

Materials

A/V Equipment

- Microphone/speakers
- Screen/television
- Projector
- Computer
- Cables, extension cords
- “Einstein’s Big Idea” video clip from www.pbs.org/nova/einstein (4 min. 38 sec.) (optional)

Welcome Table

- Pencils
- Nametags
- Markers

Trivia

- Trivia Question sheet for Round 1 (p. 31)
- Blank paper or notepads (for Round 2 answers)
- Pencils
- Markers
- Scoreboard (whiteboard or flipchart and easel)
- Stopwatch and buzzer
- Prizes (see ideas below)

General

- Agenda
- Scientist’s props
- Snacks
- Evaluation form

Prize Ideas

For all participants:

Bookmark, pencil, or pen with library name or science theme.

For the winning team (at least 5 prizes to accommodate a big team):

Video store, movie theater, or restaurant coupons (local establishments may donate coupons); free passes to a local science museum; book from the resource lists in this guide; Einstein-themed mugs, t-shirts, and posters (widely available at science museum gift shops or such Web sites as www.physlink.com/estore and www.scienceteacher.com).

Trivia Night at the Science Kaffeehaus

In the spirit of the Zurich cafés where Einstein did some of his most creative thinking, turn your library into a lively Science Kaffeehaus. Your guests can hear from a local scientist and take part in a trivia game—all related to $E=mc^2$. It’s a fun and effective way to reach new audiences and help bridge the gap between the scientific community and the public.

Ages: 18 and up

Time: 2½ hours

Group Size: 15 or more (depending on your space)

Big Ideas

$E=mc^2$ has a human story. Science is a process of inquiry and synthesis. Science is influenced by society. The legacy of $E=mc^2$ continues.

Get Ready

1 Get to know $E=mc^2$

Don’t worry—it’s not your job to explain the equation! Your goal is to feel comfortable sharing the following background information:

- * The year 2005 marks the centennial of Einstein’s famous equation $E=mc^2$ —a groundbreaking insight he came to at the age of 26.
- * To derive the equation, Einstein built upon the work of many scientists, including women and other scientific “outsiders.”
- * The equation’s legacy continues in countless inventions and discoveries (these connections can be made by your scientist speaker).

- **Visit NOVA’s Einstein’s Big Idea Web site** (www.pbs.org/nova/einstein).
- **Read David Bodanis’s book, $E=mc^2$: A Biography of the World’s Most Famous Equation.**
- **Review other resources** of interest from the resource lists (pp. 5–7).

2 Set a date, time, and location

- **Hold the event on an evening** when the library is closed, or **in a large meeting room**. If possible, choose a space where snacks can be served.

3 Find a scientist to host the trivia event

- **Contact the World Year of Physics 2005 Speakers Program**, which can help locate scientists who have a knack for explaining to the public Einstein’s ideas and their impact (www.physics2005.org/speakers/index.html).
- **Contact your local chapter of Sigma Xi**, the Scientific Research Society, whose members represent a diverse set of scientific disciplines (www.sigmaxi.org/chapters/lists/index.shtml).
- **Inquire at local colleges and museums** for suggestions of experts who would be interested in presenting.
- **Seek articulate, engaging presenters.** Also, consider breaking down stereotypes by finding scientists from underrepresented groups, such as women and minorities.
- **Explain their role:** To engage the general public in a dialogue and trivia game related to $E=mc^2$, its significance, and how it affects them today. Inform them that the time commitment is small and little preparation is necessary.
- **Establish whether a monetary incentive is needed** for your speaker and, if so, how you can fund it.

4 Publicize the event

- **Send a press release** or information about the event to local television stations and to online and printed calendar listings in listservs, newsletters, and newspapers (see sample press release at right).
- **Post flyers** for the event at the library and in the community.
- **List your event in the World Year of Physics national events database** (www.physics2005.org/events/index.html).
- **Suggest people sign up** individually or in teams, and ask people to register (by sign-up sheet at the library or by email) so that you have a sense of the group size.

5 Recruit volunteers

Enlist library personnel or volunteers to moderate, judge, and provide A/V support.

