Cell Biology part 7 AQA Combined Science

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Name: _____

Class: _____

Date: _____

Time: **70 minutes**

Marks: **66 marks**

Comments:

Q1.

This question is about stem cells.

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

_____

_____

(1)

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

Tick **one** box.

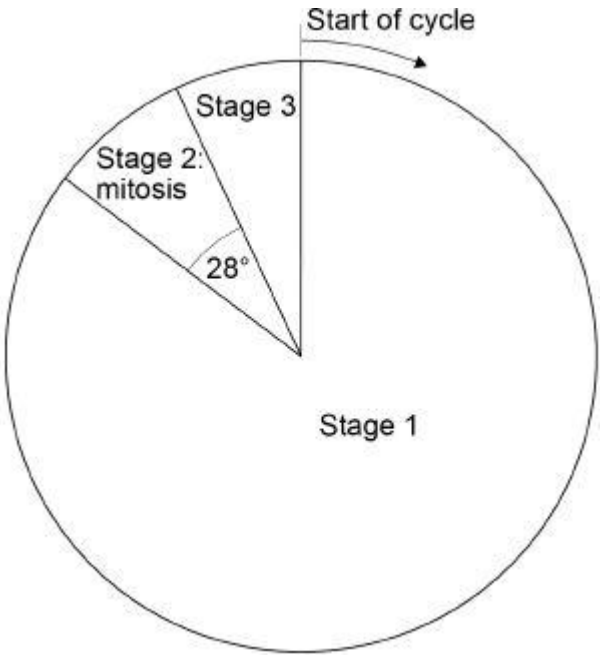
To create genetically modified crops	☐
To create new species of plants	☐
To increase variation in plants	☐
To produce large numbers of identical plants	☐

(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.

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

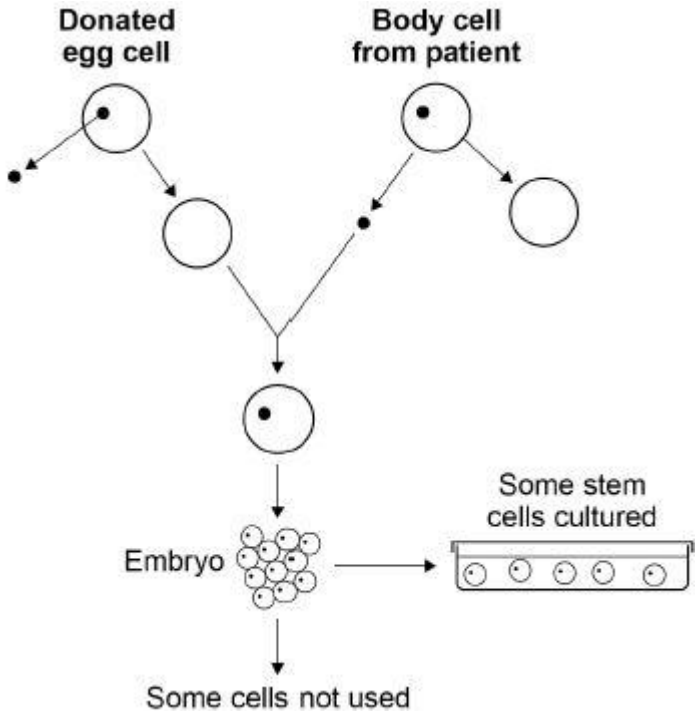
(2)

(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



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)

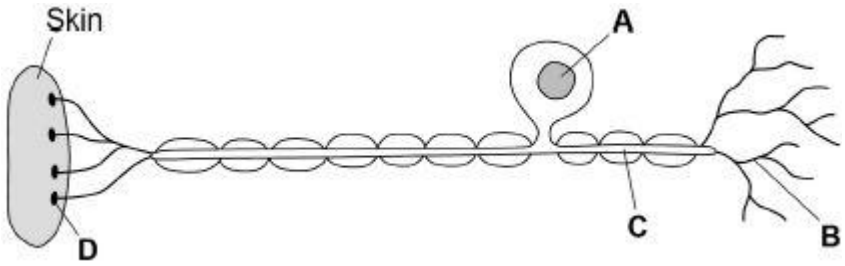
(Total 14 marks)

Q2.

This question is about coordination in the human body.

Figure 1 shows a sensory neurone (nerve cell).

Figure 1



(a) Which label is the cell nucleus?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(b) Which label is the receptor?

