

The Spectrum

White light separated
into component colours



Rainbows



Pass light through
glass prism

Double rainbow

The Spectrum



White light separated
into component colours



Rainbows



Pass light through
glass prism



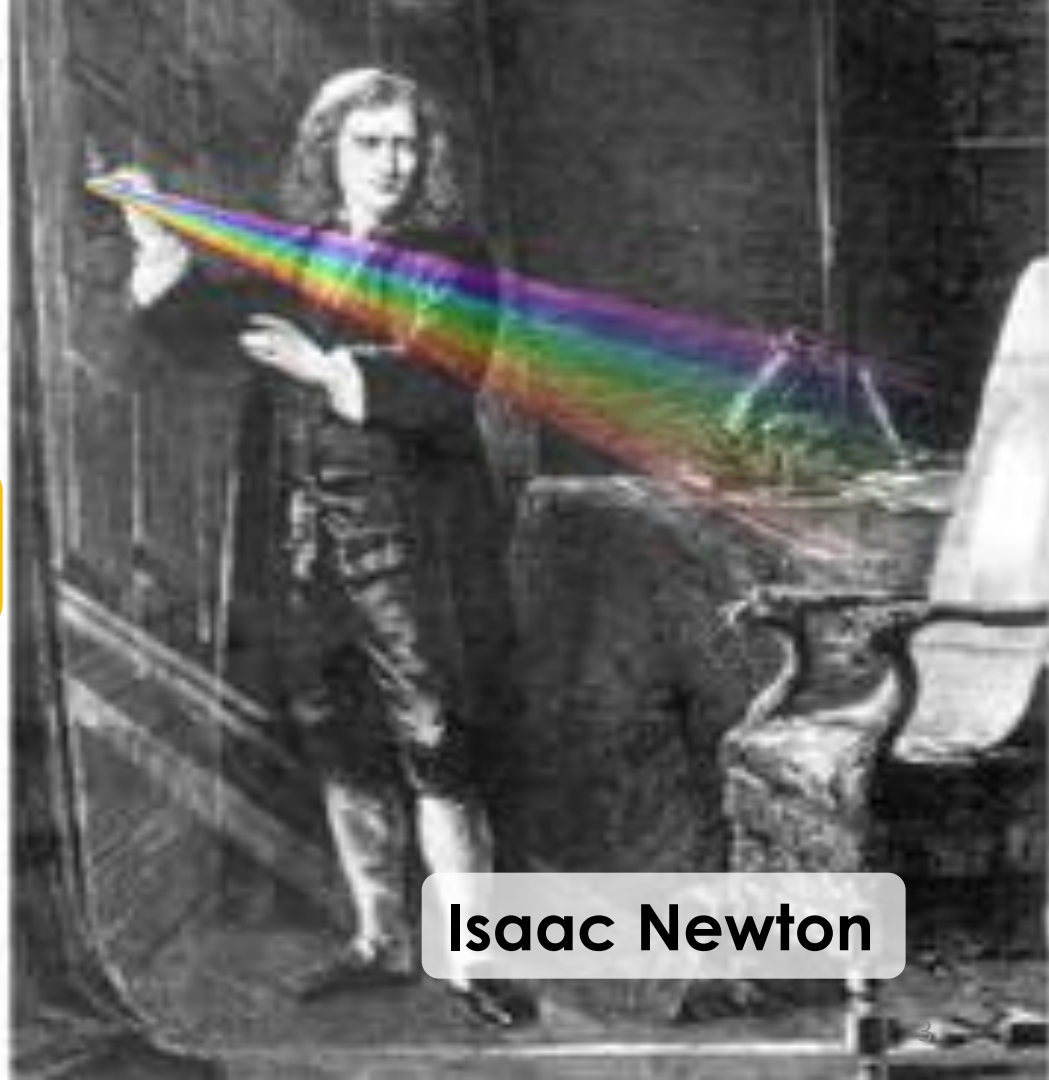
White light separated

The Spectrum

Sunlight

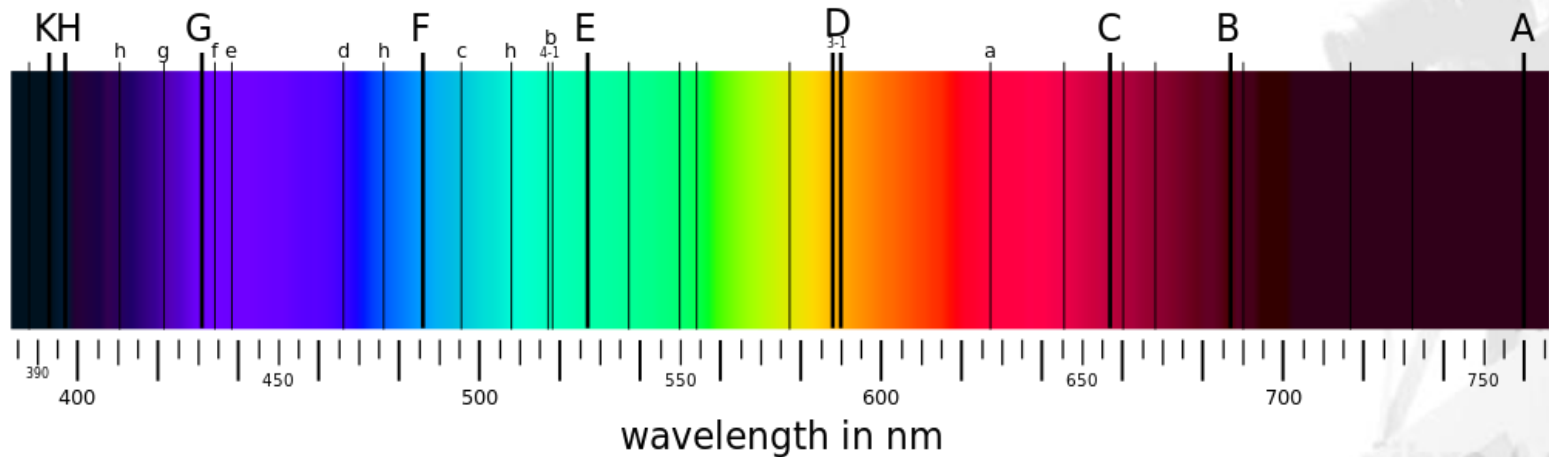


Observe resulting
spectrum



Isaac Newton

The Spectrum



Fraunhofer



Discontinuous spectrum

The Spectrum

