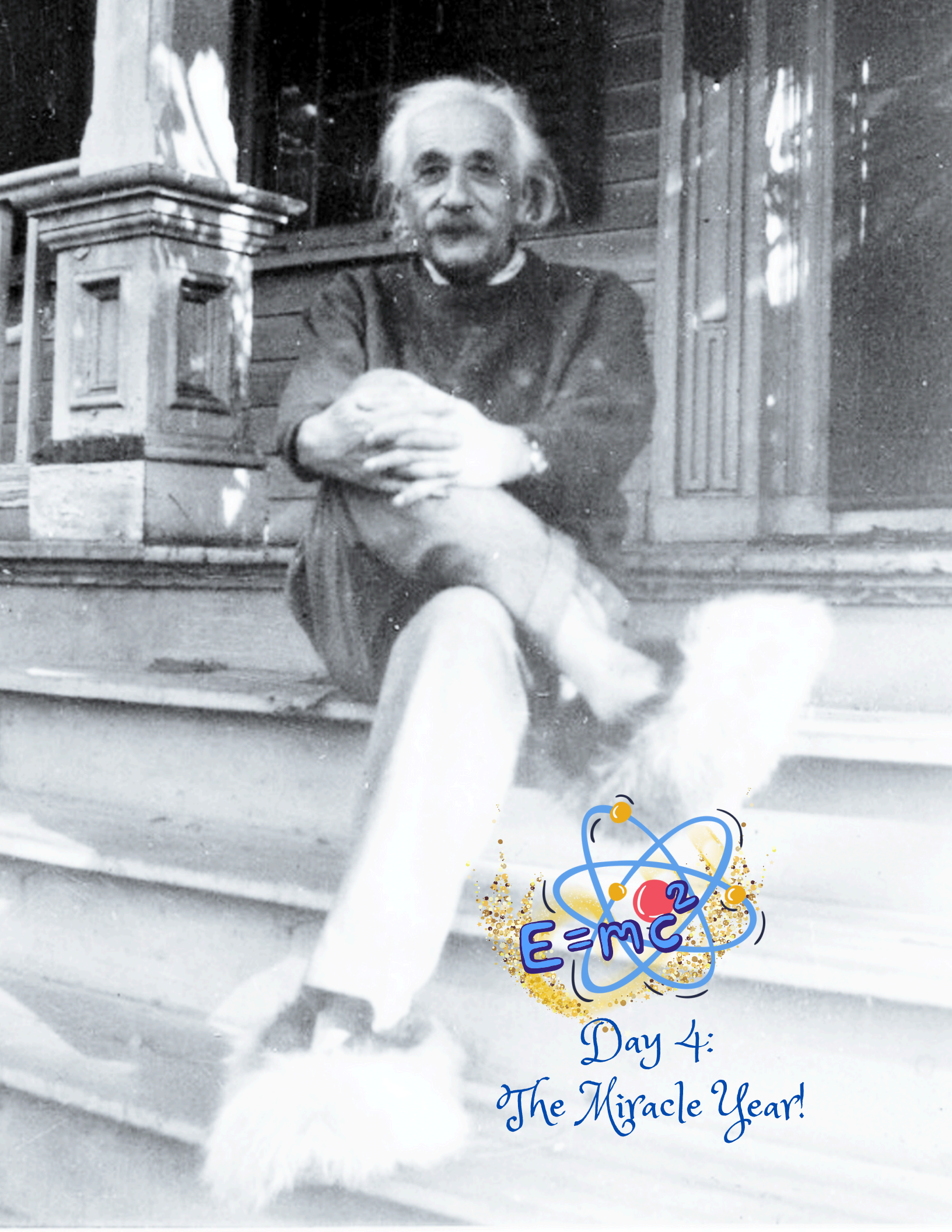
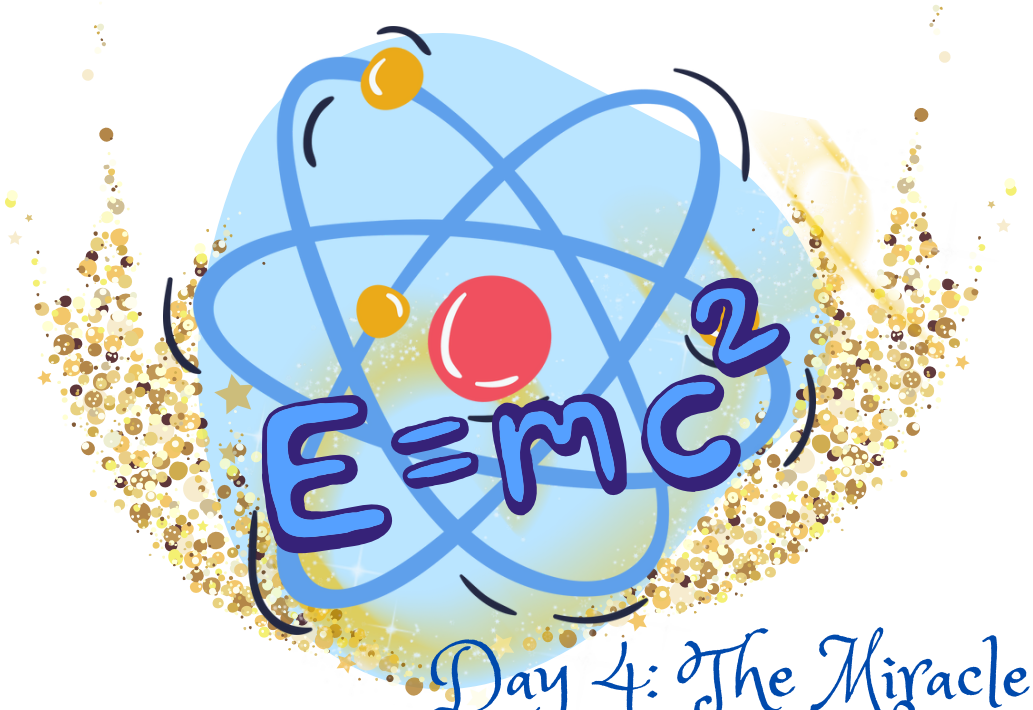