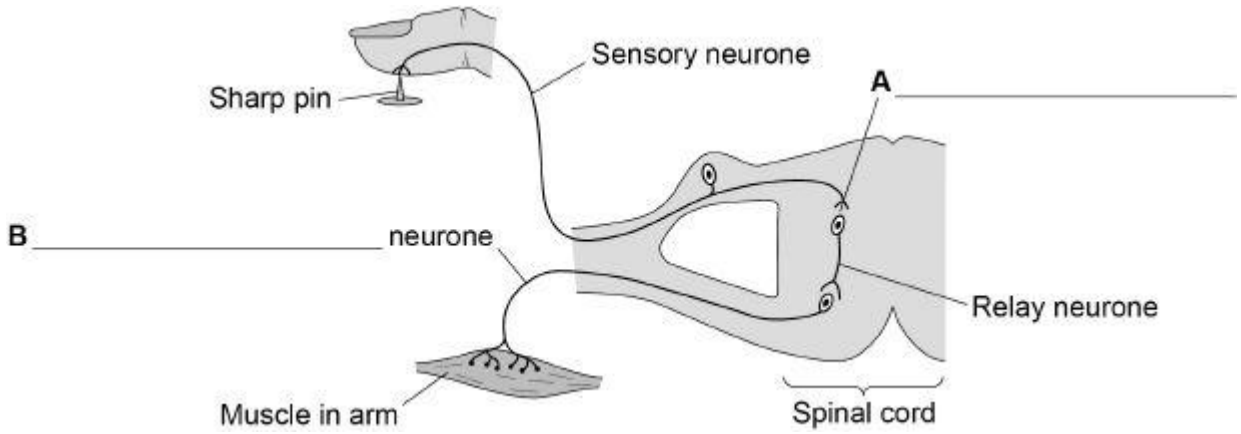
Tick **one** box.

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

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.

_____

_____

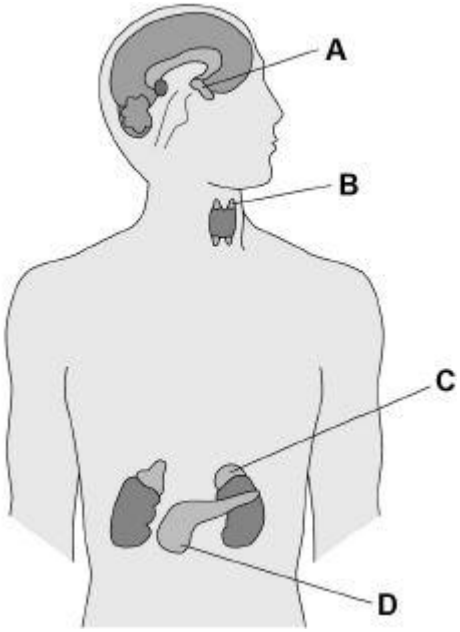
_____

Time = _____ s

(2)

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

Figure 3



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?

