Biology paper one

Stretch and challenge booklet

Exam command words

Command words are the words and phrases used in exams that tell students how they should answer a question.

The following command words are taken from Ofqual's official list of command words and their meanings that are relevant to this subject.

Calculate	Use numbers in the question to work these out.	**Draw**	Produce, or add a diagram.
Choose	Select from a range of alternatives.	**Estimate**	Give an approximate value.
Compare	Describe similarities/differences.	**Use**	The answer must include the information in the question.
Define	Specify the meaning of something.	**Work out**	Students should use numbers in the question.
Describe	Recall facts, events or process in an accurate way.	**Write**	Short answer, no explanation or description.
Design	Set out how something will be done.	**Evaluate**	Students should use the information provided as well as their own knowledge and consider evidence for or against.
Determine	Use the data provided to work out your answer.	**Explain**	Students should make something clear, or state reasons for something happening.
Give	Short answer only.	**Identify**	Name or characterise.
Label	Add words to complete a diagram, picture or graph	**Justify**	Use evidence from the information supplied to support your answer.
Measure	Find an item of data for a given quantity.	**Name**	Single word or phrase.
Plot	Mark on a graph.	**Plan**	Write a method.
Predict	Give a plausible outcome.	**Show**	Provide structured evidence to reach a conclusion.
Suggest	Apply your own knowledge.	**Sketch**	Draw approximately.

Scientific key words

These are keywords often used in questions. You need to be able to recognise and use them in your answers

Hypothesis	A scientific statement that explains certain facts or observations	**Anomaly**	A result that does not fit the pattern
Prediction	This describes what you think will happen in an experiment	**Accuracy**	How close the reading is to the true value
Independent variable	This is the variable that is changed during an investigation. There should only be one of these.	**True value**	This is the real value of a measurement in an experiment
Dependent variable	This is the variable that changes as a result of a change in the independent variable	**Precision**	This is determined by the scale on the measuring apparatus e.g. a ruler marked mm is more precise than one in cm
Control variable	Variables that remain constant, to make sure that an investigation is valid	**Resolution**	The smallest change that can be read from a measuring device for example a ruler measured in mm or cm
Fair test	This is where only the independent variable is changed and the others controlled	**Calibration**	When we make sure that the measuring apparatus is making correct readings e.g. the temperature of melting ice is 0 degrees Celsius
Valid	The results and conclusions will be this if the variables are correctly controlled	**Measurement error**	The difference between the real value and the measured value
Categoric variable	A variable that can be described by a label or category such as colour or surface	**Random error**	This error causes measurements to be spread around the true value – can be reduced by taking repeats and calculating a mean
Continuous variable	A variable which can have any numerical value	**Zero error**	When a piece of measuring equipment should be reading zero but it doesn't
Interval	This is the difference between the values of your independent variable	**Systematic error**	This is an error that is always the same for each repeat – usually because of an error in the equipment used
Range	The maximum and minimum values of the independent or dependent variables e.g. 'from 10cm to 50cm'	**Uncertainty**	When the results obtained are not as accurate as they could be due to the procedure carried out
Data	Information or measurements that you collect	**Repeatable**	If the same person can get the same reading using the same equipment and method
Datum	One piece of information	**Reproducible**	If another person can get the same result (trend/specific results) using the same method and equipment or with different method or equipment.

Biology paper 1 Revision checklist

Cells and transport		
Label the major features of animal, plant and bacterial cells		
Describe differences between animal and plant cells		
Describe the functions of all the parts – e.g nucleus, ribosomes etc		
Use Magnification=Image/Actual to calculate size of cells or magnification		
Use prefixes centi, milli, micro and nano and change numbers between these units		
Describe what is meant by 'differentiation' or specialisation		
Relate a cell's specialised features to its function		
Describe how microscopy has developed over time and give the advantages of the electron microscope over the light microscope		
Describe the stages in the cell cycle		
Recognise & define mitosis and give examples of it may occur		
Define the term 'stem cells		
Name sources of stem cells and describe their use – adult, embryo and meristem		
Evaluate the use of stem cells in medical research and treatments		
Describe diffusion and the factors that can affect the rate		
Describe how organs and surfaces are specialised for effective diffusion – lungs, gills in fish, roots and leaves in plants		
Define the term osmosis and give examples of where it happens		
Define the term 'Active Transport' and explain why it is necessary		
Name the organs in the digestive system		
Organisation		
Use the 'lock and key' model to explain how enzymes work		
Name the three digestive enzymes, what they act on and what the products are		
Explain why digestion of food is necessary		
Explain the functions of bile and hydrochloric acid in digestion		
Describe the chemical tests for sugar, starch, fat and protein and their positive results		
Label a diagram of the major structures of the heart		
Label a diagram of the major structures of the lungs		
Describe how the heart rate is normally regulated and the use of artificial pacemakers		
Describe the features of arteries, veins and capillaries		
Name and describe the functions of the four components of blood		

Describe the path blood takes around the body and the importance of valves in this		
Describe what 'coronary heart disease' is, describe and evaluate its treatment options		
Describe some of the diseases linked with lifestyle factors		
Describe the causes of cancer and what is meant by 'benign' and 'malignant' tumours		
Name the different plant tissues and describe how they are adapted for their function		
Explain how transpiration happens and describe factors that can affect the rate		
Explain what is meant by 'translocation'		
Infection & response		
Define the term 'pathogen'		
Describe the spread, symptoms and treatments of viral diseases such as measles, HIV and Tobacco Mosaic Virus (TMV)		
Describe the spread, symptoms and treatment of the bacterial infections Salmonella and Gonorrhoea		
Describe the symptoms, spread and treatment of the fungal disease Rose black spot		
Describe the spread of malaria and measures to prevent its transmission		
Describe the main physical barriers humans have to infection		
Describe how white cells fight pathogens that do get into the body		
Explain how vaccinations prevent disease		
Explain the use of antibiotics and other medicines in treating diseases		
Describe the origins of many drugs and how new drugs are developed, including the use of placebos		
Bioenergetics		
Describe the processes of aerobic and anaerobic respiration and represent them using word equations		
Compare aerobic with anaerobic respiration		
Describe and explain the changes in the body during exercise		
Explain why anaerobic respiration cannot be maintained for long periods		
Describe the process of photosynthesis and represent it using a word equation		
Describe how the rate of photosynthesis can be measured and how it can be affected		

Required practical activities

Using a light microscope to view samples

What do I need to know?

- How a microscope is used to look at, draw and label plant and animal cells
- How the IAM triangle is used
- Convert from cm to mm and micrometers

Method

1. Place a tissue sample on a microscope slide
2. Add a few drops of iodine (plant cells) or methylene blue (animal cells)
3. Lower a coverslip on to your slide using a mounting needle
4. Place the slide on the microscope stage and focus on the cells using the fine focusing knob at the lowest magnification.
5. Change it to a higher magnification and refocus.
6. Draw the type of cell that is shown, including a magnification scale.

What can I be asked?

- The name of the chemicals used to stain plant and animal cells
- The preparation of different samples
- The name of individual parts of the microscope
- Calculating image/actual/magnification size
- Using a scale bar to calculate actual size
- What organelles can and cannot be viewed under a microscope? What could be used instead?

