SCIENCE & STEM SAFETY IN A REMOTE TEACHING ENVIRONMENT

FLINN SCIENTIFIC

A RESOURCE FOR EDUCATORS

HOW CAN I OFFER A SOLID ‘ACADEMIC’ PROGRAM FROM MY HOME INSTEAD OF THE SCHOOL SCIENCE OR STEM LAB?

CONCERNS ABOUT SCIENCE SAFETY FROM AN EDUCATOR’S PERSPECTIVE - 2021

2021

James Palcik, Director of Education, Safety and Compliance at FLINN Scientific Inc.

- James Palcik, has spent his entire career within the science education market. During that time, he has been conducting science safety PD sessions and making trusted recommendations to schools and districts on their science, STEM and safety resources (including manuals, standard operating procedures, PD programming, new teacher induction programs, etc.)
- James has been immersed in the field of laboratory safety, regulatory and compliance as well as professional learning across all K-12 grades. He has also advised on product placement and blended-learning approaches to teaching and learning science. He uses his educational background as a ‘master science teacher and a health and safety expert’, along with his extensive commercial background, to bridge these gaps in instruction, compliance and best practices in instructional models in science & STEM applications.
- James is passionate about providing students with hands-on, engaging activities in the lab to inspire future innovation, especially when these actions manage to engage student learning and facilitate teacher instruction simultaneously.

Dr. Ken Roy, Director of Environmental Health & Safety, Glastonbury Public Schools, CT

- Dr. Roy has been involved with the continuous promotion of health and safety with teachers and students for many years through various roles and responsibilities in his school district and as a valued member of multiple councils and associations including the following highlights:
- **Chief Science Safety Compliance Adviser for the National Science Teaching Association (NSTA)**
- **K-12 Director of Safety and Science Emeritus – Glastonbury, CT**
- **Member on the Council of State Science Supervisors**
- **National Safety Consultants LLC where he serves as an "expert witness" in lawsuits resulting from accidents involving lack of or inappropriate school safety based on legal safety standards and better professional practices - specializing in science labs / classrooms, technology education laboratories / shops and art studios. publications in addition to over 800 journal articles**
- **Published Author with 12 book and reference manuals on safety concerns in school environments**
- **ICASE Committee on Safety in Science Education Committee Member**

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Remote Science & STEM Safety 101

Flinn has been the Safer Source for Science for over 40 years, dedicated to making school laboratories a safe environment for both students and instructors. We recognize that teaching Science and STEM remotely has a unique set of challenges and potentially serious safety concerns. Today we will explore the Remote Science Instructional Safety Concerns. Come with FLINN on a journey of exploration into the issues in offering a robust and safer remote science and STEM program with hands-on experiences for your students. **We will investigate common safety protocols and best-practices including safety acknowledgement forms, risk assessments, using PPE, chemical usage, duty of care and obligations as an educator supervising remote science investigations with Dr. Ken Roy.**

OVERVIEW OF THIS SESSION

1. **Traditional In-Person approach to Science & STEM Safety**
2. **Activity Selection for Remote Learning**
3. **Duty of Care for Educators**
4. **Student Lab Safety Acknowledgement Forms**
5. **Hazard / Risk Assessment**
6. **Use of Chemicals & PPE Remotely**
7. **Hybrid, Teacher Demos, Simulations**
8. **Remote Safety, Use of Chemicals & Emergency Situations**
9. **Summary Rules for offering Remote Safer Science with students**

Accept this is a new (*temporary)* reality for teachers across the planet!

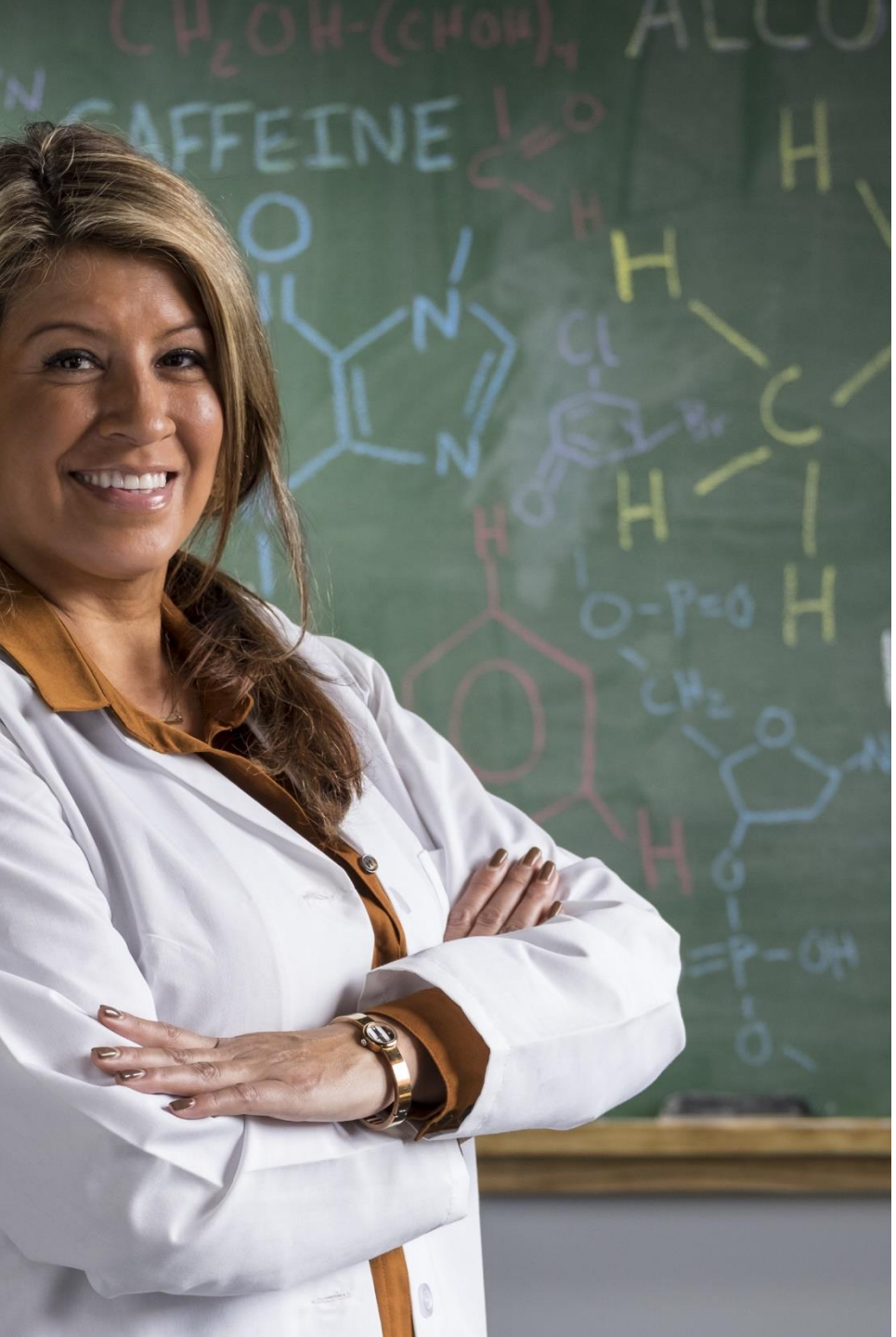
- These are certainly challenging times for teachers across the world who are now teaching classes remotely and have about 867 additional concerns that are all valid about how to do this effectively.
- Distance and Remote learning is a specialized skill set that most teachers have not had to practice since they were always in a '*traditional classroom & school setting*' until recently…..
- There are many people and organizations and layers within those organizations all working tirelessly to design and develop the '*perfect platform*' or the '*best roll-out*' or the standardized mode of delivery for students and for teachers to work from home effectively. **Too many options creates inconsistency… and Science and STEM create challenges due to safety.**

Can I have students do science / STEM activities in their house?

This is one of the most popular questions at Flinn about teaching at home and there are two possible answers:

1. Yes – the innate curiosity of students allows them to make observations and inquiry-based decisions every day. Use that to your advantage and help them learn!
2. Maybe – the risk assessment of the activity must be completed prior to the activity and the items required must have a low or no-hazard/risk outcome. SAFETY FIRST!

ALL of this will be determined by your school district policy or guideline of age-appropriate and subject-appropriate activities that may or may not be performed in a student home. There are protocols in place to minimize risks and maximize student safety from a learning vs liability perspective.



Teaching Science & STEM Remotely

- With the advance of the COVID-19 pandemic during the latter part of the 2019-2020 academic year, virtual learning became the viable alternative in many school districts nationwide. In this venue, some science/STEM teachers considered and adopted hands-on activities to be completed remotely at home by students.
- During the 2021 school year, there probably will be a continued need for such home-based, hands-on activities. This actually is not new. Teachers have assigned home activities for years, such as science fair projects, extra-credit work, general classroom homework assignments, and more.
- **The bottom line is this: Whether hands-on activities are done in a formal academic school laboratory or out in the field or at home, all modes are a springboard for developing scientific concepts and methodology.**

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Duty of Care Obligations for Educators

- This is, however, a double-edged sword. Whether in the formal academic school laboratory or off-site, these activities promote science education.
- However, they also introduce legal issues under "duty or standard of care." **Basically "duty or standard of care" is defined as an obligation, recognized by law, requiring conformance to a certain standard of conduct to protect others against unreasonable risk.**
- Check out the NSTA's Legal Implications of Duty of Care for Science Instruction for additional information and guidance on this topic.
- **Be aware that school staff and school district leaders have a duty of care in this situation that extends outside the classroom or laboratory to family members who supervise the students during these assignments at home or in the field.**

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Choice of Activity / Use of a Safety Acknowledgement Form for Remote Science

- Activities assigned must not only be aligned with the curriculum, but also support legal safety standards and better professional safety practices. Whether the teacher is on-site or not, any hands-on activity assigned introduces teacher liability, should someone get injured.
- Teachers have the professional and legal responsibility to provide safety protocols and training as part of the assignment, and they need to be properly documented in the teacher's lesson plans. A safety quiz should also be given and passed before the student is allowed to conduct the experiment.
- Students and parents also need to review and sign a safety acknowledgement form and Disclaimer form (COVID-19 Pandemic Safer Science/STEM Online and Face-to-Face Learning Environments Instruction Disclaimer Statement) before any activities are done in or outside of the science/STEM laboratory. Examples of such documents can be found on the NSTA Safety Portal site as follows:
- Elementary Safety Acknowledgement Form
- Middle School Safety Acknowledgement Form
- High School Safety Acknowledgement Form
- https://www.nsta.org/covid-19-pandemic-safer-science

Remote Safety Acknowledgement Forms

Agreement:
I have read and understand this form. I was present when these safety guidelines were discussed in class or I discussed them directly with my teacher. I am aware that the laboratory may have hazards that could make it unsafe. I acknowledge that it is important that I follow the above safety procedures to help make it a safer learning environment.