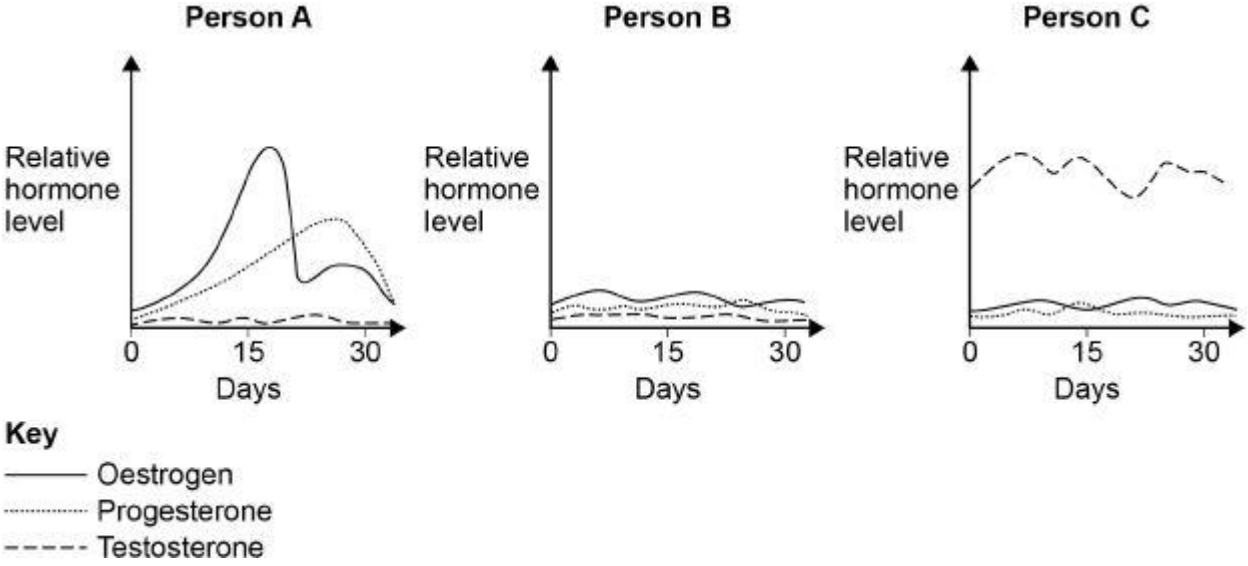
_____

(1)

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

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 _____

_____

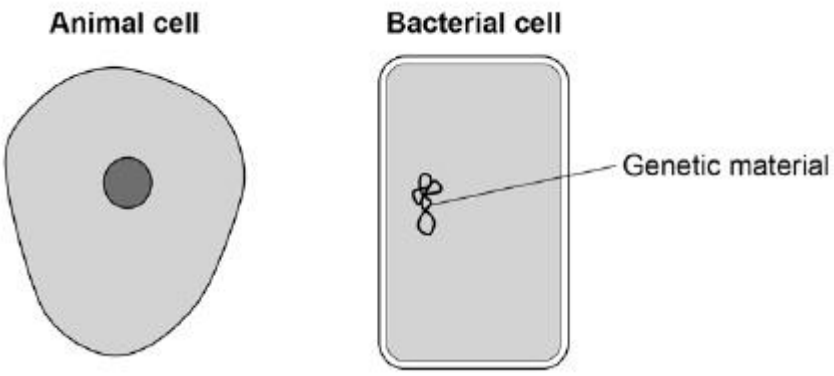
(2)

(Total 12 marks)

Q3.

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**

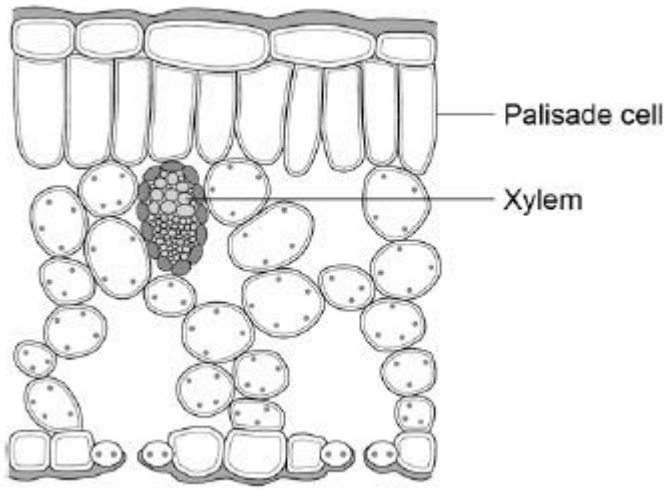
Only the animal cell contains a _____ .

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

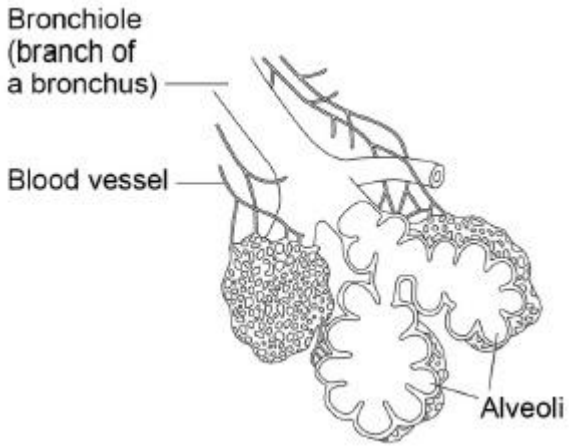
(2)

(Total 11 marks)

Q4.

Figure 1 shows part of the lungs.

Figure 1



(a) Give **two** ways the lungs are adapted for efficient exchange of gases.

Describe how each adaptation helps to maintain efficient gas exchange.