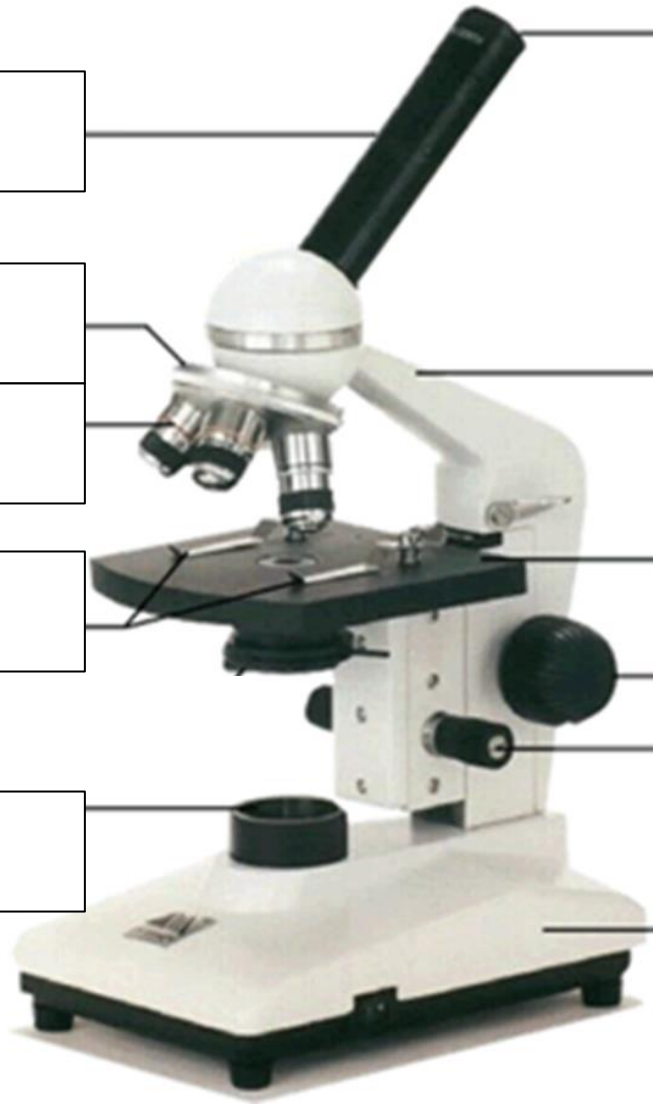
Key Definitions:

Magnification: how big an image is compared to its actual size

Microscope: a tool used by scientists to observe specimens which are not visible with the naked eye.

Resolution: the ability to tell apart two objects which are extremely close together

Specimen: the sample that you are observing



Eyepiece lens	Nosepiece	Arm (handle)	
Light source	Coarse focus knob	Base	Objective lens

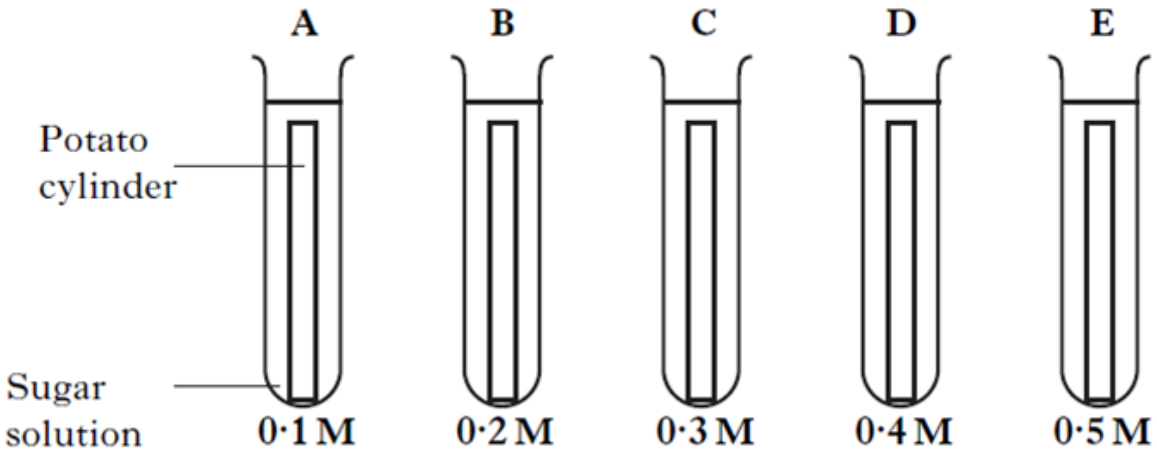
Osmosis

What do I need to know?

- The definition of osmosis
- How osmosis is affected by different sugar or salt concentrations

Method

1. Cut a piece of potato (or carrot or any other vegetable!) and measure its mass
2. Place in to a sugar solution
3. Repeat step 1 and 2, making sure the potato is the same size, and place it in to different concentrations of sugar solution, all of the same volume
4. Leave for 24 hours and measure the mass again
5. Work out the difference in mass and then work out percentage change



What can I be asked?

- To explain the results of a practical
- To predict what will happen in the practical
- To draw and/or interpret a graph
- Evaluate the method used
- Why percentage change is plotted on the graph and not the change in mass
- To identify the independent/dependent/control variables

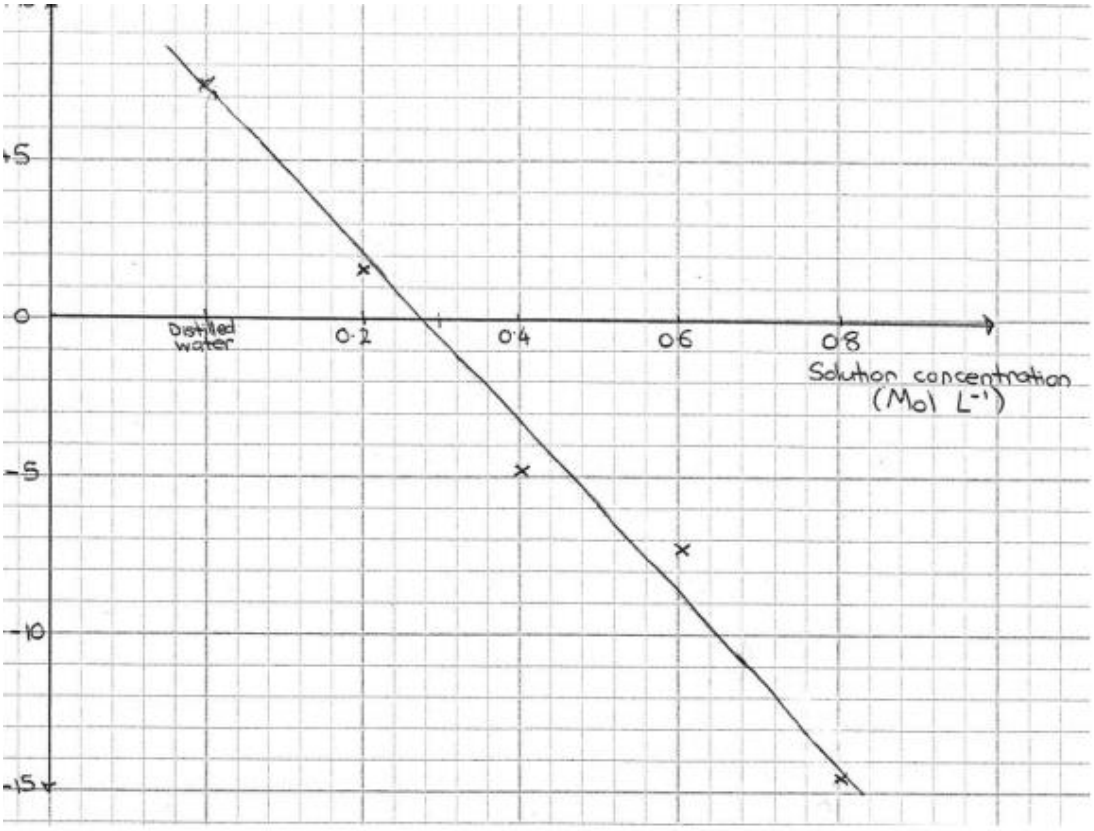
Osmosis is the movement of _____ molecules from a _____ to a more concentrated solution through a _____ membrane.

