



# Separate Biology Higher Paper 1

Name: \_\_\_\_\_

**Topic 1:** Cell Biology

**Topic 2:** Organisation

**Topic 3:** Infection and Response

**Topic 4:** Bioenergetics

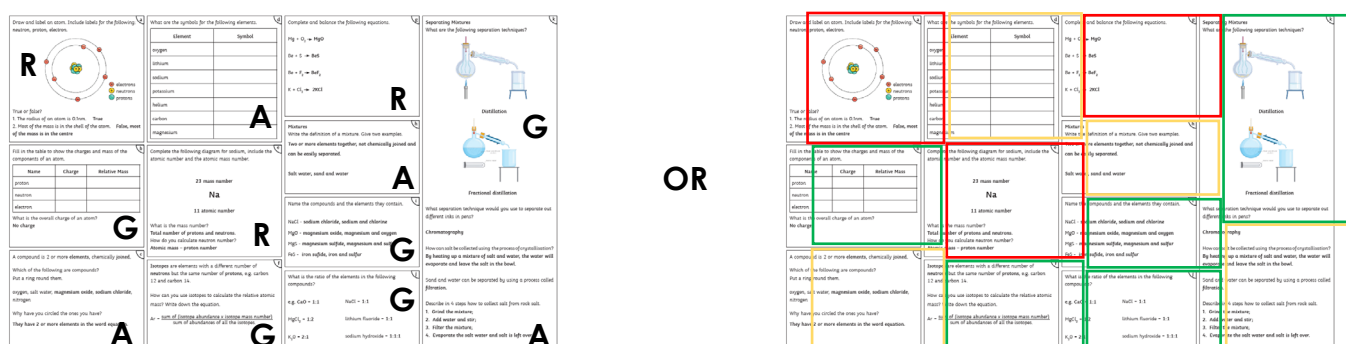
# Exam Date: Tuesday 13<sup>th</sup> May 2025

## Instructions

This booklet has been separated according to the topic that will be covered in the exam.

- Go through the revision mat for the topic and rate each box according to your understanding of that content. Use a typical RAG rating or 3 different colours of highlighter.

**For example:**



R = Red 😞 Low understanding

A = Amber 😐 Some Understanding

G = Green 😊 Good Understanding

- Cut along the dotted lines of the question card template provided. Then produce a set of revision questions and answers for that topic – you should focus on those you have rated as red or amber on the revision mat. **For example:**

**Front**

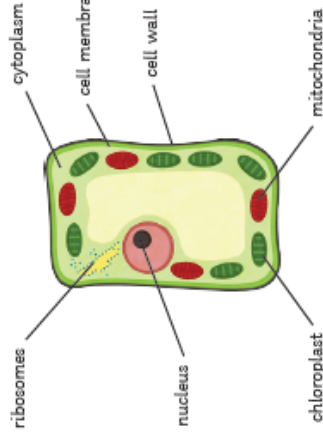
What is the mass number of an atom?

**Back**

The total number of protons and neutrons found in the nucleus

- Fold along the line indicated on the following page and glue where indicated to create a storage pocket for your question cards.
- Regularly test yourself using your question cards or ask someone to test you and return them to your storage pocket for safekeeping after each use.

**Draw and label a typical plant cell.**



**Which organelle is:**

- the site of anaerobic respiration?

Cytoplasm

- the site of protein synthesis?

Ribosomes

- the site of photosynthesis?

Chloroplasts

**How many chromosomes does:**

- a human skin cell contain?

46 / 23 pairs (diploid)

- a human gamete contain?

23 single (haploid)

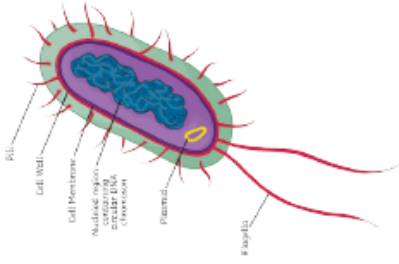


**Sperm cells are specialised cells. Explain how the acrosome helps the sperm cell to carry out its function.**



The acrosome contains enzymes to digest through the egg cell membrane.

**Draw and label the parts of a typical bacterial cell.**



**Why do cells undergo mitosis?**

To produce new cells for growth and repair.

**What happens to the cell during:**

- interphase?

The cell grows, increases the amount of organelles and replicates its DNA.

- mitosis?

1. Chromosomes line up at the centre of the cell and the copies are pulled apart by spindle fibres to opposite ends of the cell.

2. Nuclear membranes form around the chromosomes to make 2 nuclei.

3. Finally, the cell splits into two identical 'daughter' cells.

**What are 'embryonic' stem cells?**

Undifferentiated cells found in the early embryo.

**Name 2 medical conditions that could be treated with embryonic stem cells in the future.**

1. Diabetes
2. Spinal injuries/paralysis

# Topic 1: Cell Biology

**Describe how to prepare an uncontaminated culture of bacteria using the aseptic technique.**

1. Sterilise the Petri dish, inoculating loop, culture medium and working area to kill any unwanted microorganisms.
2. Lift the lid slightly to inoculate the plate and replace quickly to prevent microorganisms from the air getting in.
3. Secure the Petri dish lid with a small piece of tape.

**Diffusion is:**

The movement of water particles from a high water concentration to a lower water concentration across a partially permeable membrane.

The spreading out of the particles of any gas, or liquid from an area of high concentration to an area of lower concentration.

The movement of particles from a low concentration to a higher concentration.

**Name 3 substances that are transported into or out of animal cells by diffusion:**

1. Oxygen
2. Carbon dioxide
3. Amino acids

Light microscopes have objective lenses.

**What is the purpose of the objective lens?**

To form and magnify an image of the specimen.

**Name the tubes that transport water up the stem of a plant.**

Xylem

**List 5 important keywords from this unit.**

1. Eukaryotic/Prokaryotic
2. Differentiation
3. Mitosis
4. Aseptic technique
5. Osmosis

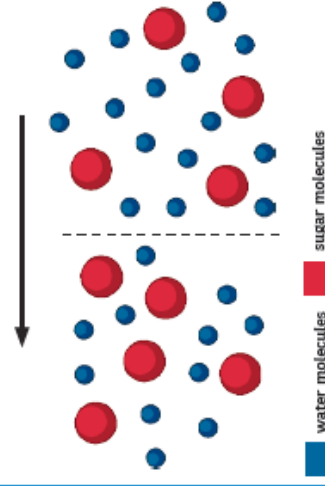
**Describe an advantage of using therapeutic cloning to treat disease.**

The stem cells would have the same DNA as the patient, so would not be rejected by the body.

**What is osmosis?**

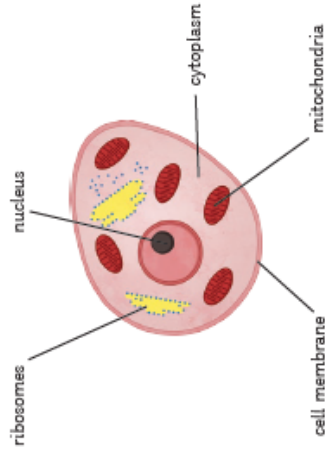
The movement of water molecules from an area of high water concentration to an area of lower water concentration, across a partially permeable membrane.

