

Passport: Day in the Life of a Glass Blower
Grade: 9-12

Description:

Feel the heat – 2,100 Degrees Fahrenheit! A day in the life of Geoff Lee, a glass blower in Honolulu, Hawaii, reveals the skill, creativity, teamwork, and sweat involved in creating glass works of art.

Preparation for the Excursion

To ensure the most meaningful learning experience for your students, it is recommended that students engage in activities prior to the excursion. The excursion is intended to complement a comprehensive unit. The video resources provide students with a context for the virtual excursion. The additional resources and activities offer opportunities for curricular connections and integration within your larger unit of study. During the excursion, classes will be asked to share their response to the challenge question and the expert will provide feedback. Select a class response for the challenge question.

Video Link: Use the following link to introduce students to the artist Geoff Lee while he creates glass pumpkins – http://www.21-learn.com/artists/geoff_lee/index.htm

Challenge Question:

As an investigate challenge for students, use the challenge questions to prepare for the introduction of the Passport excursion. Present the questions to the students in advance of the excursion to ensure they have enough time to research the answers to the questions. The presenter will activate student's prior knowledge by eliciting responses from the participants.

1. Where was **glassmaking** first discovered?
Answer – Mesopotamia (Modern day Iraq and Syria)
2. Where did **glassblowing** develop?
Answer – Phoenicia (Modern day Lebanon)
3. What is so special about glass?
Glass' diversity of properties makes it unique. When heated it forms a malleable, elastic substance that hardens. Its thermal property allows it to resist sudden hot or cold temperature changes.
4. Why was the development of glassblowing so influential?
The transition in the glassmaking industry enabled glass to be mass produced making it no longer a luxury item.

Lesson at a glance:

Students will be introduced to the different tools used by glassblowers to create their beautiful creations. Through this introduction, students will identify the tools and associate them with their function in the studio. In addition, students will investigate the periodic table and its relationship to glass blowing.

Glassblowing began as a utilitarian method to produce glass 40 centuries ago in Mesopotamia (modern day Iraq and Syria). Today, glass blowing is not only a process to build products but also a magical art form and craft.

Glass is a state of matter meaning it is produced from chemical process of melting crystalline materials at high temperatures. Natural glass is formed by volcanic action and it is called *obsidian*. *Obsidian* is formed when the intense heat of a volcano forms with silica, forming the hard glass. Because of natural impurities, it is usually shiny, black, and opaque, but it can also be very dark red or green; its splinters are often transparent or translucent.

The discovering of glass making is attributed to the Phoenician sailors who made the discovery while cooking on the beach. They noticed the sand beneath the fire melted to form a liquid and later cooled and hardened. However, the true development of glass is hypothesized to have started in western Asia, perhaps *Mesopotamia*, at least 40 centuries ago. It was later discovered that if the material were thick enough, it would stand by itself. Pieces of solid glass could then be ground to shape by grinding it with stones, or sand and water, to produce vessels.

The tools used 40 centuries ago are still used in glassblowing in modern times. Students will be exposed to the tools used for glassblowing using the *Activity 1*. This activity is designed to introduce students to the tools and how they are used to blow glass. Discuss how these tools were used in ancient times to blow glass. Present the images in *Activity 1* and question—*What do you think these tools are used for?* Elicit responses from the students. After students have given their responses, introduce the tools and their function in glassblowing. *Activity 2* is designed to establish the relationship between art and science. This interdisciplinary activity can be utilized to introduce students to chemical bonding and formation.

Vocabulary:

- blow pipe
- glory oven/glory hole
- furnace
- temperature
- anneal
- work bench
- optic mold
- gather
- neck line
- inflation
- glass
- vessel

Lesson Outcomes:

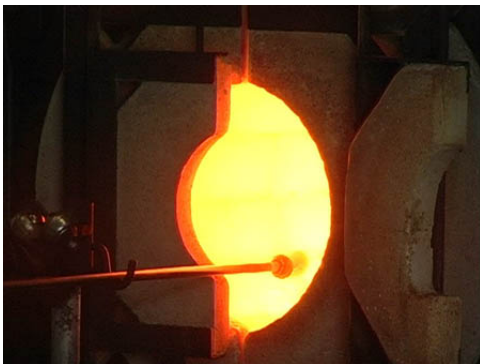
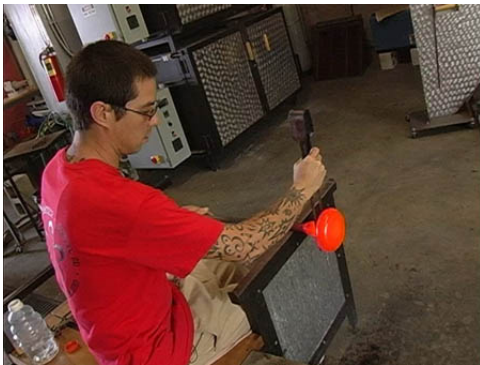
The students will:

- investigate the origins of glassblowing
- understand the tools used for glassblowing
- define the elements used in glassblowing

Activity 1 – Tools of the Glassblowing Trade

Directions: Below are images of tools used to create blown glass. Make copies of the images and ask students to match the tools with the description. After you are finished matching the tools with the description, write a paragraph describing the order of the glassblowing techniques.