It is a passive process which means it does not require _____.

If a potato is placed in to a high sugar concentration it will gain/lose mass because_____

_____

Look at the data below. Add a label to the y axis.



Circle where the concentration of water is the same in the potato and the solution that it is placed in.

Suggest why the student worked out percentage change of mass instead of change in mass.

……

……

Effect of pH on enzymes

What do I need to know?

- What a continuous sampling method is
- The name of the chemical we use to test for starch and its colour change
- The effect of pH on enzyme activity
- Evaluating the experiment and suggesting improvements

Like temperature, pH can also affect the way enzymes work. In this practical, the effect of pH on amylase will be investigated.

- Amylase breaks down starch to produce _____.
- At a pH that is too high or too low, an enzyme will become _____. This means it has lost its shape.

In this practical a **continuous sampling method** is used. This means that every 30 seconds the same solution is placed in to wells on a spotting tile to test the colour change. When starch is present, iodine changes colour from _____ to _____.

For the experiment the student carried out, identify the

- Independent variable (what they changed):

- Dependent variable (what they measured):

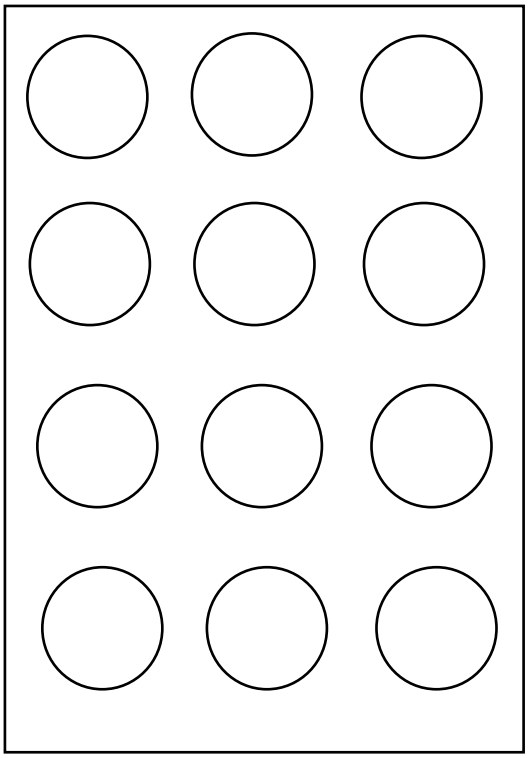
- Control variable (what they kept the same):

Suggest two problems with the way this experiment is carried out:

1.

2.

Colour in the diagram below to show what the student will have seen when it takes 210 seconds for the enzyme to break down starch. Remember that **each circle represents 30 seconds**.



Food Testing

What do I need to know?

- The names of the chemicals used to test for proteins, lipids, glucose and starch
- The method to each of the food tests

What can I be asked?

- How to detect proteins/lipids/glucose/starch presence in any sample
- The name of the chemical used
- Whether a test indicates a positive or negative result
-

Name of molecule	Reagent used to test	Positive result	Negative Result
Glucose (reducing sugar)			
Lipids			
Protein			
Starch			

Rate of Photosynthesis

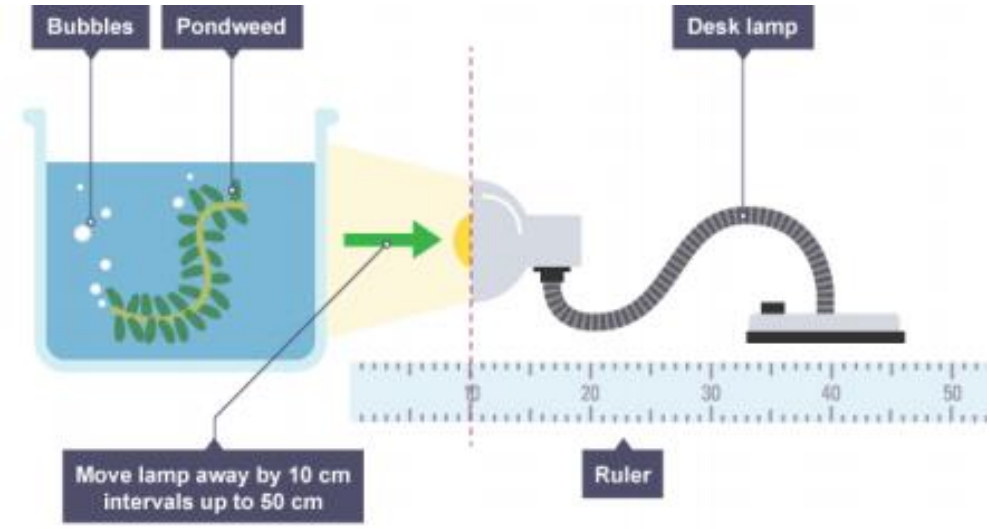
What do I need to know?

- How to set the experiment up
- What the results show
- Improving the experiment

What can I be asked?

- 6-mark question – setting up the practical to investigate the effect of a certain factor on the rate of photosynthesis. **It may not always be light intensity!**
- How to improve the experiment
- Calculating averages and plotting a graph
- About other limiting factors (e.g. carbon dioxide)

Method



Counting the bubbles gave an indication of the rate of photosynthesis. The more bubbles there were the more photosynthesis was taking place.

You need to make sure you include the link between bubbles and the rate if there is a long question!

A student carried out the experiment above to measure the rate of photosynthesis in *Elodea* pondweed. She then counted the number of bubbles produced.

The bubbles contain _____ gas.

Suggest two things that the student should keep the same during the experiment.

1.

2.

There are two main problems with the method the student used. One is that the bubbles are all different sizes. Suggest **one** other problem with her experiment.