**On the diagram below, draw an arrow to show the direction of the net movement of water molecules.**



**My main areas for improvement in this unit are:**

Draw and label a typical animal cell.



Which organelle is:

- the site of aerobic respiration?

Mitochondria

- controls the movement of substances in and out of the cell?

Cell membrane

- contains the genetic information?

Nucleus

An elephant sperm cell contains 28 chromosomes. How many chromosomes would be in an elephant:

- liver cell?

56

- ovum?

28

Root hair cells are specialised cells. Describe how the root hair cell is adapted to carry out its function.



Has a large surface area for the rapid absorption of water and mineral ions from the soil.

A bacterium can divide once every 20 minutes. A piece of chicken was contaminated with 5 bacteria; how many bacteria will there be on the chicken after 3 hours?

Time	Number
0	5
20	10
40	20
60	40.....etc
180	2560

Describe how active transport is used by:

- plants

To obtain mineral ions from the soil

- animals

To absorb nutrients (e.g. glucose), when they are at low concentrations, from the small intestine.

Describe 3 ways that exchange surfaces are adapted to their function.

1. Large surface area
2. Thin walls
3. Moist/good blood supply (animals)

Describe 2 ways in which active transport is different to diffusion.

1. Moves against a concentration gradient (low to high)
2. Requires energy

Where in the body are adult stem cells found and how do they differ from embryonic stem cells?  
Found in the bone marrow. Can only turn into certain cell types, such as blood cells.

The unit 'centimetres' is written as 'cm'. What do each of the following units represent?

mm: millimetres

$\mu\text{m}$ : micrometres

nm: nanometres

pm: picometres

Plants can be cloned from meristem cells. Give two advantages of cloning plants.

Farmers can produce clones of a desired plant quickly and cheaply. Save rare species from extinction.

List 5 important keywords from this topic.

1. Diffusion
2. Active transport
3. Meristem
4. Magnification
5. Resolution

Electron microscopes have better resolution than light microscopes. What does 'resolution' mean?

The ability to distinguish between 2 points, so higher resolution produces a clearer image.

State 2 factors that affect the rate of diffusion.

1. Temperature
2. Concentration gradient

Write each of the following numbers in standard form.

2500;  $2.5 \times 10^3$

0.003;  $3 \times 10^{-3}$

4 200 000;  $4.2 \times 10^6$

0.00000006;  $6 \times 10^{-8}$

Which has a bigger 'surface area to volume' ratio, an elephant or a mouse?

Mouse

What is the equation for calculating the magnification of an image?

Magnification =  $\frac{\text{image size}}{\text{real size}}$

Why do some people object to embryonic stem cell research?

They believe that all embryos have the potential to become a human being, so should not be used for experimentation.

How do prokaryotic cells differ from eukaryotic cells?

Bacterial cells are much smaller, they don't have a nucleus, they don't have mitochondria or chloroplasts.

My main areas for improvement in this unit are:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# Topic 2: Organisation

(2)

**e**

Place the following structures in order from smallest to largest:

cell, organ, nucleus, tissue, organism

nucleus, cell, tissue, organ, organism

**i**

Bile is made in the liver and stored in the gall bladder. Explain how bile helps digestion.

Bile neutralises stomach acid to raise the pH so protease enzymes can work.

It also emulsifies fats to give them a larger surface area for lipase to work, which speeds up digestion.

**j**

Transpiration is:

The movement of water molecules from a high water concentration to a lower water concentration across a partially permeable membrane.

The evaporation and diffusion of water from the leaves of a plant.

The movement of glucose molecules around the plant.

☐ ☒ ☐

**k**

Name 3 factors that affect the rate of transpiration.

Any 3 from;

Temperature, Light intensity, Air flow or Humidity.

**p**

Where in the plant is meristem tissue located?

Growing tips of roots and shoots.

**q**

The xylem tissue is composed of hollow tubes strengthened by lignin. What is the function of xylem tissue?

To transport water and dissolved minerals from the roots to the stem and the leaves. This is called the transpiration stream.

**r**

Describe how to test for starch.

Place the test sample into a test tube.

Add a few drops of iodine solution and mix.

The colour will change from orange to blue/black if starch is present.

**s**

My main areas for improvement in this unit are:


\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**f**

Use the graph below to describe how temperature affects enzyme function.



Initially, as temperature increases, the rate of enzyme activity also increases, up to 40°C, which is the optimum temperature. After 40°C, as the temperature increases the rate of enzyme activity decreases.

**g**

Enzymes are described as being 'specific' to a substrate. What does this mean? Use a labelled diagram to help your explanation.

A diagram showing active site of enzyme has a complementary shape to the substrate molecule. The active site of the enzyme has a unique shape, only a substrate with a complementary shape can fit and bind to form an enzyme-substrate complex.

**h**

Describe how to test for protein

1. Place the test sample into a test tube (about 2ml)
2. Add an equal amount of Biuret reagent and mix.
3. The colour will change from blue to purple if protein is present.

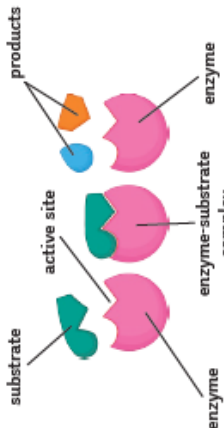
**a**

Complete the table below.

Enzyme	Site of Production	Substrate	Products
amylase	salivary glands/pancreas	starch	maltose/glucose
pepsin	stomach	protein	amino acids
lipase	pancreas	fats	fatty acids & glycerol

**b**

The diagram below shows the 'lock & key' model of enzyme function. Label the diagram using the following words:



substrate

active site

enzyme

enzyme-substrate complex

products

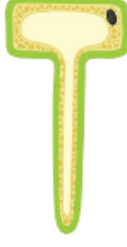
**c**

Describe how to carry out the test for reducing sugars.

1. Place the test sample into a test tube (about 2ml).
2. Add an equal amount of Benedict's reagent.
3. Heat in a water bath for 5 minutes.
4. The colour will change from blue to either green/yellow/red depending on the amount of reducing sugar present.

