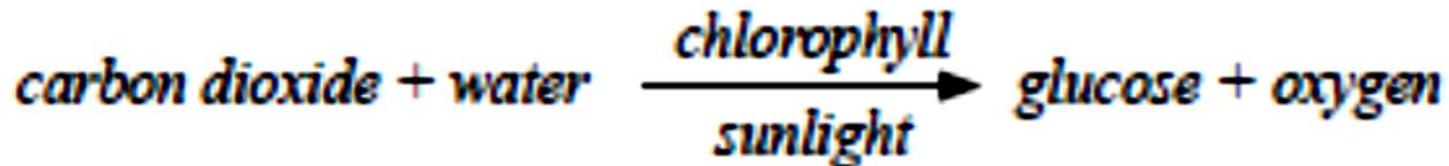


# PHOTOSYNTHESIS

1. Amazing process of photosynthesis

# Photosynthesis

- interactions and interdependence in an ecosystem are driven by the need for energy to sustain life
- the Sun is the important source providing this energy in the form of light and heat
- plants use carbon dioxide (from the air), water (from the soil) and energy from the Sun in a series of chemical reactions to produce glucose (food). This process is called *photosynthesis*
- oxygen gas is released into the air as a by-product

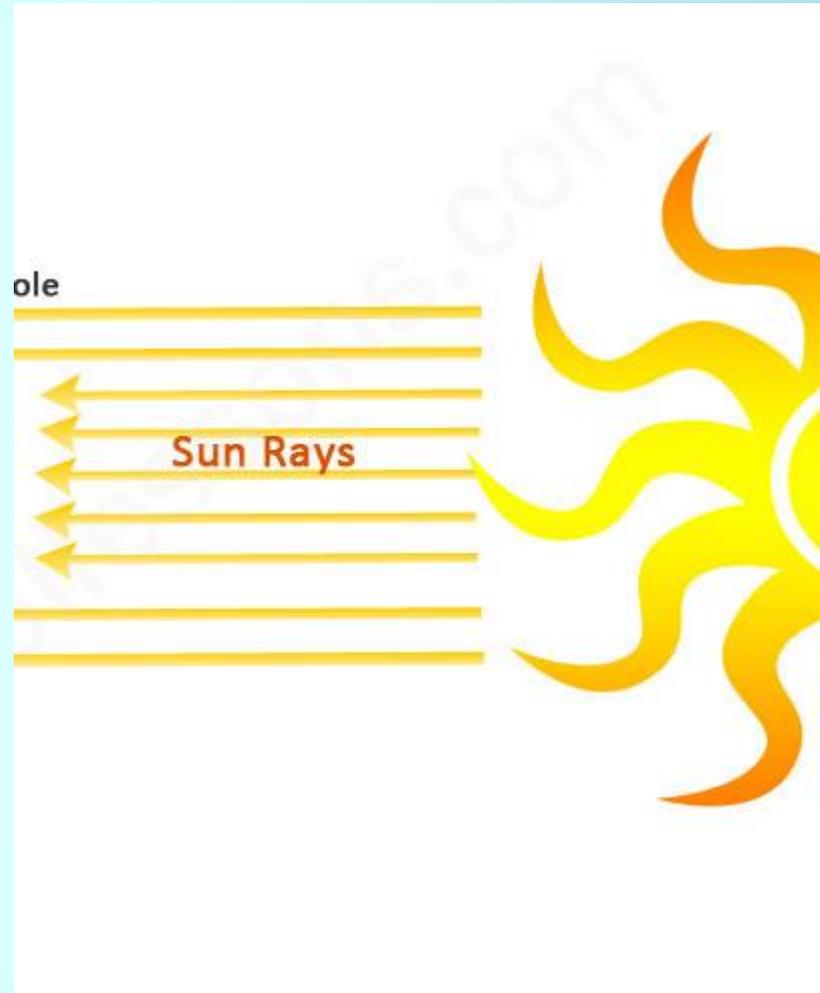


*[No further details are required]*

- plants change glucose into starch, cellulose and other chemical compounds to enable processes such as growth and reproduction

# ENERGY SUSTAINS LIFE

- ▶ Without **energy** nothing would be able to live on earth.
- ▶ Our most important source of energy is the **sun**.
- ▶ **Photosynthesis** and **respiration** are processes involved in transferring the sun's energy to our bodies.
- ▶ All life on earth depends on energy to sustain the seven **life processes**.



