Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Time 1 hour 45 minutes

Paper reference **4HB1/02**

Human Biology

UNIT: 4HB1
PAPER: 02

You must have:
Ruler, calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Q:1/1/1/1/1/

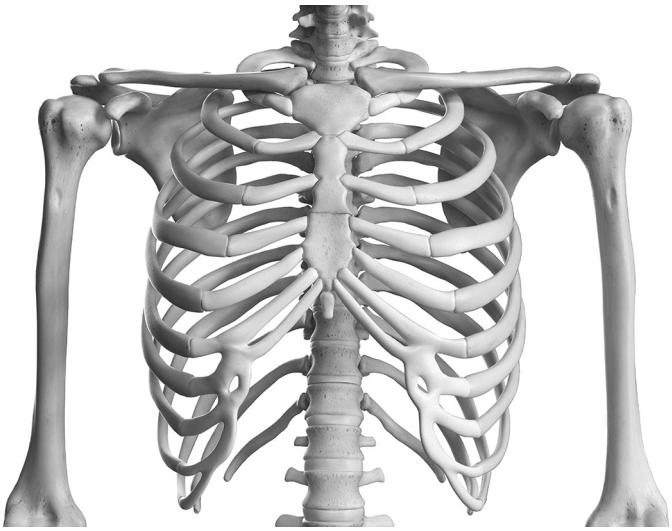
P 7 2 6 0 2 A 0 1 2 8

Pearson

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) The image shows part of the skeleton.



(Source: © SciePro/Shutterstock)

(i) Label the clavicle, scapula and vertebral column on the image.

(3)

(ii) The vertebral column is part of the axial skeleton.

Describe the functions of the axial skeleton.

(2)

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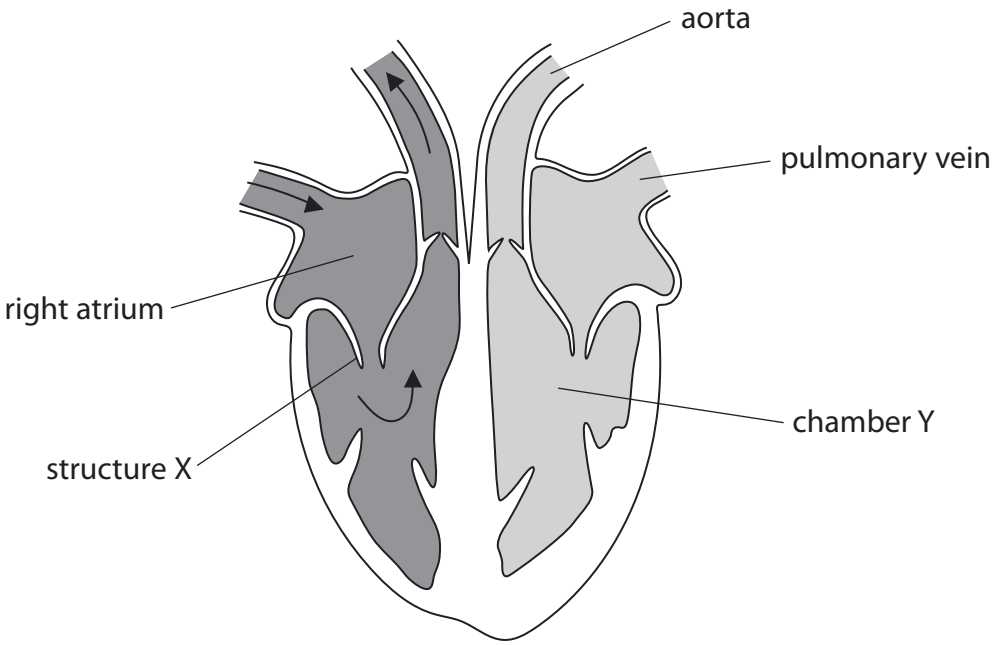
(b) Osteoporosis can affect the vertebral column.

Describe the symptoms of osteoporosis.

(3)

(Total for Question 1 = 8 marks)

2 (a) The diagram shows a section through the heart.



(i) Name chamber Y.

(1)

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(ii) Explain the function of structure X.

(2)

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(iii) The table lists some properties of blood.

Add ticks (✓) to those boxes that show the properties of blood in the aorta.

(2)

Properties of blood	Blood in the aorta
oxygenated	
deoxygenated	
high pressure	
medium pressure	
low pressure	

(iv) State where blood in the left side of the heart has come from.

