AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.1.1 CELL STRUCTURE

SCORE	PERCENTAGE
/160	%

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

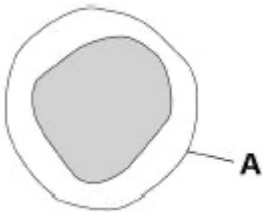
AQA publishes its past papers, mark schemes and examiner reports. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

Figure 1 shows one type of white blood cell.

Figure 1



(a) What is structure **A**?

Tick **one** box.

- Cell membrane ☐
- Cell wall ☐
- Cytoplasm ☐
- Nucleus ☐

(1)

(b) White blood cells help to defend the body against pathogens.

How do the white blood cells do this?

Tick **three** boxes.

- Clone pathogens ☐
- Engulf pathogens ☐
- Produce antibiotics ☐
- Produce antibodies ☐
- Produce antitoxins ☐
- Produce toxins ☐

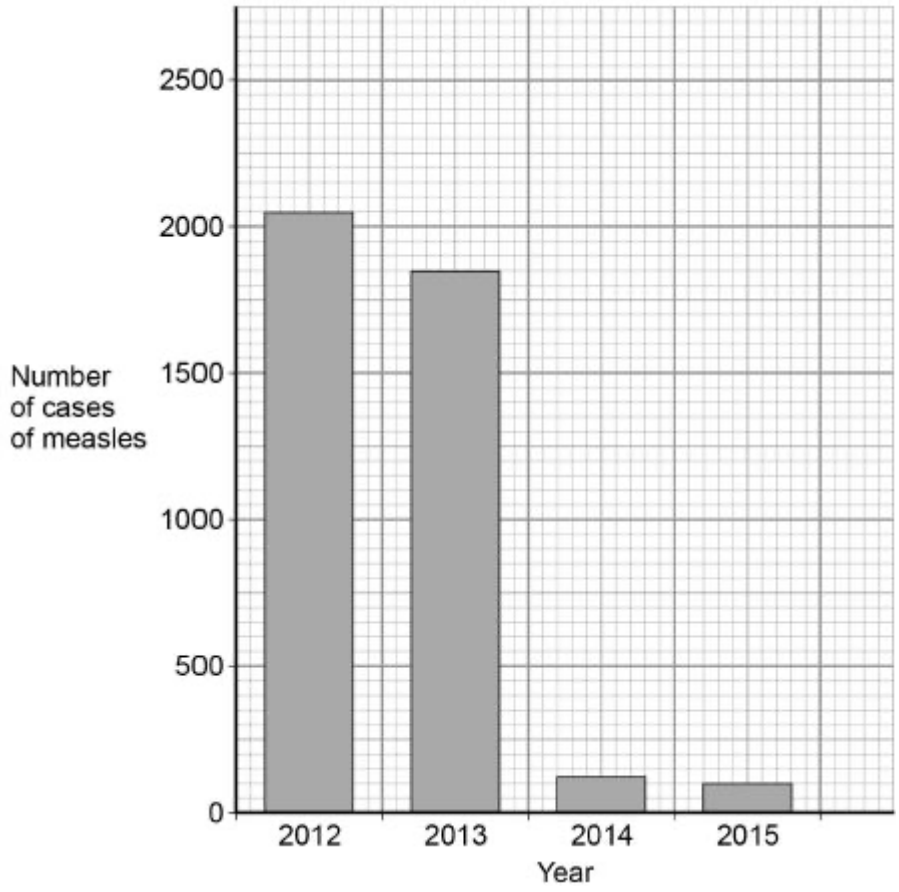
STEMUP.CO.UK

(3)

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

Figure 2 shows the number of cases of measles in England and Wales between 2012 and 2015

Figure 2



(c) Use **Figure 2** to calculate the decrease in the number of cases of measles between 2012 and 2015

_____

_____

Answer = _____ cases

(2)

(d) Suggest **one** reason for the decrease in the number of cases of measles between 2012 and 2015

_____

_____

(1)

(e) Antibiotics **cannot** be used to treat measles.

Suggest why.

STEMUP.CO.UK

_____

_____

(1)

(f) Gonorrhoea is a disease caused by a bacterium.

Gonorrhoea **can** be treated with antibiotics.

Give **one** other way to control the spread of gonorrhoea.

_____

_____

(1)

A scientist investigated how effective different antibiotics were at killing gonorrhoea bacteria.

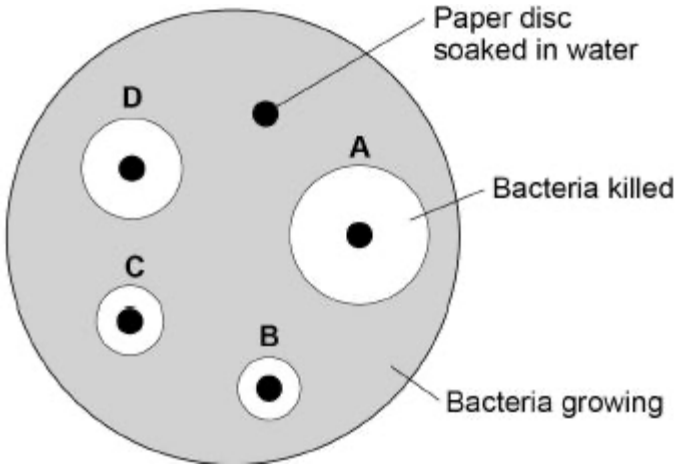
This is the method used.

1. Grow gonorrhoea bacteria on agar in a Petri dish.
2. Place one paper disc soaked in water onto the agar.
3. Place four other paper discs, each soaked in a different antibiotic, **A**, **B**, **C**, and **D**, onto the agar.
4. Use the same sized paper discs and the same concentration of each antibiotic.
5. Incubate the Petri dish for 3 days.

Figure 3 shows the scientist's results.

A clear area around the disc means the antibiotic has killed the bacteria.

Figure 3



(g) Give **one** control variable the scientist used.

_____

_____

(1)

(h) Suggest why **one** disc was soaked in water.

STEMUP.CO.UK

_____

_____

(1)

(i) Which antibiotic in **Figure 3** would be the best to treat gonorrhoea?

Give a reason for your answer.

Antibiotic _____

Reason _____

_____

(2)

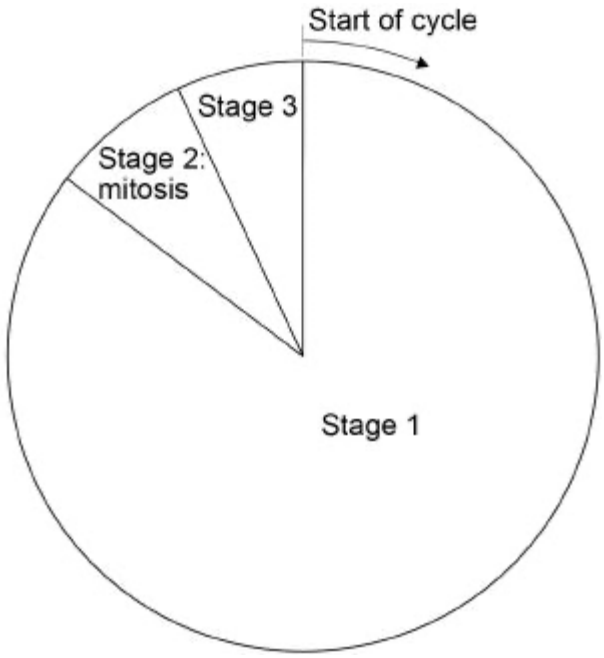
(Total 13 marks)

Q2.