# Life processes

- ▶ Movement
- ▶ **Reproduction**
- ▶ Sensing
- ▶ **Growth**
- ▶ Respiration
- ▶ Excretion
- ▶ Nutrition



- ▶ Most organisms cannot directly use the energy from the sun to perform their life processes. For example, a reptile can lie in the sun to warm up from the heat energy, but this doesn't provide the necessary energy for that animal to move, reproduce or excrete waste.

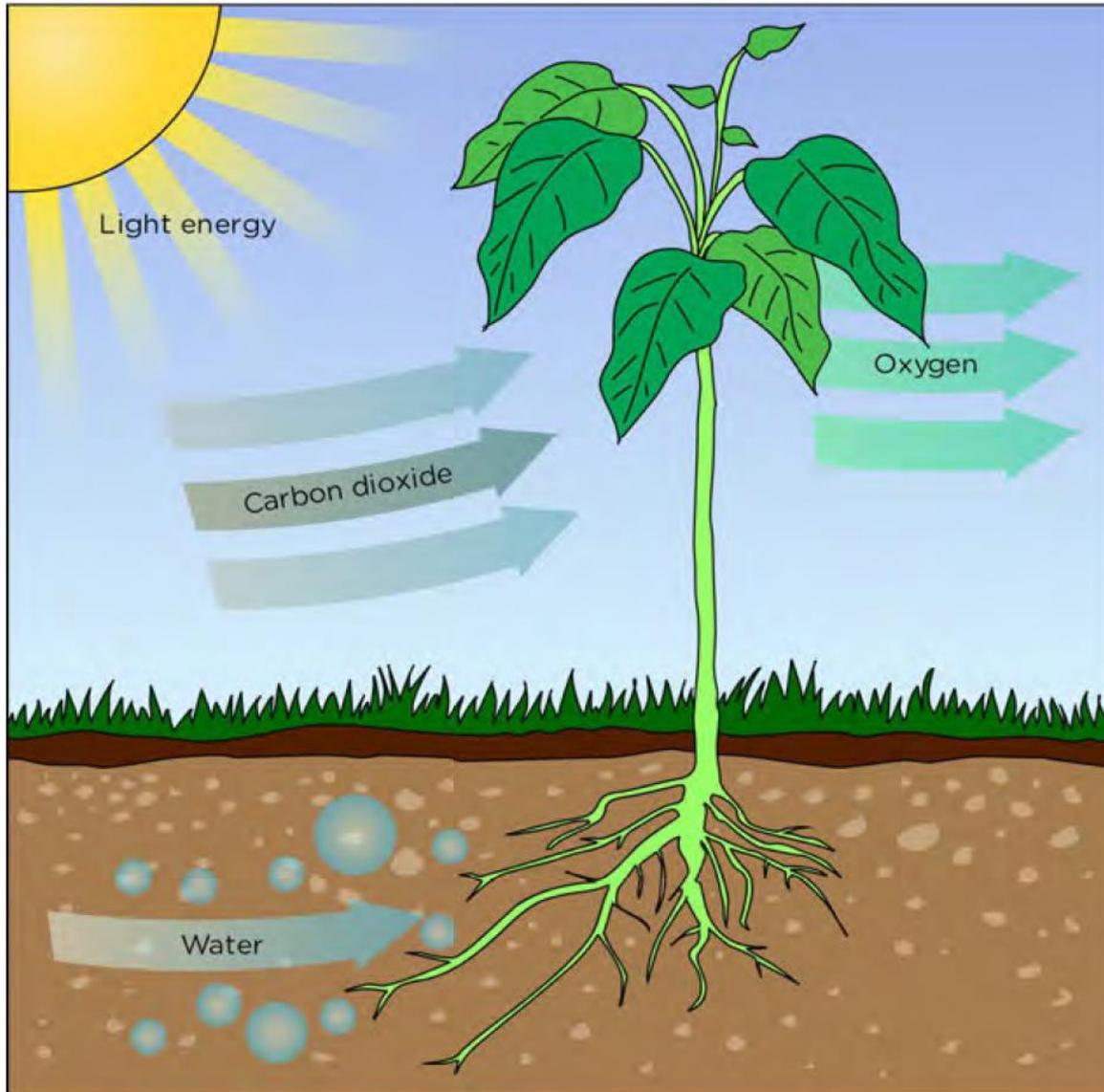
- ▶ Except for a few sea slugs, plants are the only organisms on earth that can absorb the sun's radiant energy and convert it into food for themselves and for other living organisms.