Day 4:
The Miracle Year!



Day 4: The Miracle Year!

Interactive Story Ideas!

Storytelling Role-Play: 1-5 sand dollars each
(2 Students to help cut out props and 6 students to role play)
Choose 3 girl students and 3 boy students to portray Einstein, the bus driver, Michele Besso, an atom, a photon (beam of light), and the clock.

Let students listen for their part and act out what is happening in the story.

New word: 1-5 sand dollars
Mass: Mass is how much stuff—or matter—is in an object. When an object has more mass, it means it is packed tightly with lots of matter. It's a little tricky, because a larger size alone can't guarantee that an object has more mass. It's really about how tightly matter is packed inside!

*Remind the students that they can earn a sand dollar if they tell you at the end of the story what the new word means. If they get it wrong remind them of the definition and have them try again in a few minutes.

Day 4 Albert Einstein: The Miracle Year

It is 1905, and 26-year-old Einstein is riding the city bus to work, lost in his thoughts and daydreams. As he glances behind him, his eyes fix upon the clock tower, and he returns to one of his favorite childhood daydreams: what would it be like to ride a beam of light? What if, he thinks this time, this ordinary bus was moving at the speed of light?

It is as if he's on his own special chariot, traveling at the speed of light, 186,282 miles per second, on an isolated particle of light. (Light beam prompt, light beam starts moving). Einstein's eyes narrow in on the hands of the clock. (Hands of the clock prompt. At first, the minute hand moves gradually walking along a circle shape taped on the floor.) Riding his imaginary light bus, he sees the world whizzing by, and in his creative mind, the hands of the clock begin to slow down.

(Minute hand slows down to a shuffle and light beam starts running). As he gets faster and faster at the speed of light—fast enough to encircle the world 7.5 times in 1 second—the hands on the clock can no longer keep up. As he goes faster, faster, and faster, the clock moves slower, slower, and slower, until time seems to stop completely. And it is there, suspended in this imaginary sunbeam that Einstein feels like a storm has broken in his mind.

