

THE INTERNATIONAL EXHIBITION OF

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SHERLOCK HOLMES™

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# Teacher's Guide

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## Why Sherlock Holmes in the Classroom?

Sherlock Holmes is one of the most recognizable figures in literature. Beloved by generations of readers, the character has been renewed and reinterpreted countless times in popular culture, a testament to the enduring quality of Sir Arthur Conan Doyle's stories and their unforgettable hero.

The tales of Sherlock Holmes go beyond mere storytelling. As a chemistry and forensics expert ahead of his time, Sherlock uses seemingly trivial observations to solve the most complex crimes. His practices and techniques, created by doctor-turned-author Conan Doyle, profoundly influenced the way police work was conducted at the turn of the 19<sup>th</sup> century. Many of Sherlock's methods still remain in practice today.

Sherlock Holmes has inspired generations of thinkers to use deductive reasoning and apply it to modern sciences. Many forms of forensic sciences were influenced by Conan Doyle's work, including serology, fingerprinting, and firearm identification (all methods that appear in the Sherlock Holmes stories). In the exhibit, students will be transported into Sherlock Holmes' London to solve a crime in a world that was being introduced to these ground-breaking methods for the first time.

The Sherlock Holmes stories can provoke rich classroom discussions relating to literature, history, science, technology, and psychology, making them an ideal subject for multidisciplinary study.

## How to Use This Teacher's Guide

These materials have been developed as a supplementary resource for educators bringing their students to *The International Exhibition of Sherlock Holmes*. Included are eight science and language arts lesson plans, take-home versions of the four science lesson plans, and two observation-based games.

The hour-long lesson plans have been designated as either *pre-exhibit field trip* or *post-exhibit field trip* activities. The pre-exhibit activities are designed to prepare your students to visit the Sherlock Holmes exhibit by fostering interest in the scientific investigations pioneered by Sherlock Holmes. The post-exhibit activities are designed to enhance the exhibit experience by building on the concepts of deductive reasoning, analysis, and investigation introduced in the exhibit. However, these designations are flexible and are only suggestions; both pre-exhibit and post-exhibit lessons can be taught at any point and will even stand alone without the experience of a field trip.

These resources can be used independently or combined to ensure a rich experience for students visiting *The International Exhibition of Sherlock Holmes*, or adapted to meet your classroom goals.

## Exhibit Overview

*Note: it is recommended that you allow 60-90 minutes for students to complete their tour of the exhibition.*

Footprints, spatter patterns, and the powers of observation mark the journey through *The International Exhibition of Sherlock Holmes*. The interactive experience combines science with history and culture to bring to life the historic underpinnings of author Sir Arthur Conan Doyle's rich and vibrant stories.

Students will learn how Sherlock Holmes, a scientific expert ahead of his time, used seemingly trivial observations of clues missed by others to solve some of his era's most puzzling mysteries. His practices and techniques, created in the mind of doctor-turned-author Conan Doyle, encouraged a change in the way police work was conducted and many remain in practice today.

*The International Exhibition of Sherlock Holmes* features original manuscripts and period artifacts, investigative tools influenced and used by Sherlock Holmes, and interactive crime-solving opportunities. Students will be transported into Sherlock Holmes' London to solve a crime in a quickly advancing world filled with innovation and experimentation – primed for his ground-breaking methods.

Students will learn about the practices of Sherlock Holmes, explore the world from which Conan Doyle drew to develop his stories, and gain an understanding of the core principles of forensic science. As visitors venture forth on a journey through Sherlock Holmes' London, they will ultimately find themselves immersed in modern-day Sherlockian pop culture and the science of today's real detectives.

Students will be guided through five separate galleries in the exhibition:



### **Dr. Conan Doyle's Study**

Conan Doyle, a scientifically educated physician, was a curious and tireless investigator his entire life. Students will explore his world and life starting as a medical student at Edinburgh University, an apprentice at Royal Surgeons' Hall, a practicing physician in Southsea, Portsmouth in the 1880s, and finally as a creator of literary genius who moved to London in the early 1890s and became a full time author.

