**Q1.**

This question is about cell structures.

(a)  Draw **one** line from each cell structure to the type of cell where the structure is found.

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

**(2)**

(b)  **Figure 1** shows a plant cell.

**Figure 1**



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

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 |  |

**(1)**

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.

(c)  Describe how the student should adjust the microscope to see the cells on Slide A more clearly.

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**(1)**

(d)  Describe how the student should adjust the microscope to see the cells on Slide B more clearly.

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**(2)**

(e)  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.

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Magnification = × \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(3)**

**(Total 9 marks)**

**Q2.**

The image below shows some muscle cells from the wall of the stomach, as seen through a light microscope.



(a)     Describe the function of muscle cells in the wall of the stomach.

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**(2)**

(b)     The figure above is highly magnified.

The scale bar in the figure above represents 0.1 mm.

Use a ruler to measure the length of the scale bar and then calculate the magnification of the figure above.

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Magnification = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ times

**(2)**

(c)     The muscle cells in **Figure above** contain many mitochondria.

What is the function of mitochondria?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(d)     The muscle cells also contain many ribosomes. The ribosomes cannot be seen in the figure above.

(i)      What is the function of a ribosome?

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**(1)**

(ii)     Suggest why the ribosomes **cannot** be seen through a light microscope.

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**(1)**

**(Total 8 marks)**

Mark schemes

**Q1.**

(a)



*allow* ***1*** *mark for one or two correct links*

**2**

(b)

|  |  |  |
| --- | --- | --- |
| vacuole | ribosome | cell wall |

*tick box takes precedence*

*if no tick is given, look at both the figure and the circling of words in the table*

*if writing is seen on the figure and in the table both must be correct*

**1**

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

*allow focus it*

*do* ***not*** *accept increase magnification*

*ignore decrease magnification*

*ignore clear*

*ignore references to resolution / illumination*

*ignore zoom in / out*

**1**

(d)  (rotate the) nosepiece / objective lens

*allow change the (objective / eyepiece) lens*

**1**

to a higher power (lens)

*allow (to) increase the magnification*

*a comparator is required*

*ignore change / adjust the magnification*

*allow stronger or more powerful lens*

*ignore references to resolution / illumination unqualified*

*ignore zoom in / out*

*ignore references to an electron microscope*

**1**

(e)  conversion of units:

(112 mm ⟶) 112 000 (µm)

**or**

(280 µm ⟶) 0.28 (mm)

**1**



**or**



*allow* ***1*** *mark for no conversion of units 112 / 280*

***or***

*incorrect value from step 1 correctly substituted*

**1**

400 (×)

*do* ***not*** *accept if units are given*

*if no other mark scored allow* ***1*** *mark for:*



*a triangle with words or letters in is insufficient, as the correct rearrangement is needed*

**1**

*an answer of 400 (×) scores* ***3*** *marks*

**[9]**

**Q2.**

(a)     contract / shorten

*ignore relax*

*do* ***not*** *allow expand*

**1**

to churn / move / mix food

*accept peristalsis / mechanical digestion*

*ignore movement unqualified*

**1**

(b)     400

*acceptable range 390-410*

*allow 1 mark for answer in range of 39 to 41*

*allow 1 mark for answer in range of 3900 to 4100*

**2**

(c)     to transfer energy for use

*allow to release / give / supply / provide energy*

*do* ***not*** *allow to ‘make’ / ߢproduce’ / ‘create’ energy*

*allow to make ATP*

*ignore to store energy*

**1**

by (aerobic) respiration **or** from glucose

*do* ***not*** *allow anaerobic*

*energy released* ***for*** *respiration = max 1 mark*

**1**

(d)     (i)      to make protein / enzyme

*ignore ‘antibody’ or other named protein*

**1**

(ii)     too small / very small

*allow light microscope does not have sufficient magnification / resolution*

*allow ribosomes are smaller than mitochondria*

*ignore not sensitive enough*

*ignore ribosomes are transparent*

**1**

**[8]**

Examiner reports

**Q1.**

**Foundation**

(a)  57% of students demonstrated a good understanding of prokaryotic and eukaryotic cells and were awarded two marks. To achieve both marks all three structures had to be correctly linked to the type of cell where each structure is found.

When only one mark was awarded it was usually for identifying the nucleus as being found in eukaryotic cells.

(b)  59% of students were awarded the mark for identifying the vacuole, ribosome and cell wall in the plant cell.

Students were asked to tick one box, but some labelled the diagram, whilst others circled the names of the structures in the table.

(c)  17% of students achieved this mark. The cells on slide A appeared large, but blurred. The required response was a reference to focusing the image.

Many students referred to zooming in or out, to altering the magnification or using an electron microscope. All of these were ignored. However, if they said increase the magnification this was incorrect and negated a correct answer of focusing the image.