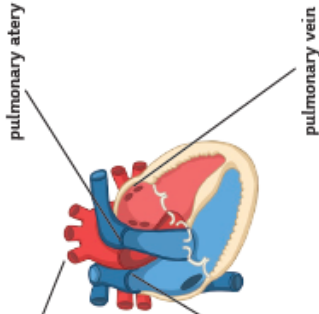

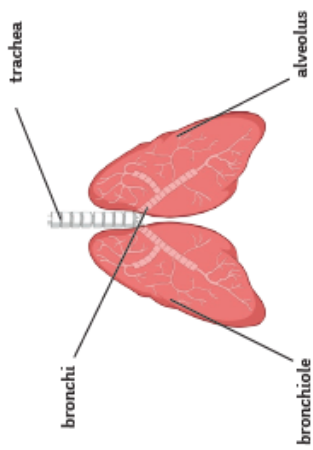
**d**

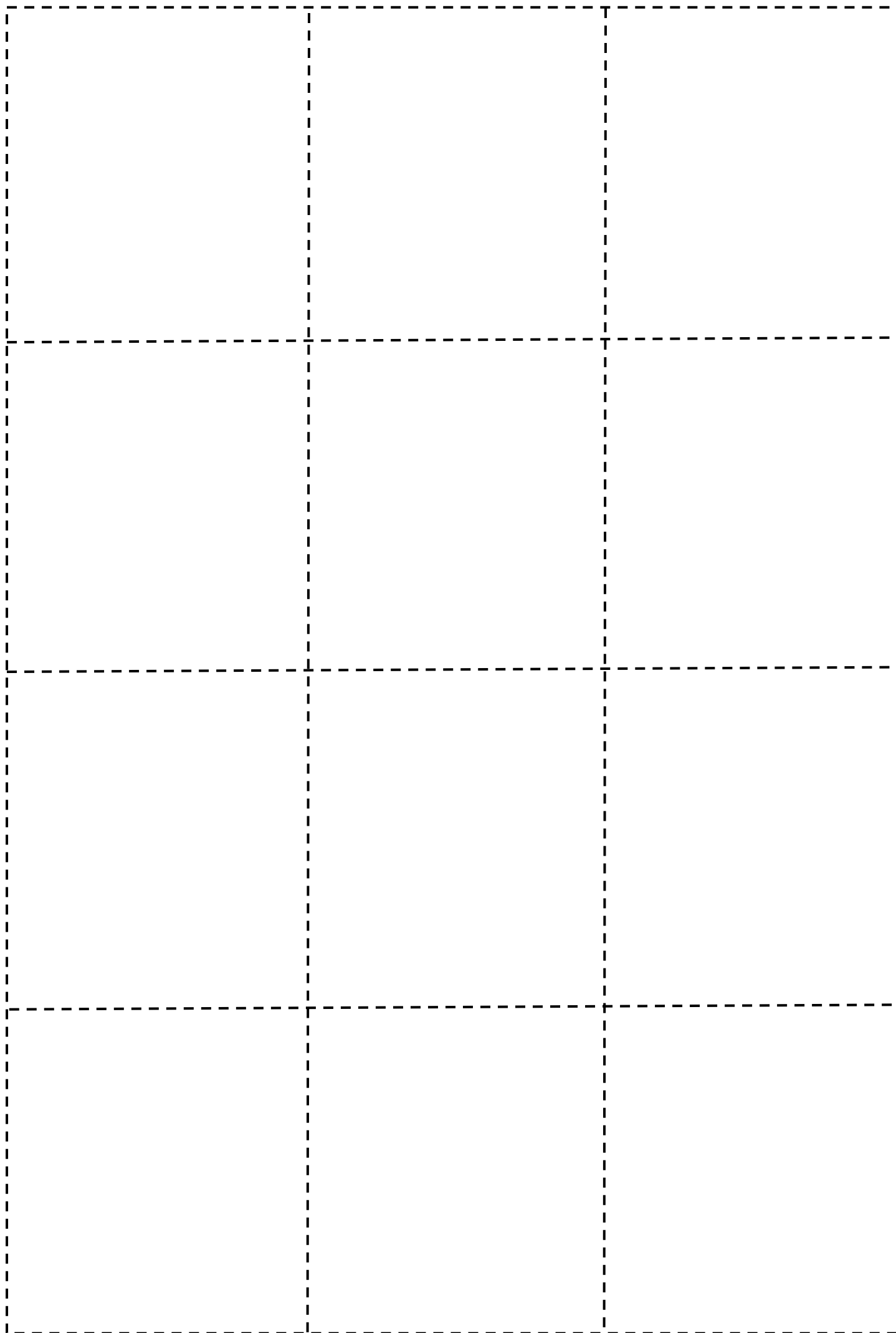
Describe how this root hair cell is adapted for the efficient uptake of water and mineral ions.



They have a large surface area for the rapid absorption of water and mineral ions from the soil.



<p><b>a</b></p> <p>Label the following blood vessels on the diagram of the heart:</p>  <p>aorta</p> <p>pulmonary artery</p> <p>vena cava</p> <p>pulmonary vein</p>	<p><b>d</b></p> <p>Describe how the structure of an artery is related to its function.</p>  <p>Thick layers of muscle for strength and elastic fibres so that they can spring back to help withstand high blood pressure.</p>	<p><b>h</b></p> <p>Why does the left ventricle have a thicker, more muscular wall than the right ventricle?</p> <p>The left ventricle has to pump blood at high pressure so that it can reach all body cells. Whereas, the right ventricle only has to pump blood to the lungs.</p>
<p><b>b</b></p> <p>Label the following parts on the diagram below:</p>  <p>trachea</p> <p>bronchi</p> <p>bronchiole</p> <p>alveolus</p>	<p><b>e</b></p> <p>In coronary heart disease, layers of fatty material build up inside the coronary arteries. Explain how this can lead to a 'heart attack'.</p> <p>The layers of fatty material block the coronary arteries and restrict blood flow to heart muscle cells. This results in a lack of oxygen and the heart muscle cells stop respiring which can lead to a heart attack.</p>	<p><b>o</b></p> <p>A problem with heart transplants is rejection of the donor heart. What is 'rejection'?</p> <p>When the body's immune system (white blood cells) attacks and destroys the donor heart muscle cells.</p>
<p><b>c</b></p> <p>Describe how smoking tobacco affects:</p> <p>Adults</p> <p>Can cause lung disease, including cancer, and cardiovascular disease.</p> <p>Unborn babies</p> <p>Can result in low birth weight and premature birth.</p>	<p><b>f</b></p> <p>Stents can be used to treat coronary heart disease. Give one advantage and one disadvantage of using stents.</p> <p>Advantage</p> <p>Patients recover quickly and they are effective for a long time.</p> <p>Disadvantage</p> <p>There is a risk of the patient developing a blood clot near the stent, which can lead to a heart attack.</p>	<p><b>p</b></p> <p>Name the group of cells that controls the resting heart rate.</p> <p>Pacemaker</p>
<p><b>i</b></p> <p>Name the four main components of the blood and describe their function.</p> <ol style="list-style-type: none"> <li>1. Red blood cells – transport oxygen.</li> <li>2. White blood cells – defend against pathogens.</li> <li>3. Platelets – help to clot the blood.</li> <li>4. Plasma – liquid part of the blood, carries many substances e.g. glucose, hormones.</li> </ol>	<p><b>i</b></p> <p>What is a 'carcinogen'? Give an example.</p> <p>Substance/chemical that causes cancer e.g. the chemicals in cigarette smoke.</p>	<p><b>n</b></p> <p>Describe 3 ways that the lungs are adapted for gaseous exchange.</p> <p>Any 3 from: Large surface area, Moist lining, Thin walls or good blood supply.</p>
<p><b>k</b></p> <p>List 5 important keywords from this unit.</p> <ol style="list-style-type: none"> <li>1. _____</li> <li>2. _____</li> <li>3. _____</li> <li>4. _____</li> <li>5. _____</li> </ol>	<p><b>j</b></p> <p>What is a 'microorganism'? Give an example.</p> <p>Substance/chemical that causes cancer e.g. the chemicals in cigarette smoke.</p>	<p><b>q</b></p> <p>What are 'statins'?</p> <p>Drugs that reduce the amount of LDL cholesterol in the blood and so reduce the build up of fatty deposits in the coronary arteries.</p>
<p><b>l</b></p> <p>Explain how an infection with a microorganism could lead to the development of other, non-communicable diseases.</p> <p>Infection with some viruses can lead to the development of cancer (e.g. HPV infection and cervical cancer). Also, infection with pathogens can sometimes trigger allergic reactions and worsen asthma.</p>	<p><b>g</b></p> <p>Describe 3 lifestyle factors that can impact a person's physical and mental wellbeing.</p> <p>Any 3 from: Diet, exercise, stress, smoking, drinking alcohol.</p>	<p><b>r</b></p> <p>What is the difference between a benign and a malignant tumour?</p> <p>A benign tumour remains in one place and doesn't invade other tissues in the body – not usually dangerous. A malignant tumour spreads to other parts of the body when cells break off and travel in the bloodstream to form secondary tumours.</p>
<p><b>m</b></p> <p>Describe how a faulty heart valve will affect a person's health.</p> <p>Breathlessness, fatigue, tiredness.</p>	<p><b>s</b></p> <p>My main areas for improvement in this unit are:</p> <p>_____</p> <p>_____</p>	<p><b>s</b></p> <p>My main areas for improvement in this unit are:</p> <p>_____</p> <p>_____</p>

