# CAMBRIDGE SCIENCE YEAR 9

Unit 1 – 9

# UNITS

1. Photosynthesis and the Carbon Cycle
2. Properties of Materials
3. Forces and Energy
4. Maintaining Life
5. Reactivity
6. Sound and Space
7. Genes and Inheritance
8. Rates of Reaction
9. Electricity

# UNIT 1: PHOTOSYNTHESIS AND THE CARBON CYCLE

# YEAR 9 SCIENCE
# MAY 10, 2023

Revision

The Carbon Cycle

Workbook 1.1, 1.2 and 1.3

Review

**UNIT 1 PRESENTATION: Wednesday 17th**

# PHOTOSYNTHESIS

Photosynthesis means ‘making with light’

In photosynthesis, plants use:

- Water from the soil
- Carbon dioxide from the air
- Energy from the sun

The equation is: **water + carbon dioxide → glucose + oxygen + energy**

*Photosynthesis is how plants create energy in the form of chemical energy*

*It is also important because the waste product of photosynthesis is oxygen*

# PHOTOSYNTHESIS

- Photosynthesis is the way that plants make food. They use carbon dioxide and water to make glucose and oxygen.
- Photosynthesis is a chemical reaction
- We can summarize using a word equation:

$$carbon\ dioxide + water \rightarrow glucose + oxygen$$

# ENERGY TRANSFER

The photosynthesis reaction needs a supply of energy to make it happen

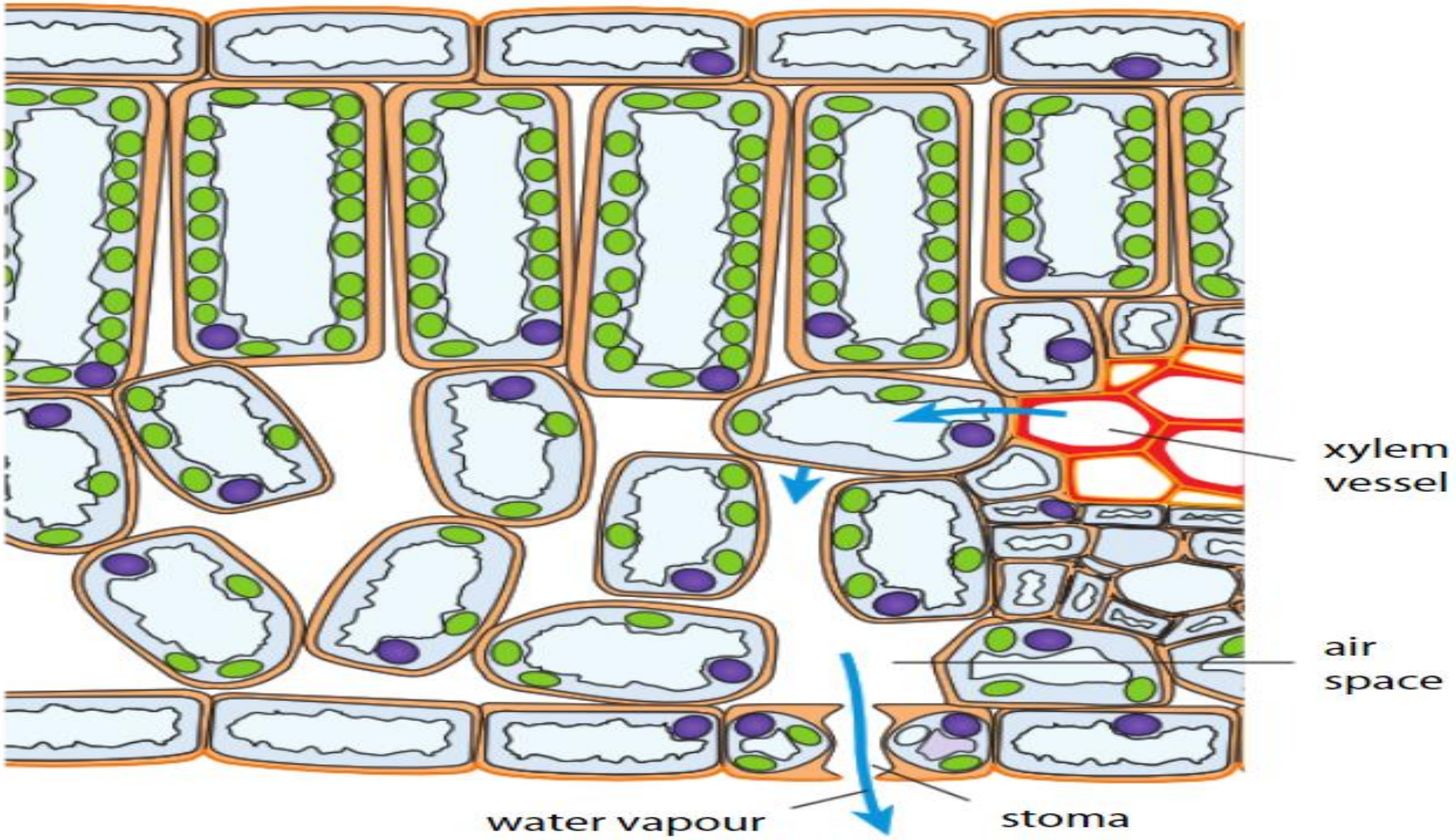
This energy comes from light

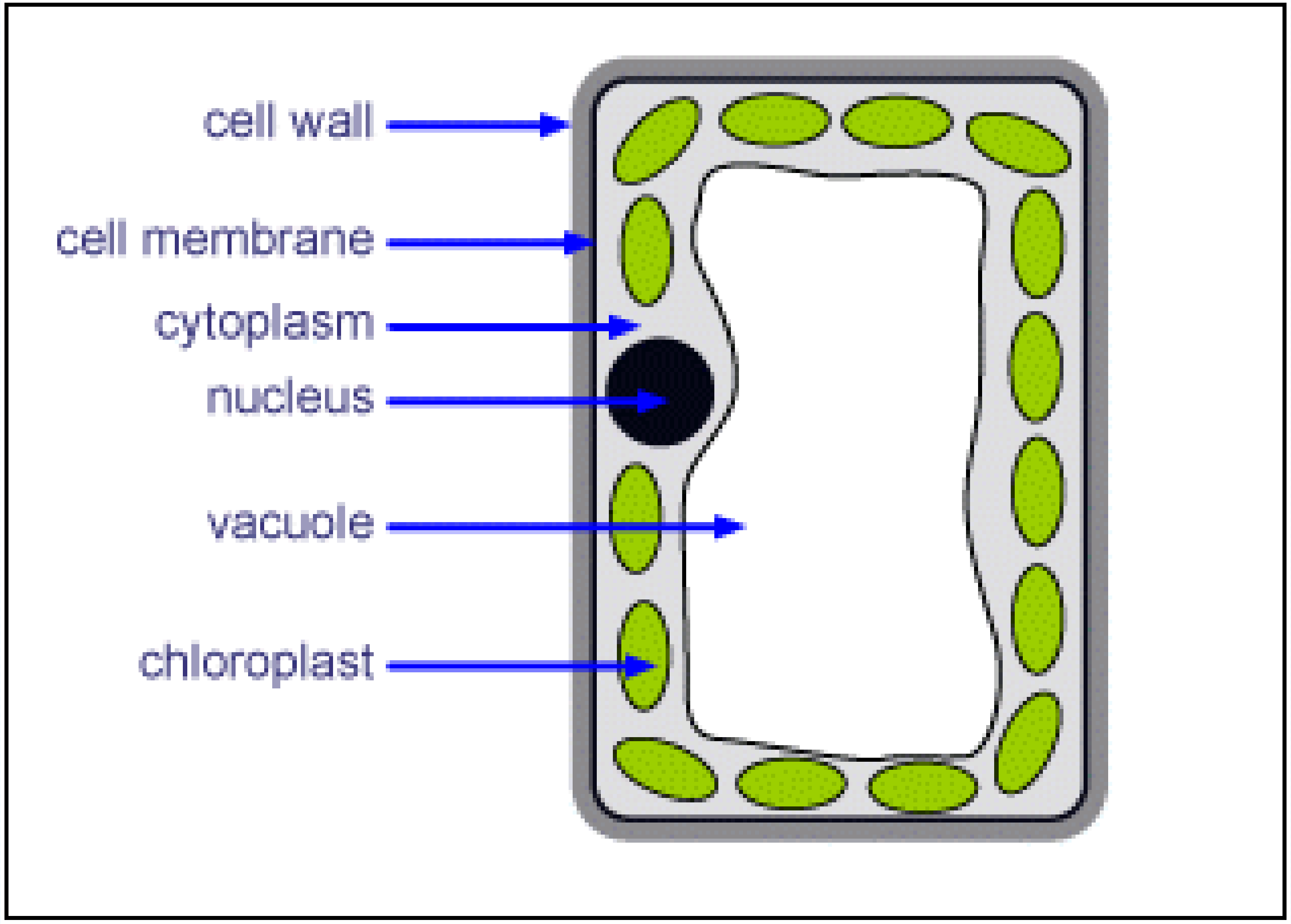
During photosynthesis, the plant’s leaves absorb the energy of light

The light energy is collected in the chlorophyll which is only in the chloroplasts

The energy is stored in the glucose that is made

The glucose is a store of chemical potential energy


xylem
vessel
air
space
water vapour
stoma




PHOTOSYNTHESIS HAPPENS INSIDE THE CHLOROPLASTS IN A PALISADE CELL LIKE THIS ONE

# QUESTIONS:

1. Where do plants get carbon dioxide from?
2. Where do plants get water from?
3. Why does photosynthesis only take place in the chloroplasts

# STORING CARBOHYDRATES

Glucose is a sugar

Sugars belong to a group of chemicals called carbohydrates

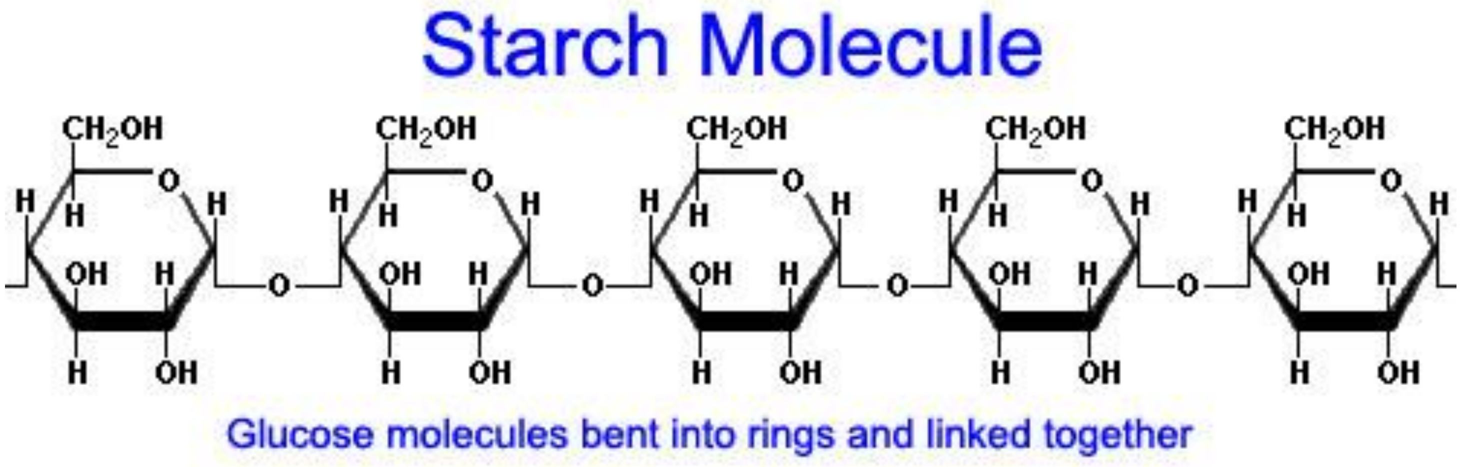
Plants usually make more glucose than they need to use immediately

