

Figure 3 is a transmission electron micrograph of a plant cell.

Figure 3



0 4 . 2

Suggest why a nucleus is **not** visible in Figure 3.

[1 mark]

0 4 . 3

Name the organelles labelled **S** and **T** in Figure 3.

[1 mark]

Organelle **S** _____

Organelle **T** _____

0 4 . 4

Give **one** advantage of viewing a biological specimen using a transmission electron microscope compared with using a scanning electron microscope.

[1 mark]

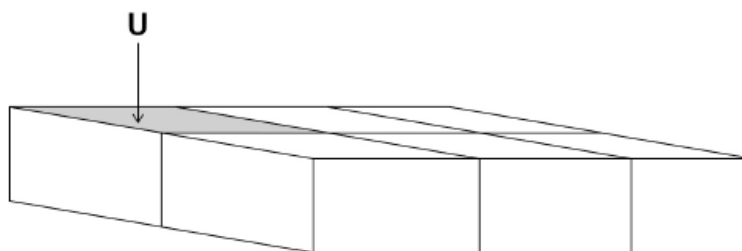
0 4 . 5

The cells in **Figure 4** are part of a continuous layer of cells forming the upper surface of a leaf.

The shaded area of cell **U** is $150 \mu\text{m}^2$

The total area of the upper surface of the leaf is 70.65 cm^2

Figure 4



Calculate the number of cells in the upper surface of the leaf.

Give the answer in standard form.

Assume that all these cells are identical in size.

Show your working.

[2 marks]

Number of cells _____

2. May/2020/Paper_1/No.6

0 6 . 1

Describe how mRNA is produced from an exposed template strand of DNA.

Do not include DNA helicase or splicing in your answer.

[3 marks]

0 6 . 2

Define the term exon.

[1 mark]

Table 3 shows mRNA codons for some amino acids.

Table 3

Serine	Proline	Glycine	Threonine	Alanine
UCU	CCU	GGA	ACU	GCA
UCC	CCA	GGG	ACC	GCG

0 6 . 3 **Figure 6** shows the DNA template nucleotide base sequence that determines the sequence of four amino acids.

Figure 6

AGG CGT CCT GGA

Use information from **Table 3** and **Figure 6** to give the amino acid sequence determined by this sequence of nucleotides.

[1 mark]

0 6 . 4 A mutation in the nucleotide sequence shown in **Figure 6** resulted in the following amino acid sequence.

Serine Glycine Glycine Proline

A student concluded that the mutation involved the addition of one nucleotide within the sequence shown in **Figure 6**. Does information in this question support the student's conclusion? Give reasons for your answer.

[2 marks]

3. May/2020/Paper_1/No.8

0 8

A scientist investigated birth mass in a population of babies. She determined the birth mass (b) of babies and grouped this information into different ranges of birth mass.

Her results are shown in **Table 4**.

Table 4

Birth mass b / kg	Range of mass / kg	Frequency density
$0.0 < b \leq 2.0$	2.0	5 000
$2.0 < b \leq 2.5$	0.5	20 000
$2.5 < b \leq 3.0$	0.5	90 000
$3.0 < b \leq 3.5$	0.5	260 000
$3.5 < b \leq 4.5$	1.0	200 000
$4.5 < b \leq 5.5$	1.0	20 000

