

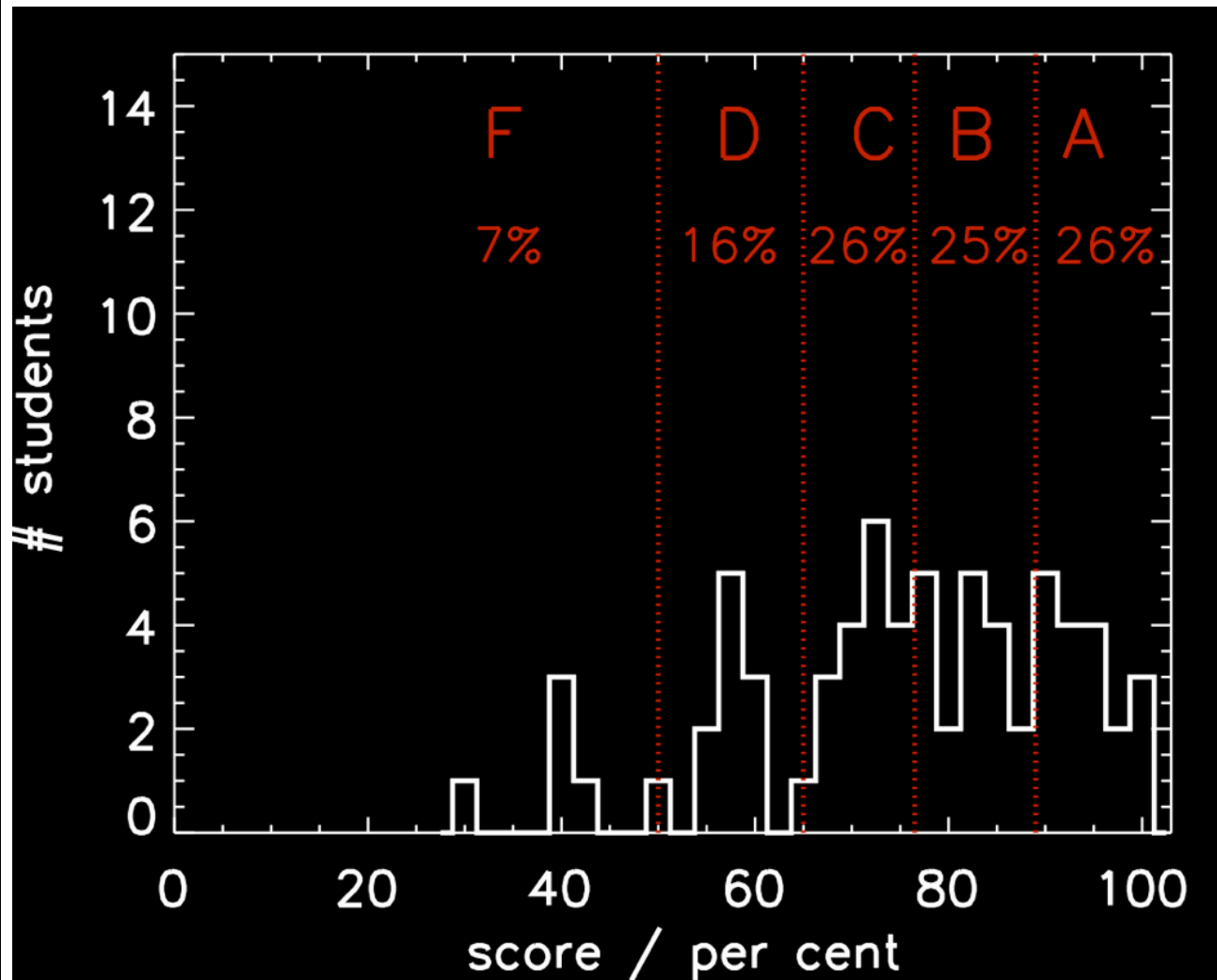
Lecture 08 – 10 February 2008



HWK 3: Out now
Due next Tuesday, 17
February 2009, 23:59
TEST 1: results are out
COMPREHENSION 01:
Thursday, 19 Feb 2009

- **SCIENCE TOPICS:**
Structure of Matter
Emission and
Absorption of Light
The Doppler Effect
- **READING**
Ch 2, Sec 2.4–2.8
- **PRACTICE**
p.66 Review: 10-15
p.67 Self-Test: 2, 3, 6, 8,
11
p.67 Problems: 4a, 7, 9