(1)

.....

(b) In one year in the United Kingdom, there were 173 heart transplants.

Heart transplant operations require hearts to be donated.

Some hearts cannot be used because the donor is too old.

Give two other reasons why a heart might not be suitable for a transplant.

(2)

1 .....

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2 .....

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(c) (i) Which blood component causes blood clotting?

(1)

- ☒ **A** lymphocytes
- ☒ **B** phagocytes
- ☒ **C** platelets
- ☒ **D** red blood cells

(ii) The diagram summarises part of the process that causes a blood clot.

Anticoagulant drugs prevent a blood clot forming.

These drugs stop the enzyme thrombin being produced.

Describe how a lack of thrombin prevents a blood clot forming.

(2)

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(Total for Question 2 = 11 marks)

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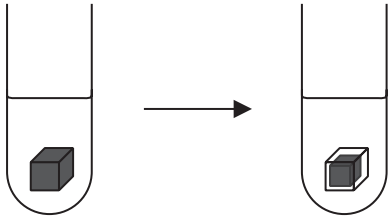
3 A student investigates diffusion using agar cubes and an acid.

The agar cube contains an alkali and a pH indicator.

The indicator is pink in alkali and colourless in acid.

Acid diffuses into the cube, causing the cube to change from pink to colourless from the edge.



agar cube when first placed in acid

agar cube starts to become colourless

(a) The cube the student placed in the acid had a side length of 2 mm.

(i) Calculate the surface area to volume ratio of the cube.

Your answer should be in the form n : 1

(3)

surface area to volume ratio = ...

(ii) The cube took 1 minute and 32 seconds to become colourless.

Which of these shows the time in seconds?

(1)

☒ **A** 62

☒ **B** 82

☒ **C** 92

☒ **D** 102

(iii) State what is meant by the term **diffusion**.

(1)

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(iv) Explain the effect of increasing the surface area to volume ratio on the time taken for the cube to become colourless.

(2)

(b) A student wants to investigate the effect of temperature on the rate of diffusion into the agar cube.

(i) Describe a method for this investigation using the apparatus shown in the diagram.

(2)

(ii) Give two variables the student would need to control in their investigation.

(2)

1

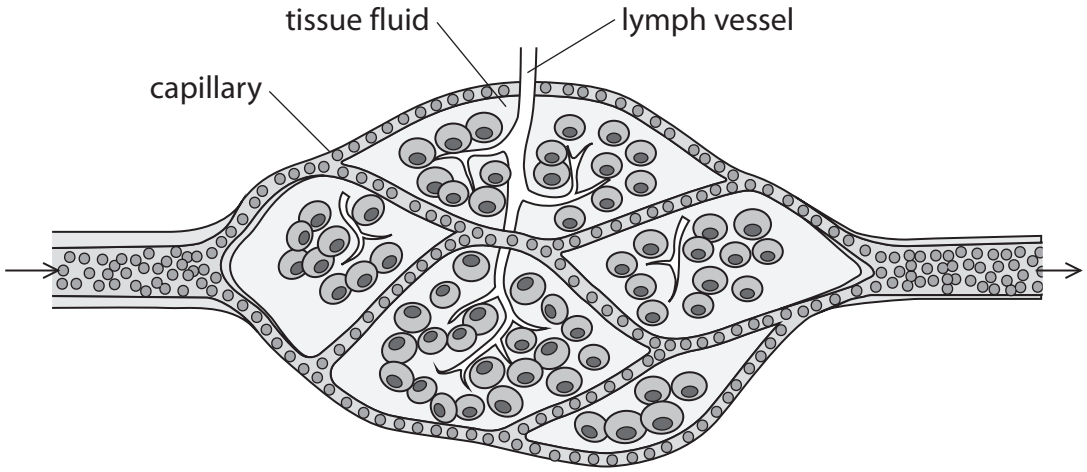
2

(Total for Question 3 = 11 marks)

4 (a) When blood flows into a network of capillaries, tissue fluid is produced.

The tissue fluid supplies the surrounding cells with molecules.

The diagram shows a network of capillaries and surrounding cells.



(i) Give two differences between the composition of tissue fluid and the composition of blood entering the capillary network.

(2)

1 .....

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2 .....

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(ii) Describe how tissue fluid is formed.