*Elysia chlorotica*, a sea slug can absorb the chloroplasts from the green algae it eats and use them to photosynthesize.

You do not have to know the name of the sea slug

# Requirements and products of photosynthesis



Draw a simple diagram indicating the requirements and products of photosynthesis

# Photosynthesis

The chemical process during which **plants use energy** (from sun) to change **carbon dioxide** and **water** into **glucose**. The process releases **oxygen**.

# Equation for photosynthesis

**carbon dioxide + water**  $\xrightarrow{\text{chlorophyll and sunlight}}$  **glucose + oxygen**

**Do activity pg. 14**

REQUIREMENT: Energy

sunlight



chlorophyll

REQUIREMENT: Pigment

carbon dioxide  
water

REQUIREMENT: Chemical

Photosynthesis



oxygen  
glucose

PRODUCTS

# What happens to the glucose

- ▶ The glucose is the food for the plant
- ▶ The plant **can use** this glucose directly, and release the energy during its own respiration or it can be stored or convert it to other chemical compounds
- ▶ Glucose is **soluble** in water (can dissolve in water) – this is useful as it means it can **transport** the glucose in **water** to where it is needed elsewhere in the plant.

# What happens to the glucose

- ▶ In order to store large amounts of glucose, plants need to convert it into compounds which are insoluble in water – therefore
- ▶ The plant needs to convert it into **starch**.
- ▶ Starch can be converted into **cellulose** and into **other substances** that plants need for their life processes.

# Importance of photosynthesis

1. To produce food for plants which can then serve as a food source for other living organisms.
2. To **maintain balance** between oxygen and carbon dioxide in the atmosphere.

- ▶ To see if a plant photosynthesizes, we can test to see if the plant produced starch.
- ▶ If it tests positive for starch photosynthesis took place.

# Test for starch

- ▶ Colour of Iodine (I) solution is yellow brown.
- ▶ Positive test for presence of starch: Iodine solution turns blue-black

Iodine and starch solution

Colour of Iodine solution without starch



# Investigation: Which leaves (in sunlight/cupboard) photosynthesize

conducting an investigation to show that leaves produce starch [*soak the leaf in boiling water, extract chlorophyll using ethanol/methylated spirits, add a few drops of iodine solution*]. Write a report using the headings; aim, hypothesis, method, results, conclusion and discussion

2. Starch test video

# 1. AIM:

- ▶ What do you want to establish by conducting this investigation

# 1. AIM:

To investigate whether light is necessary for photosynthesis

## 2. Hypothesis

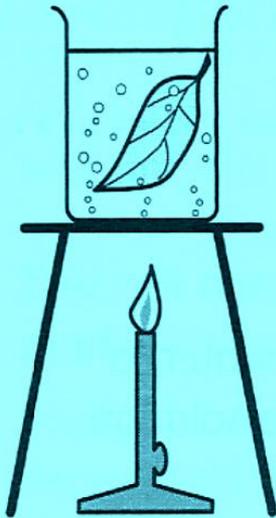
- ▶ What do you think is going to happen
- ▶ Involves a **likely answer to the question being asked, including both variables.**