……

……

The teacher told her there was a better way of measuring the rate of photosynthesis. Which of the following would be a better method? **Circle one answer.**

Measure the size of the bubbles instead

Measure the difference in mass of the pondweed before and after

Measure the volume of gas collected

At 50cm there were no bubbles produced. The student said this is because light was a limiting factor to the rate of photosynthesis.

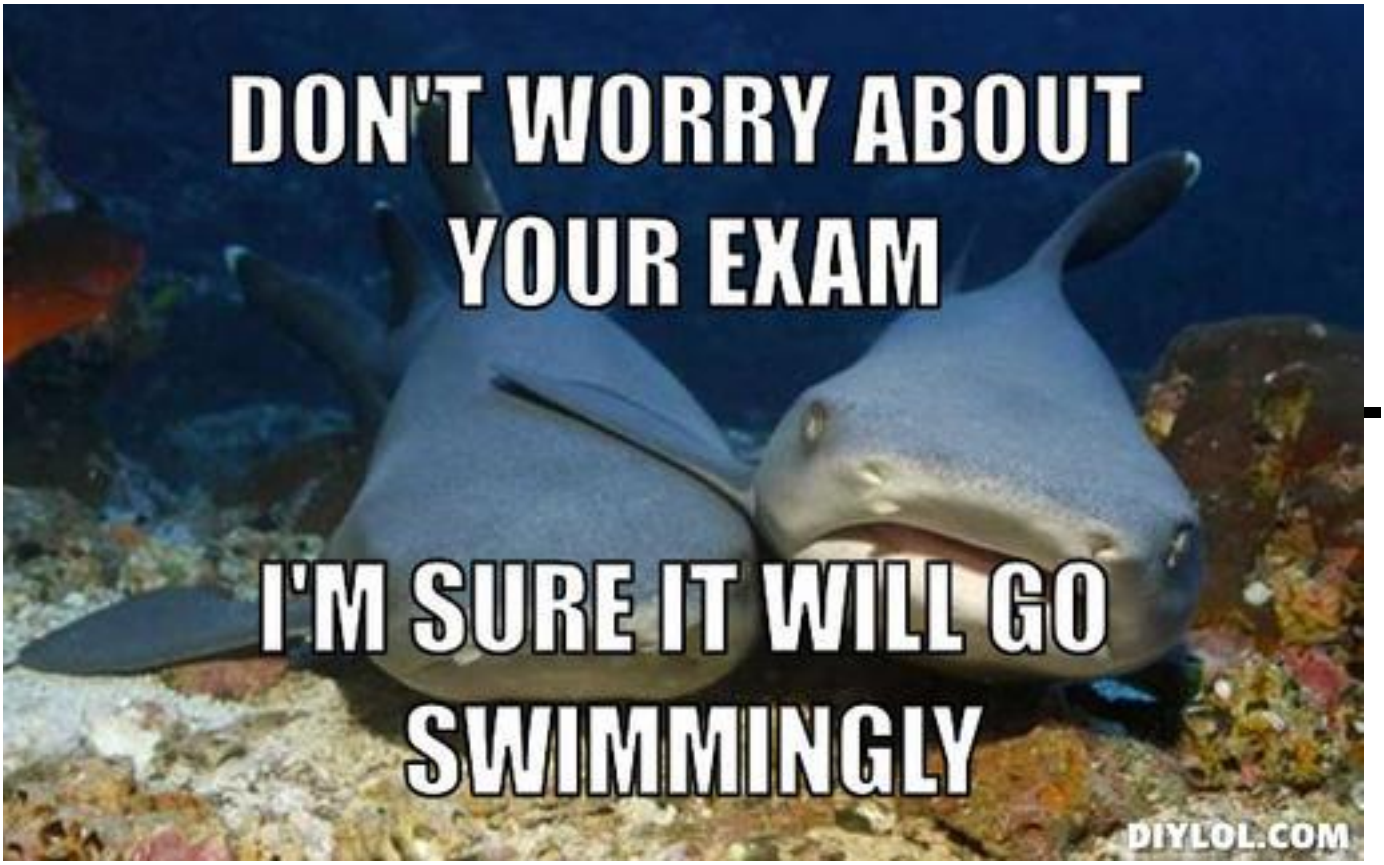
Explain what is meant by a limiting factor.

……

……

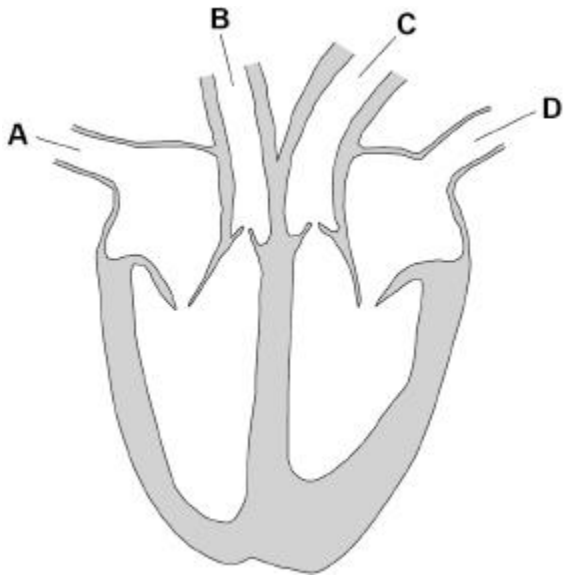
……

Exam questions



Q1.

The figure below shows the human heart.



(a) Which blood vessel transports blood with the highest oxygen concentration **into** the heart?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(b) Blood pressure is a measure of the force of the blood against the walls of the blood vessels.

Which blood vessel transports blood at the highest pressure?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(c) What is the correct order for blood flowing through the heart to the lungs?

Tick (✓) **one** box.

- left atrium → left ventricle → pulmonary artery ☐
- left atrium → left ventricle → pulmonary vein ☐
- right atrium → right ventricle → pulmonary artery ☐
- right atrium → right ventricle → pulmonary vein ☐

(1)

Every year thousands of people in the UK have heart attacks.

A heart attack is caused when the heart muscle cells do **not** get enough oxygen, causing the cells to die.

(d) Statins and stents are two treatments used to reduce the risk of someone having a heart attack.

Evaluate the use of statins compared with the use of a stent to reduce the risk of a heart attack.

(6)

(e) Many people who survive a heart attack get out of breath easily when they exercise gently.

Explain why heart attack survivors get out of breath easily.

(4)

Scientists have developed patches of beating heart cells to repair damaged heart tissue.

The patches are placed onto areas of the heart where cells have died. New cells grow to replace the dead cells.

The patches are made using a person's own cells that are converted into stem cells.

(f) Explain why stem cells are used to make the patches.

(2)

(g) The scientists could have used human embryonic stem cells to make the patches.

Give **two** advantages of using stem cells made from the person's own cells, rather than using embryonic stem cells.

1

2

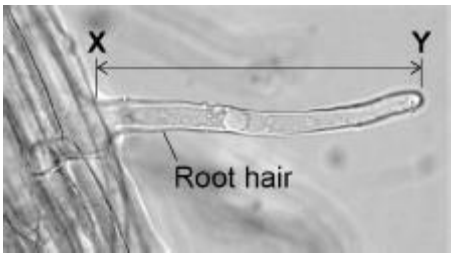
(2)

(Total 17 marks)

Q2.