Adaptation 1 _____

_____

Description _____

_____

Adaptation 2 _____

_____

Description _____

_____

(4)

(b) There are 5.4 million people with asthma in the UK.

What type of disease is asthma?

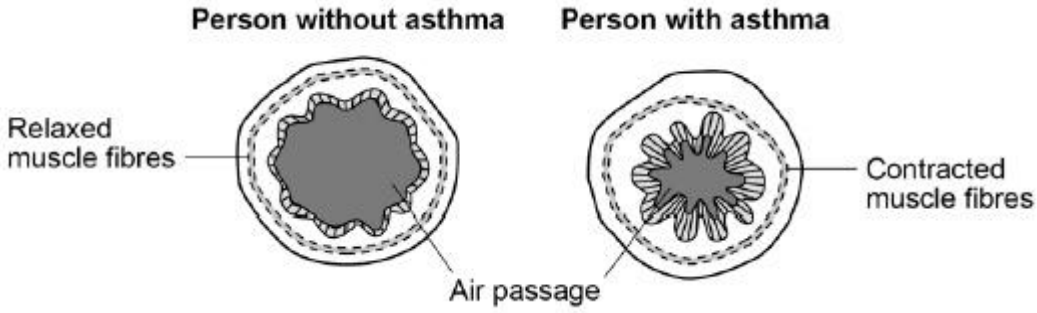
Tick **one** box.

An allergy	☐
A bacterial infection	☐
A cancer	☐
A viral infection	☐

(1)

(c) **Figure 2** shows cross-sections of bronchioles of two people.

Figure 2



Suggest why people with asthma often find it difficult to breathe.

_____

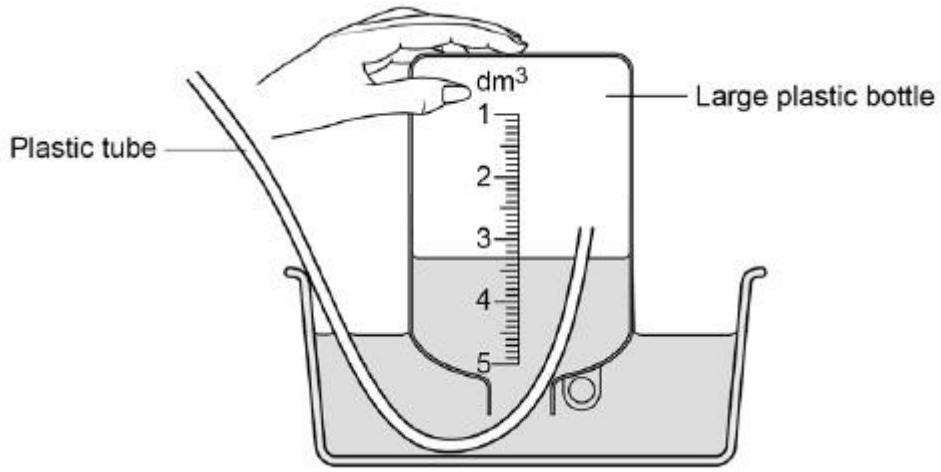
_____

(1)

(d) People with asthma often have a reduced lung volume.

Figure 3 shows the apparatus a student used to measure his lung volume.

Figure 3



This is the method used.

1 Fill the bottle with water.

2 Breathe out through the tube.

The volume of water pushed out of the bottle is equal to his lung volume.

What is the student's lung volume?

Volume = _____ dm^3

(1)

Scientists tested a new drug to treat asthma.

The scientists measured the lung volume of:
- volunteers without asthma
- some volunteers during a mild asthma attack
- other volunteers during a severe asthma attack.

Half the people in each group were given a placebo.

The other half of the people in each group were given the new drug.

The tests were carried out as a double blind trial.

(e) What is a placebo?

_____

_____

(1)

(f) Who knows which volunteers in a double blind trial are given the drug and which volunteers are given the placebo?

Tick **one** box.

The scientists but not the volunteers	☐
The scientists and the volunteers	☐
The volunteers but not the scientists	☐
Neither the volunteers nor the scientists	☐

(1)

(g) Suggest why it is a good idea that double blind trials should be used in drug testing?