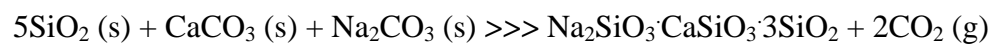
- Blowpipe**—a hollow metal tube of iron or steel
- The Bench**—a glassmaker sits at the bench and must keep rolling the blowpipe back and forth along the two extended arms of the bench
- Glory oven**—Oven that is used to reheat glass as it is being worked. Usually the front is open for easy access during the working of a piece. The glory oven temperature is 2200 degrees Fahrenheit.
- Pair of jacks** – used to shape the glass and create weak spots
- Kiln** – used for annealing, cooling the glass slowly





Activity 2—Glassblowing and Chemistry

Directions: Use the Periodic Table to investigate the different elements used to create glass and its transformation.



Si = _____

O = _____

Ca = _____

C = _____

Na = _____

Bonus Question: What chemical changes take place in this transformation?



Periodic Table Of The Elements

Solid ■
Liquid ■
Gas ■
Synthetically Prepared ■

1 1.008 -259.3 -252.8 0.090 H Hydrogen	2 4.003 -268.5 0.178 He Helium	3 6.941 180.5 1347 0.53 Li Lithium	4 9.012 2471 1.85 Be Beryllium	5 10.811 2075 3650 2.35 B Boron	6 12.011 3625 3.51 C Carbon	7 14.007 -210.0 -195.8 1.251 N Nitrogen	8 15.999 -218.8 -183.0 1.429 O Oxygen	9 18.998 -218.6 -188.1 1.696 F Fluorine	10 20.180 -248.5 -246.1 0.900 Ne Neon	11 22.990 97.7 883 0.97 Na Sodium	12 24.305 650 1090 1.74 Mg Magnesium	13 26.982 660.3 2519 2.70 Al Aluminum	14 28.086 1414 3280 2.34 Si Silicon	15 30.974 44.2 280.5 1.82 P Phosphorus	16 32.066 115.2 444.6 2.07 S Sulfur	17 35.453 -101.0 -34.0 3.214 Cl Chlorine	18 39.948 -189.4 -185.5 1.784 Ar Argon	19 39.098 63.4 766 0.86 K Potassium	20 40.078 842 1454 1.55 Ca Calcium	21 44.956 1541 2836 2.99 Sc Scandium	22 47.88 1568 3295 4.50 Ti Titanium	23 50.942 1910 3421 6.11 V Vanadium	24 51.996 1907 2690 7.14 Cr Chromium	25 54.938 1246 2000 7.43 Mn Manganese	26 55.847 1538 2861 7.87 Fe Iron	27 58.933 1495 3100 8.90 Co Cobalt	28 58.693 1455 2920 8.91 Ni Nickel	29 63.546 1084.6 2570 8.95 Cu Copper	30 65.39 419.5 907 7.14 Zn Zinc	31 69.723 29.8 2403 5.90 Ga Gallium	32 72.61 938.3 2850 5.32 Ge Germanium	33 74.922 615 5.78 As Arsenic	34 78.96 221 685 4.79 Se Selenium	35 79.904 -73 59.5 3.14 Br Bromine	36 83.80 -118.3 -153.3 3.749 Kr Krypton	37 85.468 39.3 688 1.53 Rb Rubidium	38 87.62 777 1381 2.63 Sr Strontium	39 88.906 1522 4200 6.51 Y Yttrium	40 91.224 1855 4203 6.51 Zr Zirconium	41 92.906 2477 4758 8.57 Nb Niobium	42 95.94 2023 4650 10.28 Mo Molybdenum	43 98 2157 4567 11.5 Tc Technetium	44 101.07 2334 4150 12.41 Ru Ruthenium	45 102.906 1964 3760 12.39 Rh Rhodium	46 106.42 1555 2994 11.99 Pd Palladium	47 107.868 961.8 2155 10.49 Ag Silver	48 112.411 321.1 767 8.65 Cd Cadmium	49 114.82 156.6 2080 11.99 In Indium	50 118.710 231.9 2823 7.27 Sn Tin	51 121.757 630.5 1587 6.70 Sb Antimony	52 127.60 449.5 990 6.25 Te Tellurium	53 126.904 113.6 185.2 4.94 I Iodine	54 131.29 -111.8 -108.1 9.73 Xe Xenon	55 132.905 28.4 705 1.90 Cs Cesium	56 137.327 727 1897 3.62 Ba Barium	57 138.906 918 3464 6.15 La Lanthanum	72 178.49 2233 4603 13.28 Hf Hafnium	73 180.948 3017 5534 16.65 Ta Tantalum	74 183.85 3422 5555 19.3 W Tungsten	75 186.207 3196 5650 21.0 Re Rhenium	76 190.2 3033 5025 22.57 Os Osmium	77 192.22 2446 4550 22.61 Ir Iridium	78 195.08 1758 4170 21.41 Pt Platinum	79 196.967 1964.2 2856 19.32 Au Gold	80 200.59 -38.8 356.7 13.53 Hg Mercury	81 204.383 304 1473 11.85 Tl Thallium	82 207.2 304 1751 11.34 Pb Lead	83 208.980 271.4 1564 9.81 Bi Bismuth	84 209 254 962 9.2 Po Polonium	85 210 302 337 - At Astatine	86 222 -71 -62 9.73 Rn Radon	87 223 77 1700 - Fr Francium	88 226.025 700 1700 5.5 Ra Radium	89 227.028 817 2470 10.07 Ac Actinium
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Atomic Number — 21
Atomic Weight — 44.956
Melting Point °C — 1541
Boiling Point °C — 2836
Density (g/cm³) at 25 °C — 2.99

