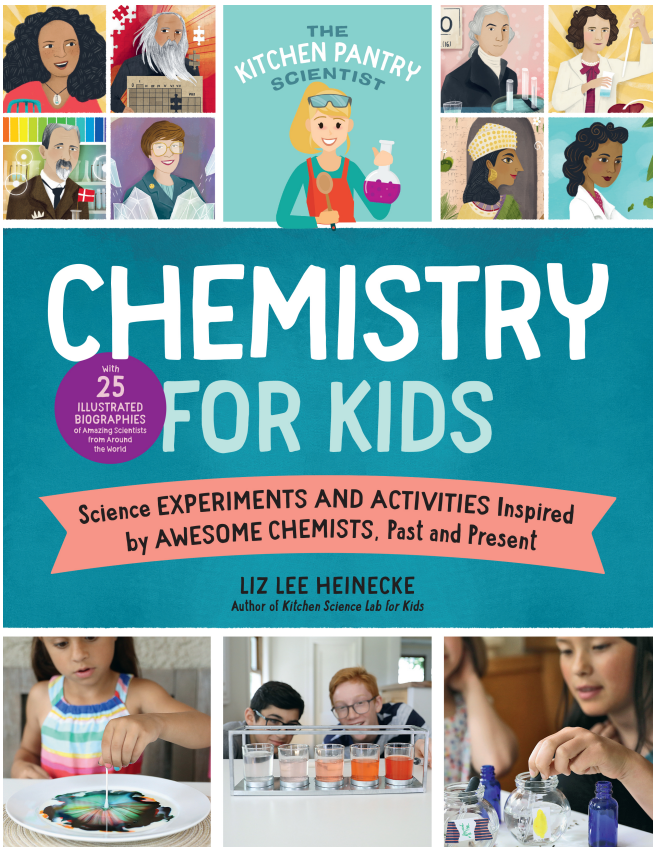

A Common Core State Anchor Standards & Next Generation Science Standards-Aligned Discussion/Activity Guide

The Kitchen Pantry Scientist

Chemistry for Kids:

Homemade Science Experiments and Activities Inspired by Awesome Chemists, Past and Present

Written by Liz Lee Heinecke

Praise for *Chemistry for Kids*:

★ "Wondrous." – *School Library Journal*, starred review
2021 EUREKA! Nonfiction Children's Honor Book
2021 NSTA-CBC Outstanding Science Trade Book

Replicate a chemical reaction similar to one Marie Curie used to purify radioactive elements! Distill perfume using a method created in ancient Mesopotamia by a woman named Tapputi! Aspiring chemists will discover these and more amazing role models and memorable experiments in Chemistry for Kids, *the debut book of The Kitchen Pantry Scientist's Guides series.*

Guide Created by
Debbie Gonzales, MFA

Guides by deb

Quarto Kids

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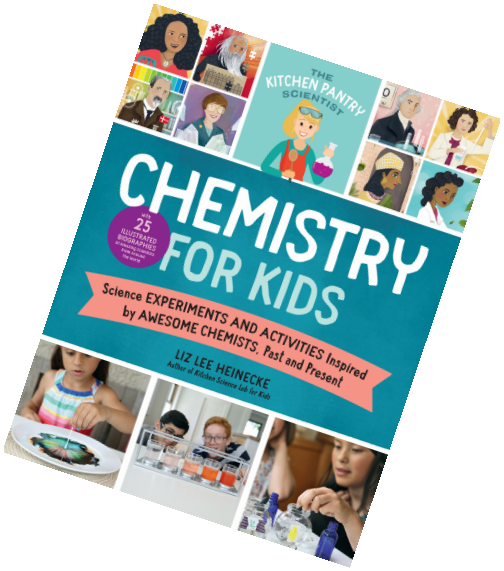


Discussion Guided by the Scientific Method

The Scientific Method is a methodical and verifiable way of studying and learning about the scientific world. This method of research is founded a systematic, measurable, and replicable process of proving a hypothesis, also known as an "educated guess." The Scientific Method consists of procedural six steps which are applicable to all fields of science.

The steps of the Scientific Method are listed below:

- Ask a Question
- Research
- Form a Hypothesis, which is a prediction of the outcome of the experiment
- Perform Experiment
- Analyze Data
- Formulate Conclusion, stating whether the hypothesis was proven or disproven

The chemists featured in *Chemistry for Kids* diligently applied this type of scientific reasoning while performing their systematic, measurable, and replicable experimentations. In the Discussion section of this guide, we will use the steps of the Scientific Method to guide inference and exploration of selected chemists featured in *Chemistry for Kids*.

Galen eventually became a physician to Roman emperors and began to write extensively about medicine (pg. 15).

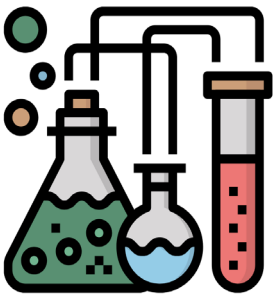
- Galen, a Roman physician in 129 CE, is attributed for the invention of soap. As a scientist, consider what question might have inspired this research. What problem do you think he was attempting to solve in the experimentation process?
- Galen attended medical school and eventually became a physician to the gladiators. Predict how caring for wounded gladiators helped to guide Galen's research.
- Predict what Galen's hypothesis might have been. Determine what outcome he predicted would happen because of his experimentation.
- Galen believed that wounds were "windows to the body." Consider how this belief might have influenced his methods of experimentation.
- Galen was a prolific writer and a philosopher. Consider the impact Galen's experimental data had upon his writings.
- In conclusion, discuss how Galen's interest in hygiene impacted history.

He set up a workspace in a garden shed and along with his brother and a friend, tested the dye and scaled its production (pg. 37).

- William Henry Perkin is attributed to the discovery of synthetic dyes, more specifically, the color purple. William was originally engaged in the experimentation process to discover a cure for malaria when he accidentally discovered the dye. Discuss how this "unexpected result" was influenced by his research, hypothesis, and experimentation process.
- The procedural steps of the Scientific Method assure that discoveries are replicable and scientifically sound. Predict how the changes in William's focus would alter his research, hypothesis, experimentation, and data analysis.
- Note that William Henry Perkin was eighteen years old when he was awarded a patent for his discovery. Examine how William's life as it prepared him for his contributions to the scientific world.
- Does age limit an individual's ability to question and explore scientific questions? Explain your answer.

Life was not easy for Dmitri Mendeleev and his family, but his mother recognized his genius early on and made it possible for him to reach his full potential (pg. 41).

- Dmitri is credited for establishing and organizing chemical elements in a remarkable table categorized by atomic number, electron configuration, and recurring chemical properties. Consider the depths of scientific questioning and research required to accomplish this task.
- It is said that the organization of the Periodic Table appeared to Dmitri in a dream. Dreams are said to be expressions of the unconscious mind. Consider how working to prove endless hypotheses about chemical elements and recording of volumes of data might have prepared his subconscious mind to help Dmitri visualize the solution to his organizational puzzle.
- Not only did Dmitri contributed to other scientific fields such as hydrodynamics, meteorology, and petroleum chemistry, he volunteered to teach women who attended the Russian university for free. He did so at a time in history when women were not welcome in the scientific world. What does his willingness to encourage females to join in the world of scientific reasoning reveal about his character?
- Do you agree with Dmitri's mother that her son was, in fact, a genius? How so?