The centerpiece is Conan Doyle's desk, surrounded by vignettes of experiences that eventually brought Sherlock Holmes to life. Students are encouraged to explore

academic, professional, and cultural influences: the professors who awakened Conan Doyle's interest in observation and deduction, period-specific medical innovations, the state of Victorian London and its sensationalized crime, and contemporary mystery writers who influenced his writing. On display will be an original manuscript, letters, and illustrations that shed light on the experiences that influenced Conan Doyle in creating Sherlock Holmes.

### **Science and History**

Sherlock Holmes solved mysteries using observation, deduction, and solid scientific experimentation, something real-world detectives (police or private) had not yet embraced. Students enter the Baker Street Underground Station and find themselves in the middle of a bustling center of innovation in the form of an International Science Exhibition.

As students enter the Science Exhibition, their photographs are taken in front of one of three painted murals in the style of the cutting-edge photographic technology of 1895. Students can don hats and other props to pose as though they are at 221B Baker Street, on a foggy London road, or in the Dartmoor countryside of *The Hound of the Baskervilles*. Photograph packages are available for purchase at the end of the exhibition.

Students will participate in experiments of their own by exploring the developments in science and technology in the 1890s – from telecommunications and printing to botany and chemistry – that are still highly relevant today. Supported by forensics expert and crime historian E. J. Wagner, author of *The Science of Sherlock Holmes*, the exhibition delves into real forensic studies in order to demonstrate the link between the Sherlock Holmes stories, detective science, and the world of today.

### **Baker Street**

Next up is Sherlock Holmes' and Dr. Watson's sitting room at 221B Baker Street, London, where their investigations began and concluded – a room looming large in popular imagination around the globe ever since the first Sherlock Holmes tale, *A Study in Scarlet*, in 1887.

As students enter the sitting room, the space feels inhabited, as though Sherlock has just stepped out. The room is dark, lit only by the fire, gaslights, and the flickers of a chemistry set's Bunsen burners. The air is thick and the clutter oppressive and overwhelming, though on closer inspection, the clutter shows the hand of a brilliant eccentric with many objects from his most recent cases still preserved throughout the room. A jackknife stuck in the mantel with a note from Sherlock Holmes states that the students are late, poorly dressed, and observing the unimportant. Students are instructed to play a recording made by Sherlock, which provides details about a recent crime. Students learn that they are needed to help solve a time-sensitive and mysterious event!

### **Become a Detective!**

The new Sherlock Holmes mystery, written exclusively for the exhibition by Sherlockian and acclaimed writer and award-winning Conan Doyle biographer Daniel Stashower, takes the students on an adventure through the streets of London as they perform scientific experiments, observe details, chase clues, and solve a crime.

As Holmes' Baker Street Irregulars with hopes of becoming detectives-in-training, students use what they learned in the Underground Station Science Exhibition and Conan Doyle's study to solve the mystery. Each mystery location also provides additional information and clues. Scotland Yard's Inspector Lestrade sees the case differently from Sherlock; if the truth is not revealed in a timely manner, an innocent person may be charged with a terrible crime. Students must work diligently to make sure that an innocent person is not sentenced to a life behind bars.

Detective notebook in hand, students document the mystery by way of embossing, stamping, rubbing, punching and drawing. The experience guides them through a crime scene and five themed vignettes. Each vignette includes scientific, hands-on experiences that let the students try their hands as professional detectives, using and reinforcing each of the five science principles presented earlier.

### **Culture of Sherlock**

Returning to the 21<sup>st</sup> century, students enter a contemporary gallery. Pop culture enthusiasts will enjoy a robust collection of all things "Sherlockian," ranging from vintage Sherlock Holmes-themed card games, comics, and magazines to radio scripts and movie and television show props and costumes.

Featured props include items from Warner Bros.' *Sherlock Holmes* movies set in the Victorian era, alongside costumes, props and behind-the-scenes tools from the hit CBS television show *Elementary* and the BBC's *Sherlock*, both of which set Sherlock Holmes in the present day. The exhibition offers students the most comprehensive display of Sherlock Holmes as portrayed in the popular imagination since his creation over 100 years ago.

