Organisation part 7

headstartscience.co.uk

Name: _____

Class: _____

Date: _____

Time: **80 minutes**

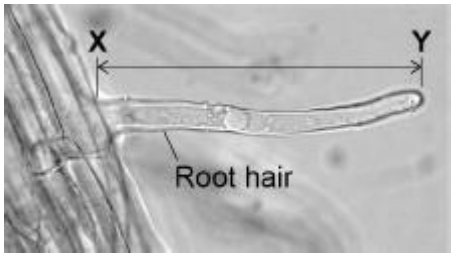
Marks: **76 marks**

Comments:

Q1.

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

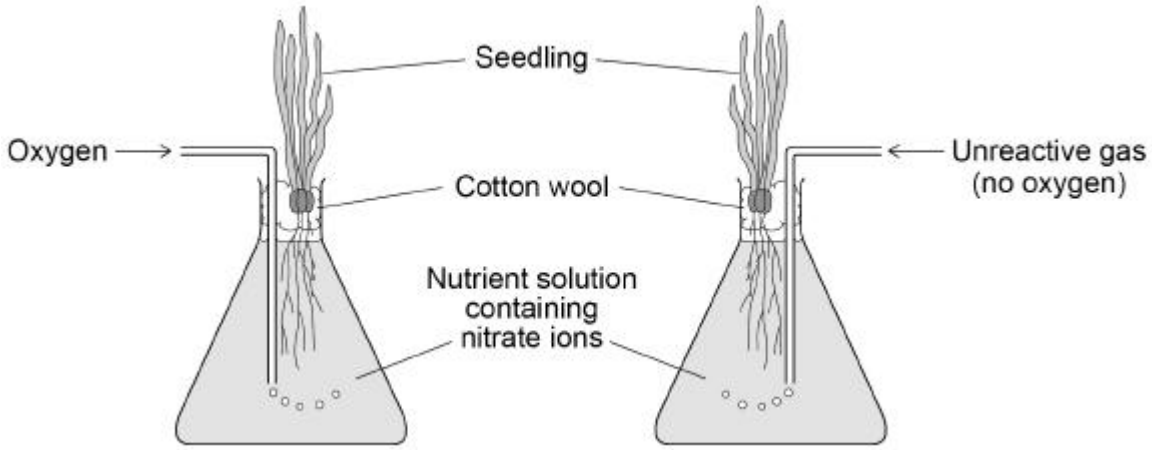
(4)

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)

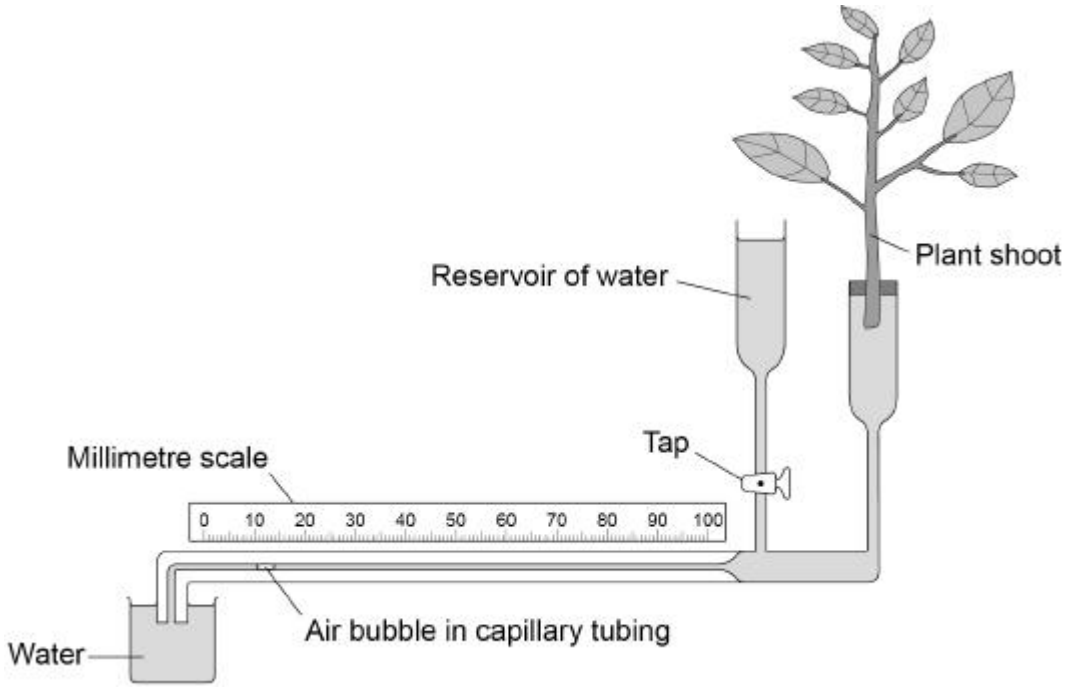
(Total 18 marks)