"Your stop?" calls out the bus driver, who is used to seeing Einstein on this route and knows it is time for him to get off. Einstein smiles, "There's no telling how far I would have traveled if you hadn't reminded me." The bus driver tips his cap. (Cap prompt, nod politely and look fondly at Einstein).

Einstein keeps exploring this mind-blowing idea in more detail. Doing what all great scientists do, he decides to write his thoughts down. 1905 is known as the miracle year. This is the year that his ideas and work all come together.

In this year, Einstein publishes four scientific papers!

"Nobody even knows you as a physicist yet," warns his friend, Michele Besso as they strolled home together side by side. Einstein often discusses his ideas with Michele, and the two are very close friends. But Einstein sees something that even Michele can't see yet. He is confident that his thoughts and ideas matter and that he can help change the way we think about the entire universe! He is right.

Einstein's first paper explains the photoelectric effect, showing that light comes in tiny packets called photons. In Greek, "photo" (φωτό) means "light." So, "photoelectric" means "electricity produced by light."

Day 4 Albert Einstein: The Miracle Year

His second paper helps explain an invisible particle. In 1827, the English botanist Robert Brown had noticed that pollen grains suspended in still water moved in an energetic dance, but what was making them move? Einstein reasons that *invisible* atoms in the liquid might be making them jiggle. (Atom prompt, Einstein closely studies the atom structure). His paper is proof that atoms existed and were tiny pieces of matter too small to see, something that was still hotly contested amongst scientists at the time.

And while his 'light bus' gives the world an understanding that our movement is always relative to something else, his fourth paper of the miracle year is mind-bendingly exciting!

Instead of viewing space and time as two different things, Einstein discovers they are connected; he calls it "spacetime." Like how a bowling ball on a trampoline will make the trampoline sag and pull other things in towards the dip, Einstein proposes that objects with mass warp the fabric of spacetime, creating what we perceive as gravity. He also forms the most famous math equation, E=mc^2, demonstrating how energy and mass are connected.

Essentially, his theories weave space, time, and mass together, changing how we understand light, gravity, time, and space. However, it will be a long time before Einstein is celebrated for his work. He doesn't let that get him down, though!

"Life is like riding a bicycle. To keep your balance, you must keep moving," he always says. And even if he isn't going at the speed of light, he keeps on riding.

Questions/Reading discussion: 1-5 sand dollars

Ask: Why is 1905 called the miracle year in Einstein's life?

Example: It is called a miracle year in Einstein's scientific journey because he wrote 4 papers and had lots of amazing new ideas.

Ask: What is spacetime?

Example: It is like a connected fabric of time and space.

