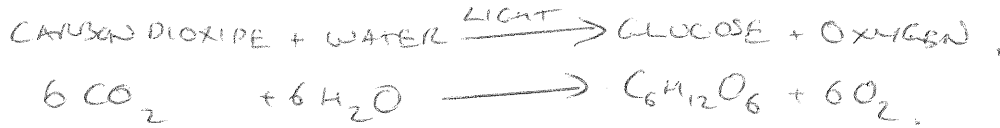


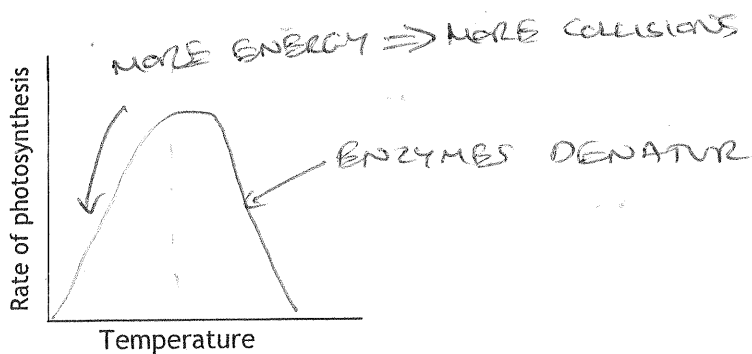
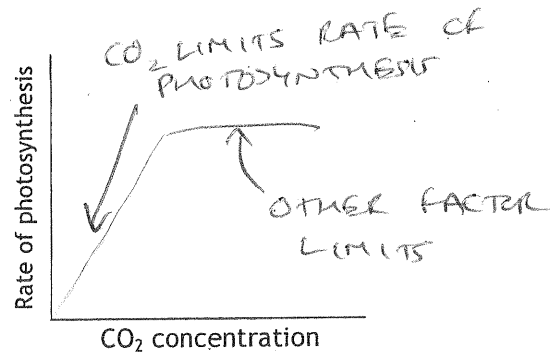
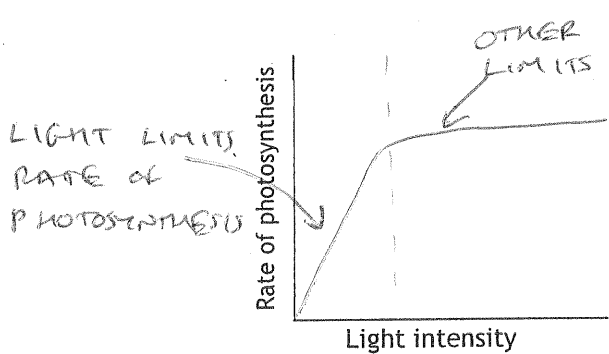
Photosynthesis

Photosynthesis is the process by which plants make GLUCOSE..... from water and carbon dioxide using energy from SUNLIGHT.... In this way light energy is converted into CHEMICAL... energy. This glucose can then be used to create other carbohydrates as well as other macromolecules such as PROTEINS..... and fats.

Write the word and balanced symbol equation for photosynthesis below:

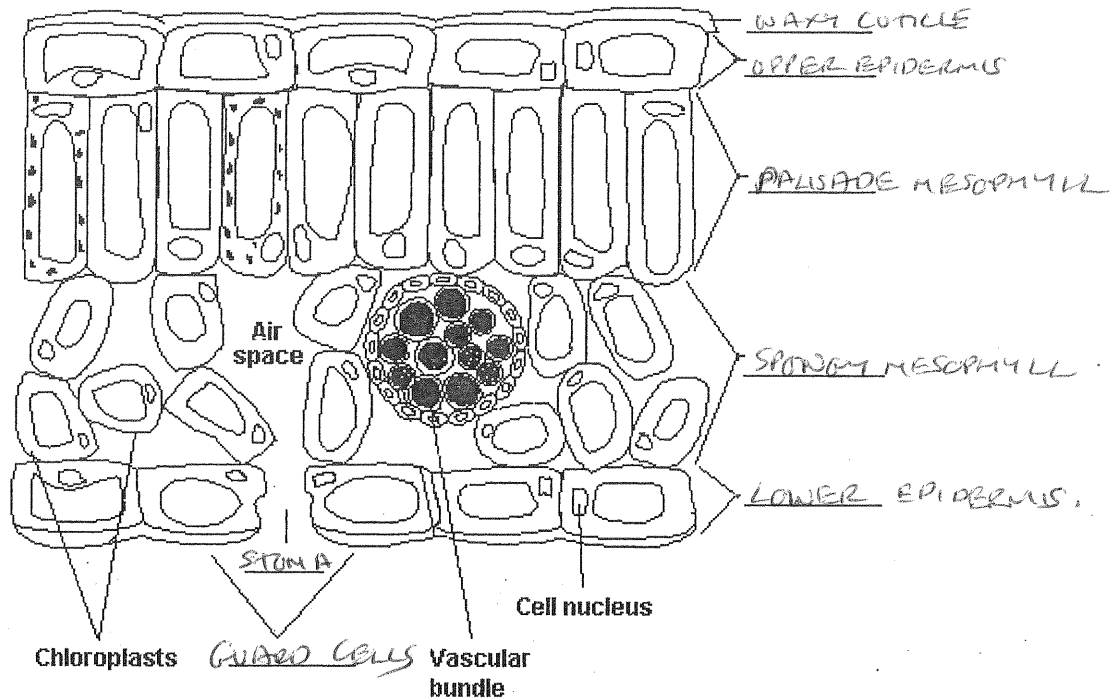


Complete the three graphs below to show how the amount of CO₂, light and temperature affect photosynthesis. In the space below each graph explain its shape.



On the following page is an unlabelled diagram of a leaf. Label the diagram. In the following space give three ways in which the leaf is adapted to carry out its function of photosynthesis.

1. LARGE SURFACE AREA TO CAPTURE LIGHT
2. UPPER LAYER (PALISADE MESOPHYLL) CONTAINS MANY CHLOROPLASTS
3. SPONGY MESOPHYLL & STOMATA ALLOW EFFICIENT EXCHANGE OF O₂/CO₂

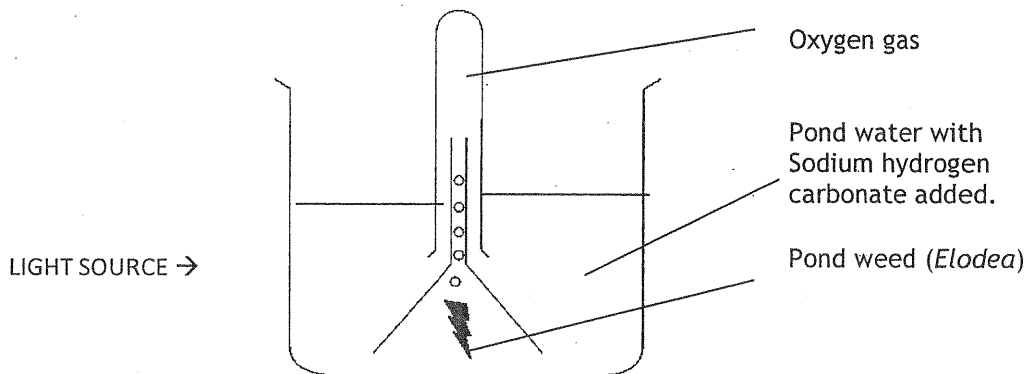


In addition to light, carbon dioxide and water plants also need a supply of mineral ions. These are usually taken up through the ROOTS..... by active transport from the soil. Two important mineral ions include:

Nitrate: Used to make amino acids to form proteins for growth.....

MAGNESIUM.....: an important component of the chlorophyll molecule.

Experiment to show the evolution of oxygen from pondweed:



What is the function of the Sodium hydrogen carbonate?

..... PROVIDE ADEQUATE CO₂

How could you test to ensure the gas given off was oxygen?

..... RE-LIGHT GLOWING SPLINT?

How do you test a leaf for the presence of starch?