Test 0 I

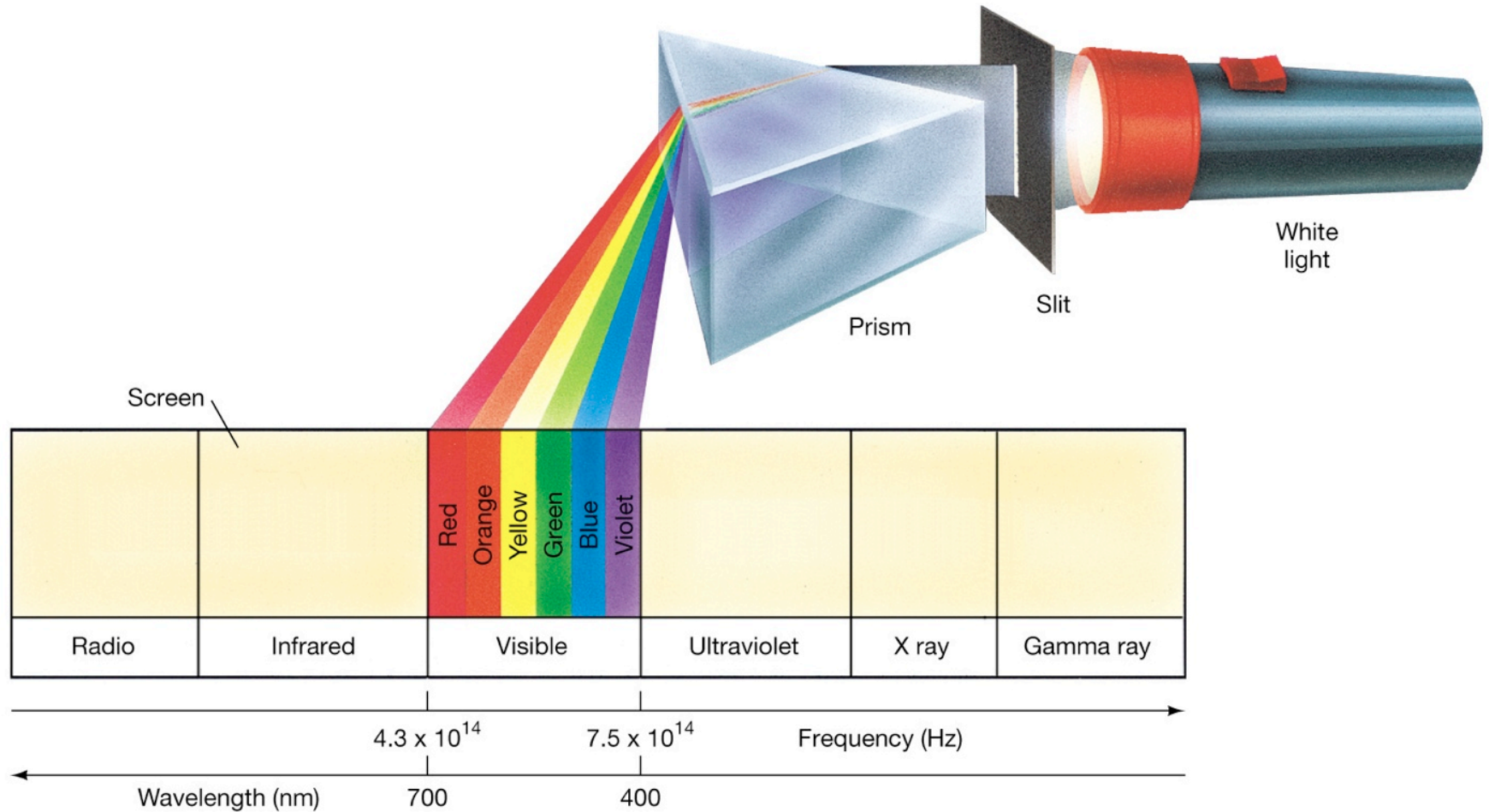


- Letter grades close but *not* final
- Several scantrons not fully filled in
- Check the backpage!!

Recap

- Wave-particle duality of light
 - Light comes in “packets of energy” called **photons**
- Spectra
 - continuous spectra
 - emission-line spectra
 - absorption-line spectra