- The **moderator** will introduce the scientist, clarify rules for trivia, and run the Q & A session. The moderator should be comfortable speaking in public and familiar with the concepts being discussed.
- Have **two to three volunteers** hand out, collect, and score trivia answer sheets. They don't need to have any special expertise but should understand the questions and answers so they can accurately score response variations.
- An **A/V volunteer** should set up any equipment before the event begins and be available to help with glitches that may arise during the evening. Use of a microphone is recommended to ensure that everyone can hear.

6 Gather snacks, prizes, and materials

- **Create a Swiss Kaffeehaus** by offering coffee, tea, and hot chocolate, along with small pastries such as strudel slices and butter cookies. Play classical music, such as Bach's *Brandenburg Concerti*.
- **Obtain prizes** for all participants and/or the winning team.
- **Photocopy the Round 1 question sheet** (p. 31) for each team.
- **Collect blank pads of paper and pencils** for teams to record answers during Round 2.
- **Create your own trivia Q's.** Increase the challenge by adding a third round of questions. You can develop your own or choose from those provided by the World Year of Physics at: www.physics2005.org/events/projects.html#teachers

7 Do a test run on the day of the event

- **Prepare the space**, set out food and trivia materials, and test any A/V equipment.
- **Set up a welcome table** with blank nametags and markers available.
- **Set up a whiteboard or a flipchart** on an easel to use as a trivia scoreboard.
- **Have the scientist run through his or her presentation** before the guests arrive.

Run the Event

1 Welcome

- **Welcome and sign in participants.** Invite them to make nametags and have a snack while waiting for others to arrive.
- **Introduce the evening** to the entire group.
- **Show the NOVA video clip** to introduce the young Einstein and other scientists whose work laid essential groundwork for the equation. (optional)

2 Introduce the scientist

- Scientist comments on video clip (optional), reiterates the main concepts of $E=mc^2$, gives an example of how it affects our daily lives, or makes a connection between the equation and his or her work.

Sample Press Release

<LIBRARY NAME> INTRODUCES
THE "SCIENCE KAFFEEHAUS":
A LIVE TRIVIA NIGHT TO CELEBRATE
THE CENTENNIAL OF $E=mc^2$

Hosted by <Scientist Name, Affiliation>

WHAT: A Trivia Night with a Science
Flavor and Wide Appeal, hosted
by <scientist name>

WHEN: <Start Time to End Time> on
<Day, Date, Year>.

WHERE: The <Library Name>,
<address>, <town>, <phone>,
<Web site>

In the 19th century, people packed the lecture halls of Europe to hear talks and debates by prominent scientists—who were considered the rock stars of their day. Now the <Library Name> is introducing this tradition of lively public dialogue about science with our Science Kaffeehaus. The Kaffeehaus will serve up a mix of popular culture and science-flavored trivia, with teams competing to answer questions and win prizes. Trivia sessions will be interspersed with question-and-answer sessions with <scientist name> of <institution>.

The Science Kaffeehaus is inspired by the new NOVA special program, "Einstein's Big Idea" (www.pbs.org/nova/einstein). The two-hour film brings to life the dramatic stories of men and women whose innovative thinking led to Einstein's revolutionary equation, and explores the tremendous impact of the equation on humanity.

This exciting event is designed for all—physics degrees are not required! To join us, sign up at the library's main desk or email <email contact>.

Round 1 Answers

- 1 Germany (Ulm)
- 2 You might think the metal would weigh less, but Lavoisier's experiments showed it actually weighed *more*. He also determined that the surrounding air weighed *less* afterward than it had before, by exactly the same amount—as if some of the mass from the air had “stuck to” the metal.
- 3 Marie Antoinette
- 4 (a) Marie and Pierre Curie.
(b) Ossie Davis and Ruby Dee.
- 5 (c) 29 million years. If every particle became energy, the lump would yield around 25 billion kilowatt hours—enough to keep the bulb glowing for about 29 million years.
- 6 (a) flea. Even zooming at roughly 18,000 mph, a space shuttle is nowhere near a speed that would significantly change its mass. When subatomic particles travel near the speed of light, though, as they do in the world's most powerful particle accelerators, they can become 40,000 times heavier than they are at rest.
- 7 Franklin D. Roosevelt
- 8 Walter Matthau
- 9 300,000 km/sec; 186,000 miles/sec
- 10 Israel

Round 2 Answers

(See questions and answers on p. 32.)

