

Structure and bonding of carbon: teacher guidance

These **In context** worksheets ask learners to use their knowledge of structure and bonding of carbon 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/3VoBE4C.

Answers

Foundation

- (a) **D.** rings of six carbon atoms
 - (b) **A.** empty spaces
 - (c) **A.** 3.45×10^{-10} m
- (a) intermolecular forces
 - (b) One or more of **A.**, **B.**, **C.** All are acceptable answers.
 - (c) one delocalised electron
 - (d) thickness of the graphite sample = $(3 \times 0.345) + (2 \times 0.340)$
 $= 1.035 + 0.680$
 $= 1.715$ nm
- (a) Until then, the diamond and graphite were the only known forms of carbon. Both have a **giant covalent** structure. The formula of the Buckminsterfullerene is **C₆₀**. The Buckminsterfullerene has a **simple molecular** structure.
 - (b) Carbon atoms are arranged in hexagons and pentagons in a hollow spherical molecule.
 - (c) relative formula mass = 60×12
 $= 720$

- 4 (a) Each carbon atom in diamond forms four strong covalent bonds with four other carbon atoms. Diamond has a rigid tetrahedral structure, which makes diamond very hard.
- (b) mass of 2.5 carat diamond = $2.5 \times 0.200 = 0.500 \text{ g}$
- (c) volume of 2.5 carat diamond = $\frac{0.500}{3.51} = 0.142 \text{ cm}^3$

Higher

- 1 (a) i. rings of carbon atoms
ii. empty spaces
- (b) Graphite consists of layers of carbon atoms. These layers are held in place with weak intermolecular forces, which are easily overcome.
- (c) Graphene is a single layer of carbon atoms that is one atom thick, so scientists consider graphene to be a two-dimensional structure. Graphite consists of many layers of carbon atoms and so has three dimensions.
- (d) $3.45 \times 10^{-10} \text{ m}$
- (e) thickness of the graphite sample = $(3 \times 0.345) + (2 \times 0.340)$
 $= 1.035 + 0.680$
 $= 1.715 \text{ nm}$
- 2 (a) i. giant covalent structure
ii. giant covalent structure
iii. simple molecular structure
- (b) relative formula mass = 60×12
 $= 720$
- (c) 720 g
- (d) 6.02×10^{23} molecules
- (e) number of times larger = $\frac{0.22 \times 10^9}{1.1} = 2.00 \times 10^8$ times larger
- 3 (a) Each carbon atom in diamond forms four strong covalent bonds with four other carbon atoms. Diamonds also have a rigid tetrahedral structure, which makes diamonds very hard.
- (b) mass of 2.5-carat diamond = 2.5×0.200
 $= 0.500 \text{ g}$
- (c) number of moles = $\frac{\text{mass}}{\text{molar mass}}$
 $= \frac{0.500}{12} = 0.0416 \text{ mol}$
- (d) number of carbon atoms in 2.5-carat diamond = $0.0416 \times (6.02 \times 10^{23})$
 $= 2.50 \times 10^{22} \text{ atoms}$