They store some of it to use later – but they do not store it as glucose

Glucose is soluble in water, which makes it difficult to store inside a cell

Instead, the plant changes some of the glucose into a different kind of carbohydrate called starch

# STARCH




A starch molecule is made of thousands of glucose molecules linked together in a long chain

Starch molecules are too big to dissolve in water

They stay as insoluble grains, inside the chloroplasts in the plant cell

Photosynthesis is the production of glucose and oxygen, by reacting water and carbon dioxide, using energy from light

Plants often change some of the glucose into starch, for storage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# MINERAL AND PLANT GROWTH

- Farmers and gardeners often add ***fertilisers*** to the soil where their crops are growing
- The fertilisers provide minerals, which make the plants grow larger and healthier
- Although the fertilisers are expensive, the cost to farmers is outweighed by the extra money they can get for their crop


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# WHAT ARE FERTILIZERS?

- Fertilizers contain minerals
- There are substances that plants normally get from the soil
- But often the soil does not contain enough of some kinds of mineral salts, which stops the plants from growing as large and strong as they could


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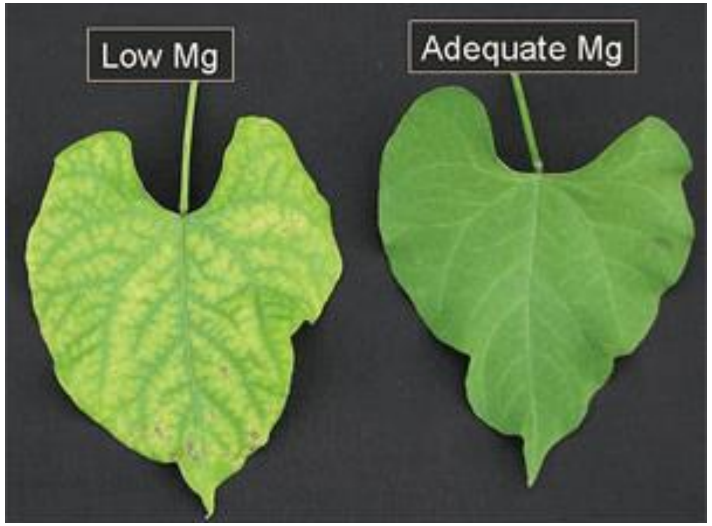


# MAGNESIUM AND NITRATE

Magnesium is needed for making chlorophyll

Therefore, if the plant is deficient in one of these the color will be changed

Nitrate contains nitrogen atoms. These are needed so that the plant can convert carbohydrates to protein

Without enough nitrogen, leaves die, and the plant stays small

# QUESTIONS

1. Give two examples of mineral salts needed by plants

2. Explain why a plant that does not have enough magnesium will not grow well.

3. Think about what you know about plant roots. How do plants absorb mineral salts from the soil?

# SUMMARY OF KEY POINTS

Plants need nitrate to make proteins, which are needed to make new cells for growth

↓

Plants need magnesium to make chlorophyll

# PHOTOSYNTHESIS IS NOT RESPIRATION : KEY DIFFERENCES

1. **Purpose**: Photosynthesis is a process used by plants to convert light energy into chemical energy (glucose), whereas respiration is a process used by all living cells to extract energy stored in the bonds of glucose.
2. **Location**: Photosynthesis occurs in the chloroplasts of plant cells, while respiration mainly occurs in the mitochondria of cells in both plants and animals.
3. **Inputs and Outputs**: Photosynthesis takes in carbon dioxide, water, and sunlight to produce glucose and oxygen. On the other hand, respiration takes in glucose and oxygen to produce carbon dioxide, water, and energy
4. **Dependency**: Photosynthesis depends on light and hence typically happens during the day, whereas respiration occurs constantly, both day and night, as long as there is a supply of glucose and oxygen.
5. **Role in the Carbon Cycle**: Photosynthesis removes carbon dioxide from the atmosphere, while respiration adds carbon dioxide to the atmosphere.

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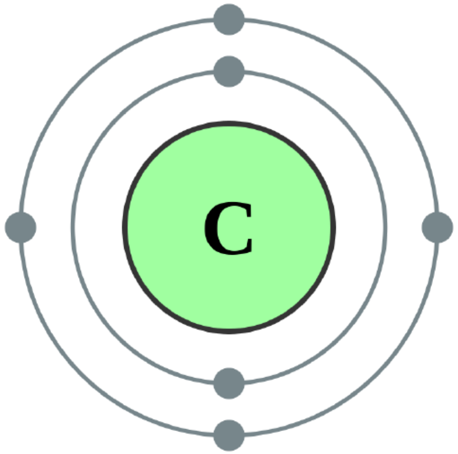
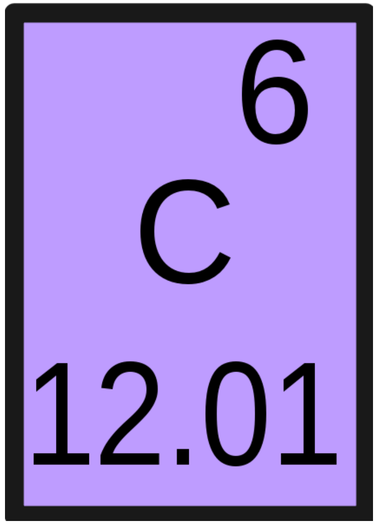


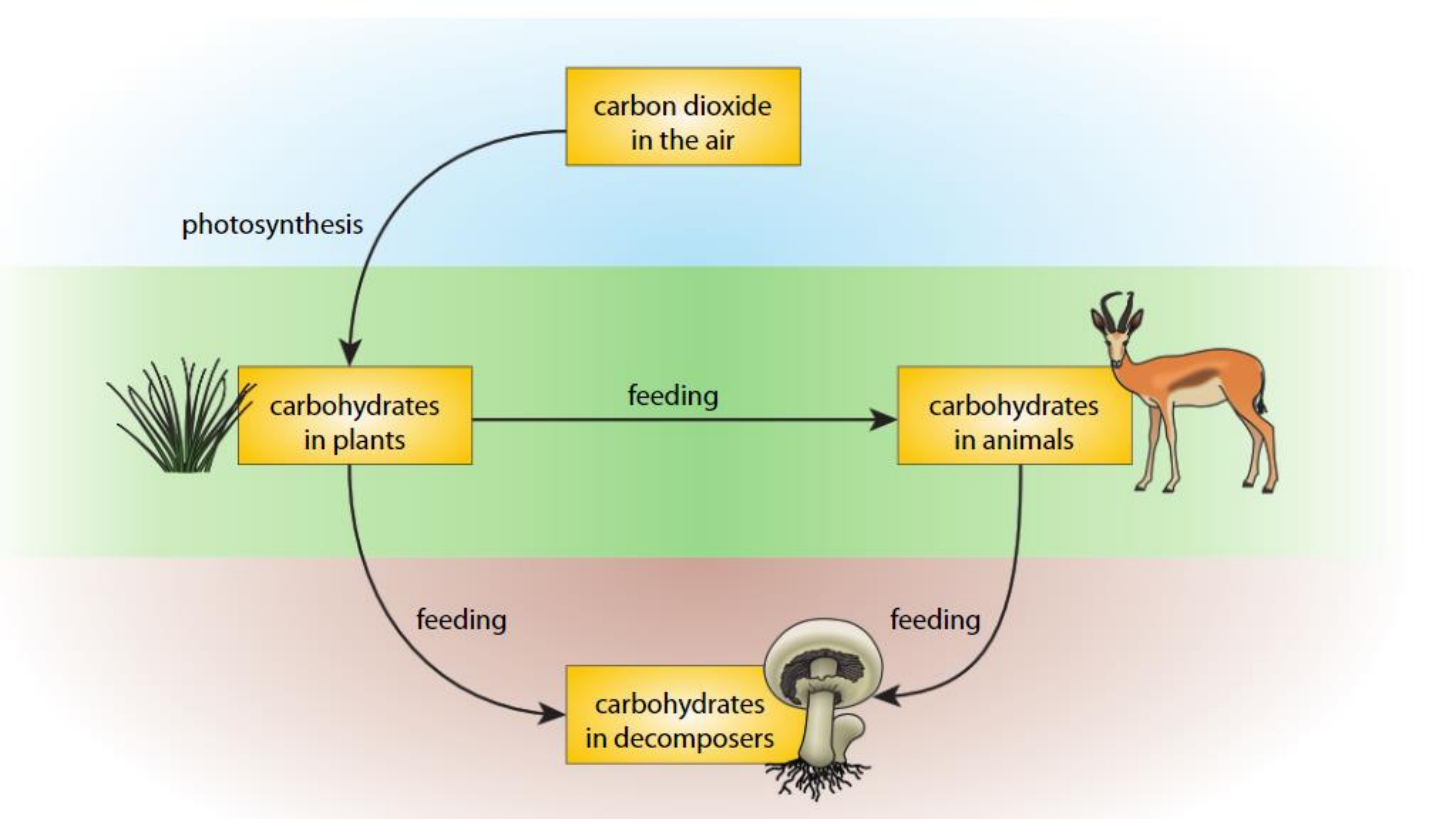




# 1.3 CARBON CYCLE

Carbon is an element that is a part of cells, carbohydrates, proteins and fats.