Frequency density is calculated using this equation

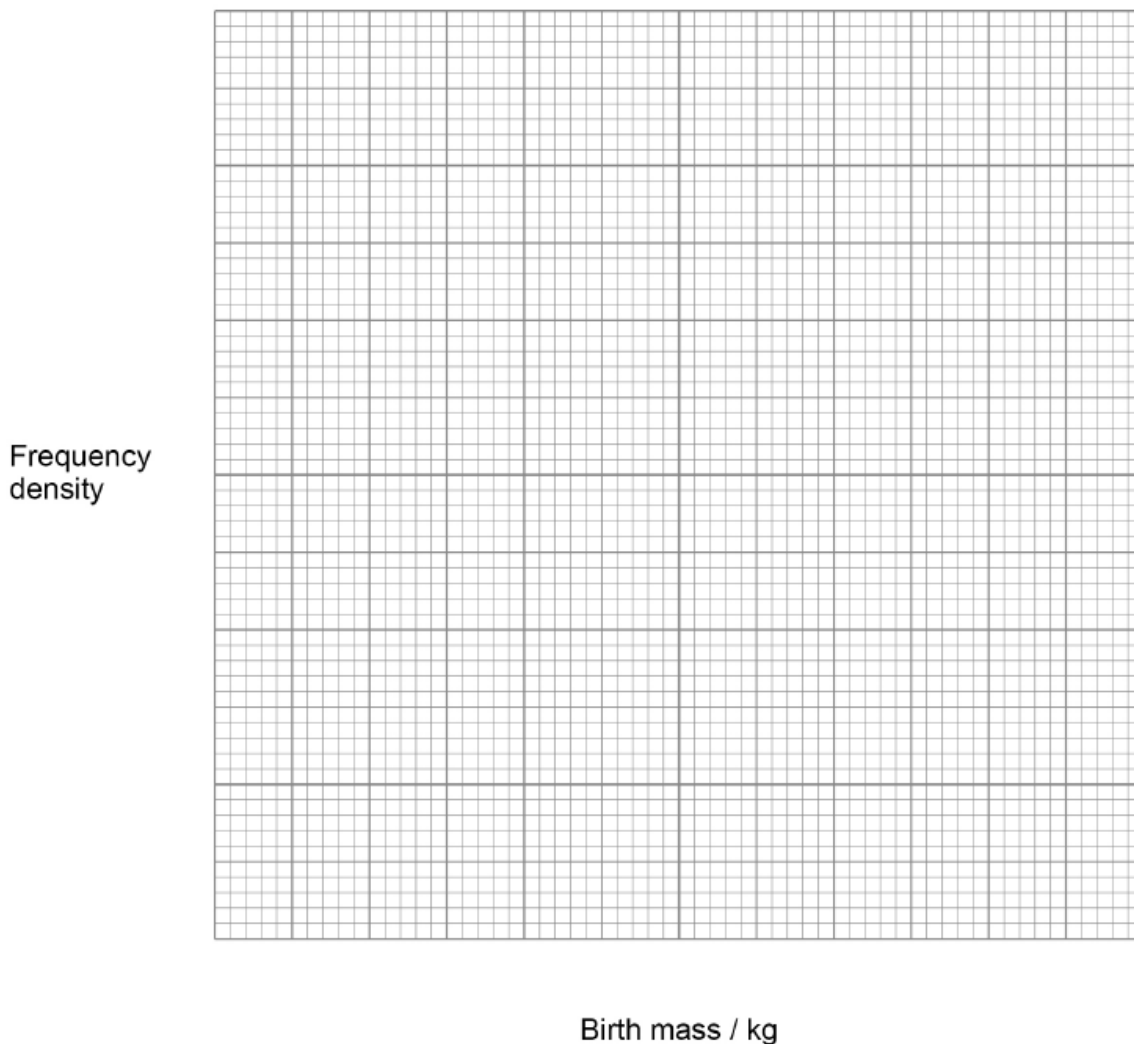
$$\text{Frequency density} = \frac{\text{number of babies}}{\text{range of mass}}$$

0 8 . 1

Draw, on **Figure 8**, a **suitable** chart to show the distribution of birth mass for this population of babies.

[4 marks]

Figure 8



0 8 . 2

Babies with birth mass less than 2.5 kg are classified as low birth mass.

Use information in **Table 4** and the equation to calculate the number of babies born with low birth mass in this population.

