Topic 4: Respiration & Photosynthesis

Question: Cellular respiration takes place in
1. Animals only
2. Plants only
3. Both animals and plants

Question: Organisms that carry out cellular respiration in the mitochondria are
1. Animals only
2. Plants only
3. Bacteria only
4. Both animals and plants

aerobic

Photosynthesis:

Write both the word equation and the chemical equation for photosynthesis in the boxes below:
- Circle the reactants
- Put a box around the products

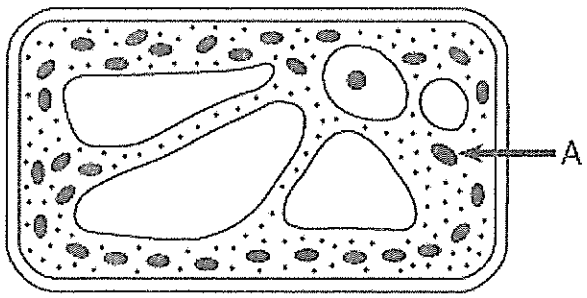
Word equation:

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

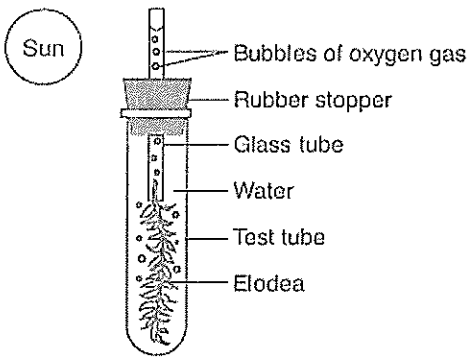
Chemical equation:

$H_2O + CO_2 \xrightarrow{\text{light}} C_6H_{12}O_6 + O_2$

Label the plant cell below:



State 2 reasons why photosynthesis is important.
- Produces glucose (organic compounds)
- Releases O_2 into the atmosphere

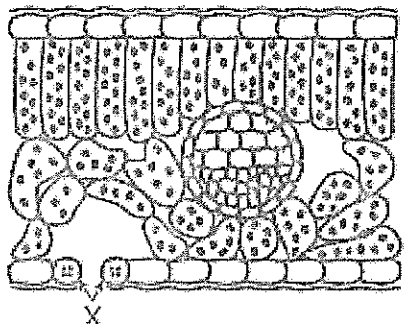


State what would happen to the amount of oxygen bubbles at night. Why does this occur?

The amount of O_2 bubbles would decrease (to zero)

Plants cannot do photosynthesis without light energy.

Water Regulation in Plant Cells:



What structures are represented by the letter "X"? Stomate

How do they help to regulate the amount of water lost by plants?

They close to prevent evaporation when water is not readily available (times of drought)

Respiration:

Write both the word equation and the chemical equation for respiration in the boxes below:

- Circle the reactants
- Put a box around the products

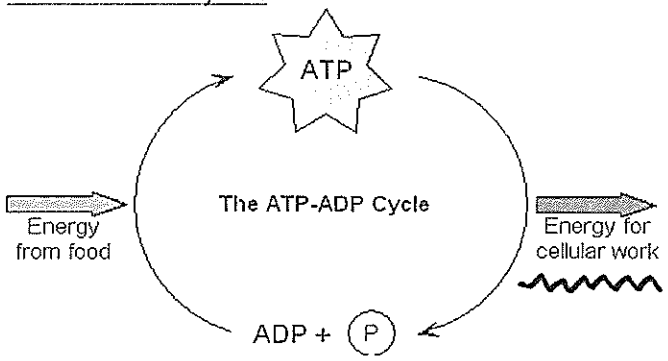
Word equation:

Glucose + Oxygen $\xrightarrow{\text{enzymes}}$ 36 ATP + Carbon dioxide + water

Chemical equation:

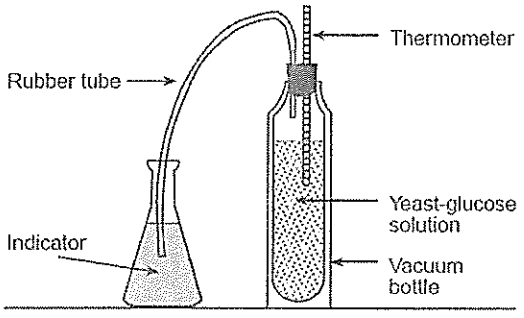
$C_6H_{12}O_6 + O_2 \xrightarrow{\text{enzymes}} 36\,ATP + CO_2 + H_2O$

ATP→ ADP Cycle:



What is the ATP used for in our bodies?

ATP is used for cellular work



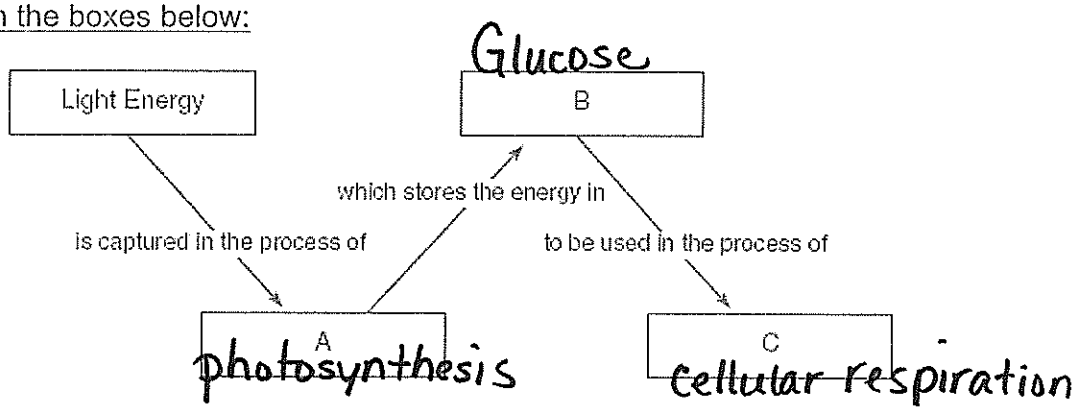
What process is being demonstrated in this setup?

fermentation (anaerobic resp.)

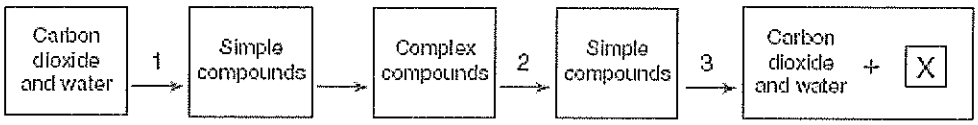
What substance is the indicator testing for?

CO_2 gas

Fill in the boxes below:



What do the numbered arrows represent?



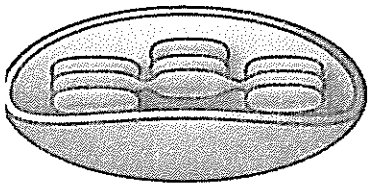
1. = photosynthesis
2. = hydrolysis (digestion)
3. = cellular respiration

Comparing and contrasting Photosynthesis and Respiration:

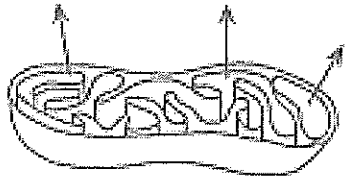
Photosynthesis | Respiration

How are they alike?

Both are "Energy Transfers"
Both exchange gases
Both are necessary



Chloroplast



Mitochondrion

How are they different?