_____

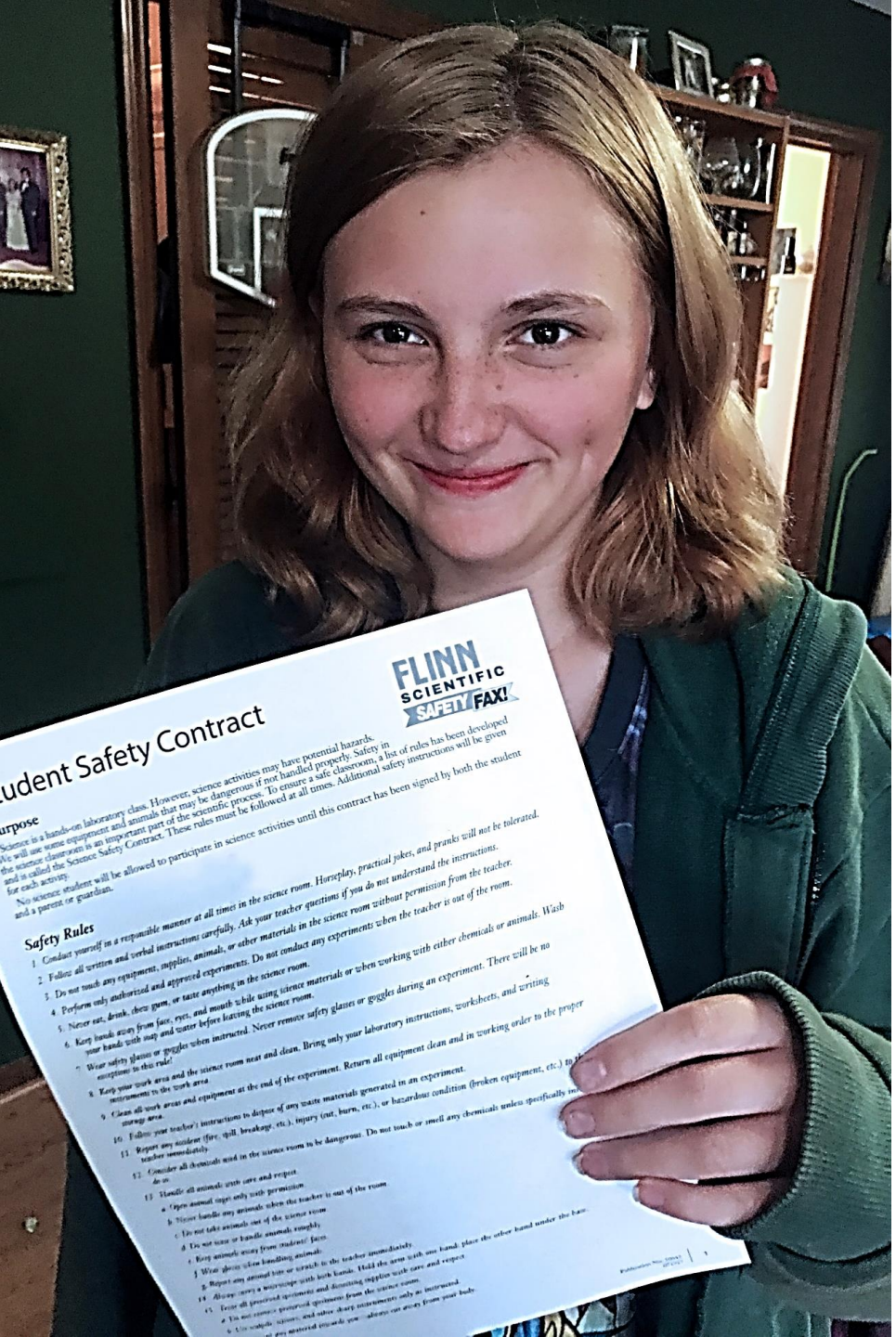
(Student Signature) (Date)

I have read and reviewed the lab safety rules with my child.

_____

(Parent/Guardian Signature) (Date)

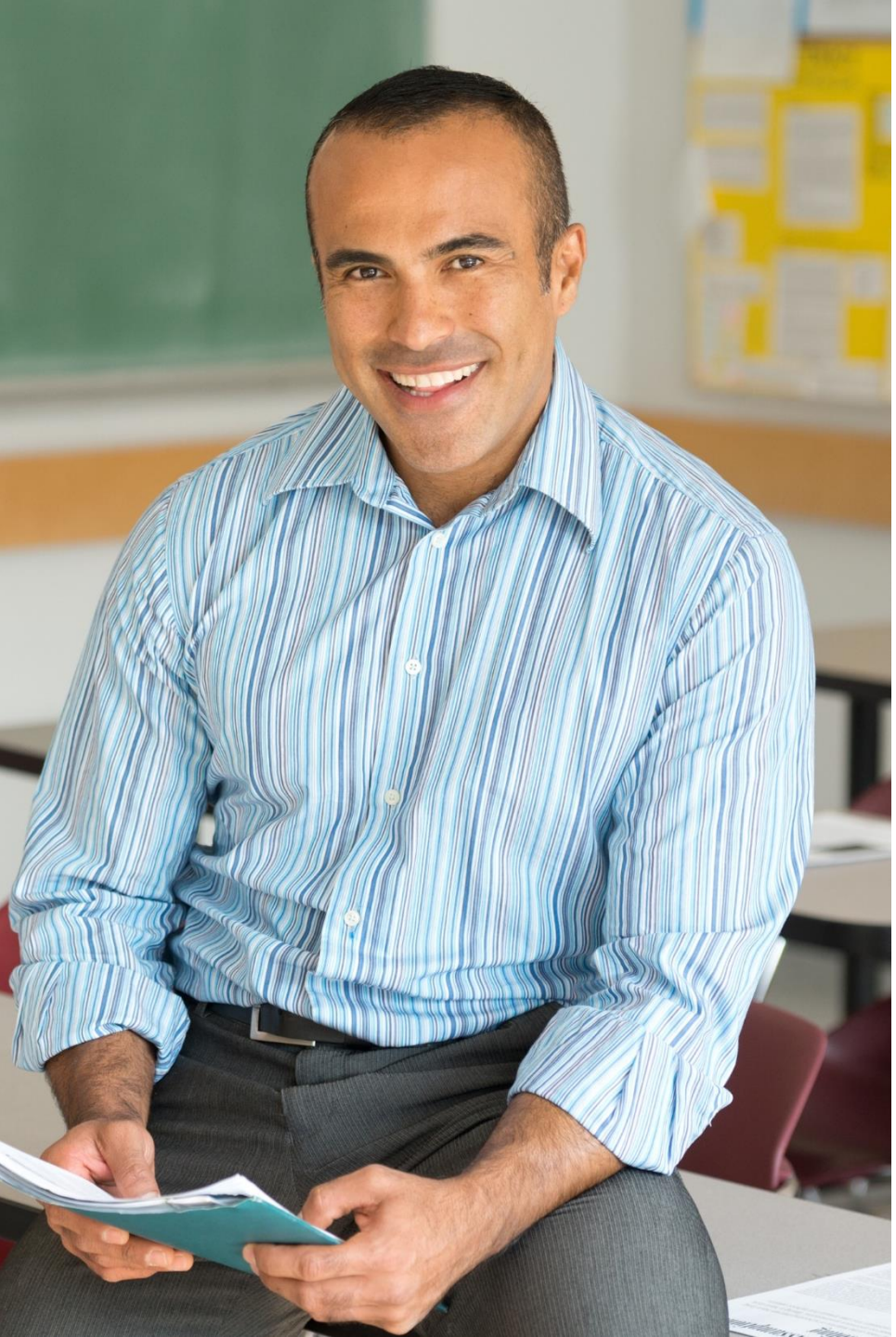
https://www.nsta.org/blog/safety-hands-science-home-instruction



Use of a Safety Acknowledgement Form for Remote Learning

- Teachers can use these as models and fine-tune them as appropriate, depending on hazards, risks, and needs safety actions for hands-on activities.
- **Please note that these documents must be approved by your administration, and in some cases, the Board of Education**, on an annual basis. If modifications are made, they must also be approved by the administration and possibly the Board of Education.
- **Safety acknowledgement forms that are used without appropriate approval can potentially also lead to teacher liability.**

1. https://www.nsta.org/blog/safety-hands-science-home-instruction



At Home Safety Protocols – Preplanning

1. **Before beginning any hands-on work, an "AAA" activity for safety needs to be completed.**

This includes doing a hazard Analysis, a risk Assessment, and safety Actions to be taken based on legal safety standards and better professional safety practices. *Note there are three types of hazards to be considered: biological (bacteria, virus, etc.), chemicals (toxins, flammables, corrosives, etc.) and physical (sharps, impalement, spring/coils, etc.).*

Safety Data Sheets (SDSs) can be a helpful resource for determining many of the hazards associated with chemicals.

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Hazard Analysis and Risk Assessment for Remote Science & STEM Activities

- Are you aware of what to look for when students bring you an outline of their inquiry-based activity?
- **Looking at the procedures, there are a handful of red flag items or processes that you should recognize and prevent students from continuing onwards in their planned pursuit of knowledge.**
- Students often develop a plan or sequence of procedures that do not always align with the safety protocols in place on their quest to solve an inquiry or design problem. **Reminders are a good way to start this conversation without dampening their innate curiosity as a student into studying the world around them.** Once you establish safety benchmarks, it gets easier.