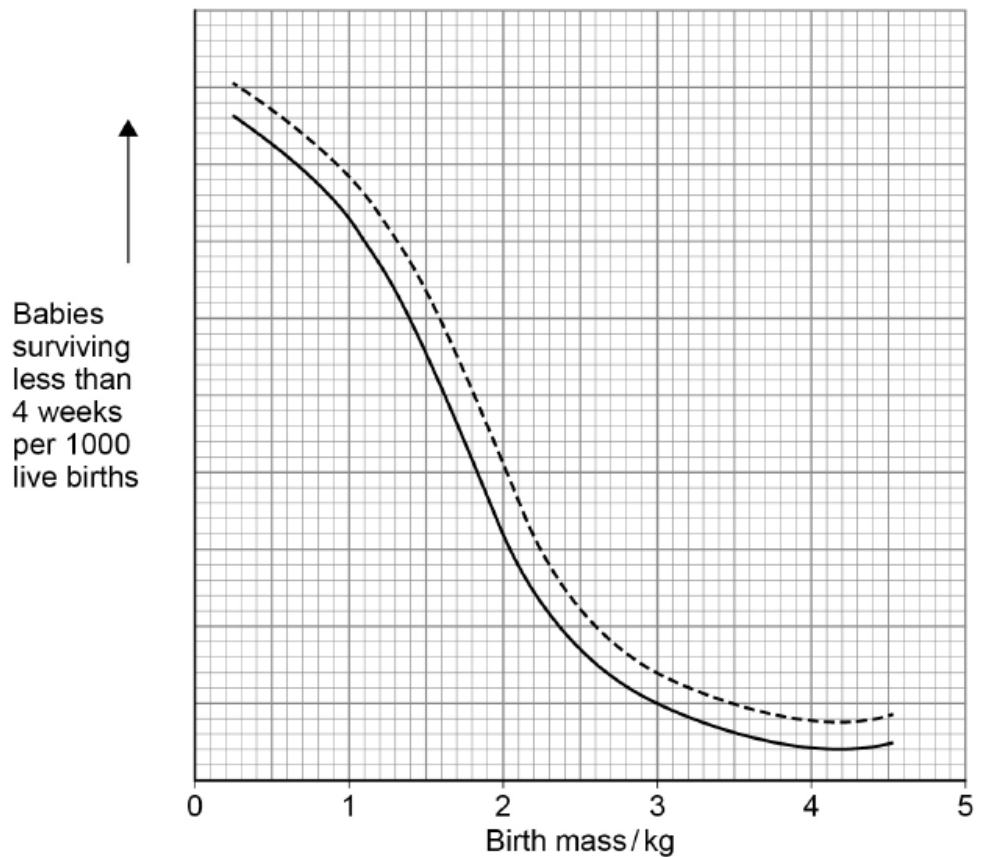
Show your working.

[2 marks]

Answer _____

The scientist also measured the relationship between birth mass and babies surviving less than 4 weeks. She determined if the mothers of these babies smoked cigarettes during pregnancy. Her results are shown in **Figure 9**.

Figure 9



Key

- Mothers who smoked cigarettes during pregnancy
- Mothers who did not smoke cigarettes during pregnancy

0 8 . 3 State **three** conclusions that can be drawn from the data in **Figure 9**.

[3 marks]

- 1 _____

- 2 _____

- 3 _____

4. May/2020/Paper_1/No.9

0 9

Channel proteins called aquaporins enable water to be transported across membranes. Aquaporins are produced in cells when genes coding for the proteins are expressed. One aquaporin gene is called *PIP1b*. The expression of *PIP1b* in tobacco plant cells produces an aquaporin located in their cell membranes.

Scientists have produced genetically modified tobacco plants. The scientists inserted a gene from a different species into the DNA of tobacco plant cells. This gene causes an increase in the rate of transcription of the *PIP1b* gene. 5

The scientists found that the stomatal density of leaves from tobacco plants with the inserted gene was greater than that of unmodified control plants.

In a different investigation, scientists measured the movement of potassium ions and water molecules through cell-surface membranes and vacuole membranes. They found 6 potassium ions moved for every 150 water molecules across vacuole membranes. They found 3 potassium ions moved for every 1500 water molecules across cell-surface membranes. 10

Use information from the passage and your own understanding to answer the questions.

0 9 . 1

Explain how the proteome of a cell from a genetically modified tobacco plant (lines 5–7) differs from that of a cell from an unmodified control tobacco plant.

[2 marks]

0 9 . 2

Explain how an increase in the rate of transcription of the *PIP1b* gene (lines 6–7) will affect the permeability of tobacco plant cell membranes to water.

[2 marks]

- 0 9 . 3** Suggest and explain **one** advantage and **one** disadvantage of increased stomatal density on the growth of tobacco plant leaves (lines 8–9). **[4 marks]**

Advantage _____

Disadvantage _____

- 0 9 . 4** How much greater is the ratio of movement of potassium ions to movement of water molecules across a vacuole membrane than across a cell-surface membrane (lines 10–14)? Show your working. **[2 marks]**

Answer _____

5. May/2019/Paper_1/No.1

0 1 . 1

The nucleus and a chloroplast of a plant cell both contain DNA.

Give **three** ways in which the DNA in a chloroplast is different from DNA in the nucleus.