## 2. Hypothesis

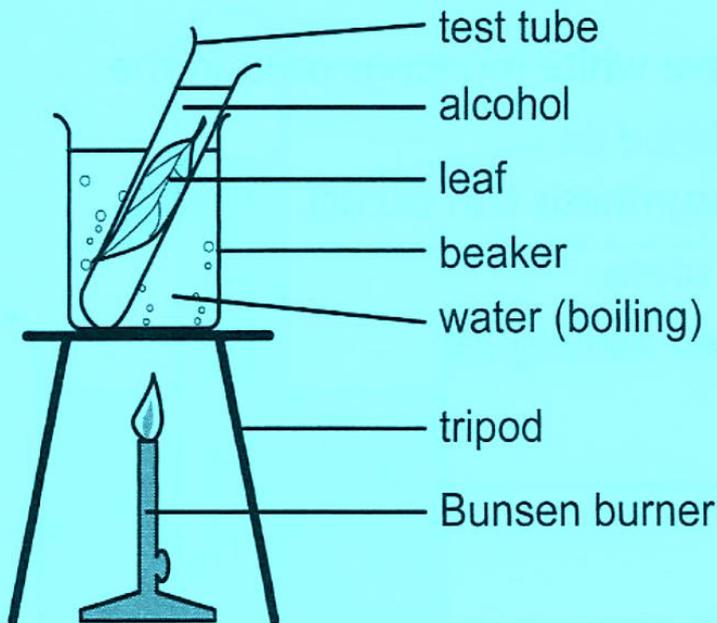
- ▶ The leaves in the light will test positive for starch/turn blue-black as they photosynthesized whereas the leaves in the dark will not photosynthesize and will test negative for starch / will not turn blue-black/will stay yellow brown

# 3. METHOD

- ▶ Write down, step-by-step, how you performed your investigation
- ▶ Someone should be able to repeat the investigation just by reading your method.



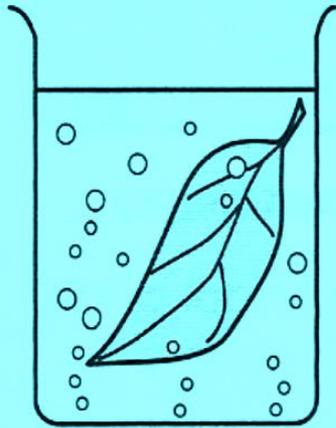
1. *Boiling the leaf in water to break down the cellulose walls.*



2. *Boiling the leaf in alcohol removes the chlorophyll. Placing the test tube in a water bath prevents the alcohol from catching fire.*

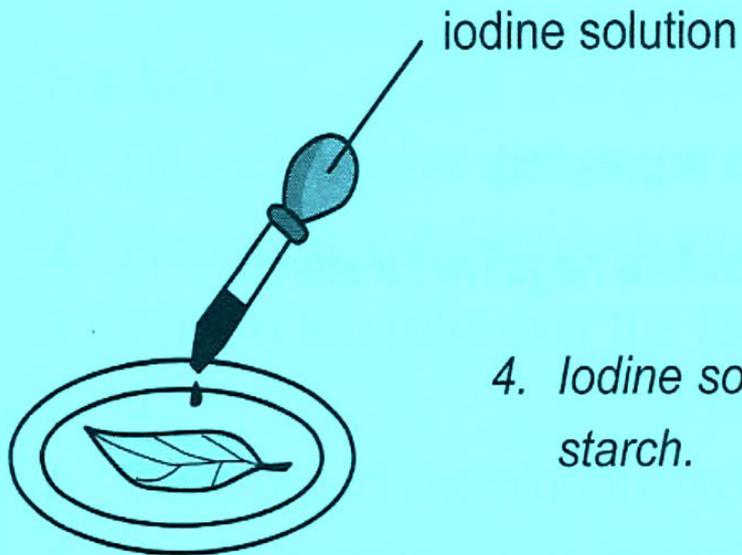
Turn off the flame as alcohol is highly flammable.