Discontinuous spectrum



Discrete
black bands

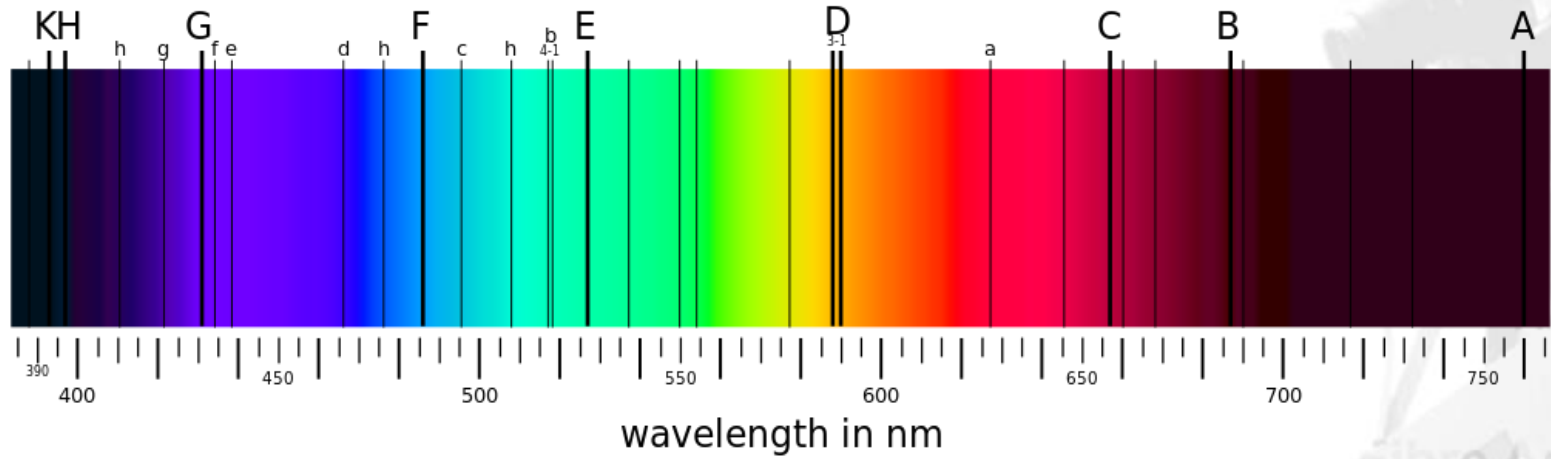


Light absorbed
by hydrogen



**Joseph von
Fraunhofer**

The Spectrum



Other lines?

The Spectrum

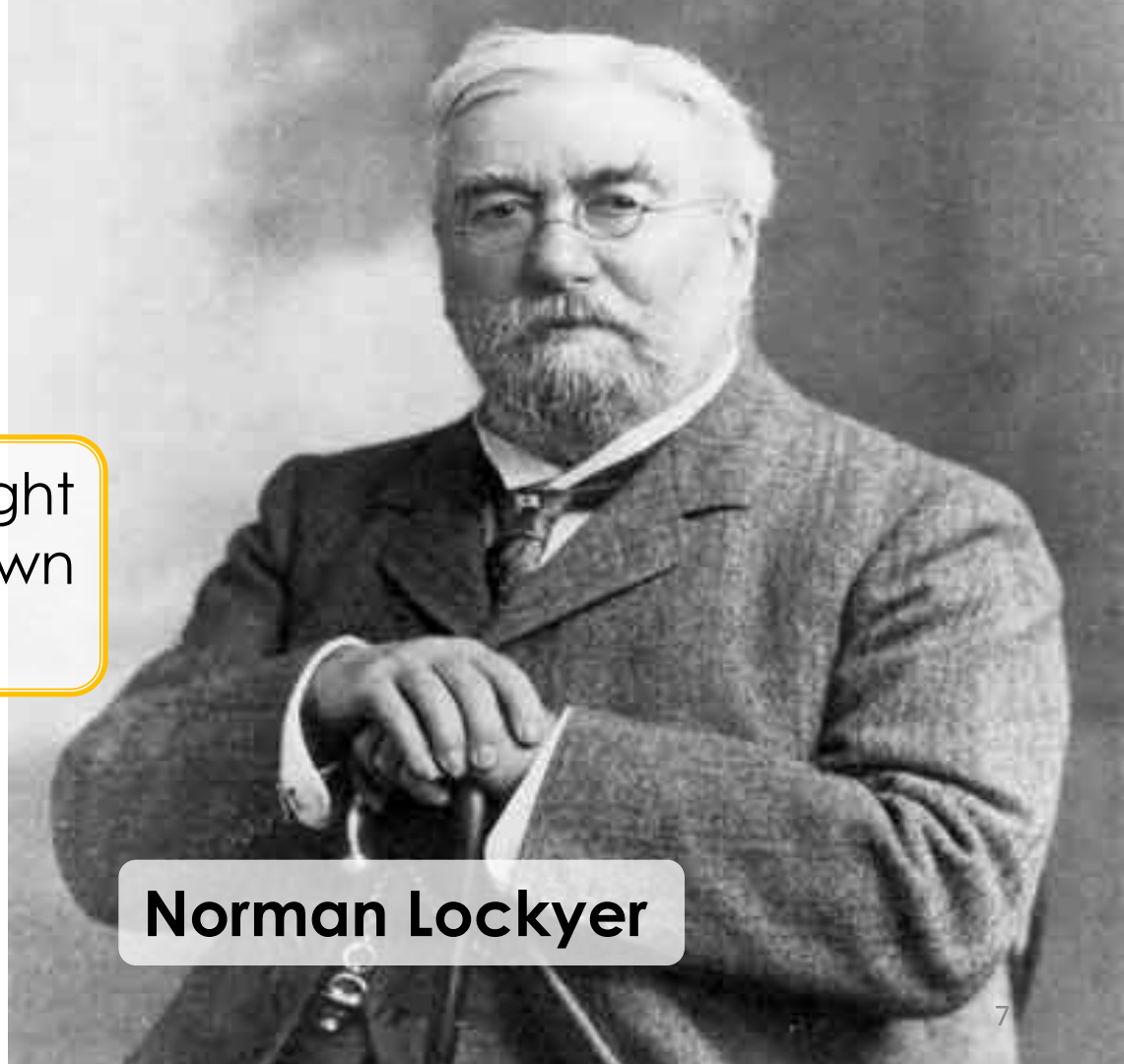
Other lines?