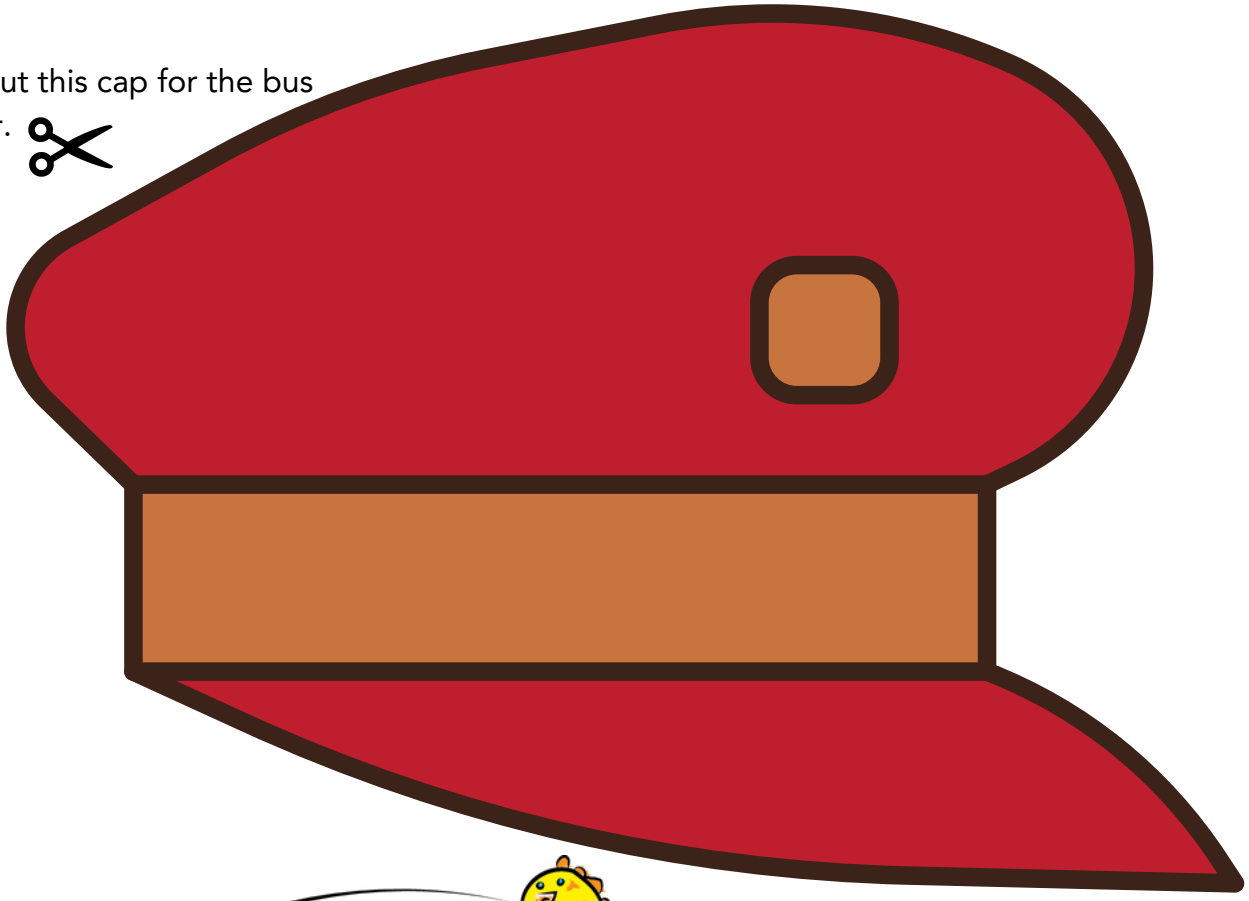
Ask: How did Einstein use his imagination to write important scientific papers?

Example: I think his imagination played a huge role because he would ask lots of questions many people might not have even thought of, like what would happen if he rode a beam of light.