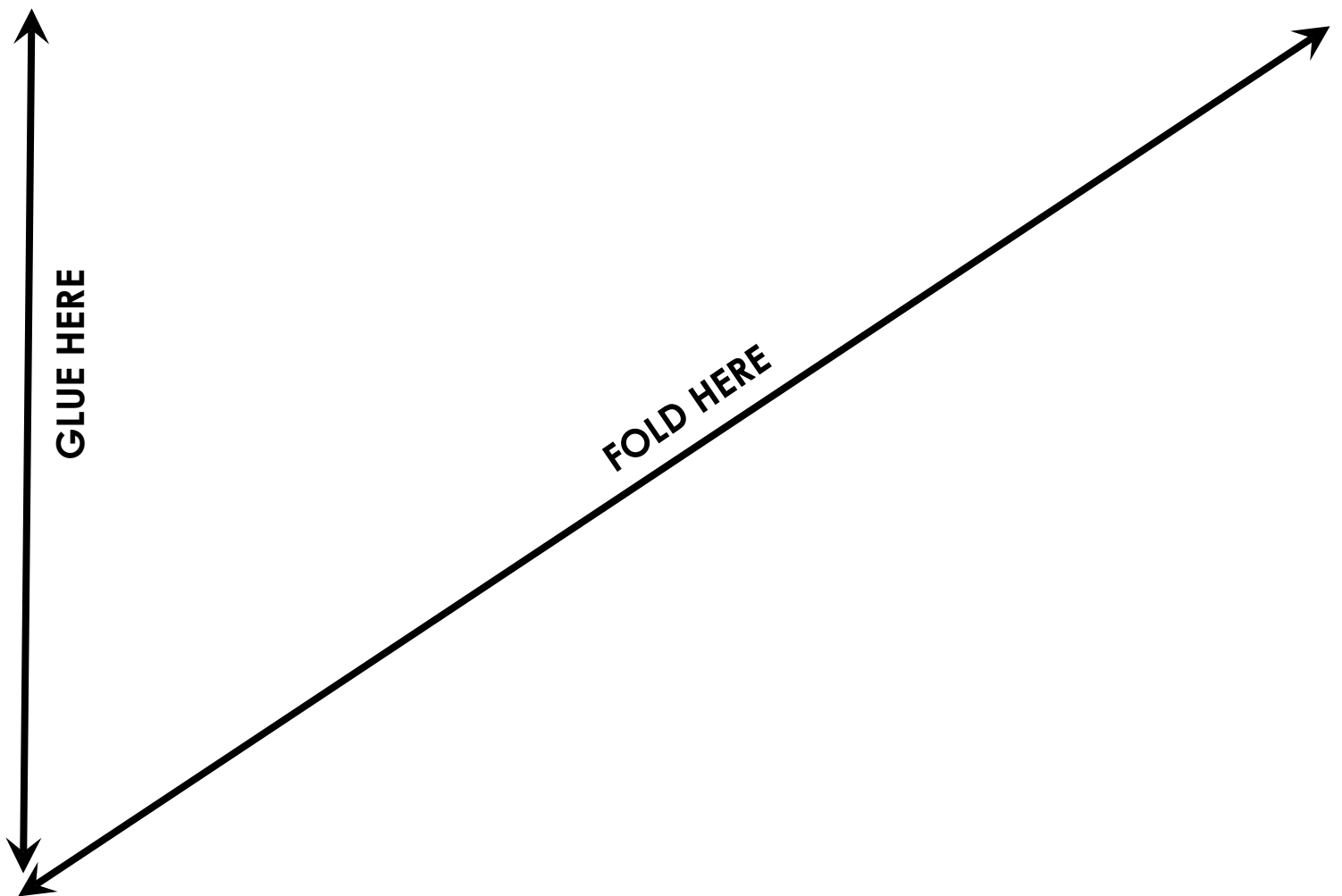






# Topic 2: Organisation

## Question Card Storage





# Topic 3: Infection and Response

(1)

**a**


Write a definition for each type of disease and give two examples.

Communicable disease: Caused by pathogens and can be passed from one person to another. Possible examples: measles, salmonella, gonorrhoea, HIV, tobacco mosaic virus, rose black spot, malaria.


Non-communicable disease: Can not be passed on from one person to another. Possible examples: heart disease, diabetes, cancer.

**b**


Label the pathogens below that cause infectious diseases.




bacteria



virus



protist



fungi

**c**

Name three ways that pathogens are spread and give at least one example.

- By air: cold, flu, tuberculosis.
- By direct contact: malaria, STDs, HIV.
- By water: cholera, salmonellosis.

**d**

How do pathogens cause disease? Fill in the gaps.

Bacteria reproduce rapidly by binary fission. They may produce toxins that damage tissues and make us feel ill.

Viruses take over the cells of your body. They live and rapidly reproduce inside. This causes cell damage.

**e**

Simple hygiene measures are one of the most effective ways of preventing the spread of pathogens.

List five ways we can be more hygienic below:

- Washing hands after going to the toilet, before cooking or eating and after contact with animals or sick people.
- Using disinfectants on surfaces.
- Keeping raw meat away from food that is eaten uncooked.
- Coughing or sneezing into a tissue.
- Keeping agricultural machinery, and people using it, clean to prevent the spread of plant diseases.

**f**

List three other methods for preventing the spread of pathogens.

- Keep infected individuals in isolation.
- Destroy the vectors that carry pathogens.
- vaccination

**g**

**Salmonella**

What type of pathogen is it caused by?  
bacteria

What are the symptoms?  
Fever, abdominal cramps, vomiting and diarrhoea.

How is it spread?  
Eating undercooked food or food contaminated from contact with raw meat, e.g. raw chicken.

What can we do about it?  
Poultry are vaccinated to control the spread.

**g**

**Measles**

What type of pathogen is it caused by?  
virus

What are the symptoms?  
A fever and red rash on the skin. Can be fatal if there are complications.

How is it spread?  
By air - the inhalation of droplets from coughs and sneezes.

What can we do about it?  
There is no treatment, so young children are vaccinated against it.

**h**

**Tobacco Mosaic Virus**

What type of pathogen is it caused by?  
virus

What are the symptoms?  
Mosaic discolouration of the leaves which reduces photosynthesis and affects the growth of the plant.

How is it spread?  
Direct contact between diseased plant material and healthy plants. Insects can also act as vectors.