Videos in the final gallery will investigate Sherlock Holmes' and Conan Doyle's influence on pop culture, history, and forensic science. Six of the country's leading forensic specialists, many from the Minnesota Bureau of Criminal Apprehension, share details of how they solve mysteries today using many of the very same techniques that Sherlock Holmes used more than a century earlier. Actual tools from the Bureau and evidence are shown, presenting an accurate example of the importance and complexity of real forensic science.

## **Detective's Notebook (for student use in exhibit)**

Every visitor will receive a notebook at the entrance of the exhibit. Students will use this notebook to help guide them through the exhibit, collect clues and evidence from the crime scene, and reflect on the material that they have been exposed to. This notebook is critical in solving the crime and will have items added to it at various stations throughout the exhibit. It is designed so that students will not need pencils to record observations, but will instead stamp, emboss, or punch their clues into the notebook. It can be used as an exhibit worksheet for field trips as students will be able keep the notebook after exploring the exhibit. This notebook is an important tool for students as it touches on key scientific concepts and provides guidance for navigating through the exhibit.



## **Educational Standards**

*The International Exhibition of Sherlock Holmes* is intended to provide strong connections to science and language arts for students and educators.

The exhibit and the accompanying educational materials are aligned with the Common Core State Standards and the Next Generation Science Standards.

Educators can integrate these materials into their classrooms to further student understanding of the concepts presented in the exhibit while complementing classroom curricula. The following information is a summary of each set of standards used in the development of the exhibit and the accompanying classroom materials.

## Common Core State Standards

The Common Core State Standards (CCSS) were created by the National Governors Association, teachers, schools, and experts in order to create a consistent framework to prepare students for college and the workforce through English Language Arts and Mathematics skills.

The CCSS are considered the most effective models from states across the US and have been reviewed and tested by thousands of teachers around the world. The goal of these standards is to allow consistency in student skill expectations country wide, regardless of where students live.

The Standards:

- align with college and work expectations
- are clear, understandable, and consistent
- include rigorous content and application of knowledge through higher-order skills
- build upon strengths and lessons of current state standards
- are informed by other top performing countries so that all students are prepared to succeed in our global economy and society

The Standards comprise three main sections: a comprehensive K–5 section and two content area–specific sections for grades 6–12, one for English and language arts and one for history/social studies, science, and technical subjects.

Each section is divided into strands. The K–5 and 6–12 English and language arts sections have Reading, Writing, Speaking and Listening, and Language strands; the 6–12 history/ social studies, science, and technical subjects section focuses on reading and writing. Each strand is headed by a strand-specific set of College and Career Readiness Anchor Standards that are identical across all grades and content areas.

Individual College and Career Readiness (CCR) anchor standards can be identified by their strand, CCR status, and number (R.CCR.6, for example). Individual grade-specific standards can be identified by their strand, grade, and number (or number and letter, where applicable), so that RI.4.3, for example, stands for Reading, Informational Text, grade 4, standard 3 and W.5.1a stands for Writing, grade 5, standard 1a.

*Information taken from the Common Core website at <http://www.corestandards.org/>*

## Next Generation Science Standards

Through a collaborative, state-led process managed by *Achieve*, new K–12 science standards have been developed that are rich in content and practice and arranged in a coherent manner across disciplines and grades to provide all students an internationally benchmarked science education. The Next Generation Science Standards (NGSS) are based on the Framework for K–12 Science Education developed by the National Research Council.

States have previously used the National Science Education Standards from the National Research Council (NRC) and Benchmarks for Science Literacy from the American Association for the Advancement of Science (AAAS) to guide the development of their current state science standards. While these two documents have proven to be both durable and of high quality, they are around 15 years old. In addition, major advances have since taken place in the world of science and in our understanding of how students learn science effectively. These advances created a need for developing new standards to accommodate not just the new learning styles of today's students, but also the new sciences that are being discovered and taught.

The standards are organized by grade levels in kindergarten through fifth grade. The middle and high school standards are grade-banded. As with the titles of the standards themselves, the first digit indicates a grade K-5 or specifies MS (middle school) or HS (high school). The next alpha-numeric code specifies the discipline, core idea, and sub-idea. PS indicates Physical Science, LS is Life Science, ESS is Earth and Space Science, and ETS indicates Engineering, Technology, and Applications of Science. The number at the end of each code designates the order in which that statement appears in the framework.