Q2.

A student used a potometer to investigate the rate of water uptake in a plant shoot.

Figure 1 shows a potometer.

Figure 1



As the shoot takes in water the air bubble moves.

The rate of water uptake is the distance the air bubble moves in a given time.

This is the method used.

1. Place the potometer in moist air at 25 °C
2. Position the air bubble at 0 mm in the capillary tube.
3. Record the position of the air bubble in the capillary tube every minute for 5 minutes.
4. Repeat steps 2 and 3 with the potometer in different conditions.

Table 1 shows the conditions used.

Table 1

Investigation	Conditions
A	Moist air at 25 °C
B	Dry air at 15 °C
C	Dry air at 25 °C

(a) After investigation **A** the air bubble had moved part way along the capillary tube.

Suggest how the student moved the air bubble back to 0 mm for the start of investigation **B**.

_____

_____

(1)

(b) Capillary tubing is very narrow.

Explain why narrow tubing was used.

_____

_____

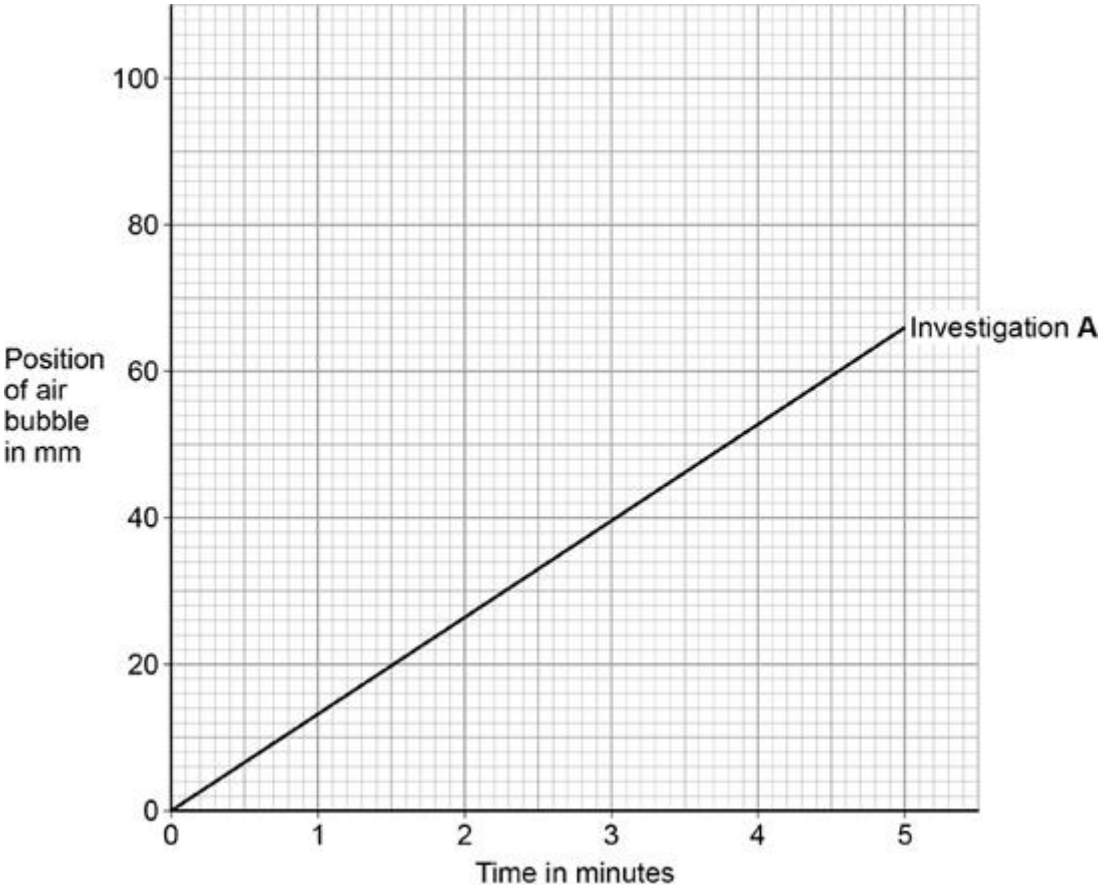
_____

_____

(2)

Figure 2 shows the results for investigation **A**.

Figure 2



(c) The cross-sectional area of the capillary tube was 0.8 mm^2

