



**Gold Seal:**

Copernicus Education Gateway

<b>Author(s):</b> Michael Lucky Voiselle			<b>Lesson Title:</b> DUST EXPLOSIONS			
<b>Grade Span</b>			<b>ICLE Application Model</b>			
K-4	5-8 XX	9-12	A	B	C	D XX

**Instructional Focus:**

**Reading**

Students read a variety of grade level materials, applying strategies appropriate to various situations

**Science as Inquiry**

Students demonstrate knowledge and skills necessary to perform scientific inquiry.

**Communication**

Students communicate and apply scientific concepts.

**History and Nature of Science**

Students develop an understanding of the nature of science, its history, and science as a human endeavor.

**Performance Task**

Your task is to explore the effect of particle size, a factor that contributes to chemical reaction rates, on sudden explosive combustions. Form groups of 4 and follow directions.

Assemble an apparatus to explode fine powder in a safe manner. Consult the accompanying diagram (Dust Explosions Chart). Most items can be obtained at home, through your science teacher, and or the local hardware store. Once the apparatus is assembled, place a small piece of paper in the bottom of the funnel and add about 5 grams of powder (a teaspoon full). Light the candle, place the top on the gallon coffee can, and stand back. Squeeze the rubber bulb. Record all observations and any other comments in your science journal. (You may use fine cornstarch, powdered aluminum, fine coal dust, fine iron filings, sulfur powder, or dry coffee creamer.)

Summarize the results of this experiment including any problems you and your group encountered in assembling the apparatus and how your group solved them as well as addressing the following questions. Summary should be well organized, well written, and free from spelling and grammatical errors.

1. Place 5 grams of the powder you used in the explosion apparatus on a chemical ring stand or some other metal object. Try to ignite the powder. What happens? Why does the pile not ignite?
2. What is the difference in the dust pile and the dust in the air? Keep in mind heat build-up and spontaneous combustion when analyzing this question.
3. Is this an endothermic or an exothermic chemical reaction and why?
4. What forms of energy are released during this reaction?
5. Record the length of time it takes to ignite each of the following with a candle, a lump of coal, hit the lump of coal into 5 or 6 pieces, hit the 6 pieces into 12 pieces, hit the 12 pieces into approximately 24 pieces, crush some of the 24 pieces and sprinkle over the candle flame, and finally pulverize some of the smallest pieces into dust and sprinkle over the candle. Plot a graph of the time versus the number of particles. What can you conclude from this experiment?
6. Do all fine powders cause dust explosions? Try sprinkling fine sugar, salt, baking soda, and other particles over a candle flame to test this question. Why are some powders able to cause explosions and some are not?
7. How does the amount of particles contribute to the collection of heat?
8. What is the relationship between the size of a substance to its surface area?
9. How do chemists use this knowledge to speed up or slow down the rate of a reaction?

Each member of your group is to research one of the following areas, grain elevators, coal mines, flour mills, and saw mills. Document evidence for explosions or accidents in these situations, describe all technological devices invented to help prevent disasters in that area, and prepare an oral presentation with a well constructed poster to your group. Each

group member will prepare a paragraph on these oral presentations in a second summary write-up to well written and free from spelling and grammatical errors.

**ICLE Essential Skills**

Understand how humans, through technology, cause environmental change by disrupting the equilibrium or balance of nature by introducing pollutants into the environment. (s6)
Understand the nature of change in the environment and how it occurs through the occurrence of an event (e.g., altering the properties of matter or of a system). Describe and measure change using time and space relationships as a frame of reference. (s24)
Know and apply the principles of scientific inquiry. <i>(Implicit in this statement are the processes of prediction, estimation, developing hypotheses, drawing conclusions, evaluation, and following ethical principles and professional procedures.) (Not Ranked s114)</i>
Apply in writing the rules and conventions of grammar, usage, punctuation, paragraphing and spelling. (ela1)
Gather information from a variety of sources, including electronic sources, and summarize, analyze, and evaluate its use for a report. (ela3)
Identify, collect and/or select pertinent information while reading. (ela5)
Prepare and deliver individual speeches by gathering information, rehearsing, making eye contact, speaking loudly enough, delivering information in a well-organized fashion, and appealing to the needs of the target audience. (ela 10)
Use writing as a tool for learning in formats such as learning logs, laboratory reports, note-taking, journals and portfolios. (ela 40)
Understand the best procedures for statistical data collection, organization, and display including making estimates and predictions and drawing inferences. (m5)

**Scoring Guide:**

RATE CRITERIA: 3=Excellent, 2=Satisfactory, 1=Unsatisfactory, 0=Does not understand or does not complete	
<b>CRITERIA</b>	<b>SCORE</b>
Group procedure and experimental cooperation	_____
Dust explosion apparatus worked well and constructed with safety in mind	_____
Student demonstrates an understanding for size of particles to reaction rates	_____
First write-up addressed all questions in an acceptable manner	_____
First write-up was well organized and free from spelling and grammatical errors	_____
Graph was neatly organized and labeled correctly	_____
Student research on one of the 4 topics was presented well to their group	_____
Student poster constructed well and enhanced the oral presentation	_____
Student second write-up addressed all 4 research areas	_____
Second write-up was well organized and free from spelling and grammatical errors	_____

### Keywords

English Language Arts	Mathematics	Science
Reading Research	Algebra	Earth Science Energy Heat Scientific Research
Writing Spelling Grammar Organization Technical Writing	Geometry	Life Science
Communications	Statistics	Chemistry Reaction Rates
Literature	Calculus	Physics Friction Lab Experiment
Other	Trigonometry	Other
	Other	

## DUST EXPLOSION