*Information taken from NGSS website at <http://www.nextgenscience.org/>*

**NEXT GENERATION  
SCIENCE STANDARDS**

		The Proof is in the Powder	Busted by Biology	Curious Contraptions	A Matter of Spatter
<b>Disciplinary Core Ideas</b>					
PS1	Matter & Its Interaction	✓	✓		
PS2	Motion & Stability: Forces & Interactions		✓	✓	✓
PS3	Energy			✓	✓
PS4	Waves & Their Applications in Technologies for Information Transfer				
LS1	From molecules to organisms: Structures & processes		✓		
LS2	Ecosystems: Interactions, Energy, & Dynamics				
LS3	Heredity: Inheritance & Variation of Traits		✓		
LS4	Biological Evolution: Unity & Diversity				
ESS1	Earth's Place in the Universe				
ESS2	Earth's Systems				
ESS3	Earth & Human Activity				
ETS1	Engineering Design			✓	✓
<b>Practices</b>					
1	Asking questions & defining problems	✓	✓	✓	✓
2	Developing & using models			✓	✓
3	Planning & carrying out investigations	✓	✓	✓	✓
4	Analyzing & interpreting data	✓	✓	✓	✓
5	Using mathematics & computational thinking				✓
6	Constructing explanations & designing solutions	✓	✓	✓	✓
7	Engaging in argument from evidence	✓			✓
8	Obtaining, evaluating, & communicating information	✓			
<b>Crosscutting Concepts</b>					
1	Patterns	✓		✓	✓
2	Cause & effect	✓	✓	✓	✓
3	Scale, proportion, & quantity		✓		✓
4	Systems & system models		✓	✓	✓
5	Energy & matter			✓	
6	Structure & function	✓	✓	✓	
7	Stability & change	✓			

# Lesson Plan Overview

Contained in this packet are a total of eight hour-long lesson plans designed for elementary, middle, and high school students. Each lesson contains themes from or is directly related to Sherlock Holmes and the exhibit. These activities were designed with the expectation that the students are somewhat familiar with Sherlock Holmes and have been crafted so that a supplementary trip to the exhibit will provide a strong context for each lesson.

Although each lesson was designed for a certain grade range, many lessons can be modified to either increase their sophistication and difficulty or decrease their complexity to use with lower grade levels. Suggestions for this process are included in each lesson under the “Optional Extensions” category.

Of the eight lessons, four are science-themed and four are language arts-themed. Each lesson is intended to fill a full hour but can be modified depending on class length.

Within each lesson, you will find:

- **Learning Objectives**
- **Alignment with Standards**  
Next Generation Science Standards for the four science lessons and Common Core State Standards for the four language arts lessons.
- **Advanced Preparation**  
These steps are designed to be done in the days or weeks before teaching the lesson.
- **Optional Extensions**  
Included are ways to adapt the activity for different age levels, as well as suggestions on how to extend the activity into multi-hour or multi-day lessons.
- **Background Information**  
Important information providing the educator with a thorough understanding of the concepts presented in the lesson.
- **Glossary**  
Prepare your students for the new terms they may encounter in the lesson or at the exhibit.
- **Supply Worksheet**  
At the end of each science lesson is a “shopping list” that can be used to calculate how many of each item is needed.
- **Student Handouts**  
Some lesson plans will include student handouts for teachers to print and photocopy for their students.
- **At-Home Versions**  
Each of the four science lesson plans includes an at-home version of the experiment for students to do with their family in the event that time does not allow for the full lesson in class.

## Science Lesson Plans:

The following science lessons were designed to expand on the sciences presented in *The International Exhibition of Sherlock Holmes* and allow students to gain hands-on experience with forensic science. In order address all aspects of STEM education (Science, Technology, Engineering, and Mathematics), activities have been included that focus on engineering and math.

### 3<sup>rd</sup> Grade – 5<sup>th</sup> Grade

- **The Proof is in the Powder**

*Suggested as a pre-exhibit field trip activity*

In this activity, students will design a way to identify a mystery powder found at a crime scene by comparing it with known powders, with the goal of solving a crime. Basic chemistry and reasoning skills are utilized.