Animals get carbon containing nutrients by eating plants or other animals

The carbon cycle describes that taking and returning carbon to the air.


carbon dioxide in the air
photosynthesis
carbohydrates in plants
feeding
carbohydrates in animals
feeding
feeding
carbohydrates in decomposers

# PRODUCERS OR CONSUMERS

Producers create their own energy from the light from the sun or from the gasses in the air, such as carbon dioxide

Consumers do not create their own energy and therefore must consume other members of the food web (Find “The Secret Life of Plankton” on YouTube)

# DECOMPOSERS

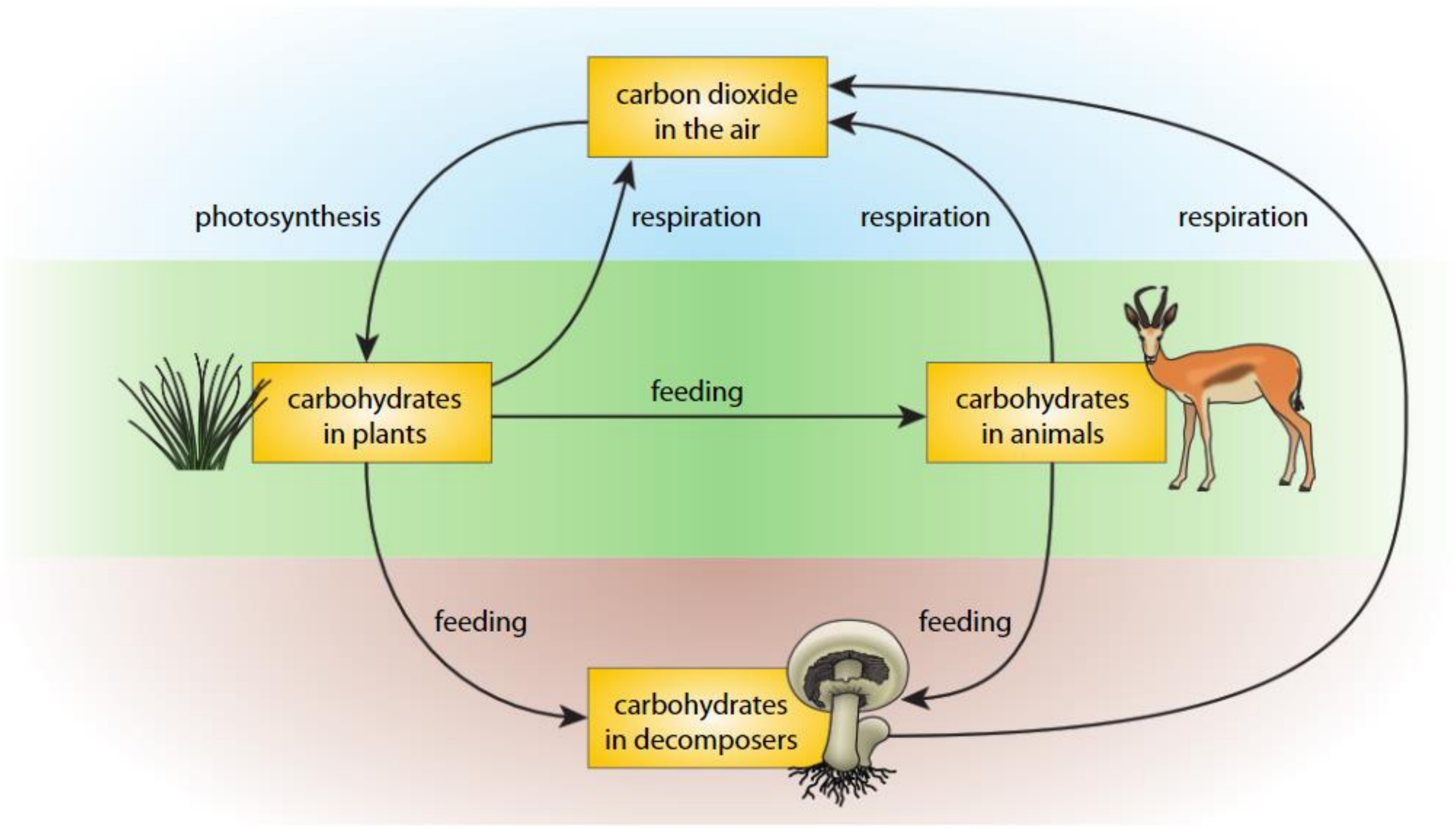
Decomposers are organisms that get their energy from dead organisms or their waste products

→

Decomposers help to recycle substances from dead organisms and waste, so that other living organisms can use them

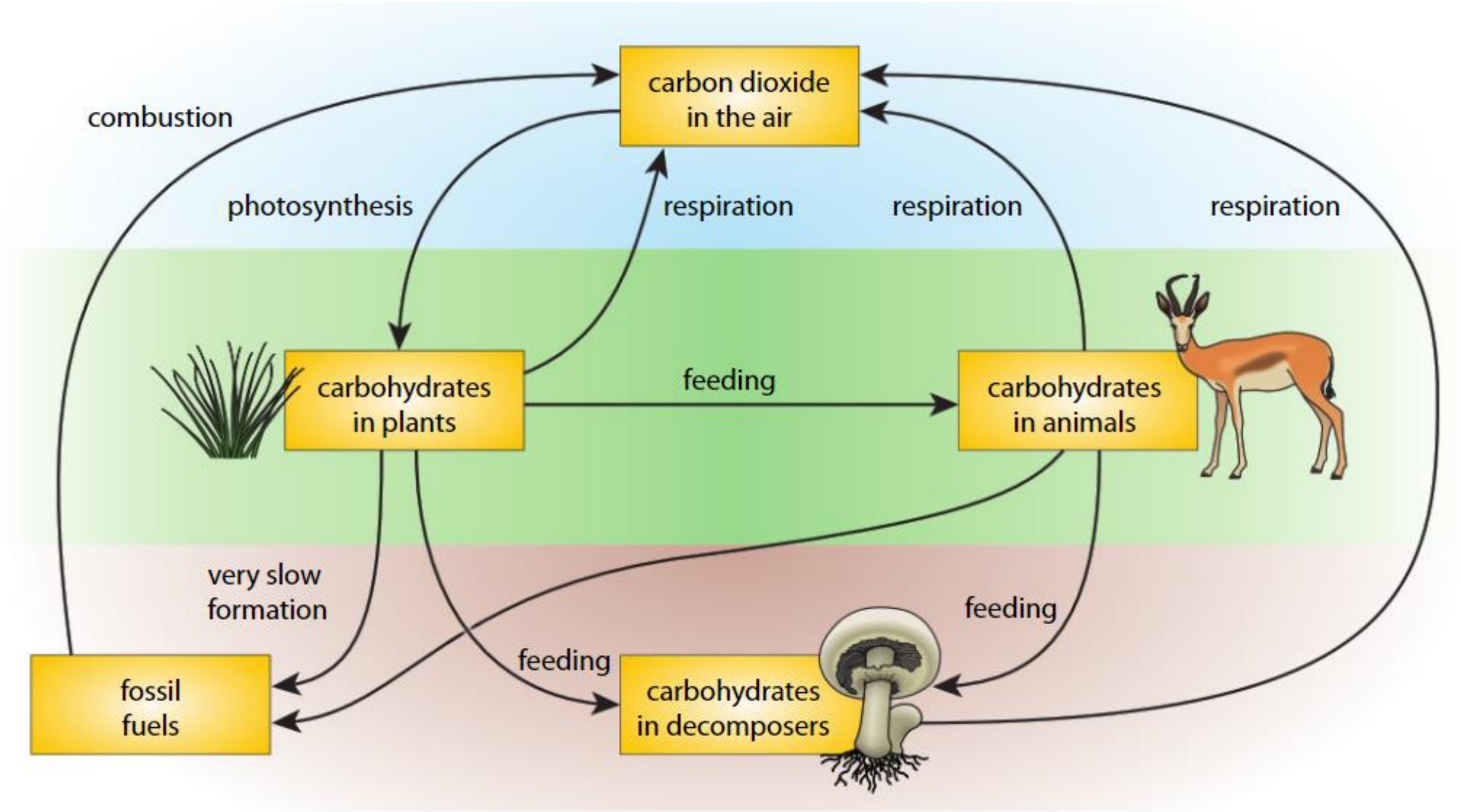
# DECOMPOSER TIME LAPSE (VIEW ON YOUTUBE)

# ANIMAL DECOMPOSITION



carbon dioxide in the air
photosynthesis
respiration
respiration
respiration
carbohydrates in plants
feeding
carbohydrates in animals
feeding
feeding
carbohydrates in decomposers

# FOSSIL FUELS AND COMBUSTION



# SUMMARY OF THE CARBON CYCLE

1. Photosynthesis
2. Consumption
3. Respiration
4. Decomposition
5. Fossilisation
6. Combustion
7. Ocean Storage

# ASSIGNMENT

**Workbook 1.1, 1.2 and 1.3**

# CLIMATE CHANGE

1.4

# GREENHOUSE GASES

Carbon dioxide and methane are considered "Greenhouse Gases"

Carbon dioxide is $CO_2$

Methane is the primary part of natural gas and is $CH_4$

- QUESTION: What would happen if there were no carbon dioxide in the atmosphere?
- ANSWER: All the Earth would be frozen and unable to support life

# CLIMATE CHANGE IN THE PAST

- Question: What is climate?
- Answer: Climate is the long-term pattern of temperatures, wind and rainfall on Earth.
- In the past, the Earth's climate has been much different than the climate today

# ICE AGES

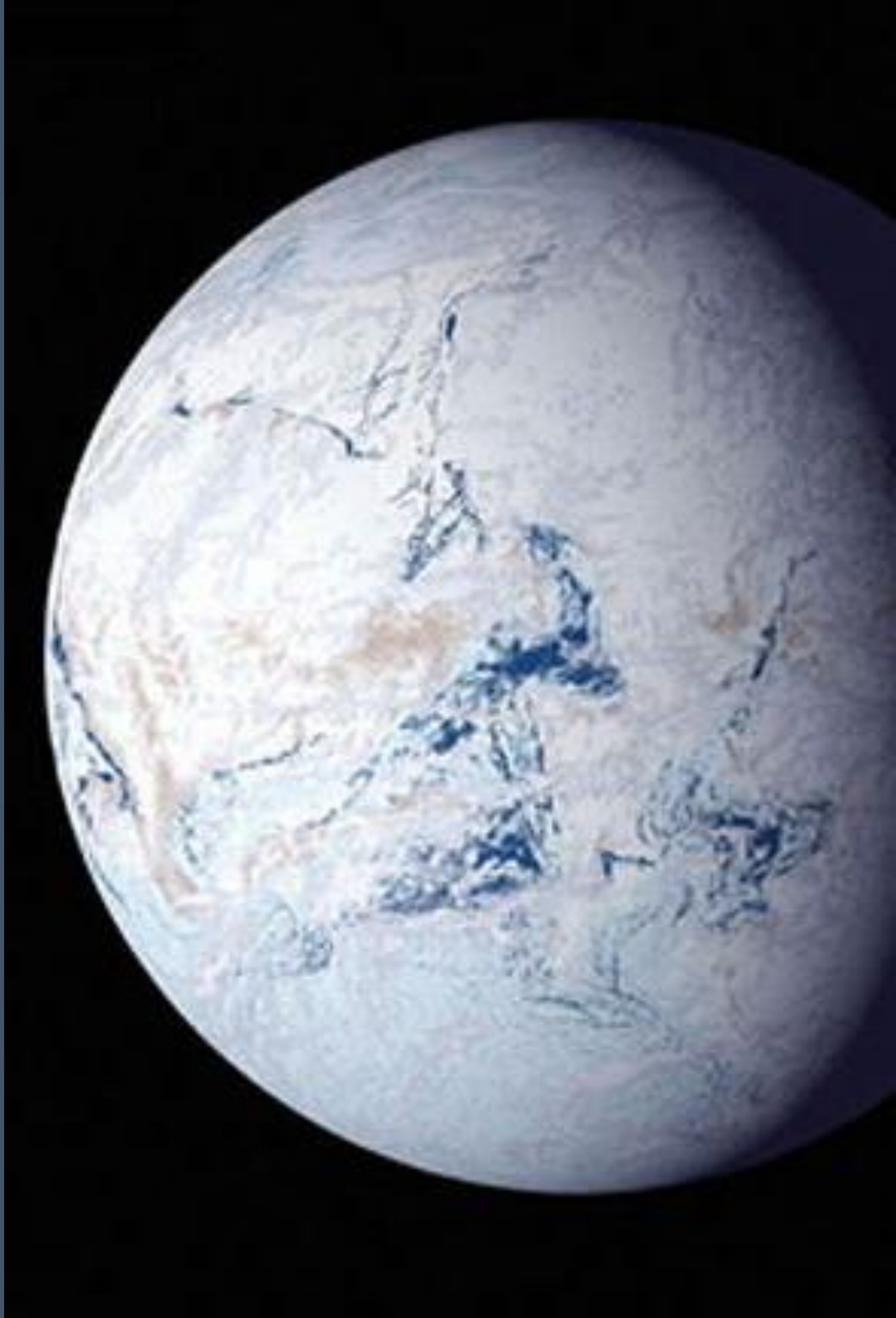
- The first ice age was approximately 2 billion years ago
- The earth has changed between warm periods with no ice and colder periods where we had ice ages and all in between

