----------YEAR 9 CELLS BOOKLET

Name

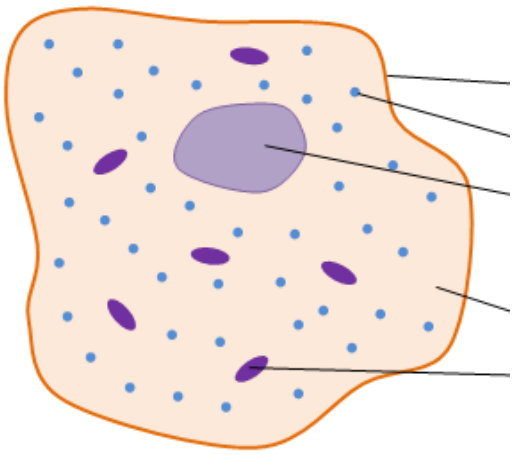
Class

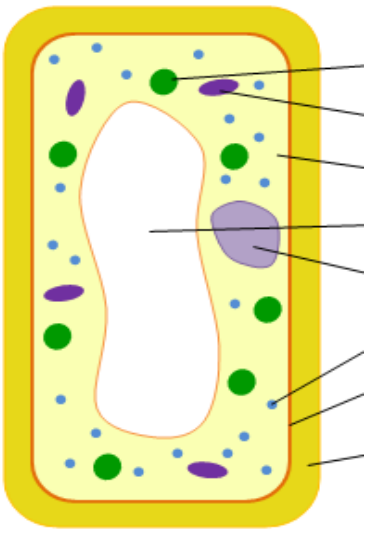
Teacher

Part 1- Animal and plant cells

All living things are made of cells. Cells can be broadly categorised into two main areas: **eukaryotic** and **prokaryotic** cells. All eukaryotic cells have a nucleus and prokaryotic cells do not have a nucleus. Animal cells and plant cells are examples of eukaryotic cells. All complex multicellular life is made of eukaryotic cells as they are more sophisticated.

Label the organelles in the cells below. You must include the function of each organelle.





1. Complete the table below:

Organelle	Found in Animal cells	Found in plant cells
Nucleus		
Cell membrane		
Cell wall		
Permanent vacuole		
Ribosome		
Chloroplast		
Mitochondria		

Cytoplasm		

Questions

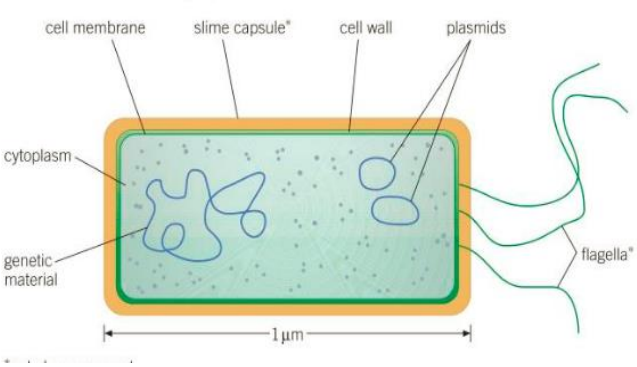
2. Define the term *eukaryotic cell*
3. List the structures found in a human cell.
4. What is the function of the nucleus and mitochondria?
5. The Krebs cycle is an important part of aerobic respiration. Where does the Krebs cycle take place?
6. What three cell structures are found only in plant cells and not in animal cells?
7. What cell structure is responsible for making proteins?
8. Salivary cells produce amylase which is a type of protein, what type of cell structure will they have a lot of?
9. Muscle cells are likely to have large amount of what cell structure and why?
10. The root hair cell is a plant cell, but it has no chloroplasts why is it not considered an animal cell?
11. Complete the following sentences:

a) Plant and animal cells are eukaryotic because…
b) Plant and animal cells are eukaryotic but……
c) Plant and animal cells are eukaryotic so……