[3 marks]

1 _____

2 _____

3 _____

0 1 . 2

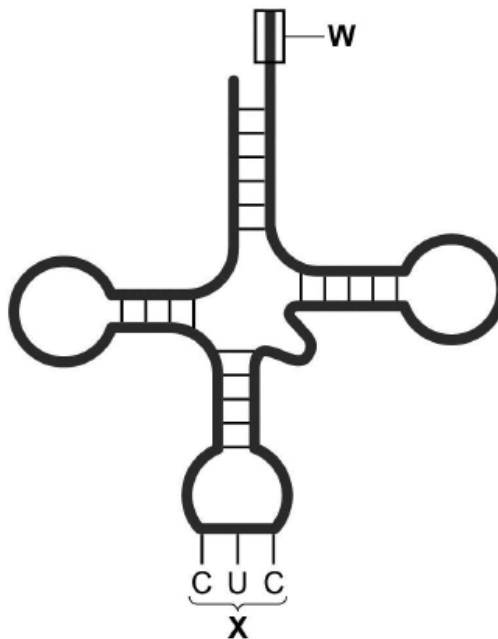
Some DNA nucleotides have the organic base thymine, but RNA nucleotides do not have thymine. RNA nucleotides have uracil instead of thymine.

Give **one** other difference between the structure of a DNA nucleotide and the structure of an RNA nucleotide.

[1 mark]

Figure 1 shows a tRNA molecule.

Figure 1



0 1 . 3

Name the structures labelled **W** and **X** in **Figure 1**.

[1 mark]

W _____

X _____

0 1 . 4

Not all mutations in the nucleotide sequence of a gene cause a change in the structure of a polypeptide.

Give **two** reasons why.

[2 marks]

1 _____

2 _____

6. May/2019/Paper_1/No.4

0 4

A scientist identified and counted the invertebrate species present in samples taken at two sites in a river. The scientist also measured the rate of water flow at each site.

His results are shown in **Table 2** and **Table 3**.

Table 2

Invertebrate species	Site 1	Site 2
Anglers' Curse mayfly	17	5
Flat-headed mayfly	6	8
Slate Drake mayfly	0	6
Water beetle	12	13
Midge fly	13	13
Total number caught	48	45

Table 3

	Site 1	Site 2
Index of diversity		4.7
Rate of water flow / cm s ⁻¹	1–14	30–60

0 4 . 1

Complete **Table 3** by calculating the index of diversity (d) at **Site 1**.

$$d = \frac{N(N-1)}{\sum n(n-1)}$$

[1 mark]

Index of diversity (d) = _____

0 4 . 2 Explain why it is more useful to calculate an index of diversity than to record species richness. **[2 marks]**

0 4 . 3 Suggest how the scientist measured the rate of water flow in the river. **[1 mark]**

0 4 . 4 Use information in **Table 2** and **Table 3** to suggest and explain a reason for the difference in the numbers of Slate Drake mayfly at these sites in this river. **[2 marks]**

0 4 . 5 It was important that the sampling procedure was standardised when collecting the Slate Drake mayflies from the two sites.
Give **one** way in which the sampling procedure could be standardised. **[1 mark]**

7. May/2019/Paper_1/No.9

0 9

Read the following passage.

In laboratory tests, scientists investigated the effects of a new drug called ABZ on stomach tumour cells. They found ABZ stopped mitosis by preventing the formation of spindle fibres. They also found that ABZ affected some healthy cells.

Mitosis is a controlled process. Cyclin B is a protein found in a cell's nucleus. It regulates the timing of mitosis during the cell cycle. Mitosis starts when the concentration of Cyclin B in the nucleus rises sharply and ends when it falls. The scientists found that ABZ increased, and maintained, a high concentration of Cyclin B in stomach tumour cells.

5

Programmed cell death is called apoptosis. Two nuclear proteins, Bcl-2 and Bax, are involved in controlling apoptosis. Apoptosis is prevented when the ratio of Bcl-2 to Bax is high and is promoted when this ratio is low. The scientists found that ABZ decreased the concentration of Bcl-2 and increased the concentration of Bax in stomach tumour cells.

10

From their results the scientists claimed that ABZ could be used for the successful treatment of stomach cancer.

15

Use information from the passage and your own understanding to answer the questions.

0 9 . 1

Suggest why preventing the formation of spindle fibres (lines 2–3) stopped the cell cycle.

[2 marks]

0 9 . 2

Suggest and explain why ABZ could be used as a treatment for cancer even though it affects some healthy cells (lines 3–4).

[1 mark]
