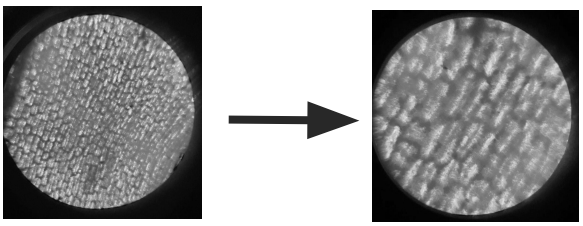
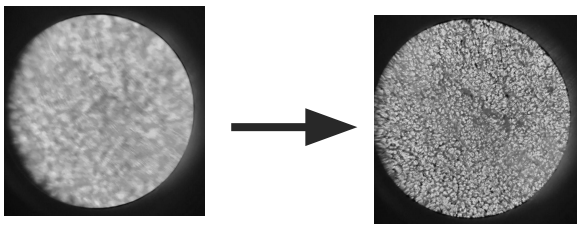
Microscopes, magnification and resolution

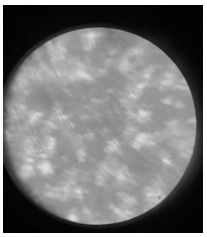
Task 1: Difference between magnification and resolution

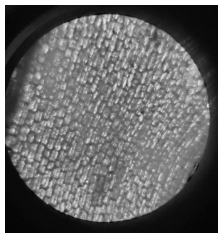
a) Describe what you could do to improve the micrograph for each image.

i) 

ii) 

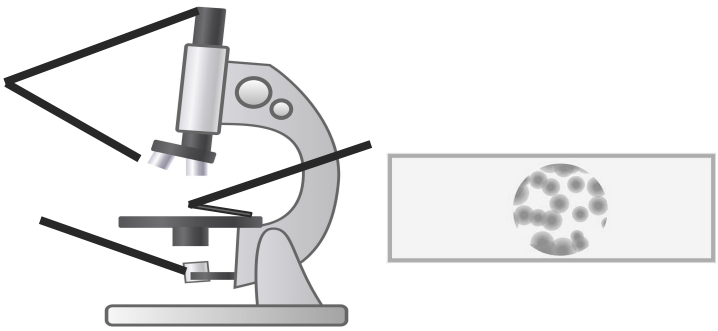
b) **Describe** what you could do to improve the micrograph for each image.

i) 

ii) 

Task 2: How light microscopes produce images

a) **Write sentences** and **label** this diagram of a light microscope to describe how it magnifies a sample. Here are some keywords you should use: slide, lenses, light source, magnify, specimen.



b) **Answer** the following questions in full sentences.

i) **What** is the maximum magnification of a light microscope?

ii) **What** is the resolution of a light microscope?

iii) **Which** sub-cellular structures can be viewed with a light microscope?

Task 3: How light microscopes produce images

a) **Complete** the table about electron microscopes.

Source of image	Magnification	Resolution	Specimen

b) **Describe** how electron microscopes have enhanced our understanding of cell structures and processes.

Task 4: Comparing light and electron microscopes

a) **Complete** this table to show the features of light and electron microscopes.

Feature	Light	Electron
Source of image		
Magnification		
Resolution		
Sub-cellular structures viewed		
Specimen		

b) Sarah has a specimen she wants to view. The specimen is dead and Sarah wants to magnify the image × 2000 and clearly see all the sub-cellular structures with a resolution of 20 nm.

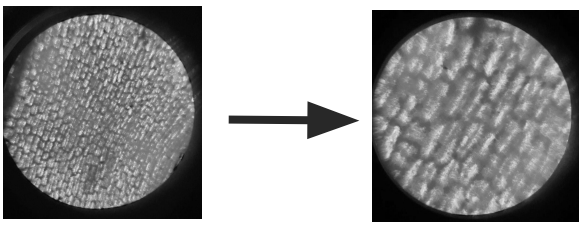
Explain to Sarah which microscope she should use and **why**.

