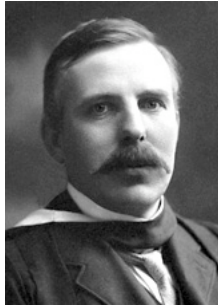


# 1.1 Atomic structure

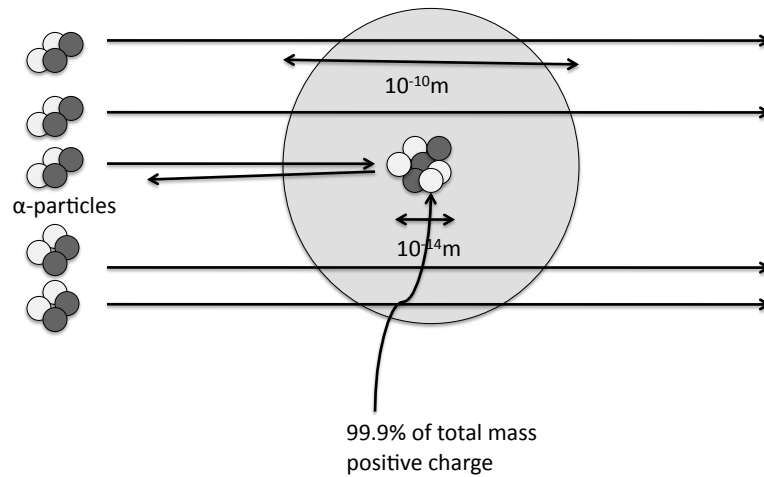
Please draw a hydrogen atom.

# Ernest Rutherford

The Nobel Prize in Chemistry 1908



## Rutherford's experiment



## Atomic spectra

http://www.ruf.rice.edu/~mcannon/Research%20Home/Research%20Home%20Pictures/Spectrum.jpg

What does atomic spectra imply about electrons in atoms?

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## Interference and diffraction

→ light is a wave

Plane waves impinge on barrier with two slits. Cylindrical wavefronts spread from each slit.

Along these lines crests meet crests and troughs meet troughs. Thus the waves interfere constructively. (a)

Where lines of constructive interference intersect the screen, bright fringes appear. (b)

Maxima of single-slit diffraction

Photo of an actual interference pattern shows alternating bright and dark fringes.

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1. Fast electron hits atom

2. Excited atom: electron in atom goes to higher energy

3. Electron jumps back to low energy, emitting light

Ground state

Excited state

Less KE

10ns

[Discharge lamp simulation](#)

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Energy levels of electron stuck in atom

3

2

1

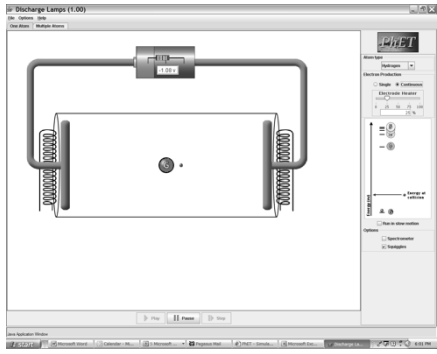
energy of colliding electron

G (ground)

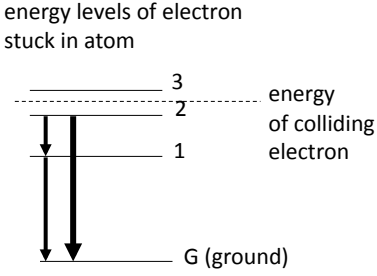
Q. If the free electrons have an energy between that of level 2 and level 3 when they hit the atom

A) no levels will be excited, and so no light will come out.  
 B) 2 colors of light will come out  
 C) 3 colors of light will come out  
 D) 4 colors come out.

