This is an adult water flea with some of its offspring. The image has been magnified.

CB1a.1



- 1 What piece of equipment has been used to examine the water flea in detail?
- 2 The main body of the adult water flea is 1 mm long in real life. How long, in millimetres, would the water flea appear at the following magnifications? Show your working in each case.

a×20 **b**×50 **c**×150 **d**×1200 **e**×0.5

- 3 Give each of your answers to question 2 in centimetres.
- 4 a Ignoring the antennae, measure the longest part of the adult water flea's body, and write it down.
 - **b** This water flea is 1 mm long in real life. What magnification is the drawing at? Show your working.
 - **c** Use your magnification to work out how wide the adult water flea's body is. Show your working.
- 5 The water flea has produced offspring. Estimate how many times bigger the adult is compared to the offspring. Show your working.
- 6 a Work out the length of the offspring (unmagnified) in millimetres.
 - **b** Give your answer to part a in metres, centimetres, micrometres, nanometres and picometres.

I can...

- calculate sizes using magnifications
- interpret the SI prefixes milli-, micro-, nano- and pico-.

Microscopes – Strengthen

as

Name	Class	Date

S1 Compare today's light microscopes with Hooke's.

Edexcel GCSE (9-1)

ciences

- 1 Which of these is the best definition for 'resolution'? Tick one:
 - the smallest distance between two points that can still be seen as two points

CB1a.2

- the longest object that can be observed using a microscope
- the amount that a microscope can magnify by
- 2 a Hooke's microscope is on the left and a modern light microscope is on the right. Draw lines from the boxes to show which features belong with which microscope. Some features belong to *both* microscopes.



b Complete the following sentences to compare today's light microscopes with Hooke's.

Hooke's and today's light _____are similar because they both contain two

____. However, Hooke's microscope had a much lower _____

- 3 A microscope with a $\times 10$ objective lens and a $\times 3$ eyepiece lens has a total magnification of $10 \times 3 = \times 30$. What would be the magnification if a $\times 20$ objective lens were used instead?
- 4 a Name a type of microscope that does not use light to produce an image.
 - **b** How does this microscope's resolution compare with a light microscope?
- 5 A piece of hair is 0.05 mm wide.
 - a What is the width of the hair in micrometres?
 - **b** The hair is magnified ×100. How wide is the magnified image in millimetres?

At the end of this topic I can...

- calculate total magnification using a formula
- interpret the SI prefixes milli-, micro-, nano- and pico-
- recall what an electron microscope is
- calculate sizes using magnifications
- recall what is meant by an instrument's resolution
- explain why some cell structures can be seen with an electron microscope but not with a light microscope.

E1 Diatoms are algae, 20–120 μm in length and with 1 μm diameter 'pores' in their outer coats. Van Leeuwenhoek described diatom shapes but not their pores. Explain why.

CB1a.3

1 The diagram shows an organism called a diatom.

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- **a** The width of the diatom is 100 μm (as shown by the arrow). On the microscope image above, this distance is 10 cm. What is the magnification of the image? Show your working.
- **b** What is the name given to the minimum distance between two points that can still be seen as two points, when using a microscope?
- **c** Look at the distance between the two spots in the upper right part of the diagram. How does the distance between these two spots compare with the diameter of one of the pores?
- **d** Antonie van Leeuwenhoek examined diatoms using his microscope but he did not draw in the pores. Explain why not.
- e The pores are about 1 µm in diameter. Give this value in millimetres, nanometres and picometres.
- **f** To produce the image of the diatom at this magnification, a microscope with a ×20 eyepiece lens could be used. What magnification of objective lens would be needed? Show your working.
- **2** a Compare an electron microscope with a light microscope. Make sure you include at least one way in which they are similar and one way in which they are different.
 - **b** Explain why we can see some details inside cells with an electron microscope that we cannot see with a light microscope.

At the end of this topic I can...

- calculate total magnification using a formula
- interpret the SI prefixes milli-, micro-, nano- and pico-
- recall what an electron microscope is
- calculate sizes using magnifications
- recall what is meant by an instrument's resolution
- explain why some cell structures can be seen with an electron microscope but not with a light microscope.