# ANIMALS OF THE ICE AGE

# MORE ABOUT ICE AGE

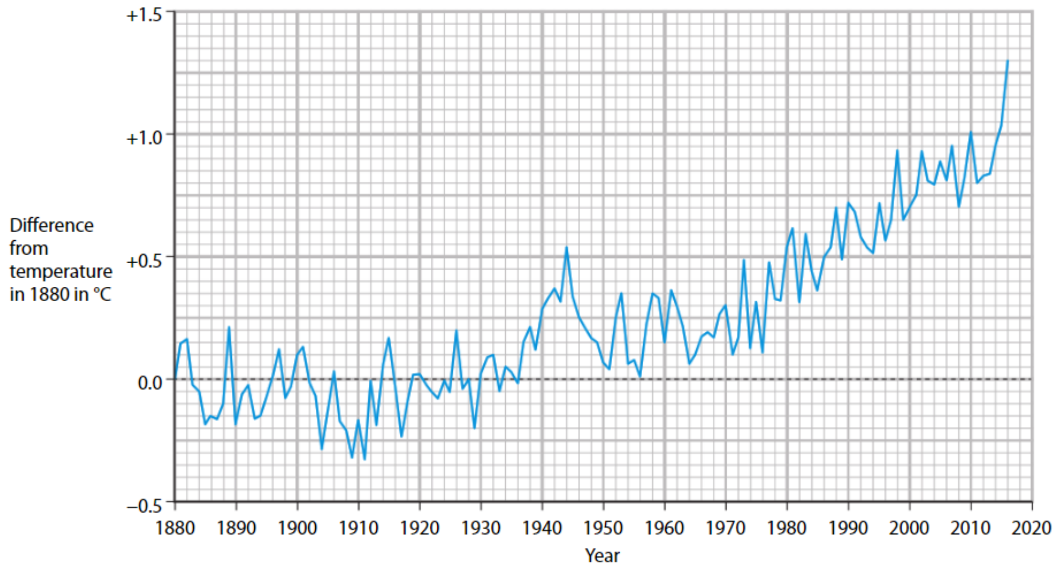
# SNOWBALL EARTH

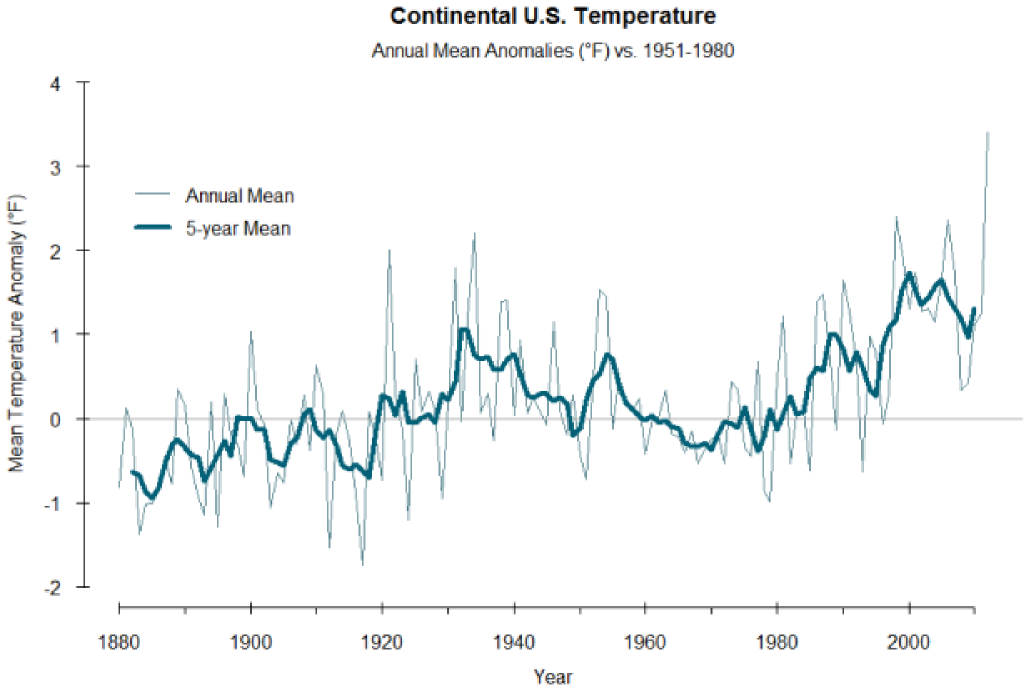
- 650 million years ago the whole Earth was covered with ice and snow
- We are not really sure why this happened



# ASTEROIDS COLLIDING WITH EACH OTHER

# ASTEROIDS COLLIDING WITH EARTH (BYE BYE DINO)




# CLIMATE CHANGE TODAY AND IN THE FUTURE

# IMPACTS OF CLIMATE CHANGE

# CONTROVERSY

## Points for Climate Change

- Scientific Consensus
- Greenhouse Gas Emission
- Extreme Weather Events

## Points against Climate Change

- Scientific Doubt
- Natural Climate Variation
- Data Accuracy and Manipulation

# SOME SCIENTISTS THINK CLIMATE CHANGE IS NOT A CRISIS AND IS NATURAL

# WORKBOOK

Climate Change 1.4

# UNIT 2: PROPERTIES OF MATERIALS

# Atomic Structure and the Periodic Table

# Do it now:

20 minutes

Find the vocabulary page 48:

1. Worksheet 2.1

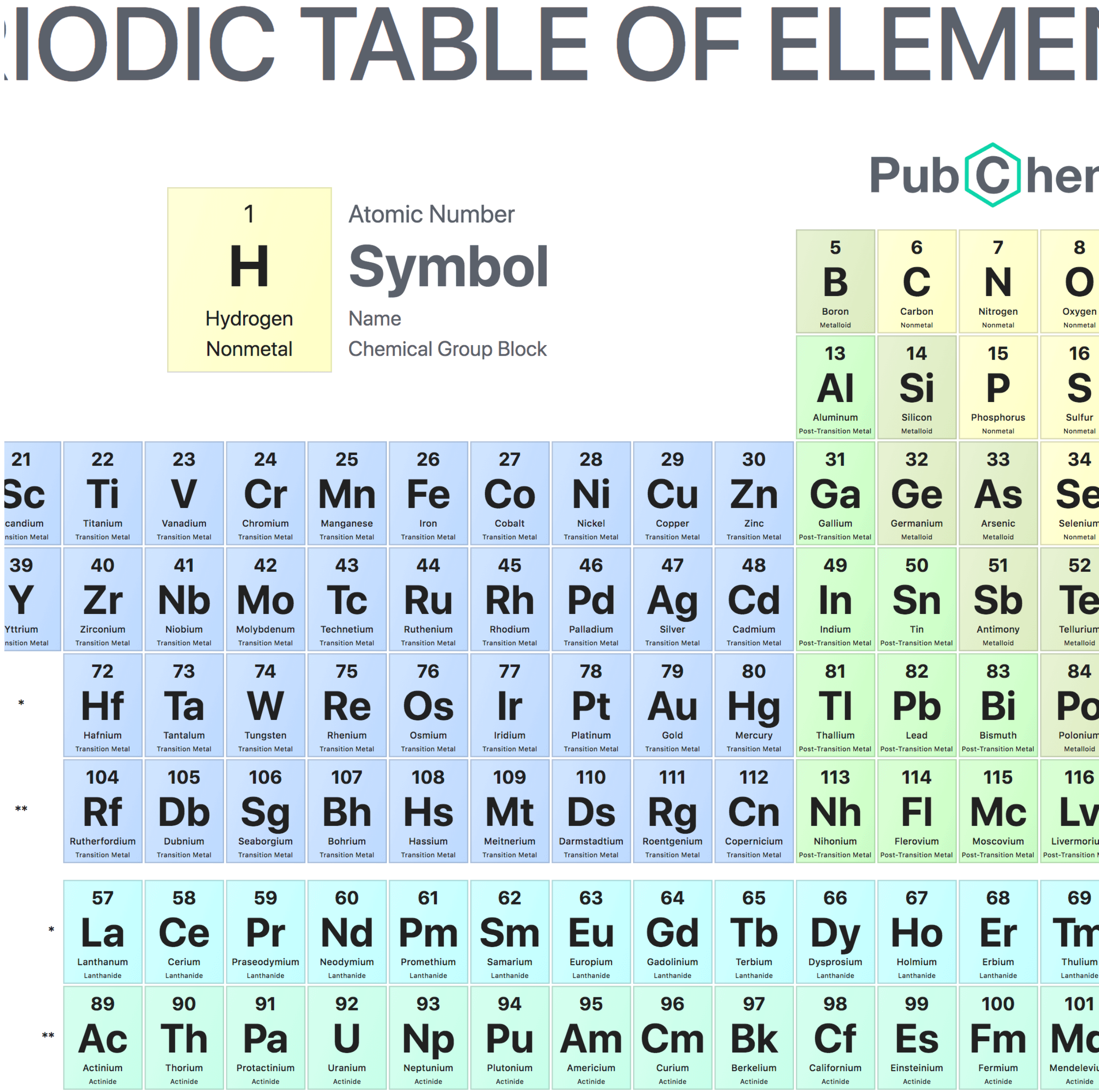
3. Read page 49-51

# Atomic Number, Mass Number

- What does the atomic number do?
- The atomic number of an atom represents the number of protons in its nucleus.
- What is the mass number of an element?
- The mass number tells you how many protons and neutrons each atom in the element has in total
- What is the atomic number of Oxygen?
- How many neutrons does oxygen have?
- How many electrons does oxygen have?

