

# Rocketry Pathway — Teacher's Guide

A walkable, 4-station STEM discovery loop that doubles as a ~1-mile movement session.

Grade Level: 5–12

Duration: 45 min (extendable)

Subjects: Science · Health · PE

Format: Walkable Pathway (4 stations)

Quiz Gate: 80% to advance

Loop: ~1 mile

## 1. Overview & Learning Objectives

Students physically walk a four-station loop that traces a rocket's journey from launch pad to Mars and back. At each station they read one concept (**Learn It**), do a 60–90 second movement challenge (**Live It**), share a takeaway (**Share It**), and must pass an 80% quiz gate to unlock the clue to the next stop. The walk is designed so the full loop totals roughly one mile — making this a graded science activity and a cardio movement session at the same time.

- 1 Identify and define the four core systems of a rocket mission: propulsion, guidance & navigation, life support, and re-entry.
- 2 Demonstrate comprehension of how each system works using Newton's Third Law, friction, orbital motion, and gas exchange.
- 3 Apply critical thinking by completing a physical challenge that models each engineering concept and passing the quiz gate.
- 4 Connect rocketry science to their own body — breathing rate, balance, friction, and reaction force — and to real-world health and movement.

## 2. Standards Alignment

*Codes below are real framework identifiers; confirm current edition with your district as frameworks are periodically revised.*

### NGSS — Next Generation Science Standards

MS-PS2-1 Forces & Interactions (Newton's Third Law)    MS-PS2-2 Motion & change in motion

MS-PS3-2 Energy transfer (friction → heat)    MS-LS1-3 Body systems / gas exchange

HS-PS2-1 Newton's Second Law (extension)

### SHAPE America — National PE Standards

Std 1: Motor skills & movement patterns (walking, jumping, balance)

Std 3: Physical activity & fitness knowledge

Std 5: Recognizes value of physical activity

### NHES — National Health Education Standards

NHES 1: Core Concepts (body systems, breathing)

NHES 7: Self-Management (activity, healthy habits)

## ISTE — Student Standards

1.1 Empowered Learner

1.3 Knowledge Constructor

1.6 Creative Communicator

ISTE applies via the QR-token check-ins, the digital quiz gates, and the Share It posts.

## ASCD Whole Child

Healthy

Engaged

Challenged

## 3. Materials & Setup

Item	Detail
Station signs / QR tokens	4 placards (see printable Placard & Route-Map set). Each shows the station name and the QR token that opens the pathway. Laminate for outdoor use.
Route map	One printed loop map posted at the start. Mark your own spacing (see below).
Devices	Phones/tablets — students scan the token or open the pathway link. The module works offline once loaded.
Space	Schoolyard, gym, hallway loop, track, or nearby park. No purchased equipment required.
Reflection sheet	One printed copy per student (Section 6).

**Spacing the ~1-mile loop.** Target  $\approx \frac{1}{4}$  mile between stations. Easy references: 1 lap of a standard outdoor track  $\approx \frac{1}{4}$  mile, so place a station at each "corner" of a 4-lap plan; or  $\sim 400$  of an adult's steps  $\approx \frac{1}{4}$  mile. **Re-space freely** for your space — in a gym or hallway, run multiple short laps between stations and tell students the target total distance. Distances are guidance, not gospel; the science and the movement both still work at any spacing.

## 4. Timing

Phase	45-min Class Period	Extended (2 periods / field day)
Briefing & hook at start line	5 min	10 min + warm-up
Walk + 4 stations (Learn/Live/Share + gate)	32 min ( $\sim 8$ min/station)	60 min, full $\frac{1}{4}$ -mile legs
Finish: badge, distance log, debrief	8 min	20 min debrief + reflection sheet

## 5. Facilitation Notes

**At the start (launch pad):** Open with the hook — *"A rocket lifts off by throwing mass downward. What in your own body throws the ground backward so you can move forward?"* Hand out devices, point out the route map, set the class distance goal.

**Mid-walk:** Roam between stations. Spot-check the Live It challenges (wall push-off, heel-to-toe gyro walk, breath-rate count, friction rub). Encourage students who pass a gate early to mentor peers walking behind them. Keep pace safe — walking, not racing.

**At the finish:** Celebrate Marstronaut badges, total the class miles toward the 26.2-mile "land on Mars" goal, and run the debrief questions below before collecting reflection sheets.

## 6. Assessment

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**Quiz gates (formative):** Each station has 2–3 multiple-choice questions; 80% unlocks the next station, and every question shows an explanation. Gate pass-rates and coins give you a quick read on comprehension per concept.

### Debrief discussion (3 questions):

1. *Surprise:* Which station's idea surprised you most — and why?
2. *Mechanism:* Explain in your own words how a heat shield protects astronauts coming home.
3. *Application:* Your breathing sped up after the jumping jacks. How is your body solving the same problem a spacecraft's life-support system solves?

### Printable reflection worksheet:

**Marstronaut Mission Log — Name:** \_\_\_\_\_

My resting breaths/min: \_\_\_\_\_ After exercise: \_\_\_\_\_ Why it changed: \_\_\_\_\_

\_\_\_\_\_

The station I understood best and one fact from it: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

One thing about rockets — or my own body — I want to learn more about: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## 7. Gamification

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- **Coins:** 25 Live It! coins per station gate passed (100 for the full loop).
- **Badge:** "Marstronaut Wings" for completing all four stations.
- **Class distance goal:** every finisher adds ~1 mile toward a 26.2-mile class total — a "marathon to Mars." This is the movement payoff that ties the science walk to a fitness target.
- **Share It:** each station ends with a one-line takeaway to tell a teammate or post; the finish offers a shareable "I'm a Marstronaut" message.

## 8. PE Crossover Note

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**For the PE teacher:** This is one activity that counts twice. Students log roughly a mile of walking plus four short bursts of movement (jumping, balance, calisthenics, controlled deceleration), so it satisfies a moderate-activity session *and* delivers graded, standards-aligned science content. Frame it as a station circuit: the "rest" between exertion is reading and answering — active recovery with a brain workout. Pair PE and Science classes to co-teach, or run it solo in either subject. The class distance goal turns the whole group into one team chasing a marathon to Mars.

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