Sciences

Edexcel GCSE (9-1)

Name

_ Class

CB1a.4

- 1 Label the microscope to show position of the:
 - a eyepiece lens
 - **b** objective lens
 - c stage
 - d slide
 - e focusing wheel



- 2 The microscope above has an eyepiece lens with a x5 magnification. It has three objective lenses: x10, x20 and x30. When the x10 objective lens is used, the total magnification is: 5 x 10 = x50
 - a Calculate the total magnification when the x20 objective lens is used. Show your working.
 - **b** Calculate the total magnification when the x30 objective lens is used. Show your working.
- 3 Shiv examines some animal hairs using a microscope. Hair X is 20 μ m wide and hair Y is 60 μ m wide.
 - a How many times wider is hair Y compared with hair X? Show your working.
 - **b** Shiv examines hair X using a total magnification of ×150. How wide will the hair appear under the microscope, in micrometres?
 - c Give your answer to part b in millimetres.
 - d What total magnification will Shiv need to make hair Y appear 6 mm wide? Show your working.
- 4 1 μ m = 1 000 000 pm
 - a What do the unit symbols µm and pm stand for?
 - **b** Complete this sentence: $1 \mu m = 1000 \text{ nm}$ and $1 \text{ nm} = _____ pm$.
- 5 Complete the sentence to explain what is meant by a microscope's resolution.
 - The resolution of a microscope is the ______ distance between two points that can still be seen
 - as ______ points rather than one point.
- 6 a What is an electron microscope?
 - **b** State two reasons why an electron microscope can detect more detail inside a cell, compared with a light microscope.

1 Copy and complete the table to show the missing magnifications.

CB1a.5

Eyepiece lens magnification	Objective lens magnification	Total magnification
×3	×5	
	×10	×60
×7.5		×225
	×20	×250

- **2** A red blood cell is 8 μm in diameter. How big will its diameter be if magnified ×2000? Show your working and give your answer in millimetres.
- 3 Flu virus particles are about 130 nm in diameter. What magnification will be needed in order to produce an image in which the flu virus is 2.6 cm in diameter? Show your working.
- **4** The resolution of microscope X is 0.2 μm. The resolution of microscope Y is 20 000 pm and that of microscope Z is 1 nm.
 - **a** Which microscope will be best at showing the finest details inside a cell? Explain your answer.
 - **b** Which microscope(s) will be able to show some details of hepatitis virus particles, which are nm in diameter?
- 5 The diagram shows what happens inside an electron microscope.
 - What goes through a specimen in a school microscope to create an image?
 - Which of the three electromagnetic coils is most like the objective lens on a school microscope? Explain your reasoning.
 - c Explain why an electron microscope would not be used to watch the heart of a water flea pumping.
 - d Explain why an electron microscope would not be used to examine the dots of colour used to produce photographs in a newspaper.
 - e Explain why an electron microscope *would* be used to see the details in the cytoplasm of a cell.

	a beam of electrons is generated
n	air molecules interfere with electron beam and so there is a vacuum inside the instrument
5	the electron beam is made into a finer, more powerful beam using an electromagnetic coil
	another electromagnetic coil directs the electron beam onto a part of the specimen
n be t	preparing the specimen is a complicated and time-consuming process in which the specimen is cut extremely thinly and
g. n	the electron beam goes through thespecimen, creating an image
be	another electromagnetic coil magnifies
n	the image becomes visible when it hits a screen, and a black-and-white image can be obtained

Extra challenge

6 Draw a table to compare electron microscopes with school-type microscopes.

E	dexcel GCSE (9–1) Sciences	CB1a			Progres	sion Check
Na	ime		Class _		_ Date _	
Progression questions						
An	swer these questions.					
1	What determines how goo	od a microscope is at a	showing small	details?		
2	What has the developmen	nt of the electron micro	oscope allowed	d us to do?		
3	What units are used for ve	ery small sizes?				

Now circle the stars in the 'Start' row in the table showing how confident you are of your answers – more stars mean more confidence.

Question	1	2	3
Start	****	****	****

Assessment

Using a different colour, correct or add to your answers above. You may need to use the back of this sheet or another piece of paper. Then circle the stars in the 'Check' row in the table – more stars mean more confidence.

Question	1	2	3
Check	****	****	****

 \square

Feedback

What will you do next? Tick one box.

strengthen my learning

strengthen then extend

extend

 \square

Note down any specific areas you need to improve.

Action

You may now be given another activity. After this, note down any remaining areas you need to improve and how you will try to improve in these areas.