Dispersion and Spectra

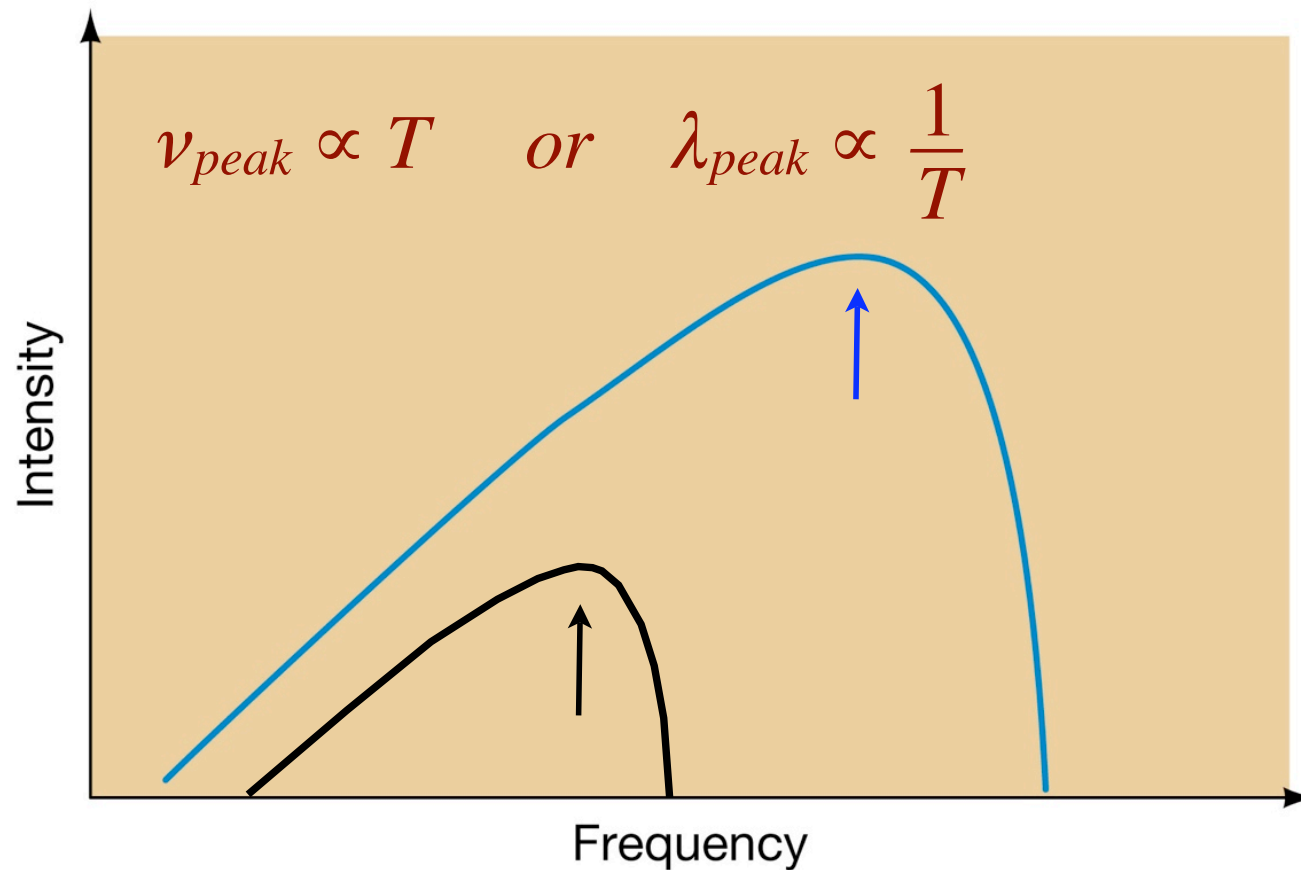


Recap

- Wave-particle duality of light
 - Light comes in “packets of energy” called **photons**
- Spectra
 - continuous spectra
 - emission-line spectra
 - absorption-line spectra
- The blackbody spectrum