(d)  The cells on slide B appeared small but in focus. The required response was a description of how to obtain a larger image. There were two marks available for this question:

•   one was for reference to changing the lens

•   one was for stating that the new lens would have a higher power or magnification.

3% of students achieved two marks, and 23% obtained one mark, usually for saying increase the magnification.

Changing or using a better magnification was insufficient. Many students referred to zooming in or out or said use an electron microscope, both of which were ignored.

(e)  There were three marks available for this question.

•   The first mark was for conversion of units. Many students did not attempt a conversion but could still go on to achieve two marks. A range of different errors were made which included multiplying or dividing by 10, 100 or 10 000, rather than by 1000. Some did not appreciate that a micrometre is smaller than a millimetre.

•   The second mark was for correctly substituting into the rearranged equation to calculate magnification. This mark was allowed even if their initial conversion was incorrect.

•   The final mark was for an answer of 400. Some students added a unit to their answer and this negated the mark.

33% of students achieved all three marks, and 33% achieved two marks. 24% of students scored zero. This was often for 280 ÷ 112 = 2.5

**Higher**

(a)  Students demonstrated a good understanding of prokaryotic and eukaryotic cells. 87% of students achieved two marks. To gain both marks all three structures had to be correctly linked to the type of cell where each structure is found.

When only one mark was awarded it was usually for identifying the nucleus as being found in eukaryotic cells.

(b)  Students demonstrated a good understanding of cell structure. 80% of students were awarded the mark for identifying the vacuole, ribosome and cell wall in the plant cell.

Students were asked to tick one box, but some labelled the diagram, whilst others circled the names of the structures in the table.

(c)  27% of students achieved this mark. The cells on slide A appeared large, but blurred. The required response was a reference to focusing the image.

Many students referred to zooming in or out, to altering the magnification or using an electron microscope. All of these were ignored. However, if they said increase the magnification this was incorrect and negated a correct answer of focusing the image.

(d)  The cells on slide B appeared small but in focus. The required response was a description of how to obtain a larger image. There were two marks available for this question.

•   One was for reference to changing the lens.

•   One was for stating that the new lens would have a higher power or magnification.

45% of students obtained a mark. Where a mark was awarded it was usually for saying increase the magnification.

Changing or using a better magnification was insufficient. Many students referred to zooming in or out or said use an electron microscope, both of which were ignored.

(e)  There were three marks available for this question.

•   The first mark was for conversion of units. Many students did not attempt a conversion but could still go on to achieve two marks. A range of different errors were made which included multiplying or dividing by 10, 100 or 10 000, rather than by 1000. Some did not appreciate that a micrometre is smaller than a millimetre.

•   The second mark was for correctly substituting into the rearranged equation to calculate magnification. This mark was allowed even if their initial conversion was incorrect.

•   The final mark was for an answer of 400. Some students added a unit to their answer and this negated the mark.

22% of students achieved two marks. 56% of students scored zero marks. This was often for 280 ÷ 112 = 2.5

**Q2.**

This question was about cell structure and function, based on a drawing of some muscle cells from the wall of the stomach.

(a)     Just over two-thirds of students scored at least one mark for describing the function of the muscle cells either in terms of their ability to contract or with respect to their use in the stomach for churning food. Relatively few gave both points. A large number spoiled their answer by stating that the muscles ‘contract and expand’, while others clearly knew nothing about muscle and suggested they might ‘secrete acid’ or, alternatively, ‘protect the body from acid’.

(b)     The mathematical requirements given in section 3.7 of the Specification include the statement: *‘All students should be able to.......Understand number size and scale and the quantitative relationship between units’*. A very common error in calculating the magnification of the drawing of the muscle cells was to mix units by measuring the scale bar as 4 centimetres (rather than 40 millimetres) and then dividing this by the 0.1 millimetres that it represented. This gave an answer of ‘40’ instead of the correct 400. Despite the instruction in the question to ‘*use a ruler to measure the length of the scale bar...*’, many students measured one or more of the cells in the diagram and scored no marks. Thus success in this question was limited, with only about a quarter scoring full marks.

(c)     The function of mitochondria in respiration and in releasing energy was well known, although often only one of these points was made and many spoiled their answer by including the phrase ‘making energy’ which, of course, defies the fundamental physical law of conservation of energy. Another common error was to state that energy was released ‘for respiration’ rather than by *respiration*. Thus only one-third of students scored both of the marks available.

(d)     (i)      Around three quarters of students knew that ribosomes were the site of protein synthesis and that they were too small to be visible in a light microscope, although some suggested that they were merely ‘transparent’.

(ii)     Around three quarters of students knew that ribosomes were the site of protein synthesis and that they were too small to be visible in a light microscope, although some suggested that they were merely ‘transparent’.