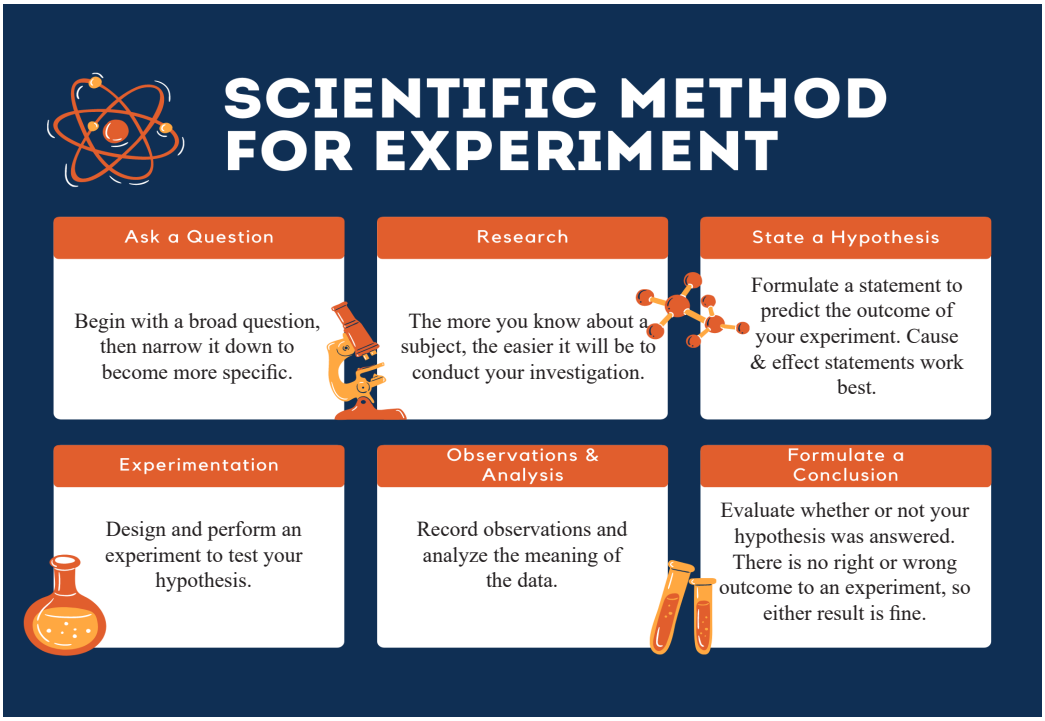


She became to believe that education was the only way to fight oppression (pg. 55).

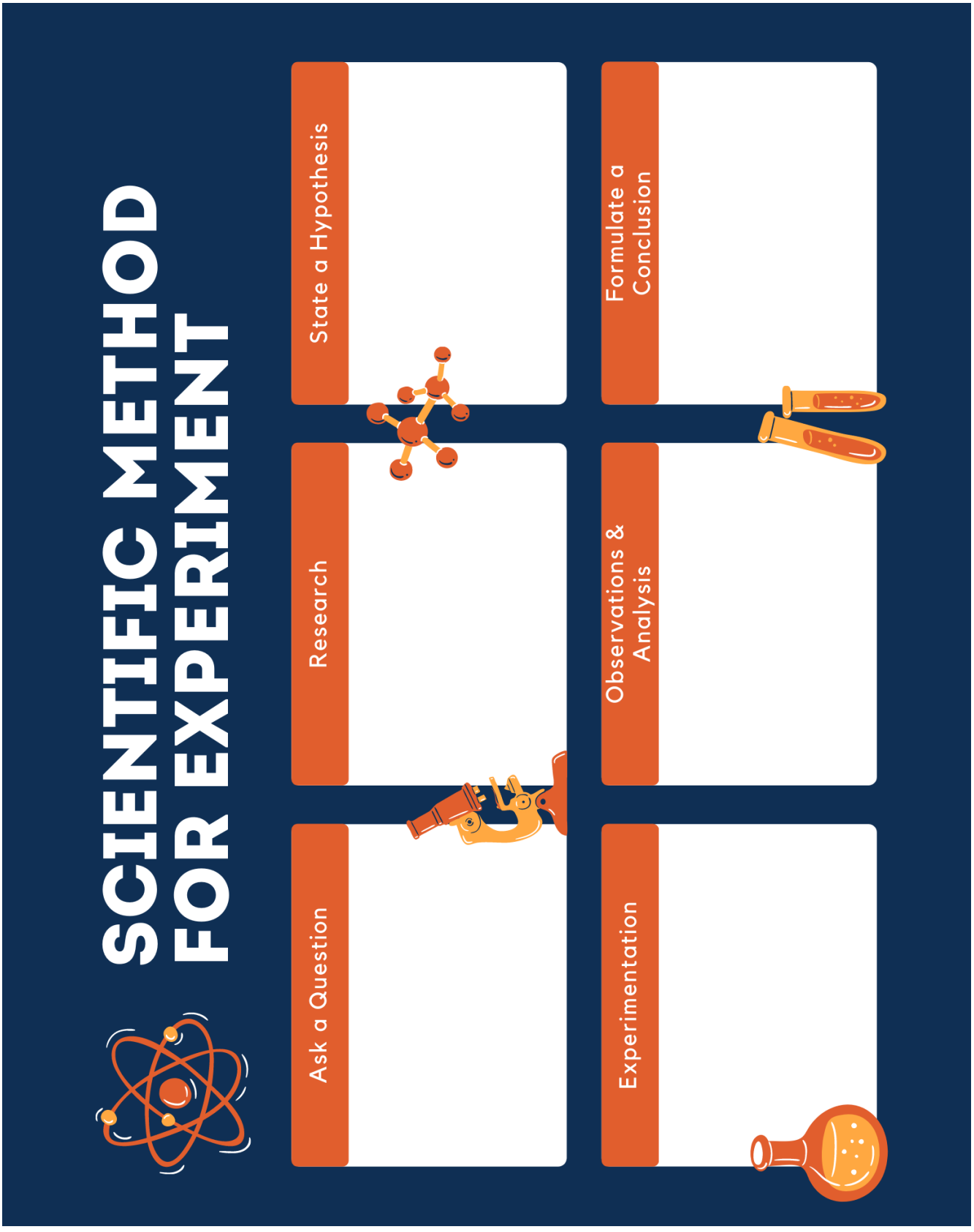
- Marie Curie passion for chemistry and biology contributed to her love for math and physics. Discuss how her belief in the empowerment of education affected her life.
- Marie discovered radium while working with pitchblende, mining waste containing several other radioactive elements. Synonyms for the word discover are to uncover, detect, and reveal. Consider the importance of questioning, researching, and hypothesizing in developing the radium extraction process. Determine the importance of establishing a systematic, measurable, and replicable process for her discoveries.
- Note that, rather than seeking wealth through her discoveries, Marie "…freely shared her technique with the scientific community and industry (pg. 55)." Discuss how her willingness to share her discoveries reflected her belief in the empowerment of education.

When reading about the rest of incredible lives and contributions of the chemists featured in *Chemistry for Kids,* consider the importance following the steps of the Scientific Method in their discoveries. Follow the steps of the Scientific Method while performing the experiments depicted in the book. Test your findings by replicating the experiments repeatedly. Question your results. Connect with the same sense of wonder, inquiry, and investigation the chemists featured in *Chemistry for Kid*s possessed. Who knows what you might find!

