

Metallic structure and bonding in electric cars: teacher guidance

These **In context** worksheets ask learners to use their knowledge of metallic structure and bonding in an applied context, building their confidence and capability to face exam questions. Calculation questions are included to give opportunities to practise mathematical skills within this topic. The worksheets are available at Foundation and Higher level and as fully editable versions, giving you the flexibility to select the questions most relevant to a particular lesson.

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.
- **Knowledge check worksheets**: select from Foundation and Higher level to assess learners' knowledge and understanding of this topic at the end of a period of teaching or as revision, rsc.li/3KGo7Aw.

Answers

Please note that particles in metals are referred to as ions. They can also be called particles.

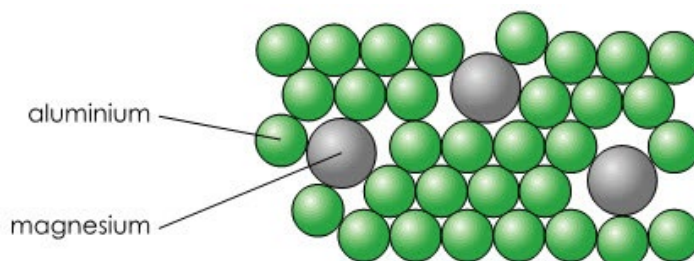
Foundation

- 1 (a) **B** Metals consist of positive metal ions in a sea of negative delocalised electrons.
(b) **B** Layers of regularly arranged metal ions can move over each other.
(c) metal ions; electrons; electrostatic

- 2 (a) percentage of magnesium in the alloy = 10%

$$\begin{aligned} 10\% \text{ of } 1000 \text{ kg} &= \frac{10}{100} \times 1000 \\ &= 100 \text{ kg} \end{aligned}$$

(b)



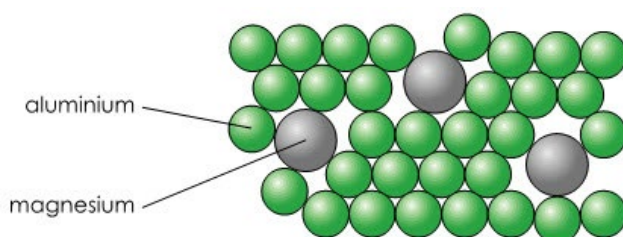
- (c) **D** The larger magnesium ions disrupt the regular arrangement of metal ions and the layers cannot roll over each other so easily.

- 3 (a) **C** The delocalised electrons move through the structure and carry the charge.
- (b) (i) 1+
- (ii) 100 electrons
- (c) 200 electrons

Higher

- 1 (a) Metals have regularly arranged layers of metal ions in a sea of delocalised electrons.
- (b) The layers of regularly arranged metal ions move over each other.
- (c) A metallic bond is the electrostatic attraction/force between positive metal ions and negative delocalised electrons.

2 (a)



- (b) The regularly arranged layers of metal ions in pure aluminium roll over each other and the metal is flexible.

The larger magnesium ions in the alloy disrupt the regular arrangement of metal ions and the layers do not roll over each other so easily.
The alloy is less flexible than the pure metal.

- 3 (a) Delocalised electrons in copper move through the structure and carry the charge.
- (b) 53 kg = 53,000 g
number of moles = $\frac{53,000}{63.5} = 834.6$ (to one decimal place)
- (c) i. One mole of copper atoms produces two moles of delocalised electrons.
- ii. Since 53 kg copper contains 834.6 moles copper, and one mole of copper produces two moles of delocalised electrons, 53 kg copper produces:
 $2 \times 834.6 = 1669.2$ delocalised electrons
- (d) One mole of lithium atoms produces one mole of delocalised electrons.
- (e) i. One mole of copper contains 6.02×10^{23} atoms.
- ii. 53 kg of copper contains 834.6 moles of copper atoms, so 834.6 moles of copper contain:
 $(6.02 \times 10^{23}) \times 834.6 = 5.02 \times 10^{26}$ atoms
- (f) i. Copper has the stronger metallic bond.
- ii. Copper ions have a 2+ charge and each copper atom produces two delocalised electrons.

Note: other factors, such as the size of the ion, influence the strength of a metallic bond.