Figure 1 shows a root hair viewed using a microscope.

Figure 1



(a) The root hair was viewed at a magnification of ×50

The image length of the root hair **X–Y** is 43 mm

Calculate the real length of the root hair in micrometres (µm).

Real length = _____ µm

(4)

(b) A microscope has a ×5 eyepiece lens.

Describe how to use this microscope to observe a prepared slide of root hair cells at a magnification of ×50

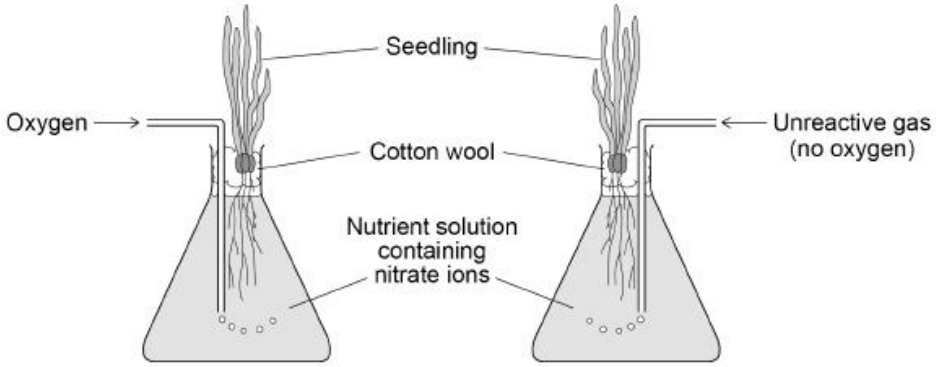
(4)

Root hair cells absorb water and mineral ions from the soil.

A scientist investigated the rate of nitrate ion uptake by two seedlings.

Figure 2 shows how the investigation was set up.

Figure 2



The scientist determined the mass of nitrate ions absorbed by each seedling every 30 minutes for 4 hours.

The table shows the results.

Time in hours	Total mass of nitrate ions absorbed by seedling in arbitrary units	
	With oxygen added	With no oxygen added
0	0	0
0.5	100	60
1.0	145	95
1.5	170	105
2.0	195	115
2.5	215	120
3.0	235	125
3.5	250	130
4.0	265	130

(c) Describe the changes in the rate of absorption of nitrate ions for the seedling with **no** oxygen added.

Use information from the table.

(3)

(d) Explain what the results in the table above show about how nitrate ions are absorbed.

(4)

(e) Nitrate ions are essential for plants to grow.

Describe how nitrate ions are used in a plant to help the plant grow.

(3)

(Total 18 marks)

Q3.

Measles is a serious disease. A person can die from measles.

The table below shows the number of medically confirmed cases of measles in England and Wales between 2012 and 2015

Year	Number of medically confirmed cases of measles
2012	2030
2013	1843
2014	121
2015	91

(a) Suggest **one** reason why the actual number of cases of measles in England and Wales might be higher than is shown in the table above

_____

_____

(1)

(b) Calculate the percentage decrease in the number of medically confirmed cases of measles between 2012 and 2015

_____

_____

_____

_____

Percentage decrease = _____ %

(2)

(c) One reason for the decrease in the number of cases of measles is that more children were vaccinated against the disease.

Vaccinating a large proportion of the population reduces the spread of the measles virus.

Explain why.

_____

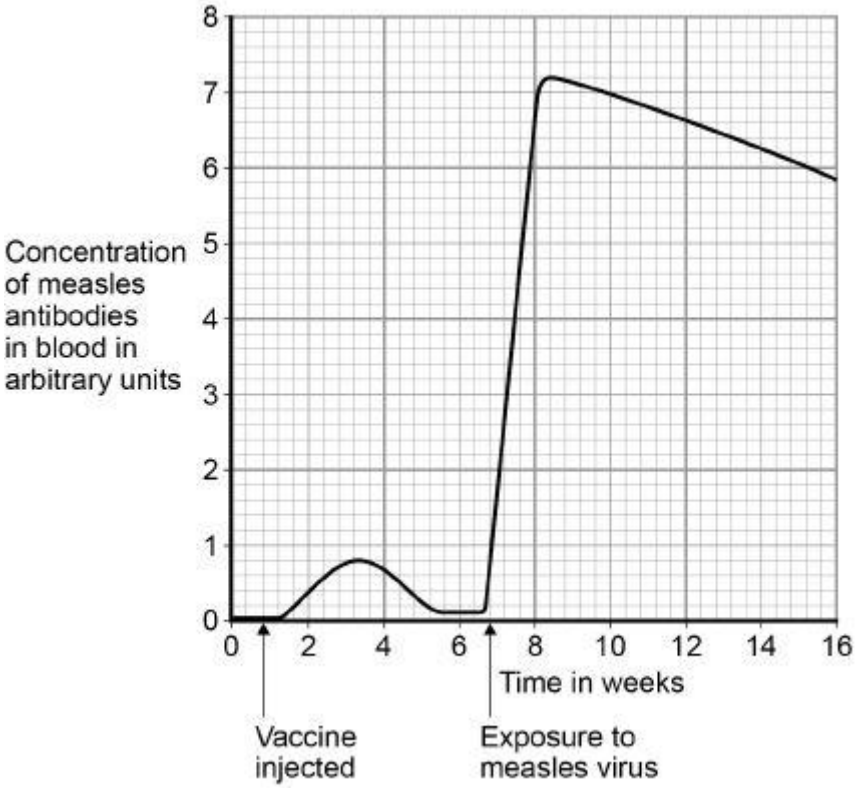
_____

_____

_____

(2)

(d) The graph below shows the concentration of measles antibodies in the blood of a boy.



Explain the differences between antibody production after the vaccine injection and after exposure to the measles virus.

You should include data from the graph above

(6)

(Total 11 marks)

Q4.

This question is about photosynthesis and food production.

(a) How can oxygen production be used to show the **rate** of photosynthesis?