Calculate the rate of water uptake for investigation **A** in mm^3/min

_____

_____

_____

_____

_____

Rate = _____ mm^3/min

(3)

(d) **Table 2** shows the results from investigation **B**.

Table 2

Time in minutes	Position of air bubble in mm
0	0
1	6
2	16
3	22
4	30
5	42

Plot the data from **Table 2** on **Figure 2**.

You should:

- draw a line of best fit
- label the line **B**.

(3)

(e) Investigation **C** was carried out in dry air at 25 °C

Draw a line on **Figure 2** to show the results you would expect for investigation **C**.

Label the line **C**.

(1)

(f) The investigations were carried out in daylight.

The air bubble would **not** move if the investigations were done in the dark.

Explain why.

_____

_____

_____

_____

_____

_____

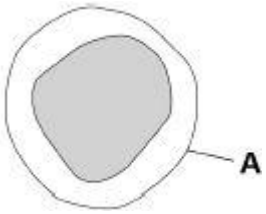
(3)

(Total 13 marks)

Q3.

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.

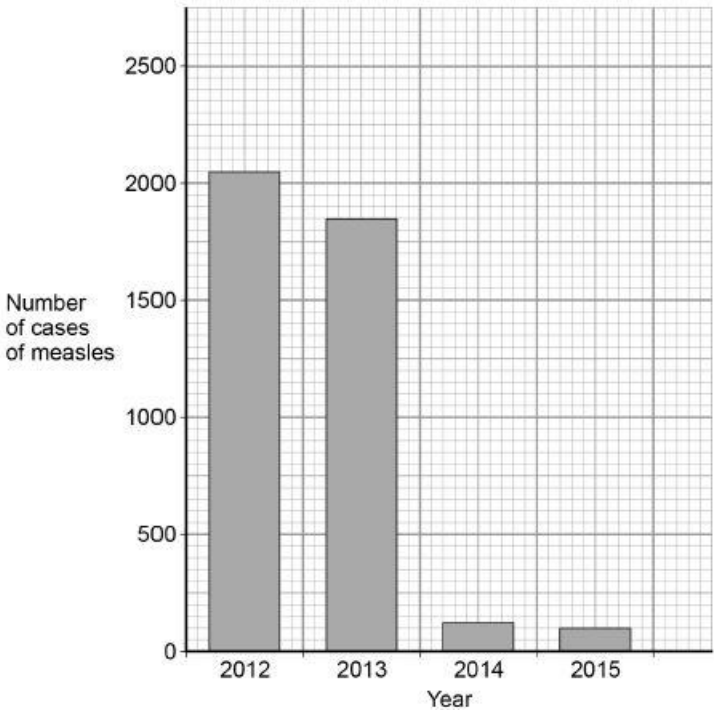
- Clone pathogens ☐
- Engulf pathogens ☐
- Produce antibiotics ☐
- Produce antibodies ☐
- Produce antitoxins ☐
- Produce toxins ☐

(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.

_____

_____

(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.

