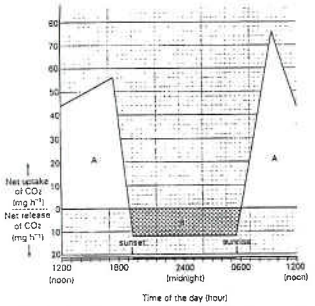
Past HKCEE Questions
Nutrition and Gaseous Exchange in Plants
Paper I

1. The graph below shows the net uptake and net release of carbon dioxide of an actively growing plant over a 24-hour period:



(i) At what times) of the day was there no net uptake and no net release of carbon dioxide by the plant? (1 mark)

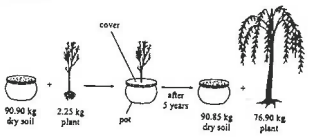
(ii)
(1) What was the respiration rate of the plant in the dark period? (1 mark)
(2) Calculate the total amount of carbon dioxide released by the plant in the same period. (2 marks)

(iii) Assuming that the plant had the same respiration rate throughout the 24-hour period, what was the highest rate of photosynthesis of the plant? (1 mark)

(iv) What information from the graph suggests that the plant was actively growing? Explain your answer. [Hint: Compare area A and area B.] (4 marks)

(HKCEE 1993)

2. In the 17th century, a Dutch scientist, van Helmont, wanted to test the following hypothesis: The soil is the main source of food for plant growth. He grew a young willow plant in a known mass of soil for five years. In this period, he only supplied the plant with water. His investigation is summarized in the diagram below:



(i) Calculate the change in mass of the dry soil and that of the plant in these five years. (1 mark)

(ii) Based on the results obtained in (i), what conclusion can you draw with reference to the above hypothesis? Explain your answer. (3 marks)

(iii) Explain why it is important to put a cover on the pot in this investigation. (2 marks)

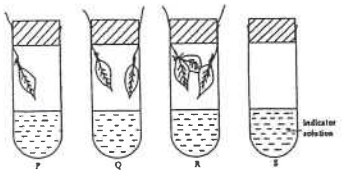
(iv) At van Helmont's time, people did not know that carbon dioxide in the air is also needed by plants for making food.
(1) You are provided with a destarched potted plant. Draw a labelled diagram of an experimental set-up which can be used to show that carbon dioxide is necessary for the plant to make food. (3 marks)
(2) What is the purpose of destarching the plant before the experiment? State how you would destarch the plant. (2 marks)

(HKCEE 2003)

Past HKCEE Questions
Nutrition and Gaseous Exchange in Plants
Paper II

90-12
Nitrogen compounds are required by plants to form
A. glucose.
B. cellulose.
C. fatty acids.
D. amino acids.

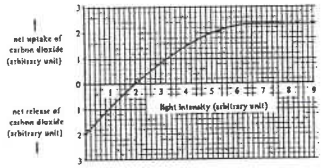
90.
Directions: Questions 16 and 17 refer to the experimental set-up shown below. Each tube contains the same volume of an indicator solution but a different number of leaves. The tubes are uniformly illuminated.



90-16
The indicator solution changes from red to purple when it becomes less acidic. In which of the tubes does the indicator solution change from red to purple most rapidly?
A. Tube P
B. Tube Q
C. Tube R
D. Tube S

90-17
If a similar set-up were kept in the dark for several hours, which tube would contain most oxygen at the end of the experiment?
A. Tube P
B. Tube Q
C. Tube R
D. Tube S

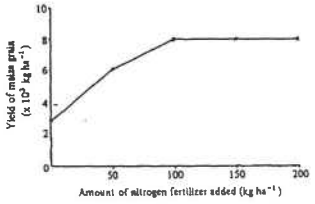
91.
Directions: Questions 21 and 22 refer to the graph below which shows the exchange of carbon dioxide between a green plant and the atmosphere under different light intensities



91-21
Which of the following can be deduced from the graph?
(1) At a light intensity of 1 arbitrary unit, only respiration takes place.
(2) At a light intensity of 2 arbitrary units, there is no cad carbon dioxide taken in or given out.
(3) At a light intensity of 9 arbitrary units, the rate of photosynthesis is greater than the rate of respiration.
A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

