

## Covalent structure and bonding in our bodies

Covalent bonds are far more common in the human body than other types of bonds. That is because about 96% by mass of our bodies is made from four non-metallic elements: carbon, hydrogen, oxygen and nitrogen.

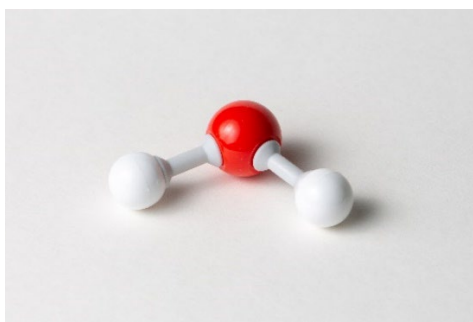


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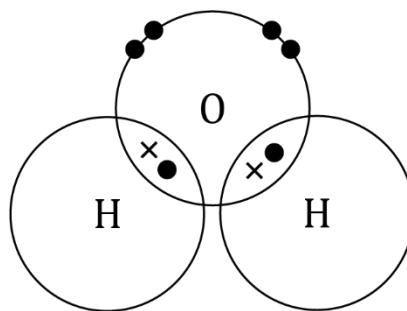
- 1 (a) Non-metals combine together with covalent bonds. Which statement about covalent bonds is correct? Circle the correct answer.

- A** Electrons are shared in a covalent bond.
- B** Electrons are transferred in a covalent bond.
- C** Ions are formed in covalent bonds.
- D** Electrons are delocalised in a covalent bond.

Approximately 60% of our body is made up of water ( $\text{H}_2\text{O}$ ). The diagrams show two ways of representing a molecule of water:



**A**



**B**

- (b) Give one limitation of diagram A.

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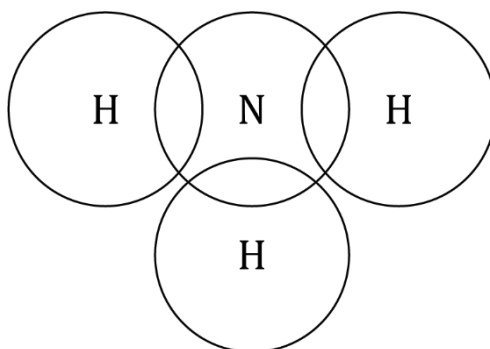
- (c) Give one limitation of diagram B.

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2 Ammonia is produced by cells throughout the body.

(a) Complete the dot and cross diagram for an ammonia atom.

Hint: Hydrogen has one outer shell electron and nitrogen has five.



(b) State the molecular formula of ammonia.

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(c) Calculate the relative formula mass ( $M_r$ ) of ammonia.

$A_r$  nitrogen = 14

$A_r$  hydrogen = 1

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(d) Calculate the percentage by mass of nitrogen in ammonia. Give your answer to one decimal place.

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3 24% of atoms in our bodies are oxygen atoms. Oxygen gas is absorbed into the blood in our lungs.

(a) Calculate how many oxygen molecules ( $O_2$ ) can be made from 100 oxygen atoms.

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- (b) Explain why oxygen is a gas at room temperature.  
Use these words in your answer:

**simple molecules****weak forces****energy****intermolecular forces**

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- 4** Starch molecules contain oxygen and are part of our diet. Starch is a natural polymer. The table shows the approximate sizes of oxygen and starch molecules:

Molecule	Approximate size /nm
oxygen molecule	0.35
typical starch molecule	70.0

- (a) Calculate how many times larger a typical starch molecule is than an oxygen molecule.

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- (b) State which molecule has stronger intermolecular forces.

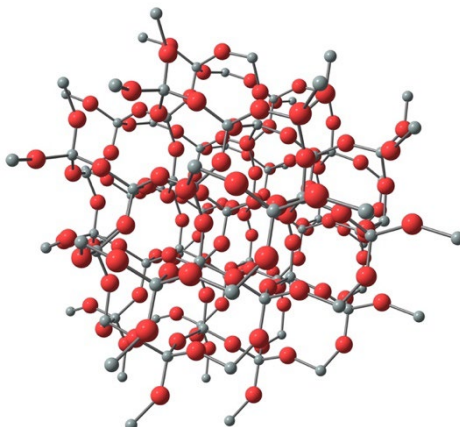
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- (c) Describe the effect stronger intermolecular forces have on the melting point of starch compared to oxygen.

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- 5 Silicon dioxide is present in small amounts in our bodies. It is essential for skeletal health. The diagram shows the structure of silicon dioxide.



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(a) Label the diagram to show:

- a silicon atom
- an oxygen atom
- a single covalent bond.

The melting point of silicon dioxide is  $1710^{\circ}\text{C}$ .

(b) Name the type of bonds that are broken when silicon dioxide melts.

(c) Which of the following explain why silicon dioxide has a high melting point. Circle the **two** correct answers.

- A** Silicon dioxide is a simple molecule.
- B** Silicon dioxide has strong bonds.
- C** It requires a lot of energy to break the bonds of silicon dioxide.
- D** Silicon dioxide has weak bonds.



Which question(s) did you get wrong? Why?

What will you do next time you're asked a similar question?