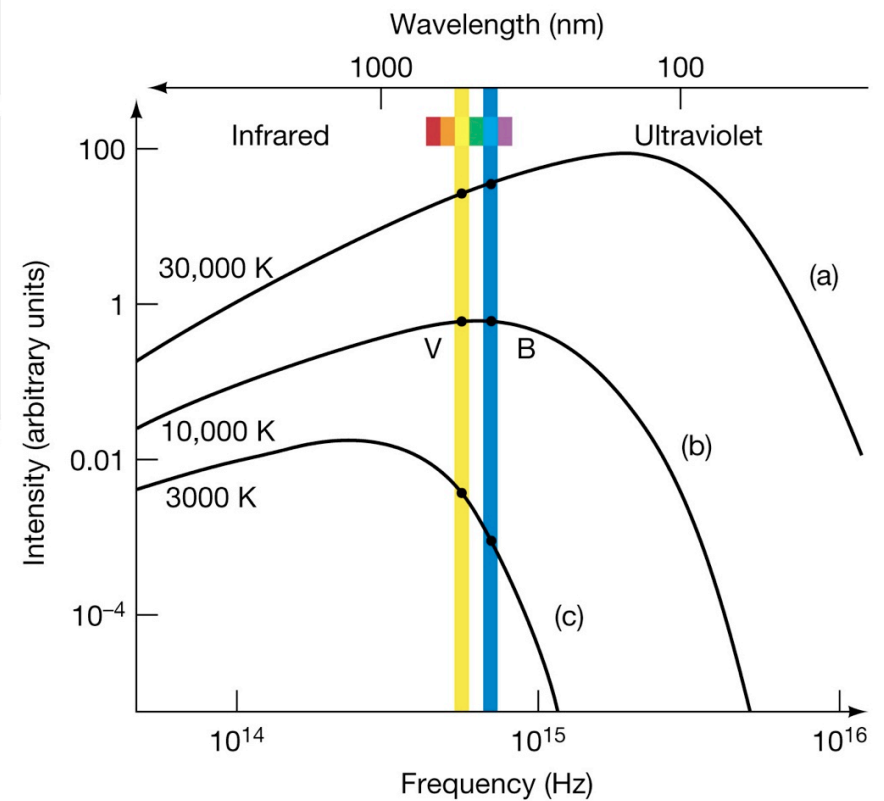
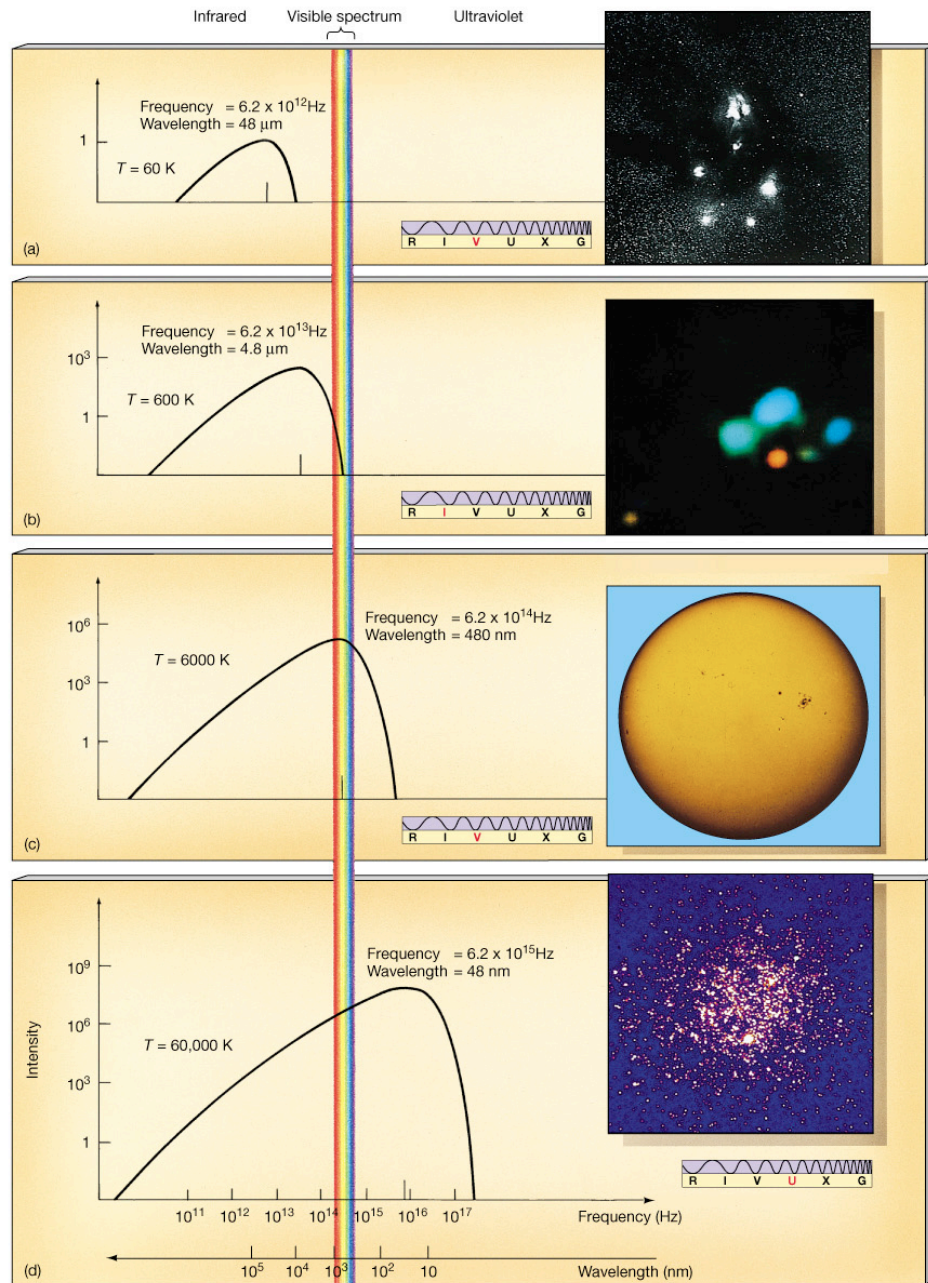
$$\nu_{peak} \propto T \quad \text{or} \quad \lambda_{peak} \propto \frac{1}{T}$$

The Planck or Black-Body Spectrum



Shape, both peak frequency and intensity, depends **only** on temperature

Temperature and Color



What does temperature mean?