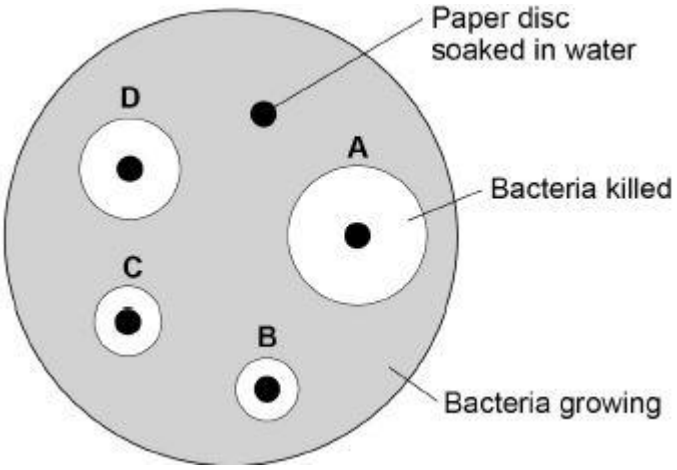
This is the method used.

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.

_____

_____

(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)

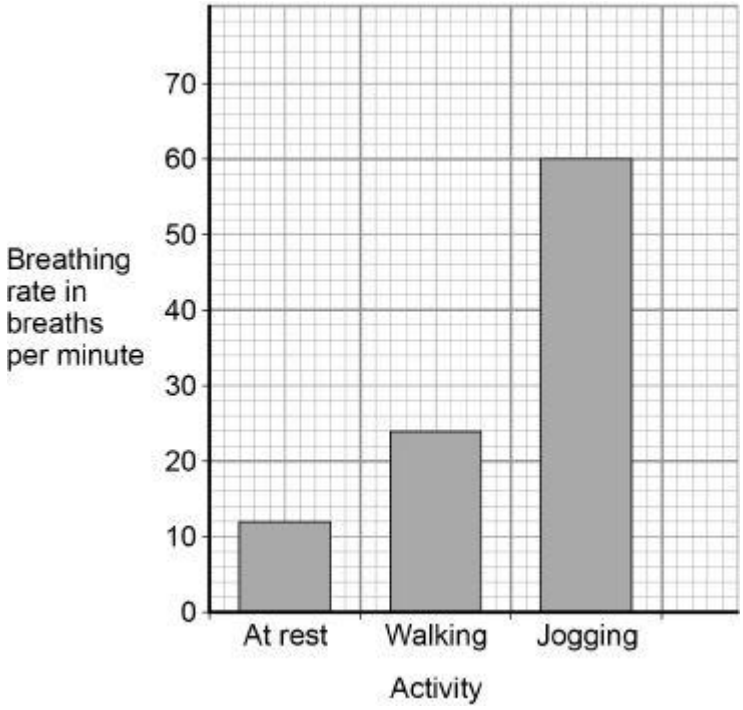
Q4.

Exercise can improve health.

A student measured her breathing rate at rest, when walking and when jogging.

Figure 1 shows her results.

Figure 1



(a) Compare the breathing rates when doing the **three** different activities.

Use values from **Figure 1** in your answer.

_____

_____

_____

_____

(3)

(b) Explain why the breathing rate changes when doing different activities.