12. Suggest why the nucleus and mitochondria are so important in all cells (4)
13. Compare a plant and animal cell (4)

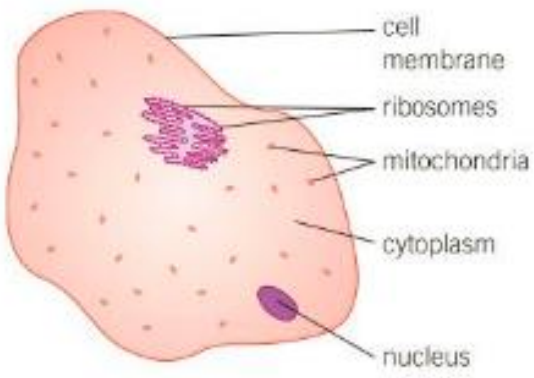
Part 2 Prokaryotic cells

As previously mentioned, animal and plant cells are eukaryotic cells because they have a nucleus. However, they are not the only cells to be eukaryotic, both fungi and Protista are also eukaryotic. In a eukaryotic cell DNA is found in structures called chromosomes in the nucleus. Bacteria are examples of prokaryotic cells. They are 10 times smaller than eukaryotic cells being only 0.2 **µm**-2 **µm long. They do not have a nucleus.**



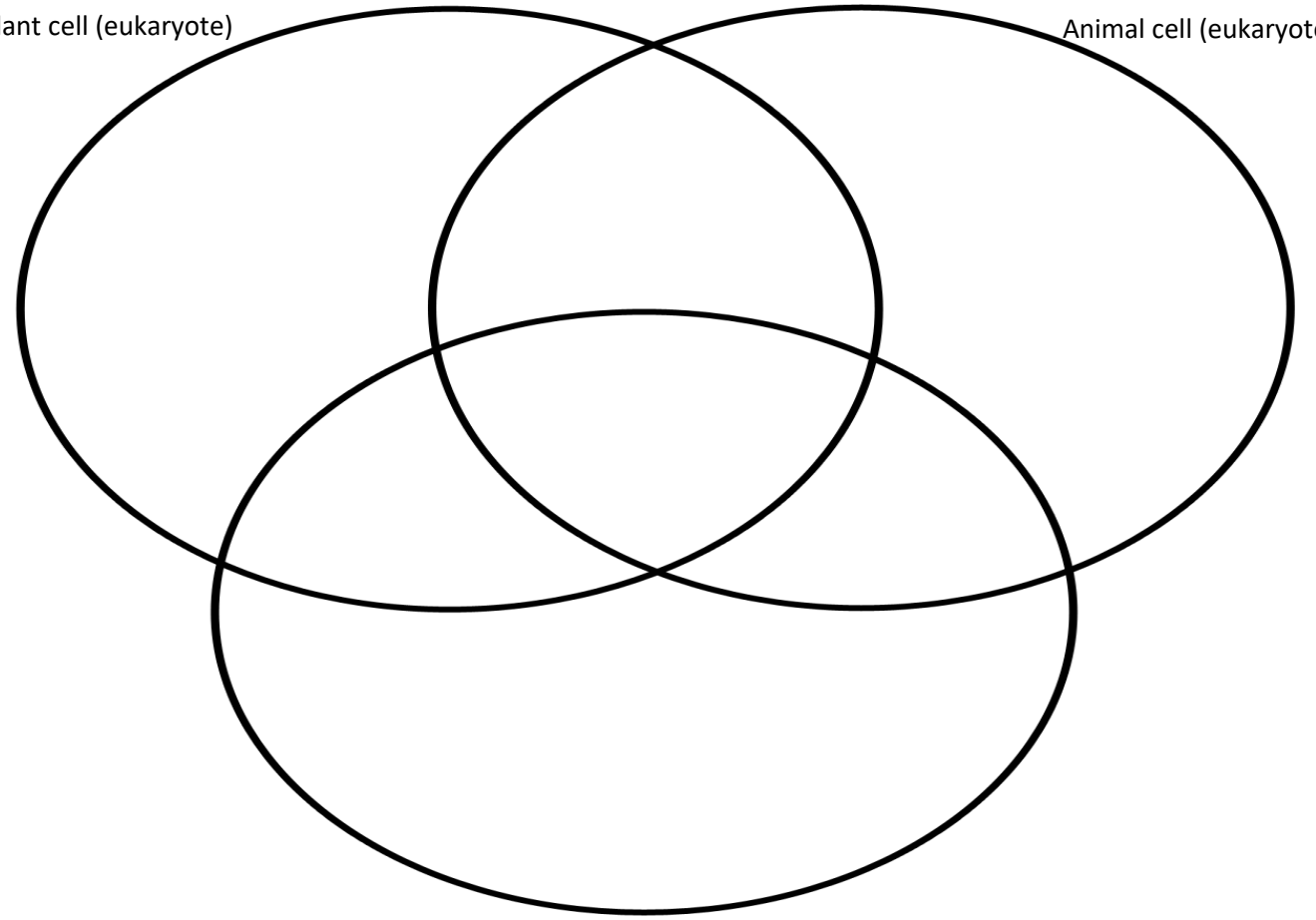
The cell wall of a bacterial cell is not made of cellulose. The bacterial genetic material is a single loop of DNA found free in the cytoplasm. A bacterial cell also has **plasmids**. These are small rings of DNA that carry useful genes eg antibiotic resistance. Some bacteria have a **flagellum** which is a strand of protein that acts like a propeller to move them forwards. Some bacteria also have a slime capsule which protects them.