- **Busted by Biology**

*Suggested as a post-exhibit field trip activity*

In this activity, students will extract their own DNA from their cheek cells and learn how DNA is analyzed and used to solve crimes. Lesson concepts introduce students to cell structure and basic genetics and can be related to information on DNA forensics as observed in the exhibit.

### 6<sup>th</sup> Grade – 8<sup>th</sup> Grade

- **Curious Contraptions**

*Suggested as a pre-exhibit field trip activity*

In this engineering design activity, students will design, test, and build a “haunting machine” to solve a Sherlockian mystery. Students will use their creativity and imagination to invent a Rube Goldberg-inspired contraption.

- **A Matter of Spatter**

*Suggested as a post-exhibit field trip activity*

In this math-based activity, students will experiment to find how height and angle affect drops of liquid (“spatter”) and then use this knowledge to solve a crime. Fractions or decimals, averages, angles, and measurement skills are reinforced in this activity.

## At-Home Versions

In addition to the four science lesson plans listed above, there are four at-home versions of these same lessons. They are designed to capture a simpler version of the full lesson plans with instructions and materials simple enough for families to do together at home. If you are unable to carry out the full hour-long lessons in class, these activities are an excellent alternative that you can send home with students.

## Language Arts Lesson Plans:

The following language arts lessons were designed to introduce the writing of Conan Doyle to the next generation while reinforcing writing and reading concepts within Common Core State Standards.

### 6<sup>th</sup> Grade – 8<sup>th</sup> Grade

- **On the Trail of a Mystery**

*Suggested as a pre-exhibit field trip activity*

Students will learn mystery vocabulary and story structure, work in pairs to identify mystery elements in a Sherlock Holmes story, and craft a persuasive response that predicts their own solution to the mystery. This lesson will familiarize students with mystery structure, which will be echoed as they solve the mystery at the exhibit.

- **The Game is Afoot!**

*Suggested as a post-exhibit field trip activity*

Students learn to recognize descriptive language, analyze its function in a Sherlock Holmes story, and employ it in their own writing. Students will participate in a fun writing exercise and use the character it inspired to write an original mystery story.

### 9<sup>th</sup> Grade – 12<sup>th</sup> Grade

- **Cheap, Healthful Literature**

*Suggested as a pre-exhibit field trip activity*

Students will view archival copies of *The Strand*, the magazine that originally published many of Conan's Doyle short stories. Students will explore short story structure and participate in a collaborative writing project.

- **Cracking an Ancient Case**

*Suggested as a post-exhibit field trip activity*

In this lesson, students will begin the lesson by solving a riddle that echoes the Sherlock Holmes story they have read. Students then learn to apply interrogation methods to academic sources and explore a real-life historical mystery.

## **Games to Engage your Class in Observation:**

In addition to the lesson plans provided, we have also included two observation games inspired by the language arts lessons for teens and adults to play at home. These may also be adapted as a fun activity for your students to play during class.

- 1. Spot the Liar!**

Can you spot a liar? This game pits Sherlocks against Suspects to determine who is the best liar and who is the next Sherlock Holmes.

- 2. If the Shoe Fits...**

This game is a great way to put your Sherlockian powers of observation to the test! Players try to match shoes (or other distinctive personal items) to their owners using nothing but carefully observed clues about the item.



### 3<sup>rd</sup> Grade – 5<sup>th</sup> Grade

Upper elementary students will gain a wealth of information from *The International Exhibition of Sherlock Holmes*. This age group will enjoy the many hands-on components throughout the exhibition but may need extra guidance when solving the mystery portion of the exhibit. You may wish to have students work in partners or small groups accompanied by a chaperone to solve the mystery.

Two science lessons are included for this age group. **The Proof is in the Powder** allows students to practice their deduction skills by performing an authentic scientific investigation using many common ingredients found in the kitchen. **Busted by Biology** gives students a more in-depth understanding of what DNA is and how it can be used to solve crimes. Students will be introduced to DNA in the exhibition's modern forensics section. A conversation about what the students learned about DNA in the exhibit is an effective way to introduce this activity.