Cells divide in a series of stages called the cell cycle.

Stage 2 of the cycle is mitosis.

The diagram below shows a simplified cell cycle for a human body cell.



(a) Draw **one** line from each stage in the cell cycle to what happens during that stage.

Stage in the cell cycle	What happens during that stage
Stage 1	Nucleus divides
Stage 2	Cell divides into two

STEMUP.CO.UK

Stage 3	Copies of the DNA are made

(2)

(b) The mass of DNA in a human body cell at the start of the cell cycle is 6 picograms.

What mass of DNA will be in each of the new cells produced by this cell division?

Tick **one** box.

- 3 picograms ☐
- 6 picograms ☐
- 9 picograms ☐
- 12 picograms ☐

(1)

(c) Stem cells are undifferentiated cells.

Which statement about stem cells is correct?

Tick **one** box.

- Animal stem cells are found in meristems ☐
- Animal stem cells divide by meiosis ☐
- Meristem cells in plants can differentiate throughout the life of the plant ☐
- Meristem cells in plants can only differentiate into one type of cell ☐

(1)

Stem cells from human embryos can differentiate into most types of human cell.

Research is being done into the use of embryonic stem cells in medical treatments.

The long-term effects of using embryonic stem cells in patients are not well understood.

In therapeutic cloning, human embryos are produced using a donated human egg cell and a cell from the patient.

- The embryo produced contains the same genetic information as the patient.
- Stem cells are taken from the embryo and stimulated to divide to form cells the

STEMUP.CO.UK

patient needs.

- The embryo is then destroyed.

(d) Suggest **two** advantages of therapeutic cloning.

1. _____

_____

2. _____

_____

(2)

(e) Suggest **two** disadvantages of therapeutic cloning.

1. _____

_____

2. _____

_____

(2)

(Total 8 marks)

Q3.

This question is about cell structures.

(a) Draw **one** line from each cell structure to the type of cell where the structure is found.

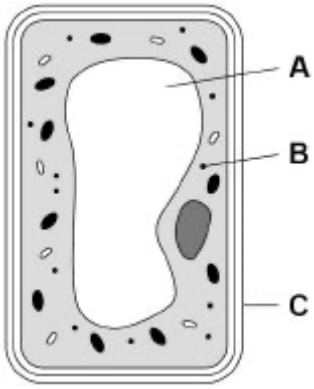
Cell Structure	Type of cell where the structure is found
Nucleus	Prokaryotic cells
Permanent vacuole	Plant cells only
Plasmid	Eukaryotic cells

(2)

(b) **Figure 1** shows a plant cell.

Figure 1

STEMUP.CO.UK



What are the names of structures **A**, **B** and **C**?

Tick **one** box.

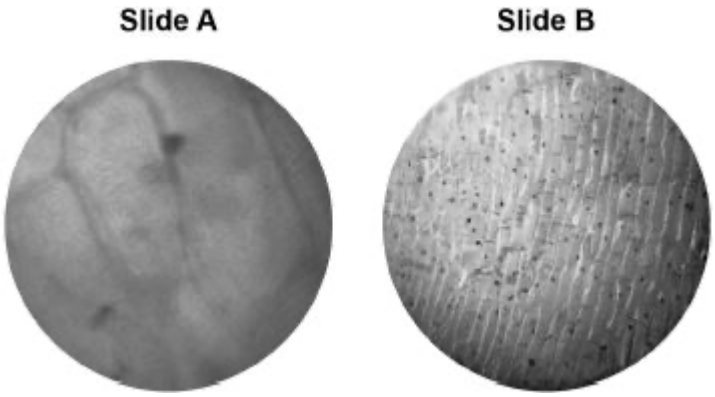
Structure A	Structure B	Structure C	
Chloroplast	Vacuole	Cell wall	☐
Nucleus	Chloroplast	Cell membrane	☐
Vacuole	Mitochondrion	Cell membrane	☐
Vacuole	Ribosome	Cell wall	☐

(1)

A student observed slides of onion cells using a microscope.

Figure 2 shows two of the slides the student observed.

Figure 2



The cells on the slides are **not** clear to see.

(c) Describe how the student should adjust the microscope to see the cells on Slide A more clearly.

_____

_____

(1)

STEMUP.CO.UK

(d) Describe how the student should adjust the microscope to see the cells on Slide B more clearly.

_____

_____

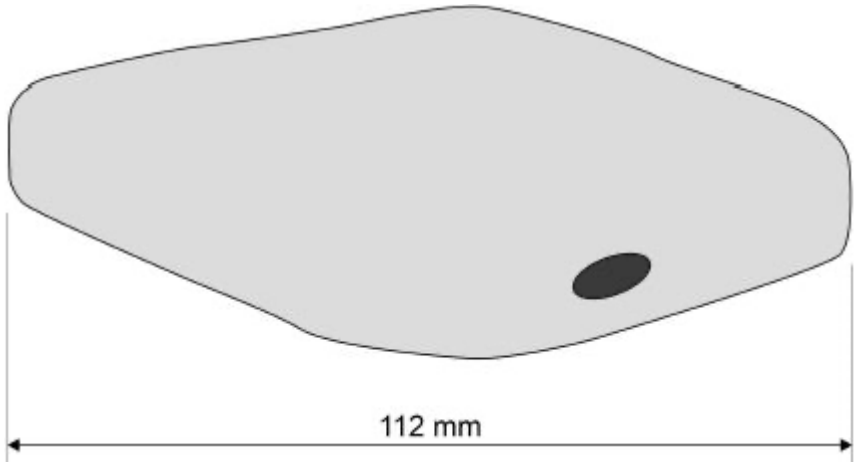
_____

(2)

(e) The student made the necessary adjustments to get a clear image.

Figure 3 shows the student's drawing of one of the cells.

Figure 3



The real length of the cell was 280 micrometres (μm).

Calculate the magnification of the drawing.

_____

_____

_____

_____

_____

Magnification = × _____

(3)

(Total 9 marks)

Q4.

This question is about stem cells.

(a) Give **one** place in a plant where stem cells are found.

_____

_____

STEMUP.CO.UK

(1)

(b) What is **one** economic use of plant stem cells?

Tick **one** box.