1. What is the difference between eukaryotic and prokaryotic cells?
2. Give two examples of eukaryotic cells
3. Give an example of a prokaryotic cell
4. List all the structures that could be found in a bacterial cell
5. What is a plasmid?
6. What are two differences between an animal cell (right) and a bacterial cell (above)
7. Where is the DNA found in a bacterial cell?

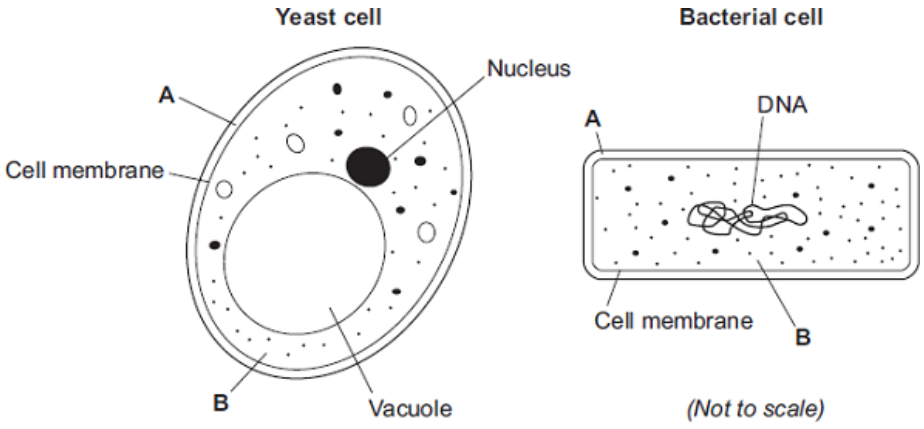


Application questions

8. Complete the Venn diagram below to compare the features of eukaryotes and prokaryotes. Use the words for the organelles in the last 2 sections to help you



9. Contrast plant cells and bacterial cells (5) (contrast means tell me differences)
10. Compare animal cells and bacterial cells (5) (compare means both similarities and differences)
11. The diagrams show the structures of a yeast cell and a bacterial cell.



a) Both the yeast cell and the bacterial cell have structures **A** and **B**. Name structures **A** and **B**.

b) The yeast cell and the bacterial cell have different shapes and sizes. Give **one** other way in which the structure of the bacterial cell is different from the structure of the yeast cell. (1)

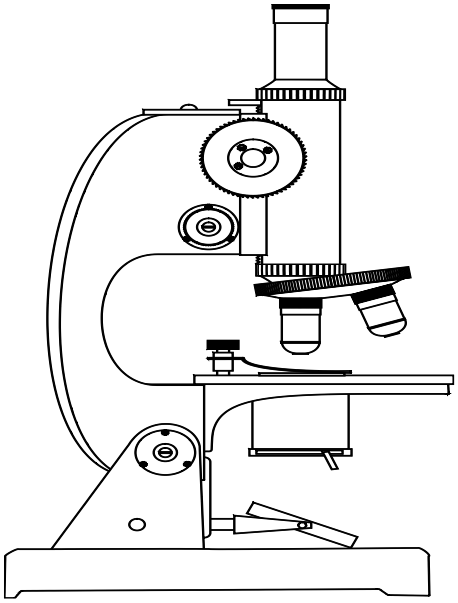
c) Suggest whether a yeast cell is a prokaryotic cell or a eukaryotic cell and why? (2)