_____

_____

_____

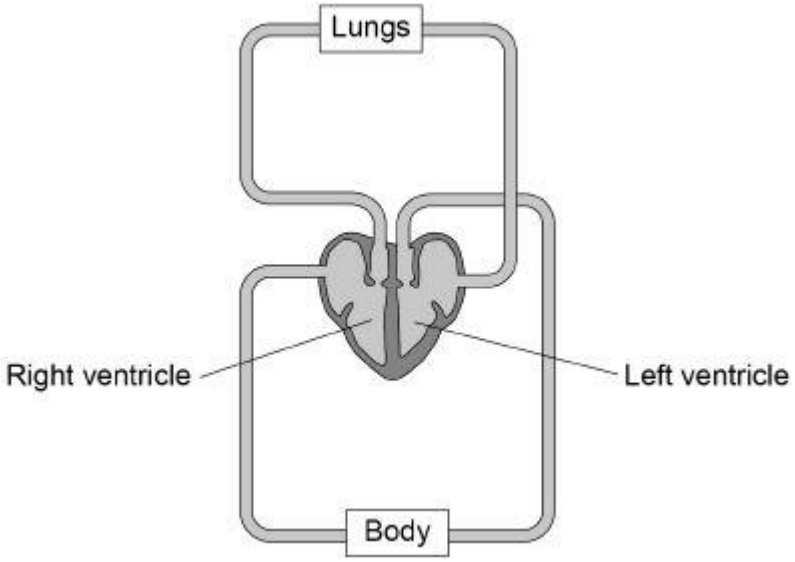
_____

_____

(3)

Figure 2 shows the heart in the circulatory system.

Figure 2



(c) The heart is a double pump.

Describe what this means.

Use **Figure 2** to help you.

_____

_____

_____

_____

(2)

(d) The wall of the left ventricle is much thicker than the wall of the right ventricle.

Suggest **one** reason for this.

_____

_____

_____

(1)

(e) People are encouraged to exercise after recovering from a heart attack.

Suggest **one** reason why.

_____

_____

(1)

(Total 10 marks)

Q5.

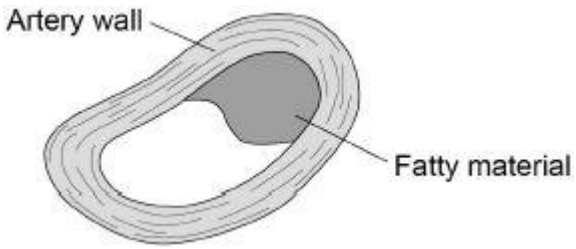
Coronary heart disease (CHD) is a non-communicable disease.

CHD is caused when fatty material builds up in the coronary arteries.

(a) Explain what a non-communicable disease is.

(2)

The diagram below shows a coronary artery of someone with CHD.



(b) Explain how CHD can cause a heart attack.

(3)

(c) Explain how lifestyle and medical risk factors increase the chance of developing CHD.

_____

_____

_____

_____

_____

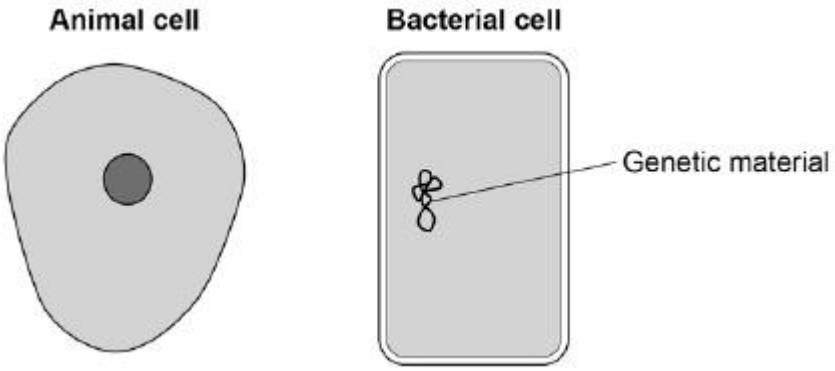
(6)

(Total 11 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.

Choose the answers from the box.

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

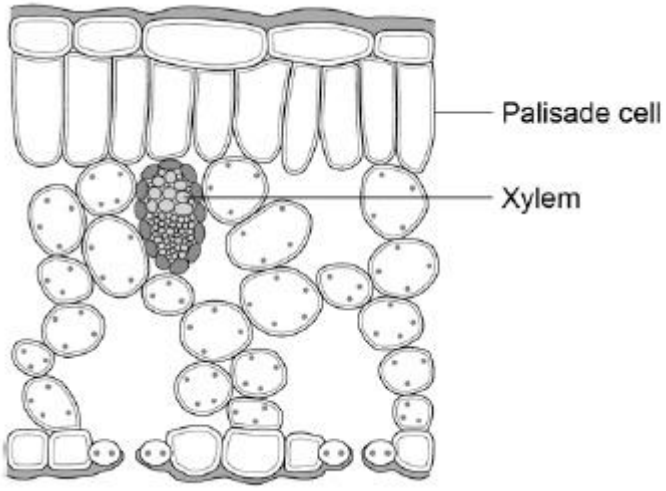
Only the animal cell contains a _____ .