- https://www.nsta.org/blog/safety-hands-science-home-instruction

Using Chemicals in a Remote Environment

2. Chemicals required outside the formal lab should only involve common, but safer household products.

These should have a relatively low safety classification on the Safety Data Sheet (SDS). For example, vinegar commonly used on salads has a safety label of 2. **If used, appropriate personal protective equipment (PPE) such as indirectly vented chemical splash goggles must be used. Under duty of care, teachers need to provide SDSs as part of the assignment.**

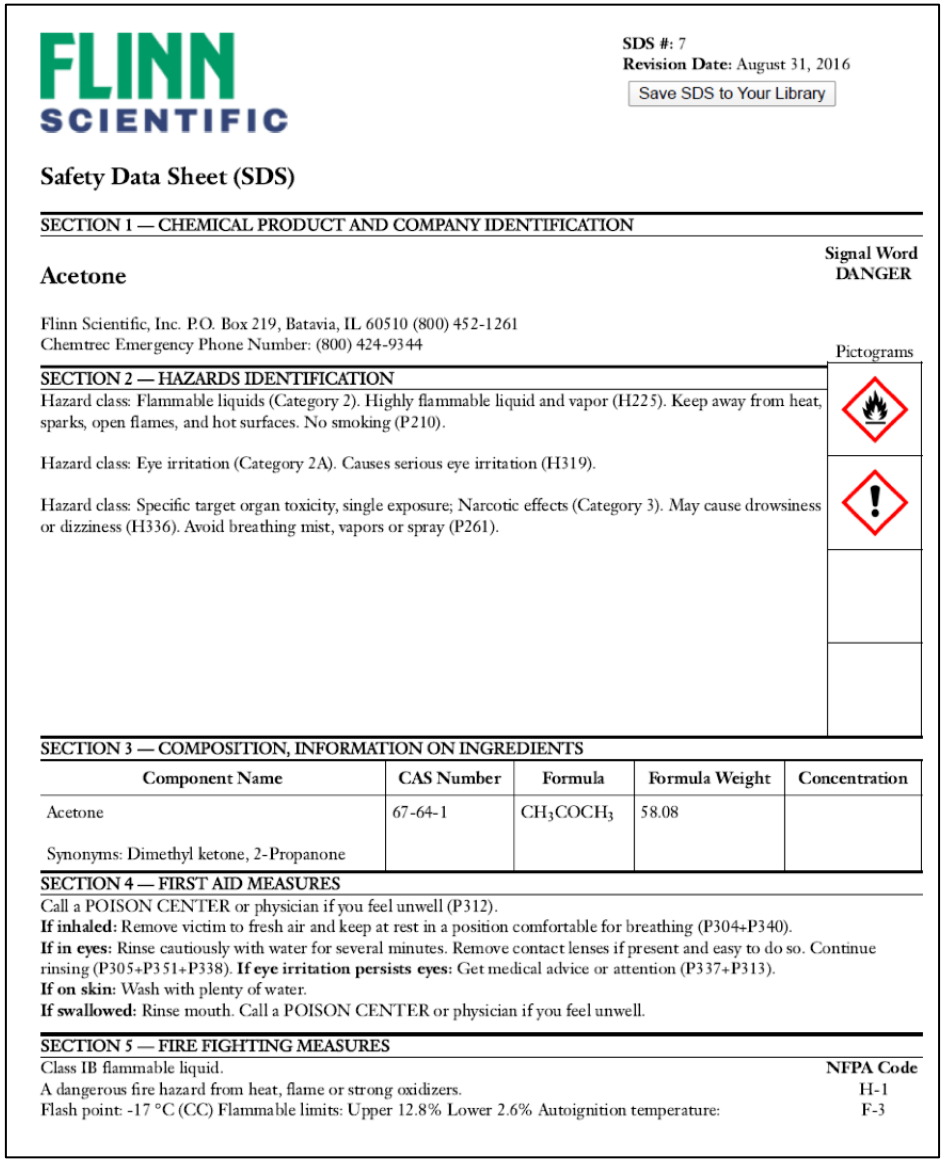
Keep in mind that not all households will have the needed common household goods to conduct a lab. What may be common to the instructor may not be common to the students and their families. Families may not have access to the stores where they can purchase the materials. Some families may not be able to afford buying materials to use in the laboratory.

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Use of SDS and ‘No-substitutions allowed’

- **Safety Data Sheets should be reviewed before indicating the use of any household substances in an activity.** Safety hazard information can be found here. Additional information on acceptable chemical use can be found on Rehab-the-Lab chemical list.
- **Do not allow students or their families to use substitute materials, especially chemicals, without the teacher’s approval. Substituting materials can lead to dangerous situations.** This can also occur if the student switches brands, as different brands have different ingredients. If the student cannot get the materials that are required to conduct the experiment, provide an alternative learning assignment.
- **Correct cleanup and disposal procedures should be enforced to maintain the safety of the areas being used in the laboratory activity. These procedures should be documented as part of the learning activity.**

1. https://www.nsta.org/blog/safety-hands-science-home-instruction



FLINN SCIENTIFIC

SDS #: 7
Revision Date: August 31, 2016
Save SDS to Your Library

Safety Data Sheet (SDS)

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Acetone

Signal Word
DANGER

Flinn Scientific, Inc. P.O. Box 219, Batavia, IL 60510 (800) 452-1261
Chemtrec Emergency Phone Number: (800) 424-9344

Pictograms

SECTION 2 — HAZARDS IDENTIFICATION

Hazard class: Flammable liquids (Category 2). Highly flammable liquid and vapor (H225). Keep away from heat, sparks, open flames, and hot surfaces. No smoking (P210).

Hazard class: Eye irritation (Category 2A). Causes serious eye irritation (H319).

Hazard class: Specific target organ toxicity, single exposure; Narcotic effects (Category 3). May cause drowsiness or dizziness (H336). Avoid breathing mist, vapors or spray (P261).

SECTION 3 — COMPOSITION, INFORMATION ON INGREDIENTS

Component Name	CAS Number	Formula	Formula Weight	Concentration
Acetone Synonyms: Dimethyl ketone, 2-Propanone	67-64-1	CH_3COCH_3	58.08	

SECTION 4 — FIRST AID MEASURES

Call a POISON CENTER or physician if you feel unwell (P312).
If inhaled: Remove victim to fresh air and keep at rest in a position comfortable for breathing (P304+P340).
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing (P305+P351+P338). **If eye irritation persists eyes:** Get medical advice or attention (P337+P313).
If on skin: Wash with plenty of water.
If swallowed: Rinse mouth. Call a POISON CENTER or physician if you feel unwell.

SECTION 5 — FIRE FIGHTING MEASURES

Class IB flammable liquid.
A dangerous fire hazard from heat, flame or strong oxidizers.
Flash point: -17 °C (CC) Flammable limits: Upper 12.8% Lower 2.6% Autoignition temperature:

NFPA Code
H-1
F-3

3. Safety Data Sheets are required to be provided to the purchaser at the school district.

They are often provided online by commercial companies where the chemicals are purchased.

If unavailable, try searching the internet for “SDS <chemical name>." Flinn Scientific is also a good reference for SDS.

1. Flinn Professional Learning Series, 2021
2. https://www.nsta.org/blog/safety-hands-science-home-instruction

How to Read A Safety Data Sheet (SDS)

Safety Data Sheets (SDS) are an important requirement of the OSHA Hazard Communication Standard. SDS are essential documents that are used to inform employees, students, and the general public about how materials can be safely handled, used, and stored. Since Flinn provides chemicals only to schools, we have written Flinn SDS specifically for teachers and their students. Using clear and straightforward language, each Flinn SDS provides all the relevant safety and hazard information in a consistent, useful, and easy-to-read two-page format. Flinn SDS follow the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). The 16 sections are divided into four major areas, each designed to answer a specific question.

What is the material and what do I need to know immediately in an emergency?
Sections 1–3.

A It is important that the chemical name on the label match the name on the SDS. Many chemicals have similar names, but very different properties.

B The most important section! Provides an overview of the physical and health hazard risks associated with using the material.

C Signal words, either Danger or Warning, heighten the awareness of the relative risk when using certain chemicals. Danger is the more severe warning!

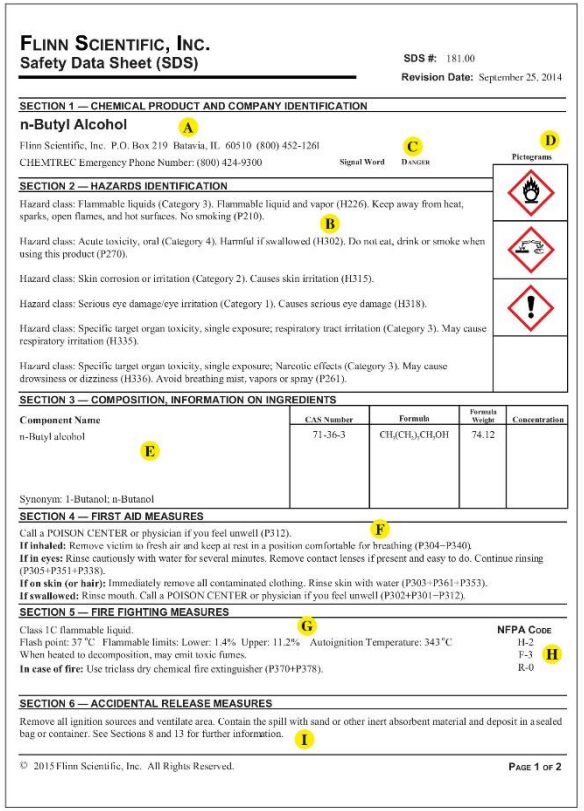
D Eight pictograms exist in the GHS classification scheme to call attention to physical and health hazards. See page 1238 for more information about GHS pictograms.

E This section includes the formula, formula weight, concentration, and CAS#. The CAS# is the single identifying number for each specific substance. CAS# should match the CAS# on the bottle label.

What should I do if a hazardous situation occurs?
Sections 4–6.

F Seek medical attention. These first-aid measures are only meant for immediate first aid and should always be followed up with professional medical care. The CAS# is the single identifying number for each specific substance. CAS# should match the CAS# on the bottle label.

G This section is written for the firefighter. Flash point (the lowest temperature at which enough vapor is present to form an ignitable mixture with air); upper and lower flammable limits; and the auto ignition temperature (AIT) are common properties included in this section.



FLINN SCIENTIFIC, INC.
Safety Data Sheet (SDS)

SDS #: 181.00
Revision Date: September 25, 2014

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

n-Butyl Alcohol (A)

Flinn Scientific, Inc. P.O. Box 219 Batavia, IL 60510 (800) 452-1261
CHEMTREC Emergency Phone Number: (800) 424-9300

Signal Word (C) DANGER

Pictograms (D)

SECTION 2 — HAZARDS IDENTIFICATION

Hazard class: Flammable liquids (Category 3). Flammable liquid and vapor (H226). Keep away from heat, sparks, open flames, and hot surfaces. No smoking (P210). (B)

Hazard class: Acute toxicity, oral (Category 4). Harmful if swallowed (H302). Do not eat, drink or smoke when using this product (P270).

