Paper Takes Flight: 5th Grade Teacher Packet

A Classroom STEM Experience by The Balloon Explorium

🎈 Welcome, 5th Grade Teachers!

The **Paper Takes Flight** program brings hands-on engineering, science exploration, and New Mexico ballooning culture directly into your classroom. Students learn the physics of flight, experiment with design, and collaborate to build and launch their own tissue paper hot air balloons.

This packet includes:

- Program overview
- Teacher preparation guidance
- Safety expectations
- Registration information
- **Full NM STEM Ready! Science Standards Alignment (district-ready)**

Program Overview

What is Paper Takes Flight?

A STEM-rich, inquiry-based activity where students:

- Explore **buoyancy, convection, and air density**
- Build a **5-foot tissue-paper hot air balloon**
- Collaborate in teams to design, assemble, and decorate
- Participate in a **safe, supervised launch**
- Connect learning to **New Mexico's Hot Air ballooning heritage**

Target Grade Level: **5th Grade** (adaptable for grades 4–8)

Program Length: 60-90 minutes to assemble the kits provided; 60-90 minutes to launch balloons

Weather dependent: Hot air balloons do not fly well in windy or wet conditions. Fly days may need to be rescheduled.

Facilitators: The Balloon Explorium volunteers + classroom teacher support

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Learning Objectives

By the end of the activity, students will be able to:

Science & Engineering

- Explain how **heated air rises** and why balloons float
- Describe how **mass, surface area, and temperature** affect flight
- Follow a **multi-step engineering process**
- Test, evaluate, and refine their assembly choices and the quality of their work

Collaboration & Creativity

- Work effectively in teams
- Communicating ideas and solve problems
- Express creativity through balloon decoration and theme choices

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3.Standards Alignment

New Mexico STEM Ready! Science Standards – 5th Grade

The **Paper Takes Flight** program aligns with NM STEM Ready! Science Standards across Physical Science, Earth & Space Science, and Engineering Design. Full Standards Alignment descriptions are at the end.

A. Physical Science (PS)

5-PS1-1, 5-PS1-3, 5-PS3-1

B. Earth & Space Science (ESS)

5-ESS2-1, 5-ESS2-2

C. Engineering, Technology, and Applications of Science (ETS)

3–5-ETS1-1, 3–5-ETS1, 5-ETS1-3

Crosscutting Concepts

Science & Engineering Practices

What The Balloon Explorium Provides

- Tissue paper balloon kits, include sheets of tissue paper, and
- Glue sticks, pattern or template, and a string for the top, a drywall tape circle (throat) for the bottom
- Heat source for launch (safe and supervised)
- Trained facilitators
- Safety equipment

What Teachers Provide

- Classroom or other space for building balloons before launch day
- Access to an outdoor area for launching
- Teams of 4 students, one kit per team
- Optional: chalk or crayons for decoration, markers are less successful

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Safety Guidelines

- Students must follow facilitator instructions
- Heat source is operated **only** by authorized volunteers
- Maintain a safe perimeter around the launch zone

Optional Classroom Extensions

STEM Add-Ons

- Measure balloon ascent time
- Compare balloon mass vs. flight duration
- Explore convection currents

Literacy Connections

- Write a “Balloon Pilot Logbook”
- Create explanatory writing about flight science

Art Integration

- Design balloon patterns inspired by NM culture
- Create a class mural of balloon silhouettes

Registration Information

The Application window for Paper Takes Flight will open on August 15 and close on September 15, 2026. Access the application on the Home page under Paper Takes Flight. First come, first served, based on time and date of your submission.

NOTE: We schedule launches from November through January. The program is primarily for the Albuquerque metropolitan area. We do encourage others (schools, museums, community events) to use CONTACT us to indicate interest in the program. We will do our best to accommodate everyone.