What can we do about it?  
TMV resistant strains. Good hygiene and pest control.

**i**

**Gonorrhoea**

What type of pathogen is it caused by?  
bacteria

What are the symptoms?  
Thick yellow or green discharge from the vagina or penis and pain on urinating.

How is it spread?  
sexual contact

What type of pathogen is it caused by?  
Treat with antibiotics. Use a barrier method of contraception.

**j**

**HIV**

What type of pathogen is it caused by?  
virus

What are the symptoms?  
Initially causes a flu-like illness. Damages the immune system so that it can't deal with other infections or cancers.

How is it spread?  
Sexual contact or exchange of bodily fluids, such as blood.

What can we do about it?  
Antiretroviral drugs help to stop the virus attacking the immune system. There is no cure or vaccine.

**k**

**Malaria**

What type of pathogen is it caused by?  
protist

What are the symptoms?  
Recurrent fever - can be fatal.

How is it spread?  
Mosquitoes act as a vector, passing the protist to the human bloodstream when they feed on the blood.

What can we do about it?  
Preventing the vectors (mosquitoes) from breeding. Using mosquito nets and repellents to avoid being bitten. Taking antimalarial drugs.

**l**

**Rose Black Spot**

What type of pathogen is it caused by?  
fungus

What are the symptoms?  
Purple or black spots develop on the leaves. Leaves turn yellow and fall off prematurely which reduces photosynthesis, affecting the growth of the plant.

How is it spread?  
Spores are carried by water or wind.

What can we do about it?  
Use fungicides to treat the plant. Remove and destroy affected leaves.

**a**  
Explain how your skin prevents microorganisms getting into your body.

It acts as a barrier to prevent pathogens reaching the tissues beneath. Platelets quickly form scabs to seal any cuts.

It produces antimicrobial secretions to kill pathogens.

It is covered with microorganisms that act as an extra barrier to entry.

**d**  
Describe each role of a white blood cell and explain how it protects you against disease.



Some white blood cells ingest pathogens, digesting and destroying them.



Some white blood cells produce antibodies which are chemicals that target specific pathogens and destroy them. An antibody only works for one type of pathogen.



Some white blood cells produce antitoxins that counteract the toxins released by pathogens.

**f**  
Define the following terms:

vaccine: Dead or inactivate form of a disease-causing microorganism.

antigen: Unique protein on the surface of cells.

antibody: Produced by white blood cells to recognise specific antigens.

herd immunity: When vaccination of a significant proportion of the population provides protection for individuals who are not immune.

**i**  
State where the following drugs were discovered.  
the heart drug digitalis: foxglove  
the painkiller aspirin: willow  
the antibiotic penicillin: Penicillium mould

Who discovered penicillin?

Alexander Fleming

Why is it difficult to discover new medicines?

You need to find a chemical that kills bacteria without damaging human cells.

**j**  
Where do most new drugs now come from?

Synthesised by chemists in a lab, but they might still start from a chemical extracted from a plant.

What has to happen before a drug can be used?

1. Test whether the drug is effective against the disease.
2. Check that the drug is not toxic.
3. Work out what dose to use.

**k**  
Describe each process of drug testing.

preclinical testing: This happens in a laboratory using cells, tissues and animals.

clinical trials: To use healthy volunteers and patients. Starting off with very low doses to check for side effects. If it is safe it is tested on patients.

double-blind trials: These tell you how effective a medicine is. Neither the patient or the doctor know whether the patient has been given a placebo or the real drug.

**h**  
Fill in the missing words:

The use of antibiotics has greatly reduced the deaths from infectious bacterial diseases. However, the evolution of strains that are resistant to antibiotics is a concern.

Antibiotics are specific which means they only work against certain bacteria.

**e**  
Tick the correct boxes.

	Treats Symptoms	Kills Bacteria	Kills Viruses
painkillers	✓		
antibiotics		✓	

**b**  
Explain how the respiratory system is adapted to reduce the entry of microorganisms.

The lining of the nose produces mucus and is full of hairs to trap particles in the air that may contain pathogens.

The lining of the trachea and bronchi produce mucus which is moved to the back of the throat by the cilia projections of epithelial cells.

**c**  
Explain how the digestive system is adapted to reduce the entry of microorganisms.

The stomach produces hydrochloric acid that destroys pathogens.

**a**

Label the diagram with the following keywords:

- lymphocyte
- monoclonal antibodies
- hybridoma
- tumour cell

monoclonal antibodies

**b**

Monoclonal antibodies are specific. What does this mean? They only bind to one antigen. This means they can be used to target a specific chemical or cell in the body.

**c**

Why are monoclonal antibodies less widely used than intended when they were first developed? They create more side effects than expected.

**d**

Describe five ways in which monoclonal antibodies can be used.

1. For diagnosis, such as in pregnancy tests.
2. For measuring the levels of chemicals (such as hormones) in the blood.
3. For detecting pathogens.
4. For research, to identify or locate specific molecules in cells or tissues.
5. To treat some diseases.

**e**

Give three ways to identify plant diseases.

1. Reference a gardening manual or website.
2. Identify the pathogen in a laboratory.
3. Use a testing kit containing monoclonal antibodies.

**h**

Give an example of a plant disease caused by each type of pathogen below.

virus: tobacco mosaic virus

fungus: black spot

insect: aphids

**i**

This plant has an ion deficiency.

Identify which ion is deficient.

magnesium

Explain how this ion deficiency causes the condition in the diagram.

Magnesium is needed to make chlorophyll. The leaves become yellow because there isn't enough chlorophyll. This is called chlorosis. Plant growth will slow down because the plant cannot photosynthesise fully.

**j**

Name three mechanical adaptations that plants have to protect themselves against herbivores.

1. Thorns and hairs to deter animals.
2. Leaves that droop or curl when touched.
3. Mimicry to trick animals.

**k**

Plant B has an ion deficiency.

Identify which ion is deficient.

nitrate

Explain how this ion deficiency causes the condition in the diagram.

Nitrate ions affect protein synthesis. They help a plant to convert the sugars made in photosynthesis into proteins needed for growth. This means if there isn't enough nitrate, the plant will have stunted growth.

**l**

Name three physical defence responses that help a plant to defend against microorganisms.