Hazard class: Skin corrosion or irritation (Category 2). Causes skin irritation (H315).

Hazard class: Serious eye damage/eye irritation (Category 1). Causes serious eye damage (H318).

Hazard class: Specific target organ toxicity, single exposure; respiratory tract irritation (Category 3). May cause respiratory irritation (H335).

Hazard class: Specific target organ toxicity, single exposure; Narcotic effects (Category 3). May cause drowsiness or dizziness (H336). Avoid breathing mist, vapors or spray (P261).

SECTION 3 — COMPOSITION, INFORMATION ON INGREDIENTS

Component Name	CAS Number	Formula	Formula Weight	Concentration
n-Butyl alcohol (E)	71-36-3	$CH_3(CH_2)_3CH_2OH$	74.12	
Synonym: 1-Butanol; n-Butanol				

SECTION 4 — FIRST AID MEASURES

Call a POISON CENTER or physician if you feel unwell (P312). (F)
If inhaled: Remove victim to fresh air and keep at rest in a position comfortable for breathing (P304+P340).
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing (P305+P351+P338).
If on skin (or hair): Immediately remove all contaminated clothing. Rinse skin with water (P303+P361+P353).
If swallowed: Rinse mouth. Call a POISON CENTER or physician if you feel unwell (P302+P301+P312).

SECTION 5 — FIRE FIGHTING MEASURES

Class 1C flammable liquid. (G)
Flash point: 37 °C Flammable limits: Lower: 1.4% Upper: 11.2% Autoignition Temperature: 343 °C
When heated to decomposition, may emit toxic fumes.
In case of fire: Use triclass dry chemical fire extinguisher (P370+P378).

NFPA Code
H-2
F-3 (H)
R-0

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Remove all ignition sources and ventilate area. Contain the spill with sand or other inert absorbent material and deposit in a sealed bag or container. See Sections 8 and 13 for further information. (I)

H The NFPA code is a numerical code established by the National Fire Protection Association. It rates the substance *under fire conditions* in four categories. Health, Flammability, Reactivity, and unusual reactivity: 4 is a severe hazard, 0 is no hazard.

I How to clean up a spill. Always remove unprotected personnel from area and make sure all students are safe. Contain the spill with sand or absorbent materials.

HOW TO READ A SAFTEY DATA SHEET (SDS) continued on next page.

Safety Data Sheets (SDS)

- The safety data sheet (SDS), formerly known as the material safety data sheet (MSDS), is provided by the manufacturer, distributor, or importer of a chemical to provide information about the substance and its use.

- The SDS, unlike the MSDS, is required to present the information in a uniform manner. The information includes the properties of each chemical; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, disposing of, and transporting the chemical. **There are 16 sections on every SDS in the same sequence.**

- The GHS provides standard language or “building blocks” for communicating the hazards of chemicals in the SDS, just as on chemical labels. These “building blocks” include the use of specific signal words, pictograms, hazard statements, and precautionary statements.

1. How to Read a Safety Data Sheet

Flinn Chemical Safety Data Sheets

FLINN SCIENTIFIC

SDS #: 7
Revision Date: August 31, 2016
Save SDS to Your Library

Safety Data Sheet (SDS)

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Acetone

Signal Word
DANGER

Flinn Scientific, Inc. P.O. Box 219, Batavia, IL 60510 (800) 452-1261
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Pictograms

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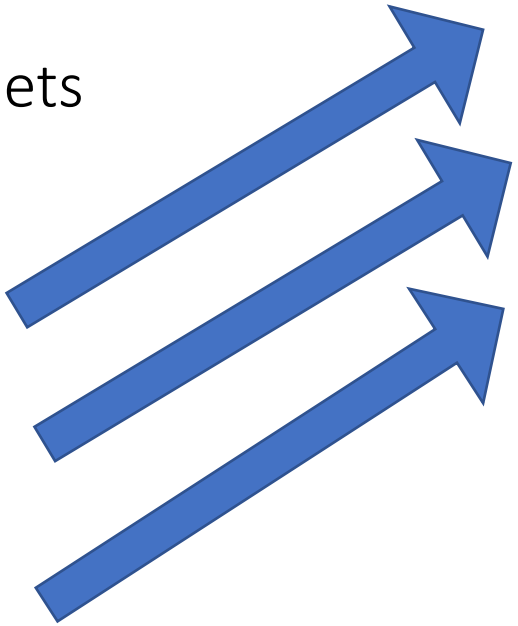
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing (P305+P351+P338). **If eye irritation persists eyes:** Get medical advice or attention (P337+P313).
If on skin: Wash with plenty of water.
If swallowed: Rinse mouth. Call a POISON CENTER or physician if you feel unwell.

SECTION 5 — FIRE FIGHTING MEASURES

Class IB flammable liquid.
A dangerous fire hazard from heat, flame or strong oxidizers.
Flash point: -17 °C (CC) Flammable limits: Upper 12.8% Lower 2.6% Autoignition temperature:

NFPA Code
H-1
F-3

Flinn Chemical Safety Data Sheets



465 °C R-0
When heated to decomposition, may emit toxic fumes.
In case of fire: Use a tri-class dry chemical fire extinguisher (P370+P378).

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Remove all ignition sources and ventilate area. Contain the spill with sand or other inert absorbent material and deposit in a sealed bag or container. See Sections 8 and 13 for further information.

SECTION 7 — HANDLING AND STORAGE

Flinn Suggested Chemical Storage Pattern: Organic #4. Store with ethers, ketones, and halogenated hydrocarbons.
Store in a dedicated flammables cabinet. If a flammables cabinet is not available, store in Flinn Saf-Stor™ can.
Keep container tightly closed (P233). Keep cool (P235). Use only in a hood or well-ventilated area (P271). Take precautionary measures against static discharge (P243).

SECTION 8 — EXPOSURE CONTROLS, PERSONAL PROTECTION

Wear protective gloves, protective clothing, and eye protection (P280). Use latex, not nitrile gloves. Wash hands thoroughly after handling (P264). Use only in a hood or well-ventilated area (P271).
Exposure guidelines: PEL 1000 ppm (OSHA); TLV 500 ppm, STEL 750 ppm (ACGIH); IDLH 2500 ppm

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Colorless liquid. Sweet pungent odor like nail polish remover.
Soluble: Miscible with water, alcohol and many other organic solvents.

Boiling point: 56.5 °C
Density: 0.79
Melting point: -94.6 °C
Vapor density: 2.00

SECTION 10 — STABILITY AND REACTIVITY

Stable. Potentially explosive reaction with strong oxidizing agents and halogenated compounds.
Shelf life: Good, if stored properly.

SECTION 11 — TOXICOLOGICAL INFORMATION

Acute effects: Eye and respiratory tract irritant, dizziness, CNS depression.
Chronic effects: Dermatitis.
Target organs: Liver, kidneys, CNS, respiratory system.

ORL-RAT LD_{50}: 5800 mg/kg
IHL-RAT LC_{50}: 50,100 mg/m^3/8H
SKN-RBT LDL_0: 20 mL/kg

SECTION 12 — ECOLOGICAL INFORMATION

Data not yet available.

SECTION 13 — DISPOSAL CONSIDERATIONS

Please review all federal, state and local regulations that may apply before proceeding.
Flinn Suggested Disposal Method #18a is one option.

SECTION 14 — TRANSPORT INFORMATION

Shipping name: Acetone. Hazard class: 3, Flammable Liquid. UN number: UN1090.

SECTION 15 — REGULATORY INFORMATION

TSCA-listed, EINECS-listed (200-662-2), RCRA code U002

SECTION 16 — OTHER INFORMATION

This Safety Data Sheet (SDS) is for guidance and is based upon information and tests believed to be reliable. Flinn Scientific, Inc. makes no guarantee of the accuracy or completeness of the data and shall not be liable for any damages relating thereto. The data is offered solely for your consideration, investigation, and verification. The data should not be confused with local, state, federal or insurance mandates, regulations, or requirements and CONSTITUTE NO WARRANTY. Any use of this data and information must be determined by the science instructor to be in accordance with applicable local, state or federal laws and regulations. The conditions or methods of handling, storage, use and disposal of the product(s) described are beyond the control of Flinn Scientific, Inc. and may be beyond our knowledge. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME

Flinn Chemical
Safety Data Sheets

RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THIS PRODUCT(S).

N.A. = Not available, not all health aspects of this substance have been fully investigated.
N/A = Not applicable

Consult your copy of the Flinn Science Catalog/Reference Manual for additional information about laboratory chemicals.

Revision Date: August 31, 2016

Use of PPE in Remote Science & STEM

4. Sanitized personal protective equipment (PPE) is to be provided by the schools or parent prior to the beginning of any lab assignment with safety considerations.

This of course includes hands-on activities outside of the formal science/STEM lab. Eye protection, such as indirectly vented chemical splash goggles (meeting the ANSI/ISEA Z87.1 D3 standard) are to be used when working with liquid hazards (chemicals or biologicals), or protective safety glasses with side shields when using solid physical hazards (springs, sharp objects, projectiles, etc.)