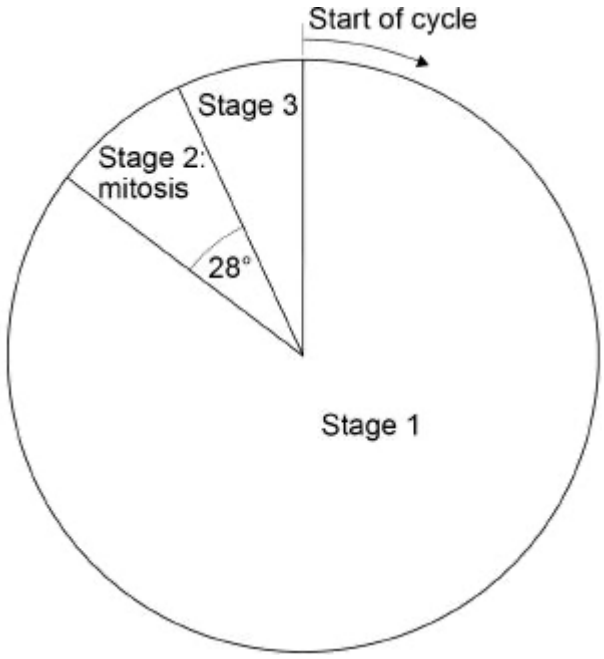
To create genetically modified crops	☐
To create new species of plants	☐
To increase variation in plants	☐
To produce large numbers of identical plants	☐

(1)

Embryonic stem cells divide by mitosis.

Figure 1 represents a cell cycle for a human embryonic stem cell.

Figure 1



(c) The mass of DNA in the cell at the start of the cycle is 6 picograms.

A picogram is 10^{-3} nanograms.

Convert 6 picograms to grams.

Give your answer in standard form.

_____

_____

STEMUP.CO.UK

Mass = _____ g

(1)

(d) The time taken for this complete cell cycle is 15 hours.

Calculate how many hours the cell spent in mitosis.

Give your answer to 3 significant figures.

_____

_____

_____

_____

Time spent in mitosis = _____ hours

(2)

(e) Describe what happens in each of the three stages of the cell cycle.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

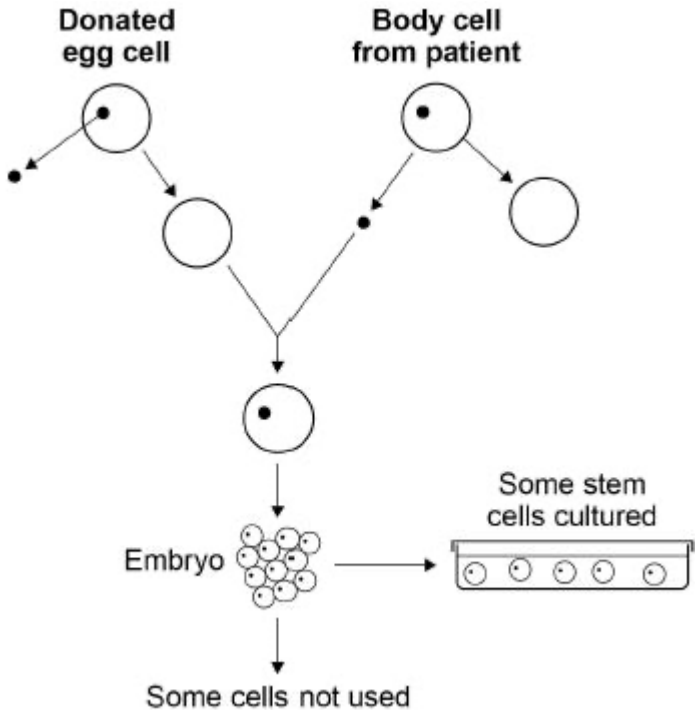
_____

(5)

(f) **Figure 2** shows how embryonic stem cells are produced in therapeutic cloning for use in patients.

Figure 2

STEMUP.CO.UK



Give **two** advantages and **two** disadvantages of therapeutic cloning in medical treatments.

Use **Figure 2** to help you.

Advantage 1 _____

_____

Advantage 2 _____

_____

Disadvantage 1 _____

_____

Disadvantage 2 _____

_____

(4)

(Total 14 marks)

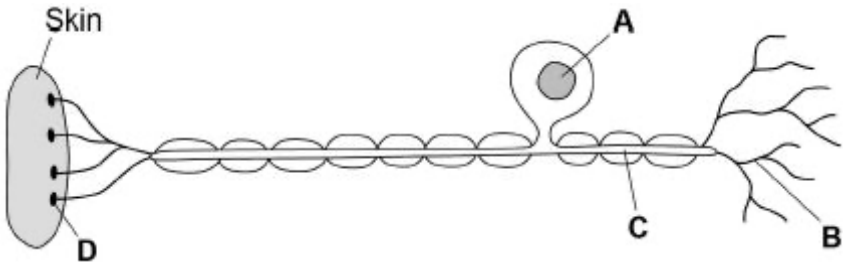
Q5.

This question is about coordination in the human body.

Figure 1 shows a sensory neurone (nerve cell).

Figure 1

STEMUP.CO.UK



(a) Which label is the cell nucleus?

Tick **one** box.

A ☐ B ☐ C ☐ D ☐

(1)

(b) Which label is the receptor?

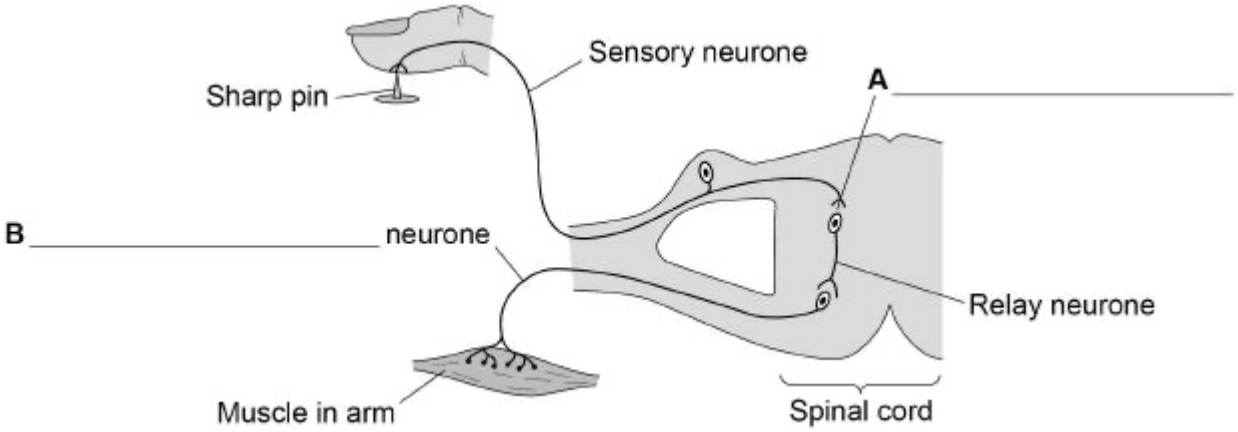
Tick **one** box.

A ☐ B ☐ C ☐ D ☐

(1)

(c) **Figure 2** shows the nerve pathway when a person touches a sharp pin.

Figure 2



Name structures **A** and **B** on **Figure 2**

(2)

(d) When the finger touches the sharp pin, the muscle in the arm contracts to pull the arm away.

What type of action is this?

Tick **two** boxes

STEMUP.CO.UK

A conscious action ☐

A delayed action ☐

A reflex action ☐

(1)

(e) Doctors tested people of different ages to time how long it took between touching a sharp pin and the arm muscle contracting.