Absorption of light
by an unknown
element



Helium



Norman Lockyer

The Electromagnetic Spectrum

Different spectroscopic techniques use different frequencies of light

Light is a small portion of spectrum

DNA

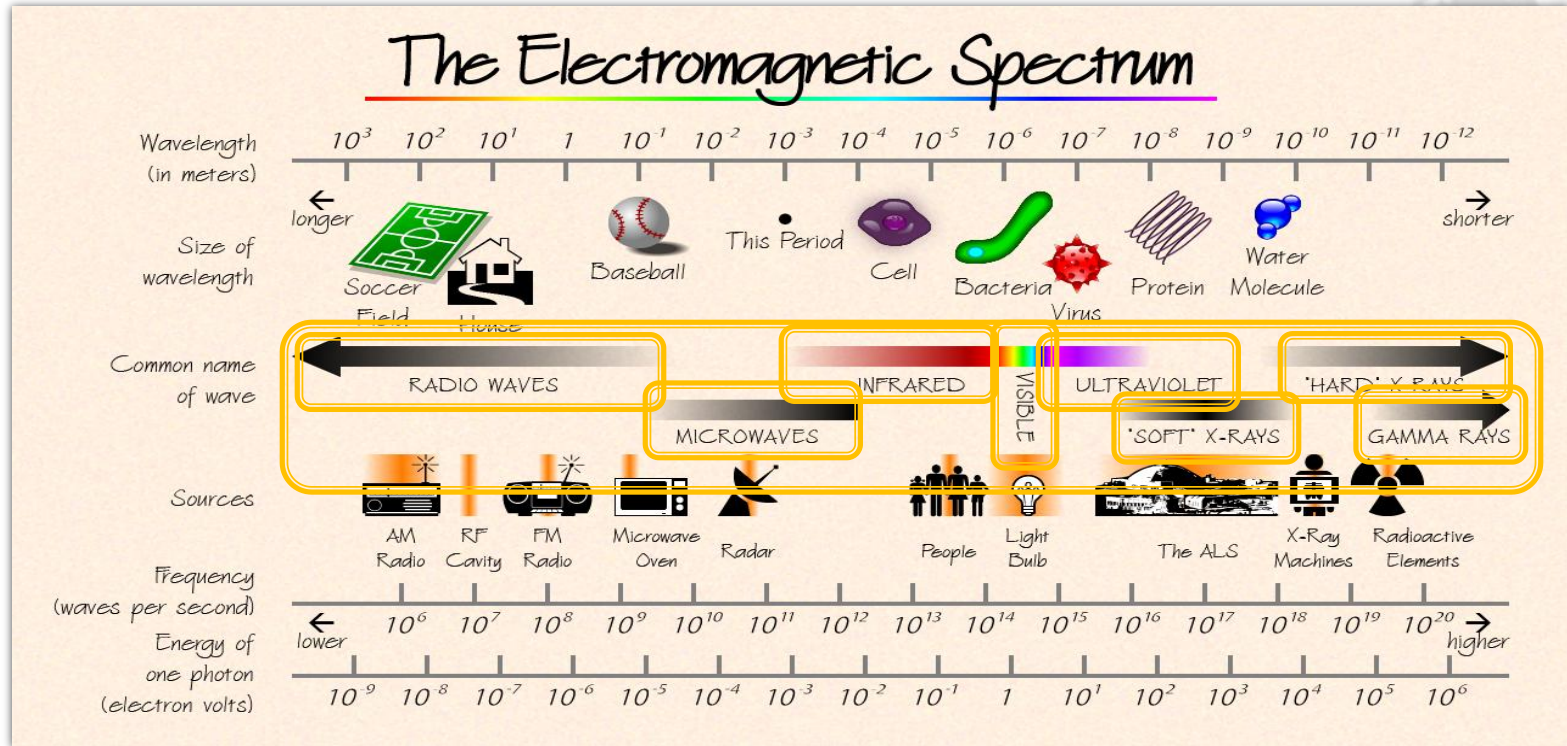
Fingerprints

Fibre Analysis

Poison

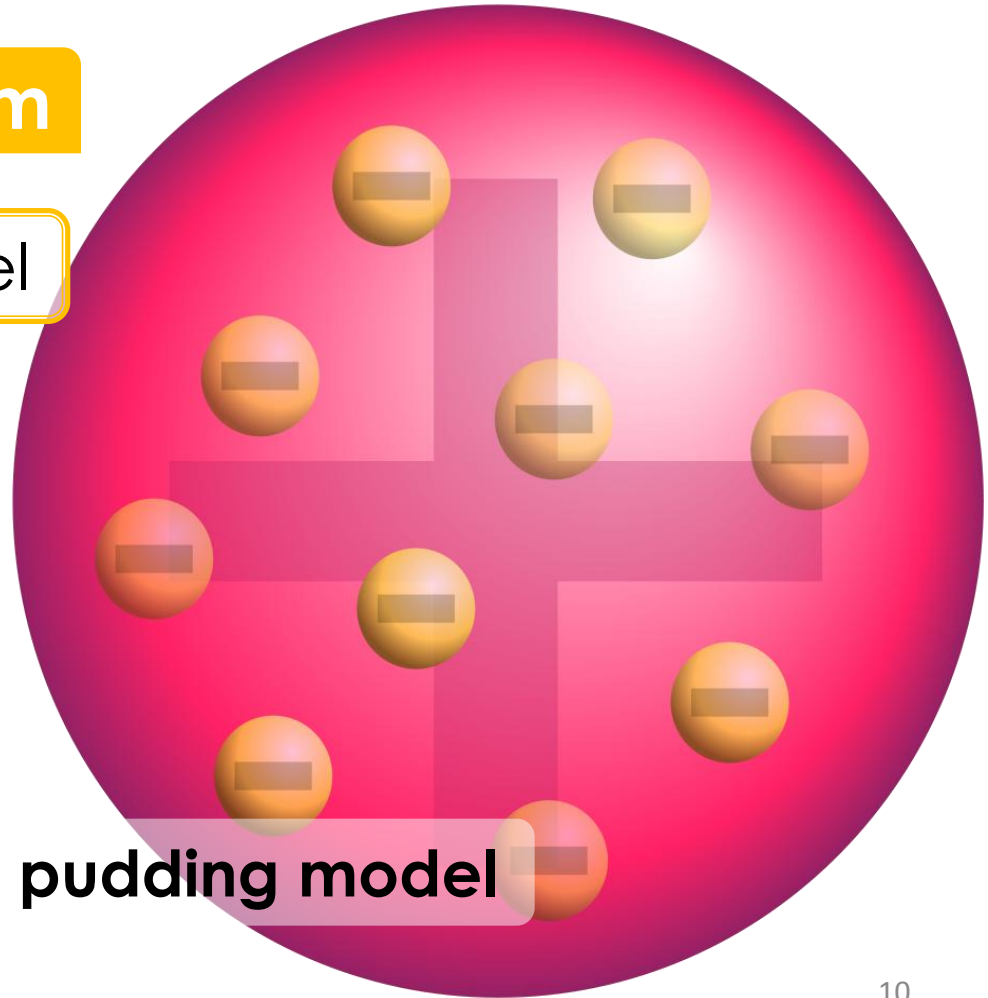
Blood

The Electromagnetic Spectrum



Structure of the Atom

1 Plum pudding model



Plum pudding model

Structure of the Atom

1 Plum pudding model

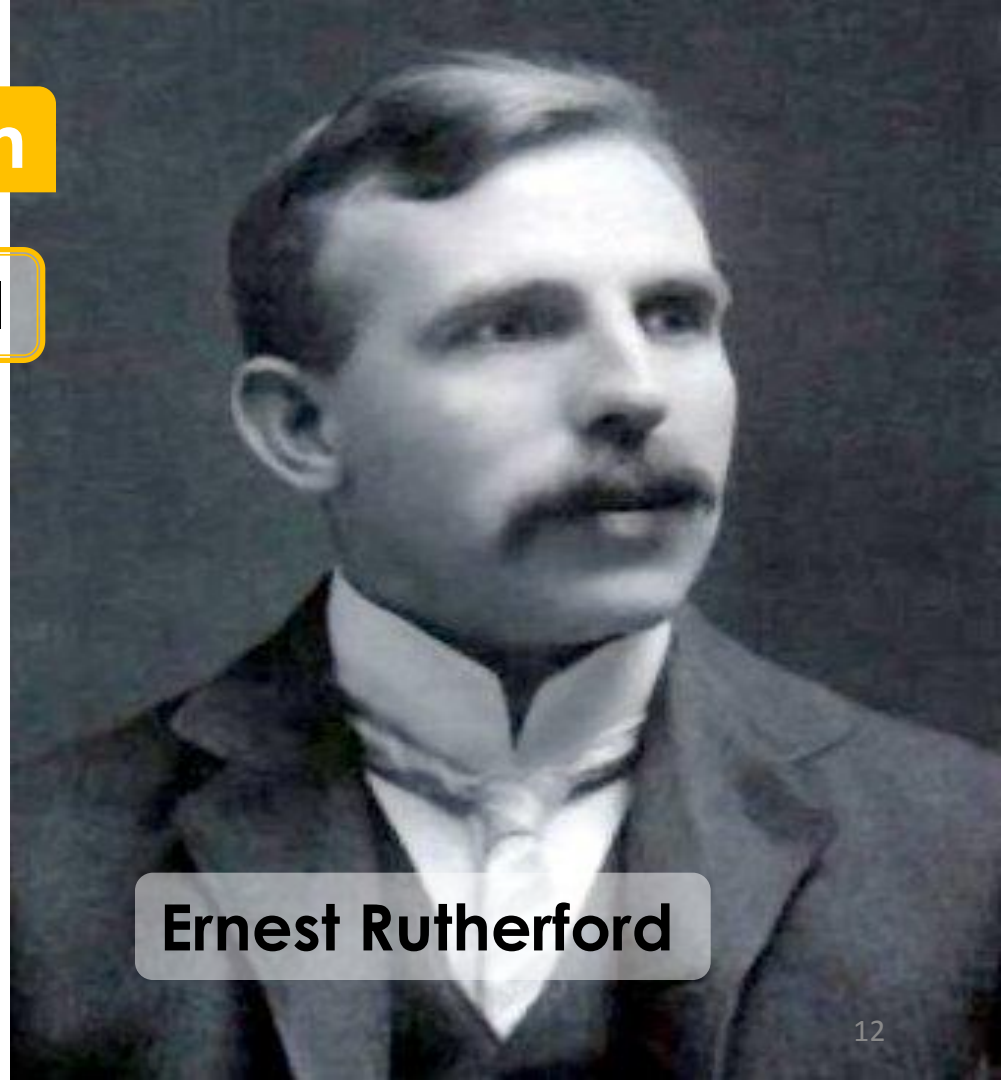


Plum pudding

Structure of the Atom