91-22
At a light intensity of 5 arbitrary units, how many units of carbon dioxide are used up in photosynthesis?
A. -2
B. 0
C. 2
D. 4

92-58
The graph shown the yield of maize grain in relation to the amount of nitrogen fertilizer added to the soil:



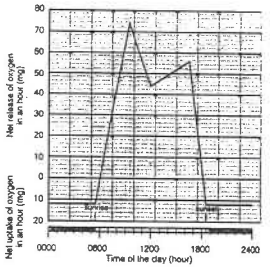
What conclusion can be drawn from the graph?
A. There would be so yield of maize grain without the addition of nitrogen fertilizer.
B. The yield of maize grain is directly proportional to the amount of nitrogen fertilizer added.
C. It is not economical to add nitrogen fertilizer beyond 100 kg ha^{-1}.

D. The addition of nitrogen fertilizer at a concentration of 200 kg ha^{-1} has a damaging effect on the environment.

93-15
In order to make proteins, plants require

	Chemicals absorbed from the soil	Chemicals synthesized by the plant
A.	nitrates	carbohydrates
B.	nitrates	vitamins
C.	magnesium compounds	vitamins
D.	magnesium compounds	carbohydrates

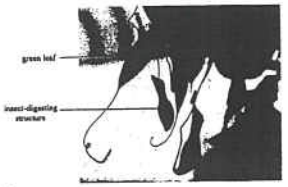
97.
Directions: Questions 15 and 16 refer to the graph below which shows the net release and net uptake of oxygen of a plant over a 24-hour period:



97-15
Which of the following can he deduced from the graph?
A. At 0600 hour, there is no respiration.
B. The fastest rate of photosynthesis occurs at 0930 hour.
C. The lowest rate of respiration occurs at 1200 hour.
D. At 1800 hour, there is no photosynthesis.

97-16
Assuming that the plant has the same respiration rate throughout the 24-hour period, how much oxygen is produced by the plant in an hour at 1630 hour?
A. 12 mg
B. 44 mg
C. 56 mg
D. 68 mg

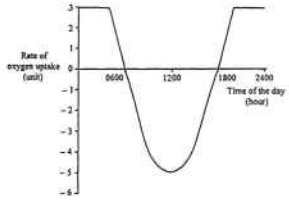
98.
Directions: Questions 12 mad 13 refer to the photograph below which shows part of a pitcher plant:



98-12
Pitcher plants carry out
(1) autotrophic nutrition.
(2) holozoic nutrition.
(3) parasitic nutrition.
A. (1) only
B. (3) only
C. (1) and (2) only
D. (2) and (3) only

98-13
The insect-digesting structure helps pitcher plants to grow
A. in dry soil.
B. on tree trunks.
C. in areas of low light intensity.
D. in soil with low nitrogen content.

00.
Directions: Questions 9 and 10 refer to the graph below, which shows the rate of oxygen uptake of a plant in 24 hours:



00-9
Which of the following correctly describes the plant at 1200 hour?
A. It carried out photosynthesis, but not respiration.
B. It carried out photosynthesis at the maximum rate.
C. The rate of photosynthesis was equal to the rate of respiration.
D. The rate of photosynthesis was lower than the rate of respiration.

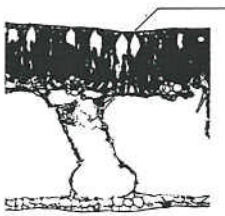
00-10
Based on the graph, we may conclude that at 1800 hour the rate of photosynthesis was 3 units. What assumption has to be made in order to arrive at this conclusion?
A. The plant did not carry out respiration at 1800

hour.

B. The rate of photosynthesis of the plant varied at different times of the day.
C. The rate of respiration of the plant was constant throughout the 24-hour period.
D. The rate of respiration of the plant was equal to the rate of photosynthesis at 1800 hour.

03.

Directions: Questions 27 and 28 refer to the following photomicrograph of a section of a leaf



03-27

Which of the following is the function of X?

A. for the absorption of water into the leaf
B. for the transmission of sunlight into the leaf
C. for the passage of carbon dioxide into the leaf
D. for the regulation of the pressure inside the leaf

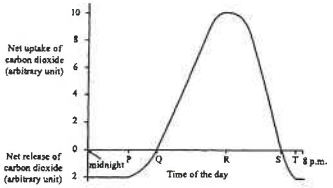
03-28

The section is probably taken from

A. a floating leaf.
B. a submerged leaf.
C. a leaf of a plant living in dry habitats.
D. a leaf of a plant growing on highlands.