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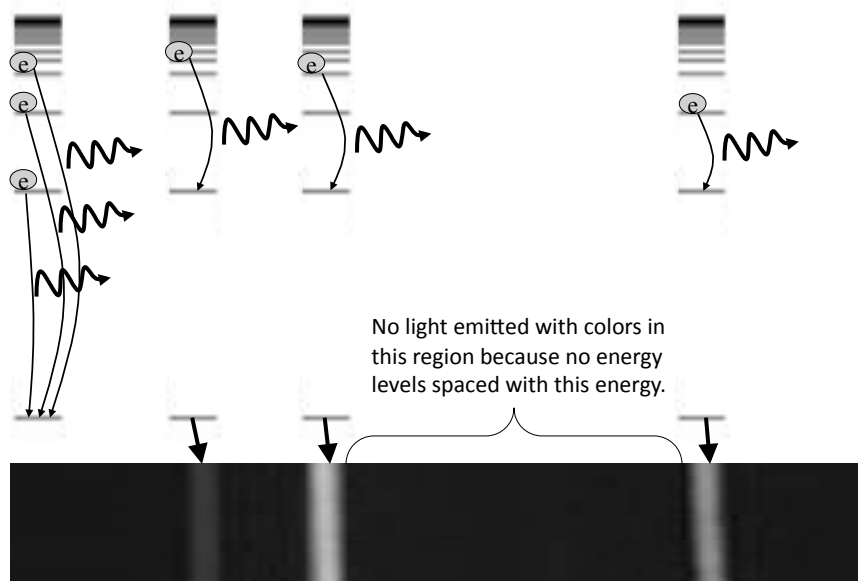
energy levels of electron stuck in atom



C) There is enough energy to excite level 2, then get  $2 \Rightarrow 1$  followed by  $1 \Rightarrow G$ , but can also go  $2 \Rightarrow G$ .

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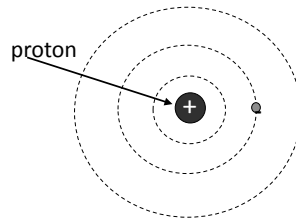
### Energy level diagrams - Hydrogen



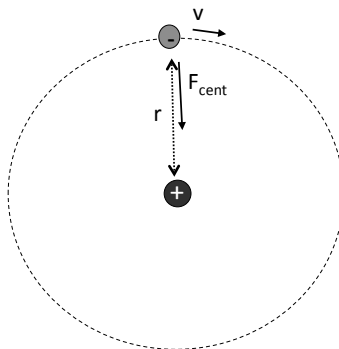
No light emitted with colors in this region because no energy levels spaced with this energy.

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## Bohr model of the atom (not quite right)

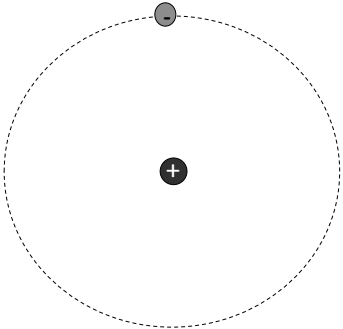


### Basic connections between $r$ , $v$ , and energy!



$$F = ma = F_{\text{cent}} = ?$$

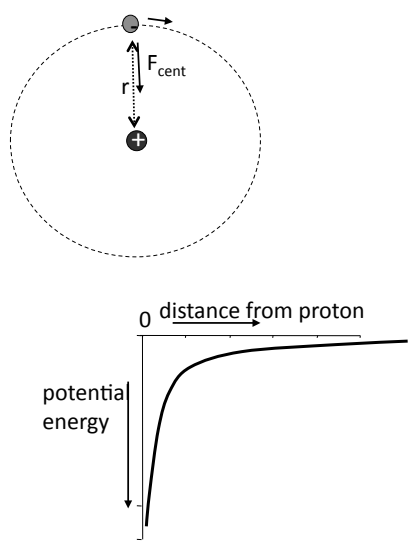
- A)  $-mvr$
- B)  $-mv^2/r$
- C)  $-v^2/r^2$
- D) I don't remember learning anything related to this



The potential energy of the electron is:

- A)  $-ke^2/r$
- B)  $-ke^2/r^2$
- C)  $-ke^2r$
- D) I don't remember

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0 distance from proton

potential energy

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