The Scientific Method



The Scientific Method Template



Dropped Phrase Vocabulary Puzzle

Using the Glossary as a reference, unscramble the words below. Match the numbers associated with the letters in the dropped phrase below. Answers to the puzzle are provided on the following page.

HISCYMTER
15 2 34 61 19 31 22 18

YOTHHISPE
42 16 1 23 28 37 33 39

MOCLUELE
S 51 5 17 32 58 12 43

NOTROP
44 53 24 55 9

TATREM
45 11 36 38 4 49

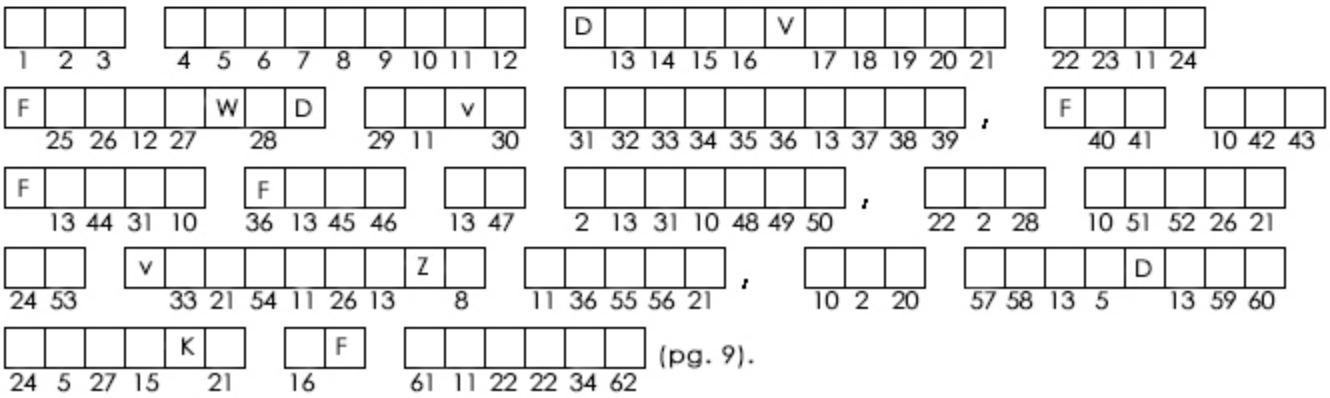
GEEN
60 6 35 46

LYMERPO
27 26 50 7 20 62

TNRONUE
47 8 54 10 25

GYEXON
40 29 3 59

SIOMEOSRB
41 13 57 48 21 52 56 30 14



(pg. 9).

Dropped Phrase Vocabulary Puzzle Answers

Using the Glossary as a reference, unscramble the words below. Match the numbers associated with the letters in the dropped phrase below. Answers to the puzzle are listed below.

HISCYMTER

C	H	E	M	I	S	T	R	Y
15	2	34	61	19	31	22	18	

YOTHHISPE

H	Y	P	O	T	H	E	S	I	S
42			16	1	23	28	37	33	39

MOCLUELE

M	O	L	E	C	U	L	E
S	51	5	17	32	58		

NOTROP

P	R	O	T	O	N
44	53	24	55	9	

TATREM

M	A	T	T	E	R
45	11	36	38	4	49

GEEN

G	E	N	E
60	6	35	46

LYMERPO

P	O	L	Y	M	E	R
27	26	50	7	20	62	

TNRONUE

N	E	U	T	R	O	N
47	8	54	10		25	

GYEXON

O	X	Y	G	E	N
40			29	3	59

SIOMEOSRB

R	I	B	O	S	O	M	E	S
41	13	57	48	21	52	56	30	14

T	H	E		E	L	E	M	E	N	T	A	L		D	I	S	C	O	V	E	R	I	E	S		T	H	A	T
1	2	3		4	5	6	7	8	9	10	11	12		13	14	15	16		17	18	19	20	21			22	23	11	24

F	O	L	L	O	W	E	D		G	A	v	E		S	C	I	E	N	T	I	S	T	S	,		F	O	R		T	H	E
25	26	12	27		28				29	11		30		31	32	33	34	35	36	13	37	38	39			40	41			10	42	43

F	I	R	S	T		T	I	M	E		I	N		H	I	S	T	O	R	Y	,		T	H	E		T	O	O	L	S
13	44	31	10			36	13	45	46		13	47		2	13	31	10	48	49	50			22	2	28			10	51	52	26	21

T	O		v	I	S	U	A	L	I	Z	E		A	T	O	M	S	,		T	H	E		B	U	I	L	D	I	N	G
24	53		33	21	54	11	26	13		8			11	36	55	56	21			10	2	20			57	58	13	5		13	59	60

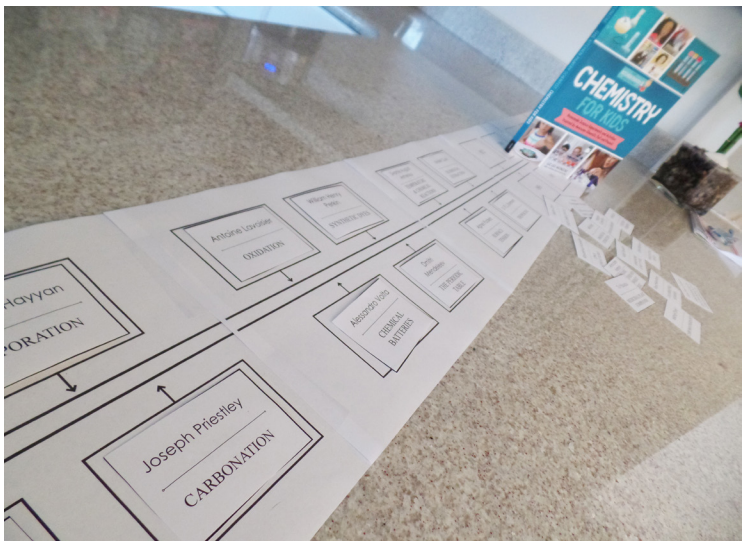
B	L	O	C	K	S		O	F		M	A	T	T	E	R	. (pg. 9)
24	5	27	15		21		16			61	11	22	22	34	62	