3 Explain the trivia rules

- **There will be two rounds**, each introduced by the scientist.
- **Participants should form teams of 2–5** (depending on group size). Each team should select a name. (For fun, offer a prize for the most creative team name that's related to $E=mc^2$.) Each team should pick an answer recorder.
- **For Round 1, teams use the pre-printed question sheet.** Remind teams to write their team name at the top of their sheet and to turn in the sheet to one of the volunteers at the end of Round 1.
- **For Round 2, questions will be read aloud.** (For multiple choice questions, you can write out the answer choices for all to see.) Teams will have two minutes to submit the answer to each question. The scientist will give the answer for each question after all answers have been turned in and before moving to the next question.
- **For all rounds, correct answers will be announced.**
- **Team totals will be tallied and posted after each round.** Each answer is worth one point. Multi-answer questions award one point per answer. The last question in Round 2 can make or break a winner—it's worth up to ten points. Teams wager points based on their confidence in their answer. These points are *added* to a team total for a correct answer and *subtracted* from a team total for an incorrect answer.

4 Play the trivia game (see sample time line below)

5 Wrap up

- **Hand out prizes.**
- **Wrap it up and thank participants.** Ask them to fill out a brief event evaluation.

When	Who	What
4:00	Moderator, Volunteers	Set up A/V (e.g., computer, screen, projector, microphone, speakers), chairs, and Welcome Table with sign-up sheets, nametags, markers, and any handouts.
5:00	Moderator, Scientist, Volunteers	Run through welcome, video clip (optional), and Scientist's presentation. Set out snacks and all trivia materials.
6:00	Moderator, Volunteers	Help guests settle in. Play classical music.
6:10	Moderator	Welcome participants, explain purpose of the evening, introduce $E=mc^2$, and show video clip (optional).
6:18	Moderator	Introduce scientist.
6:20	Scientist	Discuss how work relates to $E=mc^2$ (or other appropriate topic).
6:30	Moderator, Scientist	Moderate brief Q & A session for scientist (to be continued after the trivia). Review trivia rules. Teams choose names.
6:40	Scientist	Introduce Round 1. Teams read and answer questions directly on trivia question sheet (see p. 31).
6:55	Volunteers	Collect Round 1 sheets.
7:00	Scientist, Moderator, Volunteers	Give the answers for Round 1. Volunteers score Round 1 and record team results on the scoreboard.
7:10	Scientist, Moderator	Introduce Round 2. Scientist reads each question aloud; teams have two minutes to turn in single answers after each question is read. Moderator presses a buzzer when answer period is over. Scientist gives answer for question after all teams' answers have been turned in and before reading next question.
7:10	Volunteers	Score answers as they come in. Halfway through Round 2, tally and post team standings on the scoreboard.
8:00	Moderator, Scientist	Invite the group to ask the scientist more questions. Repeat participants' questions so the entire audience can hear. Encourage a dialogue.
8:00	Volunteers	Tally final team standings.
8:10	Moderator, Scientist	Announce final scores and give prizes.
8:20	Moderator, Scientist	Have the audience fill out an evaluation form. Point participants to library displays, books, and handouts related to $E=mc^2$.
8:30		Event ends.

Sample Time Line

Team Name: _____

$$E = mc^2$$

Trivia

Round
1

- 1 In what country was Einstein born? _____
- 2 Antoine-Laurent Lavoisier was an amateur chemist who was very concerned with accuracy. He set up an elaborate apparatus to measure where every part of the mass involved in a chemical reaction would end up. His results showed that when a piece of metal rusts, it weighs (a) LESS, (b) MORE, or (c) THE SAME afterward as it did before? _____
- 3 Lavoisier was also a tax collector. Unfortunately, his obsession with accuracy led him to rebuild a 6-foot wall surrounding the city of Paris to facilitate tax collection. Naturally, he was quite unpopular as a result. A few years later during the French Revolution, Lavoisier was executed, as was this reigning queen:

- 4 The couple that works together, stays together.
 - (a) What husband and wife duo investigated radioactivity and discovered the element radium?

 - (b) What husband and wife team performed together in such productions as *Raisin in the Sun*, *Purlie Victorious*, and *Do the Right Thing*?

