

Question Paper

Analysis and Integration

Name: _____

Class: _____

Date: _____

Time:

27 min.

Marks:

25 marks

Comments:

EXAM PAPERS PRACTICE

Q1.

Read the following passage.

Microscopes are important tools in the study of cells.

Optical microscopes use light rays. The light rays pass through a specimen and are focused by the objective lens and eyepiece lens to produce an image.

5 Electron microscopes can be used to observe much smaller objects than optical microscopes. There are two types of electron microscope: the scanning electron microscope (SEM) and the transmission electron microscope (TEM).

10 Electron microscopes have a higher magnification and a higher resolution than optical microscopes. Electron microscopes can magnify up to $\times 2\,000\,000$, optical microscopes can magnify up to $\times 2\,000$. A TEM has a resolution of up to 0.1 nm, a SEM has a resolution of up to 20 nm and an optical microscope has a resolution of about 0.2 μm .

The method to prepare a specimen for the electron microscope is complicated and the resulting image may contain artefacts.

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

(a) What is meant by resolution (line 8)?

(1)

(b) Explain why electron microscopes have a higher resolution than optical microscopes (lines 8 – 12).

(2)

(c) Calculate how many times higher the resolution of a TEM is than the resolution of an optical microscope (lines 9 – 12).

(1)

- (d) Optical microscopes use lenses to focus light rays (line 2).

What is used to focus on the specimen in an electron microscope?

(1)

- (e) For each of the following investigations, state which of the three types of microscope named in the passage should be used.

Give a reason for your choice.

To observe the diffusion of a coloured pigment out of a cell.

Type _____

Reason _____

To measure the length of cristae in a mitochondrion.

Type _____

Reason _____

To observe the movement of chromosomes during cell division.

Type _____

Reason _____

To investigate the arrangement of proteins on the surface of the cell membrane.

Type _____

Reason _____

(4)

- (f) Suggest the meaning of 'artefacts' (line 14).

(1)
(Total 10 marks)



EXAM PAPERS PRACTICE

Mark schemes

Q1.

- (a) (Idea of) minimum distance between two objects for them to appear as separate objects;
Ignore 'the ability to distinguish 2 points' 1
- (b) 1. ° (Electron microscopes) use (a beam of) electrons;
 2. ° (Electrons) have a shorter wavelength/higher frequency;
Must be a comparative statement
Only allow TEM/SEM has a shorter wavelength if MP1 has been awarded 2
- (c) 2.000; 1
- (d) (Electro) magnet; 1
- (e) 1. ° (Optical microscope because) electron microscope images not colour/optical microscopes images are in colour
 OR
 membrane properties altered in TEM/SEM
 OR
 Specimen needs to be alive;
 2. ° (TEM because) shows internal structure of organelles/optical microscope magnification/resolution not high enough
 OR
 TEM has high enough magnification or sufficient resolution;
 3. ° (Optical microscope because) electron microscopes cannot view living cells;
 4. ° (SEM because) shows surface structure/gives 3D image; 4
- (f) °(Structures that are) not part of the natural specimen/produced as a result of specimen preparation; 1
- [10]**

Examiner reports

Q1.

Two thirds of students failed to gain the mark for (a) although some of these responses were very close. Students generally described resolution as the ability to... rather than describe it being the minimum distance between two objects to still see them as separate objects.

In (b), approximately half of students gained one mark for stating that electron microscopes use electrons but only a small proportion went on to explain that electrons have a shorter wavelength to gain the second mark.

Only a third of responses were awarded one mark for (c). The remainder did not convert units correctly and so could not gain this mark.

In (d), less than half of students were able to state that (electro)magnets are used to focus electrons.

In (e), students had to correctly name the type of microscope to use in a given context and give a reason for their choice. It is possible that students were running out of time whilst answering this question, as many responses were left incomplete or with gaps. Weaker responses confused the difference between the applications of TEM and SEM.

There were a number of unanswered responses to (f) and of those who attempted this question, approximately half gained the mark. Weaker responses to this question just stated that artefacts are 'things' that ruin or block the image or described them as 'black dots' without referring to why they are present or describing that they are not part of the natural specimen.

EXAM PAPERS PRACTICE