12. What is the function of the nucleus, ribosomes and mitochondria?

<u>Part 3 Microscopes and Magnification</u>

Cells are too small to be seen with the naked eye. Instead microscopes must be used. The first light microscopes were made in the 17th century. They use a beam of light to form an image of an object and can only reach magnifications of x2000. They are relatively cheap, easy to use and can magnify live specimens. The invention of electron microscopes in the 1930's allowed scientists to see cells in more detail and discover new sub cellular structures like ribosomes. Electron microscopes have a higher magnification and resolution. They use a beam of electrons and can magnify up to 2 000 000 times. Electron microscopes are large, very expensive, must be kept in special conditions and cannot use live specimens. Resolution is the ability to distinguish between two objects as separate points. Magnification is making an image larger than the object. When we focus the image we make the image become sharp and easy to see.

13. Label the microscope below with the following words: (Objective lens, Eyepiece, Stage, Stage Clips, Fine Focus, Course Focus, Light, Base, Arm)



Magnification of a light microscope can be calculated very easily.

Total magnification = eyepiece lens magnification x objective lens magnification

14. Calculate the overall magnification

Eyepiece Magnification	Objective Magnification	Overall Magnification
X10	X4	
X10	X10	
X10	X40	
X10	X100	

Below is a table that shows the differences between Light Microscopes (the ones we have in school) and electron microscopes.

Optical/light Microscope	**Electron microscope**
Used for hundreds of years	Very recently invented
Uses light rays	Uses electron beams of high energy
Specimen can be living	Specimen is dead
×1000 to 2000 magnification	About ×2 000 000 magnification
Not possible to see internal structures inside the cytoplasm	Internal structures inside the cytoplasm are possible to see
Quite cheap	Very expensive
Anyone can use this and observe images	Highly trained scientists needed to operate and analyze results
Not much space needed	Lots of space required
2D image only	3D image can be produced
Not possible to get better magnification with this technology	Technology can be improved over time

Use the information in the table to suggest which microscope is most suitable for the following situations.