Paper Takes Flight – 5th Grade Science Standards Alignment Document

The Balloon Explorium | 5th Grade Science Integration

Program Type: STEM Enrichment • Engineering Design • Physical Science
Grade Level: 5th Grade (adaptable 4–8)

1. Program Description

Paper Takes Flight is a hands-on engineering and physical science program in which students design, construct, and launch tissue-paper hot air balloons. The experience integrates scientific modeling, engineering design, and real-world application of heat transfer, buoyancy, and atmospheric science. The program supports New Mexico's STEM Ready! Science Standards through inquiry-based learning, collaborative problem-solving, and data-driven reflection.

2. Standards Alignment Overview

This program aligns with the **New Mexico STEM Ready! Science Standards (NGSS-based)** for 5th grade, including:

- **Physical Science (PS)**
- **Earth & Space Science (ESS)**
- **Engineering, Technology, and Applications of Science (ETS)**
- **Crosscutting Concepts**
- **Science & Engineering Practices**

The alignment below identifies **specific performance expectations**, describes **how the program meets each standard**, and outlines **evidence of student learning**.

3. Detailed Standards Alignment

A. Physical Science (PS)

5-PS1-1

Develop a model to describe that matter is made of particles too small to be seen.
Program Connection: Students observe how heated air expands and becomes less dense, supporting the concept that air is matter with measurable properties.
Evidence of Learning: Student explanations, diagrams of air particle movement, balloon performance observations.

5-PS1-3

Make observations and measurements to identify materials based on their properties.
Program Connection: Students compare tissue paper thickness, mass, and durability to determine which materials create the most effective balloon structure.
Evidence of Learning: Material comparisons, team design choices, recorded observations.

5-PS2-1

Support an argument that the gravitational force exerted by Earth on objects is directed downward.
Program Connection: Students observe how gravity interacts with buoyant force during balloon launch and descent.
Evidence of Learning: Student arguments citing balloon behavior, annotated diagrams.

5-PS3-1

Use models to describe how energy from the sun is transferred as heat.
Program Connection: Students explore heat transfer and convection as the balloon fills with warm air, modeling energy flow and temperature effects.
Evidence of Learning: Heat-flow diagrams, explanations of convection currents.

B. Earth & Space Science (ESS)

5-ESS2-1

Develop a model to describe interactions among the geosphere, biosphere, hydrosphere, and atmosphere.
Program Connection: Students examine how atmospheric conditions (wind, humidity, temperature) influence balloon flight.
Evidence of Learning: Weather observations, flight condition predictions, student models.

5-ESS2-2

Describe and graph the amounts of saltwater and freshwater in various reservoirs.
Program Connection (Optional Extension): Teachers may integrate this standard through weather-system discussions, atmospheric moisture, and ballooning conditions.
Evidence of Learning: Graphs, written explanations, weather-cycle connections.

C. Engineering, Technology, and Applications of Science (ETS)

3–5-ETS1-1

Define a simple design problem with criteria and constraints.
Program Connection: Students must build a balloon that is lightweight, sealed, and structurally sound using limited materials and time.
Evidence of Learning: Team planning sheets, identified constraints, design sketches.

3–5-ETS1-2

Generate and compare multiple possible solutions.
Program Connection: Teams test different seam overlaps, panel shapes, and construction techniques.
Evidence of Learning: Comparison charts, team discussions, prototype adjustments.

3–5-ETS1-3

Plan and carry out fair tests in which variables are controlled.
Program Connection: Students evaluate balloon performance (lift, stability, flight duration) and connect outcomes to design choices.
Evidence of Learning: Data tables, controlled variable identification, post-launch analysis.

4. Crosscutting Concepts Addressed

- **Cause and Effect:** How heat affects air density and lift
- **Energy and Matter:** Flow of thermal energy through the balloon
- **Structure and Function:** How balloon shape and seams influence performance
- **Patterns:** Observing weather and flight behavior

5. Science & Engineering Practices Embedded in the Program

Students engage in the following SEPs throughout the activity:

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Constructing explanations
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

6. Evidence of Student Learning

Teachers may collect the following artifacts:

- Balloon design sketches
- Material comparison charts
- Heat-flow or convection models
- Launch observation notes
- Flight-time or ascent-rate data
- Student explanations or written reflections
- Team collaboration rubrics