

Photosynthesis

Word equation for photosynthesis

Photosynthesis

Chemical symbols for the four substances in photosynthesis

Photosynthesis

Why is photosynthesis an endothermic reaction?

Photosynthesis

Where does photosynthesis happen in a plant cell?

Photosynthesis

Name four factors that affect the rate of photosynthesis

Photosynthesis

How does light intensity affect the rate of photosynthesis?

Photosynthesis

How does carbon dioxide concentration affect the rate?

Photosynthesis

How does temperature affect the rate of photosynthesis?

Carbon dioxide CO_2 , water H_2O , glucose $\text{C}_6\text{H}_{12}\text{O}_6$, oxygen O_2 .

carbon dioxide + water $\rightarrow$ glucose + oxygen
(in the presence of light)

In the chloroplasts, which contain chlorophyll.

Energy is transferred from the environment to the chloroplasts by light.

The rate increases as light intensity increases, until another factor becomes limiting and the rate levels off.

Temperature, light intensity, carbon dioxide concentration and the amount of chlorophyll.

Rate rises up to an optimum, then falls because the enzymes are denatured.

The rate increases as concentration increases, until another factor becomes limiting. Carbon dioxide is a reactant.

Photosynthesis

How does the amount of chlorophyll affect the rate?

Photosynthesis

What is a limiting factor?

Photosynthesis

Equation for the rate of photosynthesis from oxygen production

Photosynthesis

On a graph of rate against a factor, what does the flat part show?

Photosynthesis

Required practical: independent and dependent variables with pondweed

Photosynthesis

Required practical: how do you control the temperature of the pondweed?

Photosynthesis

Required practical: how do you control carbon dioxide concentration?

Photosynthesis

Required practical: what gas do the bubbles contain?

The factor in shortest supply, which stops the rate from increasing even if other factors are increased.

Less chlorophyll means less light is absorbed, so the rate is lower.

The factor on the x-axis is no longer limiting. Another factor is limiting the rate.

rate = volume of oxygen produced $\div$ time

Use a water bath, or place a heat shield (a beaker of water) between the lamp and the pondweed. A cool LED lamp also helps.

Independent: distance of lamp (light intensity). Dependent: bubbles, or volume of oxygen, per unit time.

Oxygen, the product of photosynthesis.

Dissolve sodium hydrogencarbonate in the water.

Photosynthesis **Higher tier**

Why is the limiting factor idea important in a greenhouse?

Photosynthesis **Higher tier**

Can any one factor limit photosynthesis?

Photosynthesis **Higher tier**

State the inverse square law for light intensity

Photosynthesis **Higher tier**

Light is 100 units at 10 cm. What is the intensity at 30 cm?

Photosynthesis **Higher tier**

How do you explain a graph with two or three factors?

Photosynthesis

Five uses of glucose made in photosynthesis

Photosynthesis

Why do plants need nitrate ions?

Photosynthesis

Why is glucose stored as starch?

Yes. The factors interact and any one of them may be the factor that limits photosynthesis.

Growers can add heat, light or carbon dioxide to gain the maximum rate of photosynthesis, but must still maintain a profit.

Distance $\times 3$, so intensity $\div 3^2 = 100 \div 9 = 11.1$ units (to 1 decimal place).

Light intensity is inversely proportional to the square of the distance ($\propto 1 \div \text{distance}^2$). Double the distance and intensity falls to one quarter.

Respiration, starch (storage), fat or oil (storage), cellulose (cell walls) and amino acids (protein synthesis).

Find which factor is limiting in each part: the x-axis factor where the line rises, another factor where it is flat.

Starch is insoluble, so it is suitable for storage.

To produce proteins: nitrate ions from the soil are used with glucose to make amino acids.

Photosynthesis

What does cellulose do for plant cells?

Respiration

Describe cellular respiration

Respiration

What does exothermic mean?

Respiration

What do organisms need energy from respiration for?

Respiration

Word equation for aerobic respiration

Respiration

Symbol equation for aerobic respiration

Respiration

Equation for anaerobic respiration in muscles

Respiration

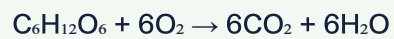
Equation for anaerobic respiration in plant and yeast cells

An exothermic reaction which is continuously occurring in living cells.

It strengthens the cell wall.

Chemical reactions to build larger molecules, movement, and keeping warm.

Energy is transferred to the surroundings / environment.



glucose + oxygen → carbon dioxide + water

glucose → ethanol + carbon dioxide

glucose → lactic acid

Respiration

Why does anaerobic respiration transfer much less energy?

Respiration

What is aerobic respiration?

Respiration

What is anaerobic respiration?

Respiration

What is fermentation?

Respiration

Why is fermentation economically important?

Respiration

Compare aerobic and anaerobic respiration in muscles

Respiration

What three things increase during exercise?

Respiration

What happens in muscles if insufficient oxygen is supplied?

Respiration that uses oxygen.

The oxidation of glucose is incomplete.

Anaerobic respiration in yeast cells.

Respiration without oxygen.

Aerobic: oxygen needed, makes CO_2 and water, transfers much more energy.
Anaerobic: no oxygen, makes lactic acid, transfers much less energy.

It is used in the manufacture of bread and alcoholic drinks.

Anaerobic respiration takes place, causing a build-up of lactic acid.

Heart rate, breathing rate and breath volume, to supply the muscles with more oxygenated blood.

Respiration

What is muscle fatigue?

Respiration

What causes an oxygen debt to be created?

Respiration **Higher tier**

What happens to lactic acid after exercise?

Respiration **Higher tier**

Define oxygen debt

Respiration

How could you investigate the effect of exercise on the body?

Respiration

Define metabolism

Respiration

What is the energy from respiration used for in metabolism?

Respiration

Which carbohydrates can be made from glucose?

The incomplete oxidation of glucose in anaerobic respiration, which builds up lactic acid.

After long periods of vigorous activity, muscles stop contracting efficiently.

The extra oxygen the body needs after exercise to react with the accumulated lactic acid and remove it from the cells.

Blood transports it from the muscles to the liver, where it is converted back into glucose.

The sum of all the reactions in a cell or the body.

Measure pulse or breathing rate at rest, after exercise, and during recovery, controlling the type and time of exercise.

Starch, glycogen and cellulose.

The continual enzyme controlled processes of metabolism that synthesise new molecules.

Respiration

What is a lipid made from?

Respiration

How are proteins made in metabolism?

Respiration

What is formed when excess proteins are broken down?

Respiration

Which small molecules are used to build, and released when breaking down, carbohydrates, proteins and lipids?

Glucose and nitrate ions form amino acids, which are used to synthesise proteins.

One molecule of glycerol and three molecules of fatty acids.

Sugars (carbohydrates), amino acids (proteins), and fatty acids and glycerol (lipids).

Urea, for excretion.