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)

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.

_____

_____

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)

Q1.

(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]

Q2.

(a) opened and closed the tap (so water enters from reservoir)
allow opened the tap (carefully / gently)

1

(b) air bubble moves further (in a given time)
allow air bubble moves faster

1

(so) resolution is improved
allow it is easier to see a small change (in volume)
ignore is easier to measure unqualified

allow measurements are more accurate
ignore to make test more accurate
ignore references to precision or validity

1

(c)

*an answer of 10.56 (mm^3/min) scores **3** marks*

$\frac{66}{5}$

or

13.2 (mm/min)

*allow tolerance of ± $\frac{1}{2}$ square allow full marks from calculation from other **correct** pairs of readings*

allow value in range 13 to 13.4 for $\frac{66}{5}$ only

ignore $\frac{66}{5}$ or 12.6

1

13.2 × 0.8

allow their calculated value in the range from 12 to 14 × 0.8

1

10.56 (mm^3/min)

allow 10.6 or 11

1

(d) points plotted correctly

allow +/- $\frac{1}{2}$ a square
allow 1 mark for 4/5 correct plots

2

suitable line of best fit

1

(e) straight line starting at 0,0 with a steeper gradient than A

1

(f) no photosynthesis

allow plants need light for photosynthesis

1

(so) stomata closed (as no carbon dioxide needed)

1

(so) no transpiration

*allow very little transpiration **or** little water lost*

1

[13]

Q3.

(a) cell membrane

extra ticks negates marks

1

(b) engulf pathogens

1

produce antibodies

1

produce antitoxins

1

extra ticks negates marks

(c) 2050 − 100

1

= 1950

*allow **1** mark for a correct subtraction of incorrect values*

1

*an answer of 1950 scores **2** marks*

(d) any **one** from:

- (more) people vaccinated

  ignore injections / treatments / medicines unqualified
  allow vaccine produced
  allow (more people given) MMR (vaccine)
  *do **not** allow antibiotics*
  ignore less people infected

- (more) people immune
- no new measles strain

1

(e) any **one** from:

- measles is (caused by) a virus

  allow measles is not caused by a bacterium

- viruses cannot be killed / destroyed by antibiotics

  *allow antibiotics **only** kill / destroy bacteria*
  ignore harmed / treated

1

(f) any **one** from:

- use of a barrier method of contraception

  ignore use of diaphragm

- use of a condom

  ignore use protection / safe sex

- vaccination / immunisation
- avoid sexual intercourse / contact

  *do **not** accept less sexual intercourse / contact*

1

(g) any **one** from:

- size / shape/ type of paper disc

  ignore paper disc unqualified

- concentration of antibiotic

  allow strength / dosage of antibiotic
- volume / amount of antibiotic
- (incubation) time

  allow 3 days
- (incubation) temperature

  ignore size of petri dish

1

(h) to check that the disc / water did not have an effect
or
to make sure it was the antibiotic that had an effect

allow for comparison with the antibiotics

allow as a (experimental) control

*do **not** accept as a control variable*

1

(i) (antibiotic) **A**

no marks if wrong antibiotic given

1

any **one** from:
- (antibiotic **A**) had the larg**est** clear area around it
- (antibiotic **A**) killed the **most** bacteria

1

[13]

Q4.

(a) breathing rate when walking is twice that at rest

allow breathing rate when walking is 12 (breaths / minute) more than at rest

1

breathing rate when jogging is 5 times that at rest

allow breathing rate when jogging is 48 (breaths / minute) more than at rest

1

breathing rate when jogging is 2.5 times that when walking

allow breathing rate when jogging is 36 (breaths / minute) more than when walking

1

*allow for **1** mark if no other marks gained:*
breathing rate at rest is 12 (breaths per minute),
breathing rate when walking is 24 (breaths per minute) and breathing rate when jogging is 60 (breaths per minute)
or
breathing rate increases with increasing activity

