Covalent structure and bonding

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

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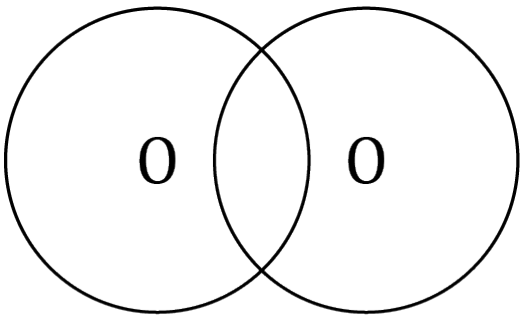
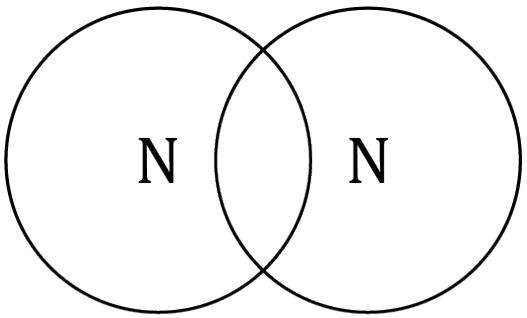
(a) Add lines to link the molecules with the type of covalent bond between their atoms.

oxygen molecule	single covalent bond
nitrogen molecule	double covalent bond
hydrogen molecule	triple covalent bond

(b) Complete the dot and cross diagrams:



oxygen molecule



nitrogen molecule

2 Starch molecules contain carbon, hydrogen and oxygen. Starch is a natural polymer and is part of our diet.

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.

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

(c) Explain the effect the stronger intermolecular force have on the melting point of starch.

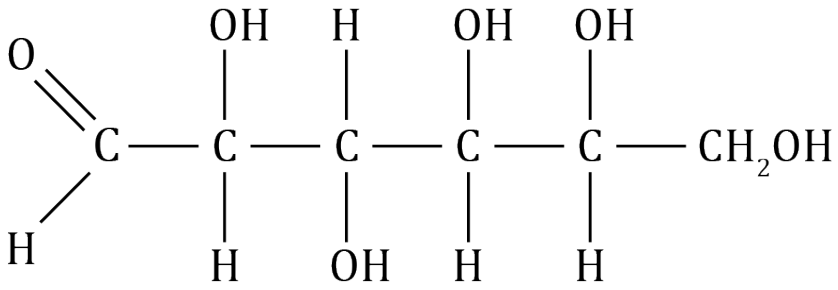
(d) Explain why oxygen is a gas at room temperature.

The molecular formula of the polymer starch is $(C_6H_{10}O_5)_n$

(e) What does 'n' represent?

(f) Calculate the relative formula mass of a small starch molecule where n = 200.

Starch is broken down into glucose in our digestive systems. This is one form of glucose:



(g) State the molecular formula of glucose.

_____

(h) Calculate the percentage by mass of carbon in glucose.

A_r carbon = 12, A_r oxygen = 16, A_r hydrogen = 1

_____

_____

_____

(i) Glucose reacts with oxygen in body cells to produce carbon dioxide and water only. State how many moles of carbon dioxide one mole of glucose produces.

_____

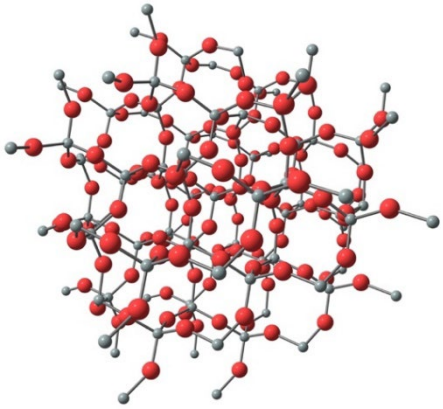
(j) A carbon dioxide molecule can be represented as O=C=O. Give three pieces of information shown by this formula.

1. _____

2. _____

3. _____

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



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(a) Name this type of structure.

_____

(b) State how many single covalent bonds each silicon atom makes.

_____

The melting point of silicon dioxide is 1710 °C.

(c) State which bonds are broken when silicon dioxide melts.

_____

(d) Explain why silicon dioxide has a high melting point.

_____

_____

4 Electric charges move around our bodies in our nervous system. Explain why the covalent substances glucose, amino acids and fatty acids are not used to conduct electrical charges.

_____

_____

_____

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

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