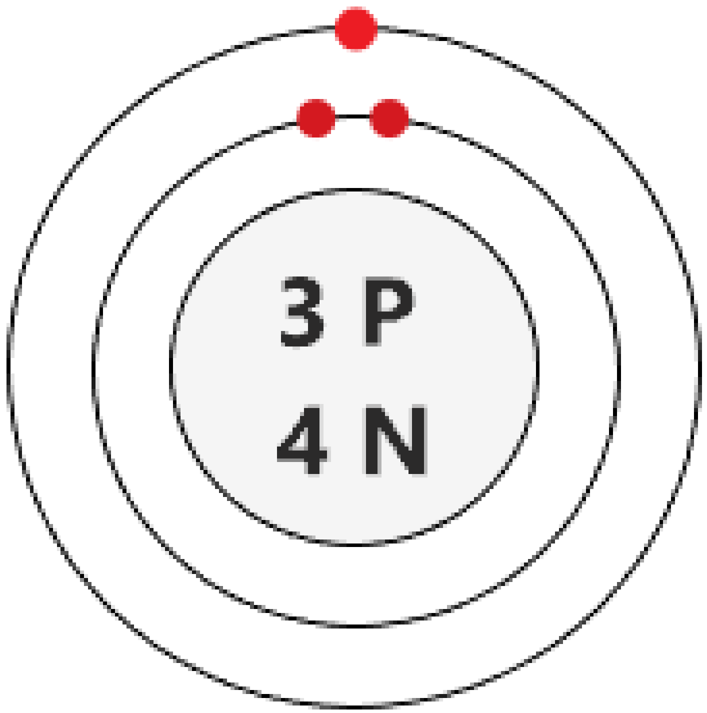
# The Periodic Table

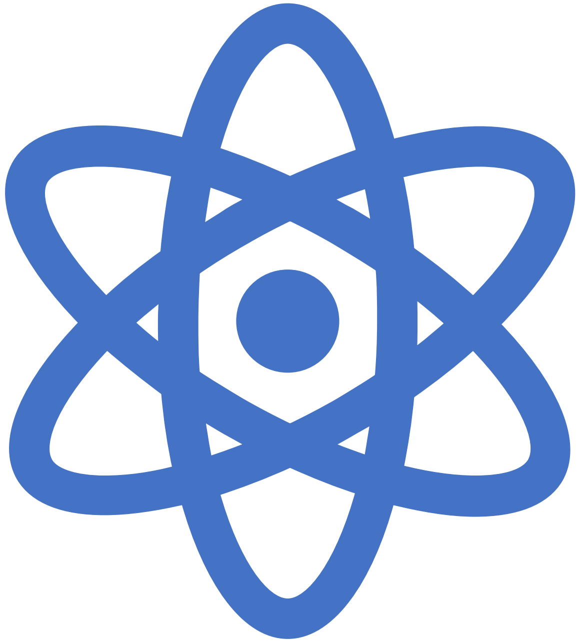
- As you progress from left to right, what is the trend of the atomic mass for the elements in the periodic table?
- The atomic masses increase from left to right.
- As you go from top to bottom, what is the trend in the atomic mass for the elements in the periodic table?
- The atomic masses increases from top to bottom.



# Electronic Structure

- What is the name of this model of an atom?
- This is called the “Bohr Model”, developed by Danish scientist Niels Bohr.
- What kind of atom is this?
- You have to find the atom with mass number equal to:
- The atomic number is?

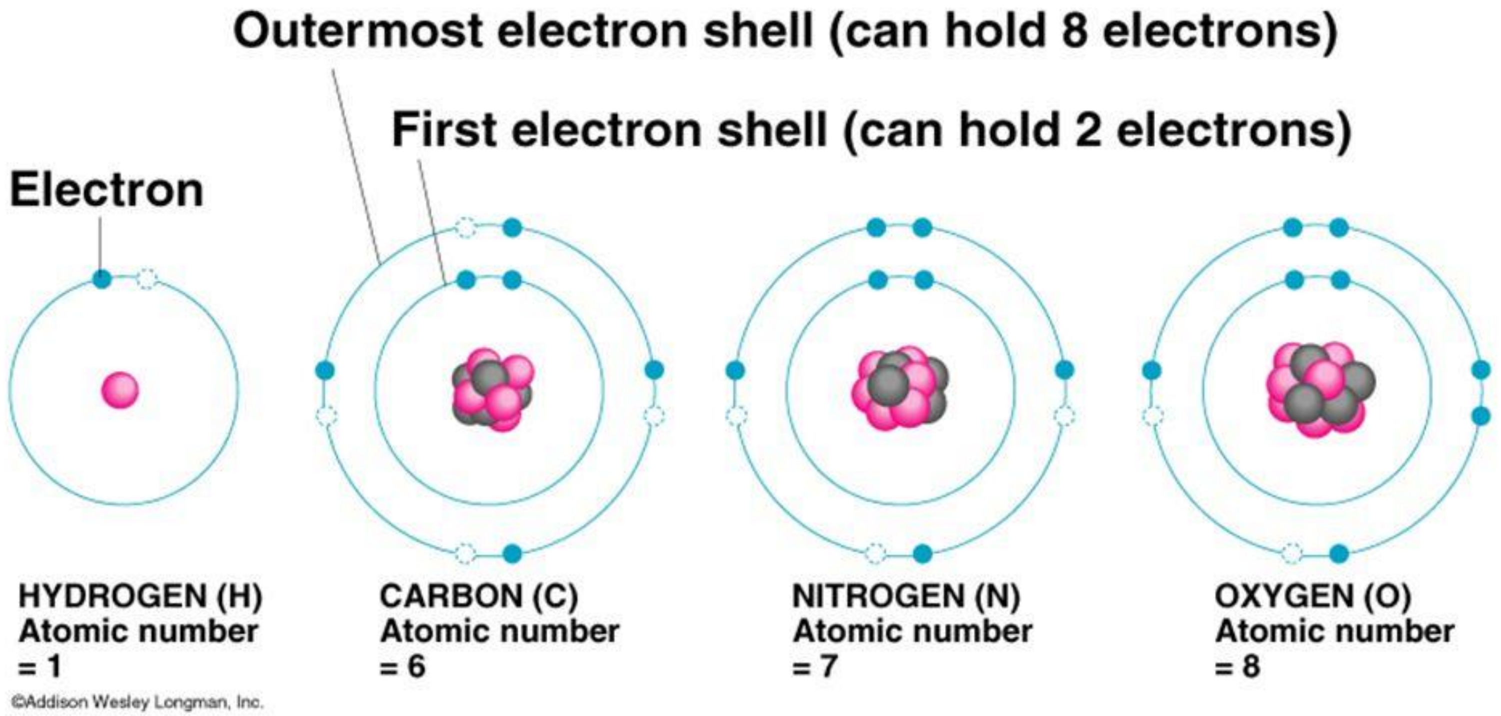




# Electrons Shells and the Octet Rule

- Electrons in an atom are arranged in energy levels known as electron shells.
- Each shell can hold a certain number of electrons: the first can hold up to 2, the second can hold up to 8, and so forth.
- An atom is most stable when its outermost electron shell is full. For many atoms, this means having 8 electrons in their outermost shell - a concept known as the Octet Rule.

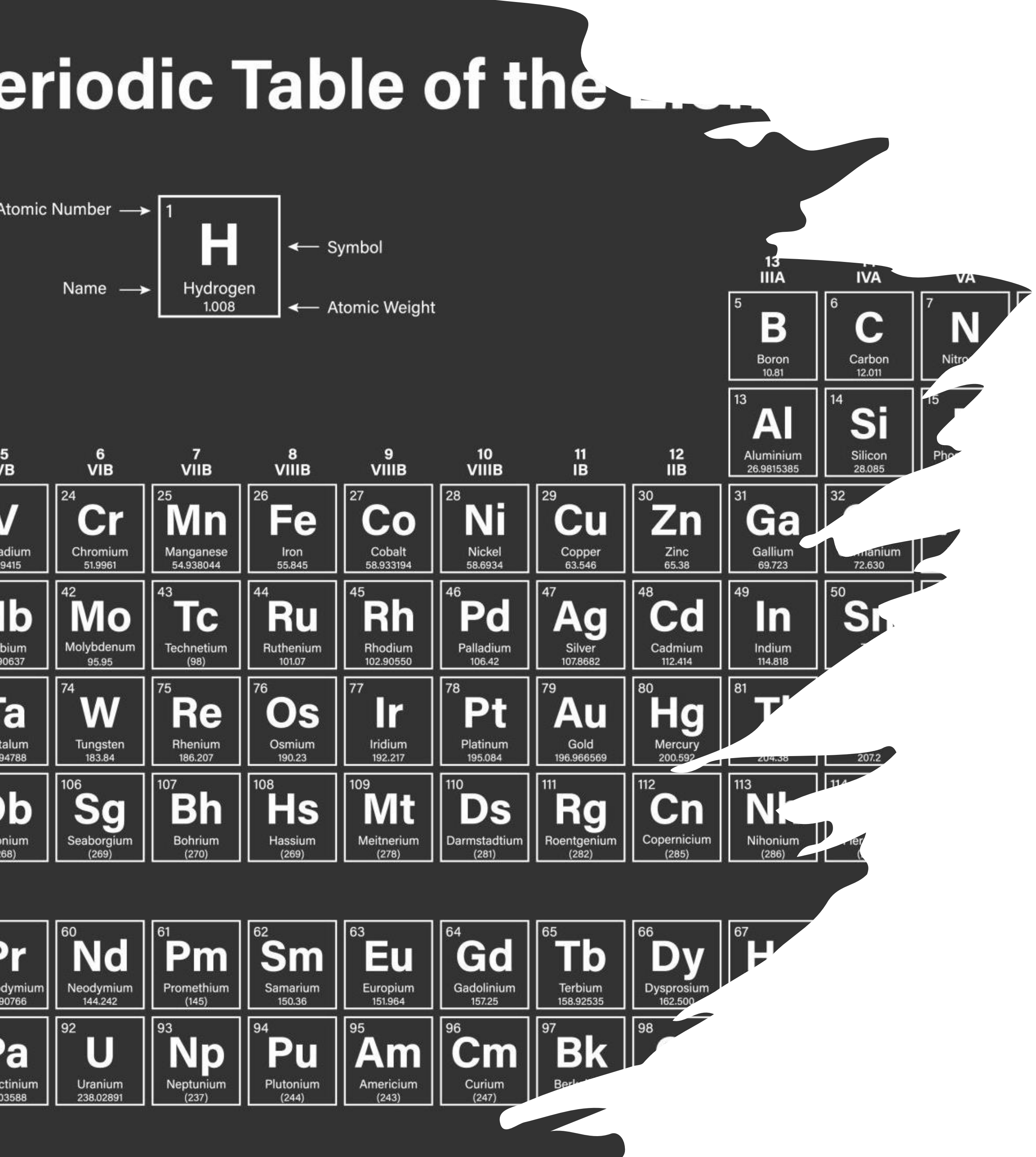
# Electronic Structure




Octet Rule = atoms tend to gain, lose or share electrons so as to have 8 electrons