_____

_____

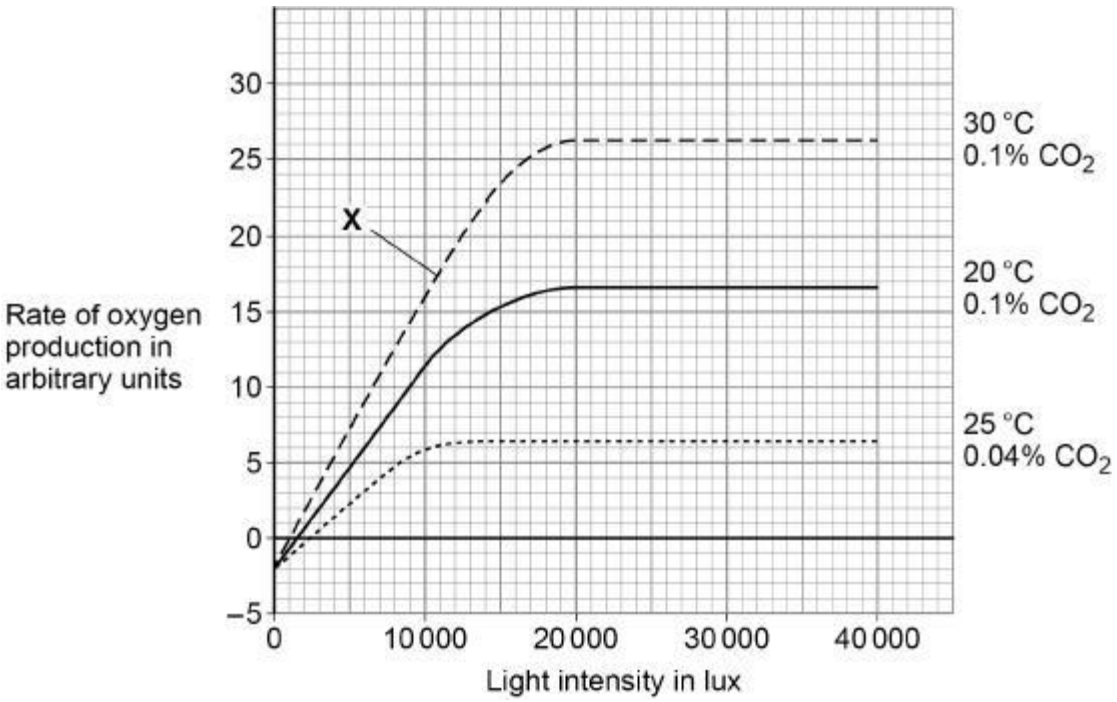
_____

(1)

Scientists investigated factors affecting the rate of photosynthesis in tomato plants.

The tomato plants were growing in a commercial greenhouse in the UK during winter.

The graph below shows the results.



The percentage of carbon dioxide in the Earth's atmosphere is 0.04%

(b) Name the factor that is limiting the rate of photosynthesis at point **X**.

_____

(1)

Farmers growing tomatoes commercially try to control the rate of photosynthesis and make maximum profit.

A farmer can control the temperature and carbon dioxide concentration in a greenhouse.

(c) What is the **minimum** light intensity a farmer should use to get the maximum rate of photosynthesis shown in above graph?

Light intensity = _____ lux

(1)

(d) The light intensity you gave in part (c) may **not** give the farmer maximum profit.

Explain why.

_____

_____

_____

_____

_____

_____

(3)

(e) Explain the results when the light intensity was 0 lux.

Use the diagram above.

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 10 marks)

Q5.

This question is about photosynthesis.

(a) What is the correct balanced equation for photosynthesis?

Tick **one** box.

$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$ ☐

$O_2 + H_2O \longrightarrow C_6H_{12}O_6 + CO_2$ ☐

$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$ ☐

$6O_2 + 6CO_2 \longrightarrow 6H_2O + C_6H_{12}O_6$ ☐

(1)

(b) What type of reaction is photosynthesis?

Tick **one** box.

Aerobic ☐

Endothermic ☐

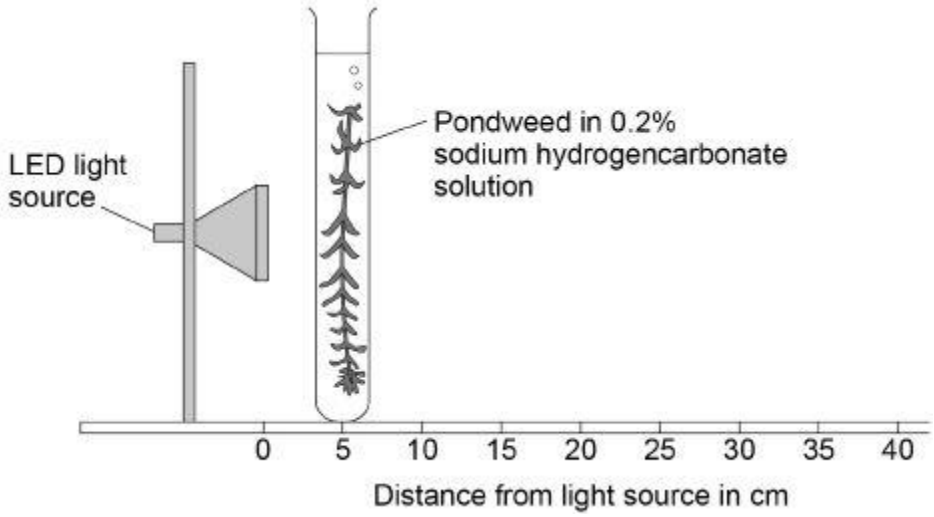
Exothermic ☐

Oxidation ☐

(1)

A student investigated the effect of light intensity on the rate of photosynthesis.

The diagram below shows the apparatus used.



Sodium hydrogencarbonate solution releases carbon dioxide gas for the pondweed.

This is the method used.

1. Place the pondweed at 5 cm from the light source.
2. Measure the rate of photosynthesis by counting the number of bubbles produced in 1 minute.
3. Repeat with the pondweed at 10 cm and at 20 cm from the light source.

(c) Counting the number of bubbles produced in 1 minute is not an accurate way to measure the rate of photosynthesis.

Suggest **two** ways the method could be improved to measure the rate of photosynthesis more accurately.

1. _____

_____

2. _____

_____

(2)

(d) The LED light source does **not** get hot.

Explain why it is important that the pondweed remains at a constant temperature.

_____

_____

_____

_____

(2)

(e) Light intensity can be calculated using the inverse square law:

$$I \propto \frac{1}{d^2}$$

Where I is light intensity and d is the distance of the pondweed from the light source.

The student placed the pondweed at 5, 10 and 20 cm from the light source.

Explain how light intensity changes as the distance of the pondweed from the light source is doubled.

You **must** include calculations in your answer.

_____

_____

_____

_____

_____

_____

(3)

(f) The student's results are shown in the table below

Distance of the pondweed from the light source in cm	Number of bubbles produced in 1 minute
5	129
10	31
20	8

Predict how many bubbles of gas would be produced in 1 minute if the pondweed was placed 40 cm from the light source.

Give a reason for your prediction.

_____

_____

_____

_____

(2)

(g) Describe how the student could change the method to investigate the effect of carbon dioxide concentration on the rate of photosynthesis.

You should include:

- how to change the independent variable
- **two** control variables.

Use the diagram above to help you answer this question.