At each age they tested five men and calculated a mean value for the time.

The table below shows the results.

Age in years	**Mean time for muscle to contract in milliseconds**
20	18
40	20
60	23
80	30

How much longer does it take for the muscle to contract at 80 years of age compared to at 20 years of age?

Give your answer in seconds.

_____

_____

_____

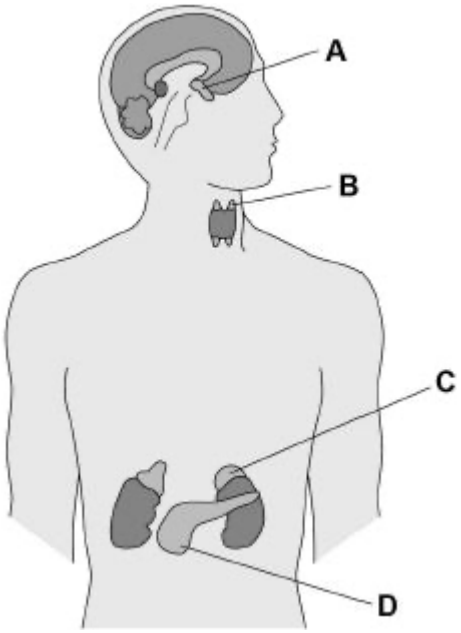
Time = _____ s

(2)

(f) **Figure 3** shows the position of some of the glands which release hormones.

Figure 3

STEMUP.CO.UK



Which label on **Figure 3** shows the position of the pituitary gland?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(g) Luteinising hormone (LH) is a hormone released by the pituitary gland.

What is the function of LH?

Tick **one** box.

Controls blood glucose concentration ☐

Controls the formation of sperm ☐

Controls the growth of muscles ☐

Controls the release of an egg ☐

(1)

(h) How does LH travel from the pituitary gland to its target organ?

_____

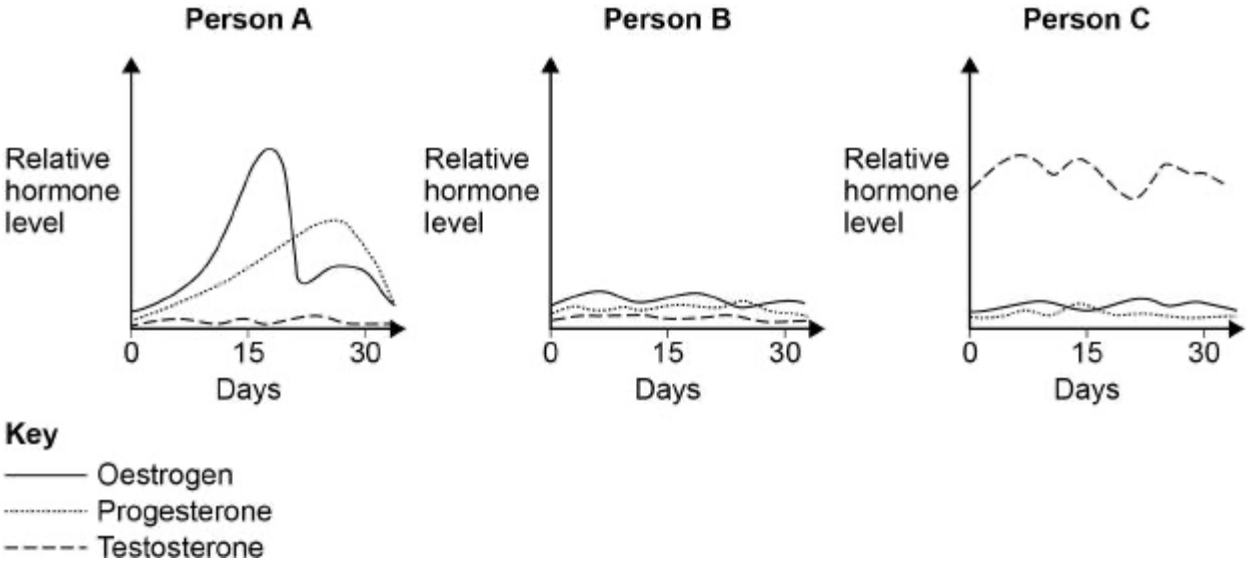
(1)

(i) **Figure 4** shows the relative levels of sex hormones of three young people over 30 days.

STEMUP.CO.UK

One person is an 8-year-old girl, one is an 18-year-old boy and the other is an 18-year-old girl.

Figure 4



Which person is the 18-year-old boy?

Give **one** reason for your answer.

Person _____

Reason _____

_____

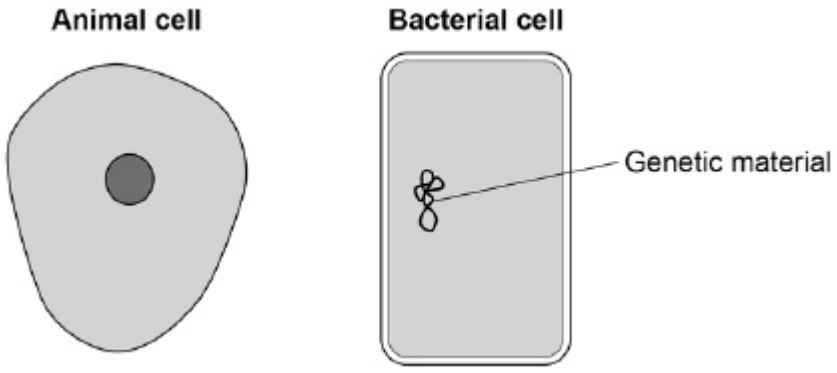
(2)

(Total 12 marks)

Q6.

Figure 1 shows an animal cell and a bacterial cell.

Figure 1



(a) Compare the structure of the cells in **Figure 1**.

Complete the sentences.

STEMUP.CO.UK

Choose the answers from the box.

cell membrane	**cell wall**	**chloroplast**
cytoplasm		**nucleus**

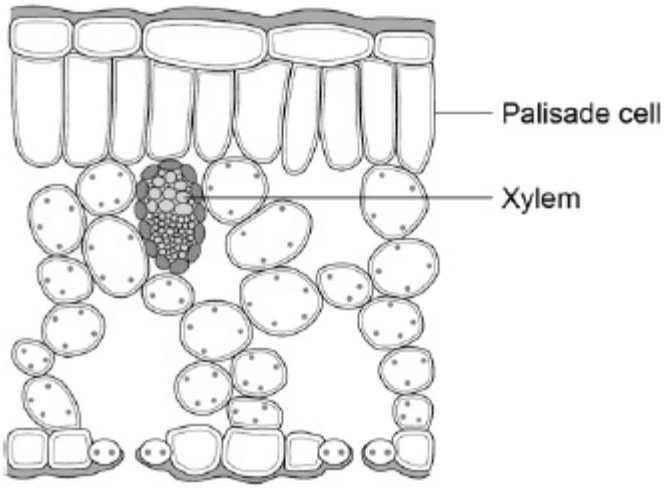
Only the animal cell contains a _____ .

