1. Spinal muscular atrophy (SMA) is a genetic disease.

Researchers have developed a treatment for SMA.

This involves using a virus to insert a replacement gene into the nucleus of motor neurone cells.

i. Why is the gene inserted into the **nucleus** of the motor neurone?

---

[1]

ii. Researchers tested this treatment on animals first.

Suggest **one** reason why they did this.

---

[1]

2(a). A light microscope is used to view a specimen.

Draw lines to connect each **part of the microscope** to its **role** in viewing the specimen.

Part of the microscope	Role
Stage	Moves the lenses up and down so the specimen can be seen clearly.
Objective lens	Makes the image bigger.
Focusing knob	Shines a light onto the specimen so that it can be seen.
Lamp	The part where the slide is placed.

[3]

(b). A student uses a light microscope to look at pollen grains.

i. The total magnification of the microscope is ×400.

The magnification of the eyepiece lens is ×10.

Calculate the magnification of the objective lens used by the student.

Magnification = ... **[2]**

ii. The student was asked to produce a drawing of the pollen cells from the microscope view.

Describe to the student how a scientific drawing is produced.

[3]

(c). Give **two** reasons why an image shows more detail with an electron microscope than an image produced by a light microscope.

.

1

2

[2]

3. Which structures are found in prokaryotic cells but **not** in the eukaryotic cells of animals?

A Cell membranes
B Mitochondria
C Nuclei
D Plasmids

Your answer ☐ **[1]**

4. Which structures are found in plant cells but **not** in animal cells?

A Chloroplasts
B Mitochondria
C Nuclei
D Ribosomes

Your answer ☐ **[1]**

5(a). DNA is found in both eukaryotic and prokaryotic cells.

Draw lines to connect the **cell type** to the **form its DNA takes** then to the **part of the cell where the DNA is found**.

Cell type	Form its DNA takes	Part of the cell where the DNA is found
eukaryote	chromosomes	cytoplasm
prokaryote	plasmids	nucleus

[2]

(b). A light microscope is used to see structures in cells.

Complete these sentences about the parts of a light microscope.

Use words from the list.

clips	**eyepiece**	**focusing knob**	**light**
objective	**stage**	**stain**	

i. The microscope slide is placed on the ..... of the microscope.

[1]

ii. The ..... lens is used to change the magnification of the object being viewed.

[1]

iii. The part of the microscope that moves the lens to see the image more clearly is called the ..... .

[1]

6(a). The diagram shows a tulip plant. Many gardeners like to grow tulip plants.

In 1637, tulip growers found that a small number of their tulip plants produced flowers with different coloured stripes.

The growers did not know what was causing the colour changes.

Complete the sentences to show **two** possible explanations for the colour changes.
Use words from the list.

antibody	**gene**	**mutation**
pathogen	**phenotype**	**producer**

The tulips could be diseased because they have been infected by a ..... .

This has altered the production of a chemical that colours the flowers.

Another explanation is that a ..... has occurred in the DNA of the tulip.

This is a change in the ..... that codes for a coloured chemical.

[3]

(b). It was not until 1960 that scientists could show that the tulips were infected with a virus.

Viruses are much smaller than human cells.

Suggest why it took so long to identify the cause of the infection.

_____

[1]

7. Plant cells are eukaryotic cells and bacteria are prokaryotic cells.

Plant cells and bacterial cells have similarities and differences between their structures.

Give **one** similarity and **one** difference.

Similarity _____

Difference _____

[2]

8(a). A student observes the stages of cell division in cells taken from the root tips of garlic.

They cut a small amount of root tip and squash it onto a microscope slide.

Complete each sentence to describe what they do next. Use words from the list.

coverslip	**eyepiece**	**focus**	**light**
objective	**stage**	**stain**	**water**

To make the chromosomes more visible, the student adds a few drops of ..... .

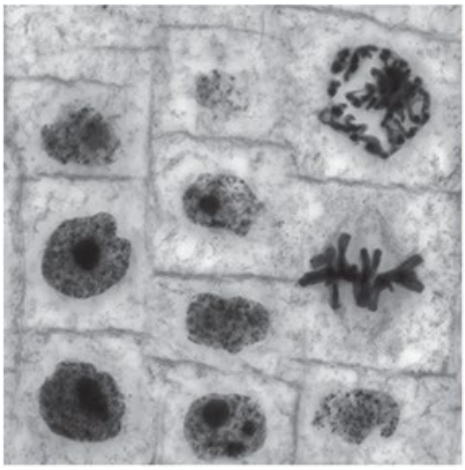
The slide is then placed on the microscope ..... .

The student first chooses the low power ..... lens.

The student twists a knob on the side of the microscope to bring the image into ..... .

[4]

(b). The image shows some of the cells observed by the student.



i. Identify one cell in the image that shows the chromosomes starting to move apart.

Draw an arrow to this cell on the image. Label the arrow **A**.

[1]

ii. Draw a second arrow to identify one nucleus in the image. Label this arrow **N**.

[1]

9. What do electron microscopes have that allow scientists to see cells in greater detail?

A A high magnification and a high resolution
B A high magnification and a low resolution
C A low magnification and a high resolution
D A low magnification and a low resolution

Your answer ☐ **[1]**

END OF QUESTION PAPER