Draw this diagram under materials and apparatus



3. *The leaf is rinsed in boiling water and then dipped in cold water.*

The alcohol makes the leaf brittle. It is rinsed to remove the alcohol and soften the leaf again.



4. *Iodine solution is used to test for the presence of starch.*

# 4. Materials and apparatus

- ▶ Draw bottom diagram on slide 24 & list other materials not indicated on the diagram

# Safety precautions

- ▶ Do not heat the alcohol directly because it is extremely flammable/ heat in a water bath.
- ▶ Remove the flame when alcohol is boiled as it is extremely flammable

- ▶ If the leaf turns blue black, starch is present and we can conclude that photosynthesis took place.



- ▶ If it remains brown/the colour of iodine, starch is not present and photosynthesis didn't take place



# 5. RESULTS

# Results (using green leaf)

Leaf in dark

Leaf in sunlight



Remained yellow  
brown

Turned blue-  
black

# 6. Results

- ▶ Draw a table to record and compare the results.

# 6. Results

Table indicating the results

	Leaves in dark	Leaves in sunlight
Colour of Iodine	Remains yellow brown	Turns blue black

# 7. Discussion

- ▶ The leaf kept in the dark didn't photosynthesize and couldn't produce starch therefore it tested negative.
- ▶ Mention safety precautions
- ▶ Explain anything that they might have improved on when doing the investigation – for example:
  - Using more than one leaf (increase sample size) or repeat the investigation.
  - Use the same type of leaf; use the same amount of Iodine; follow the same method etc.

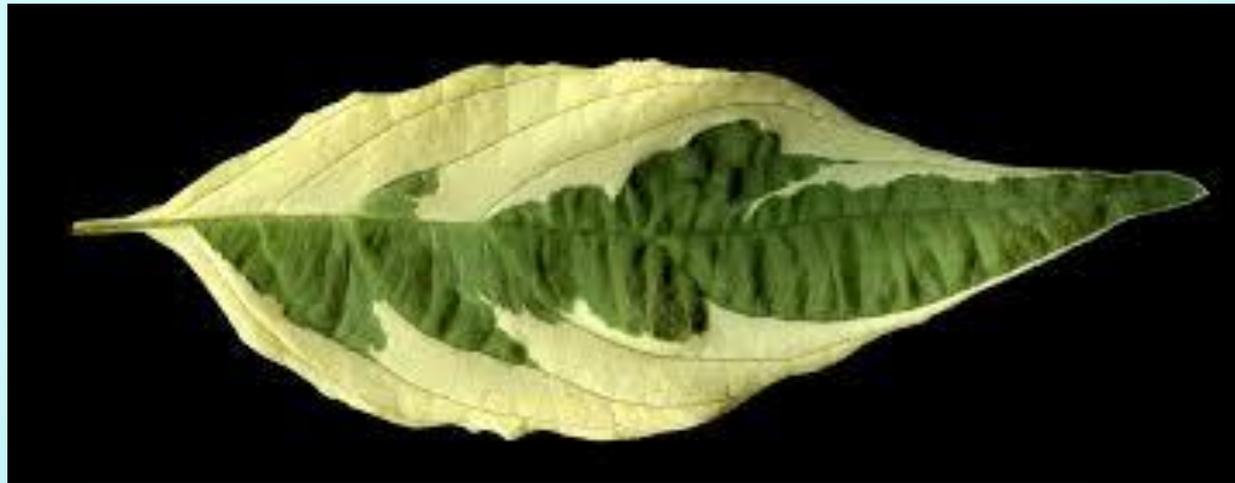
# 8. Conclusion

- ▶ What did you learn from doing this investigation? This is the answer to your investigative question.

