

Cell Theory & the Microscope

KEY IDEAS

Cell theory: all living things are made of cells; the cell is the basic unit of life; all cells come from other cells.

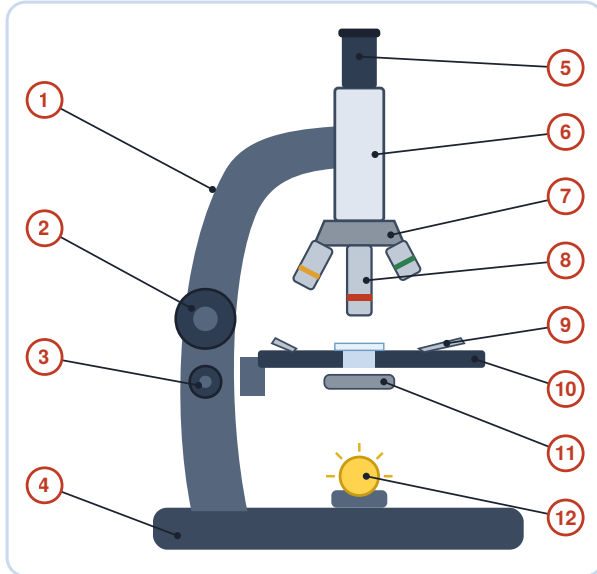
Total magnification = eyepiece × objective ($10\times \times 40\times = 400\times$). Higher magnification shows **less** of the specimen.

Field of view (FOV) is the diameter of the circle you see. $1\text{ mm} = 1000\text{ micrometres }(\mu\text{m})$.

A Parts of a compound light microscope

6 marks (½ each)

Word bank: **arm** · **base** · **body tube** · **coarse adjustment knob** · **diaphragm** · **eyepiece** · **fine adjustment knob** · **light source** · **objective lens** · **revolving nosepiece** · **stage** · **stage clips**



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

B Magnification

3 marks

Total = eyepiece × objective. ½ mark each.

Eyepiece	10×	10×	10×
Objective	4×	10×	40×
Total			

13.

14.

15.

16. $400\times$ total, $40\times$ objective → eyepiece = _____

17. $600\times$ total, $15\times$ eyepiece → objective = _____

C What does each part do?

3 marks (½ each)

Job	Part
18. Holds the slide in place on the stage	
19. Rotates to change from one objective lens to another	
20. Controls how much light passes up through the specimen	
21. Moves the stage a lot, for focusing on low power only	
22. Makes small, sharp focus changes (use on high power)	
23. The lens you look through; it usually magnifies $10\times$	

D Focusing a microscope

3 marks

24. These steps are mixed up. Write the letters in the correct order: _____

A	Use the fine adjustment knob to make the image sharp.
B	Turn the revolving nosepiece to the lowest-power (shortest) objective.
C	Switch to a higher-power objective and focus with the fine adjustment knob only.
D	Place the slide on the stage and hold it with the stage clips.
E	Look through the eyepiece and turn the coarse adjustment knob to focus.

E Field of view and cell size

6 marks (2 each)

25. At 40× the field of view is 4.5 mm across. What is the field of view at 100×?

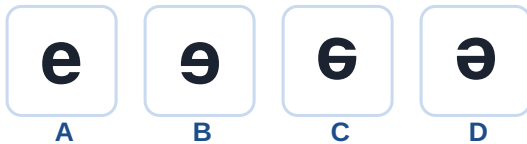
26. At 100×, about 6 onion cells fit end to end across the field of view. Estimate the length of one onion cell in mm and in micrometres (1 mm = 1000 µm).

27. What is the field of view at 400×? Give your answer in mm and µm. Why do you see less of the specimen?

F What you see

2 marks

28. A slide has the letter **e** on it, placed the right way up. Circle how it looks through the microscope.



29. You move the slide to the **left** on the stage. Which way does the image move as you look through the eyepiece?

G Cell theory

3 marks

Word bank: **cells** · **structure** · **pre-existing** · **organs** · **atoms**

30. All living things are made of one or more _____.

31. The cell is the basic unit of _____ and function in living things.

32. All cells come from _____ cells.

H Who discovered what?

2 marks (½ each)

Word bank: **Robert Hooke** · **Antonie van Leeuwenhoek** · **Matthias Schleiden** · **Theodor Schwann** · **Rudolf Virchow** (one is not used)

	Discovery	Scientist
33.	Looked at thin slices of cork in 1665 and named the tiny boxes "cells"	
34.	Built simple microscopes and was the first to see living microorganisms (1670s)	
35.	Concluded that all animals are made of cells (1839)	
36.	Stated that all cells come from other cells (1855)	

I Spot the mistake

2 marks

37. A student focuses on high power (400×) using the coarse adjustment knob. Explain why this is a problem.

Cell Theory & the Microscope

ANSWER KEY

KEY IDEAS

Cell theory: all living things are made of cells; the cell is the basic unit of life; all cells come from other cells.

