



A Day Made of Glass

Made possible by Corning

Dear Educator,

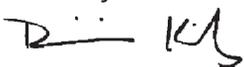
In 2011 and 2012, Corning's "A Day Made of Glass" video series became a viral sensation. The videos depict a future where glass technology will enhance every aspect of daily life, allowing us to work, play, and interact in amazing new ways. As a result, educators at all grade levels reached out to Corning to learn more about this cutting-edge vision for glass technologies.

Now, the award-winning curriculum specialists at Young Minds Inspired (YMI) are proud to work with Corning Incorporated, the creators of these videos, to bring you this free education program based on the "A Day Made of Glass" video series. Designed to meet science standards for students in grades 4-8, these materials will serve as a study guide to help your students understand the technologies depicted in the "A Day Made of Glass" videos and the role of advanced glass in a broad range of applications.

Glass is a critical material in some of the most important technologies, from Edison's light bulb to the smartphones, LCD televisions, and communications networks of today. Corning played a key part in all these technologies, and ongoing developments promise to make glass even more far-reaching in the near future.

We encourage you to share this program with fellow teachers and your school science department. Although the materials are protected by copyright, you may make as many copies as you need for educational purposes. Please let us know your opinion about this program by commenting at www.ymiclassroom.com/Corning. We depend on your feedback to continue providing free educational programs that expand students' horizons and help them gain a greater understanding of the world around them.

Sincerely,



Dr. Dominic Kinsley
Editor in Chief
Young Minds Inspired



CORNING

YMI is the only company developing free, innovative classroom materials that is owned and operated by award-winning former teachers. Visit our website at www.ymiclassroom.com to send feedback and download more free programs. For questions, contact us at 1-800-859-8005 or email us at feedback@ymiclassroom.com.

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Watch the "A Day Made of Glass" video series at YouTube.com/CorningIncorporated to learn about the future of glass technologies.



A Day Made of Glass

Target Audience

This program is designed for elementary and middle school students, grades 4-8, as a supplement to the STEM curriculum.

Program Objectives

- To guide students' appreciation for the glass technologies behind modern communications, and the potential for advancements in medical, environmental, and infrastructural applications as depicted in Corning's "A Day Made of Glass" video series.
- To encourage students to consider their role in advancing the future of technology.

Standards Alignment

This program aligns with National Standards for Science, Common Core Standards, and Next Generation Science Standards for grades 4-8. For more details, visit www.ymiclassroom.com/corning.

Program Components

- This one-page teacher's guide
- Three reproducible student activity sheets
- A teacher feedback form at www.ymiclassroom.com/Corning.

How To Use This Program

Make a copy of these materials to share with fellow teachers and your school science department. Complete the first activity before students have watched the "A Day Made of Glass" video series. Afterwards, have students complete the post-viewing activity sheet appropriate for your grade level, either as a class or on their own.

Activity 1: Pre-Viewing for Grades 4-8 Glass in Your World

Ask students to speculate when glass was first invented and some of its most common uses, past and present. Have them do some research and complete the timeline. Then, review the answers as a group, noting the diversity of application and identifying any surprises. Provide time for students to watch the "A Day Made of Glass" video series (YouTube.com/CorningIncorporated) in class, or on their own.

Once students have seen the videos, lead a discussion about the new technologies students saw and ask them to brainstorm additional ideas. Focus on applications of glass in homes, hospitals, classrooms, or other everyday places in the future. Provide time for students to update the timeline with their favorite scenes from the film, and to come up with their own ideas for new ways to use glass.

Answers: Part 1: A-1952, B-1926, C-1947, D-1970, E-1972, F-1997, G-2007, H-1982, I-1915, J-1879, K-2012, L-1944

To extend the activity: Ask students to research one of the technologies portrayed in the "A Day Made of Glass" video series and present the class with a timeline based on that particular glass application.

Activity 2: Post-Viewing for Grades 4-6 Imagine the Possibilities

Have students complete Part 1 at home, listing some of the glass technologies they recognize in their world today. Compare answers in a class discussion to broaden student awareness of glass in their lives, then lead a discussion about some ways the technologies shown in the "A Day Made of Glass" video series will enhance different areas of our daily life—communication, entertainment, productivity, transportation, even our health—with an emphasis on how technology impacts us as individuals. Encourage students to picture themselves in the world made of glass, then have them complete Part 2, listing their own ideas for how glass will impact their future. Part 3 can be completed in class or at home, with the help of parents.

To extend the activity: Have students compare and contrast the glass applications they included in each section of the chart with their classmates' responses. Tally and chart the most common responses, or poll the class on which applications they think will be most important for society.

