Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier
Biology Paper 1H

Tuesday 15 May 2018 Afternoon Time allowed: 1 hour 15 minutes

Materials
For this paper you must have:
- a ruler
- a scientific calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

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0 1 This question is about cell structures.

0 1 . 1 Draw **one** line from each cell structure to the type of cell where the structure is found.

[2 marks]

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

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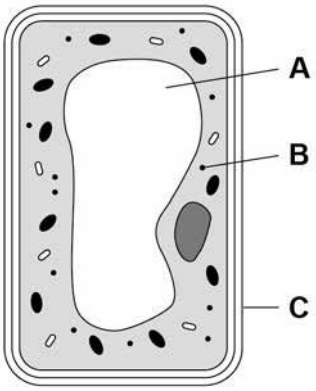
0 1 . 2 **Figure 1** shows a plant cell.

Figure 1



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

[1 mark]

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	☐

Question 1 continues on the next page

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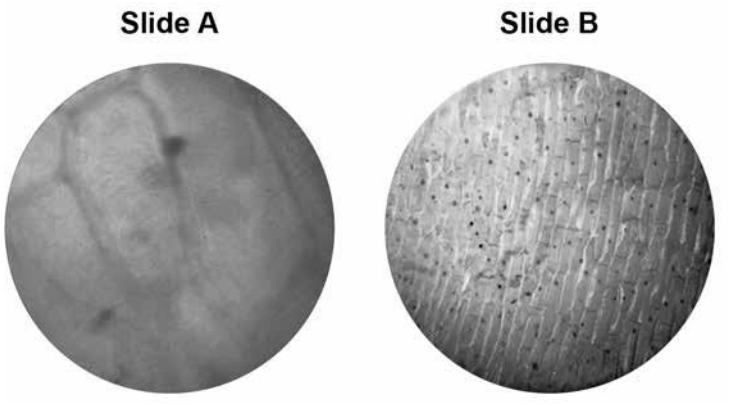
A student observed slides of onion cells using a microscope.

Figure 2 shows two of the slides the student observed.

Figure 2



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

0 1 . 3 Describe how the student should adjust the microscope to see the cells on **Slide A** more clearly.

[1 mark]

turn the (fine focusing) knob until the cells are in focus

0 1 . 4 Describe how the student should adjust the microscope to see the cells on **Slide B** more clearly.

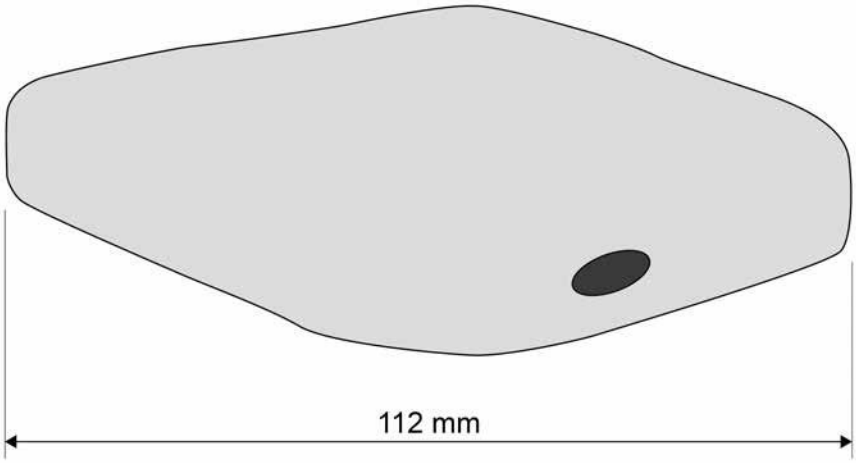
[2 marks]

(rotate the) nosepiece / objective lens
to a higher power (lens)

0 1 . 5 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.

conversion of units: (112 mm) 112 000 (μm) or (280 μm) 0.28 (mm)
(magnification =) 112 0.28 or (magnification =) 112 000 280 400 (×)

[3 marks]

9

Turn over for the next question

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0 2 Coronary heart disease (CHD) is a non-communicable disease.

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

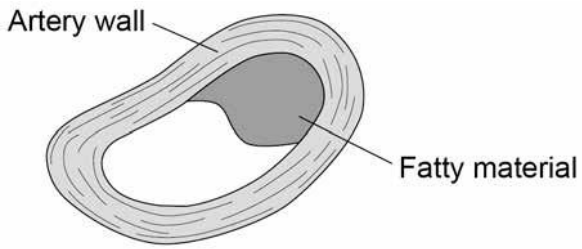
0 2 . 1 Explain what a non-communicable disease is.