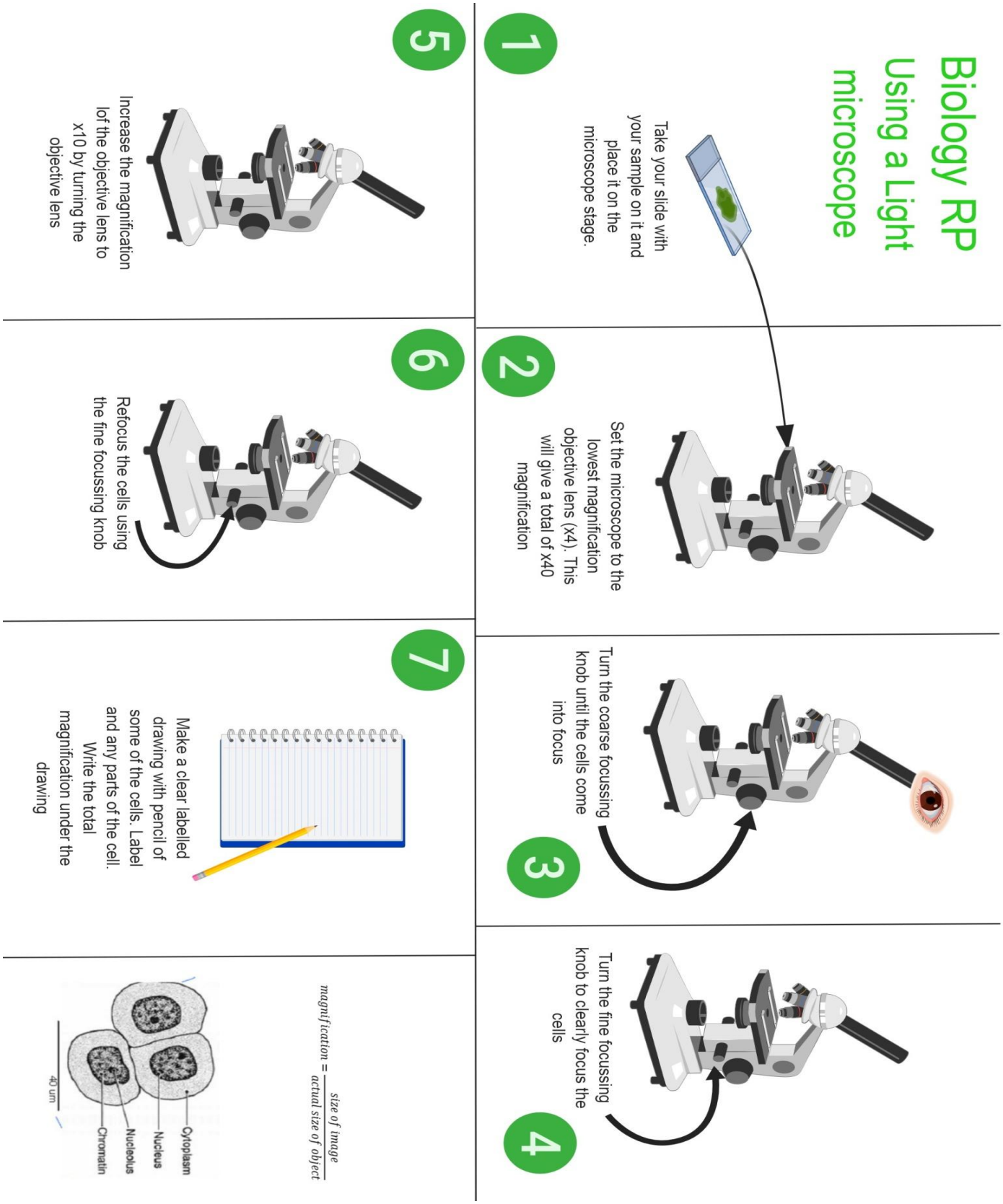
1. School experiments.
2. A university experiment looking at the overall structure of a cell.
3. An experiment to investigate the inside of the nucleus.
4. Experiment involving a living bacterial cell.
5. An experiment investigating viruses.

Explain why electron microscopes have not completely replaced light microscopes.

_____
_____
_____
_____
_____
_____

Using a Light microscope:

15. How do you improve the focus of a microscope?



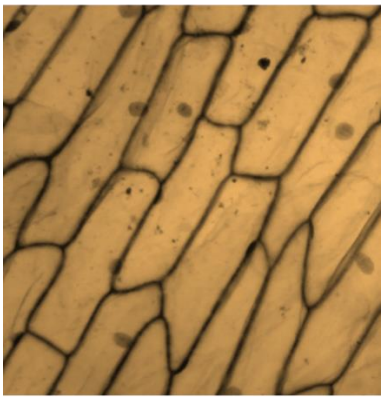
16. How do you increase the magnification of an image?
17. Boris is looking at a fuzzy image of a cell "I need to increase the magnification by changing the objective." Is he correct? Give a reason for your answer.
18. Write a step by step method on how a person could prepare a slide of onion cells. Include the following terms: Iodine, Onion, Upper Layer, tweezers, Glass slide, Cover Slip, Pipette