Chloroplast	With regard to...	mitochondrion
plants only	← location →	plants and animals
day only	← type of organism →	day and night
CO_2 and H_2O	← time of day →	O_2 and Glucose
glucose and O_2	← raw materials →	ATP, CO_2, H_2O
	← products →	

Photo / Resp 41

Name: _____

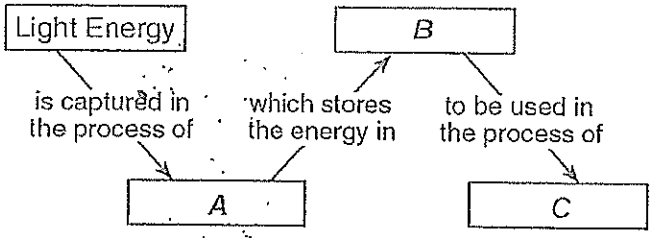
1) Mice store only a small amount of the energy they obtain from plants they eat. State what might happen to some of the remaining energy they obtain from the plants.

They use the energy for metabolic activities

2) Which process usually uses carbon dioxide molecules?

A) active transport
B) cellular respiration
C) asexual reproduction
D) autotrophic nutrition (photosynthesis)

3) Which numbered set of terms *best* identifies the letters in the diagram below?



A) *A* — respiration, *B* — inorganic molecules, *C* — photosynthesis
B) *A* — photosynthesis, *B* — inorganic molecules, *C* — decomposition
C) *A* — photosynthesis, *B* — organic molecules, *C* — respiration
D) *A* — respiration, *B* — organic molecules, *C* — digestion

4) In heterotrophs, energy for the life processes comes from the chemical energy stored in the bonds of

A) inorganic compounds
B) organic compounds (food - glucose)
C) oxygen molecules
D) water molecules

5) How do guard cells of a leaf help to maintain homeostasis in a plant?

Guard cells regulate the size of stomates to prevent excess evaporati

6) Leaves of green plants contain openings known as stomates, which are opened and closed by specialized cells allowing for gas exchange between the leaf and the outside environment. Which phrase *best* represents the net flow of gases involved in photosynthesis into and out of the leaf through these openings on a sunny day?

A) oxygen moves in; nitrogen moves out
B) water and ozone move in; carbon dioxide moves out
C) carbon dioxide and oxygen move in; ozone moves out
D) carbon dioxide moves in; oxygen moves out

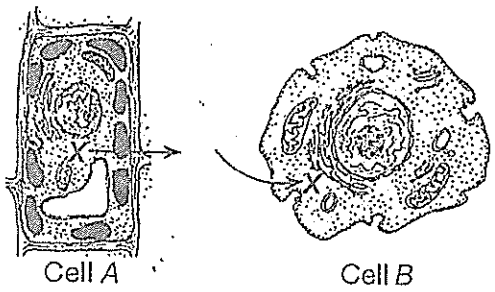
7) Cellular respiration in humans occurs in

A) the cells of the digestive system, only
B) red blood cells, only
C) the cells of the lungs, only
D) all the cells of the body

All cells must make ATP !!!

Questions 8 through 10 refer to the following:

In the two different cells shown below, only cell *A* produces substance *X*. Both cells *A* and *B* use substance *X*.



8) Identify the type of organelle in cell *A* that produces substance *X* in the diagram.

Chloroplast

9) Identify the type of organelle found in *both* cell *A* and cell *B* in the diagram that uses substance *X*.

mitochondrion

10) Identify substance *X* in the diagram shown.

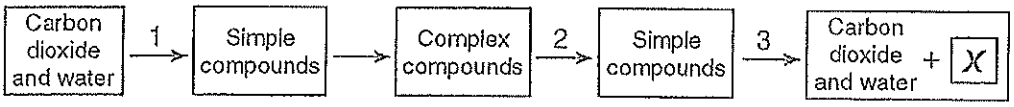
Glucose ($C_6H_{12}O_6$)

11) Which process is directly used by autotrophs to store energy in glucose?

A) active transport B) respiration (C) photosynthesis D) diffusion

Questions 12 through 15 refer to the following:

The arrows in the diagram below represent biological processes.



12) Identify process 3 in the given diagram.

Cellular respiration

13) Identify what letter *X* represents in the given diagram.

ATP !!!!