Microscopes, magnification and resolution

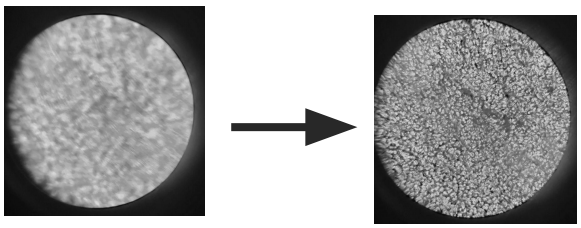
Answers

Task 1: Difference between magnification and resolution

a) Describe what you could do to improve the micrograph for each image.

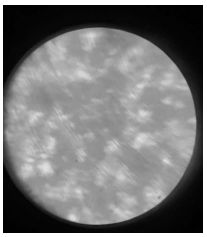
i) 

The magnification has been increased.

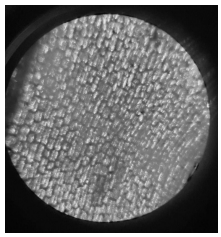
ii) 

The resolution has been increased.

b) **Describe** what you could do to improve the micrograph for each image.

i) 

The resolution needs increasing to see the micrograph in more detail.

ii) 

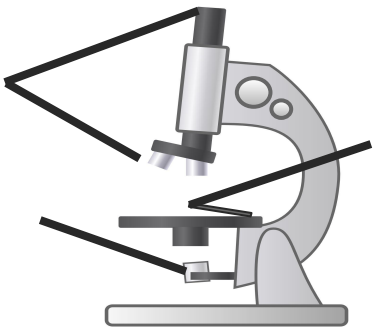
The magnification needs increasing to magnify the cells.

Task 2: How light microscopes produce images

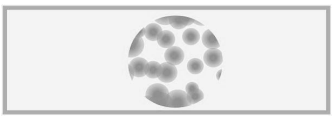
a) **Write sentences** and **label** this diagram of a light microscope to describe how it magnifies a sample. Here are some keywords you should use: slide, lenses, light source, magnify, specimen.

Lenses magnify the image.

Light source shines light up through the sample.



The slide holds the live specimen to be viewed.



b) **Answer** the following questions in full sentences.

i) **What** is the maximum magnification of a light microscope?

Light microscopes can magnify images by up to 2000 times.

ii) **What** is the resolution of a light microscope?

Light microscopes have a resolution of 0.2 µm or 200 nm.

iii) **Which** sub-cellular structures can be viewed with a light microscope?

Light microscopes can view larger sub-cellular structures such as the nucleus and chloroplasts.

Answers

Task 3: How light microscopes produce images

a) **Complete** the table about electron microscopes.

Source of image	Magnification	Resolution	Specimen
electrons fired at sample	*1-50 million times*	*1 nm*	*dead*

b) **Describe** how electron microscopes have enhanced our understanding of cell structures and processes.

Electron microscopes allowed scientists to see smaller sub-cellular structures such as ribosomes. It also allowed them to see inside other sub-cellular structures which helped us to understand cellular processes.

Task 4: Comparing light and electron microscopes

a) **Complete** this table to show the features of light and electron microscopes.

Feature	Light	Electron
Source of image	*light*	*electron beam*
Magnification	*× 2000*	*× 1-50 million*
Resolution	*200 nm*	*1 nm*
Sub-cellular structures viewed	*larger (nucleus and chloroplasts)*	*smaller (ribosomes) and inside structures*
Specimen	*alive*	*dead*

b) Sarah has a specimen she wants to view. The specimen is dead and Sarah wants to magnify the image × 2000 and clearly see all the sub-cellular structures with a resolution of 20 nm.

Explain to Sarah which microscope she should use and **why**.

Sarah can use a light or electron microscope as her sample is dead.
A light microscope will magnify by × 2000 but the resolution will only go to 200 nm, not enough to see all the sub-cellular structures.
An electron microscope will magnify × 2000 and resolve to 1 nm.
The electron microscope must be used to clearly see all the sub-cellular structures.