BOIL (10 MINS.); ADD TO HOT ETHANOL (1 MIN.) RINSE
ADD IODINE SOLUTION \Rightarrow BLUE/BLACK = STARCH,
ELSE BROWN

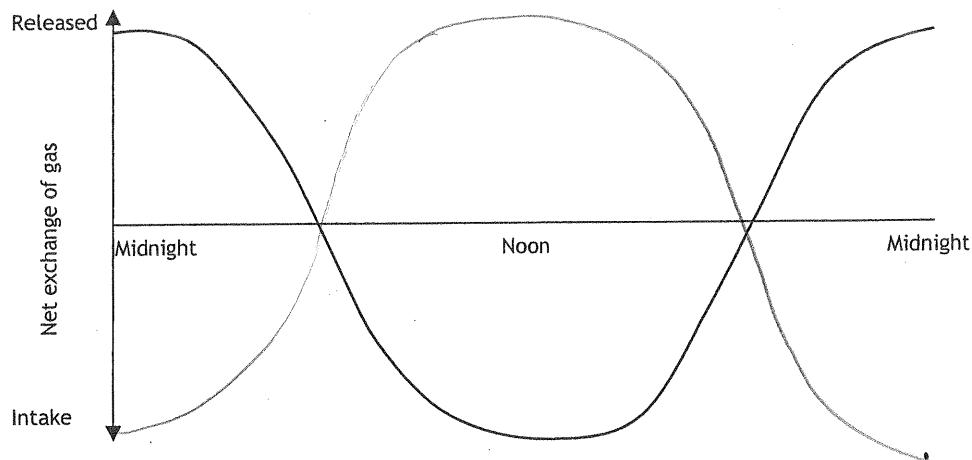
What do you need to do to see if the following are necessary to produce starch in a plant?

Light: GROW IN DARK - TEST BEFORE & AFTER
CO₂: " IN BELCHAMBER WITH SODA LIME
Chlorophyll: TEST A VARIEGATED LEAF

Gas Exchange

The net gas exchange in plants depends upon the rate of RESPIRATION and photosynthesis in the plant. The former of these means that the plant will take in O₂ and release CO₂, while for photosynthesis it is *vice versa*. The net gas exchange will therefore depend upon the RATE of these processes, which will vary during the day. Respiration takes place all day while the rate of photosynthesis varies according to the amount of light.

The following graph shows the net exchange of carbon dioxide during the course of the day:



On the graph sketch what you expect the line for oxygen to be like.

Because both oxygen and carbon dioxide are released from the plant at some point and are by-products of metabolism, they can be classified as WASTE products.

With reference to the previous diagram of the leaf write below how it is adapted to allow efficient gas exchange, include the role of stomata:

AIR SPACES BETWEEN SPONGY MESOPHYLL. - LARGE SURFACE AREA
STOMATA OPEN/CLOSE AT DIFFERING TIMES OF DAY
MOIST FOR DISSOLVING GASES. 4.

✶

.....
.....
.....
.....
.....

Experiment to show net gas exchange:

This experiment relies on the hydrogen carbonate indicator. A fall in pH (due to the production of CO_2) turns the indicator yellow while a rise in pH (due to less CO_2 ...) turns it first red and eventually purple.

For this experiment three tubes are filled with hydrogen carbonate indicator. Into two of these a rolled up leaf (upper surface facing outward) is placed (not touching the solution). To one of these tin foil is wrapped around. The three tubes are left for 40 minutes in bright light. What colour do you expect the indicator to change?

Leaf and light: PURPLE

Leaf and darkness: ~~RED~~ YELLOW

No leaf and light: RED

Why did one of the tubes have no leaf?

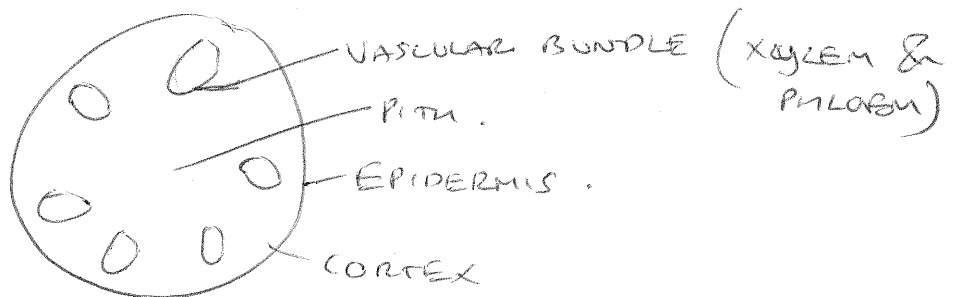
..... TO SHOW THAT COLOUR CHANGE DOESN'T
..... JUST HAPPEN

Transport in plants

Why do plants need a transport system?