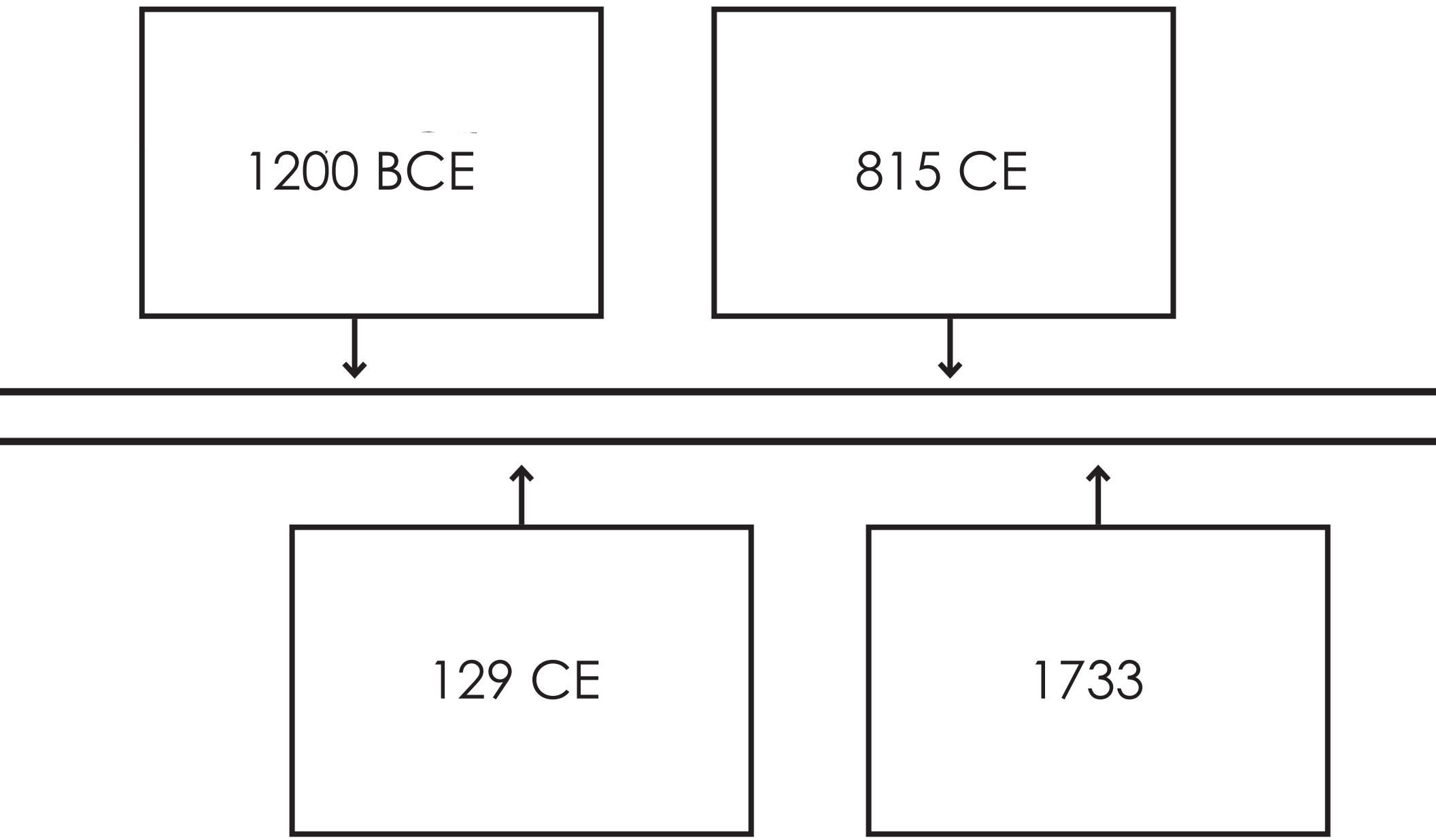
Chemistry For Kids: A Historical Timeline

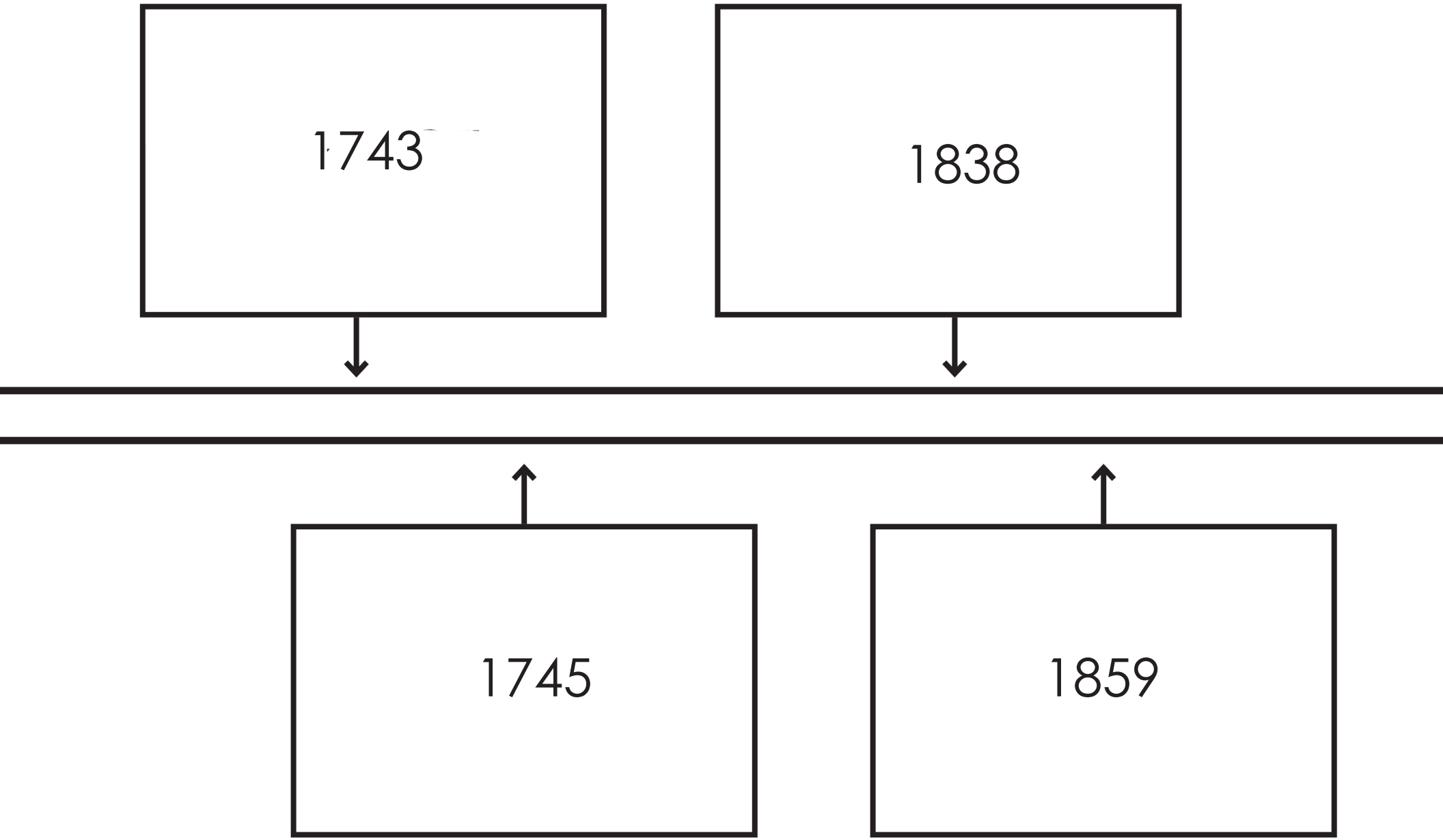
Objective: Integrate, interpret, and analyze historical information in a visual format.