Where does light come from?



What is “stuff” made of?

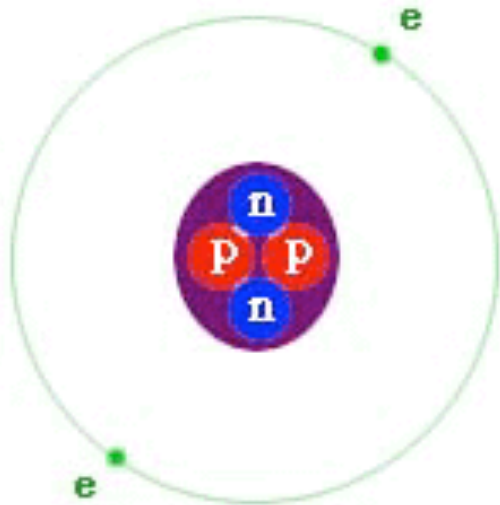
Atoms

- Atoms are the building blocks of matter
- They are composed of protons, neutrons and electrons.
- The number of protons an atom has determines what element it is, e.g.
 - 1 proton = Hydrogen
 - 2 protons = Helium
 - 3 protons = Lithium
 - 6 protons = Carbon
 - 8 protons = Oxygen

Hydrogen Atom



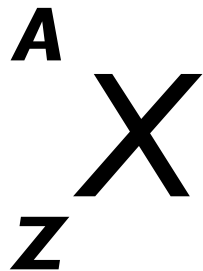
Helium Atom



- Atoms are composed of **protons**, **neutrons** and **electrons**.
- The **protons** and **neutrons** are found in the nucleus
- **Electrons** orbit the nucleus
- In a neutral atom, the number of **protons** = number of **electrons**

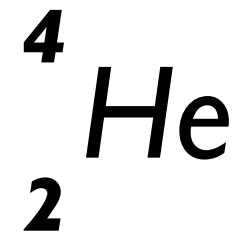
Atoms (2)

<u>Property</u>	<u>Protons</u>	<u>Neutrons</u>	<u>Electron</u>
Mass	1	1	$\frac{1}{2000}$
Charge	+1	0	-1
Location	Nucleus	Nucleus	Orbiting nucleus



A is Mass number
X is the element
Z is Atomic number

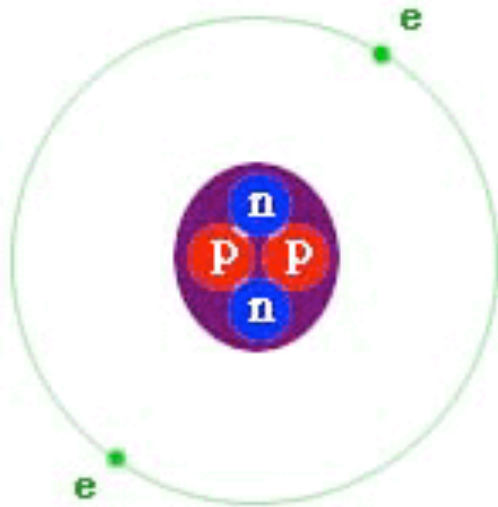
e.g.