- 5 The equals in $E = mc^2$ represents what Einstein realized: energy and mass are not distinct, but different forms of the same thing, and each can be converted into the other. If converted entirely to energy, a lump of coal weighing 2.2 pounds could power a 100-watt light bulb for about how long?
 - (a) 67 hours
 - (b) 30 years
 - (c) 29 million years
- 6 Just as mass can become energy, energy can become mass. When a space shuttle travels at its top speed, the energy of motion adds to its mass. The amount of gain is roughly comparable to:
 - (a) a flea
 - (b) a cantaloupe
 - (c) a bowling ball
- 7 From his equation, Einstein also understood the potential for creating a highly destructive bomb. To which U.S. President did Einstein write a letter warning of a possible Nazi nuclear threat?

- 8 Who played Einstein in the 1994 movie *I.Q.* with Meg Ryan and Tim Robbins?

- 9 Light can travel from the earth to the moon in 1.28 seconds. How fast is this in kilometers per second or miles per second? _____
- 10 What nation once invited Einstein to be its president? _____

$E=mc^2$ Trivia

Round
2

Directions

These questions are to be read aloud by the scientist host. Teams will have two minutes to submit the answer to each question on a sheet of paper (be sure to include team names) and hand in each sheet for scoring. The host will give the answer for each question before moving to the next one.

Introductory Demonstration

Scientist host should take out a cell phone and loudly pretend to place a call to someone a few hundred miles away in another state. After “hanging up,” the scientist should ask the group for a show of hands to indicate who they think heard his or her words first—the Kaffeehaus guests in the back of the room (about 10 meters/30 feet away) or the friend in another state. The answer may surprise some, but it gets back to the speed of light. Cell phones carry signals as electromagnetic radiation (that is, at light speed). Light speed is 900,000 times faster than the speed of sound traveling through the air of the room. So the scientist’s voice made it to the other state before it made it across the room to the people’s ears.

Questions & Answers

- 1 Einstein was fascinated by the nature of light. One interesting thing about light is that although it appears white, it can be broken out into a spectrum of different colors by passing the white light through a prism. What are the colors of the rainbow from longest wavelength to shortest? **Answer: Red, orange, yellow, green, blue, violet** (Also acceptable is red, orange, yellow, green, blue, **indigo**, violet—forming the familiar mnemonic ROYGBIV. The labels used for the colors of the spectrum are arbitrary, and while indigo is no longer commonly used, it is included to make the sequence easier to read.)
- 2 What was the name of the top-secret U.S. government program to build the atomic bomb?
Answer: The Manhattan Project
- 3 What radioactive element was used in the bomb that was dropped on Hiroshima?
Answer: Uranium; offer bonus point for naming specific isotope uranium-235
- 4 Einstein was working as a patent clerk in Switzerland when he arrived at $E=mc^2$. A particularly notable patent that was awarded within the last few years was to inventor Dean Kamen for the Segway Human Transporter. What was the

code name for this invention?

Answer: “Ginger” is the code name for the Segway Human Transporter. Also acceptable, “IT” (rhymes with “fit”).

- 5 How long does it take for light to travel from the sun to earth?
(a) 10 seconds
(b) 85 minutes
(c) 850 minutes
(d) 10 minutes
(e) 8.5 minutes
- 6 This Hollywood comedian who starred in the movie *iThree Amigos!* wrote a play called *Picasso at the Lapin Agile* about a fictional meeting between Albert Einstein and Pablo Picasso.
- 7 What instrument did Albert Einstein play starting at the age of five?
(a) Trombone
(b) Violin
(c) Piano
(d) Accordion

Answer: (e) 8.5 minutes

Answer: Steve Martin

Answer: (b) Violin

- 8 Working after Einstein proposed his famous equation, Lise Meitner was the first to show that a uranium atom can be split, converting a tiny amount of mass into a prodigious amount of energy in accordance with the formula $E=mc^2$. What is the name of this splitting process?
Answer: Fission
- 9 Suppose you have a light bulb shining on a page of a book. Now you move the bulb half the distance closer to the page. How much more intense will the light be on the page?
Answer: 4 times more intense. The intensity of the light has an inverse squared relationship to its distance from the page. $\frac{1}{(1/2)^2} = 4$
- 10 **Ten-Point “Make or Break” Question**
(**Note to host:** Remind players that they can wager up to ten points on this question. Points will be *added* to a team total for a correct answer and *subtracted* for an incorrect answer.)

To what institute did Einstein come when he immigrated to the United States?

Answer: Institute for Advanced Study (located in Princeton, New Jersey, but not affiliated with Princeton University)