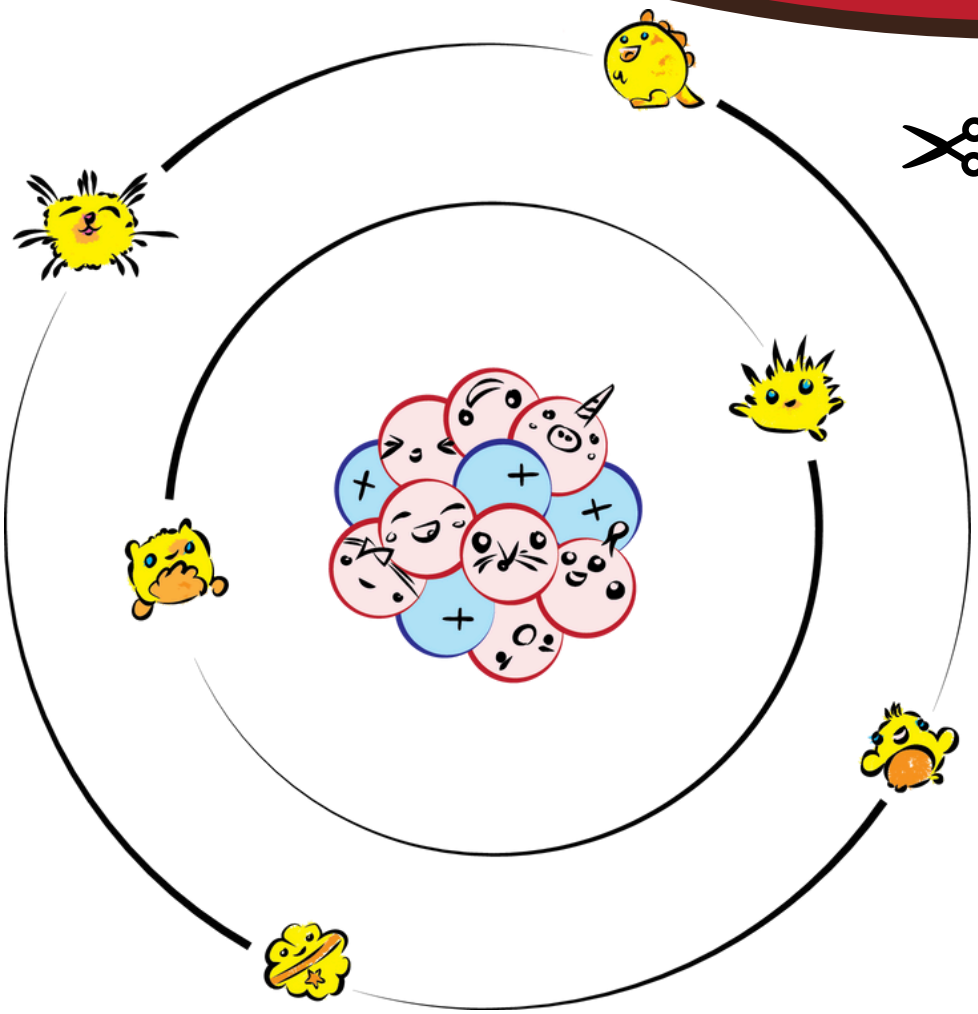
Ask: Which theory did you find most interesting? What would you like to learn more about? Why?

Example: Answers will vary. Allow students to be imaginative.

Cut out this cap for the bus driver.



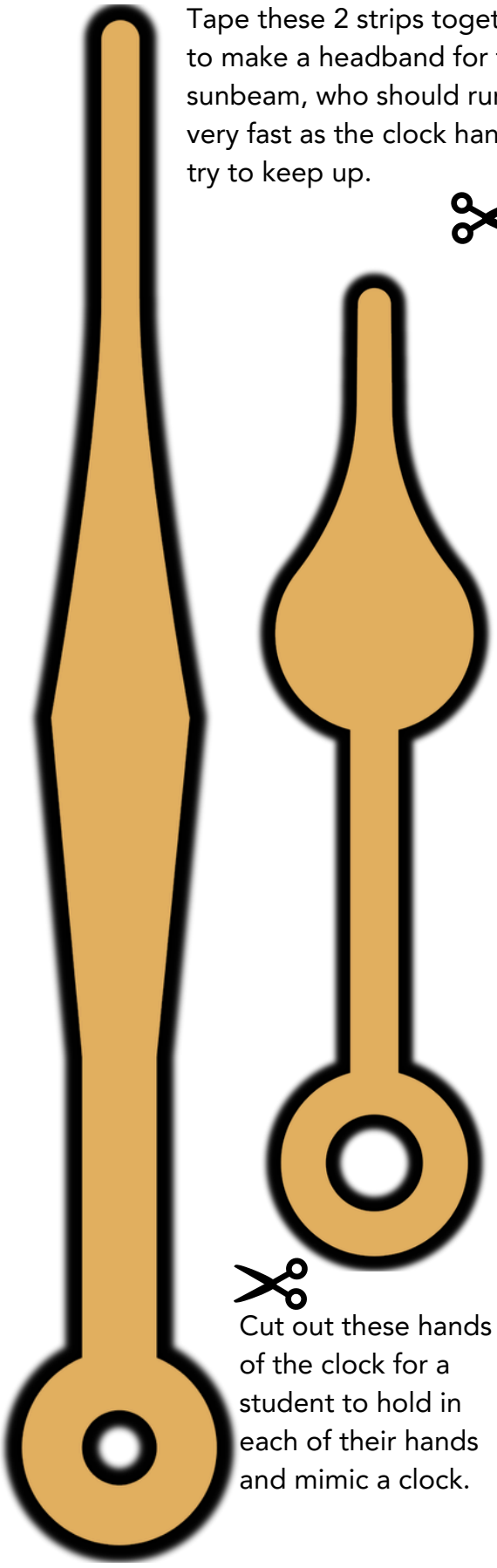
Cut out this model of an atom.