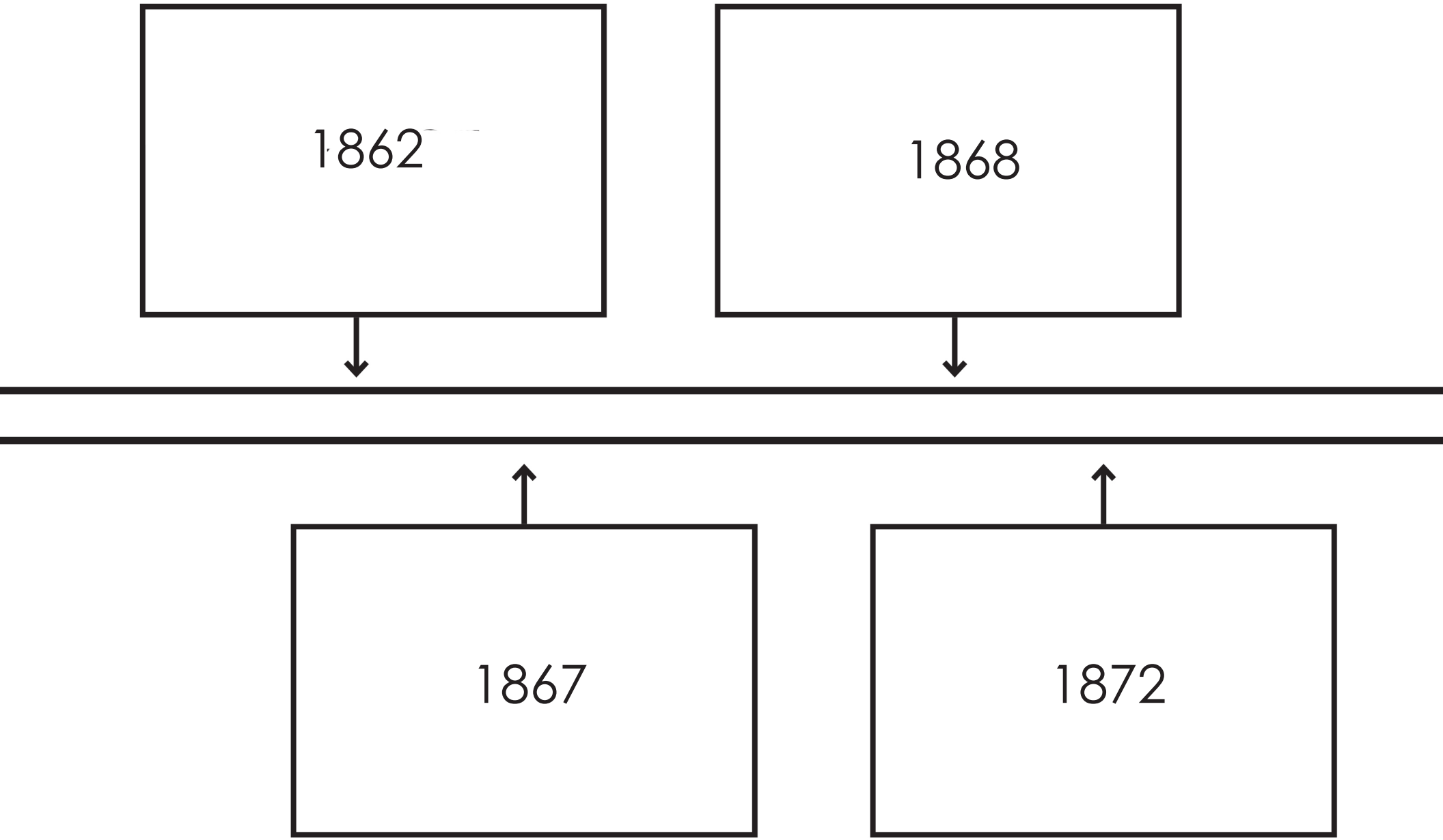
Materials:
- *Chemistry For Kids*, the book
- Historical Timeline Grid (Guide, pg. 10-15)
- Timeline Labels (Guide, pg. 16-19)
- Cardstock
- Tape
- Scissors
- Pencil

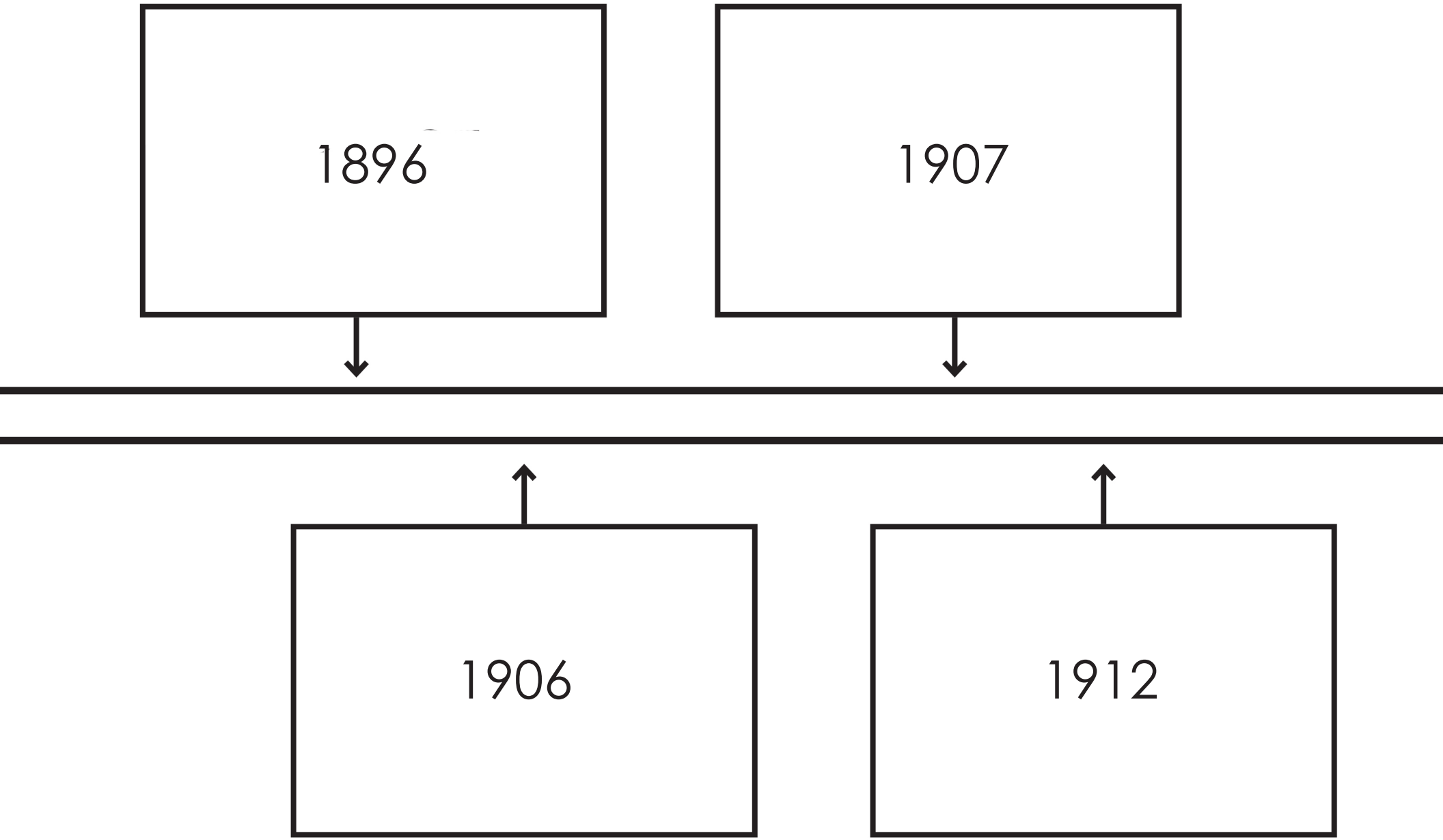
Procedure:
- Print Historical Timeline Grid sheets on computer paper. Tape sheets together in a sequential manner.
- Print Timeline Labels on cardstock. Use scissors to trim around the borders of the cards.
- Lay timeline out on the floor.
- Using *Chemistry For Kids,* the book, as a reference, match each Timeline Label to its corresponding place on the timeline.
- Analyze the connectivity between the chemists and their discoveries by answering the following questions:
    - Identify ways that the discoveries correspond with each other.
    - Which discoveries inspired subsequential inventions throughout time?
    - Determine how each discovery has impacted today's world.
- Instruct students to summarize their observations in a short essay.
- Encourage students to share their work with the class.