Vinyl or nitrile gloves and non-latex aprons should be used when dealing with biological or chemical hazards. **If proper PPE is not available, the laboratory exercise or activity must not be conducted.**

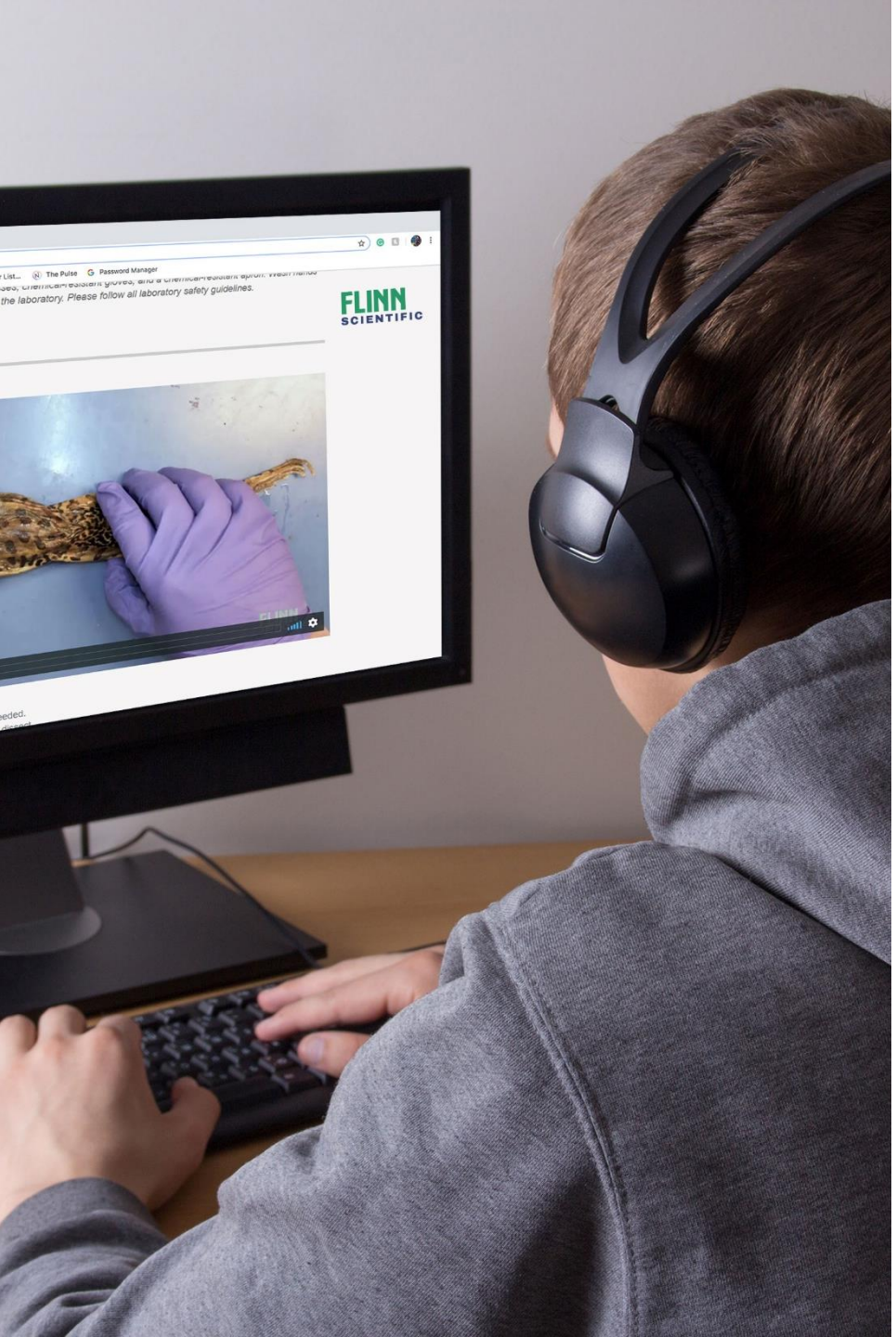
All students and parents involved in the laboratory activity should be properly trained on how to use, wear, and dispose of PPE. The teacher is responsible for making sure that everyone involved in the laboratory experiment is properly trained.

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Adult Supervision for At-Home Activities

5. For hands-on science/STEM activities involving students in grades K-5 or elementary level, duty of care must be provided directly by a responsible adult.

1. https://www.nsta.org/blog/safety-hands-science-home-instruction



Use of Virtual Activities for Science & STEM

6. In the case of middle and high school lab activities, teachers should consider using simulations when school-based laboratory investigations are not an option.

We can't always provide the same authentic learning experiences for our students in a remote / distance education environment, but we can help reduce the learning loss and contribute to their overall continuity of learning and their trajectory towards post-secondary and the workplace.

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Some existing online resources that will help you provide the continuity of learning in science and STEM for your students from K-12

From our vast offering of science education products and resources, please consider adding these innovative digital learning solutions to your science program leaders.

Flinn is making these solutions available for you and your science and STEM programs at no-charge or obligation to your schools as part of our commitment to enhancing student learning during these challenging times.

We created a listing of these solutions for you with special product codes that can be activated until the end of the school year for FREE!

Safe ‘at-Home’ or Remote learning activities from FLINN

At-Home Labs		
L1 Flinn At-Home Lab 1–Chemical Reactions	L2 Flinn At-Home Lab 2–Acid-Base Chemistry	L3 Flinn At-Home Lab 3–Chemical Bonding
L4 Flinn At-Home Lab 4–Properties of Materials	L5 Flinn At-Home Lab 5–Solutions	
At-Home Activities		
A01 Glue–Slime	A06 Glowing Fingers	A11 Red Licorice Decay
A02 Soap Bubbles	A07 Making Homemade Glue	A12 Red Cabbage Indicator
A03 Straw Pressure Popper	A08 A Burning Candle	A13 Water Sand and Popcorn
A04 Silly Putty	A09 Egg Float	A14 Everyone Scream for Ice Cream
A05 Quick Freeze	A10 Plotting Trends	A15 Test Tube Challenge
P01 POGIL Activities for AP® Chemistry	P02 POGIL Activities for Chemistry	**New -** A47 Food Dye Chromatography
New A49 How Sweet it is - A Colorful Sugar Solution Density Column	**New -** A50 Chromatography Challenge	**New -** A51 Equilibrium Water Games
New - A58 Water Drops on a Penny	**New -** A59 Density of Soft Drinks	
At-Home Kits		
K01 Goldenrod Paper—Demonstration Kit	K02 Polymer Bead—Demonstration Kit	K03 Slime for Everyone! Small-Size Lab Kit
K06 Mystic Sand		
The Science Behind		
SB01 Snow and Ice	SB02 Pennies	SB03 Green Chemistry

Safe ‘at-Home’ or Remote learning activities from FLINN

At-Home Activities

A16 Rainforest Biodiversity
A17 The Lynx Eats the Hare
A18 Toothpick Biochemistry
A19 Genetic Engineering Cleaner Clothes
A20 Brown Out
A21 Hot Potato
A22 Make a DNA Model
A23 Translation and Transciption and Replication Oh MY
A24 Up and Downs of Grapes
A25 Sewer Lice
A26 The Greehouse Effect Analogy
P03 POGIL Activities for AP® Biology
P04 POGIL Activities for Biology
New - A45 Karyotyping Cancer Cells
New - A46 Add Up and Cross Over
New - A52 Studying Disease Vectors - West Nile Virus
New - A55 How to Make a Germination Bottle
New - A57 Butterfly Camouflage
New - GN1 Getting Nerdy - Evolution Task Cards
New - GN2 Getting Nerdy - Respiratory System Notes and Lab
New - GN3 Getting Nerdy - Science Cubing Activity
New - GN4 Getting Nerdy - Cells Cootie Catcher
New - GN5 Getting Nerdy - Ecology Vocabulary
New - GN6 Getting Nerdy - Intro to Microscopes Lab
New - GN7 Getting Nerdy - Lab Report Templates

The Science Behind

SB04 Optics

Safe ‘at-Home’ or Remote learning activities from FLINN

At-Home Labs

L4 Flinn At-Home Lab 4–Properties of Materials

L5 Flinn At-Home Lab 5–Solutions

At-Home Activities

A01 Glue–Slime
A02 Soap Bubbles
A03 Straw Pressure Popper
A04 Silly Putty
A05 Quick Freeze
P02 POGIL Activities for Chemistry
A33 Celt Spoon
New - A49 How Sweet it is - A Colorful Sugar Solution Density Column
New - A50 Chromatography Challenge
New -A59 Density of Soft Drinks

A06 Glowing Fingers
A07 Making Homemade Glue
A08 A Burning Candle
A09 Egg Float
A10 Plotting Trends
A31 The Spinning Can
A34 Soap Motor Boat

New - A53 Build the Simplest Electric Motor

New - A51 Equilibrium Water Games
New - A56 Gummy Bear Wave Machine

A11 Red Licorice Decay
A12 Red Cabbage Indicator
A13 Water Sand and Popcorn
A14 Everyone Scream for Ice Cream
A15 Test Tube Challenge
A32 Centripetal Acceleration
New - A47 Food Dye Chromatography

New - A54 Build a Binder Clip Catapult

New - A58 Water Drops on a Penny
New - A60 Twirling Toy Challenge

At-Home Kits

K01 Goldenrod Paper—Demonstration Kit
K06 Mystic Sand
K07 Ghost Crystals, 100 g
K10 The Two-Potato Clock

K02 Polymer Bead—Demonstration Kit
K04 Bottle Balance Beam—Demonstration Kit
K08 Tornado Tube
K11 Ultraviolet Detecting Beads

K03 Slime for Everyone! Small-Size Lab Kit
K05 Newtonian Demonstrator, Economy Choice
K09 Putt Putt Boat—Demonstration Kit

The Science Behind

SB01 Snow and Ice

SB02 Pennies

SB03 Green Chemistry

Safe ‘at-Home’ or Remote learning activities from FLINN

5th-8th Middle School Life Science

At-Home Activities

A16 Rainforest Biodiversity
A17 The Lynx Eats the Hare
A18 Toothpick Biochemistry
A19 Genetic Engineering Cleaner Clothes
A20 Brown Out
A21 Hot Potato
A22 Make a DNA Model
A23 Translation and Transciption and Replication Oh MY
A24 Up and Downs of Grapes
A25 Sewer Lice
A26 The Greehouse Effect Analogy
P04 Activities for Life Science

New - A45 Karyotyping Cancer Cells
New - A46 Add Up and Cross Over
New - A52 Studying Disease Vectors - West Nile Virus
New - A55 How to Make a Germination Bottle
New - A57 Butterfly Camouflage
New - GN1 Getting Nerdy - Evolution Task Cards
New - GN2 Getting Nerdy - Respiratory System Notes and Lab
New - GN3 Getting Nerdy - Science Cubing Activity
New - GN4 Getting Nerdy - Cells Cootie Catcher
New - GN5 Getting Nerdy - Ecology Vocabulary
New - GN6 Getting Nerdy - Intro to Microscopes Lab
New - GN7 Getting Nerdy - Lab Report Templates

The Science Behind

SB04 Optics

Safe ‘at-Home’ or Remote learning activities from FLINN

5th-8th Middle School STEM		
At-Home Activities		
A35 Cartesian Diver Design Challenge	A38 Egg-streme Parachuting	A41 Measurement Challenge
A36 Chromatography Challenge	A39 Iodine Clock Challenge	A42 Medieval STEM from FlinnSTEM
A37 Density Challenge	A40 Marbling Paper with Oil Paints	A43 Mousetrap Cars
A09 Egg Float		

Hybrid Learning Models and Science Safety

7. In some instances, a hybrid model of instruction or blend of both traditional classroom instruction and online learning activities can be used.

