Youth Rocketry Program Lesson Plan

Estes Low-Power Model Rockets

Guide: George “Randy” Collins · South Texas

Audience, scope and schedules

Designed for **ages 8–17**, using easy-assembly or preassembled Estes kits matched to readiness and the exact manufacturer age, tool and supervision guidance. Younger children participate in **demonstrations only**, within kit age guidance and supervision.

All activities use **Estes low-power model rockets only**. George “Randy” Collins’ 30 years of high-power rocketry experience is biography; no high-power flights or certifications are included. There are no component or motor interchangeability claims between a large display rocket and an Estes kit.

Six-session lesson format: Session 1 is a 75-minute introduction. Five further learning sessions are 60–75 minutes each. An approved outdoor launch of about 90 minutes is **separate from those six learning sessions** and occurs before the final reflection, or students use a video alternative. Confirm its timing, staffing and fee before budget approval.

Eight-session core: Adds assembly and analysis time and includes supervised launch, recovery and reflection in session eight, subject to conditions. See the distinct eight-session schedule below. Confirm session lengths and launch arrangements.

Twelve-session advanced / extended format: Additional low-power learning time; exact sequence, session lengths and launch arrangements must be confirmed. It does not add high-power flights or certification.

Learning outcomes

By the end of the introductory lesson, each student works toward:

1. Identifying **five rocket parts**.
2. Explaining **three functions**.
3. Giving **two safety rules and their reasons**.
4. Demonstrating **Stop and step back**.
5. Setting a **personal learning goal**.

Ask every student: **“What would you like to learn from rocket classes?”** Accept spoken, drawn, written or dictated goals. Revisit goals throughout the program.

Guide preparation

Secure a large **unpowered display rocket** before student access. Remove motors, igniters and energetic recovery materials. Disconnect batteries. Use an **inert motor mockup** only for comparison. Do not introduce live energetic materials into student display or dry-practice activities.

Prepare the exact Estes kit and instructions, component labels, parachute or streamer, measuring tools, pencils and student logs. Show one display part at a time and help students locate the equivalent kit part. Compare **shared functions only**; do not claim that display components or motors can be interchanged with kit components or motors.

Follow manufacturer age and tool guidance. Arrange permissions, sufficient adult supervision, emergency procedures, an approved site, compatible launch and recovery equipment, and kit-listed certified commercial

motors. Check weather, fire restrictions and local requirements. Follow current Estes instructions and the current NAR Model Rocket Safety Code.

Introductory lesson — 75 minutes

Time	Activity	Guide / student focus
0–10 min	Welcome and goals	Ask what each student wants to learn. Accept spoken, drawn, written or dictated goals.
10–20 min	Safety: Stop and step back	Practice Stop, Ask, Verify. Pause immediately when unsafe or unclear.
20–40 min	Display-to-kit comparison	Show one inert part at a time; students find the kit equivalent. Compare function, not interchangeability.
40–55 min	Paired labels and functions	Partners label parts, explain jobs and make appropriate measurements.
55–65 min	Dry countdown and permissions	With disconnected equipment, practice countdown, stop and recovery permission.
65–75 min	Scenarios and exit tickets	Five parts, three functions, two rules with reasons, Stop / step back, next goal.

Parts and functions

Part	Shared function / explanation
Nose cone	Forms the rocket’s front.
Body tube	Connects and houses the parts.
Fins	Help stability and alignment.
Motor mount / retention	Holds and retains the kit-compatible motor.
Inert motor mockup	Distinguishes motor thrust from recovery. Use a teaching mockup, not a live motor in practice.
Parachute / streamer	Slows descent as the rocket’s recovery system.
Shock cord	Keeps sections connected during recovery.
Launch lug	Guides the rocket on its compatible launcher.

Students label and measure inert parts, compare recovery systems, and rehearse roles with disconnected equipment. The responsible adult handles **motor selection, installation and ignition**. Students **never modify motors or make propellant**.

Safety at every session

> **STOP. ASK. VERIFY.** Stop immediately, step back and resolve concerns before continuing.

Follow the **exact Estes kit and equipment instructions** and the **current NAR Model Rocket Safety Code**. The Guide may stop or postpone any activity.