_____

_____

_____

_____

_____

_____

(3)

(Total 14 marks)

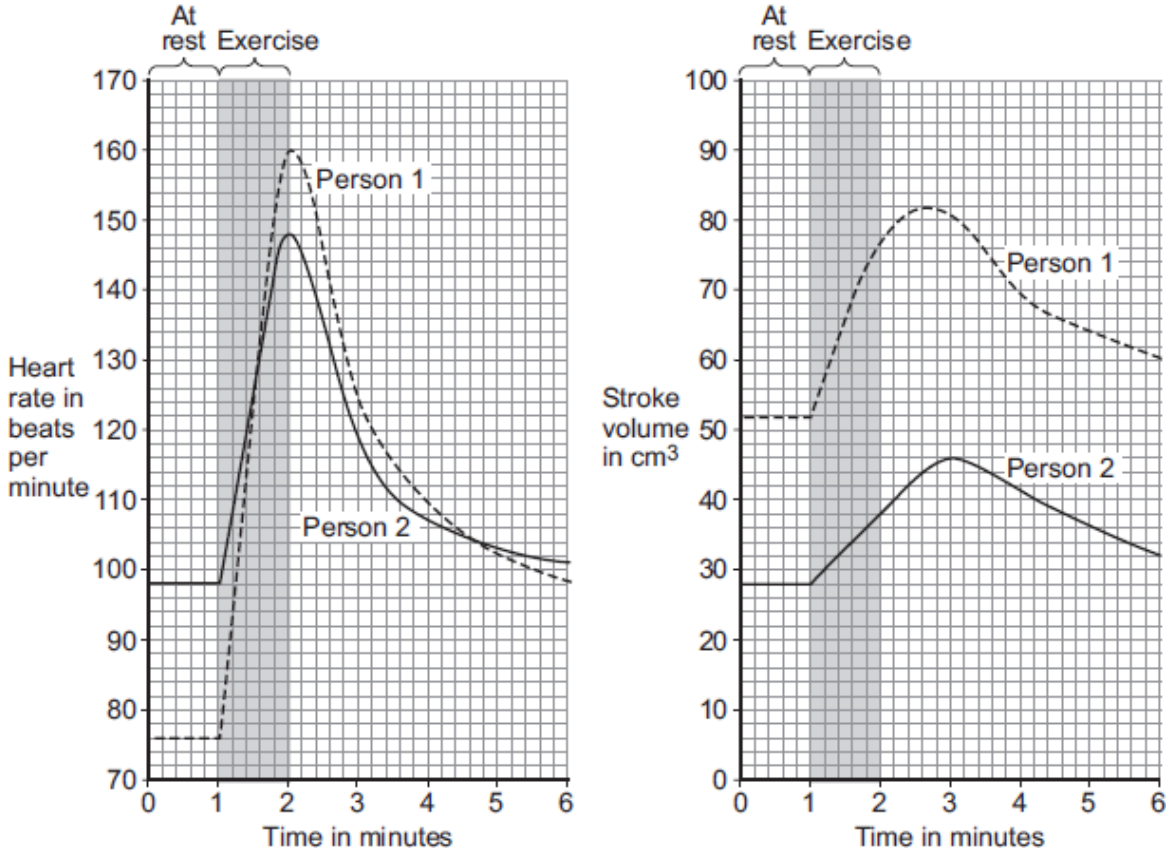
Q6.

During exercise, the heart beats faster and with greater force.

The 'heart rate' is the number of times the heart beats each minute.The volume of blood that travels out of the heart each time the heart beats is called the 'stroke volume'.

In an investigation, **Person 1** and **Person 2** ran as fast as they could for 1 minute. Scientists measured the heart rates and stroke volumes of **Person 1** and **Person 2** at rest, during the exercise and after the exercise.

The graph below shows the scientists' results.



(a) The 'cardiac output' is the volume of blood sent from the heart to the muscles each minute.

Cardiac output = Heart rate × Stroke volume

At the end of the exercise, **Person 1**'s cardiac output = 160 × 77 = 12 320 cm^3 per minute.

Use information from the figure above to complete the following calculation of **Person 2**'s cardiac output at the end of the exercise.

At the end of the exercise:

Person 2's heart rate = _____ beats per minute

Person 2's stroke volume = _____ cm^3

Person 2's cardiac output = _____ cm^3 per minute

(3)

(b) **Person 2** had a much lower cardiac output than **Person 1.**

(i) Use information from the figure above to suggest the **main** reason for the lower cardiac output of **Person 2**.

_____

_____

(1)

(ii) **Person 1** was able to run much faster than **Person 2**.

Use information from the figure above and your own knowledge to explain why.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(5)

(Total 9 marks)

Mark schemes

Q1.

(a) D

1

(b) C

1

(c) right atrium → right ventricle → pulmonary artery

1

(d) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

5–6

Level 2: Some logically linked reasons are given. There may also be a simple judgement.

3–4

Level 1: Relevant points are made. They are not logically linked. 1–2 AO1

1–2

No relevant content

0

Indicative content

Advantages of statins

- easy to take **or** not invasive (procedure)
- decrease blood cholesterol
- slow down build-up of fatty materials in arteries
- maintain blood flow to heart muscle cells
- low cost (compared to stent operation)

Disadvantages of statins

- might be side effects of drug eg muscle pain
- effects take time to happen
- drug will need to be taken long term
- might forget to take drug

Advantages of stent

- blocked artery is held open
- blood flow to heart muscle cells is increased
- stent will remain in place for a long time
- effect of stent is immediate
- rapid recovery from operation

Disadvantages of stent

- risk of infection from operation
- risk of surgery eg heart attack **or** bleeding
- risk of thrombosis **or** blood clot

For Level 3, arguments for and against **both** treatments are needed.

(e) heart (muscle) cannot contract / pump as effectively / powerfully

allow heart (muscle) is not as strong

1

(so) less blood pumped out of heart **or** to body (on each beat / contraction)

ignore reference to rate of blood flow

1

(so) less oxygen (reaches cells / body) for (aerobic) respiration

allow (so) more anaerobic respiration

1

(so) breathing rate increases to supply more oxygen
or
(so) breathing rate increases to repay oxygen debt

allow (so) breathing rate increases to break down lactic acid

1

(f) stem cells are undifferentiated cells

allow stem cells can differentiate

allow stem cells can develop into different types of cell

ignore stem cells can become specialised

ignore stem cells are not specialised

1

(therefore) can form heart (muscle) cells

allow (therefore) can form muscle cells

1

(g) any **two** from:

- cells will not be rejected

  allow converse if clearly referring to embryonic stem cells

- no risk of damage to embryo

  allow no (potential) human life destroyed / damaged

- adult can give consent

  ignore unethical unqualified

  ignore religion unqualified

2

[17]

Q2.

(a) $50 = \frac{43}{\text{size of real object}}$

1

(size of real object =) $\frac{43}{50}$

1

(size of real object =) 0.86 (mm)

1

(size of real object =) 860 (µm)

an answer of 860 (µm) scores 4 marks

allow correct conversion of their calculated value

if no other marks awarded allow 1 mark for

$$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$$

1

(b) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

3–4

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–2

No relevant content

0

Indicative content

- place slide on stage
- use lowest power / ×4 objective lens (initially)
- adjust mirror **or** switch light on so light passes through slide
- move stage as close to lens as possible
- slide must not touch lens
- turn focussing knob so slide moves away from lens
- turn focussing knob until image comes into focus
- use fine focus to get clear image
- change objective lens to ×10
- ×5 eyepiece and ×10 objective lenses (gives total magnification of ×50)
- refocus slide using focussing knob

For Level 2 reference to how to focus the slide / cells **and** achieve magnification of ×50 is required

(c) any **three** from:

- (rate) fastest in the first 0.5 hours

  allow fastest rate is 120 units per hour (at start)

- (rate gradually) decreases after first 0.5 hours

  allow mean rate over 3.5 hours is 37.14 units per hour

  or
- (rate gradually) decreases throughout the investigation

- rate is constant between 1.0 and 2.0 hours

  or
- rate is constant between 2.0 and 3.5 hours

- (rate) becomes zero between 3.0 and 3.5 hours

  allow (rate) is zero after 3.5 hours

allow 'it' for rate

3

(d) more nitrate ions are absorbed in the presence of oxygen

allow nitrate ions absorbed faster in the presence of oxygen

1

(which suggests) they are absorbed by active transport / uptake

1

which requires energy from respiration

*do **not** accept energy produced / created / made*

1

some nitrate ions absorbed by diffusion
or
some nitrate ions absorbed (by active transport / uptake) requiring energy from anaerobic respiration
or
some nitrate ions absorbed by active transport / uptake using oxygen already dissolved in the solution

1

(e) nitrate ions are used with glucose

1

to form amino acids

1

(which are) used to synthesise proteins (needed for growth)

1

[18]

Q3.