For more mature students, the two observation games **Spot the Liar!** and **If the Shoe Fits...** may be appropriate. These games reinforce scientific concepts of making observations and drawing conclusions while helping cultivate students' interest in Sherlock Holmes. These games could be played in preparation for your visit to the exhibit or after the field trip.

## Middle School

Before visiting the exhibit, it is recommended that students complete the lesson **Curious Contraptions**. This engineering activity is sure to get students excited about their trip to see *The International Exhibition of Sherlock Holmes*. Students will use ingenuity, imagination, and a bit of patience to build machines similar to Rube Goldberg machines, all in the context of a Sherlock Holmes story.

The science lesson **A Matter of Spatter** is excellent for students studying angles, averages, or measurement. Teachers can choose to have their students use fractions or decimals and can decide if students will be allowed to use a calculator depending on what concepts are being reinforced. For younger students not yet familiar with angles or protractors, there is a suggestion in the Optional Extensions section on how to expand the portion of the activity that does not use angles so that the lesson remains a full hour in length. For more advanced students, there are also suggestions of how to incorporate basic trigonometry in the activity.

The activity **The Proof is in the Powder** may also be appropriate for this age level if the activity is expanded using the Optional Extensions. For more advanced students, the educator can provide fewer directions and allow students to design the experiment on their own as much as possible.

Two language arts lessons and two science lessons are included for middle school students. In the **On the Trail of a Mystery** lesson, students are introduced to a Sherlock Holmes story and learn about the structure and vocabulary of the mystery form, preparing them to jump into the mystery in the “Become a Detective!” portion of the exhibit. This lesson also includes information about the history of the mystery genre and Conan Doyle’s significant contribution to the form.

The post-exhibit lesson, **The Game is Afoot!**, focuses on the crucial role of descriptive language in Conan Doyle’s stories and in the students’ own work. Inspired by their visit to the exhibit, the students will write their own mysteries, integrating their own experiences the way Conan Doyle did when he incorporated his medical knowledge into the Sherlock Holmes stories. The two high school lessons plans, which focus on short story structure and “interrogating” academic sources, respectively, can be adapted for middle school students using the Optional Extensions sections from those lesson plans.

For science and language arts instructors, the observation games **Spot the Liar!** and **If the Shoe Fits...** can be used as fun classroom activities that encourage students to practice their Sherlockian observation skills. It may be possible to adapt these games to play while on a school bus for your field trip to keep students engaged and excited about viewing the exhibition.

## High School

Two lesson plans are included for high school students. The first, **Cheap, Healthful Literature**, introduces students to *The Strand* magazine, the British magazine that published a great deal of Conan Doyle's work. *The Strand* archives are available online and students can peruse these rich sources of information on turn-of-the-19<sup>th</sup>-century celebrities, science, technology, and literature before they "enter" that world in the exhibit. The students read one of the Sherlock Holmes stories that was originally published in *The Strand*, learn what makes a short story "work," and apply that knowledge to a collaborative short story writing project.

In the post-exhibit lesson, **Cracking an Ancient Case**, students will parlay their newly honed interrogation skills into academic research, choosing a "mystery from history" to explore and learning how to distinguish reliable sources from suspect ones. The two middle school plans, which focus on mystery vocabulary and conventions and descriptive language, can be adapted for high school students using the Optional Extensions sections from those lesson plans.

While high school teachers address unique course content, many of the middle school lessons can easily be adapted for this age level. **Curious Contraptions** encourages students to use the engineering design process to invent a Sherlockian Rube Goldberg machine. Higher-level students may surprise you with their enthusiasm for this type of activity as well as with the inventions they create! **A Matter of Spatter** has a strong math focus and would be an excellent activity for students learning trigonometric functions. The Optional Extensions section provides suggestions of ways to alter the activity to include higher-level thinking.

For science and language arts instructors, the observation games **Spot the Liar!** and **If the Shoe Fits...** can be used as fun classroom activities that encourage students to practice their Sherlockian observation skills. It may be possible to adapt these games to play while on a school bus for your field trip to keep students engaged and excited about viewing the exhibition.

*The International Exhibition of Sherlock Holmes* was developed by Exhibits Development Group and Geoffrey M. Curley + Associates in collaboration with the Conan Doyle Estate Limited, the Oregon Museum of Science and Industry, and the Museum of London.