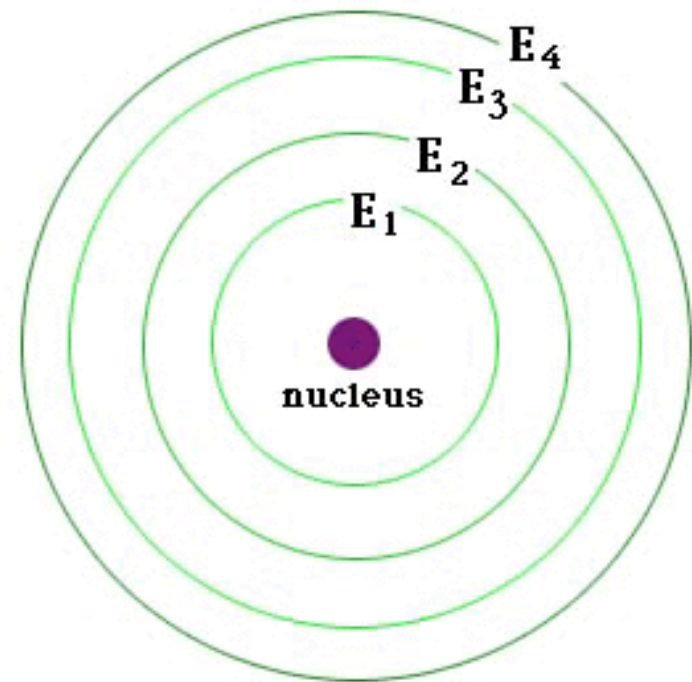
Hydrogen Atom



Helium Atom

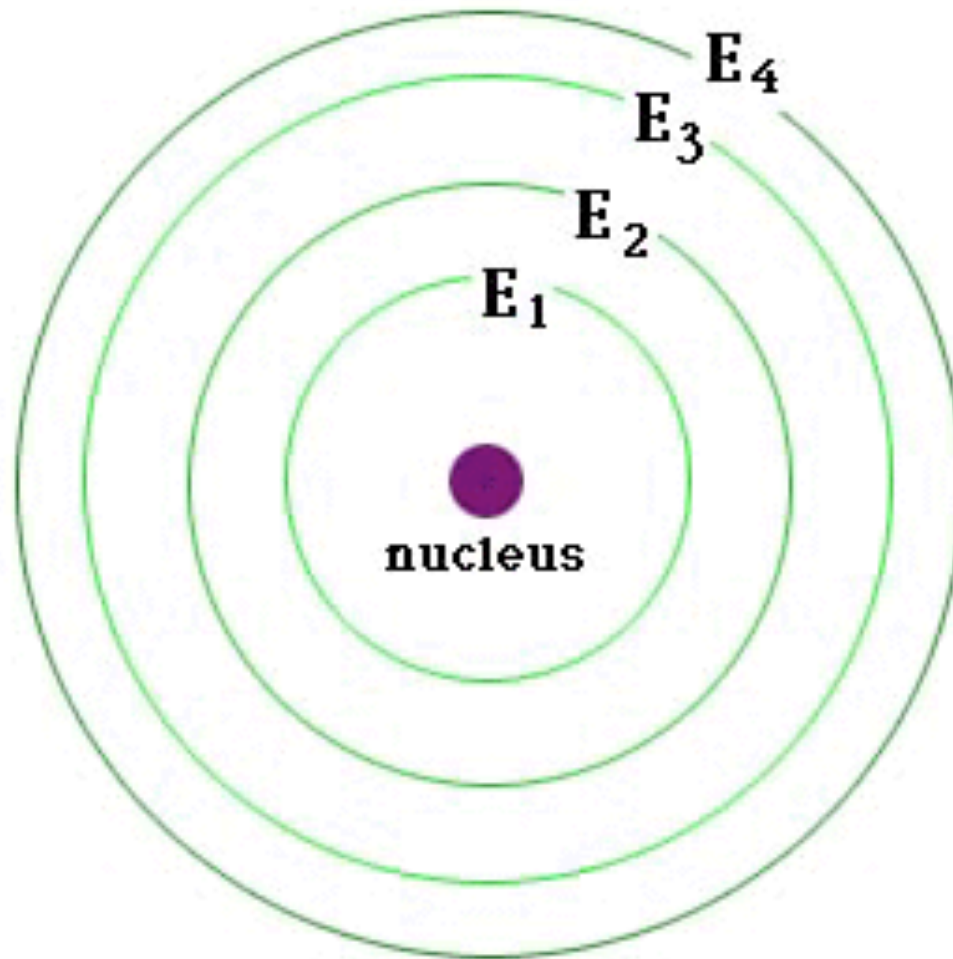


DISCRETE Energy Levels of Hydrogen Atom

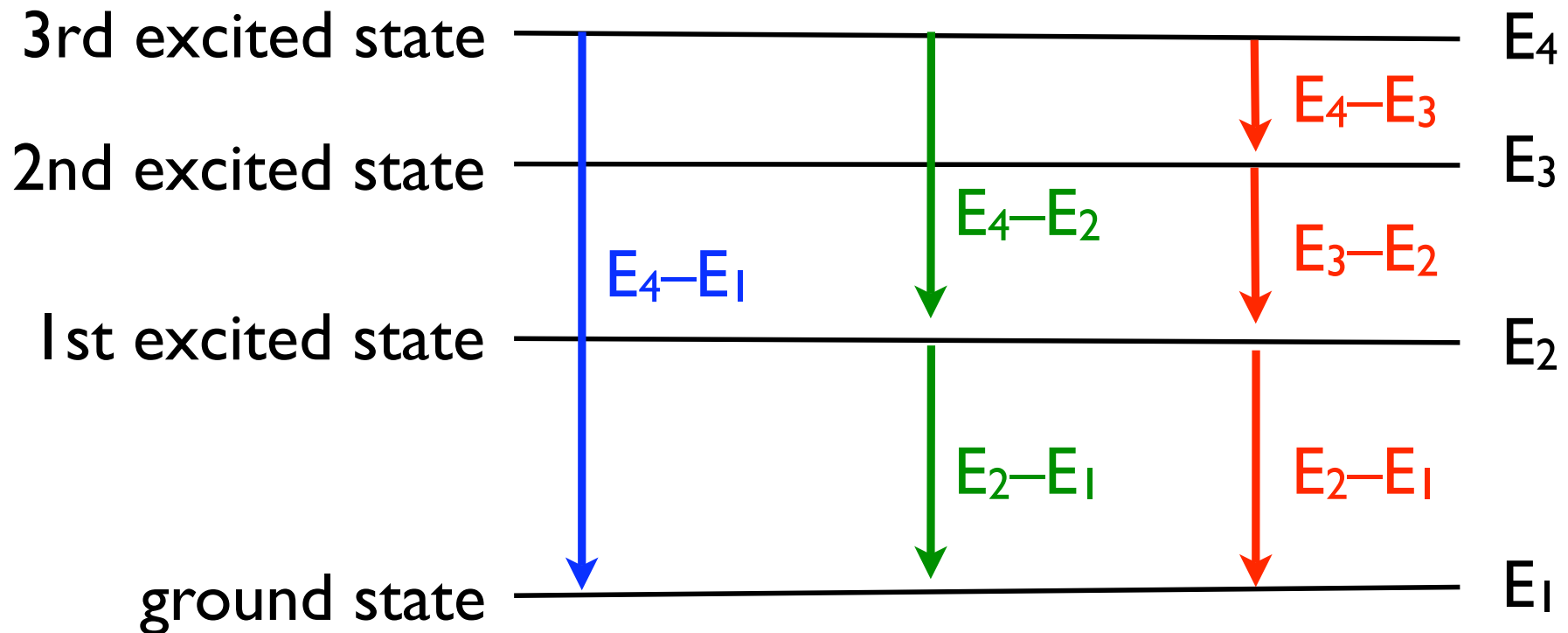


DISCRETE

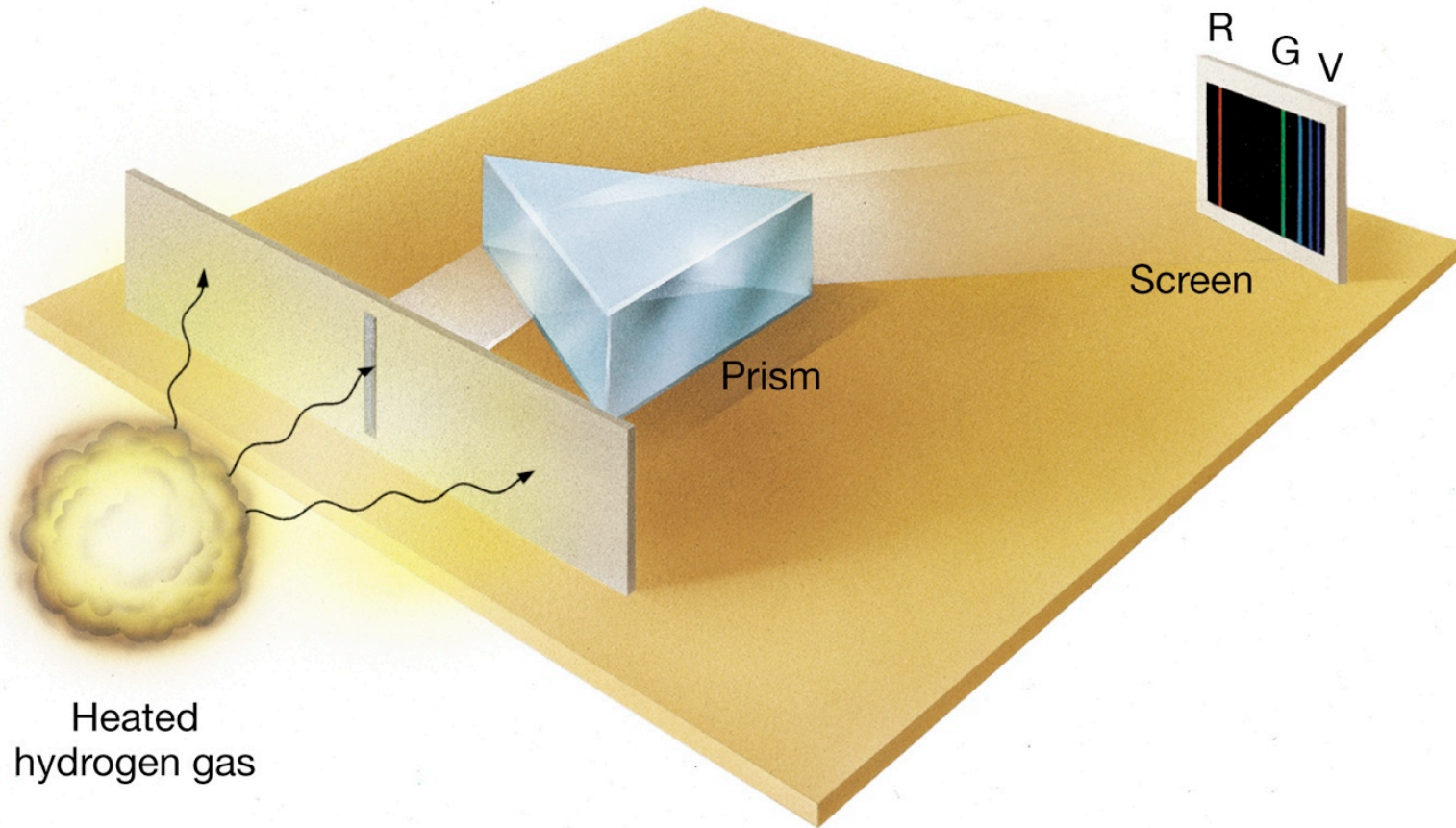