..... MOVE H_2O / NUTRIENTS AROUND PLANT - CAN'T
..... SIMPLY RELY ON DIFFUSION TO EVERY
..... CELL

Draw and label a cross section diagram of a plant stem below:

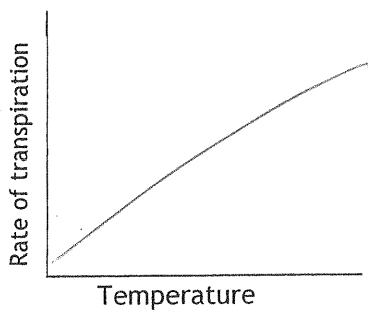
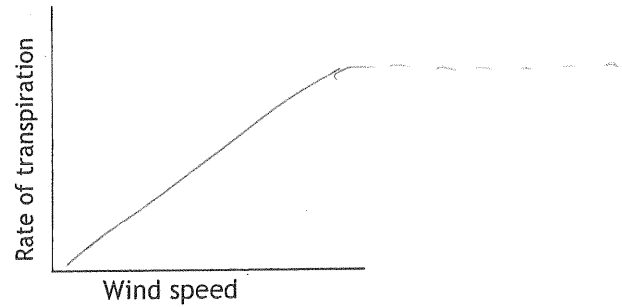
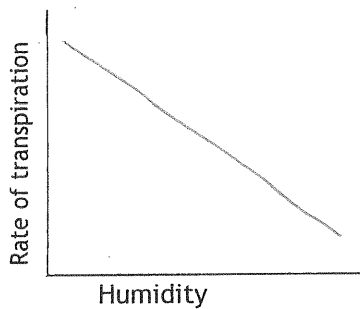


In a plant, sugars and other nutrients are transported in the PHLOEM..... These cells are ALIVING..... Transport can be both up and down the plant from SOURCES (where photosynthesis takes place) to all other parts of the plant. Such movement is known as translocation and it is energy requiring.

Describe how water moves up a plant (from the roots to the leaves) in the space below; also include how water is absorbed by root hair cells:

ENTER ROOT HAIR CELL BY OSMOSIS
 MOVES TO XYLEM VESSELS IN MIDDLE OF ROOT
 PULLED UP XYLEM - WATER MOLECULES ARE
 COHESIVE, THE EVAPORATION OF WATER OUT OF
 LEAVES CAUSES A DRAG ON WATER IN XYLEM
 FROM LEAF TO ROOT → WATER IS THEREFORE
 PULLED UP STEM TO LEAF

The process you have described above is often called TRANSPIRATION. Complete the graphs below to show how this is affected by different factors:



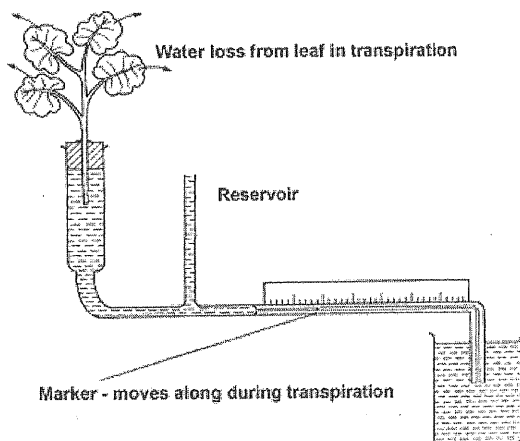
How might light intensity affect transpiration?

MORE LIGHT → OPENS
 MORE STOMATA →
 FASTER TRANSPIRATION

The following apparatus can be used to measure transpiration:

What is this piece of apparatus called?

POTOMETER



Use the following space to describe how this apparatus can be used to investigate how some of the factors above affect transpiration:

CUT LEAFY SHOOT. INSERT INTO POTTYNECKER (UNDER WATER). INTRODUCE AIR BUBBLE INTO WATER STREAM. MEASURE MOVEMENT OF BUBBLE OVER A TIME PERIOD. ALTER CONDITIONS e.g. TEMP, WIND SPEED etc.