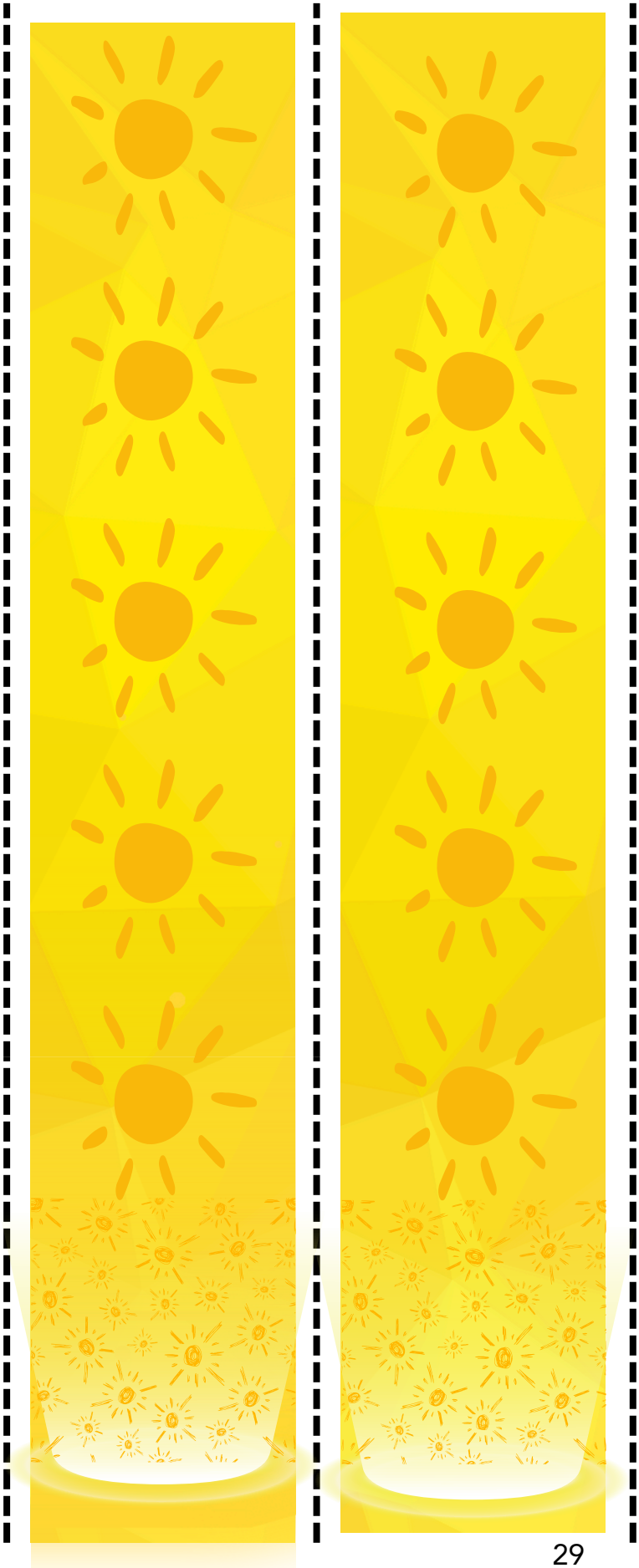
Bus driver: Tip your cap to Einstein when you remind him of his stop.

Einstein: Study the structure of this atom.

Tape these 2 strips together to make a headband for the sunbeam, who should run very fast as the clock hands try to keep up.



Cut out these hands of the clock for a student to hold in each of their hands and mimic a clock.



Clock Hand: Minute hand slows down as lightbeam speeds up.

Clock Hand: Hour hand stays slow and still.

Sunbeam: Sunbeam runs faster and faster.