Actual hands-on laboratory experiments and collaborative activities should involve focus of face-to-face instruction.

This is particularly important when these laboratory exercises and activities require the use of personal protective equipment. Online portions of instruction should then focus on laboratory experiences and independent in-class activities.

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Use of Teacher Demos for safety & compliance

8. In other instances, it may be safer to use teacher demonstrations, either in a face-to-face session or through a virtual platform.

It is critical to communicate that these demonstrations should not be conducted outside of a formal laboratory setting following specific safety protocols like use of appropriate personal protective equipment

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Responsibility and Role of Supervision

9. Although by following safety protocols, an activity can be made safer, it possibly may not be totally safe. Accidents can still happen.

This is especially true when teaching remotely. In this case, as in all others, **absolute caution must be exercised by a reasonable and responsible adult who is supervising such activities outside of school.**

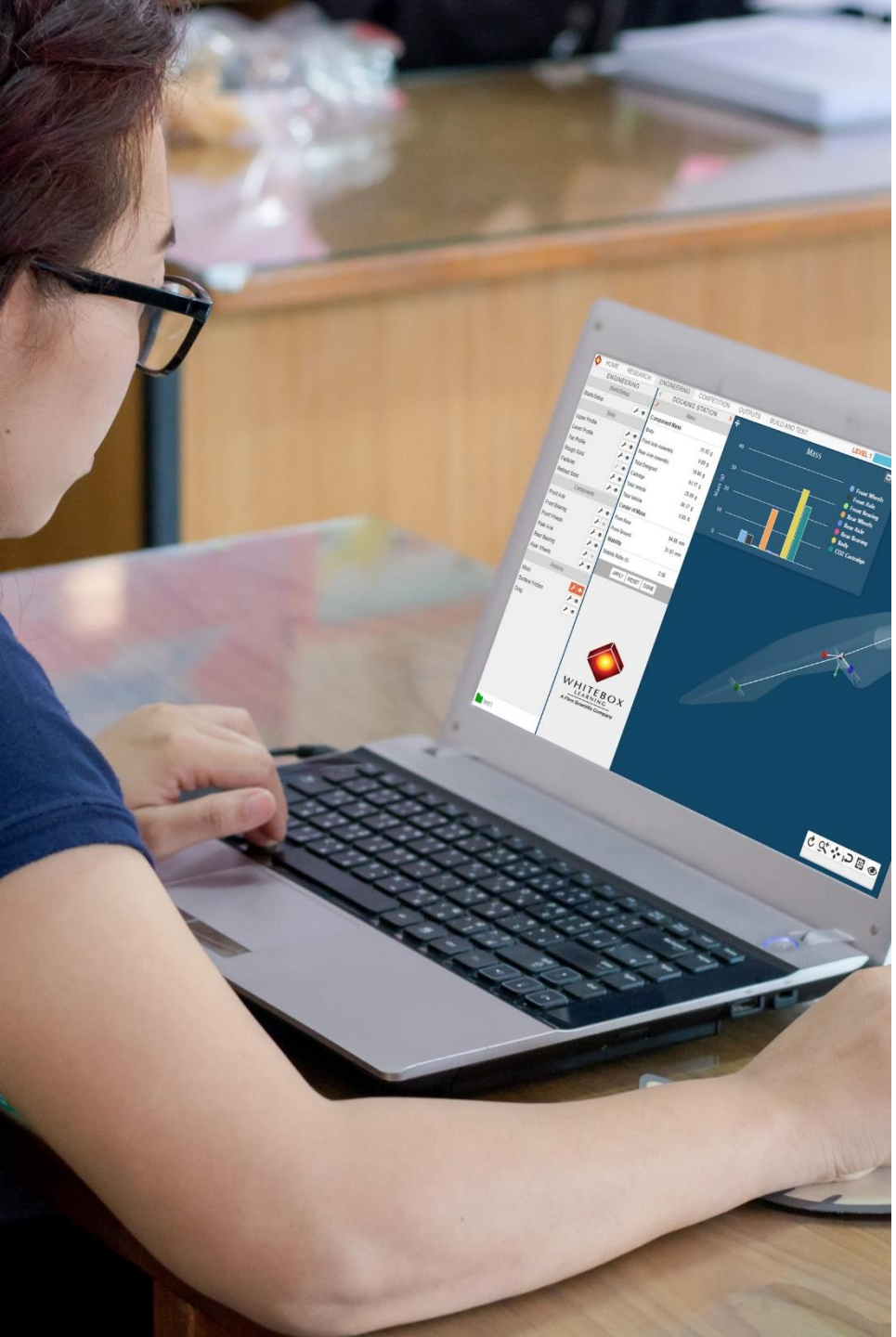
In school, this is directly the teacher's responsibility. Remember, that **the teacher's responsibility for safety still applies when students conduct hands-on activities at home or out in the field.**

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Home-based Science & STEM Safety Guidelines for students and parents

- In addition to the safety protocols provided in the NSTA Safety Acknowledgement forms, there are a number of additional resources on the internet noting basic safety guidelines for home lab safety.
- A prime example are the posted guidance documents for home lab safety developed by The Centre for Science at Athabasca University, Athabasca, AB T9S 3A3 Canada, found here. These are applicable and a great resource for students and home supervisors to follow for a safer home science activity experience.
- The site first states the importance of thoroughly reading the lab activity instructions before beginning the lab. This is for not only better understanding the purpose of the activity, but also to be aware of the potential safety hazards involved.
- Below are some specific examples of home lab safety guidelines that can be found on their website relative to Personal Safety and Equipment in Remote Environments.

1. https://www.nsta.org/blog/safety-hands-science-home-instruction



Personal Safety Equipment Guidance

- **Keep the Home Lab Kit and the supplementary materials safely away from children.**

- **Wear approved eye protection at all times when doing your lab activities.**

- Confine long hair when doing your lab activities.

- **Perform no unauthorized experiments**

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Remote Science & STEM Workspace Ideas

- **Select a safe site for lab activities in your home that is well ventilated and protected from spills, children, and pets.** Use a work area, such as your kitchen, where there is a flat and stable working surface, and access to water and various supplies.
- **Have no food or drink in the lab area.**
- Never place any instrument or materials in your mouth.
- **Wash your hands with soap and water before taking a break for a snack or meal.**
- Wear appropriate foot coverings in case of spills; i.e., no open-toed sandals, no bare feet, etc.

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Chemicals used in the Home

- **Keep all chemicals and equipment out of the reach of children and pets.**
- **If possible, keep all unauthorized people out of your selected site when chemicals are in use** in order to avoid any unforeseen accidents. If anyone is allowed to observe you or participate in science experiments, follow all of the proper safety rules.
- **Never wear contact lenses when working with chemicals.**
- **Work with the (small) quantities indicated. Follow the instructions to prevent fires, burns, and cuts.**
- **Do not smoke or eat when you are using flammable or poisonous materials.**
- **Label all materials clearly, and make accurate observations and measurements so that you do not make mistakes or need to repeat experiments.**
- **Ensure that the area you are working in is well-ventilated.**

1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Safety Concerns When Students Are Working Remotely (At-home) Without Teacher Supervision

- Having students learning remotely creates its own challenges from a classroom management, continuum of learning and a safety perspective. By recognizing that not every home will have the essential PPE items, access to common chemicals and items *(vinegar, baking soda, food dyes, sugars, salts, starch and straws, plastic cups, balances, coffee filters etc*.) **we need to be respectful and choose activities accordingly**.
- There are safety concerns that result from the choice of student-managed science / STEM activity and there are ways to minimize these risks or hazards, but there is responsibility on the part of the student and the parents/guardians to cultivate and practice safe procedures and techniques in order to learn about the science being demonstrated. **The teachers will need to be especially safety conscious when selecting remote learning activities that use any potential hazards including consumer commodities listed in their procedures / instructions for each activity. The use of digital delivery reduces the safety risks.**

1. https://www.nsta.org/blog/safety-hands-science-home-instruction
2. https://www.nsta.org/science-teacher/science-teacher-julyaugust-2020/remote-learning-problem-or-opportunity

Spills & Cleanup in the Home

- **In case of a chemical spill, clean up thoroughly with paper towels and dispose of chemicals out of the reach of children and pets.**
- If chemical spills occur on people or clothing, rinse thoroughly with lots of running water, and seek medical attention if necessary.
- **Be sure to thoroughly clean up the lab site and all utensils used after working on labs.**

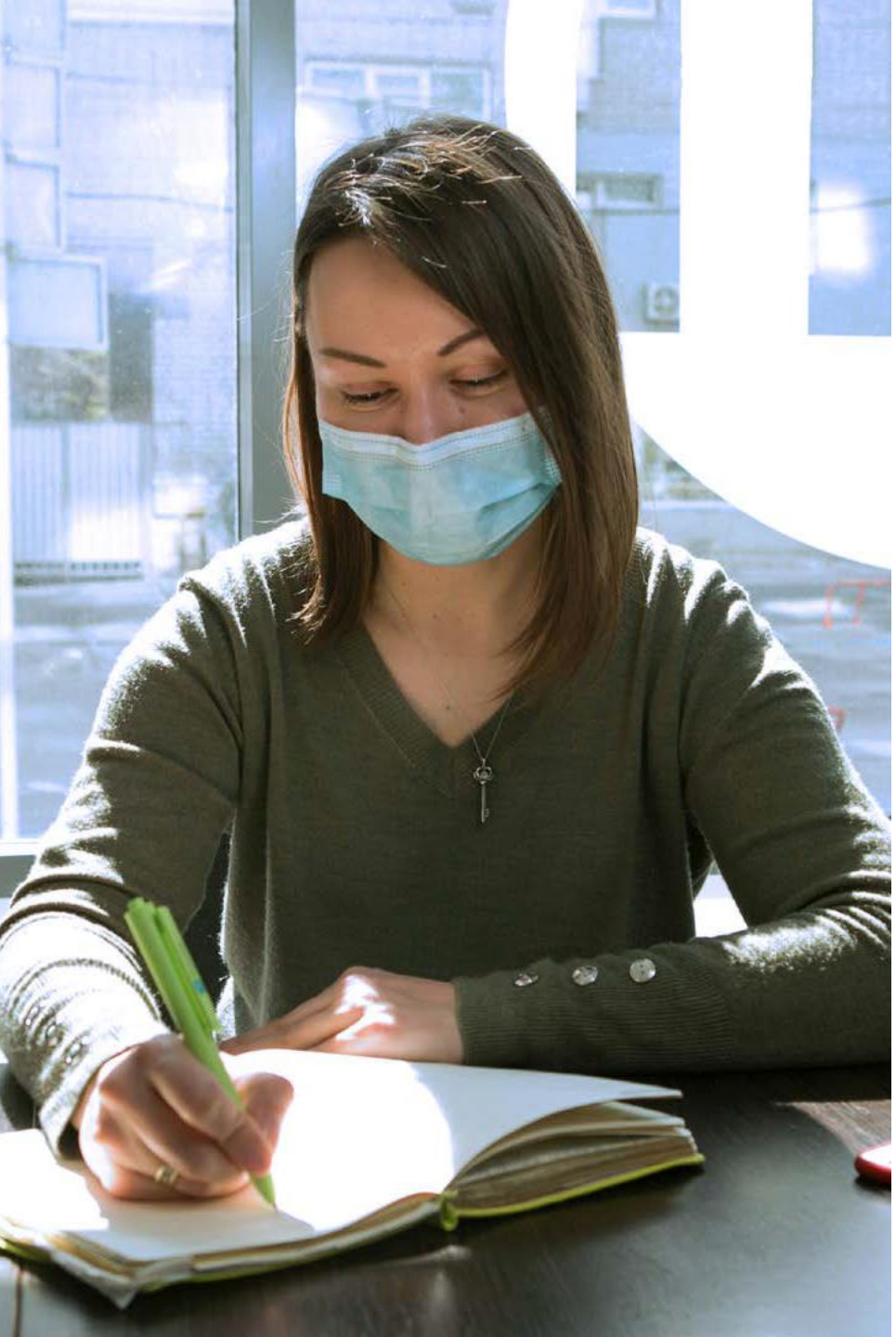
1. https://www.nsta.org/blog/safety-hands-science-home-instruction