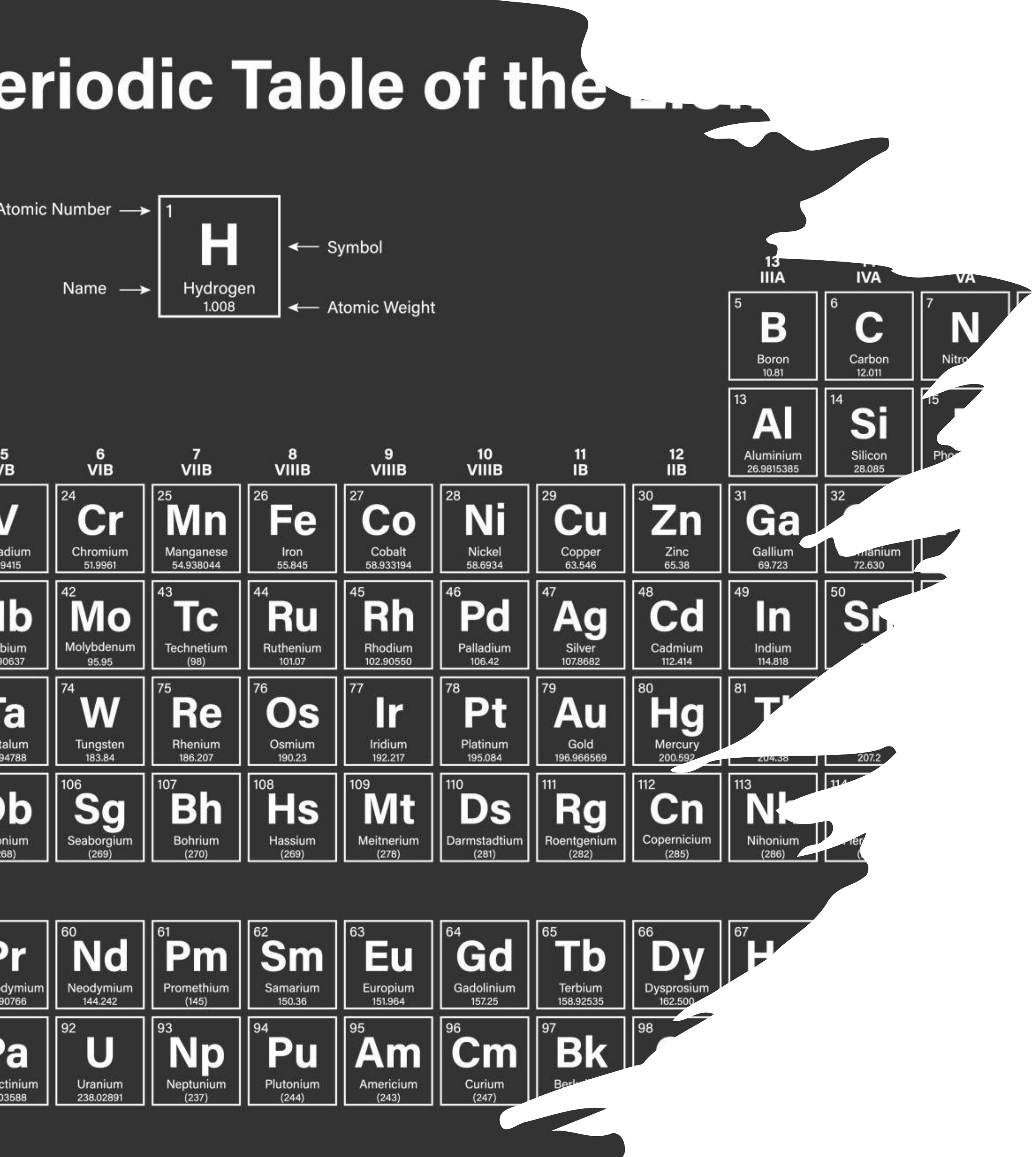
- ✓C would like to Gain 4 electrons
- ✓N would like to Gain 3 electrons
- ✓O would like to Gain 2 electrons

# Trends in Groups within the Periodic Table




# Trends in Groups Within the Periodic Table

- The Periodic Table is a chart that organizes all known elements based on their properties.
- Elements are organized into vertical columns known as "Groups" and horizontal rows known as "Periods."
- Now we'll focus on three important groups: Group 1 (Alkali Metals), Group 7 (Halogens), and Group 8 (Noble Gases).




# Group 1: Alkali Metals

- Alkali metals are found in Group 1 of the Periodic Table.
- These metals are very reactive, especially with water, and are never found in nature in their pure form.
- They include elements such as Lithium (Li), Sodium (Na), and Potassium (K).
- Alkali metals have 1 electron in their outermost shell, which makes them highly reactive.

# Properties of Alkali Metals

- Alkali metals are soft and can be cut with a knife.
- They have low melting and boiling points compared to most other metals.
- As you move down the group, reactivity increases. For example, potassium is more reactive than sodium.
- They react vigorously with water to form hydroxides, releasing hydrogen gas.

# Group 7: Halogens

- Halogens are found in Group 7 of the Periodic Table.
- They are very reactive non-metals and exist in all three states of matter at room temperature (Solid: Iodine, Liquid: Bromine, Gas: Fluorine and Chlorine).
- Halogens have 7 electrons in their outermost shell, which makes them highly reactive as they tend to gain an electron to achieve a stable configuration.

# Properties of Halogens

- They have low melting and boiling points which increase as you move down the group.
- Halogens react with metals to form salts. For example, Sodium (a metal) reacts with Chlorine (a halogen) to form Sodium Chloride (table salt).
- As you move down the group, reactivity decreases. For example, Fluorine is more reactive than Chlorine.

# Simple Giant Structures - Cambridge Checkpoint Science Year 8

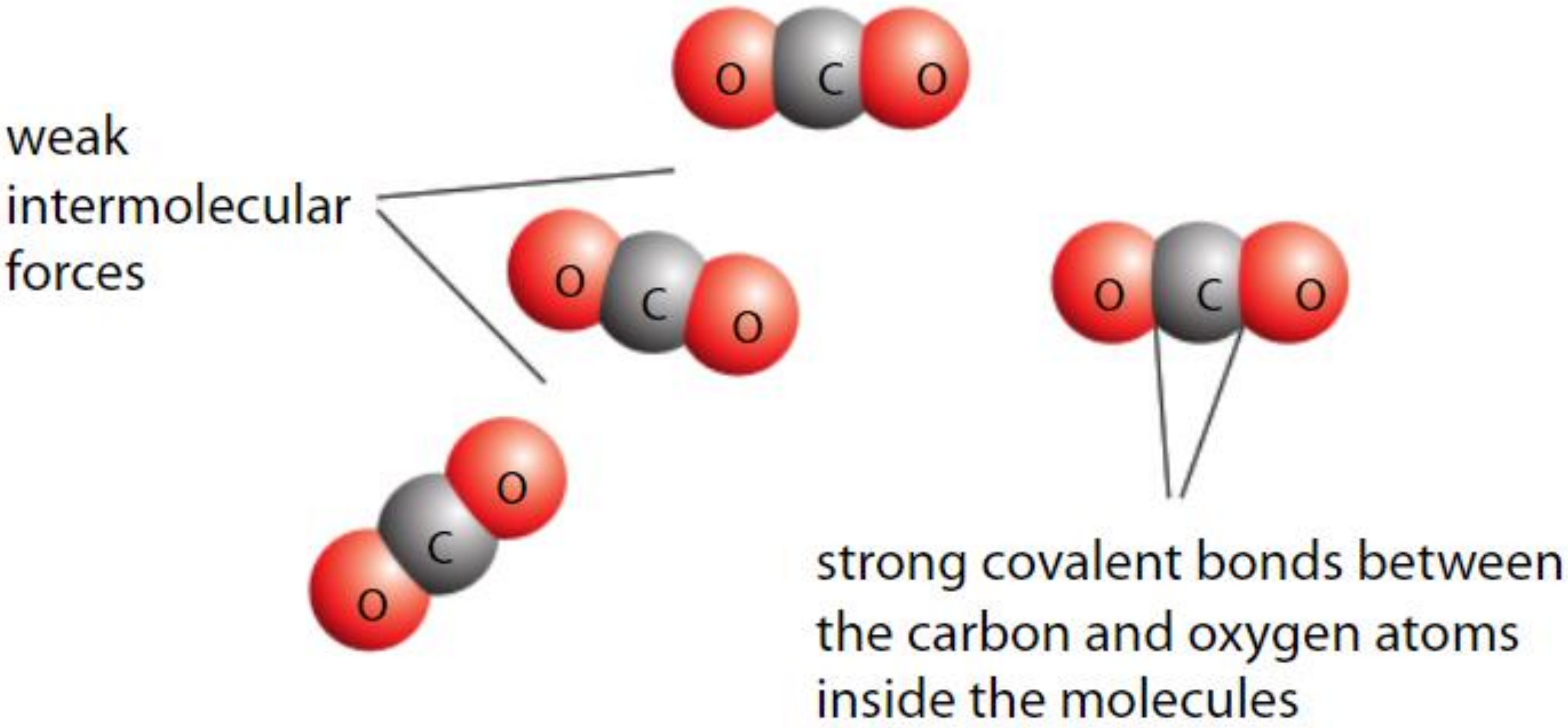
Vocabulary: Graphite, Intermolecular forces, Lattice, Layers, Macromolecules

# Giant Covalent Structures

Giant covalent structures are when molecules held together by covalent bonds form giant structures