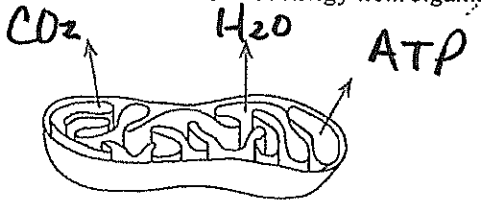
14) Explain why process 2 in the given diagram is essential in humans.

Complex molecules must be broken down so that they are small enough to enter cells.

15) Identify *one* type of organism that carries out process 1 in the diagram shown.

Plants

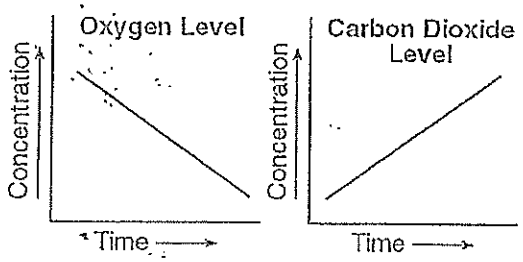
16) The diagram below represents a cell organelle involved in the transfer of energy from organic compounds.



The arrows in the diagram could represent the release of

A) glucose from a chloroplast carrying out respiration
(B) carbon dioxide from a mitochondrion carrying out respiration
C) ATP from a chloroplast carrying out photosynthesis
D) oxygen from a mitochondrion carrying out photosynthesis

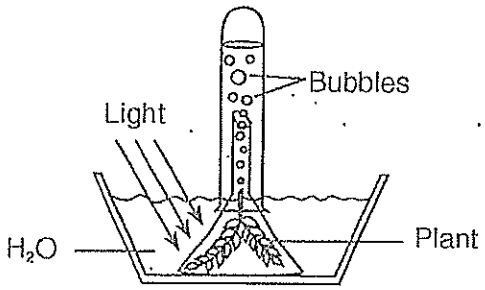
17) The graphs below show the changes in the relative concentrations of two gases in the air surrounding a group of mice.



Which process in the mice most likely accounts for the changes shown?

(A) respiration B) photosynthesis C) active transport D) evaporation

18) The green aquatic plant represented in the diagram below was exposed to light for several hours.



Which gas would most likely be found in the *greatest* amount in the bubbles?

A) carbon dioxide B) nitrogen (C) oxygen D) ozone

19) ATP is a compound that is synthesized when

(A) energy stored in chemical bonds is released during cellular respiration
B) digestive enzymes break amino acids into smaller parts
C) chemical bonds between carbon atoms are formed during photosynthesis
D) energy stored in nitrogen is released, forming amino acids

20) When organisms break the bonds of organic compounds, the organisms can

(A) obtain energy or reassemble the resulting materials to form different compounds
B) use the smaller molecules to plug the gaps in the cell membrane to slow diffusion
C) excrete smaller amounts of solid waste materials during vigorous exercise
D) use the energy obtained to digest molecules produced by respiration that uses oxygen

Questions 21 and 22 refer to the following:

Carbon exists in a simple organic molecule in a leaf and in an inorganic molecule in the air humans exhale.

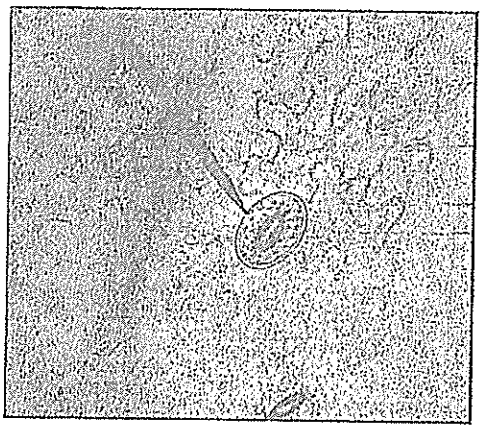
21) Based on the given statement, identify the carbon-containing molecule that humans exhale and the process that produces it.

CO_2 - it is produced by cellular respiration

22) Based on the given statement, identify the simple organic molecule formed in the leaf and the process that produces it.

