

LAB GUIDE

SUBMARINE

THE LAB: Students tour the historic submarine and participate in hands-on activities as they explore the science and history behind the U-505.

GRADE: 4th–8th **CAPACITY:** 30 students **DURATION:** 65 minutes

KEY CONCEPTS & TERMS

TO REVIEW WITH YOUR STUDENTS BEFORE YOUR VISIT:

ARTIFACT: An object produced or shaped by human beings that is of historical interest.

BALLAST TANKS: One of several external or internal tanks fitted in submarines which, when filled or emptied, allow the boat to submerge or rise to the surface.

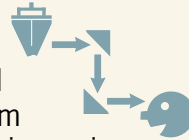
BUOYANCY: The upward force that a fluid exerts on an object that is less dense than itself. Buoyancy allows a boat to float on water.

DENSITY: The mass of a substance compared to its volume. Density is calculated as mass divided by volume and recorded as a cubed measurement (units are g/cm^3).

GRAVITY: The natural force of attraction exerted by a celestial body, such as Earth, upon objects at or near its surface, tending to draw them toward the center of the body.

MASS: The amount of matter that is contained by an object.

PERISCOPE: An instrument that has angled mirrors and allows objects not in the direct line of sight to be seen. The word periscope comes from two Greek words: peri meaning “around,” and scopus meaning “to look.”



REFLECTION: The change in direction of a wave, such as a light or sound wave, away from a boundary the wave encounters; the return in light, heat, sound, etc. after striking a surface.

REFRACTION: The turning or bending of a wave, such as a light or sound wave, as it passes from one medium to another medium of different density.

U-BOAT: A German submarine; short for unterseeboot which means, “undersea boat.”

VOLUME: The amount of space occupied by a three-dimensional object or region of space.

LAB GUIDES provide tools to help you make the most of your Museum visit and lab experience. You'll find key vocabulary and activity ideas to share with your students *before your visit*, a list of Illinois Learning Standards addressed by the lab, important things to remember *on the day of your visit* and follow-up activities and additional resources to continue the exploration *back in the classroom*. We look forward to seeing you and your students at the Museum!

LEARNING STANDARDS:

The content of this lab aligns with the following Illinois learning standards:
State Goal 4: 4.A, B
State Goal 11: 11.A, B
State Goal 12: 12.D
State Goal 13: 13.A, B

{OVER}



SUBMARINE

ADDITIONAL INFORMATION:

MUSEUM VISIT: Plan to arrive at the Museum at least 30 minutes before your first lab is scheduled.

LAB INFORMATION: Let the Lab Coordinator know of any special needs or requests in advance at (773) 684-9844 ext. 6254 or learning.lab@msichicago.org. On the day of your lab, please advise the Lab Facilitator of those requests as soon as you arrive.

The Lab Facilitator is not responsible for the discipline of your students and, for safety reasons, has the right to ask disruptive students to leave the lab. Please notify chaperones they will be responsible for student behavior. The Lab Facilitator may request the help of teachers and chaperones during the lab. Please notify your chaperones to be prepared to assist during the lab.

PAYMENT AND REFUND POLICY:

Payments must be received two weeks prior to the lab or it will be cancelled. Labs cancelled with fewer than two weeks notice will not be refunded. Based on availability, labs may be rescheduled for a handling fee of \$10. No exceptions.

LATE ARRIVAL POLICY: If you are late to your scheduled lab session, the Museum reserves the right to cancel the lab and reschedule it at a later date if availability permits. If the lab cannot be rescheduled, lab fees are forfeited.

PRE-VISIT ACTIVITY

SINK, FLOAT, AND HOVER- DESIGN A SUBMARINE!

www.msichicago.org/online-science/activities/activity-detail/activities/design-a-submarine/
Students will learn about density, buoyancy, and how submarines dive.

STREAMLINED DESIGNS

www.pbs.org/saf/1208/teaching/teaching2.htm
Students test different designs to answer the question: what hull shape moves through the water best?

RESOURCES

www.msichicago.org/whats-here/exhibits/u-505/
The official U-505 website.

www.msichicago.org/whats-here/exhibits/u-505/learning-tools/for-teachers/

U-505 Instructor's Manual. Prepare your group for a trip to the U-505 with these activities designed for before, during, and after your visit.

<http://science.howstuffworks.com/submarine.htm>

How Stuff Works describes the science and technology of both modern-day and older-model submarines, with photos and animations.

Instructions and links for these activities, along with additional activities and resources can be found on our website.

www.msichicago.org/education/field-trips/learning-labs



Specific questions about lab content or information in this guide?

Contact us at 773.684.9844, ext. 6254 or e-mail learning.lab@msichicago.org

Museum of Science and Industry ★ 57th Street and Lake Shore Drive ★ Chicago, IL 60637 ★ www.msichicago.org