Only the bacterial cell contains a _____ .

(2)

Figure 2 shows a section through a leaf.

Figure 2



(b) The function of palisade cells is to photosynthesise.

Describe **one** way palisade cells are adapted to carry out their function.

_____

_____

(1)

(c) Complete **Table 1** to show whether each structure is a tissue, an organ or an organ system.

Tick **one** box for each structure.

Table 1

Structure	**Tissue**	**Organ**	**Organ system**
Leaf			
Xylem			
Roots, stem and leaves			

(2)

STEMUP.CO.UK

A student observed palisade cells using a microscope.

The microscope had four objective lenses, each with a different magnification.

(d) Which objective lens should the student use first?

Tick **one** box.

Give a reason for your answer.

×4 magnification ☐

×10 magnification ☐

×40 magnification ☐

×100 magnification ☐

Reason _____

_____

(2)

The student measured the width of 5 different palisade cells at a total magnification of ×400

(e) Eyepiece lenses are usually ×5 or ×10 magnification.

What combination of eyepiece and objective lenses would give a total magnification of ×400?

Eyepiece lens _____

Objective lens _____

(1)

(f) **Table 2** shows the student's results.

Table 2

Cell	Width of cell image in mm
1	12
2	13
3	16
4	10
5	11

(f) Calculate the mean width of the palisade cell images.

STEMUP.CO.UK

Mean width = _____ mm

(1)

(g) Calculate the real width of a palisade cell.

Use the mean width you calculated in part (f).

Use the equation:

$$\text{real width} = \frac{\text{image width}}{\text{magnification}}$$

Real width = _____ mm

(2)

(Total 11 marks)

Q7.

Eukaryotic cells respire continuously to transfer energy.

(a) Give **two** uses of energy transferred by respiration in eukaryotes.

1. _____

2. _____

(2)

(b) Name the cell structure in a eukaryotic cell where aerobic respiration occurs.

(1)

(c) Muscle cells and plant cells can respire anaerobically.

Compare the processes of anaerobic respiration in muscle and plant cells.

STEMUP.CO.UK

_____

(4)

(d) Anaerobic respiration in muscle cells creates an oxygen debt.

What does oxygen debt mean?

_____

_____

(1)

(Total 8 marks)

Q8.

Food poisoning can be caused by eating food that is contaminated with *Salmonella* bacteria.

(a) Give **one** difference between a bacterial cell and an animal cell.

_____

_____

(1)

The table shows the number of confirmed cases of salmonella food poisoning in the UK.

Year	Confirmed cases per 100 000 population
2006	23.82
2007	22.24
2008	18.82
2009	17.17
2010	15.39
2011	15.12
2012	14.00
2013	13.16
2014	12.63
2015	14.50

It is estimated that in the UK, for every confirmed case of salmonella poisoning there are another 3 unconfirmed cases.

(b) Estimate the total probability of suffering from salmonella food poisoning in 2015.

_____

_____

STEMUP.CO.UK

_____

_____

_____

_____

(3)

(c) Describe the trend in the number of confirmed cases of salmonella food poisoning between 2006 and 2014.

_____

_____

(1)

(d) Suggest two reasons for the trend in the data between 2006 and 2014.

1. _____

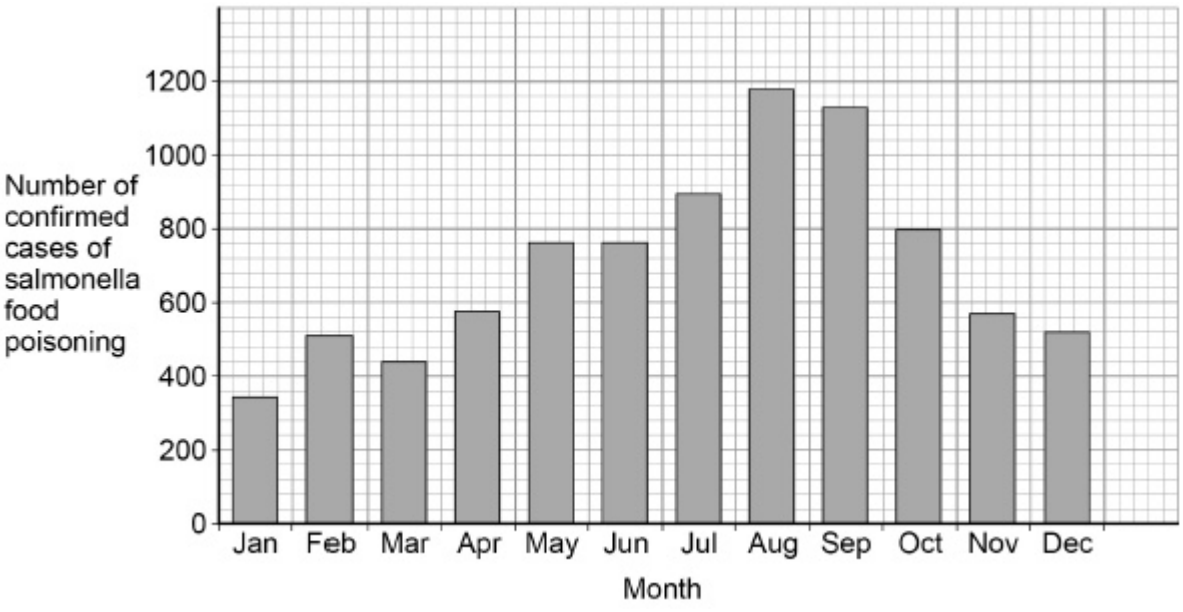
_____

2. _____

_____

(2)

(e) The graph shows the number of confirmed cases of salmonella food poisoning in the UK during one year.



Suggest **one** reason for the high number of cases of salmonella food poisoning in the summer.

_____

_____

(1)

STEMUP.CO.UK

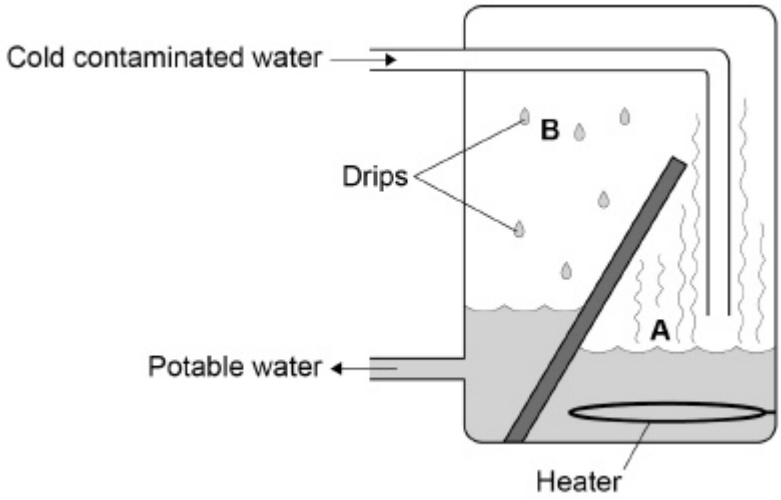
(Total 8 marks)

Q9.

Large water companies can treat millions of litres of water a day.