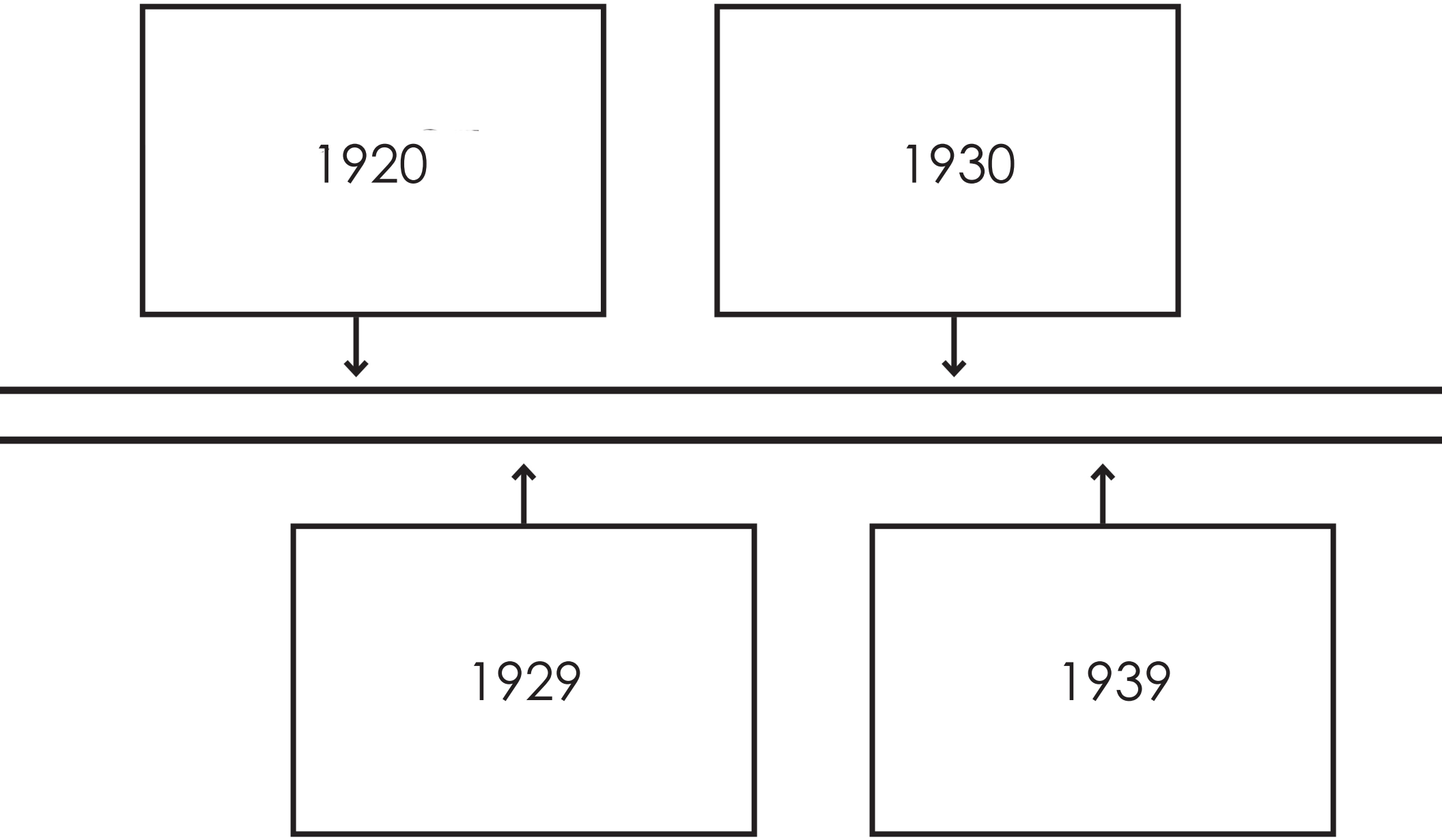



1200 BCE
815 CE
129 CE
1733


1743
1838
1745
1859


1862
1868
1867
1872


1896
1907
1906
1912


1920
1930
1929
1939

1943

1975

1947

Timeline Labels

Tapputi-Belatikallim FRAGRANCE DISTILLATION	Antoine Lavoisier OXIDATION
Galen SOAP	William Henry Perkin SYNTHETIC DYES
Jabir ibn Hayyan EVAPORATION	Dmitri Mendeleev THE PERIODIC TABLE
Joseph Priestley CARBONATION	Svante August Arrhenius TEMPERATURE & CHEMICAL REACTIONS