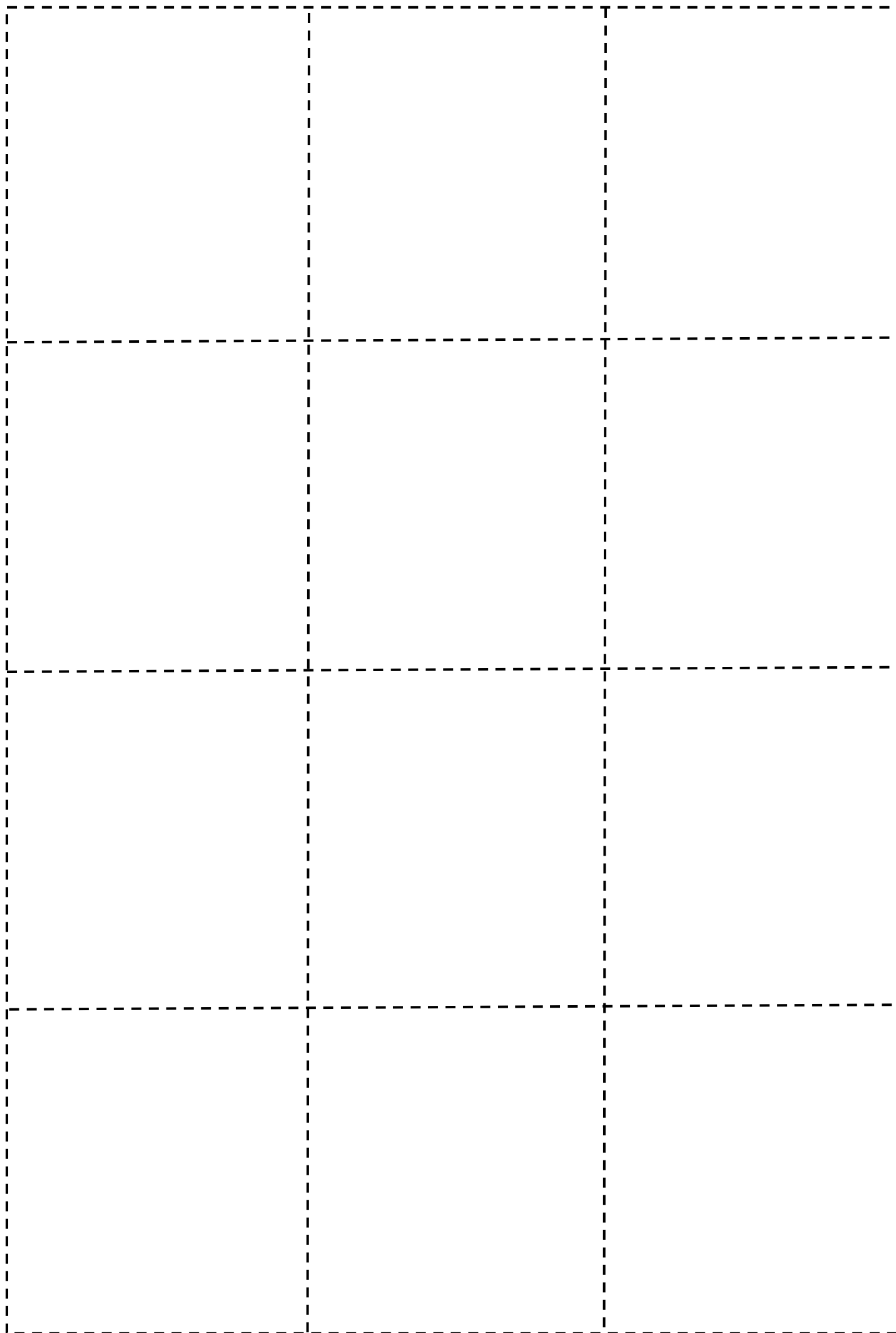
1. cellulose cell walls
2. Tough waxy cuticle on leaves.
3. Layers of dead cells around stems (bark on trees) which fall off.

**m**

Name two chemical plant defence responses.

1. antibacterial chemicals
2. poisons to deter herbivores



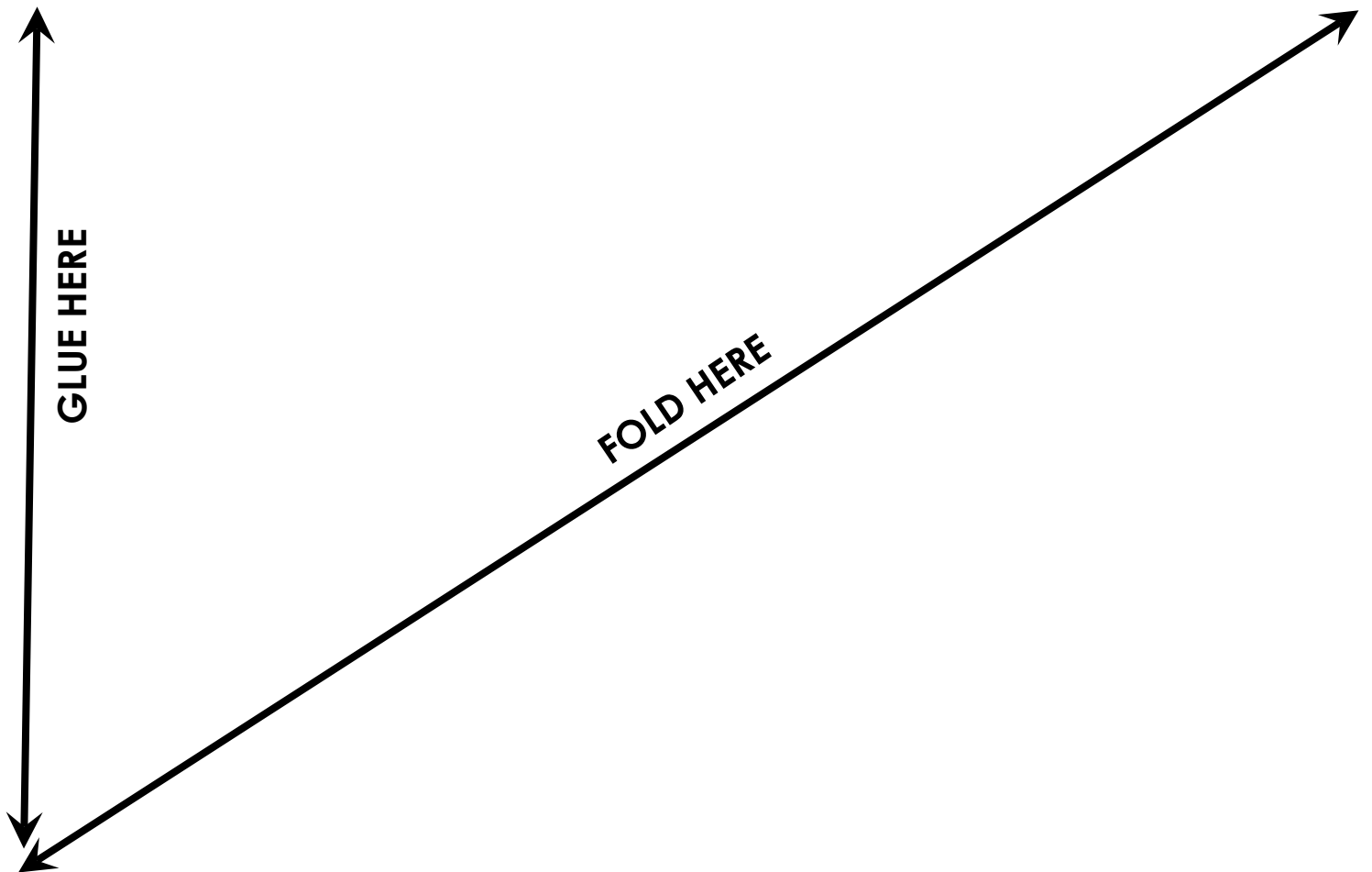






# Topic 3: Infection and Response

## Question Card Storage





# Topic 4: Bioenergetics

1 Complete the word equation for photosynthesis.

sunlight

carbon dioxide + water  $\rightarrow$  oxygen + glucose

2 Write the name of each chemical next to its formula. Which elements make up each chemical?

CO<sub>2</sub> carbon dioxide - carbon and oxygen

H<sub>2</sub>O water - hydrogen and oxygen

O<sub>2</sub> oxygen

C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> glucose - carbon, hydrogen, oxygen

3 Choose the correct answer:

Photosynthesis is an ~~exothermic~~/endothermic reaction.