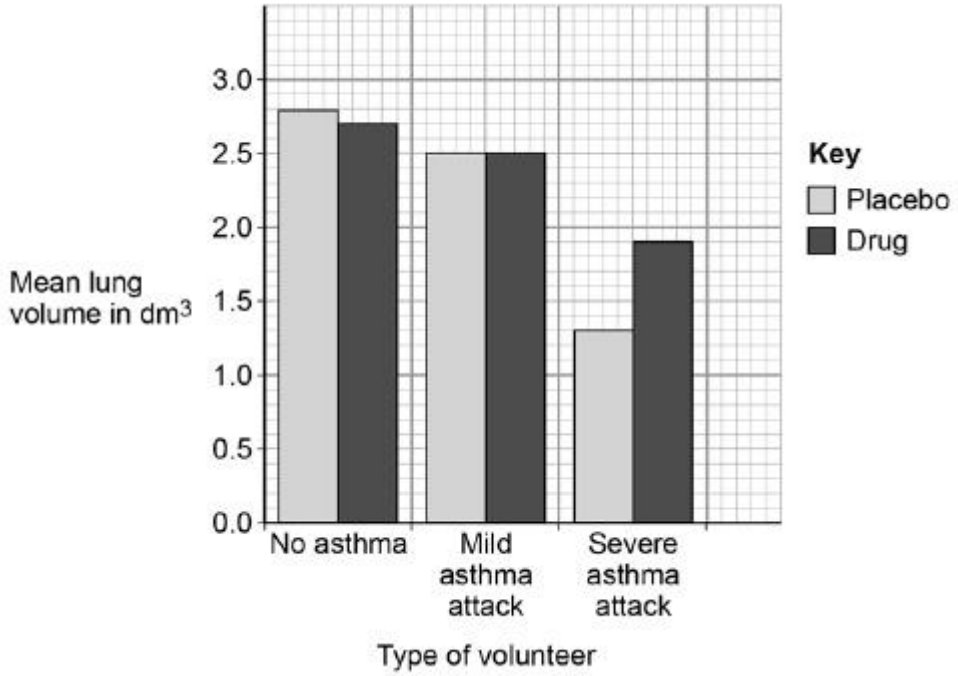
_____

_____

(1)

(h) **Figure 4** shows the results of the drug tests.

Figure 4



Give **two** conclusions that can be made about the usefulness of the drug.

1. _____

_____

2. _____

_____

(2)

(Total 12 marks)

Q5.

A student investigated the effect of different concentrations of a salt solution on the mass of pieces of potato.

This is the method used.

1. Weigh five pieces of potato.

2. Put each piece of potato into a different concentration of salt solution.

3. Leave the potato pieces for 24 hours.

4. Remove each piece of potato, dry it and re-weigh it.

5. Calculate the change in mass of each piece of potato.

The table shows the results.

Concentration of salt solution in arbitrary units	**Mass at start in g**	**Final mass in g**	**Change in mass in g**
0	2.60	3.04	0.44
1	2.71	2.98	**X**
2	2.60	2.70	0.10
3	2.63	2.56	−0.07
4	2.46	2.22	−0.24

(a) Calculate value **X** in the table.

_____

_____

X = _____ g

(1)

(b) Two of the numbers for the change in mass have a negative value.

What do these negative values indicate?