Activity 3: Post-Viewing for Grades 7-8 Many Layered Wonders

After students have watched the video series, lead a discussion about Corning's vision, prompting students to share their favorite technologies. Ask students what questions they had while they were

watching the videos, and then have them complete the activity sheet. Review answers as a class.

Answers: Part 1: A-Cover Glass, B-Touch Sensor, C-Frontplane, D-Backplane

Answers: Part 2: video conferencing, Twitter, Internet, e-books, online shopping, chat rooms, wireless devices, data transmission between devices — and many more.

To extend the activity: Select an additional vision of glass from the "A Day Made of Glass" video series, such as communication or automotive advances, and guide students in researching how the attributes of glass — being thin, tough, flexible, and damage-resistant — make it possible. Here are a few links to get you started:

- Corning.com/ADayMadeofGlass
- Corning.com/GlassClass
- Corning.com/DisplayTechnologies
- Corning.com/GlassStack
- Corning.com/OpticalFiber/FiberBasics

Resources

YouTube.com/CorningIncorporated – Corning's YouTube channel featuring the "A Day Made of Glass" video series and many more informative videos.

Corning.com – a vast wealth of information on cutting-edge technologies.

Corning.com/FactCentral – features an innovation timeline, facts about glass, and historical information about glass applications that have helped change the world.

Corning.com/GlassStack – overview of advanced glass properties that allow it to be used in various applications.

Corning.com/OpticalFiber/FiberBasics – information on optical fiber

ymiclassroom.com/Corning – for Corning and other educational programs

Watch the "A Day Made of Glass" video series at YouTube.com/CorningIncorporated to learn about the future of glass technologies.

Activity 1 | Glass in Your World

Glass is one of the oldest substances in the universe. Scientists found tiny silica glass spheres that are 3 billion years old in the lunar soil brought back by Apollo astronauts. And glass objects are among the oldest human creations, perhaps dating before 3400 B.C. Since then, glassmakers have developed hundreds of new ways to produce and use glass for art, architecture, and technology. But some of the most impressive advances have occurred in just the past century, with a company called Corning Incorporated at the forefront.

Part 1

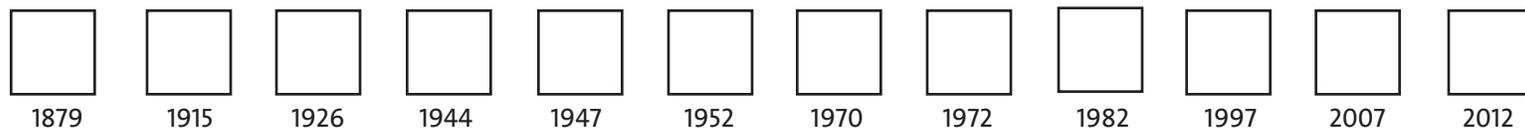
Place the letter for each of the following innovations next to the year it was first developed or applied.

- A. An accidental experiment leads to the development of glass-ceramic, a shatter-resistant material that soon becomes part of American mealtimes as CorningWare®.
- B. Corning engineers develop the ribbon machine, which can produce 400,000 light bulb blanks in just 24 hours — 5 times faster than earlier technology — making electric light available to millions.
- C. Corning develops a spin casting method that uses centrifugal force to produce TV picture tubes, soon making television affordable for every family.
- D. Glass enters the digital age with the development of an optical fiber capable of maintaining the strength of laser light signals over significant distances — a breakthrough in the development of high speed Internet and communication.
- E. Glass technology helps Earth’s ecosystem breathe easier with the development of a ceramic that is still at the core of catalytic converters used to reduce auto emissions.
- F. Corning manufactures the 27-ton glass mirror for Japan’s Subaru telescope, one of the largest pieces of glass ever made.
- G. Corning® Gorilla® Glass is developed — thin and lightweight enough for mobile devices, but still tough enough to resist the wear and tear of everyday use.
- H. When ordinary glass proves inadequate for liquid crystal displays, Corning engineers develop a new glassmaking process that opens the way for today’s flat-screen TVs and touchscreen devices.

TUNE IN: Check out the “A Day Made of Glass” video series, Corning’s vision for a not-too-distant future driven by glass and shaped by exciting partner technologies. Be sure to watch all three videos in the series: “A Day Made of Glass,” “A Day Made of Glass 2,” and “A Day Made of Glass 2: Unpacked.” Find them at: YouTube.com/CorningIncorporated.