Figure 1 shows a distillation unit.

Figure 1



(a) What is happening to the water at point **A**?

Tick **one** box.

- Filtration ☐
- Evaporation ☐
- Melting ☐
- Sublimation ☐

(1)

(b) What is happening at point B?

Tick **one** box.

- Water is being boiled ☐
- Water is being lost ☐
- Water is condensing ☐
- Water is freezing ☐

(1)

STEMUP.CO.UK

(c) The water collected from the distillation unit is called potable water.

Complete the sentence.

Potable water is water that is _____ to drink.

(1)

(d) Give one disadvantage of using the distillation unit in **Figure 1** to produce potable water.

_____

_____

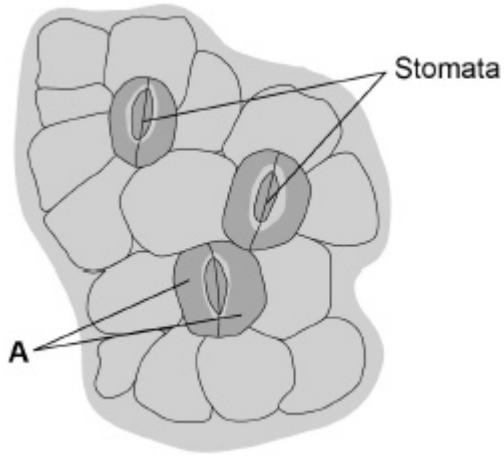
(1)

Plants need water to survive.

Water moves through a plant in the transpiration stream.

Figure 2 shows stomata on the underside of a leaf seen through a microscope.

Figure 2



(e) Name the cells labelled **A** in **Figure 2**.

_____

(1)

(f) Which **two** structures would you find in a plant cell and **not** in an animal cell?

Tick **two** boxes.

Chloroplasts ☐

Mitochondria ☐

Nucleus ☐

STEMUP.CO.UK

Permanent vacuole ☐

Ribosomes ☐

(2)

(g) One of the cells in **Figure 2** is 12 mm in length in the microscope image.

The size of the real cell is 0.03 mm

Calculate the magnification of the microscope.

Use the equation:

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

_____

_____

_____

_____

Magnification = _____

(2)

(h) The table shows the number of stomata on the underside of leaves from different plants.

Plant	**Number of stomata per mm²**
A	423
B	146
C	549
D	109

Which plant is most likely to lose the most water in warm weather?

Give a reason for your answer.

Plant _____

Reason _____

_____

(2)

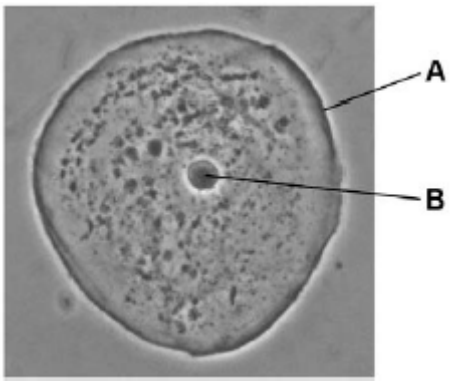
(Total 11 marks)

Q10.

STEMUP.CO.UK

Figure 1 shows an animal cell.

Figure 1



© alex-mit/iStock/Thinkstock

(a) What is structure **A**?

Tick **one** box.

- Cell membrane ☐
- Cell wall ☐
- Chromosome ☐
- Cytoplasm ☐

(1)

(b) What is structure **B**?

Tick **one** box.

- Chloroplast ☐
- Mitochondria ☐
- Nucleus ☐
- Vacuole ☐

(1)

(c) **Figure 2** shows a sperm cell.

STEMUP.CO.UK

Figure 2



Describe how a sperm cell is adapted to carry out its function.

_____

_____

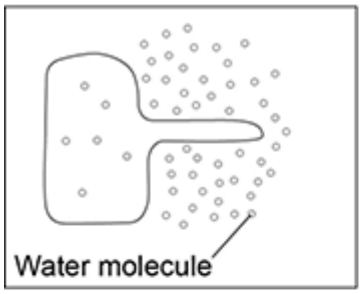
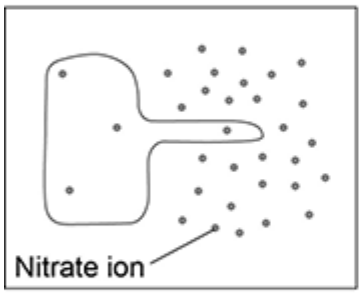
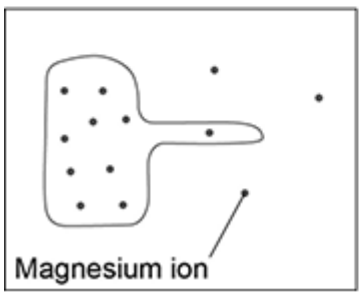
(1)

(d) Substances can move into and out of cells by three processes.

The diagrams show the concentration of different substances inside and outside a root hair cell.

How would each substance move into the root hair cell?

Draw **one** line from each root hair cell to the correct process.

Root hair cell	**Process**
	Active transport
	Diffusion
	Osmosis

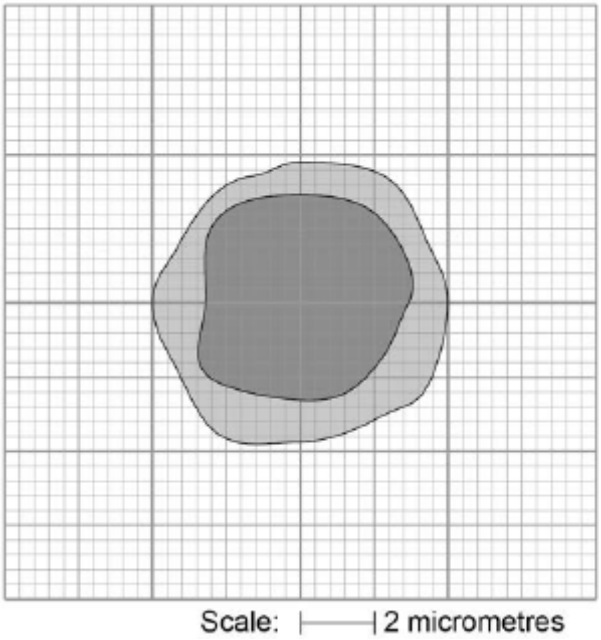
(2)

(Total 5 marks)

STEMUP.CO.UK

Q11.

The figure below shows a scale drawing of one type of cell in blood.



(a) Use the scale to determine the width of the cell.

Give your answer to the nearest micrometre.

Width of cell = _____ micrometres

(1)

(b) Complete the table below.

Part of the blood	Function
	Carries oxygen around the body
	Protects the body against infection
Plasma	

(3)

(c) Platelets are fragments of cells.

Platelets help the blood to clot.

Suggest what might happen if the blood did **not** clot.

STEMUP.CO.UK

(1)
(Total 5 marks)

Q12.

Pathogens cause infectious diseases in animals and plants.

(a) Draw **one** line from each disease to the type of pathogen that causes the disease.