Glucose ($C_6H_{12}O_6$) - it is produced by photosynthesis

23) The photograph below shows a microscopic view of the lower surface of a leaf.



What is the *main* function of the cells indicated by the black pointer?

A) give support to the veins in the leaf
B) undergo mitotic cell division
C) store food for winter dormancy
D) regulate the rate of gas exchange

24) An iodine test of a tomato plant leaf revealed that starch was present at 5:00 p.m. on a sunny afternoon in July. When a similar leaf from the same tomato plant was tested with iodine at 6:00 a.m. the next morning, the test indicated that less starch was present. This reduction in starch content most likely occurred because starch was

A) transported downward toward the roots through tubes
B) changed directly into proteins
C) transported out of the leaves through the guard cells
D) changed into simple sugars

25) The table below shows the rate of water loss in three different plants.

DATA TABLE

Plant	Water Lost (liters/day)
Cactus	0.02
Potato plant	1.00
Apple tree	19.00

One reason each plant loses a different amount of water is that each has

A) different types of insulin-secreting cells that regulate water levels
B) different guard cells adapted to maintain homeostasis
C) the same rate of photosynthesis but different numbers of chloroplasts
D) the same number of chloroplasts but different rates of photosynthesis

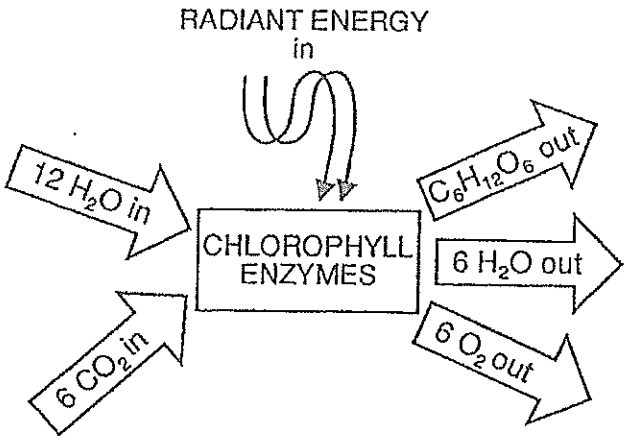
Name _____

45

26. In photosynthesis, chlorophyll functions in changing
    1) glucose molecules to starch
    2) water and carbon dioxide to sugar
    3) light energy to chemical bond energy
    4) hydrogen bonds to water

27. By which process are CO_2 and H_2O converted to carbohydrates?
    1) transpiration
    2) respiration
    3) fermentation
    4) photosynthesis

28. Which process is best illustrated by the diagram?

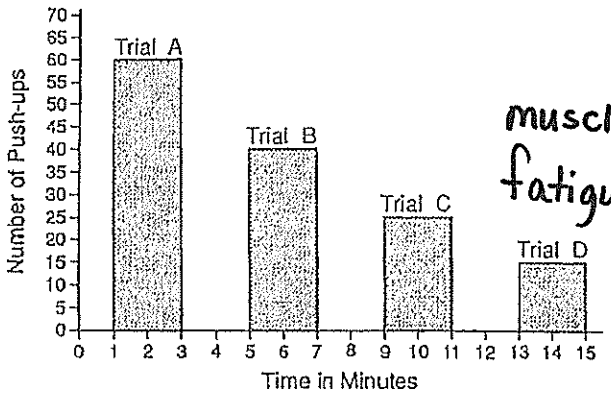


    1) respiration
    2) photosynthesis
    3) transpiration
    4) hydrolysis

29. The presence of lactic acid in the cells of an animal's muscle tissue is an indication that the
    1) animal is not adapted to the use of glucose
    2) number of mitochondria in the muscle cells has increased
    3) animal carries on a complex form of respiration during daylight hours
    4) muscle cells have been active during a period of oxygen deficiency

30. Organisms make energy readily available by transferring the chemical bond energy of organic molecules to
    1) mineral salts
    2) adenosine triphosphate
    3) light energy
    4) nitrogenous wastes

