IGCSE CHEMISTRY • EXERCISE SHEET

2.6 Giant covalent structures

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

KEY WORDS giant covalent structure 巨型共价结构 • silicon(iv) oxide 二氧化硅 • graphite 石墨 • diamond 金刚石 • lubricant 润滑剂

Objective

Build the skills to answer exam questions on **giant covalent structures** 巨型共价结构 — **diamond** 金刚石, **graphite** 石墨 and silicon(IV) oxide, and how structure explains their properties.

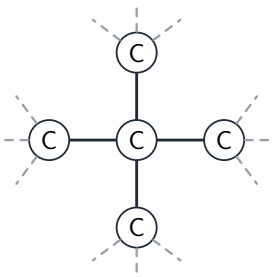
You must be able to:

- describe the bonding in diamond and graphite
- link structure to properties (hardness, conductivity, lubrication)
- describe silicon(IV) oxide as a giant covalent structure

1 Worked examples

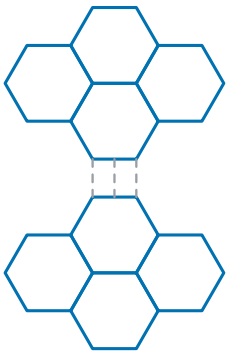
Diamond vs graphite

diamond



each carbon bonded to **4** others: a hard 3-D network

graphite



flat layers of hexagonal rings (each C bonded to **3**); weak forces let the layers slide

Diamond: each C bonded to 4 others (hard). Graphite: flat layers with weak forces between (slippery)

- **diamond:** rigid 3-D network → very hard → cutting tools.

- **graphite:** layers slide (lubricant); one free electron per C → conducts (electrodes).
- **SiO_2:** giant covalent like diamond → very hard, very high melting point.

2 Practice

2.1 State how many carbon atoms each carbon is bonded to in diamond. [1]

2.2 State one use of graphite. [1]

3 Exam-style questions

3.1 Graphite conducts electricity because: [1]

- **A** it contains ions
- **B** each carbon has a free (delocalised) electron
- **C** the layers are strongly bonded
- **D** it is a metal

3.2 Diamond and graphite are both forms of carbon.

(a) Explain why diamond is very hard. [2]

(b) Explain why graphite is a good lubricant. [2]

3.3 Explain why both diamond and graphite have very high melting points. [2]

Solutions

2.1 four.

2.2 as a lubricant (or as an electrode).

3.1 B. Each carbon has one free (delocalised) electron that can move.

3.2 (a) each carbon is bonded to four others by strong covalent bonds; forming a rigid 3-D network, so it is very hard.
(b) graphite has layers held by weak forces; the layers can slide over each other.

3.3 they are giant covalent structures with many strong covalent bonds; a lot of energy is needed to break them, so the melting point is very high.