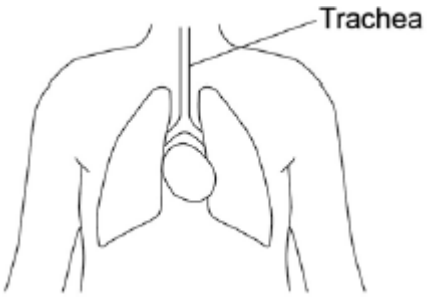
Disease	Type of pathogen
Gonorrhoea	Bacterium
Malaria	Fungus
Measles	Protist
	Virus

(3)

(b) Some parts of the human body have adaptations to reduce the entry of live pathogens.

Look at **Figure 1**.

Figure 1



Explain how the trachea is adapted to reduce the entry of live pathogens.

STEMUP.CO.UK

_____

_____

(4)

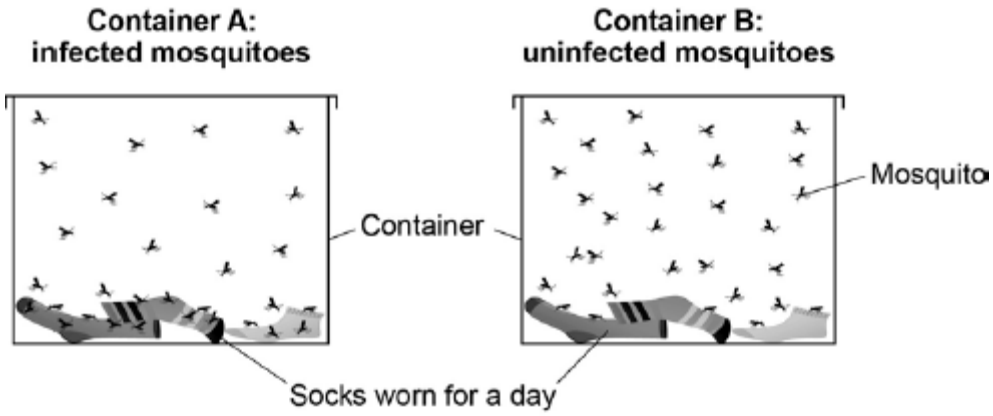
(c) Malaria is a serious disease that can be fatal.

Malaria is spread to humans by infected mosquitoes.

Scientists investigated the behaviour of mosquitoes to understand how the spread of malaria could be controlled.

Figure 2 shows the equipment the scientists used.

Figure 2



This is the method used.

1. 30 mosquitoes **infected with malaria** were placed in Container **A**.

2. 30 **uninfected** mosquitoes were placed in Container **B**.

3. The total number of times the mosquitoes landed on the socks was recorded.

Name the dependent variable and suggest **one** control variable in this investigation.

Dependent variable _____

_____

Control variable _____

_____

(2)

(d) Infected mosquitoes landed on the socks three times more often than uninfected mosquitoes.

Explain how this information can be used to reduce the spread of malaria.

_____

_____

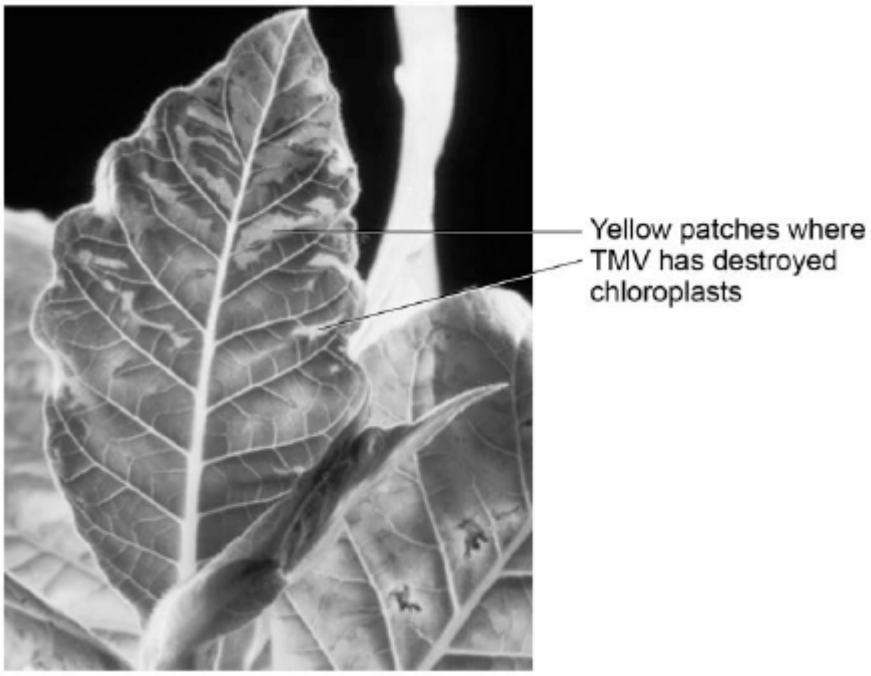
STEMUP.CO.UK

(2)

(e) Tobacco mosaic virus (TMV) affects many species of plant.

Figure 3 shows a leaf infected with TMV.

Figure 3



© Nigel Cattlin/Getty Images

TMV destroys chloroplasts in the leaf.

Explain how this could affect the growth of the plant.

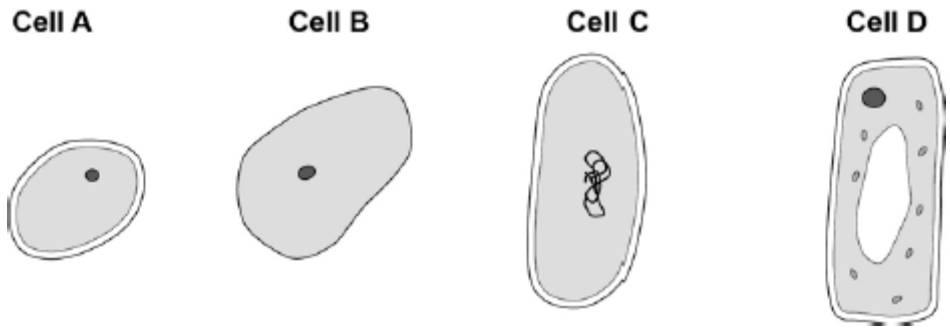
(3)

(Total 14 marks)

Q13.

The figure below shows four different types of cell.

STEMUP.CO.UK



(a) Which cell is a plant cell?

Give **one** reason for your answer.

Cell _____

Reason _____

(2)

(b) Which cell is an animal cell?

Give **one** reason for your answer.

Cell _____

Reason _____

(2)

(c) Which cell is a prokaryotic cell?

Give **one** reason for your answer.

Cell _____

Reason _____

(2)

(d) A scientist observed a cell using an electron microscope.

The size of the image was 25 mm.

The magnification was × 100 000

Calculate the real size of the cell.

Use the equation:

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

Give your answer in micrometres.

_____

_____

_____

STEMUP.CO.UK

Real size = _____ micrometres

(3)

(Total 9 marks)

Q14.