***max 2** marks if written in terms of heart rate*

(b) (breathing rate increases)

to supply more oxygen / O_2
or
to supply oxygen / O_2 faster

allow to remove more carbon dioxide / CO_2
or
to remove carbon dioxide / CO_2 faster
*do **not** accept incorrectly written formulae*

1

for (aerobic) respiration
or
to reduce anaerobic respiration
or
to reduce lactic acid build up

1

(so) that more energy is transferred / released
or
(because) more energy is required

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

1

reference to more / faster required at least once for full marks

(c) right ventricle / side of the heart pumps (blood) to the lungs

1

left ventricle / side of the heart pumps (blood) to the body

1

*if no other marks scored allow **1** mark for one side pumps blood to the lungs and the other side pumps blood to the body*

(d) any **one** from:

- (the left ventricle) has to pump blood further (than the right ventricle)

  allow (the left ventricle) has to pump blood all around the body

- (the left ventricle) has to pump blood with a greater force (than the right ventricle)

  allow (left ventricle) has to pump blood harder

- (the left ventricle) has to pump blood at a higher pressure (than the right ventricle)

1

there must be a comparative statement

(e) any **one** from:

- strengthens heart (muscle)

- reduces chance of another heart attack

  ignore prevents / no heart attacks

- reduces / controls weight

- improves circulation

  allow decreases chance of fatty deposits
  ***or** fat building up (in arteries / blood vessels)*

  allow reduces resting heart rate

1

[10]

Q5.

(a) is not caused by a pathogen / infective organism

allow not caused by a microorganism / microbe
ignore not caused by infection

ignore named pathogen unless bacteria, virus and fungus all mentioned

1

(so) is not passed / spread (from person to person)

allow cannot be spread / caught
allow is not infectious / contagious

1

(b) reduced / restricted / stopped blood flow

it does not matter where blood flow is restricted to − heart / body

1

(so) less oxygen reaches heart (muscle / cells)

must reference heart / it
allow no oxygen reaches the heart (muscle / cells)

1

(so heart muscle / cells) cannot respire (enough)

or
(so heart muscle / cells) do not release (enough) energy

*do **not** accept do not make / produce / create energy*

ignore references to breathing / suffocation

ignore blood clots / blockages

1

allow 'it' for heart

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

5−6

Level 2: Relevant points (factors / effects) 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

Indicative content

medical risk factors:
- high blood pressure
- high cholesterol
- diabetes
- genetic factors
- medications

lifestyle risk factors:
- smoking
- obesity
- lack of exercise
- high fat / energy diet
- eating insufficient fruit / vegetables
- alcohol
- high salt intake
- exposure to air pollution
- certain drugs / correct named drug

examples of links:
- smoking − high bp / cholesterol / fatty deposition
- obesity − lack of exercise / high bp / cholesterol / fatty deposition / diabetes
- exercise − obesity / bp /diabetes
- diet − obesity / cholesterol / diabetes
- alcohol − bp / cholesterol
- high salt intake − high blood pressure
- genetic factors − bp / cholesterol / diabetes / obesity
- medication − can affect blood / blood vessels / metabolism

the main discriminator is the quality of linking
both lifestyle and medical factors are required for **level 3**

[11]

Q6.

(a) nucleus

1

cell wall

1

(b) any **one** from:

- contain (many) chloroplasts
- positioned near the top surface of the leaf
- packed closely together

1

(c)

Structure	Tissue	Organ	Organ system
Leaf		✓	

Xylem	✓		
Roots, stem and leaves			✓

additional tick in a row negates the credit for that row

allow **1** mark for two correct rows

2

(d) ×4

1

reason: any **one** from:

- gives the largest field of view
- easier to focus

1

(e) eyepiece lens: ×10
and
objective lens: ×40

or

eyepiece lens: ×5
and
objective lens: ×80

allow sensible suggestions that give a magnification of ×400

1

(f) 12.4 (mm)

allow 12 (mm)

1

(e) real width = $\frac{12.4}{400}$

1

0.031 (mm)

*an answer of 0.031 (mm) scores **2** marks*
allow ecf from part (f)

1

[11]