[2 marks]

is not caused by a pathogen / infective organism (so)
is not passed / spread (from person to person)

Figure 4 shows a coronary artery of someone with CHD.

Figure 4



0 2 . 2 Explain how CHD can cause a heart attack.

[3 marks]

reduced / restricted / stopped blood flow (so) less oxygen reaches heart (muscle / cells)
(so heart muscle / cells) cannot respire (enough)

Do not write outside the box

0 2 . 3 Explain how lifestyle and medical risk factors increase the chance of developing CHD.

[6 marks]

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

11

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0 3 This question is about photosynthesis.

0 3 . 1 What is the correct balanced equation for photosynthesis?

[1 mark]

Tick **one** box.

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

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

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

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

0 3 . 2 What type of reaction is photosynthesis?

[1 mark]

Tick **one** box.

Aerobic ☐

Endothermic ☐

Exothermic ☐

Oxidation ☐

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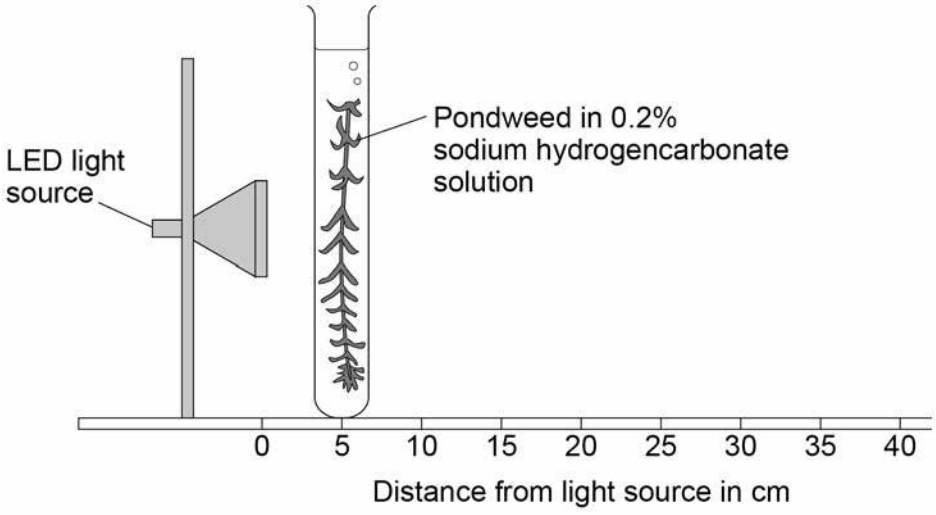
A student investigated the effect of light intensity on the rate of photosynthesis.

Figure 5 shows the apparatus used.

Figure 5



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.

0 3 . 3 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.

[2 marks]

1 measure the volume of gas released

2. increase length of time

Question 3 continues on the next page

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0 3 . 4 The LED light source does **not** get hot.

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

[2 marks]

temperature affects rate of bubble production (because) reaction / photosynthesis is controlled by enzymes

0 3 . 5 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 marks]

evidence of squaring for two distances that double: 25 and 100 or 100 and 400 calculate 1/d2 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 (therefore as distance doubles) light intensity is quartered

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0 3 . 6 The student's results are shown in **Table 1**

Table 1

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 marks]

2 (bubbles would be produced) (as) very little light / energy for photosynthesis to occur

0 3 . 7 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 **Figure 5** on page 9 to help you answer this question.

[3 marks]

distance from light source

• temperature of solution

Do not write outside the

Do not write outside the box

0 4 A student investigated the effect of different concentrations of sugar solution on pieces of carrot.

This is the method used.

1. Weigh five pieces of carrot.
2. Place each piece into a different tube.
3. Into each tube add 20 cm^3 of water or one of the sugar solutions as shown in **Figure 6**
4. Leave the apparatus for 2 hours.
5. Remove the carrot and dry each piece on paper towel.
6. Reweigh each piece.
7. Calculate the percentage (%) change in mass of each piece.

Figure 6 shows how the investigation was set up.