Fill in the blanks:

In photosynthesis, energy is transferred from the environment to the chloroplasts by light.

4 Name five ways the glucose produced in photosynthesis could be used.

1. 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

Fill in the blanks:

To produce proteins, plants also need nitrate ions that are absorbed from the soil.

5 How does the rate of photosynthesis affect the biomass of a plant?

The more photosynthesis, the more biomass the plant makes, so the faster it grows.

6 Explain how the amount of chlorophyll in a leaf affects the rate of photosynthesis.

The less chlorophyll in a leaf, the less photosynthesis.

Give two reasons there may be less chlorophyll in the leaf.

1. If the plant has diseases, like tobacco mosaic virus or rose black spot.
2. If the plant does not have enough minerals, like magnesium.

7 Explain how farmers manipulate the environment of their crops to help them make a profit.

Farmers control the temperature and levels of light and carbon dioxide to get the fastest possible rates of photosynthesis. This means that they produce bigger crops, faster.

They have to use expensive monitoring equipment, electricity, and gas to maintain the optimum conditions. However, they need less staff, the crops are clean and soil free, they can use land where the ground is poor, turnover of crops is quicker, and the crops are larger.

Farmers balance the cost of the systems they use against the increased income from more harvests of larger crops each year.

8 Fill in the gaps:

As the distance of the light from the plant increases, the light intensity **decreases**. This is called an **inverse** relationship.

The light intensity changes in inverse proportion to the square of the distance.

You would write this as:

light intensity  $\propto \frac{1}{\text{distance}^2}$

If you double the distance between the light and the plant, how much will the light intensity fall by?

$\frac{1}{4}$

9 Respiration is an **exothermic/endothermic** reaction that takes place in the mitochondria of cells.

The more active a cell is, the more mitochondria it needs. Name two cell types that have lots of mitochondria.

muscle cells, sperm cells, ciliated epithelial cells, phloem companion cells

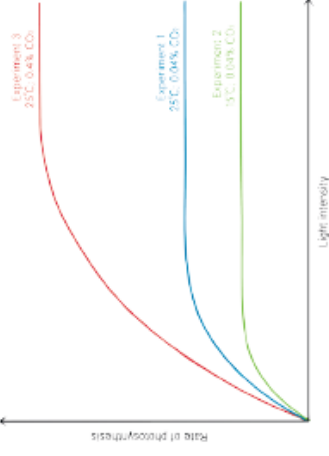
Respiration transfers energy into a form we can use for living processes.

Respiration can take place **aerobically** (using oxygen), or **anaerobically** (without oxygen).

10 Explain what happens to your muscles during long periods of vigorous activity.

- There is a build up of lactic acid which contributes to muscle fatigue.
- Muscles stop contracting effectively.
- An oxygen debt is created.

11



Compare the graphs for experiments 1 and 2, explain what they tell you about the rate of photosynthesis.

As the temperature increases, the rate of photosynthesis increases.

Now compare these graphs with experiment 3, explain what this tells you about the rate of photosynthesis.

When the carbon dioxide is increased, the rate of photosynthesis increases.

Describe how light intensity affected the rate of photosynthesis.

Initially, as the light intensity increased so did the rate of photosynthesis. However, the line levelling indicates that at that point, the light intensity was no longer the limiting factor for photosynthesis.

12

Complete the word equation for aerobic respiration.

glucose + oxygen  $\rightarrow$  carbon dioxide + water

Complete the formula equation for aerobic respiration.



- 13 What happens to the waste lactic acid produced during anaerobic respiration?  
It is transported to the liver where it is converted back to glucose.  
What is the oxygen debt?  
The amount of extra oxygen the body needs after exercise to oxidise the lactic acid.  
How does your body clear the oxygen debt?  
You keep a higher breath volume and breathing rate after exercise.

- 14 Explain what happens to your breathing rate when you exercise.
- Your breathing rate and breath volume increase.
  - The rate at which oxygen is brought into your body is increased.
  - The rate at which carbon dioxide is removed is increased.
  - This means more oxygen is available to be transported to cells for respiration.

- 15 Complete the word equation for anaerobic respiration in plant and yeast cells.  
**glucose** → **ethanol + carbon dioxide**  
What is anaerobic respiration in yeast called?  
**fermentation**  
Why does this process have economic importance?  
Is it used to make alcohol and bread.

- 16 Explain what happens to your heart rate when you exercise.
- Your heart rate increases so that more oxygenated blood is carried to your muscles.
  - Therefore, more oxygen and glucose reach the cells.
  - The rate of respiration can increase to transfer more energy for muscle contraction.
  - Carbon dioxide is removed from the muscles at a faster rate.

- 17 The illustration shows a method for investigating the effect of light intensity on photosynthesis.



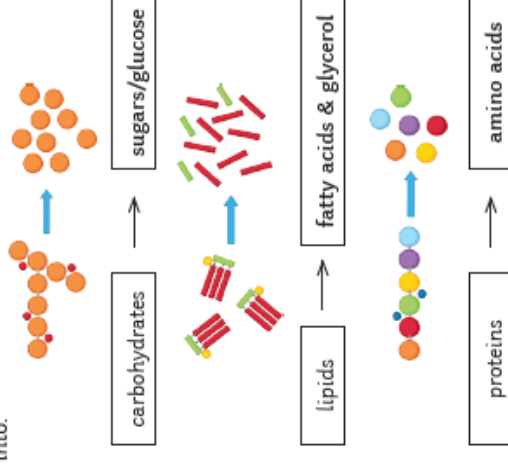
- How could you measure the rate of photosynthesis using this equipment?  
Count the number of bubbles released in a given time (e.g. per minute).  
What is the independent variable in this experiment and what additional equipment would you need to measure it?  
Distance of the lamp from the pondweed, measured using a ruler or tape measure.  
We often add a heat shield to the apparatus shown, what is the purpose of this?  
To absorb any heat given off by the lamp so that we can control the temperature of the pondweed.

- 18 When does anaerobic respiration happen?  
When your body can't supply oxygen to the muscles fast enough.  
Complete the word equation for anaerobic respiration in muscles.  
**glucose** → **lactic acid**  
Why is anaerobic respiration not as efficient as aerobic respiration?  
The glucose molecules are not completely broken down, so much less energy is transferred.

- 19 Respiration is an exothermic/endothermic reaction that takes place in the mitochondria of cells.  
The more active a cell is, the more mitochondria it needs. Name two cell types that have lots of mitochondria.  
**muscle cells, sperm cells, ciliated epithelial cells, phloem companion cells**  
Respiration transfers energy into a form we can use for living processes.  
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The amount of extra oxygen the body needs after exercise to oxidise the lactic acid.  
How does your body clear the oxygen debt?  
You keep a higher breath volume and breathing rate after exercise.

- 21 The illustrations show the macromolecules in the foods that we eat. Complete the labels to identify the molecules they are broken down into.



What do the small dots on each of the macromolecules above represent?

enzymes

Why is respiration important in this process?

The energy transferred in respiration is used for enzyme controlled processes.