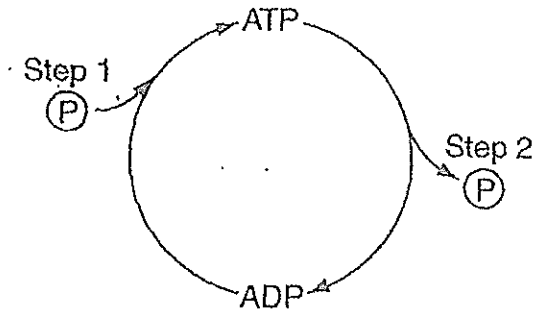
31. The graph below shows the number of push-ups a student completed in each of four 2-minute trials (*A*-*D*) during a 15-minute exercise period.



muscle fatigue

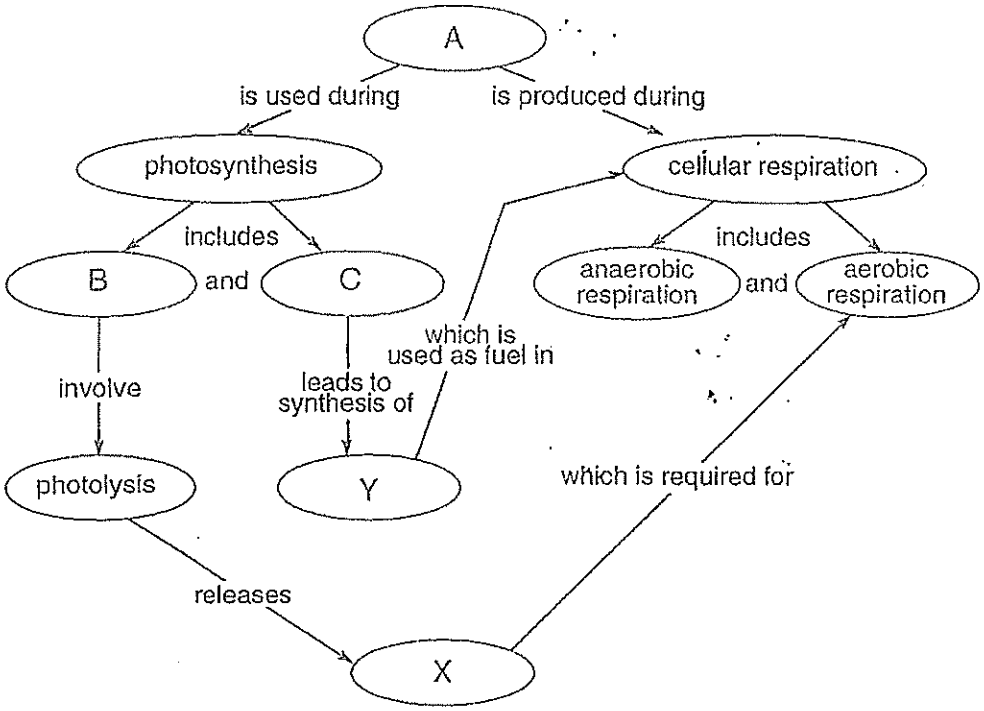
The concentration of lactic acid in the student's muscle tissue was most likely greatest during trial
    1) *A*
    2) *B*
    3) *C*
    4) *D*

32. The diagram below represents part of the process of cellular respiration.



Energy is released and made available for metabolic activities at
    1) step 1, only
    2) step 2, only
    3) both step 1 and step 2
    4) neither step 1 nor step 2

Base your answers to questions 33 and 34 on the diagram below, which is a concept map that shows the relationship between photosynthesis and respiration, and on your knowledge of biology.