Figure 6

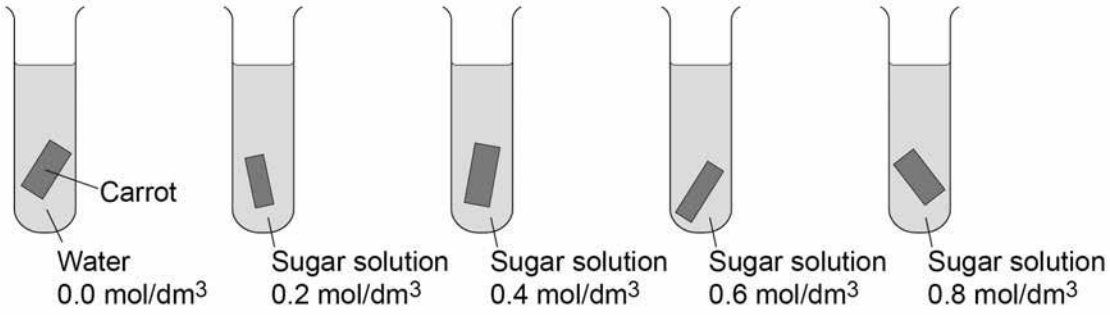

Table 2 shows the results.

Table 2

Concentration of sugar solution in mol/dm^3	Percentage (%) change in mass
0.0	+24
0.2	+12
0.4	+1
0.6	–8
0.8	–15

0 4 . 1 Suggest why the student calculated the percentage (%) change in mass of each piece of carrot.

[1 mark]

to control for the starting mass (of the pieces of carrot)

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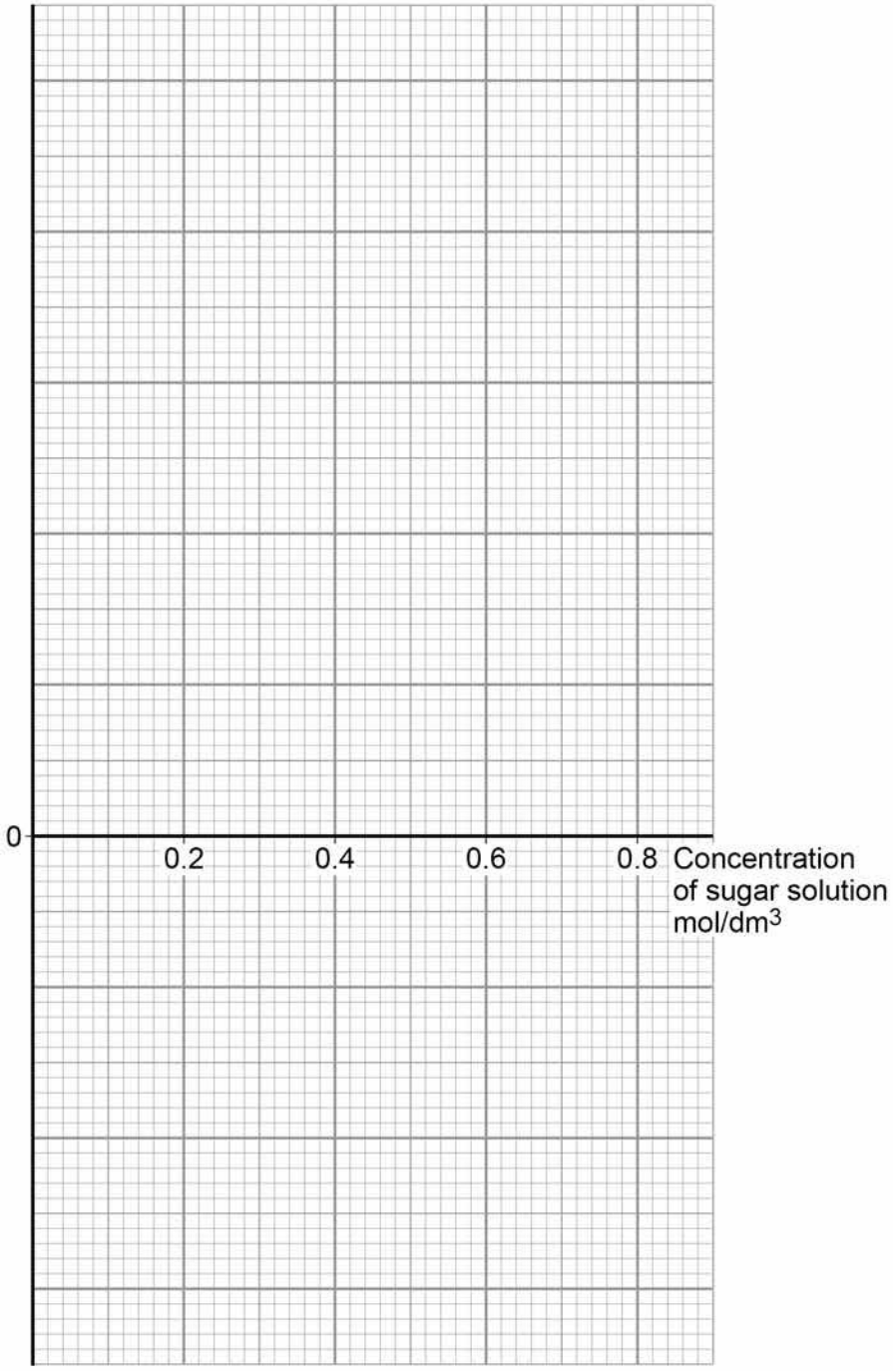
0 4 . 2 Complete **Figure 7** using the results in **Table 2**