The covalent bonds holding the elements in one molecule together are strong

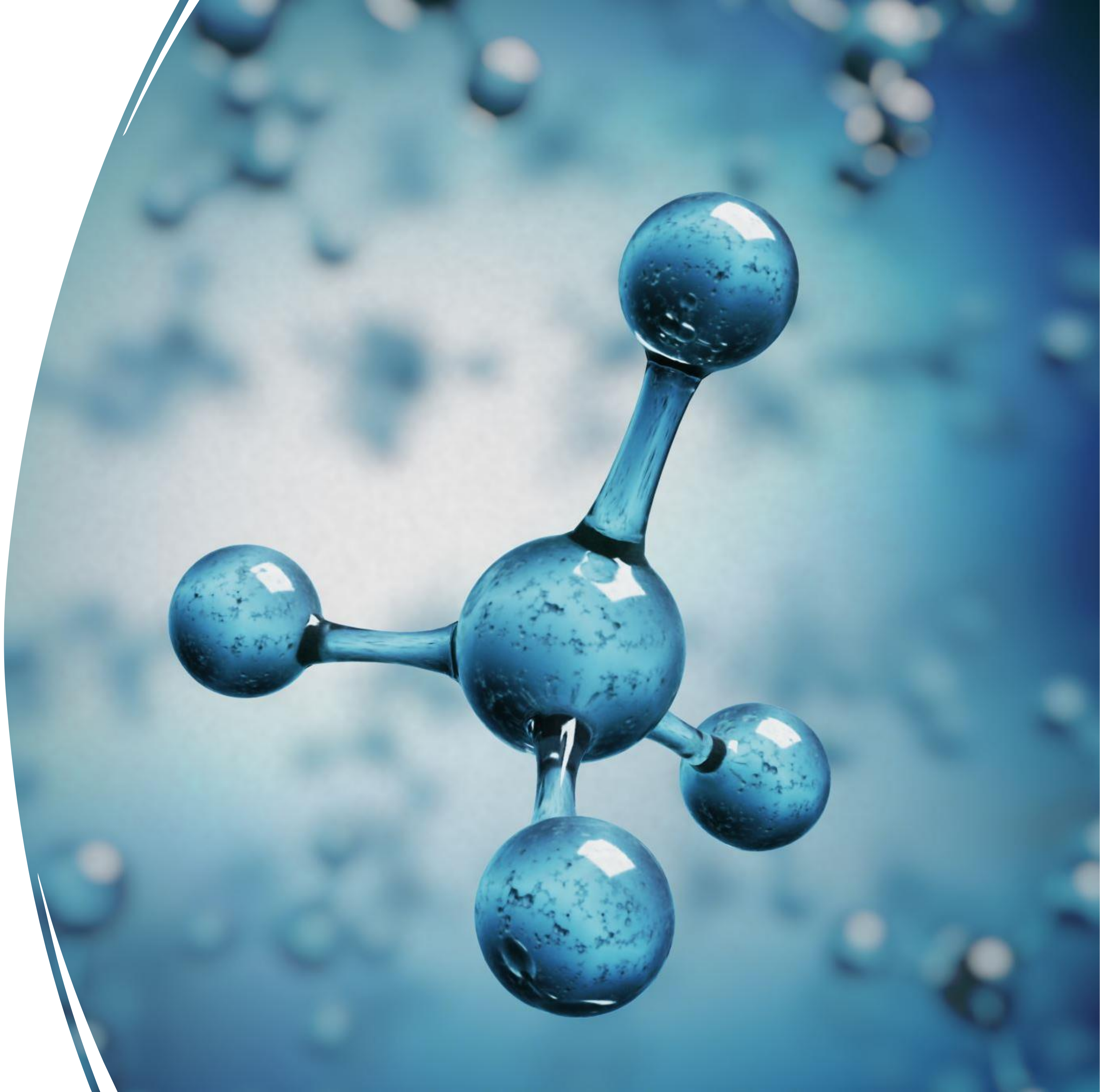
However, the intermolecular forces holding the molecules together into a giant structure are weak




Carbon dioxide molecules

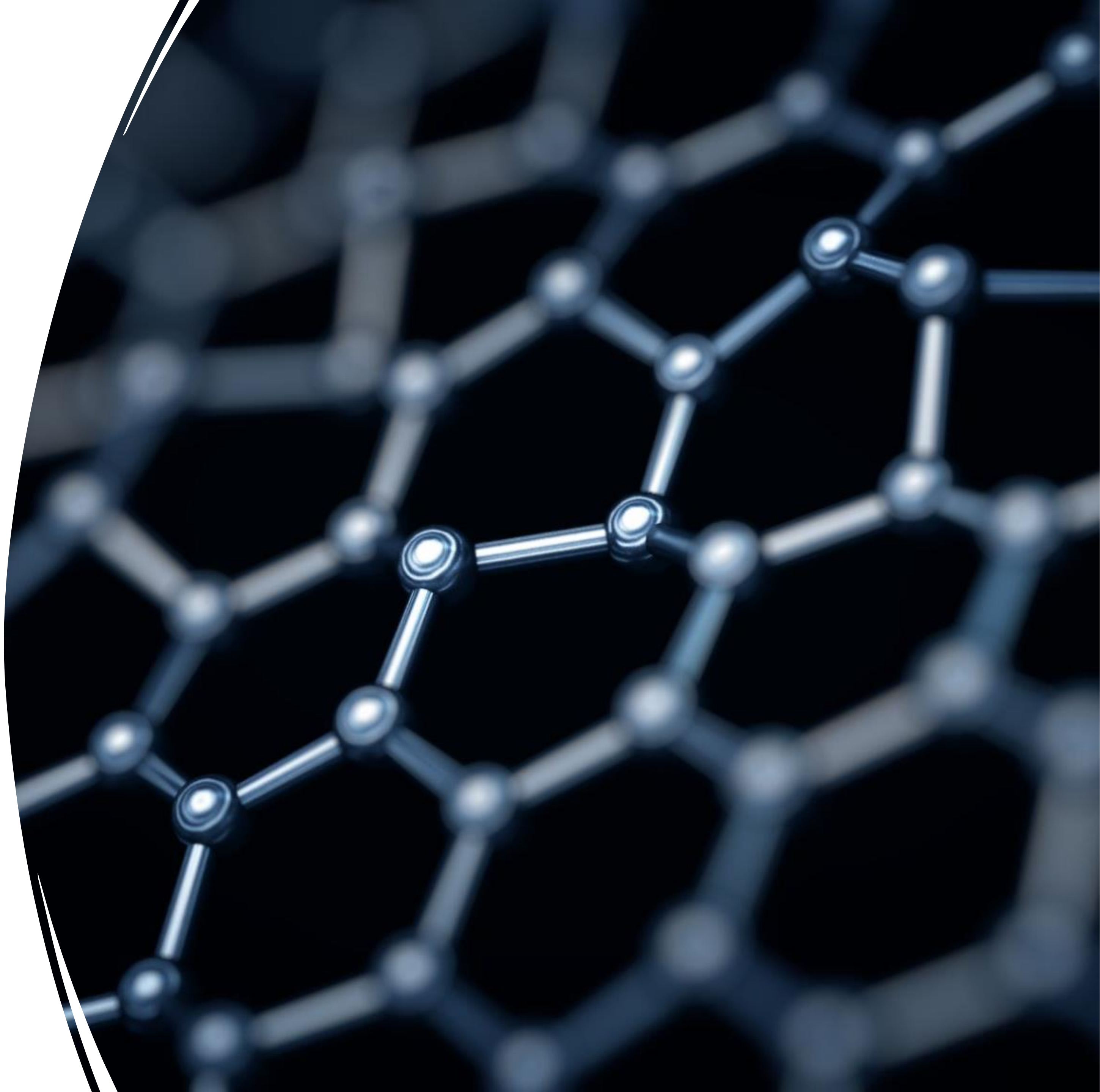
# Intermolecular forces

- Intermolecular forces are the forces of attraction between different molecules.
- They are weaker than the forces of chemical bonding (covalent and ionic bonds).



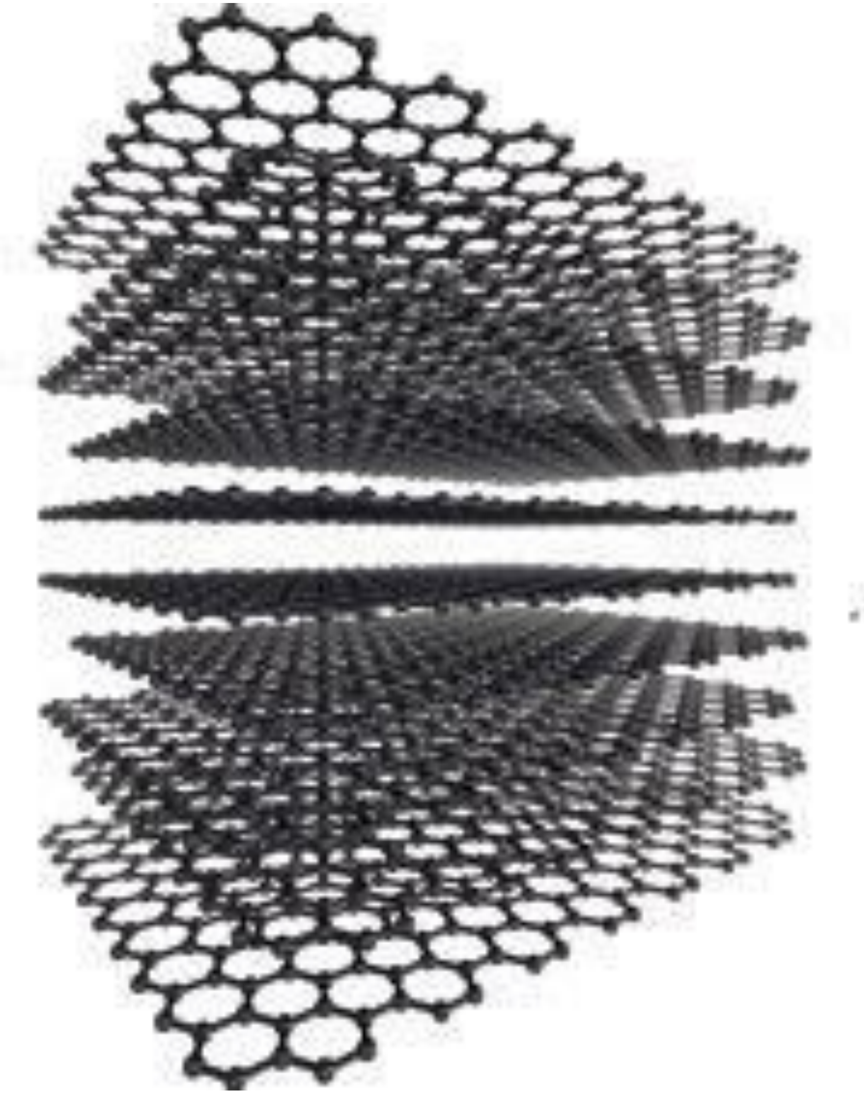
# Graphite

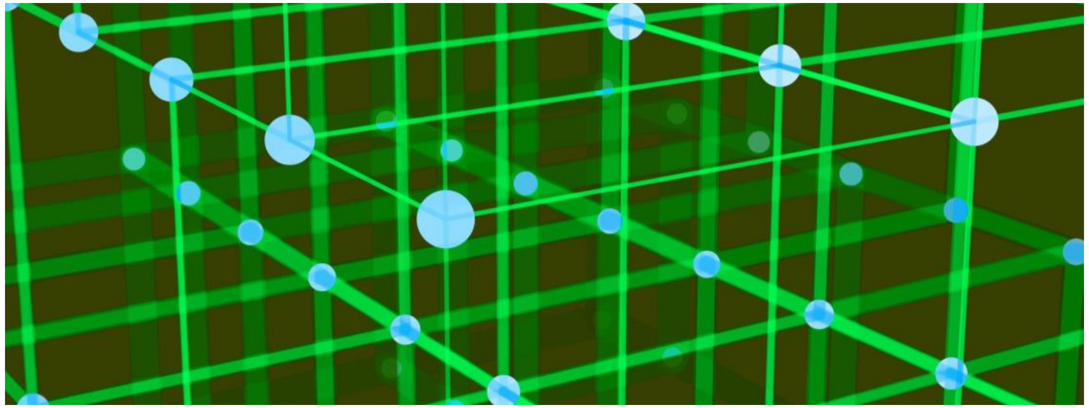
- Graphite is a form of carbon where the carbon atoms form layers.
- Within each layer, the carbon atoms are bonded in a hexagonal lattice.