# 8. Conclusion

Sunlight is needed for photosynthesis

# Which part of variegated leaves photosynthesize? (pg.10)



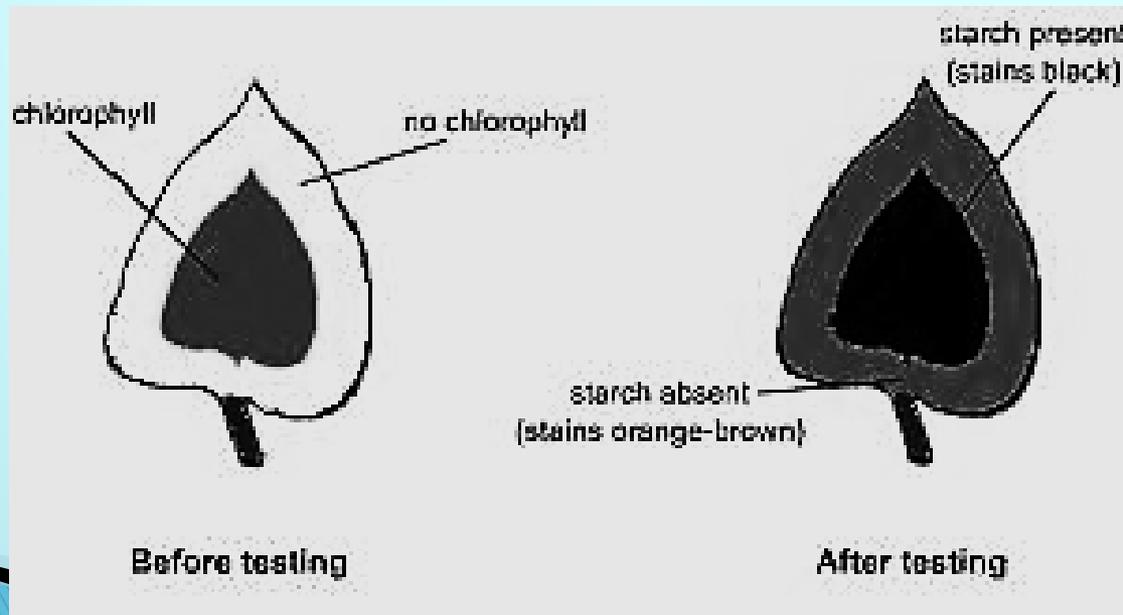
Variegated leaves have green and white sections

**1. Aim: To see which part of a variegated leaf will turn blue-black with the starch test**

**2. Hypothesis: Only the green part of leaf will turn blue-black in presence of Iodine**

**3. Apparatus and method will be the same as with the starch test**

## 4. Results to indicate which part of a variegated leaf will photosynthesize



## 5. Conclusion:

- ▶ Only the green part of the leaf will photosynthesize

# CELLULAR RESPIRATION

Video 3: Photosynthesis and cellular respiration

## Respiration

- food contains energy (potential energy). This energy can be released from food by a series of chemical reactions. This process is called *respiration*
- *respiration* (in all living organisms) is the process by which energy is released from food in a series of chemical reactions  
$$\text{glucose} + \text{oxygen} \longrightarrow \text{energy} + \text{carbon dioxide} + \text{water}$$

*[No further details are required]*

- **writing** about the requirements for, and products of respiration
- **testing** for the presence of carbon dioxide in exhaled air using clear lime water

# Energy from food

- ▶ The energy from the food that is produced during photosynthesis needs to be used by plants and by all the animals who eat those plants
- ▶ Our bodies need energy **to move and do work**
- ▶ We get that energy from the food we eat because food contains **chemical potential energy**

# Energy from food

- ▶ Fuels, such as wood, coal, and oil, also contain **chemical potential energy**. When this fuel is burned in the presence of oxygen, the chemical potential energy is transferred into light and heat energy.
- ▶ In the same way, the glucose from the food that you eat is combined with oxygen in a series of chemical reactions to release the energy.
- ▶ **The glucose is broken down and the energy is released.**
- ▶ This energy is then used to **drive all the other life processes** in your body.
- ▶ This process is called **respiration**.