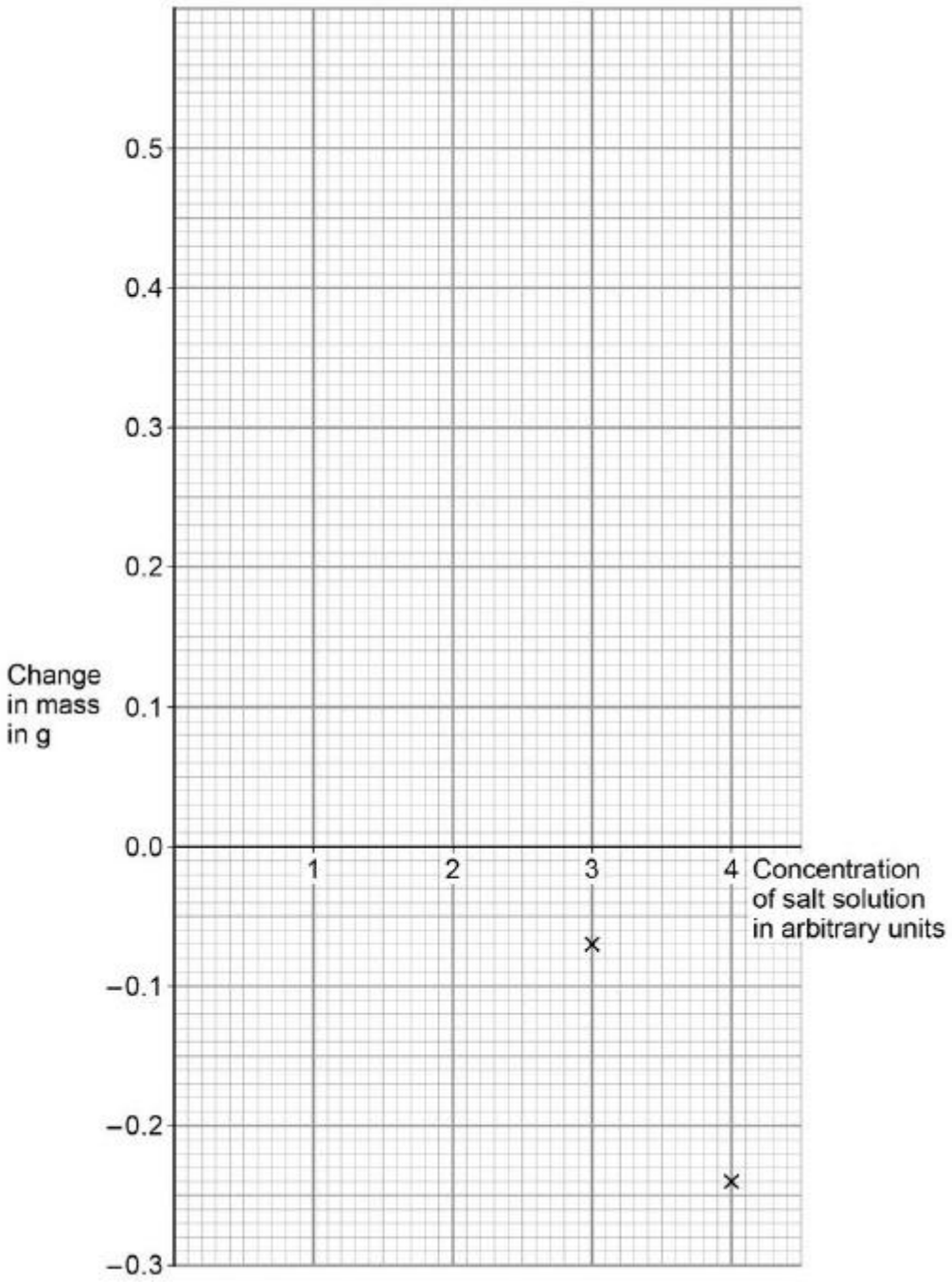
_____

_____

(1)

(c) Complete the graph.

- Plot data from the table and your answer to part (a).
- Draw a line of best fit.



(3)

(d) Which concentration of salt solution would give no change in mass?

Use the graph.

Concentration = _____ arbitrary units

(1)

(e) Explain why there would be no change in mass of a piece of potato at the salt concentration you gave in part (d).

_____

_____

_____

_____

(3)

(Total 9 marks)

Q6.

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.

_____

_____

_____

_____

_____

_____

_____

(4)

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

What does oxygen debt mean?

_____

_____

(1)

(Total 8 marks)

Q1.

(a) any **one** from:

- meristem(s)
- **tip** of shoot
  ignore stem and embryo
- **tip** of root

1

(b) to produce large numbers of identical plants

1

(c) 6×10^{-12} (grams)

1

(d) $\frac{28}{360} \times 15$

or

1.166666666(r)

allow $\frac{7}{90} \times 15$

allow correct rounding
allow 1.16

1

1.17 (hours)

*allow **1** mark for 1 hour 10 minutes **or** 1 and 1/6 hours **or** 70 minutes **only** if units given*

1

*an answer of 1.17 (hours) scores **2** marks*

(e) **stage 1**
cell growth
or
increase in number of organelles

allow increase in named organelle e.g. ribosomes / mitochondria

1

<u>DNA</u> replicates*
or
two copies of each chromosome form*

**allow DNA duplicates / doubles*
**ignore genetic information replicates*
if this statement given as part of stage 2 allow **max 4 marks*