- Choose a suitable scale and label for the y-axis.
- Plot the results.
- Draw a line of best fit.

[4 marks]

Figure 7



Question 4 continues on the next page

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0 4 . 3 Estimate the concentration of sugar solution inside the carrot cells.

Use your completed graph on **Figure 7**

[1 mark]

Concentration = _____ mol/dm^3

0 4 . 4 Explain why the mass of the carrot in the 0.6 mol/dm^3 sugar solution changed.

[4 marks]

mass decreased (due to) loss of water by osmosis through a partially / selectively / semi permeable membrane (as) concentration of sugar solution is greater than concentration of sugar (solution) inside cells / carrot

0 4 . 5 The student repeated the investigation using boiled pieces of carrot.

The pieces of carrot did **not** change in mass.

Suggest why.

[1 mark]

the (partially permeable / cell) membrane was damaged

11

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0 5 Measles is a serious disease. A person can die from measles.

Table 3 shows the number of medically confirmed cases of measles in England and Wales between 2012 and 2015

Table 3

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

0 5 . 1 Suggest **one** reason why the actual number of cases of measles in England and Wales might be higher than is shown in **Table 3**

[1 mark]

not everyone would go to the doctor

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

Percentage decrease = _____ %

Question 5 continues on the next page

Turn over ►

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0 5 . 3 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.

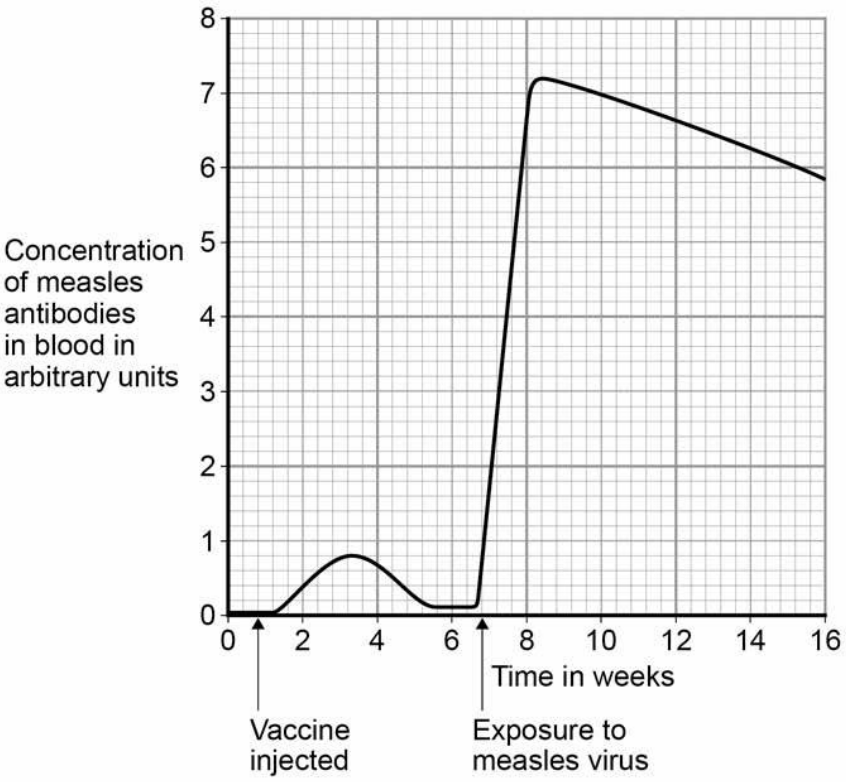
Explain why.

[2 marks]

most people are immune so do not become ill (from infection) less chance of non-immune / unvaccinated individuals being exposed to pathogen / measles

0 5 . 4 **Figure 8** shows the concentration of measles antibodies in the blood of a boy.

Figure 8



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

You should include data from **Figure 8**

[6 marks]

differences (after exposure to measles virus): • greater number / higher concentration of antibodies produced • quantitative statement, eg 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

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Explain the differences between antibody production after the vaccine injection and

Turn over ►

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0 6 This question is about stem cells.