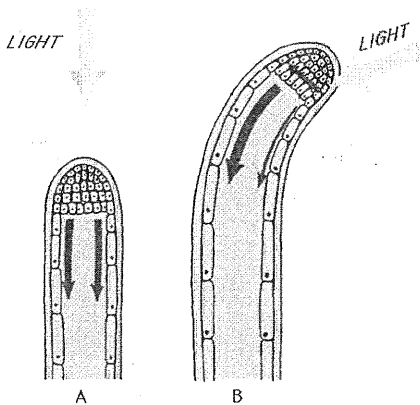
CORMS

Plant responses

Plants respond to a number of stimuli, such as, light, gravity and WATER.

Plant stems are said to be NEGATIVELY geotropic as they grow against gravity, while they are positively PHOTOTROPIC as they grow towards light. Roots, however, are POSITIVELY geotropic. These responses increase the likelihood of a plant obtaining sunlight and water.

The response of plants to sunlight is due to the plant hormone AUXIN. The following diagram shows what happens:



In this diagram the sunlight causes more auxin to accumulate on the shaded side (the arrow thickness indicates this). This causes this side of the plant to GROW/ELONGATE more causing the stem to bend.

Use the space below to describe experiments to demonstrate both phototropism and geotropism:

LIGHT BOX EXPERIMENT
REMOVE TIP TO SHOW
NO RESPONSE => ROLE OF TIP IN INITIATING
RESPONSE
USE OF CLIMAXANT TO SHOW GEOTROPISM

Plant reproduction

Define:

Sexual reproduction:

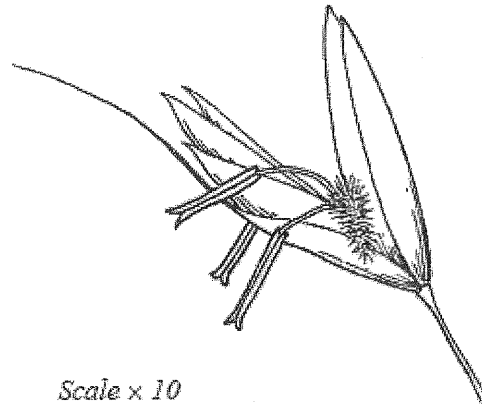
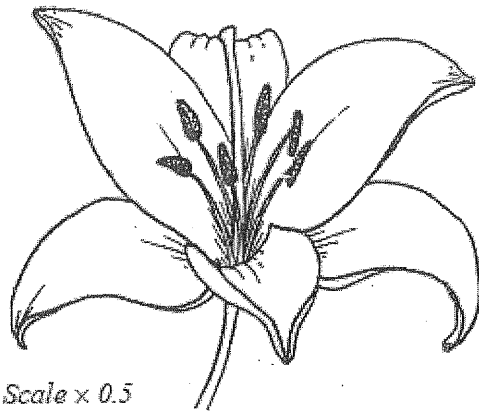
2 PARENTS INCREASES GENETIC VARIETY

Asexual reproduction:

..... SINGLE PARENT ORGANISM
..... PRODUCES CLONES - GENETICALLY IDENTICAL

In both plant and animal sexual reproduction a male and female HAPLOID..... gamete combine during fertilisation to produce a ZYGOTE/EMBRYO

Below is a typical insect and wind pollinated flower for you to label:



Adaptations: COLOUR SCENT
..... ANTHOR/PILAMENT & STIGMA /
..... STYLE INSIDE PLANT
..... STICKY POLLEN
..... & " STIGMA

Adaptations: NO COLOUR / SCENT
..... ANTHOR/PILAMENT & STIGMA /
..... STYLE OUTSIDE
..... LIGHT POLLEN
..... FEATHERY STIGMA
es REDUCED FLOWERS