- I. Two years after a Corning physicist asks his wife to bake a cake on a piece of heat-resistant glass, PYREX® cookware becomes a favorite in American kitchens.
- J. Corning glassblowers create the transparent case for Thomas Edison’s incandescent lamp — and the light bulb shape that now symbolizes innovation.
- K. A new ultra-thin, flexible glass is developed. Slimmer than a dollar bill, the glass is so thin and flexible, it can be rolled almost like sheets of paper.
- L. A Corning chemist combines electric melting and new stirring techniques to speed up the production of optical glass — techniques still used today.

Timeline



FUN FACT: Corning supplied windows for all of the United States’ manned spacecraft—including the Friendship 7 flown by John Glenn for the first U.S.-manned orbital flight. Find out more about Corning’s innovations at Corning.com/history.

Part 2

Now that you have seen the videos, extend the timeline with two advanced glass technologies depicted in “A Day Made of Glass” and two of your own futuristic ideas for using glass. Next to each, suggest the year you think it will be possible.

“A Day Made of Glass” Technologies	Year
_____	_____
_____	_____
My Ideas for Future Glass Technologies	Year
_____	_____
_____	_____



Activity 2 | Imagine the Possibilities

Corning’s “A Day Made of Glass” video series features some exciting new ways to communicate, work, and play today and in the years to come. Imagine how these technologies will change your world!

Part 1

How does glass enhance your daily life today? Take this sheet home and research some of the ways you use glass — in your home, at school, on the road, etc. Record your answers in the “Today” column of the chart below. (We’ve filled in one space to get you started.) You can add your own category in the space provided.

	Today	Future
Getting information	<i>Optical fiber for Internet</i>	<i>Touchscreen table tops</i>
Getting ready for school/work		
Classroom lessons		
Homework		
Field trips & after-school activities		
Having fun with friends		
Weekends		
Family vacations		
Decoration & art		

Part 2

Now, think about how glass might enhance your daily routines, relationships, and activities. In the “Future” column of the chart at left, record how each aspect of your life might be different if you lived in the world depicted in the “A Day Made of Glass” video series.

Part 3

Now it’s time to really stretch your imagination! Brainstorm all the ways glass can impact your life and the world around you. What would you do? Where would you go? How would glass technology help make it happen faster or more efficiently? You can use the back of this sheet to write about what you think the future of glass technologies will look like.



FUN FACT: Many people believe that glass is rigid and would break if you tried to bend it. But Corning’s ultra-thin glass can be rolled like sheets of paper and flexed like wire. Find out more at Corning.com/myths.



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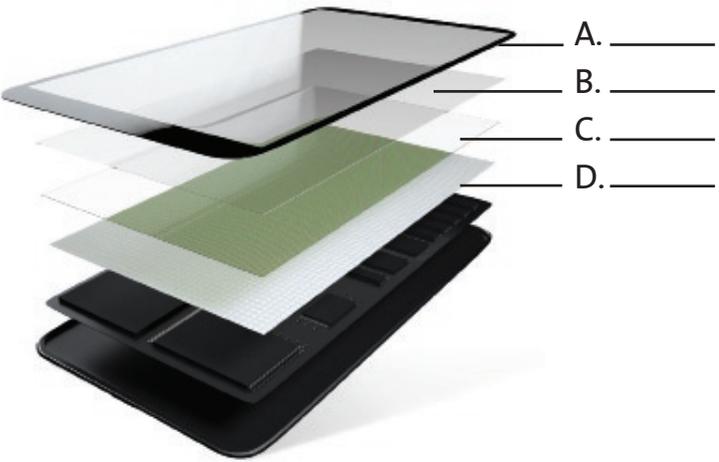
Watch the “A Day Made of Glass” video series at YouTube.com/CorningIncorporated to learn about the future of glass technologies.

Activity 3 | Many Layered Wonders

As you watched Corning’s “A Day Made of Glass” video series, did you wonder how it all worked? How a mobile phone transmits your voice instantly across the city, country, or world? Or what makes it possible to stream the latest movie right to your handheld device? To answer these questions, we first have to take a closer look at how these devices are made.

Part 1

In the diagram, we see that smartphones are composed of several layers of glass and electronics that sense and process information. So what does all that glass do? Match the description of the glass to the layer in the diagram.



1. Backplane—Processes millions of thin-film transistors
2. Cover Glass—Helps protect the device
3. Frontplane—Houses the color filter to create the picture
4. Touch Sensor—Helps detect physical touch

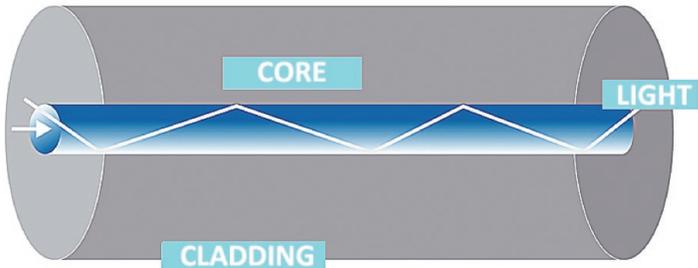
As you saw in the “A Day Made of Glass” video series, this same type of design can allow us to use glass to turn nearly any glass surface into a touchscreen device, with the ability to display, transmit, and receive real-time images and information. For example, Mom uses her bathroom mirror to respond to email and update her calendar, while Dad and the kids can video chat with Grandma right on the kitchen counter. Corning’s glass technologies can make all this possible. Learn more at Corning.com/DisplayTechnologies and Corning.com/AdvancedGlass.