04.

Directions :Questions 8 and 9 refer to the graph below, which shows the gaseous exchange of a green leaf from midnight to 8 p.m:



04-08

The leaf carried out photosynthesis during the period

A. P to S only.
B. P to T only.
C. Q to R only.
D. Q to S only.

04-09

What is the highest rate of photosynthesis of the leaf?

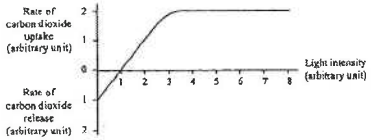
A. 6 arbitrary units
B. 8 arbitrary units
C. 10 arbitrary units
D. 12 arbitrary units

05-43

A student found that the leaves of a plant growing in the laboratory had turned yellow. Which of the following is the ***least*** probable explanation for this observation?

A. shortage of nitrate in the soil
B. shortage of magnesium in the soil
C. insufficient light supply to the plant
D. insufficient carbon dioxide supply to the plant

Directions: Questions 45 and 46 refer to the graph below, which shows the rates of carbon dioxide uptake and release of a plant under different light intensities:



05-45

When the light intensity is 6 units, what is the actual rate of photosynthesis of the plant in terms of the rate of carbon dioxide uptake?

A. 1 unit
B. 2 units
C. 3 units
D. 4 units

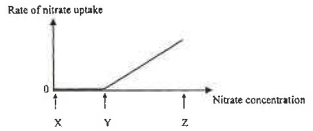
05-46

At 1 unit of light intensity, the rate of carbon dioxide uptake is zero. This is because at this light intensity,

A. the plant cannot undergo photosynthesis.
B. the closure of stomata stops gas exchange.
C. the rate of photosynthesis of the plant is equal to its rate of respiration.
D. the plant takes in oxygen instead of carbon dioxide from the atmosphere.

06-6

The graph below shows the rate of nitrate uptake by root hair cells. The root hair cells are immersed in solutions of different nitrate concentrations.



Which of the following can be deduced from the graph?

A. Between X and Y, the root hair cells take up nitrate by diffusion.
B. Between Y and Z, the root hair cells take up nitrate by diffusion.
C. Between Y and Z, the root hair cells take up nitrate by active transport.
D. Between X and Z, the root hair cells take up nitrate by active transport and diffusion.

Past HKCEE Questions
Nutrition and Gaseous Exchange in Plants
Suggested Answers

Paper I

1. (i) 1800 hour and 0600 hour 1

(ii) (1) rate of respiration = 12 mg of CO_2 released per hour (N.B. No unit, no mark) 1

(2) The total amount of CO_2 released = rate x time =12x11 1
= 132 mg (N.B. No unit, no mark for the answer) 1

(iii) The highest rate of photosynthesis = highest net uptake of CO_2 + net release of $C0_2$ in the dark
= 76 + 12 = 88 mg of C02 per hour 1
(N.B. no unit, no mark)

(iv) The total area of A could be taken as the net food production by the plant 1
The total area of B could be taken as the net food consumption by the plant 1
The total area of A is greater than that of B 1
indicating there is an overall gain in food production which is a characteristic feature of an actively growing plant 1

2. (i) dry soil : 50 g / 0.05 kg
plant : 74.65 kg 1

(ii) The soil is not the main source of food for plant growth, 1
because the drop in mass of the dry soil is very small in comparison 1
with the gain in mass of the plant. 1

(iii) To reduce the amount of substance in air added to the soil / the amount of soil lost to the air, 1
so that the loss in weight of the soil is mainly due to the plant. 1

(iv) (1)

3

(2) To make sure that the starch detected at the end of the experiment was made during the experiment. 1
By keeping the plant in darkness for two days. 1

Paper II

90-12	D
90-16	C
90-17	D
91-21	C
91-22	D
92-58	C
93-15	A
97-15	B
97-16	D
98-12	C
98-13	D
00-9	B
00-10	C
03-27	C
03-28	A
04-08	B
04-09	D
05-43	D
05-45	C
05-46	C
06-6	B