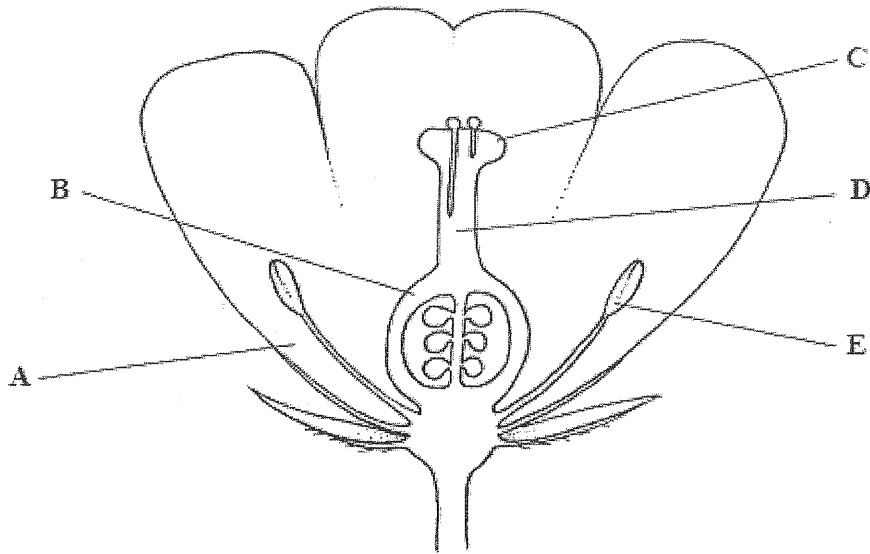
its way through the style and allows the nucleus of the pollen grain to travel to the ovary to fuse with the nucleus of the OVUM..... The ZYGOTE formed becomes an embryonic plant. The other contents of the ovule will develop into the cotyledons, which will act as a food reserve during germination before the plant can PHOTOSYNTHESISE itself. The ovary surrounding this will develop into a FRUIT..... This seed will remain relatively dormant until conditions are favourable for germination. These favourable conditions include WATER....., O₂....., SUITABLE TEMPERATURE

Plants can reproduce asexually, for example spider plants and strawberry plants which produce RUNNERS..... These are lateral shoots which the parent plant produces new individuals when they make contact with the ground.

Alternatively gardeners often artificially reproduce plants asexually by taking CUTTINGS.....

IGCSE Questions.

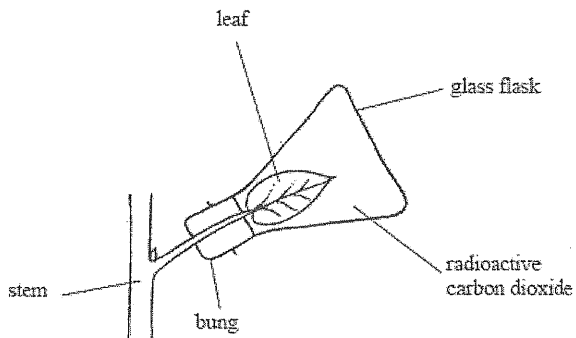
1. The diagram shows a section through a flower.



(a) Name the parts labelled A, B, C and D.

- A
- B
- C
- D (4)

2. A plant leaf was exposed to radioactive carbon dioxide as shown in the diagram below. When the plant leaf is placed in the light and exposed to radioactive carbon dioxide, the carbohydrate it makes is radioactive.



(a) (i) Describe how carbon dioxide gets into the leaf.

.....

(2)

(ii) Name the process that uses carbon dioxide to make the carbohydrate.

.....(1)

(b) The amount of carbohydrate transported to other parts of the plant can be found by measuring the amount of radioactivity.

(i) Name the tissue that transports the carbohydrate.

.....(1)

(ii) Name the carbohydrate that is transported in this tissue.

.....(1)

(c) The table below shows the amount of radioactivity in different parts of the plant after 24 hours.

Part of plant	Amount of radioactivity in counts per minute
shoot tip	1 123
leaf exposed to radioactive carbon dioxide	11 325
other leaves	234
stem	819
seeds	9 055
roots	842

(i) What evidence in the table shows that carbohydrate is transported both up and down the plant?

.....(1)

(ii) Suggest why the "other leaves" contain only small amounts of radioactive carbohydrate.

.....(1)

(iii) Ignoring the leaf that was exposed, calculate how much more radioactive carbohydrate was found in the seeds than in all the other plant parts added together.

..... counts per minute(1)

(iv) Explain why a supply of carbohydrate is needed for the uptake of minerals by roots.