Energy Levels of Hydrogen Atom



Transitions Between Atomic Energy Levels: Part I



Emission Spectra



Spectra are like fingerprints



Hydrogen

H-alpha $E_3 - E_2$ 656.3nm Red

H-beta $E_4 - E_2$ 486.1nm Green-Blue

H-gamma $E_5 - E_2$ 434.1nm Blue

H-delta $E_6 - E_2$ 410.2nm Violet

The “Balmer” Series of Hydrogen

650

600

550

500

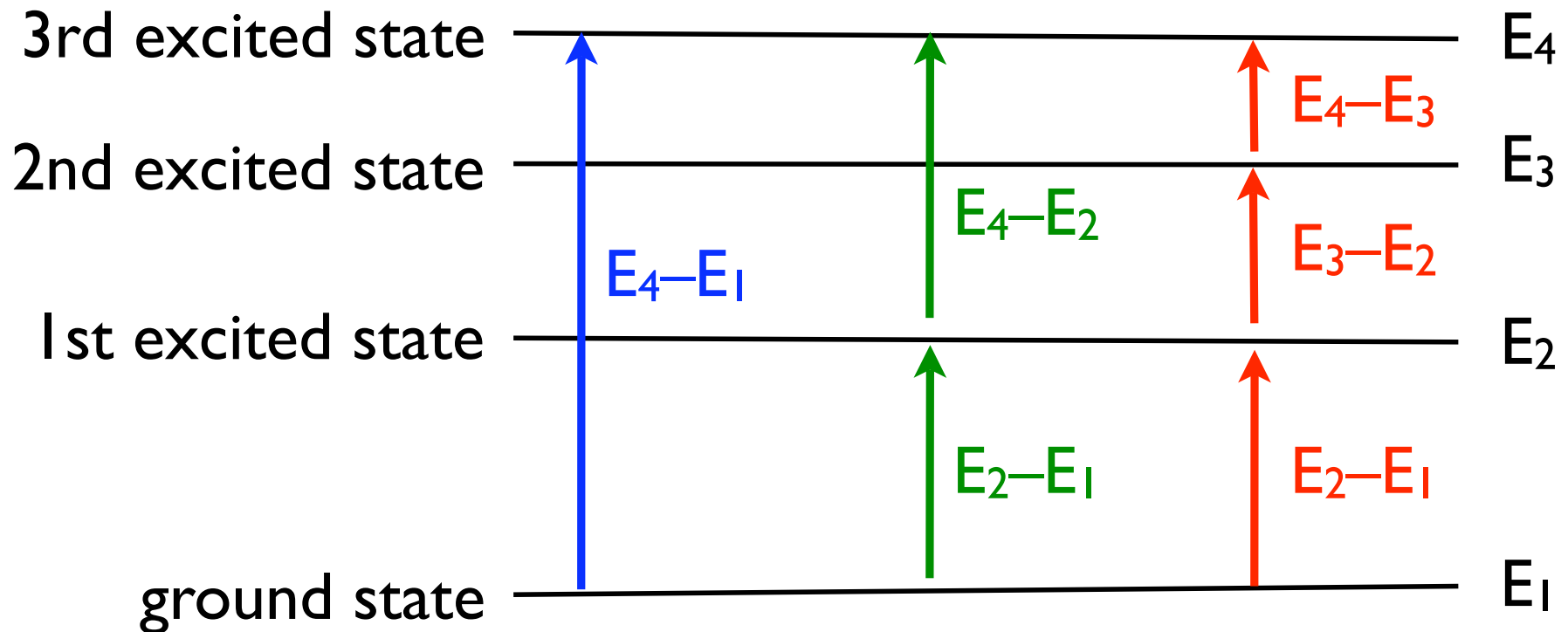
Wavelength (nm)

450

400

350

Transitions Between Atomic Energy Levels: Part 2



Absorption Spectra