(4)

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(iii) Lymphoedema occurs when tissue fluid builds up causing swelling.

This is more common in the legs and arms.

One treatment for this is to increase physical activity, resulting in more muscle contraction.

Explain why increased muscle contraction could reduce the swelling caused by the build up of tissue fluid.

(2)

(b) Lymphocytes, found in lymph nodes, produce antibodies in response to specific antigens.

Explain why the reaction between an antigen and an antibody is specific.

(3)

(Total for Question 4 = 11 marks)

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5 Some athletes train at high altitudes to improve their performance.

Performance improves if more energy is released from aerobic respiration.

(a) (i) Complete the balanced symbol equation for aerobic respiration.

(2)

..... + $6O_2$ → ..... + $6CO_2$

(ii) Aerobic respiration produces ATP.

Describe how energy is released from ATP during exercise.

(2)

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(b) The table shows the percentage change in mass of haemoglobin in the blood after different periods of time training at altitude.

Period of time in hours	Percentage change in mass of haemoglobin
0	0
100	0.7
200	2.4
300	4.1
400	5.9
500	6.5
600	7.2

(i) Plot the results on the grid.

(4)

(ii) Draw the curve of best fit.

(1)

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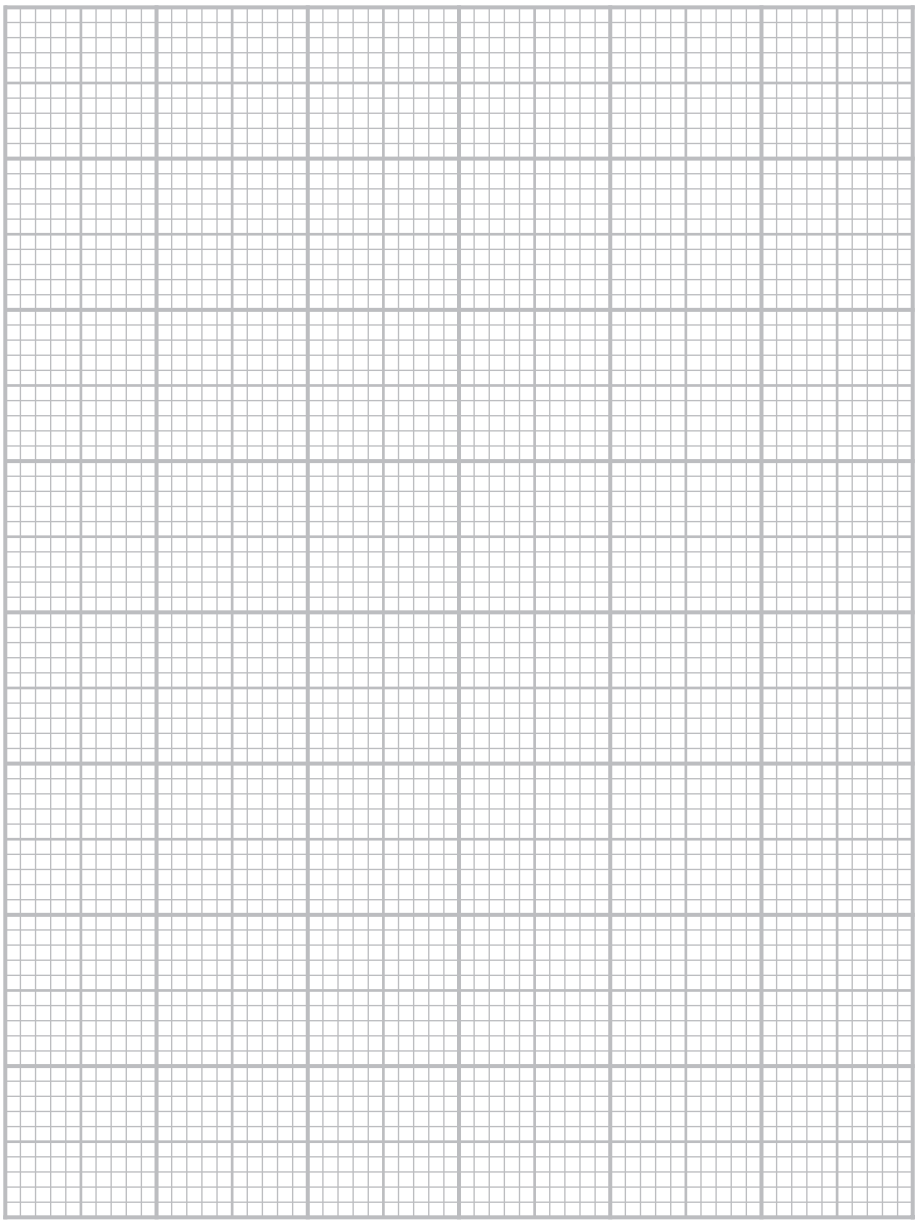

(iii) Discuss how the percentage change in mass of haemoglobin, after training at altitude, could result in an increase in performance during exercise.

