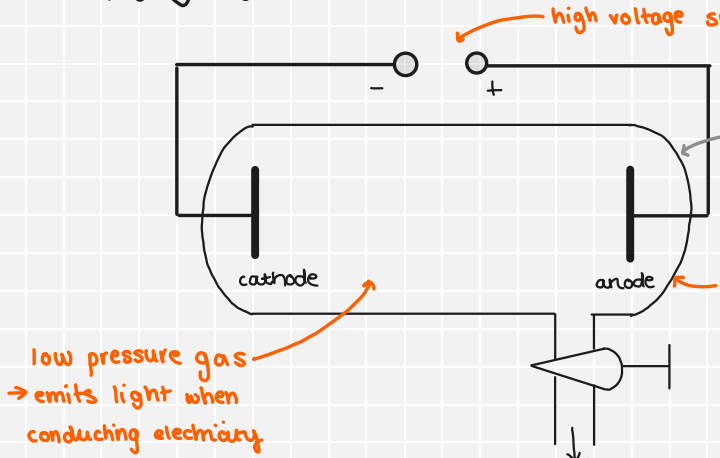
CATHODE RAYS

19th Century: Faraday, Geissler, Crookes & Hertz

→ applying high p.d across discharge tubes



→ scientists conclude cathode must be emitting rays that travel towards anode and strike the tube.

↳ **cathode rays**

e.g. mecury vacuum pump (1865)
→ achieved much lower pressure
∴ gas stopped emitting light

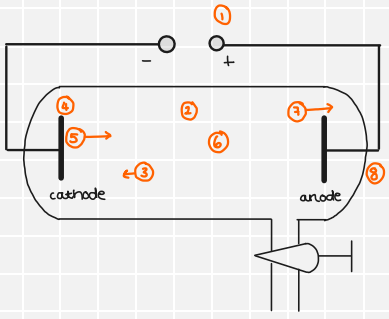
This was followed by a number of discoveries:

1888 Philipp von Leonard — 1905 Nobel Prize
- cathode rays can exist outside discharge tubes
- they are not EM waves

1895 Jean Perrin
- Cathode rays have a negative charge

1897 J. J. Thomson — 1906 Nobel Prize (using charged plates and coils.)
- showed deflection of cathode rays in E and B fields
- concluded ray was made of −ve charge particles (corpuscles)
- These particles are much less massive than H atom.
  → the electron!

How the discharge tube works



1. High p.d across cathode/anode creates a strong E field.
2. Strong E field ionises the gas atoms (creating +ve gas ions)
3. +ve ions accelerated towards cathode (possible due to low pressure)
4. +ve ions collides with cathode at high speed causing large numbers of e^- to be knocked off cathode.
5. e^- are accelerated towards anode
6. e^- collide with gas atoms causing ionisation or excitation. (light thus emitted by gas!) (due to susequent dexcitation)
7. If gas pressure is low enough, e^- gain much higher speeds (and collide less) so effectively travel in straight lines (called cathode rays)
8. e^- strike end of tube, exciting the atoms in the glass. When glass atoms deexcite they emit visible photons.