

Physics 100 - Spring 2007 - Recitation 5

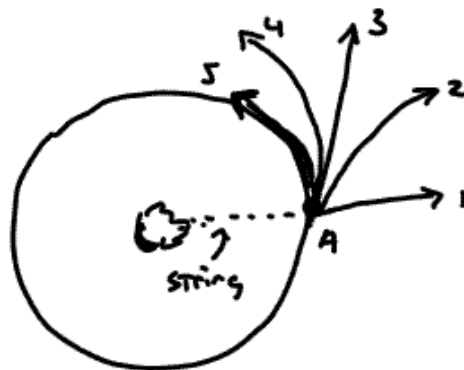
①



A kid twirls a rock attached to a string about his head. The rock moves along a circular path.

What happens if the string breaks?

Looking from above ... what path will

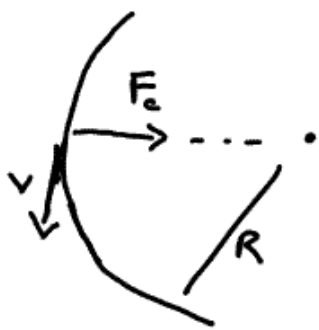


the rock take if the string breaks at point A?

Defend your answer using Newton's Laws.

②

For an object to move on a circle there must be a net force toward the center of circle, $F_c = \frac{v^2}{R}$,



called the "centripetal force".

The string supplies the centripetal force for the rock in the example above.

What supplies the centripetal force for a speed skater going around a curve?

What supplies the centripetal force for a car going around a curve?

for a given set of road conditions, what happens if you take a curve too fast?

if you take too sharp a curve?

defend your answers using the circular motion equation above.

③ In the Bohr model, what is the force that acts as the centripetal force?

④ For the space shuttle in orbit, what force acts as the centripetal force?

Are the astronauts on the space shuttle in orbit weightless?

⑤ How much work is done by the centripetal force as an object moves around a circle one time?

⑥ If you were captain of the space shuttle, how would you move to a higher orbit if asked to do so by NASA?

(i.e., in what direction would you fire your rockets?)

7 In the Bohr Model of the atom, what happens to the electron when the atom absorbs a photon? What happens to the electron when the atom emits a photon?

Below is a schematic diagram of an atom with four different states (or orbits) in which the electron could exist. Next to it is a graphical representation of the electron energy in each possible STATE ... $E_1 < E_2 < E_3 < E_4$.

In terms of E_1, E_2, E_3, E_4 , what is the energy of the most energetic photon emitted by this atom?

In terms of E_1, E_2, E_3, E_4 , what is the energy of the least energetic photon?

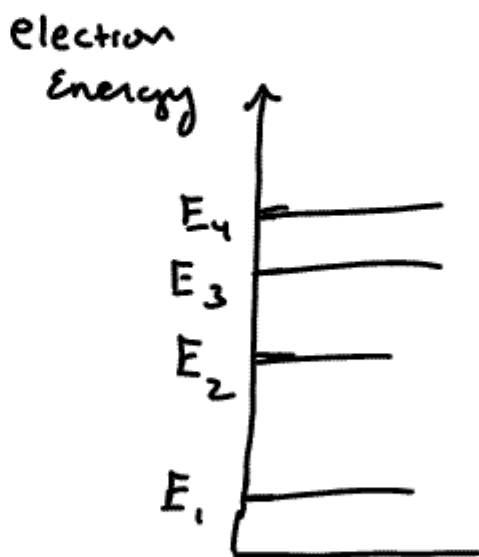
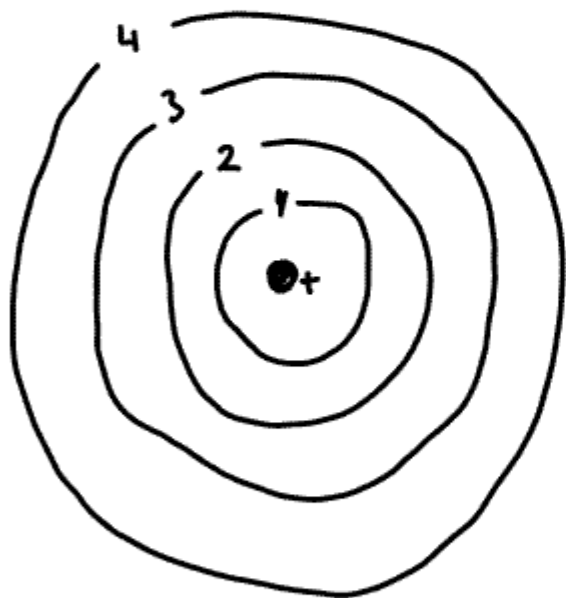
Suppose for a moment that $h = 6.6 \times 10^{-34} \text{ J}\cdot\text{s}$
or
 $4.1 \times 10^{-21} \text{ MeV}\cdot\text{s}$

$E_1 = -13.6 \text{ eV}$
 $E_2 = -3.4 \text{ eV}$
 $E_3 = -1.5 \text{ eV}$
 $E_4 = -0.85 \text{ eV}$

I know the "-" sign seems strange ... it means the electron is bound in the atom. Just think of scale as offset from zero.

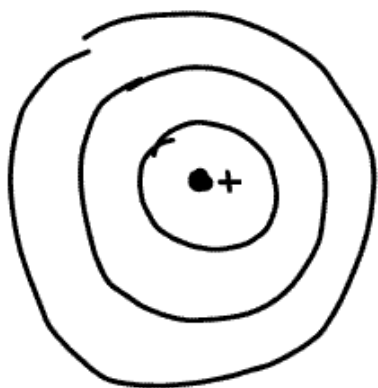
What is the highest frequency light emitted by this atom?

What is the lowest frequency light emitted by this atom?



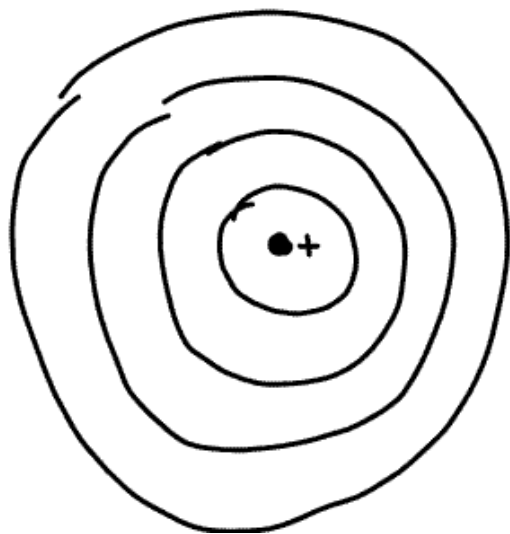
Look on p 196 of Hobson to determine the region of the electromagnetic spectrum where light of this frequency would be found.

8



An atom has 3 possible energy states in which the electron could exist. How many spectral lines could be emitted by this atom?

9



An atom has 4 possible energy states in which the electron could exist. How many spectral lines could be emitted by this atom?

10

What was Rutherford's contribution to our modern concept of the atom?

Describe the experiments done in Rutherford's lab and what was learned from them.

Your TA will set up an "atom" for you to explore.

Your group will have a pile of " α -particle" ping pong balls

Use the ping pong balls to explore the nature of the "atom" before you. Can you determine what, if any, structures exist in your atom?