Emergency Situations at Home

Have the following emergency equipment handy in your working area: a fire extinguisher, water, a first aid kit, and a telephone.

Again, remember that safety guidelines needed depend on the types of hazards and resulting risks associated with the activity. Although the samples provided at The Centre for Science at Athabasca University, Athabasca, are very good, they may not be complete for all types of at-home activities.

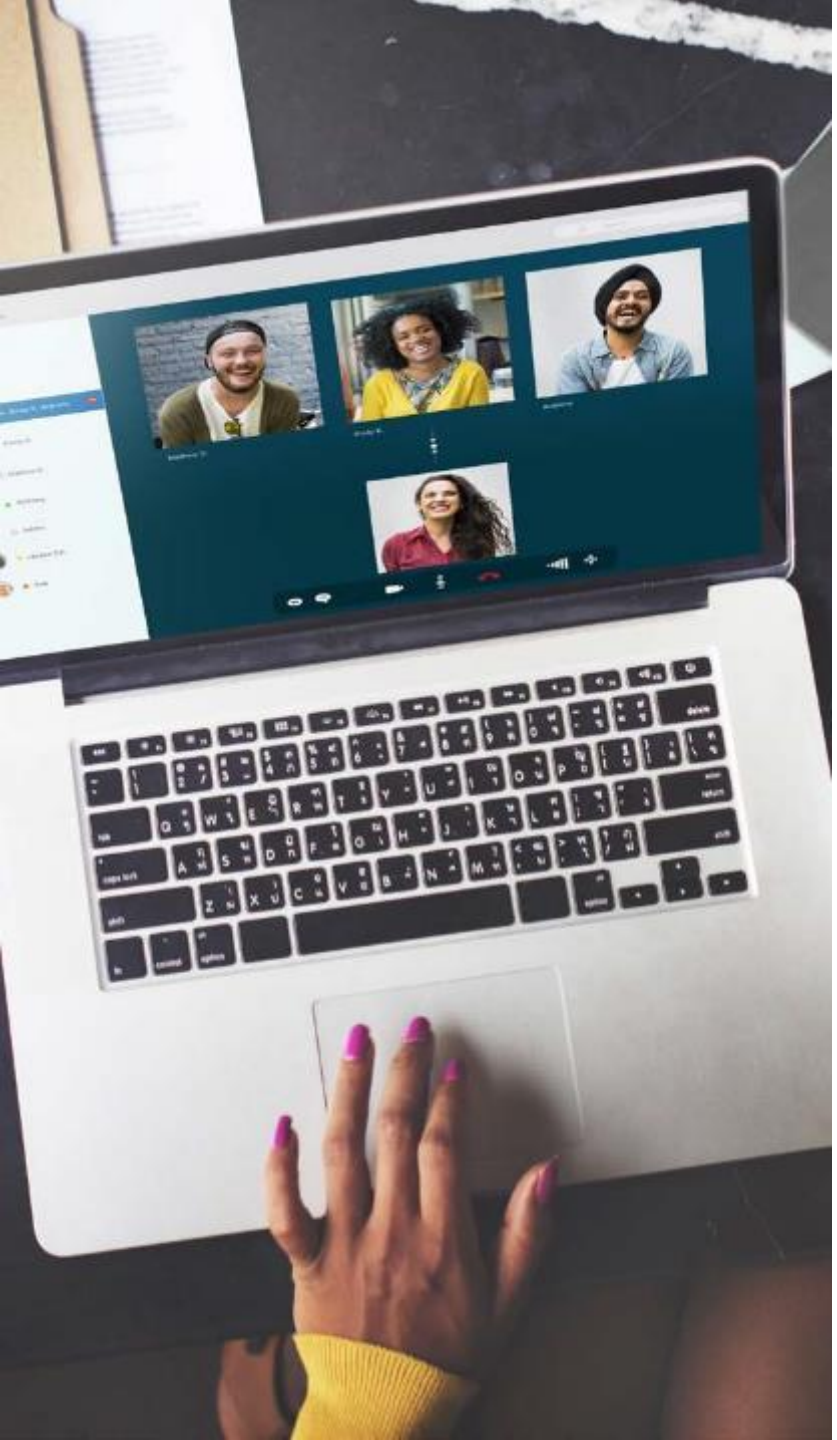
1. https://www.nsta.org/blog/safety-hands-science-home-instruction



Safety at Home Summary

- This information should be helpful for teachers, students, and parents/guardians in planning for safer home science/STEM activity assignments. Please note the content of this commentary is based on prudent professional safety practices (e.g., NSTA, ACS, etc.) and on OSHA, NFPA, and other legal safety regulations, but do not purport to specify all legal standards.
- They are intended to provide basic guidelines in the areas of employee and student health and safety. Therefore, it cannot be assumed that all necessary warning and precautionary measures are contained in this information.
- Users of this information should also consult pertinent school board safety policy; local, state, and federal laws; and legal counsel for additional safety prevention program components during these challenging times of the COVID-19 pandemic.

1. https://www.nsta.org/blog/safety-hands-science-home-instruction
2. Flinn Scientific Professional Learning Series 2021

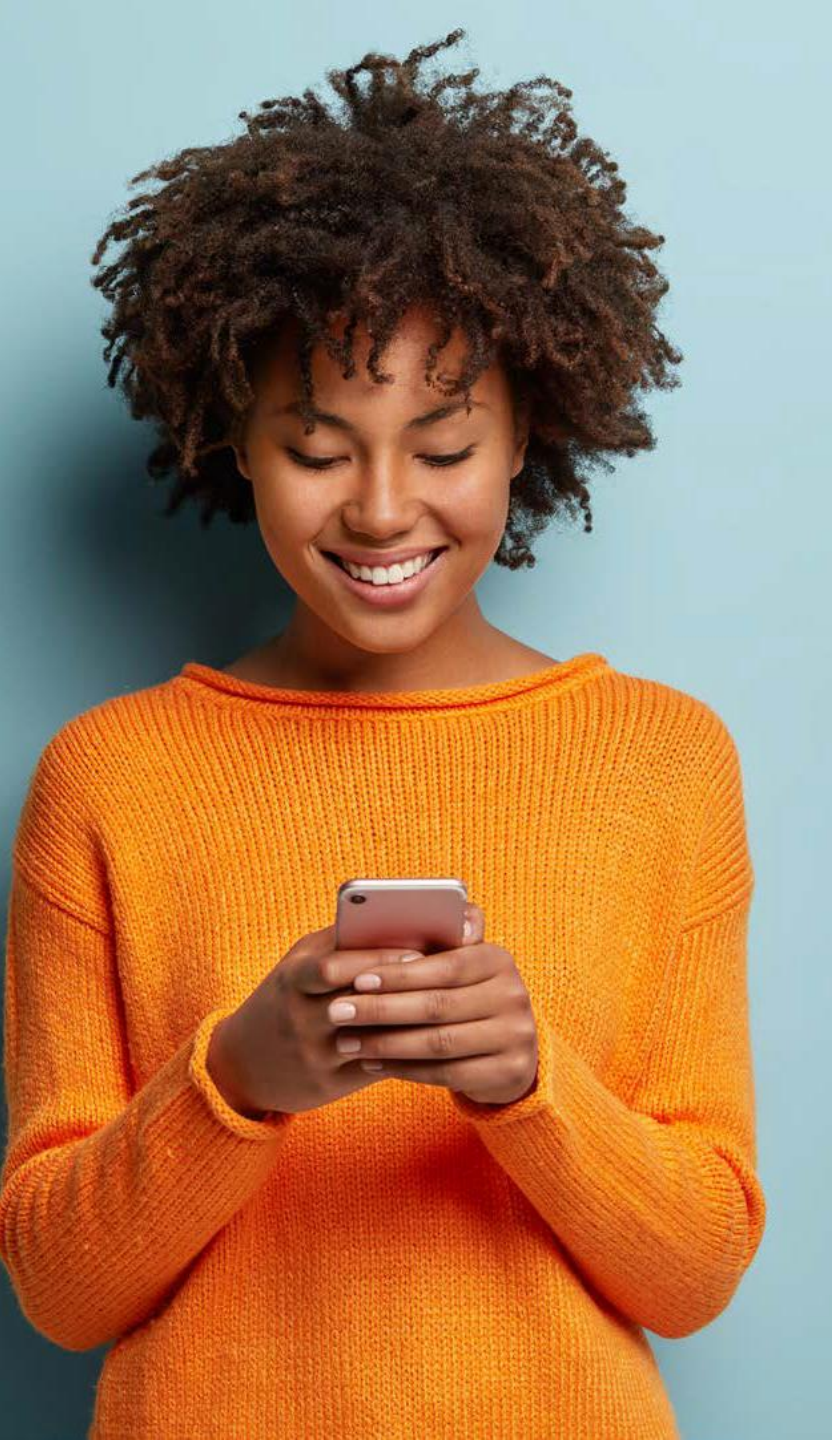


General Lab Guidance for Remote Teaching

If a school is unable to hold in-person lab classes, we strongly recommend labs are conducted by teachers and observed by students instead of having students conduct labs at home. If some form of practical work is done at home during remote learning, we recommend the following guidelines to support student safety and prioritize equitable learning opportunities.