Atomic Weight — 44.956
Oxidation State[†] — 3
Symbol — **Sc**
Name — Scandium

Notes
() Indicates most stable or best known isotope based upon carbon-12.
* Refers to the gaseous state at 0°C and 1 atmosphere pressure. Units are g/l.
† Indicates estimated values.
‡ Most common oxidation state is shown in boldface.

58 140.115 796 3443 6.77 Ce Cerium	59 140.908 981 3520 6.77 Pr Praseodymium	60 144.24 1021 3074 7.01 Nd Neodymium	61 145 1042 3000 7.52 Pm Promethium	62 150.36 1074 1794 7.26 Sm Samarium	63 151.965 822 1529 5.24 Eu Europium	64 157.25 1313 3273 7.90 Gd Gadolinium	65 158.925 1356 3230 8.23 Tb Terbium	66 162.50 1412 2567 8.55 Dy Dysprosium	67 164.930 1474 2700 8.80 Ho Holmium	68 167.26 1529 2868 9.07 Er Erbium	69 168.934 1545 1950 9.32 Tm Thulium	70 173.04 819 1196 6.90 Yb Ytterbium	71 174.967 1663 3402 6.84 Lu Lutetium	90 232.038 1750 4850 11.78 Th Thorium	91 231.036 1572 4227 15.37 Pa Protactinium	92 238.029 1135 3900 19.05 U Uranium	93 237.048 644 5235 20.45 Np Neptunium	94 244 640 5235 19.86 Pu Plutonium	95 243 1176 2900 13.67 Am Americium	96 247 1345 2600 13.51 Cm Curium	97 247 1050 — 14.78 Bk Berkelium	98 251 900 — 15.1 Cf Californium	99 252 860 — — Es Einsteinium	100 257 1527 — — Fm Fermium	101 258 827 — — Md Mendelevium	102 259 827 — — No Nobelium	103 262 1627 — — Lr Lawrencium
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Glassblowing – A Bibliography

Websites

- *Metropolitan Museum of Art—Blown Glass from Islamic Lands*
http://www.metmuseum.org/toah/hd/blow/hd_blow.htm
- *Metropolitan Museum of Art—Glass with Mold-Blown Decorations from Islamic Lands*
http://www.metmuseum.org/toah/hd/mold/hd_mold.htm
- *Corning Museum of Glass* <http://www.cmog.org/index.asp?pageId=426>
This website offers the ancient history of glassblowing.
- *Glassblowing.com* <http://www.glassblowing.com/hotglass/process.php>
A more advanced interpretation of the history of glassblowing.
- *Museum of Glass* http://www.museumofglass.org/s02_virtual_hotshop.jsp
This interactive website allows students to use the tools to design blown glass.

Books

- Campbell Geeslin, Ana Juan (Illustrator). *Elena's Serenade* (*Americas Award for Children's and Young Adult Literature*). Atheneum/Anne Schwartz Books: 2004. ISBN: 0689849087
This book is about a Mexican girl who is ready to prove why she can be a glassblower, even if she is a girl. A winner of *Americas Award for Children's and Young Adult Literature*.
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