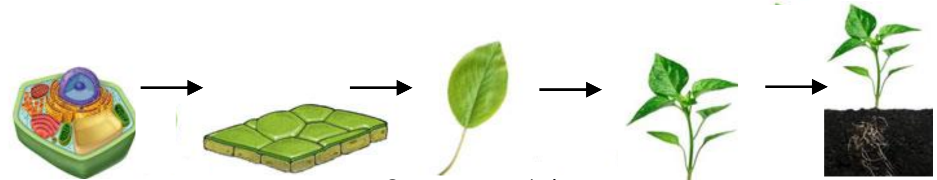
GCSE Knowledge Organiser
Unit 2.2 – Plants and Photosynthesis

SCIENCE

ONE – SPECIALLISED PLANT CELLS

SPECIALISED CELLS	
Specialised Cell	**How structure relates to function**
Root hair cell	Long extension to increase surface area for water and mineral uptake; thin cell wall.
Xylem cell	Waterproofed cell wall; cells are hollow to allow water to move through.
Phloem cell	Some cells have lots of mitochondria for active transport; some cells have very little cytoplasm for sugars to move through easily.
Palisade cell	Lots of chloroplasts to absorb lots of light and increase rate of photosynthesis.
Guard cell	Flat, thin, kidney bean shape enables two cells to form a pore to allow carbon dioxide in. Large vacuole to regulate osmotic pressure and control the opening and closing of the stoma.

TWO – PLANT TISSUES AND ORGANS



Cell – the smallest unit of an organism → **Tissue** – consists of groups of similar cells → **Organ** – contain different tissue working together to carry out a function → **Organ** system – contains different organs → **Organism**

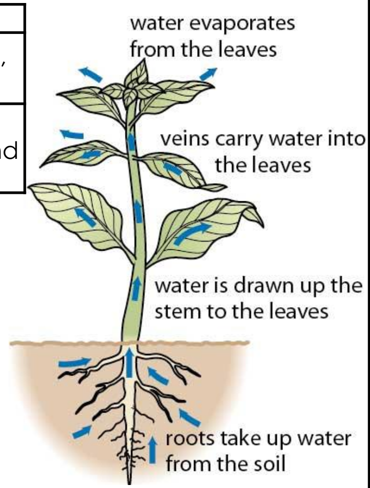
Type of tissue	Properties	Function
Meristem tissue	Found in the growing tips of roots and shoots. Can differentiate (divide) into any type of plant cell.	Can be used to clone rare species to prevent extinction.
Xylem	Long hollow tube strengthened by lignin found throughout the plant.	Transport water from the roots to shoots and leaves.
Phloem	Composed of sieve cells and companion cells.	Transports sugars from the leaves to elsewhere in the plant.

THREE – TRANSPIRATION

DEFINITIONS	
Transpiration	The loss of water vapour from a leaf, mainly through the stomata.
Transpiration stream	The movement of water through a plant from the roots, up the stem and then out through the leaves.

The rate of transpiration varies with:

- **light intensity** – which affects the opening of stomata
- **air movements –** which affect the concentration of water vapour in the air around leaves
- **Temperature –** which affects the rate at which water evaporates.



FOUR - PHOTOSYNTHESIS

Photosynthesis takes place in the chloroplasts in the cells of the leaves of plants. The chloroplasts contain the chlorophyll, which absorbs sunlight.

$$\text{carbon dioxide} + \text{water} \xrightarrow{\text{light}} \text{glucose} + \text{oxygen}$$

$$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$$

Endothermic reaction

The glucose produced in photosynthesis may be:

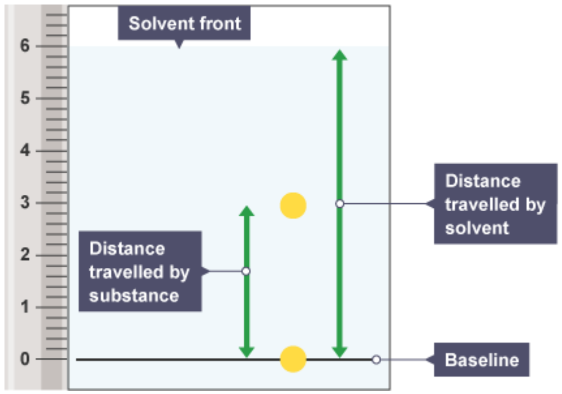
1. used for respiration
2. converted into insoluble starch for storage
3. used to produce fat or oil for storage
4. used to produce cellulose, which strengthens the cell wall
5. used to produce amino acids for protein synthesis

The rate of photosynthesis depends on:

- the energy available from light
- the concentration of carbon dioxide in the air
- the temperature

FIVE – CHROMATOGRAPHY

The chlorophyll and other pigments in plant leaves can be separated and identified by chromatography.



R_f values can be used to identify unknown chemicals if they can be compared to a range of reference substances. The R_f value is always the same for a particular substance.

The R_f value of a spot is calculated using:

$$R_f = \frac{\textit{distance travelled by substance}}{\textit{distance travelled by solvent}}$$

R_f values vary from 0 (the substance is not attracted at all to the mobile phase) to 1 (the substance is not attracted at all to the stationary phase).

Chromatography Phases	The different dissolved substances in a mixture are attracted to the two phases in different proportions. This causes them to move at different rates through the paper.
Mobile phase	the solvent that moves through the paper, carrying different substances with it
Stationary phase	which in paper chromatography is the very uniform, absorbent paper

SIX – PLANT DISEASES

Communicable disease	**Effects**	**Control methods**
Tobacco mosaic virus	This virus gives a distinctive 'mosaic' pattern of discolouration on the leaves, which affects the growth of the plant due to lack of photosynthesis.	• removing and destroying infected plants; • washing hands and tools after handling infected plants; • crop rotation to avoid planting in soil that has been infected for at least two years.
Rose black spot	This fungal disease causes purple or black spots to develop on leaves, which often turn yellow and drop early. It affects the growth of the plant as photosynthesis is reduced. The disease is spread by spores of the fungus that are produced in the black spots.	• not planting roses too close together – to allow the air to flow freely around them; • avoiding wetting the leaves when watering – wet leaves encourage the fungal disease; • cleaning up any infected leaves from the ground round the roses – to avoid spores spreading; • using a fungicide to prevent infection – spraying, especially in advance of warm, wet weather.