# Definition of Cellular respiration

- ▶ Cellular respiration is a **chemical process** where **oxygen** break down **glucose** molecules to **release energy**. **Carbon dioxide** and **water** is **released** as by products.

# Breathing

Breathing  $\neq$  cellular respiration!

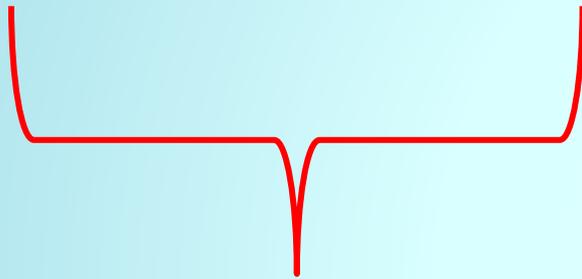
- ▶ Breathing is the act of inhaling and exhaling air into and out of the lungs.

# Energy from food

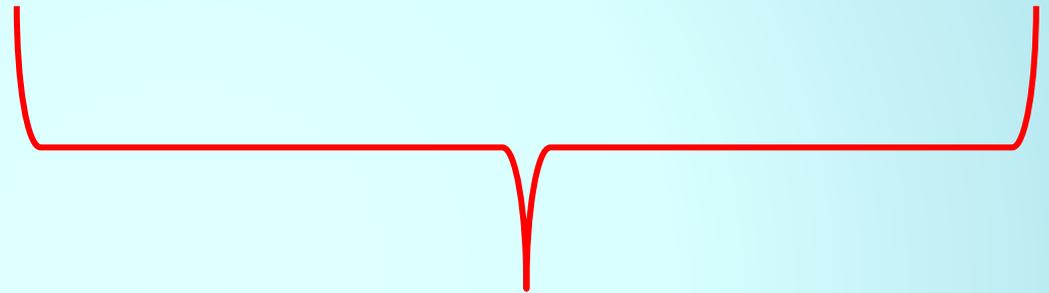
- ▶ Respiration takes place in **all organisms**, even plants.
- ▶ However, plants do not need to eat any food as they make their own food during photosynthesis.

# Equation for cellular respiration

Glucose + oxygen → water + carbon dioxide + Energy



Requirements/  
reactants



Products

- ▶ The carbon dioxide that is produced in the body of an organism during respiration needs to be removed.
- ▶ In humans, we do this by **breathing out** carbon dioxide-rich air.

# Testing the products of respiration

- ▶ We can test for the products of respiration using our own breath.
- ▶ Carbon dioxide is a colorless gas, so we cannot see it directly
- ▶ So how do we test that our breath contains carbon dioxide?
- ▶ Carbon dioxide will turn clear lime water milky

## **ACTIVITY:**

Testing for the presence of carbon dioxide in exhaled air using clear lime water

Video 4: Lime water test for carbon dioxide

# Complete activity pg. 16 & 17 (NB)

**ACTIVITY:** Does our breath contain carbon dioxide?

**ACTIVITY:** Requirements and products of respiration

PRODUCTS

carbon dioxide  
water

REQUIREMENTS

oxygen  
glucose

PRODUCT

energy

Cellular respiration



**Tabulate the differences between respiration and photosynthesis**

## **Table showing differences between photosynthesis and cellular respiration**

<b>Photosynthesis</b>	<b>Cellular respiration</b>
1. Occurs only in green plants	1. Occurs in plant and animal cells
2. Occurs only in the presence of light	2. Can occur without light.
3. Glucose is produced.	3. Glucose is broken down to release energy
4. Light energy is converted to chemical potential energy and stored	4. Chemical potential energy is converted into energy for use.