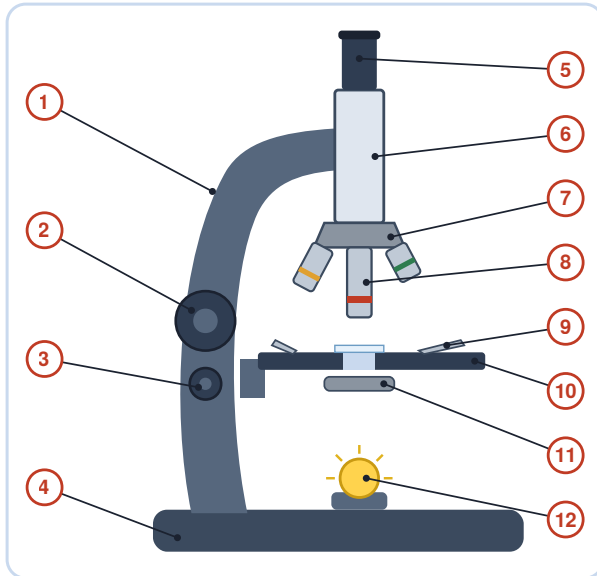
Total magnification = eyepiece × objective ($10\times \times 40\times = 400\times$). Higher magnification shows **less** of the specimen.

Field of view (FOV) is the diameter of the circle you see. 1 mm = 1000 micrometres (μm).

A Parts of a compound light microscope

6 marks (½ each)

Word bank: arm · base · body tube · coarse adjustment knob · diaphragm · eyepiece · fine adjustment knob · light source · objective lens · revolving nosepiece · stage · stage clips



- | | |
|-------------------------|---------------------------|
| 1. arm | 2. coarse adjustment knob |
| 3. fine adjustment knob | 4. base |
| 5. eyepiece | 6. body tube |
| 7. revolving nosepiece | 8. objective lens |
| 9. stage clips | 10. stage |
| 11. diaphragm | 12. light source |

B Magnification

3 marks

Total = eyepiece × objective. ½ mark each.

Eyeiece	10×	10×	10×
Objective	4×	10×	40×
Total	40×	100×	400×
	13.	14.	15.

16. 400× total, 40× objective → eyepiece = **10×**

17. 600× total, 15× eyepiece → objective = **40×**

C What does each part do?

3 marks (½ each)

Job	Part
18. Holds the slide in place on the stage	stage clips
19. Rotates to change from one objective lens to another	revolving nosepiece
20. Controls how much light passes up through the specimen	diaphragm
21. Moves the stage a lot, for focusing on low power only	coarse adjustment knob
22. Makes small, sharp focus changes (use on high power)	fine adjustment knob
23. The lens you look through; it usually magnifies 10×	eyepiece

D Focusing a microscope

3 marks

24. These steps are mixed up. Write the letters in the correct order: **B → D → E → A → C**

A	Use the fine adjustment knob to make the image sharp.
B	Turn the revolving nosepiece to the lowest-power (shortest) objective.
C	Switch to a higher-power objective and focus with the fine adjustment knob only.
D	Place the slide on the stage and hold it with the stage clips.
E	Look through the eyepiece and turn the coarse adjustment knob to focus.

E Field of view and cell size

6 marks (2 each)

25. At 40× the field of view is 4.5 mm across. What is the field of view at 100×?

FOV gets smaller as magnification gets bigger: $4.5 \times 40 \div 100 = 1.8 \text{ mm}$

26. At 100×, about 6 onion cells fit end to end across the field of view. Estimate the length of one onion cell in mm and in micrometres (1 mm = 1000 µm).

$1.8 \text{ mm} \div 6 = 0.3 \text{ mm} = 300 \text{ µm}$

27. What is the field of view at 400×? Give your answer in mm and µm. Why do you see less of the specimen?

$4.5 \times 40 \div 400 = 0.45 \text{ mm} = 450 \text{ µm}$. Higher power zooms in on a smaller area.

F What you see

2 marks

28. A slide has the letter **e** on it, placed the right way up. Circle how it looks through the microscope.



D: the image is upside down and backwards (turned 180°).

29. You move the slide to the **left** on the stage. Which way does the image move as you look through the eyepiece?

To the **right**. The image is inverted, so it moves the opposite way.

G Cell theory

3 marks

Word bank: **cells** · **structure** · **pre-existing** · **organs** · **atoms**

30. All living things are made of one or more **cells**.

31. The cell is the basic unit of **structure** and function in living things.

32. All cells come from **pre-existing (other)** cells.

H Who discovered what?

2 marks (½ each)

Word bank: **Robert Hooke** · **Antonie van Leeuwenhoek** · **Matthias Schleiden** · **Theodor Schwann** · **Rudolf Virchow** (one is not used)

	Discovery	Scientist
33.	Looked at thin slices of cork in 1665 and named the tiny boxes "cells"	Robert Hooke
34.	Built simple microscopes and was the first to see living microorganisms (1670s)	Antonie van Leeuwenhoek
35.	Concluded that all animals are made of cells (1839)	Theodor Schwann
36.	Stated that all cells come from other cells (1855)	Rudolf Virchow

I Spot the mistake

2 marks

37. A student focuses on high power (400×) using the coarse adjustment knob. Explain why this is a problem.

On high power the objective is very close to the slide. The **coarse** knob can crash the lens into the slide and break it. Use only the **fine** adjustment knob.