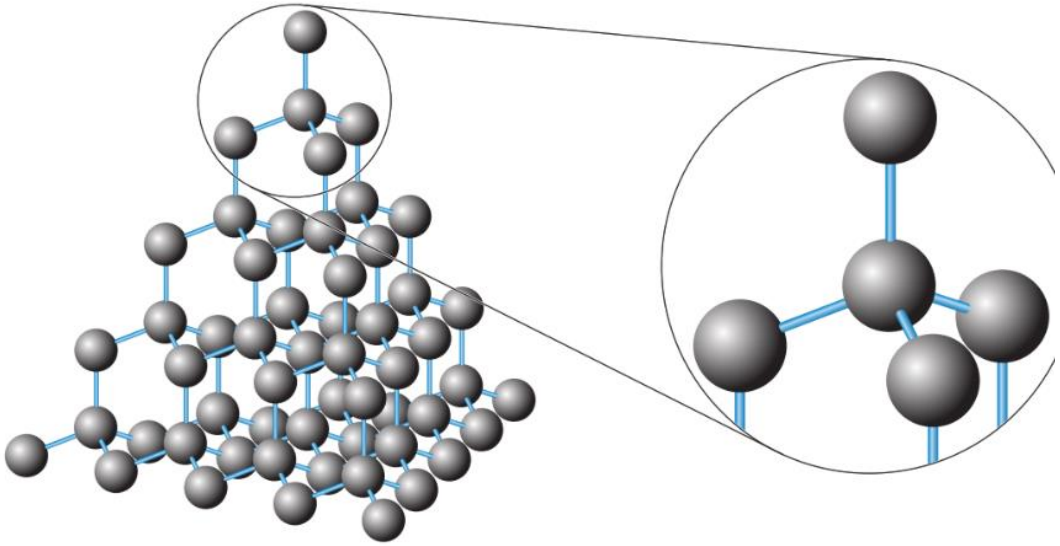


# Layers

- In the context of simple giant structures, layers refer to the sheets of atoms that are bonded together.
- In graphite, for instance, the carbon atoms form layers.







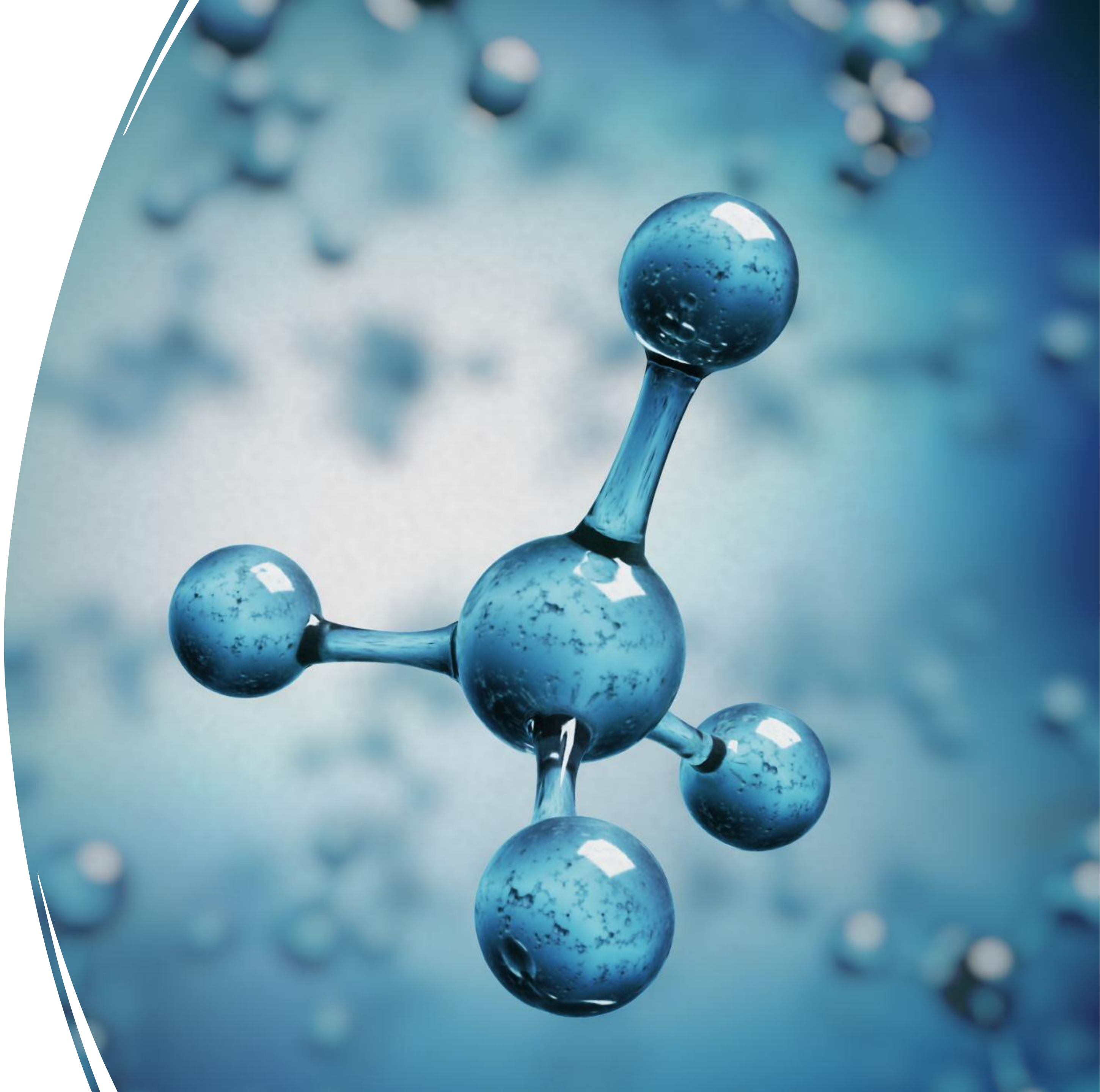
A diamond lattice structure; each carbon atom forms four strong covalent bonds

# Lattice

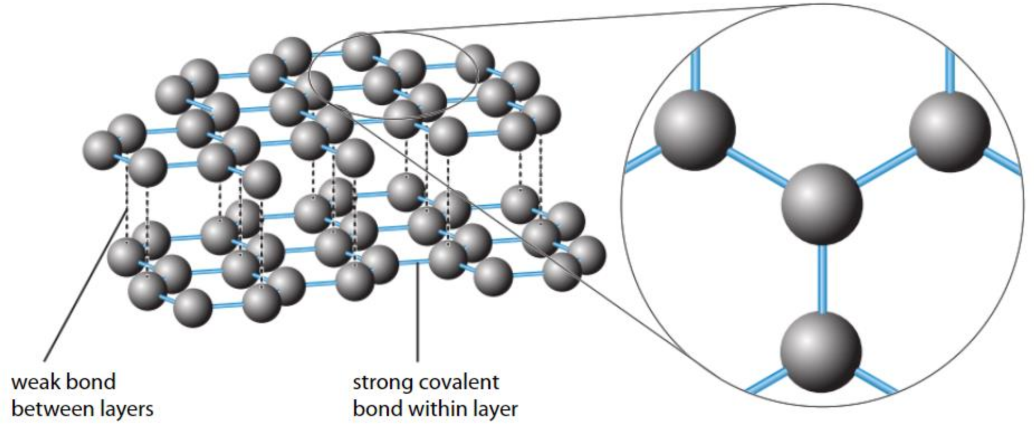
- A lattice is a regular, repeating arrangement of atoms, ions, or molecules in a crystal.
- The picture on the right is a diamond lattice structure also known as a macromolecule

# Macromolecules

- Macromolecules are large complex molecules, such as proteins, nucleic acids, and synthetic polymers, that have a complex structure with many atoms.



# Graphite in Pencils



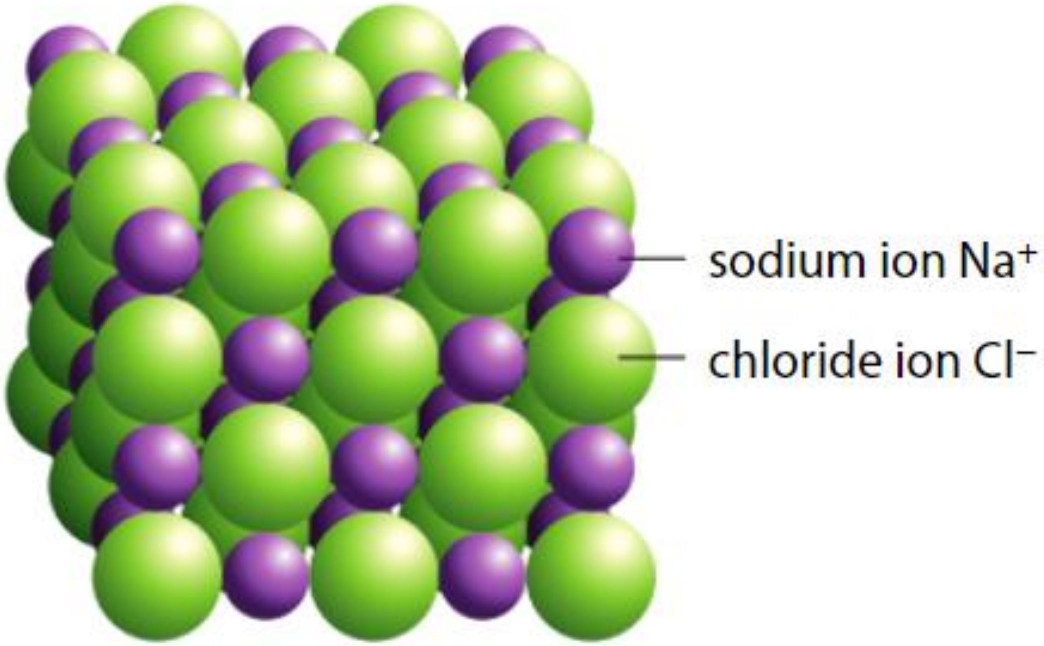

Graphite giant structure; in graphite layers, each carbon atom forms three covalent bonds

- Graphite is a giant structure made of carbon found in pencils
- Because intermolecular forces are weak, when you push the pencil across the paper, a layer of carbon molecules is left on the page

# Giant Structures in Ionic Compounds

- Ionic compounds can also form giant structures by arranging themselves into lattices
- Recall that ionic bonds are formed when atoms that have gained or lost an electron have equal and opposite charge
- This causes them to be attracted through electrostatic force

The ions in sodium chloride make a giant structure known as a **lattice**.




The giant lattice structure of sodium chloride

Sodium chloride crystals

In the lattice structure, a sodium ion, $Na^+$, is surrounded by six $Cl^-$ ions. Sodium chloride forms crystals with a regular shape because the ions are arranged in a regular pattern.