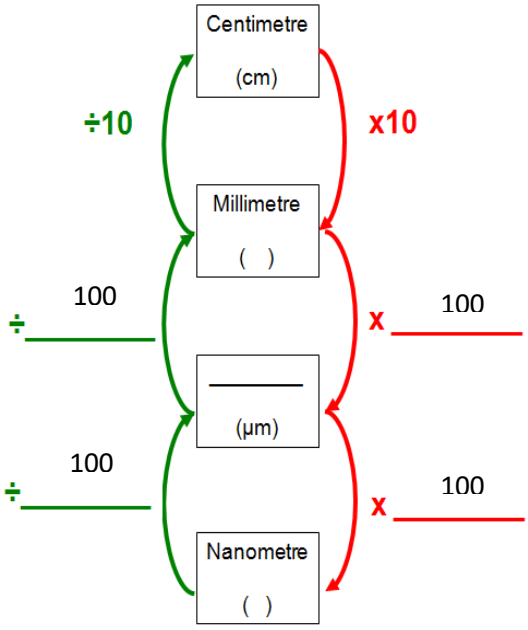
Microscope Drawing Task

- No colours (in pencil)
- No shading
- Subcellular structures should be in proportion (no giant nuclei)

Label the important features of your diagram using straight lines. These lines should not cross each other. Put the magnification and a title.

Draw a scientific drawing of the image below. Onion cells at 160 magnification.





19. Complete the table below to show the corresponding value nanometres, micrometres and millimetres for the measurements given in each row. The first row has been completed for you.

Nanometre (nm)	Micrometre (µm)	Millimetre (mm)
5	0.005	0.000005
1		
	1	
		1

	3	
7		
		0.5

Using the magnification formula

People find the magnification formula hard, but that is because they do not practise enough.

$$Magnification = \frac{Image\ size}{Actual\ size} \text{ or } M = \frac{I}{A}$$

FINDING THE MAGNIFICATION

Example 1: Magnification *Calculate the magnification of an object that is 0.01mm long but looks 10mm long in the image*	Example 2: Magnification *Calculate the magnification of an object that is 0.25mm long but looks 50mm long in the image*	Example 3: Magnification *Calculate the magnification of a fruit fly that is 3mm long but looks 3cm long in the image*
1. Write out the **F**ormula	1.Formula	F
M=I÷A		
2.**I**nsert values	2.Insert	
M=10 ÷ 0.01	*M*=_____ *I*=_____ *A*=_____	I
3.Fine tune (do you need to rearrange; check units are the same)	M=_____ ÷ _____	
	3.Fine Tune if needed	F
4.**Answer**	4.Answer	
M=10 ÷ 0.01= 1000	M=_____÷ _____	
Magnification = x1000		A

25. Calculate the magnification of an object that is 400mm long but has an image 8000mm long
26. Calculate the magnification of an object that is 0.005mm long but has an image 20mm long
27. Calculate the magnification of a grain of sand that has an image of 2.5cm but is actually 0.25mm long (hint: UNITS)
28. Pritesh finds a photo of a yellow shield bug. He measures the photo and the bug is 11.3cm long. He goes online and finds the average length of the beetle to be 7mm. What is the magnification of the image?

FINDING THE OBJECTS ACTUAL SIZE

Example 1: Actual size *Calculate the size of an amoeba which is 75mm long under x100 magnification.*	**Example 2: Actual size** *Calculate the size of a sperm which is 50mm long under x1000 magnification.*	**Example 3: Actual size** *Calculate the size of a pollen grain that looks 3cm long in the image under x100 magnification*
1. Formula	1.Formula	
M=I÷A	M=I÷A	F
2.Insert Values	2. Insert values	
M=x100 I=75mm A=?	*M*=_____ *I*=_____ *A*=_____	
100 =75 ÷ ?	_____ =_____ ÷ _____	I
	3. Fine Tune (rearrange)	

3.Fine Tune (rearrange if needed) ?=75÷100 = 0.75 4. Answer Actual size = 0.75mm	_____ =_____ ÷ _____ 4.Answer Actual size = _____	F A

29. What is the actual size of an object that looks 24mm under a x10 magnification?
30. What is the size of an object that looks 0.1m in a x500 magnification? What is that number in mm?
31. Owen is using a microscope to look and pond water. Under the x400 magnification the fresh water shrimp look 1.8cm long. How long are they in real life?
32. A gemstone is viewed by an eyepiece of x25 magnification. It looks to be 0.1m wide how wide is it in real life? Give your answer in μm using standard form.
33. A student is looking at a diagram of a red blood cell. The diagram tells him that the cell has a magnification of x5000. The student then measures the size of the image and finds that it is 7mm long.
    a) What equation would the student need to use in order to calculate actual size?
    b) Calculate actual size in nm/micrometer/cm