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A – D) next to the question number

1. During cellular respiration...
  - a. food is made.
  - b. energy is made.
  - c. energy is released.
  - d. both A and B.

2. \_\_\_\_\_ is a requirement of photosynthesis but a product of cellular respiration.

- A. hydrogen.
- B. carbon dioxide.
- C. nitrogen.
- D. oxygen.

**1.2 Give the correct biological term for each of the following descriptions. Write only the term in the space provided.**

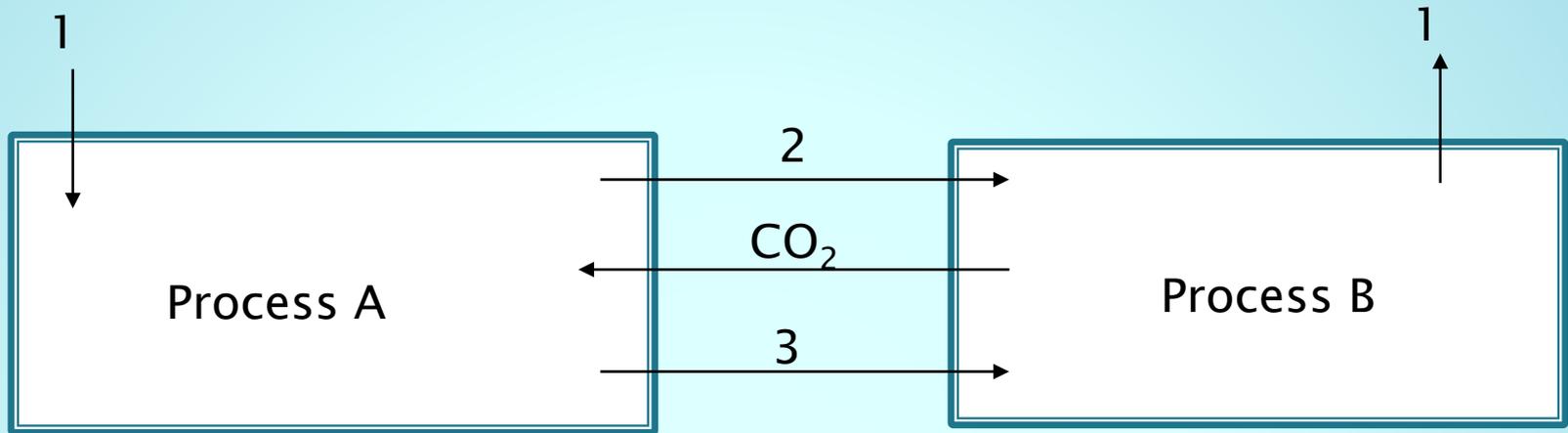
**1.2.1. The energy rich compound essential for cellular respiration.**

**1.2.3. The gas that is required for cellular respiration.**

**1.2.4 Indicator/chemical used to test for starch**

**Indicate whether each of the statements in COLUMN I apply to A ONLY, B ONLY, BOTH A AND B or NONE of the items in COLUMN II. Write A only, B only, both A and B or none next to the question number**

<b>COLUMN I</b>	<b>COLUMN II</b>
1. Gas used by plants	A: Oxygen B: Carbon dioxide
2. Takes place during day and night	A: Photosynthesis B: Cellular respiration
3. Part of variegated leaf that will turn blue black during starch test	A: White part B: Green part
4. Chemical used to test for carbon dioxide	A: Iodine B: Lime water



1. Identify process A and B
2. Identify gas 2
3. Identify substance 3
4. What does number 1 represent?
5. Which process (A/B) takes place
  - a) During day and night
  - b) Only during the day

**Do revision exercise pg. 21 – 24**