0 6 . 1 Give **one** place in a plant where stem cells are found.

[1 mark]

tip of root

0 6 . 2 What is **one** economic use of plant stem cells?

[1 mark]

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 ☒

Question 6 continues on the next page

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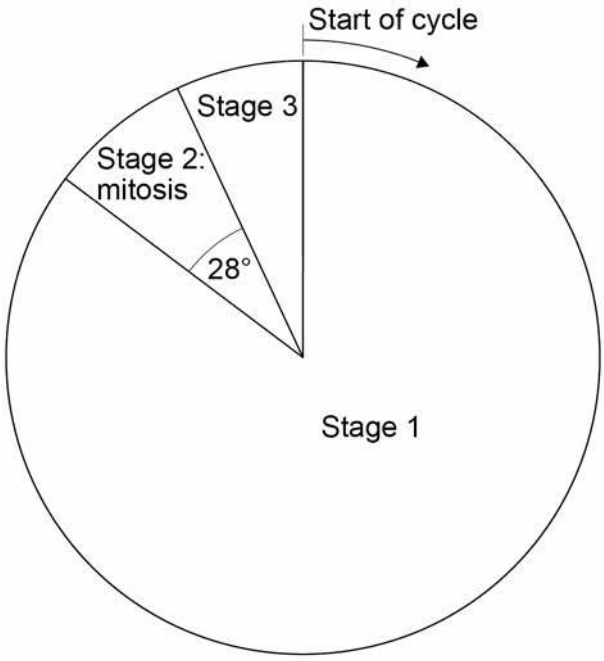
Embryonic stem cells divide by mitosis.

Figure 9 represents a cell cycle for a human embryonic stem cell.

Figure 9



0 6

. **3** 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.

[1 mark]

Mass = 6 × 10−12 (grams)_____ g

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0 6 . 4 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.

28 360 × 15 or 1.166666666(r) 1.17 (hours)

[2 marks]

Time spent in mitosis = _____ hours

0 6 . 5 Describe what happens in each of the three stages of the cell cycle.

[5 marks]

stage 1 cell growth or increase in number of organelles DNA replicates or two copies of each chromosome form

stage 2 / mitos**is** one set of chromosomes moves to each end of cell nucleus divides

stage 3 cytoplasm / cell membrane divides to form two (genetically) identical cells

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Question 6 continues on the next page

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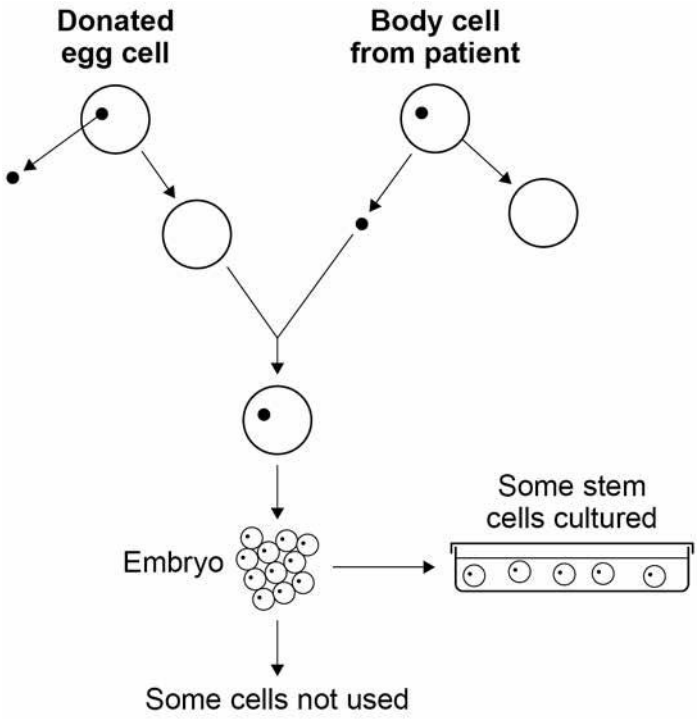
0 6 . 6 **Figure 10** shows how embryonic stem cells are produced in therapeutic cloning for use in patients.

Figure 10



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

Use **Figure 10** to help you.

[4 marks]

Advantage 1 may be used to cure / treat (current / future) diseases

Advantage 2 would reduce waiting time for organ transplants

Disadvantage 1 do not yet know risks /side effects of the procedure on the patient

Disadvantage 2 may transfer (viral) infection

14

END OF QUESTIONS

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