FINDING THE IMAGE SIZE

Example 1: Image size *Calculate the size of an image made of an amoeba which is 0.7mm long under x100 magnification.* Write out **Formula** M=I÷A Insert Valules *M=x100 I=? A=0.7mm* 100 =? ÷ 0.7 Fine Tune (rearrange if needed) ?=0.7x100 = 70 Answer Actual size = 70mm (7cm)	**Example 2:Image size** *Calculate the size of an image of a sperm which is 0.05mm long under x1000 magnification.* Formula M=I÷A Insert Values *M*=_____ *I*=_____ *A*=_____ _____ =_____ ÷ _____ Fine Tune _____ =_____ x _____ Answer Actual size = _____	**Example 3: Image size** *Calculate the size of the image a pollen grain that is 0.06mm long if viewed under x1000 magnification* F I F A

34. An object 4.5mm wide is viewed under a x600 magnification. How wide is the image?
35. An object that is 200μm long is viewed under an x2000 microscope. How long is the image?
36. A sample of food infected with bacteria is viewed under the microscope. The bacteria are 0.5μm long. How big will they look when using a light microscope which has a magnification of x1500? Explain if this is a good use of the microscope.
37. An atom is 0.1nm wide. When viewed under an electron microscope with a magnification of x10,000,000 how wide will it look? Give your answer in metres using standard form. Explain if this is a good use of the microscope

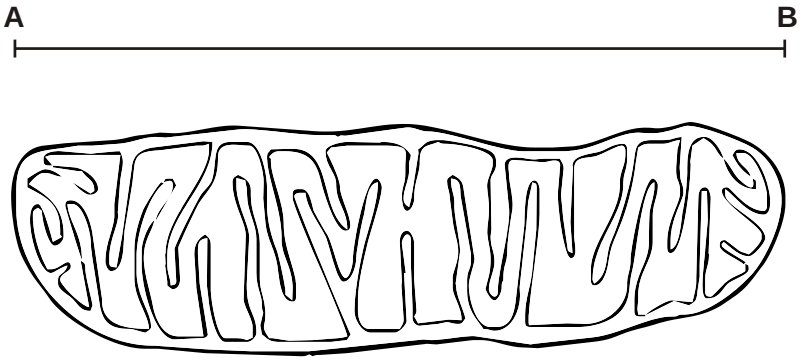
38. Outline the method that a student would need to follow in order to prepare an onion slide.
39. A student says:

"In school we use electron microscopes because they are less expensive and smaller."

a) Is this student correct?

b) Explain why electron microscopes are not commonly found in school labs but light microscopes are (6 marks)

The diagram below is a drawing of an organelle from a ciliated cell as seen with an electron microscope.