1 Plum pudding model

2 Rutherford's
planetary model



Ernest Rutherford

Structure of the Atom

1 Plum pudding model

2 Rutherford's planetary model

3 Bohr's model



Niels Bohr

Bohr's Model

Electrons

1 Restricted to specific energy levels



Energy is quantized



Energy is not continuous



Very small quanta of energy

Bohr's Model

2 Can move from one energy level to another

→ Jump to higher energy level → Absorb energy

→ Drop to lower energy level → Release energy

→ Electromagnetic radiation / light

→ Frequency proportional to energy change

→ de Broglie equation: $E = h\nu$

Allowed Energy Levels for Absorption



Energy
absorbed



Energy levels = ladder rungs



Energy added matches gap to next rung

Elemental Analysis

1 Using electrons



Absorption spectroscopy

DNA



Fingerprints

Fibre Analysis

Poison

Blood

Allowed Energy Levels for Emission



Energy
emitted



Energy levels = ladder rungs



Energy released matches gap to next rung

Elemental Analysis

1 Using electrons



Absorption spectroscopy



Emission spectroscopy

Elemental Analysis

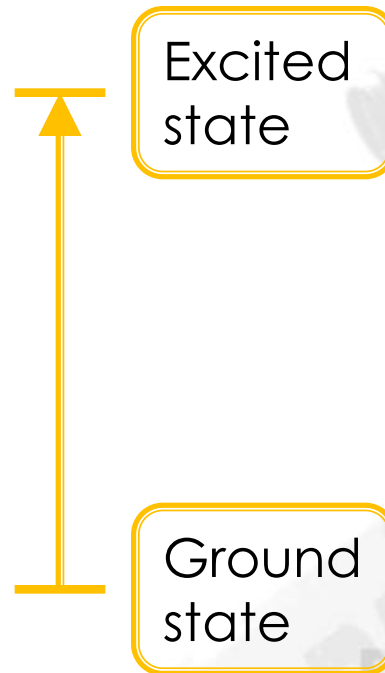