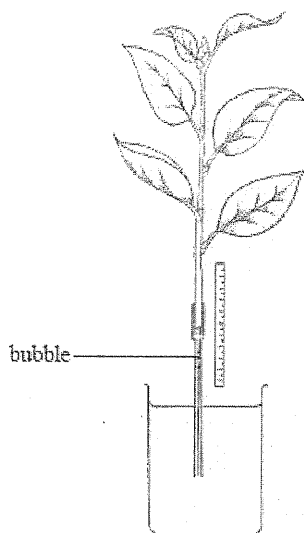
.....

(3)

(Total 11 marks)

3. (a) What word is used to describe water loss from the leaves of a plant?
(1)

(b) Loss of water from a leafy shoot can be measured using the apparatus below.



This apparatus was used by a student, in a brightly lit room, to measure the rate of water loss from a leafy shoot. He measured how far the bubble moved in five minutes. He measured this three times. The results are shown in the table.

Measurement	Distance moved by the bubble in cm
1	11.9
2	12.6
3	13.0

(i) Use these results to calculate the mean (average) rate of water loss in cm per minute. Show your working.

Answer..... cm per minute.(2)

(ii) If the room became colder, explain what would happen to the distance moved by the bubble.

(2)

(iii) If the light intensity became lower, explain what would happen to the distance moved by the bubble.

(2)

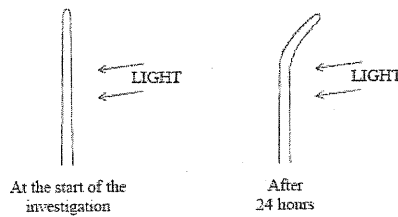
(c) Another student investigated the rate of water loss using a similar sized leafy shoot from a different species of plant. She noticed that the upper and lower surfaces of these leaves were covered with tiny hairs. Suggest how these hairs would affect the rate of water loss from this leafy shoot.

.....
.....
.....(2)

(Total 9 marks)

4. A student wanted to investigate how plants respond to stimuli.

(a) First of all, she used a seedling that had a small shoot. She shone light onto one side of the shoot for 24 hours. The results of her investigation are shown in the diagram.



(i) Describe what effect the light had on the shoot.

.....
.....
.....(1)

(ii) What is the name of the response of this shoot to light?

.....(1)

(iii) Explain how auxin is involved in the response of this shoot to light.

.....
.....
.....(2)

(b) The student then allowed another seed to germinate. After three days she placed the seedling on its side in the dark. The diagram shows the seedling after a further 24 hours.



(i) What is the name of the response of the seedling root?

.....(1)

(ii) Give two advantages to the seedling of the root growing in this way.

1.
.....
2.
.....(2)

(Total 7 marks)

IGCSE Revision booklet 2 Answers

1.

petal / corolla / perianth / tepals;
 ovary / carpel / pistil;
 stigma;
 style; (4)

2.

- (a) (i) diffusion (in); stomata / correct ref. to guard cells; (2)
 (ii) photosynthesis; (1)
- (b) (i) phloem; (1)
 (ii) sucrose; (1)
- (c) (i) in shoot tip + in roots / all parts of plant; (1)
 (ii) make their own / use non radioactive CO₂ / not exposed to radioactive CO₂; (1)
 (iii) 6037; (1)
 (iv) active uptake;
 low concentration to high concentration / eq
 energy / ATP;
 respiration;
 maximum of 3 (3)

Total 11 marks

3.

- (a) transpiration; (1)
- (b) (i) 2.5 ;; allow 1 for 37.5/3 or 12.5 / 5 (2)
 (ii) less distance / eq;
 water molecules have less kinetic energy / move less; max
 slows diffusion rate; (2)
 (iii) less distance / eq;
 stomata close; (2)
- (c) reduces water loss;
 hairs trap moist air; max
 reduces concentration / diffusion gradient; (2)

Total 9 marks

4. (a) (i) shoot has grown/bent towards the light; 1
 (ii) (positive) phototropism; 1
 (iii) more (auxin) on dark side;
 growth / cell elongation; 2
- (b) (i) (positive) geotropism; 1
 (ii) obtain water;
 obtain minerals/nutrients / name mineral/nutrient; max
 anchorage idea; 2

Total 7 marks