Agnes Pockels

SURFACE TENSION

Alice Ball

ORGANIC OIL EXTRACTION

Marie Curie

ELEMENTAL EXTRACTION

Gerty Cori

THE CORI CYCLE

S. P. L. Sorensen

THE PH SCALE

Maria Goeppert-Mayer

THE NUCLEAR SHELL MODEL

Mikhail Tsvet

CHROMATOGRAPHY

Rachel Carson

DISPERSION OF ENVIRONMENTAL CONTAMINANTS

Anna Jane Harrison

ORGANIC COMPOUNDS AND ULTRAVIOLET LIGHT

Ada Yonath

RIBOSOME STRUCTURE

Rosalind Franklin

DNA STRUCTURE

Margaret Cairns Etter

CRYSTALLOGRAPHY

Edith Flanigen

MOLECULAR SIEVES

Linda Buck

OLFACTORY CHEMISTRY

Tu Youyou

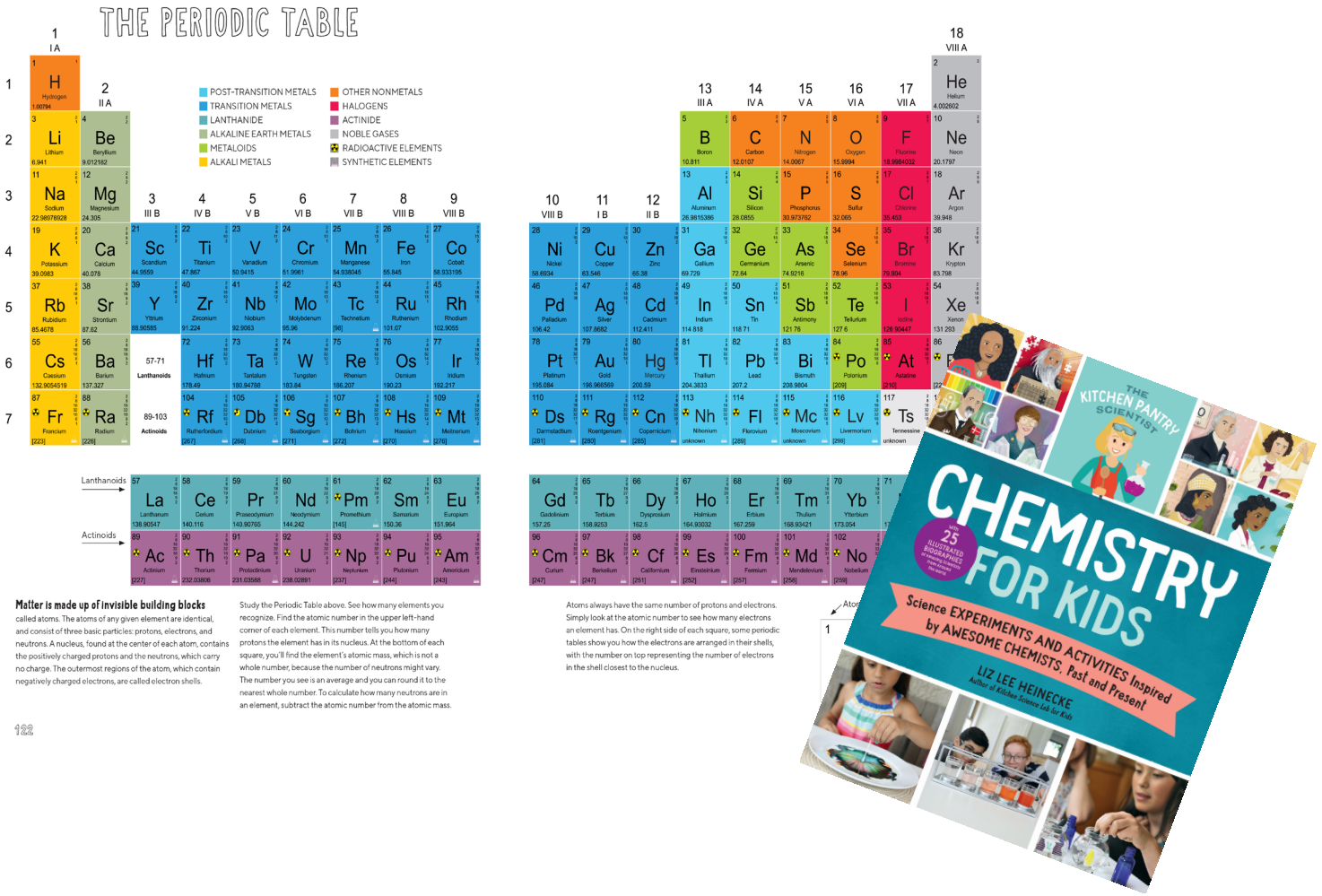
MEDICINAL PLANT COMPOUNDS

Raychelle Burks

COLORMETRIC SENSORS

Alessandro Volta

CHEMICAL BATTERIES



lizleeheinecke.com
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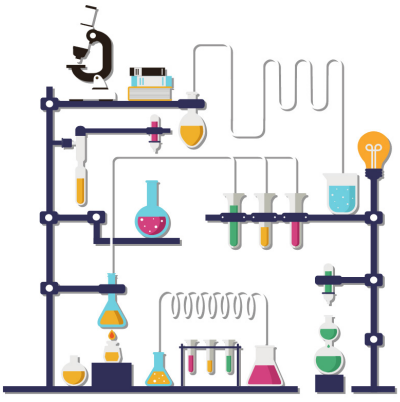
debbiegonzales.com
guidesbydeb.com

A Biographical Timeline

Objective: Integrate and create content presented in diverse media and formats.

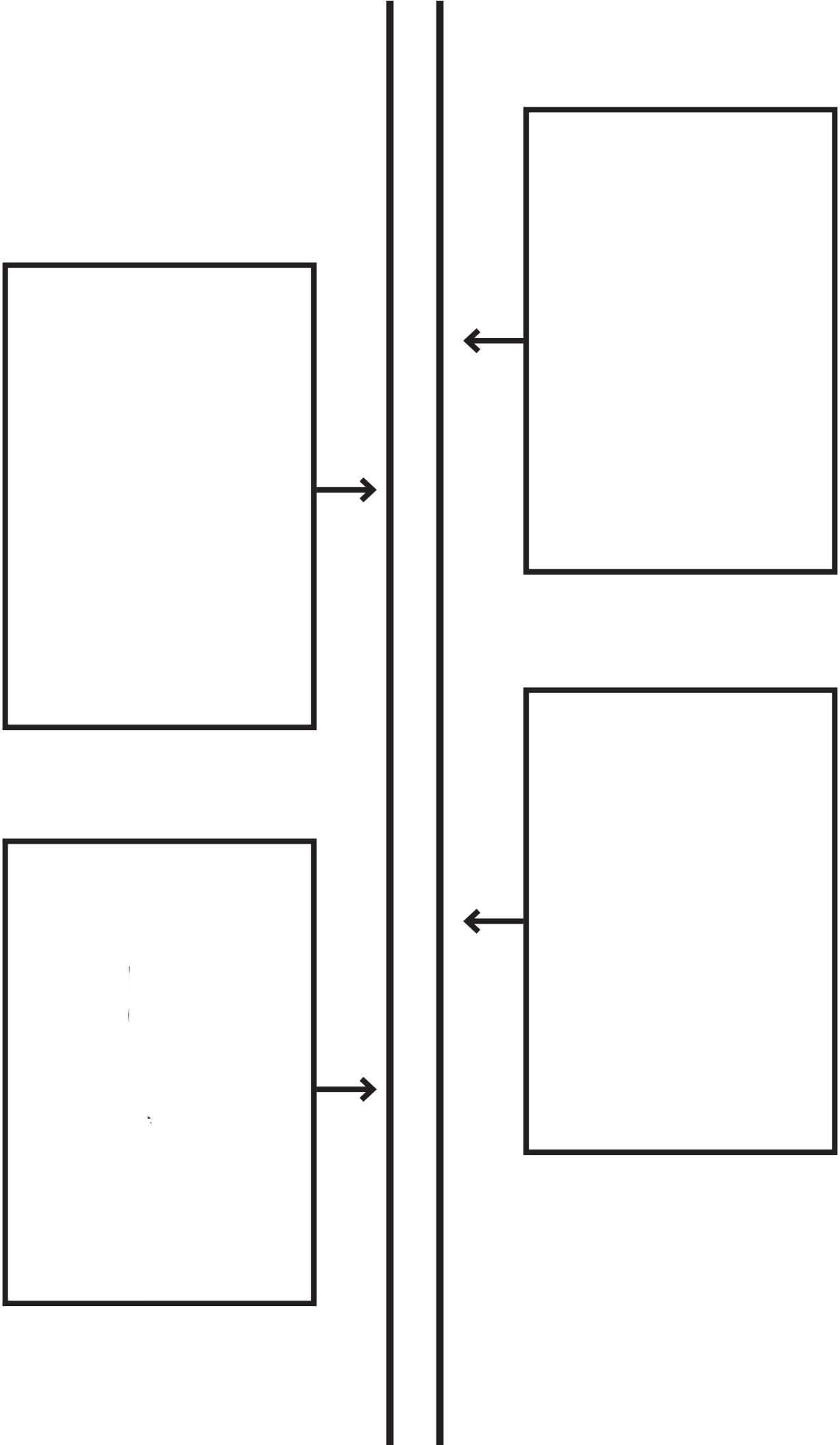
Materials:
- *Chemistry For Kids*, the book
- A Biographical Timeline Planner (Guide, pg. 21)
- Blank Timeline Grids (Guide, pg. 22-23)
- Blank Timeline Labels (Guide, pg. 24)
- The Scientific Method Template (Guide, pg. 6)
- Research materials
- Tape
- Scissors
- Pencil
- Markers