(5)

(Total for Question 5 = 14 marks)

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6 (a) Read the passage below.

Use the information in the passage and your own knowledge to answer the questions that follow.

In 2012, Shinya Yamanaka, a Japanese research scientist, won a Nobel Prize for his work on stem cells. He demonstrated that it was possible to take a sample of blood or skin cells from a person and induce these cells to have the properties of stem cells.

In the past, stem cell research scientists needed to obtain human embryonic stem cells from embryos produced by IVF. This required the agreement of those people involved. Embryonic cells can continually divide and can become any human body cell. Scientists have been exploring the use of embryonic stem cells as medical treatments for many different diseases and conditions.

Using the work of Yamanaka and his team, scientists can now produce cells called induced pluripotent stem cells (iPS cells). Cells from the patient are treated with four factors which control the expression of genes. This produces iPS cells from the patient's own cells, which can then be used in stem cell therapies.

This technique is easy to replicate but there are concerns that unlicensed clinics are offering stem cell treatments. Many of these treatments are expensive and success rates are not proven. In addition, stem cells have the potential to continue to divide in the body. Many of the diseases and conditions that stem cell therapies could be used to treat have no other effective treatments. This makes stem cell therapy a desirable option.

(i) Describe the benefits of producing iPS cells from a patient's own cells.

(3)

(ii) Give two possible risks of using stem cells to treat diseases and medical conditions.

(2)

1 .....

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2 .....

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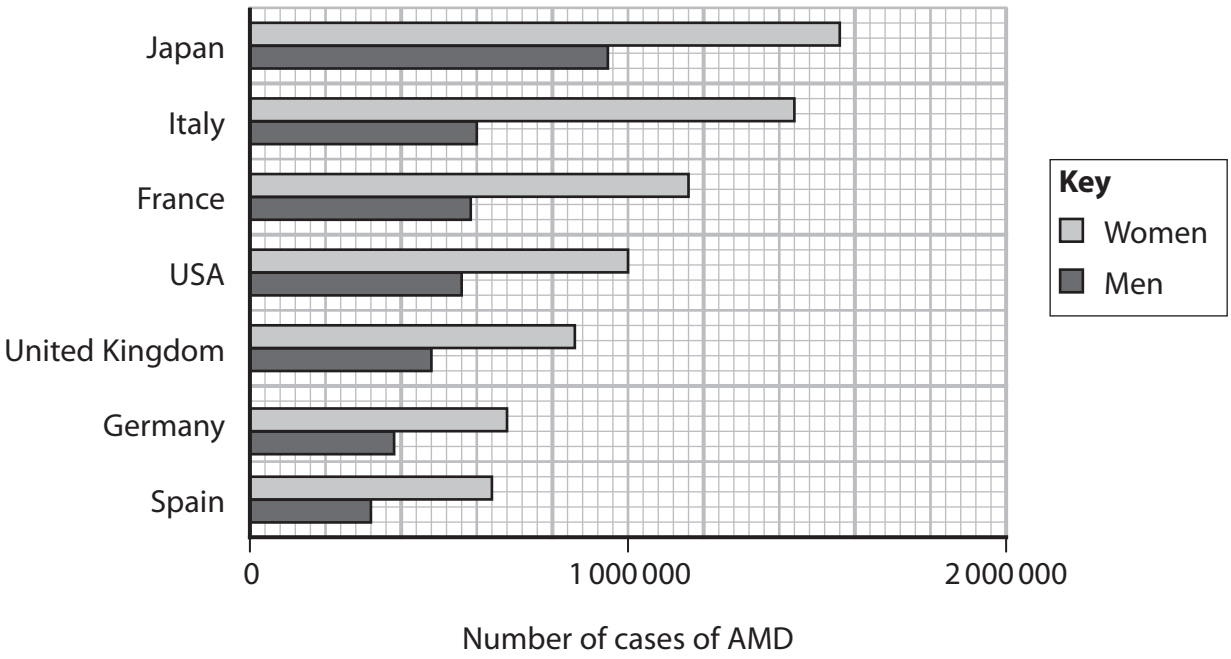
(b) One condition that stem cells could be used to treat is age-related macular degeneration (AMD).

