d) $2.27 \times 10^{-14}$

1

**[9]**

**6.** (a) $1 \times 10^{-10}$ m

1

(b) 1 / one

*allow alkali metals*

1

(c) R and S

**1**

because they have the same number of protons

*allow same atomic number, different mass number*

**1**

and a different numbers of neutrons

**1**

(d) **Level 3 (5–6 marks):**
A relevant and coherent explanation of the trend in reactivity. The response makes logical links between the points raised and considers both the number of energy levels and the distance between the nucleus and the outer energy level.

**Level 2 (3–4 marks):**
Statements that are linked to provide a simple explanation of the trend in reactivity using either the number of energy levels or the distance between the nucleus and the outer energy level.

**Level 1 (1–2 marks):**
Simple statements made about the halogens or the trend in reactivity.

**0 marks:**
No relevant comment

**Indicative content**

Simple statements / descriptions

- have 7 electrons in the outer shell
- need to gain an electron
- form ions with a -1 charge
- halogens further down the group are less reactive (or vice versa)
- halogens further down the group have more shells or energy levels (or vice versa)

Linked statements / explanations

- have 7 electrons in the outer shell so need to gain an electron to have the electronic structure of a noble gas
- halogens further down the group are less reactive because they have more shells or energy levels (or vice versa)
- halogens further down the group have more shells or energy levels so less attractive force on the incoming electron (or vice versa)
- halogens further down the group have more shells or energy levels so more 'shielding' against the incoming electron (or vice versa)
- outer electrons of halogens further down group are further away from the attractive force of the nucleus (or vice versa)
- an electron is less easily gained because there are more shells or energy levels (or vice versa)
- an electron is less easily gained because the outer electrons are further from the attractive force of the nucleus (or vice versa)

**6**

**[11]**