- 22 Explain what happens to your heart rate when you exercise.  
Your heart rate increases so that more oxygenated blood is carried to your muscles.  
Therefore, more oxygen and glucose reach the cells.  
The rate of respiration can increase to transfer more energy for muscle contraction.  
Carbon dioxide is removed from the muscles at a faster rate.

23

Give three reasons why organisms need energy.

1. For chemical reactions that build bigger molecules.
2. For movement.
3. For keeping warm.

24

What is metabolism?

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

Metabolism includes the synthesis of new molecules. Complete the sentences to identify some of the molecules that are made in plant and/or animal cells.

1. Glucose is converted to starch, glycogen and cellulose.
2. Glycerol and three molecules of fatty acid are used to form lipids.
3. Glucose and nitrate ions are used to form amino acids, which are used to form proteins.

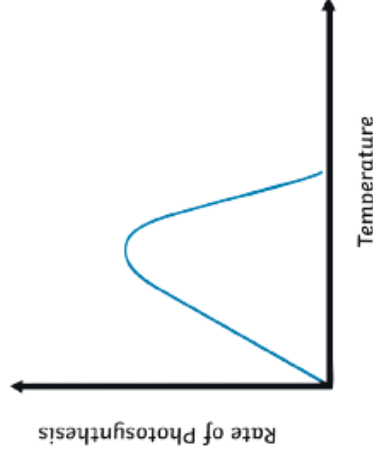
What happens to excess proteins in the body?

They are broken down to form urea for excretion.

25

Draw a line on the graph to show how temperature affects the rate of photosynthesis.

## Temperature



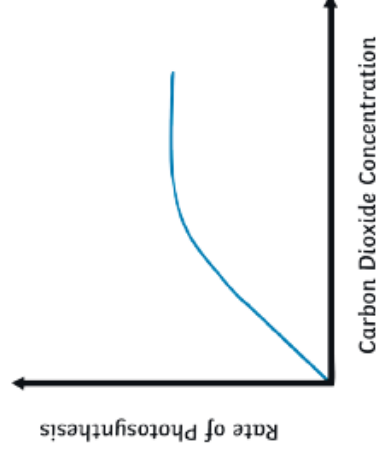
Explain how temperature affects the rate of photosynthesis.

As the temperature increases, the rate of photosynthesis increases. When the temperature gets too high, the enzymes that control photosynthesis denature and the rate of photosynthesis decreases.

26

Draw a line on the graph to show how carbon dioxide affects the rate of photosynthesis.

## Carbon Dioxide



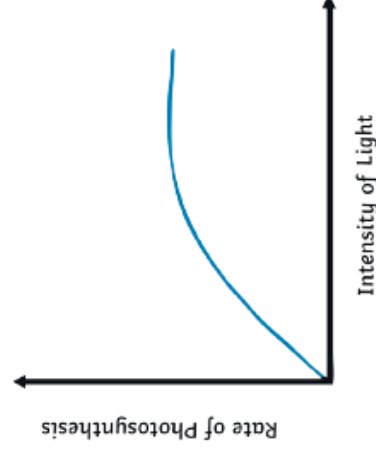
Describe how carbon dioxide affects the rate of photosynthesis.

Increasing the concentration of carbon dioxide will increase the rate of the photosynthesis, until another factor limits the rate.

27

Draw a line on the graph to show how light intensity affects the rate of photosynthesis.

## Light

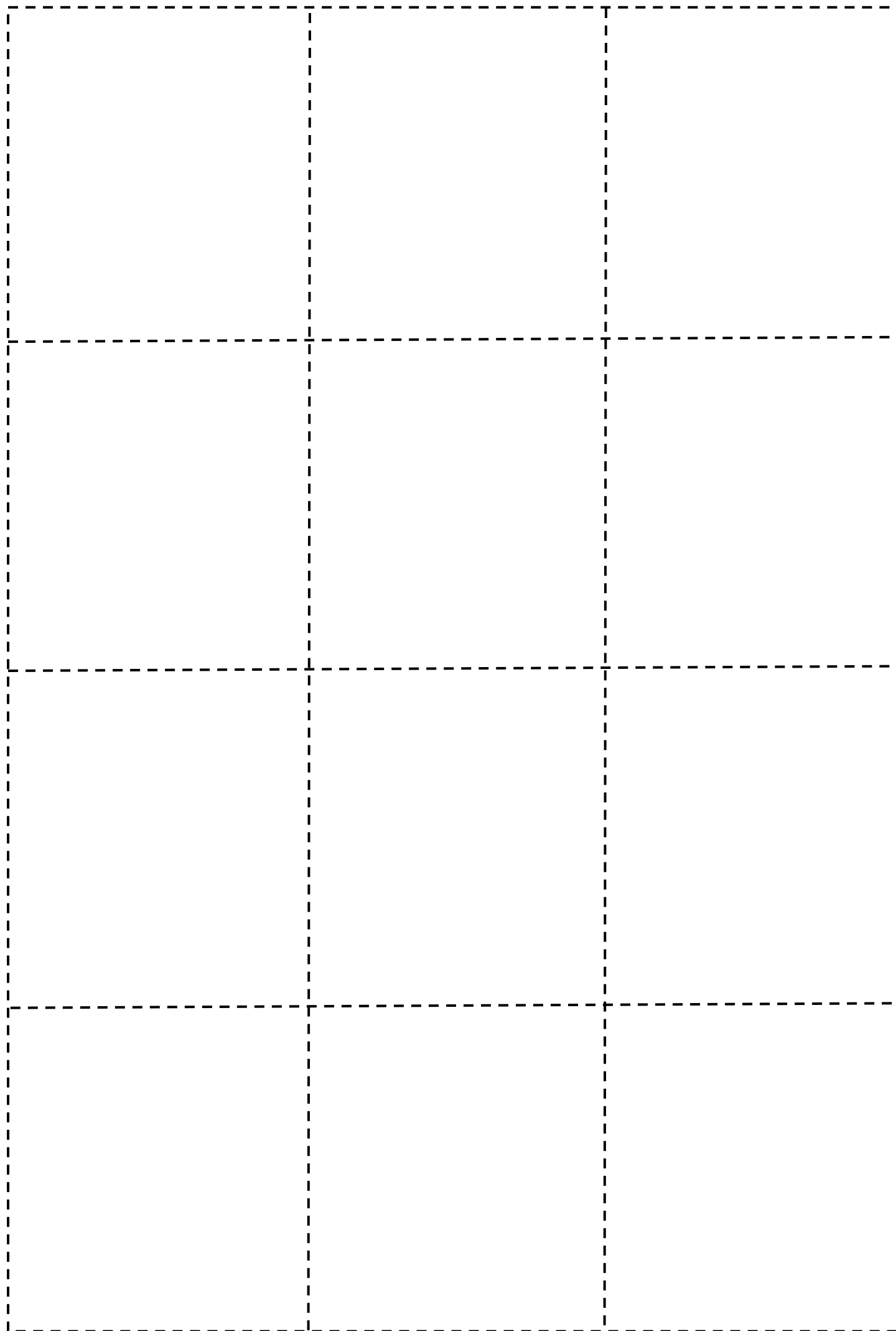


Describe how light intensity affects the rate of photosynthesis.

Increasing light intensity increases the rate of photosynthesis, until another factor limits the rate.









# Topic 4: Bioenergetics

## Question Card Storage