1 Using electrons



Absorption
spectroscopy



What light is absorbed?



Elemental Analysis

1 Using electrons



Emission
spectroscopy



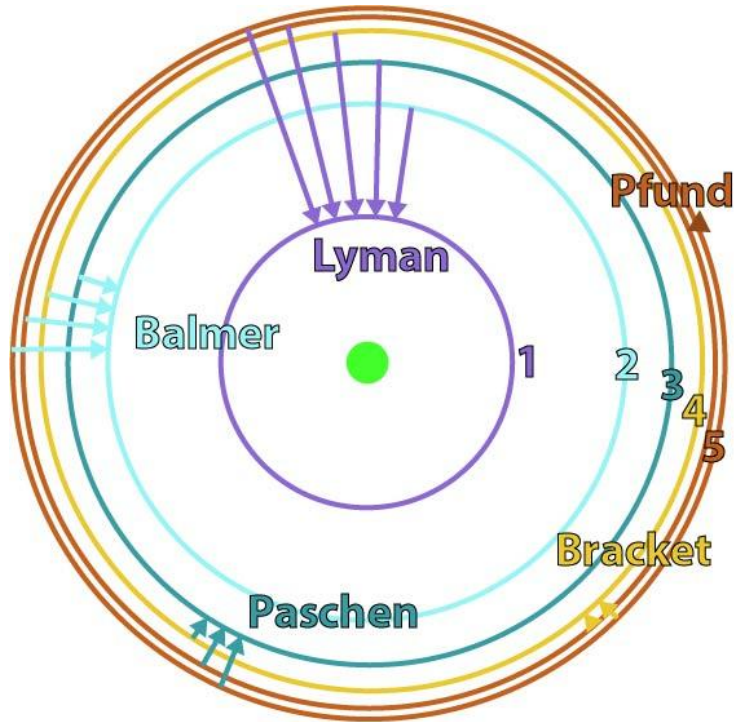
What light is emitted?

Excited
state



Ground
state

Bohr's Theory



Multiple energy levels



Multiple emissions or absorptions



Multiple lines in spectra



Pattern is **characteristic** for each element

Flame test for Metals

Metal salt added to flame



Characteristic colour produced

Energy of flame excites electrons



Drop back to ground state



Emit light



**Sodium
(orange)**