This is the main cause of vision loss in people over the age of 50.

The graph shows the number of people affected by AMD in some countries.



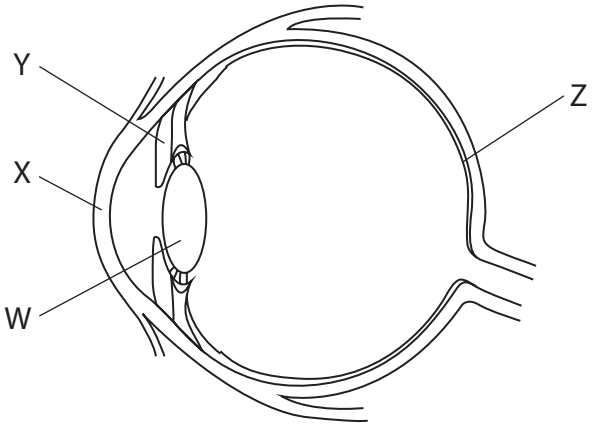
(i) Calculate the difference between the number of women and the number of men affected by AMD in the United Kingdom.

(2)

difference = ...

(ii) The diagram shows a human eye.

AMD affects the retina of the eye.



Which of these structures is affected by AMD?

(1)

- ☒ **A** structure W
- ☒ **B** structure X
- ☒ **C** structure Y
- ☒ **D** structure Z

(c) A deficiency of vitamin A can also cause blindness.

A genetically engineered rice product can be used to prevent deficiency of vitamin A.

Describe how genetic engineering is used to produce this rice product.

(3)

(Total for Question 6 = 11 marks)

7 The renal system is involved in osmoregulation.

(a) (i) Name the area of the brain that detects the water content of the blood.

(1)

.....

(ii) The kidneys are part of the renal system.

Put one tick (✓) in each column of the table to identify the function of different structures in the kidney.

(3)

	Structure		
Function	**glomerulus**	**proximal tubule**	**renal vein**
regulation of water level			
ultrafiltration			
reabsorption of glucose			
removal of blood from kidney			
supply of blood to kidney			
removal of urine from collecting duct			

(b) The table shows the percentage composition of two urine samples taken from one person.

Not all of the components are shown.

The first sample was taken at midday and the second sample was taken four hours later.

Component	Percentage composition	
	first sample	second sample
ammonia	0.05	0.08
uric acid	0.03	0.08
ions	1.34	1.46
urea	2.00	2.80
water	95.00	91.50

(i) Describe how urea is produced in the body.

(2)

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(ii) The ADH response changes the percentage composition of urine.

Explain the ADH response that occurred in the person's body between the first and the second sample being collected.

(5)

(Total for Question 7 = 11 marks)

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8 (a) When women cannot conceive naturally, they can have fertility treatment.

Women having fertility treatment can be given the hormones FSH and LH.

(i) Give a role of LH in women.

(1)

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(ii) Giving birth to twins or triplets is described as a multiple birth.

Explain how the use of FSH to treat infertility could increase the chances of a multiple birth.

(3)

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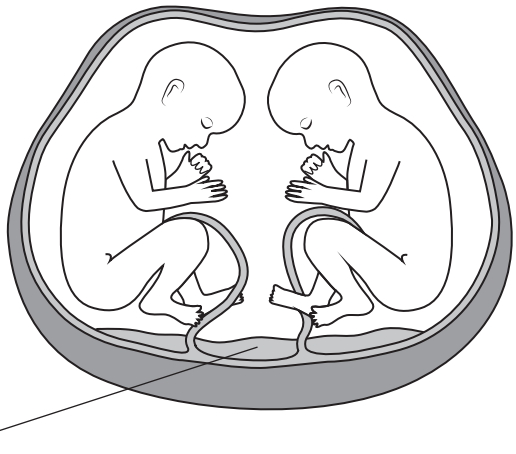
(b) Some identical twins share a placenta, as shown in the diagram.



(i) Twins that share a placenta are often born with a lower mass than twins that have separate placentas.

Explain why twins sharing a placenta have a lower mass when they are born.