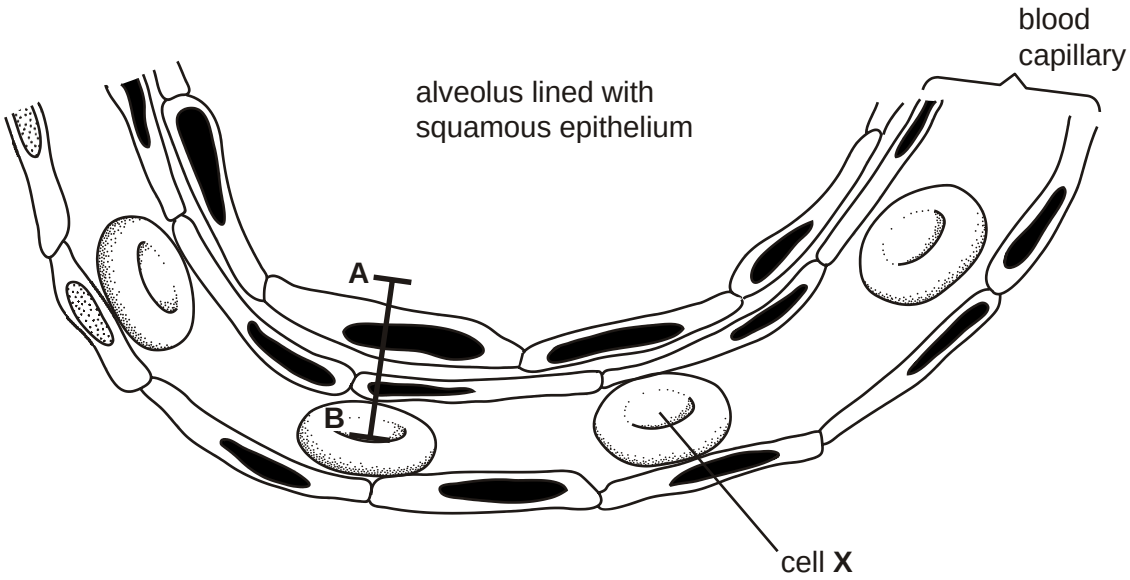
× 20 000

Calculate the actual length of the organelle as shown by the line AB in the diagram. Express your answer to the nearest micrometer (μm).

Show your working.

Answer = ... μm

The diagram below is a drawing of an alveolus together with an associated blood capillary.

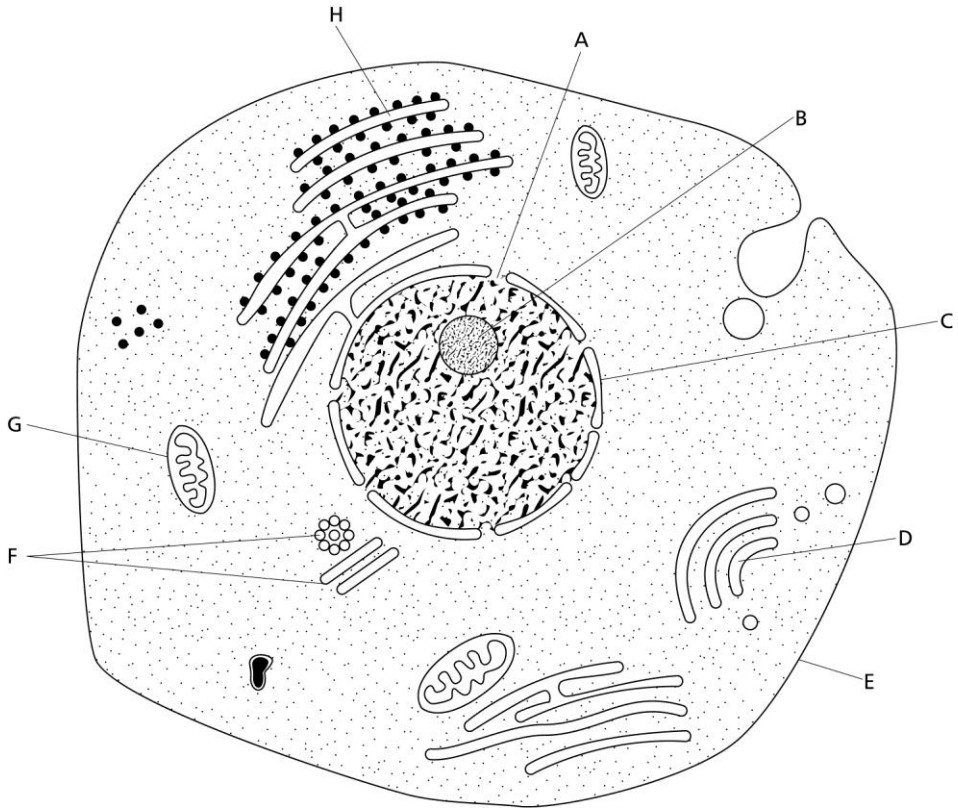


The line **AB** in the diagram represents an actual distance of 1.5 μm.

Calculate the magnification of the drawing. Show your working.

Answer = × .....

The diagram below shows the general structure of an animal cell as seen under an electron microscope.



5μm

1) Calculate the magnification factor of the diagram (use the scale bar above- number below it is actual size, use a ruler to work out image size)

2) Calculate the actual length of structure G

3) Calculate the diameter of the nucleolus (structure B)

4) Calculate the diameter of the nucleus

5) Calculate the diameter of the cell at its widest point