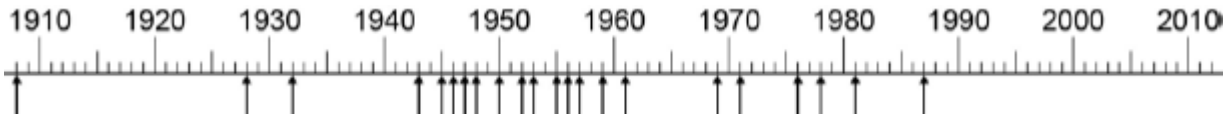
(a) Some antibiotics work by destroying the cell membranes of bacteria.

Suggest why these antibiotics may have side effects in the animals that are given these antibiotics.

_____

(1)

(b) Each arrow on the figure below shows the date of discovery of each new type of antibiotic.



In which 10 year period were most new types of antibiotic discovered?

_____

(1)

(c) The figure above shows 22 new types of antibiotic. These were discovered before 2010.

Determine the percentage of types of antibiotic that have been discovered between 1980 and 2010.

Use information from the figure above.

Give your answer to 2 significant figures.

_____

_____

_____ %

(2)

(d) Bacteria can evolve rapidly.

Many bacteria can develop into new strains which are resistant to antibiotics.

Complete the table below to show if each action is **more likely** or **less likely** to help bacteria to become antibiotic resistant.

Put a tick in each row.

Action	More likely	Less likely
Take painkillers for headache		

STEMUP.CO.UK

Washing with antiseptic hand gel		
Adding antibiotics to food for cows		
Giving antibiotics for colds and flu		
Stopping antibiotics as soon as you feel better		

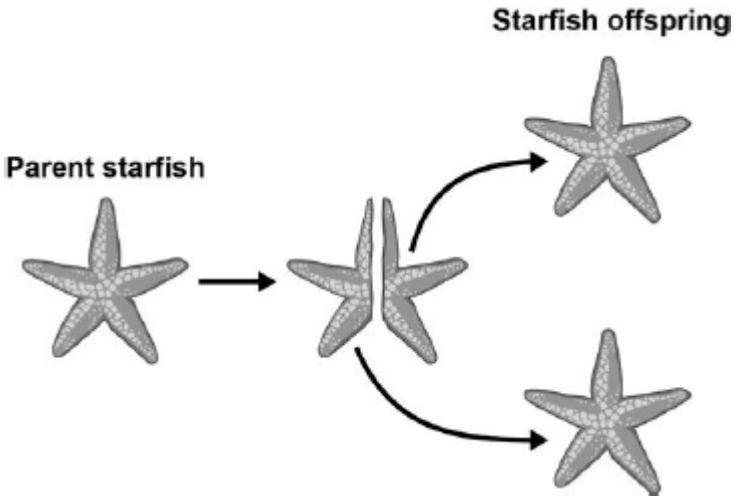
(4)

(Total 8 marks)

Q15.

Starfish can split in half. Each half can then grow new arms to form offspring.

This process is shown in the figure below.



(a) What process produces the starfish offspring?

Tick **one** box.

Asexual reproduction ☐

Fertilisation ☐

Selective breeding ☐

Sexual reproduction ☐

(1)

(b) More cells are produced as the starfish grows more arms.

What process will produce more cells in the starfish as they grow?

_____

(1)

STEMUP.CO.UK

(c) All the offspring produced are genetically identical.

What name is given to genetically identical organisms?

_____

(1)

(d) Each body cell of the parent starfish contains 44 chromosomes.

How many chromosomes are in each body cell of the offspring?

_____

(1)

(Total 4 marks)

Q16.

Different antibiotics destroy bacteria in different ways.

- Some antibiotics disrupt the bacterial cell membrane.
- Some antibiotics disrupt the bacterial cell wall.

(a) Antibiotics that disrupt the bacterial cell membrane often cause more side effects in humans compared with antibiotics that disrupt bacterial cell walls.

Suggest why.

_____

(1)

(b) Some antibiotics prevent ribosomes functioning.

Suggest how this damages the bacterium.

_____

(1)

(c) Drug manufacturers are spending less on research into new antibiotics.

One reason why is because new antibiotics are rarely prescribed.

Some people think that governments should pay drug manufacturers to develop new antibiotics.

Suggest why.

_____

_____

_____

_____

_____

STEMUP.CO.UK

_____

_____

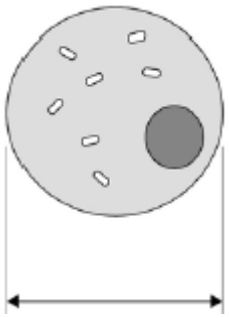
(3)

(Total 5 marks)

Q17.

Figure 1 shows a cell viewed through a light microscope.

Figure 1



The size of the real cell is 0.03 mm.

(a) Calculate the magnification of the microscope.

Use **Figure 1** to help you answer.

_____

_____

Magnification = _____

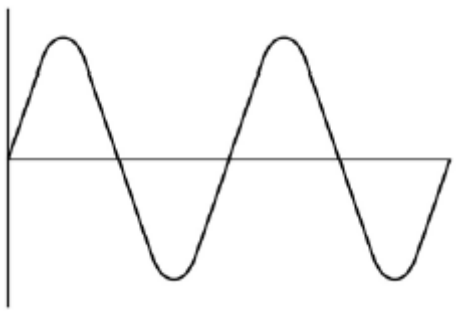
(2)

(b) A light microscope uses light waves to observe objects.

Light waves can be modelled using water waves.

Figure 2 shows a water wave.

Figure 2



Give **one** similarity between a light wave and a water wave.

_____

(1)

STEMUP.CO.UK

(c) Write down the equation that links frequency, wave speed and wavelength.

_____

(1)

(d) The wave in **Figure 2** has a wavelength of 75 cm.

The wave moves at a speed of 1.6 m / s.

Calculate the frequency of the wave.

_____

_____

_____

_____

_____

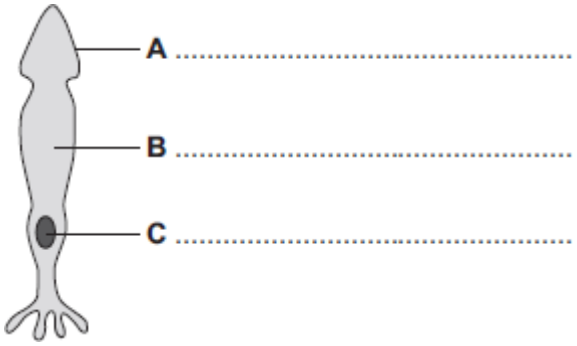
Frequency = _____ Hz

(4)

(Total 8 marks)

Q73.

(a) The diagram shows a light receptor cell.



Label structures **A**, **B** and **C** on the diagram.

(3)

(b) It is important that the nervous system can detect stimuli.

Give **two** reasons why.

_____

_____

_____

_____

(2)

(Total 5 marks)

STEMUP.CO.UK

Q74.

Cells called receptors detect stimuli in the environment.

The diagram shows a light receptor cell.



Use words from the box to label structures **A**, **B** and **C**.

Cell membrane	**Cytoplasm**	**Nucleus**	**Synapse**

(Total 3 marks)

STEMUP.CO.UK