(3)

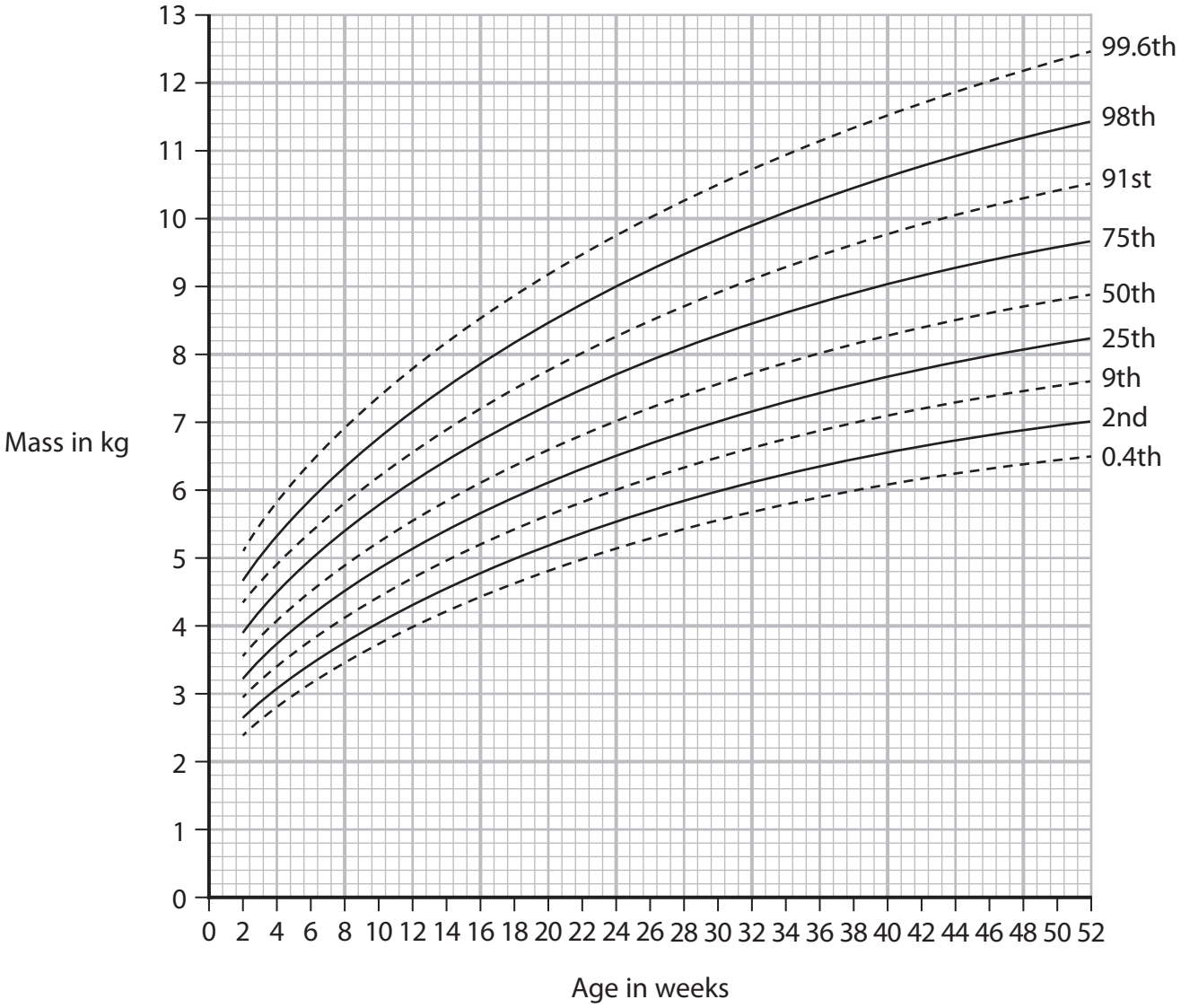
(ii) Identical twins form when the embryo splits early in pregnancy.

Explain why the twins are genetically identical.

(2)

(c) When babies are young, their growth is monitored using a percentile chart.

The diagram shows a percentile chart for baby girls.



(i) Determine the growth percentile of a six-week-old baby girl with a mass of 5 kg.

(1)

percentile = ...

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(ii) Describe how percentile charts are used to identify concerns about the growth of a baby.

(3)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 90 MARKS

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