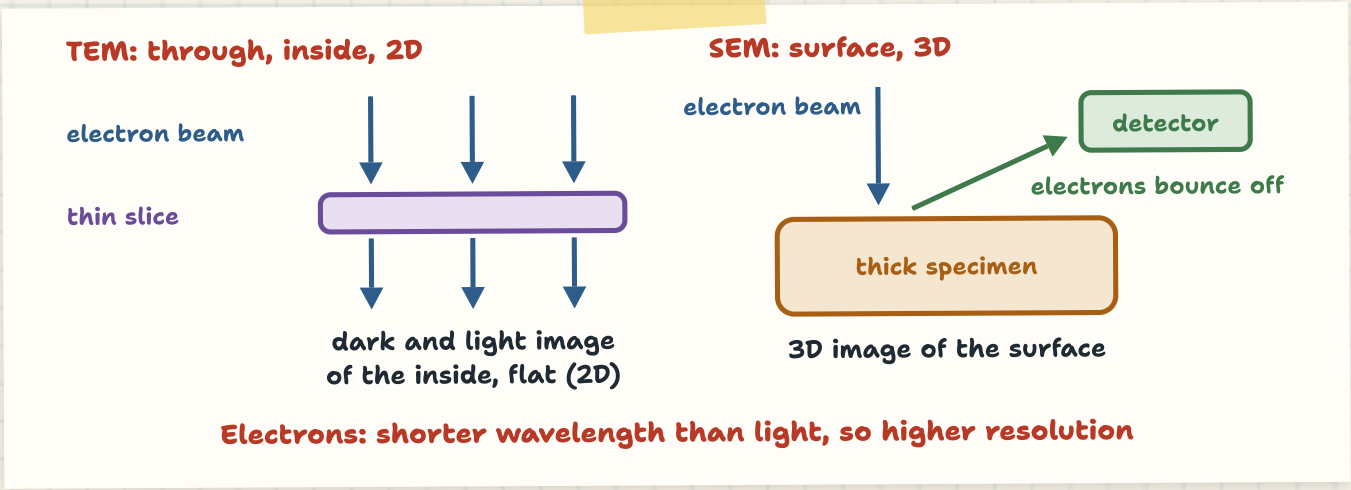
# Optical, TEM and SEM Microscopes Compared

Electron microscopes have a higher resolution than optical ones; TEM shows the inside in 2D, SEM the surface in 3D.




## Key terms

| | |
|---|---|
| **resolution** | the smallest distance between two points at which you can still see them as separate points. |
| **wavelength** | the shorter the wavelength, the higher the resolution; electrons have a much shorter wavelength than light. |
| **TEM** | a beam of electrons is fired through a very thin slice of specimen, giving a flat, 2D image of the inside of cells. |
| **SEM** | the beam sweeps across the surface and electrons bounce into a detector, giving a 3D image of the surface. |
| **vacuum** | electrons are blocked by air, so the specimen sits in a vacuum and must be dead. |
| **artefact** | something that shows up in the image but was not there in the living cell. |

## I can...

- [ ] Principles and limitations of optical microscopes, transmission electron microscopes and scanning electron microscopes

**EXAM TRAP**

Optical microscopes have a low resolution, never a low magnification. And electron microscopes can never view living specimens.

## 4 marks: what earns them

1. Electrons have a shorter wavelength than light
   Not: electrons are smaller; light is weaker
2. So electron microscopes have a higher resolution (can distinguish points closer together)
   Not: higher magnification alone; clearer, with no reference to resolution
3. TEM gives a 2D image of the inside of a thin specimen; SEM gives a 3D image of the surface (both needed)
   Not: TEM and SEM reversed; TEM is 3D
4. One limitation: specimen in a vacuum so must be dead / cannot view living cells; OR preparation can create artefacts
   Not: expensive alone; low magnification

**Remember**

Short wavelength, high resolution.
TEM: through, inside, flat.
SEM: surface, three dimensional.



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