1

stage 2 / mitosis
one set of chromosomes moves to each end of cell

allow chromosomes separate or are pulled apart

1

nucleus divides

allow nucleus splits into two

1

stage 3

cytoplasm / cell membrane divides to form two (genetically) identical cells

allow cytokinesis

1

***max 4** if correct sequence but no reference to stage numbers*

***max 4** marks if no stage numbers given*

ignore names of phases

marks can be awarded for labelled diagrams

(f) any **two** from:

advantages:

- may be used to cure / treat (current / future) diseases
  or
  cure medical conditions
  or
  produce replacement cells / tissues / organs

  allow example e.g. diabetes / paralysis
  ignore used for medical treatments

- cells / tissues of any type could be produced

  allow cells differentiate into many types

- cells / tissues of any type could be produced

  ignore identical cells are produced unqualified

- many cells produced
- cells produced could be used for research
- would reduce waiting time for organ transplants

2

any **two** from:

ignore references to cost
ignore unethical unqualified
ignore references to religion / beliefs

disadvantages:

- potential life is killed / destroyed

  allow embryo is destroyed
  ignore cells destroyed or wasted

- shortage of donors / eggs
- egg donation / collection has risks
- do not yet know risks /side effects of the procedure on the patient

  allow may cause tumours / cancer

- may transfer (viral) infection

- poor success rate to produce viable eggs / embryo

2

ignore references to cost

[14]

Q2.

(a) A

1

(b) D

1

(c) A = synapse

1

B = motor (neurone)

1

in this order only

(d) a reflex action

1

(e) 12 (ms)

1

0.012 (s)

1

*an answer of 0.012 (s) scores **2** marks*

(f) A

1

(g) controls the release of an egg

1

(h) in the blood(stream)

allow in the plasma / blood vessels

*do **not** accept in blood cells / platelets*

1

(i) (person) C

1

any **one** from:

- the testosterone level is high(er)

  allow testosterone is the main male (sex) hormone

- the oestrogen **and** / **or** progesterone levels are low

- the oestrogen and progesterone levels do not rise and fall as they do in a menstrual cycle

  allow there is no menstrual cycle

1

no marks if A or B given

[12]

Q3.

(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]

Q4.

(a) any **two** adaptations with linked descriptions from:

- many alveoli to provide a large surface area
- good blood supply to maintain steep diffusion / concentration gradient
- thin walls so gases do not have far to diffuse / travel
- well ventilated to maintain steep diffusion / concentration gradient

__1__ mark for adaptation and __1__ mark for linked description
*allow to collect oxygen **or** to bring carbon dioxide to lungs*

4

(b) an allergy

1

(c) any **one** from:

- narrow(er) / small(er) (air) passages / bronchioles
- less air / oxygen can pass through

1

(d) 3.3 (dm^3)

1

(e) any **one** from:

- fake drug
- inactive form of drug

1

(f) neither the volunteers nor the scientists

1

(g) to avoid / reduce bias

1

(h) any **two** from:

- drug only works for severe asthma attacks

or

drug only increased lung capacity in severe asthma attacks

- drug had little effect **or** slight reduction in healthy people
- drug had no effect in mild asthma attacks
- drug does not alleviate the problem entirely

2

[12]

Q5.

(a) 0.27 (g)

1

(b) potato lost mass

allow potato (cells) lost water

1

(c) all 3 points plotted correctly

allow ecf from art (a)

*allow **1** mark for 1 or 2 correct plots*

2

suitable line of best fit

allow ecf from their plots

1

(d) 2.6 (arbitrary units)

allow answer from their line

1

(e) same concentration as inside potato (cells)

1

(so) no (net) movement of water

allow description of this

1

by osmosis

1

[9]

Q6.

(a) any **two** from:

- synthesis of new molecules

  allow named molecule eg starch / glycogen / cellulose / lipids / fats / proteins / hormones / antibodies

- for active transport

- to keep warm (in mammals / birds)

  allow description

  allow to keep warm (in animals)

  allow for movement (in animals)

  allow for transmission of nerve impulses (in animals)

2

(b) mitochondria / mitochondrion

1

(c) both occur without oxygen

1

both release (a small amount of) energy

1

muscle cells produce lactic acid but plant cells produce ethanol

1

muscle cells do **not** produce carbon dioxide but plant cells do

marks can be awarded from correct word or balanced symbol equations

1

(d) the amount of oxygen needed to react with the lactic acid formed

allow the amount of oxygen needed to break down

***or** oxidise the lactic acid*

1

[8]