(a) any **one** from:

- not everyone would go to the doctor

  allow not all cases recorded
  allow only medically confirmed cases recorded
  ignore some cases are unknown

- sample will not always be sent for analysis
- some cases not tested / diagnosed / confirmed

  allow idea that doctor may make a judgemental error or mis-diagnosis

1

(b) $\frac{1939}{2030} \times 100$

*allow for **1** mark:*

$\left(\frac{91}{2030} \times 100 =\right) 4.5\%$

1

96 / 95.5

*allow **2** marks for correct rounding of 95.51724138*

*allow **1** mark for correct calculation using incorrect subtraction **only** if working shown*

1

*an answer of 96 / 95.5 scores **2** marks*
*allow **1** mark only for 95 or other incorrect rounding*

(c) most people are **immune** so do **not become ill** (from infection)

allow herd / community immunity so do not become ill (from infection)

allow most people are immune so do not become infected

ignore most people are immune so don't get / catch it

1

less chance of **non-immune** / **unvaccinated** individuals being exposed to pathogen / measles / virus

reference to an organism is needed

allow 'it' for the measles virus

allow fewer people to pass it on to non-immune people

1

(d) **Level 3:** Relevant points (comparisons / reasons) are identified, given in detail and logically linked to form a clear account.

5–6

Level 2: Relevant points (comparisons / reasons) are identified and there are attempts at logical linking. The resulting account is not fully clear.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content

differences (after exposure to measles virus):

- greater number / higher concentration of antibodies produced
- quantitative statement, e.g. 9 times higher **or** 0.8 to 7.2
- antibodies produced sooner − idea of immediate response
- antibodies produced quicker
- antibodies stay (in higher concentration) for longer

explanation

- white blood cells / leucocytes / lymphocytes / B cells
  ignore phagocytes / macrophages
- reference to previous exposure (of white blood cells) to pathogen / virus
- (white blood cells) recognise pathogen / virus / antigen

- memory cells
- production of specific / correct antibodies

[11]

Q4.

(a) measure the volume of oxygen produced in a given time

or

when more oxygen is produced in a given time the rate of photosynthesis is faster

a reference to rate is needed

allow gas for oxygen

allow when oxygen is produced faster the rate of photosynthesis is faster

ignore the faster the rate of photosynthesis, the more oxygen is produced

allow the slower the oxygen is produced the slower the rate of photosynthesis

or

less oxygen being produced in a given time, the slower the rate of photosynthesis

1

(b) light (intensity)

ignore temperature

1

(c) 20 000 (lux)

allow answers in range 19 500 to 20 500 (lux)

1

(d) there is a cost for heating the greenhouse

1

there is a cost for increasing the carbon dioxide in the atmosphere (of the greenhouse)

allow there is a cost for lighting (in winter)

1

(therefore) the additional costs might exceed the (additional) sale price / profit
or
(additional) costs could not be recovered by increasing the sale price of the tomatoes

ignore these additional costs would reduce profits unqualified

1

(e) when there is no light there is no photosynthesis

1

(so) no oxygen is produced

1

(but) respiration happens (all the time) and oxygen is used

1

(therefore) the net / overall oxygen production is negative / - 2 (arbitrary units)

*do **not** accept an answer of -2 (arbitrary units)*

unqualified

1

[10]

Q5.

(a) $6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

1

(b) endothermic

1

(c) measure the volume of gas released

allow use a measuring cylinder / capillary tube / (gas) syringe

1

increase length of time

allow sensible length of time

allow video the investigation so you could re-count the bubbles later

*allow repeat the measurement at each distance several times **and** calculate a mean*

ignore references to using other distances

1

(d) temperature affects **rate** of photosynthesis
or
temperature affects **rate** of bubble production

allow correct description of effect of temperature on rate

1

(because) reaction / photosynthesis is controlled by **enzymes**

allow high temperatures denature enzymes

enzymes being denatured must be linked to high temperature

1

(e) evidence of squaring for **two** distances that double:
25 **and** 100
or
100 **and** 400

1

calculate $1/d^2$ for **two** distances that double:
0.04 **and** 0.01
or
1/25 **and** 1/100
or
0.01 **and** 0.0025
or
1/100 **and** 1/400

*allow **2** marks for these calculations without*

working

ignore calculations for a third distance as long as two where the distance doubles are correct

1

(therefore as distance doubles) light intensity is quartered

1

(f) 2 (bubbles would be produced)

1

(as) very little light / energy for photosynthesis to occur

*do **not** accept no light*

1

*allow **2** marks for a quarter of the bubbles are produced as light distance doubles so 2 bubbles would be expected*

(g) (independent variable)
use different concentrations of sodium hydrogencarbonate solution

allow three concentration values

ignore different concentrations of carbon dioxide

1

(control variables)

***max 2** marks for control variables*

any **two** from:

- distance from light source

  allow light intensity
  ignore light unqualified
  ignore same lamp

- temperature of solution
- same plant

  allow type / size of plant

- time for plant to equilibrate

  allow time for plant to adjust to different solution
  ignore time unqualified

2

[14]

Q6.

(a) 5624

***allow 2 marks** for:*

- *correct HR = 148 **and** correct SV = 38 plus wrong answer / no answer*

or

- *only one value correct **and** ecf for answer*

***allow 1 mark** for:*

- *incorrect values **and** ecf for answer*

or

- *only one value correct*

3

(b) (i) **Person 2** has low(er) stroke volume / SV / described

*eg **Person 2** pumps out smaller volume each beat*

*do **not** allow **Person 2** has lower heart rate*

1

(ii) **Person 1** sends <u>more blood</u> (to muscles / body / lungs)

1

(which) supplies (more) oxygen

1

(and) supplies (more) glucose

1

(faster rate of) respiration **or** transfers (more) energy for use

ignore aerobic / anaerobic

allow (more) energy release

allow aerobic respiration transfers / releases more energy (than anaerobic)

*do **not** allow makes (more) energy*

1

removes (more) CO2 / lactic acid / heat

allow less oxygen debt

or less lactic acid made

or (more) muscle contraction / less muscle fatigue

if no other mark awarded,

allow person 1 is fitter (than person 2) for max 1 mark

1

[9]