- Supplies to support learning activities should be readily available in homes or provided by the district. No chemicals outside of common household items should be required for an activity. Consider opportunities to distribute materials needed to implement activities before requiring an activity to be completed at home.

1. Harvard School of Public Health, Schools For Health: Risk Reduction Strategies for Reopening Schools. (2020, June).
2. CDC, Considerations for Schools. (2020, May 19).
3. Flinn Scientific, Guidance on Re-Entry to Schools, K-12: Part A. (2020)
4. Lab Manager, COVID-19: What You Need to Know and What You Should Do Now. (2020, March)
5. Association of Library Service for Children, Best Practices for Cleaning Play and Learning Spaces. (2017, April)
6. Centers for Disease Control and Prevention, Considerations for Schools. (2020, May)



REMOTE SCIENCE SAFETY CONTINUED

- Educators should model (e.g., live, video, in writing) safety practices before assigning labs. Provide students and families with information on materials, procedures, and safety protocols of labs. Provide families with a lab safety acknowledgement form tailored to remote learning. Experiments should be done under adult supervision.

- The use of household chemicals or kitchen supplies should be limited to those that have a safety classification as 1 on the Safety Data Sheet (SDS). For example, vinegar should not be used without appropriate PPE because of the safety label of 2. Safety data sheets should be reviewed beforehand, including the use of any household substances in an activity. Safety hazard information can be found here. Safety Data Sheets can be found by searching the internet for “SDS <chemical name>.

- Prepare alternative methods (e.g., videos, simulations, demos) for labs as needed for students to learn the concept.

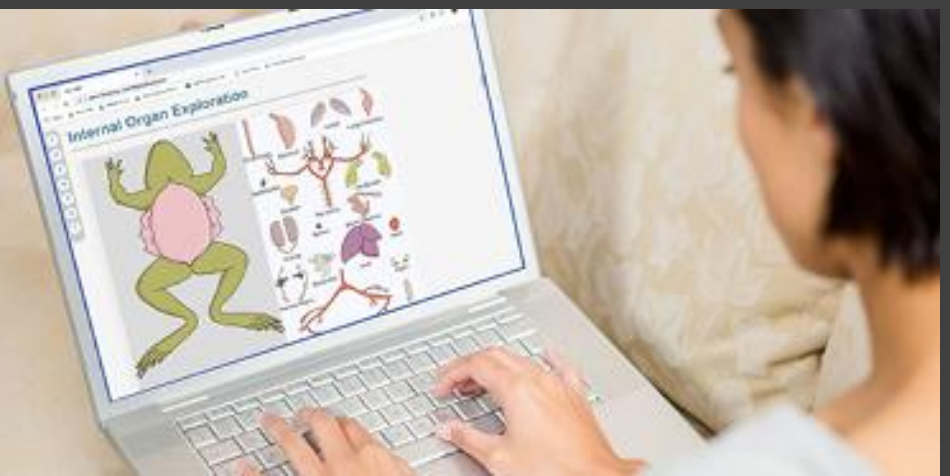
1. Harvard School of Public Health, Schools For Health: Risk Reduction Strategies for Reopening Schools. (2020, June).
2. CDC, Considerations for Schools. (2020, May 19).
3. Flinn Scientific, Guidance on Re-Entry to Schools, K-12: Part A. (2020)
4. Lab Manager, COVID-19: What You Need to Know and What You Should Do Now. (2020, March)
5. Association of Library Service for Children, Best Practices for Cleaning Play and Learning Spaces. (2017, April)
6. Centers for Disease Control and Prevention, Considerations for Schools. (2020, May)

Safety at Home Concerns Continued

- Teachers will need to over-communicate their expectations and ensure that the following guidance is adhered to with their students:

1. **Encourage parent/guardian supervision when doing science activities when possible / practical**
2. **Encourage students to follow the prescriptive lesson instructions sequentially**
3. **Have contingency safety protocols in place (In case of X, do Y…)**
4. **Choose age / grade / level appropriate activities**
5. **Choose readily available items typically located in a home**
6. **Have students watch a pre-recorded version from the teacher so that they have a better understanding of the possible outcome and procedures to follow when conducting the activity themselves**
7. **The development and use of a Remote Science Safety Acknowledgement Form**

1. Flinn Professional Learning Series 2020
2. https://www.nsta.org/science-teacher/science-teacher-julyaugust-2020/remote-learning-problem-or-opportunity



Digital Learning Solutions for Students

FlinnPREP

Using a blended learning approach FlinnPREP™ provides science teachers with the flexibility to personalize learning and empowers students to master key concepts with anytime, anywhere access. This is typically used in an AP classroom but can be applied to most science programs.

WhiteBox Learning

WhiteBox Learning is a complete Standards-Based STEM Learning System for Engineering, Science, and Technology Education classrooms, grades 6-10. Completely web-based, students can design, analyze, and simulate their designs, hundreds of times, from a web browser, and compete with other students throughout their district.

Digital Dissection

Enjoy anywhere, anytime access to Flinn Digital Dissection Labs! These dissection study tools can be used as prelab practice, post lab quizzing or even as dissection alternatives. Engaging content and interactive tools reinforce animal anatomy and dissection technique.

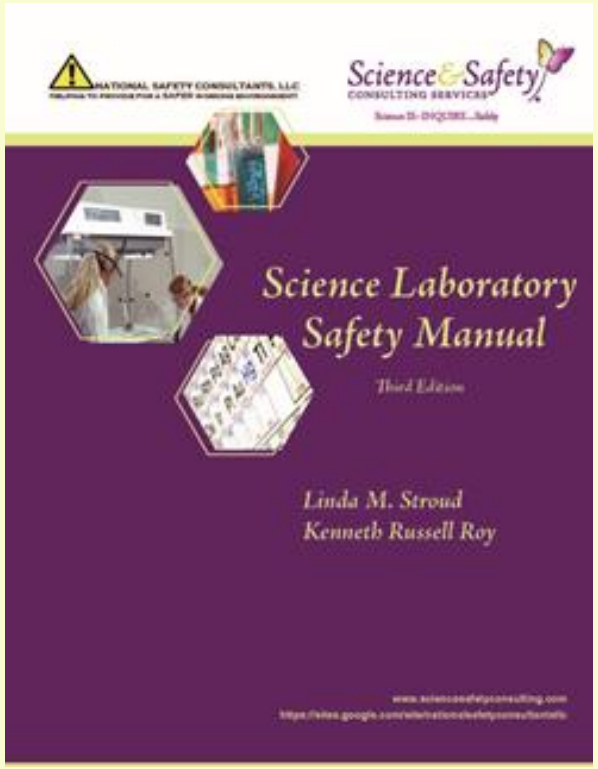
https://www.flinnsci.com/athomescience/digital-learning-solutions/#contactus

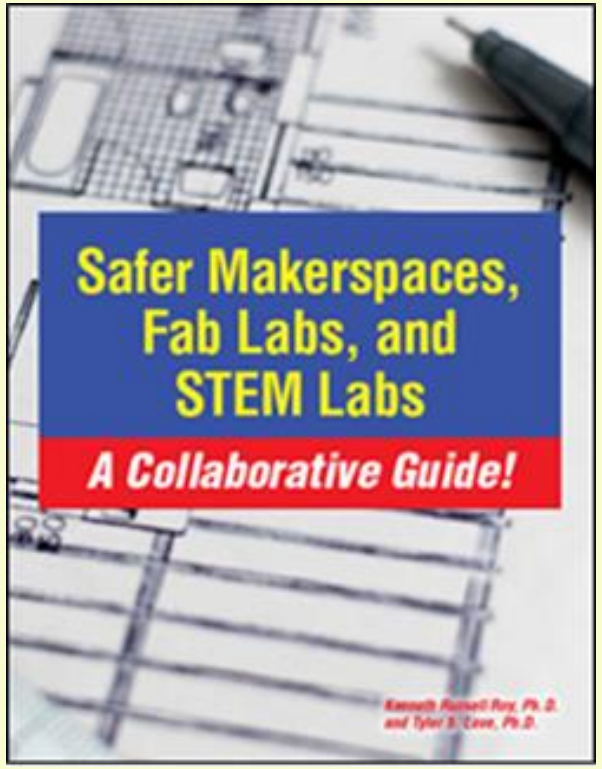
Flinn Science 2 Go and Flinn 360 Series can help deliver key lab activities to your students safely in any setting.

- ***"Thank You so much for the online Labs. With school being closed and schools being forced to work from home online, I had no idea how I was going to be able to produce quality Chemistry instruction on a daily basis. These lessons are quality. My students will get so much more because of you. Thank You, Thank You, Thank You."*** **—Pete Pratt, Jefferson-Morgan High School, Jefferson, PA**
- Science2Go lets students experience the laboratory component of science in any learning environment:
- Videos focused on lab technique and data collection with prompts and analysis questions to engage students in science practices.
- Teachers can edit any lab to include additional content and change prompts and analysis questions to best suit their students.
- Highly adaptable, the lab solutions are aligned with **NGSS and other state science standards** and can be used with any curriculum.
- Each digital lab solution includes a recommendation for a hands-on lab kit.
- Use for synchronous or asynchronous learning, with students completing labs individually or in groups in approximately 45 minutes. Grade and leave comments for students online. **You can teach authentic science without the supplies in a distance or blended environment.**

https://www.flinnscience2go.com/UnAuthHome/Index

Essential Safety Resources from Dr. Ken Roy





FLINN SCIENTIFIC

Science Laboratory Safety Manual
https://www.flinnsci.com/science-laboratory-safety-manual/ap7292/

Safer Makerspaces, Fab Labs, and STEM Labs
https://www.flinnsci.com/safer-makerspaces-fab-labs-and-stem-labs-a-collaborative-guide/ap9964/

FLINN SCIENTIFIC

Ask about our custom district solutions designed to support a safe return to school:

- Custom safety and professional development/learning proposals to ensure full school safety
- Full PPE for students, faculty, and support staff
- Blended science learning solutions that provide continuity of lab instruction for both onsite & remote learners

www.flinnsci.com | **1-800-452-1261**