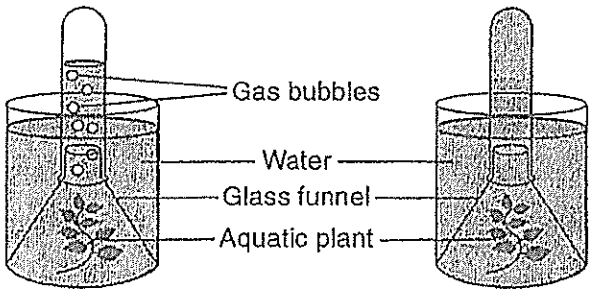


33. Which molecule belongs in area *X*?
    1) lactic acid 2) carbon dioxide 3) water (4) oxygen

34. Which molecule belongs in area *Y*?
    1) water 2) oxygen (3) glucose 4) hydrogen

---

35. The diagram below shows the setup of an experiment.

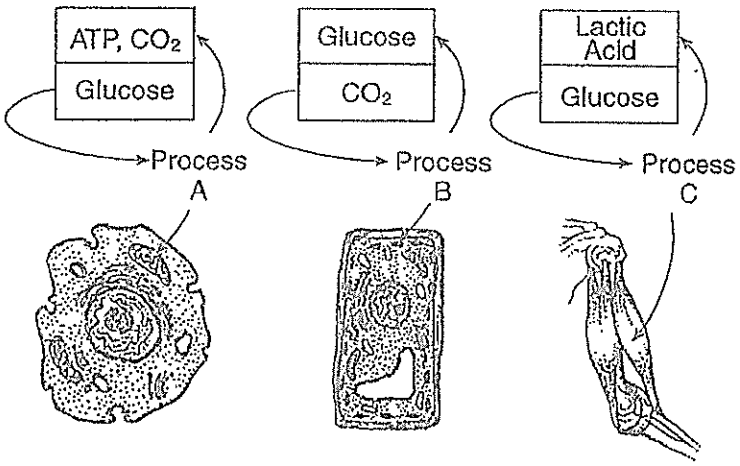


Setup in Light Setup in Dark

Using one or more complete sentences, state a problem that could be investigated using this experimental setup.

Does photosynthesis occur in the dark?

36. Base your answer to the following question on the diagrams below and on your knowledge of biology. The arrow below each lettered process indicates where the process takes place.



Process *A* is known as
1) photosynthesis 2) fermentation 3) dehydration synthesis (4) aerobic respiration

37. Base your answer to the following question on the investigation described below and on your knowledge of biology.

As part of an investigation, 10 bean seedlings in one setup were grown in the dark, while 10 seedlings in another setup were grown in sunlight. All other growth conditions were kept the same in both setups. The seedlings grown in the dark were white with long, slender stems. These seedlings soon died. The seedlings grown in the sunlight were green and healthy.

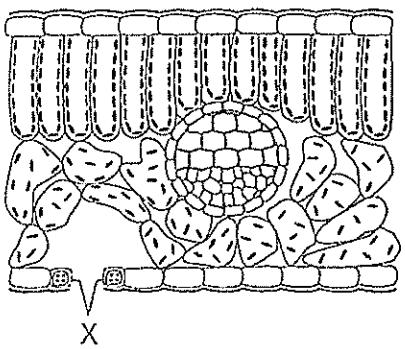
Identify the independent variable in this investigation.

Light

38. An unknown microorganism was observed with a compound light microscope. Identify the structure that, if observed in the organism, would indicate that it is an autotroph.

Chloroplast

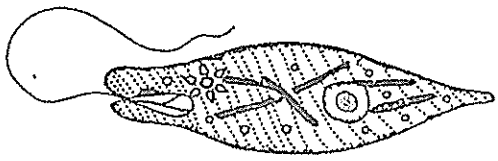
39. The diagram below represents a cross section of a leaf.



Explain how the structures labeled X function to maintain homeostasis in a plant.

Stomates regulate gas exchange and water loss in leaves

40. Base your answer to the following question on the information and the diagram below which represents a single-celled organism known as *Euglena*.



This organism is able to carry out both photosynthesis and cellular respiration. Choose *one* of these processes and write the name of the process you chose below.

Photosynthesis

Using words or chemical symbols, summarize the reaction involved in the process you chose.

$CO_2 + H_2O \xrightarrow{light} C_6H_{12}O_6 + O_2$