Part 2

Glass does more than help transfer a signal from your fingertips to your smartphone. It is also capable of carrying voice, data, and video information in the form of light signals at very high speeds. This glass, called optical fiber, is a thin, flexible, pure strand of glass that is stronger than steel, yet thinner than a human hair.

Optical fiber is comprised of two basic elements made of glass:

1. The glass core, the center part of the fiber, that carries the information in the form of light signals.
2. The glass cladding that surrounds the core and reflects the light signals, causing them to move along the core on an angled path.



We use optical fiber when we talk on a cell phone, watch TV, and surf the Internet. It’s what makes voice, video, and data communications work. Get together with a partner and brainstorm four more ways optical fiber makes every day “A Day Made of Glass.”

FUN FACT: Corning invented glass optical fiber in 1970. Today, optical fiber is the most effective way to transmit information and data across long distances without garbling your message. A single modern optical fiber can carry 10 trillion bits per second a distance of a kilometer. That’s enough information to fill 250 DVDs every second! For more fascinating facts about Corning technology, check out Corning.com/OpticalFiber/FiberBasics.



Watch the “A Day Made of Glass” video series at YouTube.com/CorningIncorporated to learn about the future of glass technologies.



Educational Standards

A Day Made of Glass

The “A Day Made of Glass” activity sheets align with the following national educational standards:

Common Core Standards

Grades 4-5

- CCSS.ELA-Literacy.SL.4.1
Engage in a range of collaborative discussions, building on others’ ideas, and expressing their own clearly.
- CCSS.ELA-Literacy.RI.4.4
Determine the meaning of general academic and domain-specific words or phrases in a text.
- CCSS.ELA-Literacy.RI.5.3
Explain the relationships between two or more ideas or based on specific information in the text.
- CCSS.ELA-Literacy.RI.5.7
Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.

Grades 6-8

- CCSS.ELA-Literacy.RST.6-8.2
Determine the central ideas or conclusions of a text and provide an accurate summary distinct from prior knowledge or opinions.
- CCSS.ELA-Literacy.RST.6-8.4
Determine the meaning of key terms as they are used in a specific scientific or technical context.
- CCSS.ELA-Literacy.WHST.6-8.7
Conduct short research projects to answer a question (including a self-generated question), drawing on several sources, and generating additional related, focused questions that allow for multiple avenues of exploration.

National Science Education Standards & Emphases for K-8

Grades K-8

- Standard E, Science and Technology: Understanding about science and technology; abilities of technological design including identifying a problem, proposing a solution and evaluating design; communicating problem, design and solution.
- Standard F, Personal and Social Perspectives: Science and technology in society and in local challenges.
- Standard G, History and Nature of Science: History of science (e.g., history of glass for various applications).
- Overall Curriculum Emphasis: Learning subject matter disciplines in the context of inquiry, technology science in personal and social perspectives, and history and nature of science.

Next Generation Science Standards for Grades 4-5 and Middle School

- 4-ESS3-1: Over time, people’s needs and wants change, as do their demands for new and improved technologies;
- 4-PS4-3: Information Technologies and Information. Digitized information transmitted over long distances without significant degradation; high-tech devices, such as computers or cell phones, can receive, decode and convert information from digitized form to voice—and vice versa.
- 5-ETS1.A: Defining and Delimiting Engineering Problems (properties of glass).
- 5-PS1-3: Make observations and measurements to identify materials based on their properties.
- MS-PS4-2: Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.
- MS-PS4-C: Information Technologies and Instrumentation: Digitized signals (sent as wave signals) are a more reliable way to encode and transmit information.
- MS-LS2-5: The use of technologies is driven by individual or societal needs, desires and values; by the findings of scientific research; and by differences in such factors as resources and economic conditions.
- MS-LS4-5: Interdependence of Science, Engineering and Technology: Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems.

In addition, the materials and concepts contained in these activities can be used as a starting point for more complex scientific lessons, such as crafting a class experiment relating to the properties of glass or the transfer of waves; research into how glass is made; and a focus on the properties of glass.