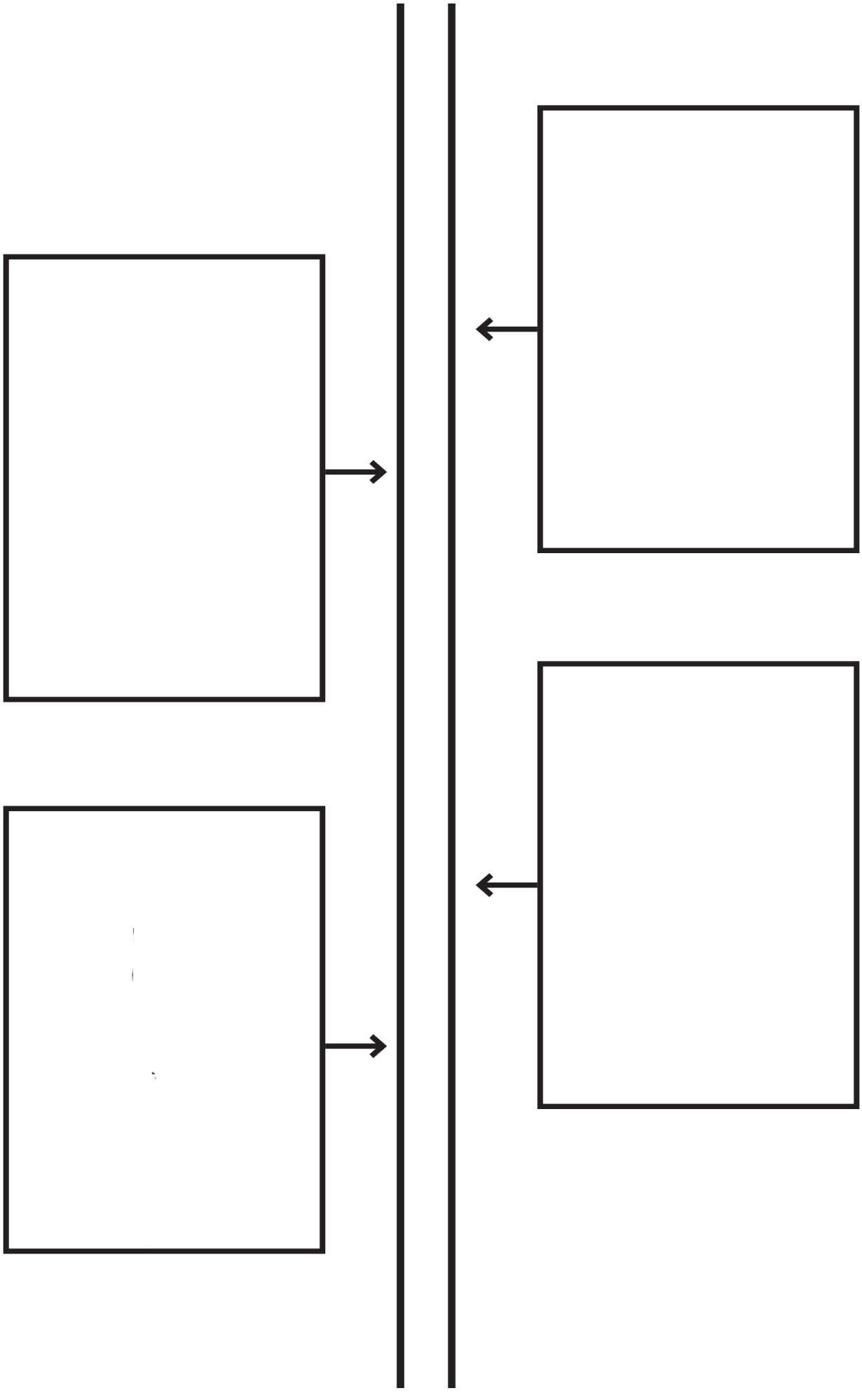
Procedure:
- Instruct students to choose a chemist featured in *Chemistry For Kids* to research.
- Using the Biographical Timeline Planner as guide, tell students to discover or infer the following information about their chosen chemist:
  - Date and place they were born.
  - Dated information about their childhood experiences.
  - Dated information about their educational background.
  -Dated information about their scientific contributions.
  -Dated information about their death.
  -Dated information regarding the legacy their work has left behind. Report on how their scientific contributions have impacted the modern world.
- Record dates on Blank Timeline Grid in a sequential manner.
- Tape pages of the Timeline Grid together
- Write and illustrate researched corresponding facts on Blank Timeline Labels.
- Use scissors to trim around the borders of Blank Timeline Labels.
- Match Timeline Labels to corresponding spaces on the Timeline Grid.
- Analyze how moments in their chemist's life served to prepare them for their scientific contributions, their legacy, and their impact on today's world.
- Use the Scientific Method Template as a guide to perform the experiment associated with their chemist.
- Write an essay making a connection between biographical facts discovered in their timeline research and the experiment associated with their chemist.
- Encourage students to share their work with the class.



A Biographical Timeline Planner

Chemist's Name	
Birth:	Childhood:
Education:	Scientific Contributions:
Death:	Legacy:





Common Core State Anchor Standards

		Discussion	Dropped Phrase Puzzle	Timeline	Biographical Timeline
English Language Arts Standards » Anchor Standards for Reading					
CCSS.ELA-LITERACY.CCRA.R.1	Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.	●	●	●	●
CCSS.ELA-LITERACY.CCRA.R.2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.	●	●	●	●
CCSS.ELA-LITERACY.CCRA.R.4	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.	●	●		
CCSS.ELA-LITERACY.CCRA.R.7	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.	●	●	●	●
CCSS.ELA-LITERACY.CCRA.R.10	Read and comprehend complex literary and informational texts independently and proficiently.	●	●	●	●
English Language Arts Standards » Anchor Standards for Writing					
CCSS.ELA-LITERACY.CCRA.W.2	Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.			●	●
CCSS.ELA-LITERACY.CCRA.W.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.			●	●
CCSS.ELA-LITERACY.CCRA.W.7	Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.				●
CCSS.ELA-LITERACY.CCRA.W.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.	●	●	●	●
English Language Arts Standards » Anchor Standards for Speaking and Listening					
CCSS.ELA-LITERACY.CCRA.SL.1	Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.	●	●	●	●
CCSS.ELA-LITERACY.CCRA.SL.2	Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.	●		●	●
CCSS.ELA-LITERACY.CCRA.SL.4	Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.			●	●
CCSS.ELA-LITERACY.CCRA.SL.5	Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.			●	●
CCSS.ELA-LITERACY.CCRA.SL.6	Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.	●	●	●	●

Next Generation Science Standards

		Discussion	Dropped Phrase Puzzle	Timeline	Biographical Timeline
K-LS1 From Molecules to Organisms: Structures and Processes					
	Scientific Knowledge is Based on Empirical Evidence - Scientists look for patterns and order when making observations about the world.				●
K-PS2-1 Motion and Stability: Forces and Interactions					
	Planning and Carrying Out Investigations - Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.				●
	With guidance, plan and conduct an investigation in collaboration with peers.				●
	Scientific Investigations Use a Variety of Methods - Scientists use different ways to study the world.				●
2-PS1 Matter and Its Interactions					
	Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.				●
	Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.				●
	Cause and Effect - Events have causes that generate observable patterns.				●
	Energy and Matter - Objects may break into smaller pieces and be put together into larger pieces, or change shapes.				●
5-PS1 Matter and Its Interactions					
	Developing and Using Models - Use models to describe phenomena.				●
	Planning and Carrying Out Investigations - Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.				●
	Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.				●