- Use tools and materials only with permission and appropriate supervision.
- Adults handle unaltered, kit-listed certified commercial motors, motor selection, installation and ignition. Students do not modify motors or make propellant.
- Stay behind the marked boundary. Follow the countdown and watch the flight.
- Never approach a misfire independently. The launch official controls shutdown, the required wait and any approach under the current official instructions and safety code.
- Recover only after clearance. Avoid roads, power lines, trees, water and restricted or otherwise hazardous areas.
- Accept weather, fire and site delays. Site rules, local requirements and the written safety plan apply throughout.

These classroom rules do not replace the full official safety code, exact kit instructions or a written venue-specific safety plan. Adults establish the required distances, site dimensions, weather limits and misfire procedures from the current official guidance for the chosen equipment and motors.

Dry rehearsal — no energetic materials

Mark a clear boundary. Disconnect equipment and use inert mockups. Assign readers and observers. Rehearse inspection, countdown, stopping, a simulated misfire and recovery permission. Check that all students understand the boundary and the difference between an inert practice and an authorized flight.

Approved outdoor launch — about 90 minutes

Adjust the schedule to the group and conditions; this is not an automatic flight authorization.

1. Confirm attendance, permissions, adults, emergency procedures and briefing. Establish and review boundaries.
2. The adult checks the model, kit-listed motor compatibility, launch equipment and recovery equipment, plus the approved site, current rules, weather and fire conditions.
3. The Guide / launch official authorizes **each flight** only after readiness checks and range clearance.
4. Students observe and log the flight. Recovery occurs only after explicit clearance and only in safe areas.
5. Debrief observations, teamwork and safe decisions.

If conditions are unsuitable, rehearse or use video for observations and reschedule the outdoor launch. The Guide may stop or postpone. Never attempt a flight to satisfy a calendar deadline.

Six learning sessions — separate outdoor launch

Session	Learning focus	Evidence of learning
1 · 75 min	Display / kit comparison, goals and safety	Identify parts; demonstrate Stop and step back.
2 · 60–75 min	Inert forces, stability and measurement	Explain fins and balance; record measurements.
3 · 60–75 min	Exact kit assembly; Guide checks joints and alignment	Complete a quality checklist and report issues.

Session	Learning focus	Evidence of learning
4 · 60–75 min	Kit-directed recovery using inert materials	Explain recovery functions; identify and report concerns.
5 · 60–75 min	Launch rehearsal with disconnected equipment	Demonstrate boundaries, countdown, stopping and recovery permission.
Separate approved launch · about 90 min	Adult-authorized flights, observation and cleared recovery	Flight notes and safe behavior; or video observations if launch is unsuitable.
6 · 60–75 min	Reflection after the separate launch or video	An observation, a lesson learned and a next learning goal.

The separate launch is not a seventh learning session hidden inside the six-session allowance. Confirm the launch's timing, staffing, Guide fee and any additional costs separately.

Eight-session core — distinct schedule

Session	Learning focus
1	Welcome, safety, rocket parts and team roles
2	How rockets fly: thrust, gravity, drag and stability
3	Exact kit instructions, components and build sequence
4	Guided assembly, safety and quality checks
5	Recovery system preparation and inspection
6	Flight predictions, weather and launch roles
7	Launch rehearsal and readiness checklist
8	Approved supervised launch, recovery, debrief and celebration

This format adds time for assembly and analysis. Confirm session lengths and launch arrangements. Conditions can postpone the outdoor launch; rehearsal or video remains the alternative while rescheduling.

Age and readiness adaptations

Ages 8–11: Pictures, labels, short explanations and adult-assisted tasks. Stay within kit age guidance.
Ages 12–13: Measurements, build logs and predictions. Encourage explanations supported by observations.
Ages 14–17: Stability, data and technical records. Connect work to aerospace careers while retaining the same low-power and adult motor-handling limits.
Younger children: demonstrations only, per manufacturer guidance and supervision. Grade-based pathways do not override readiness or kit requirements.

Assessment, reflection and recognition

Use an exit ticket: **five parts; three jobs; two safety rules and reasons; a next goal**. Observe the Stop / step back demonstration. Spoken, drawn, written or dictated responses are acceptable.
Reteach **stopping, boundaries, adult motor handling and recovery clearance before flight** if any student is unsure. Flight eligibility follows Guide readiness and range clearance, not completion of an exit ticket alone.
Maintain build logs and checklists. With permissions, photos and a team presentation document skills, teamwork and lessons learned. Revisit personal goals. Class recognition is for **learning and safety, not certification**. Club

discussion emphasizes responsible participation and current rules without implying a club affiliation or endorsement.

Planning allowances

Guide fee: **$175 per facilitated session**. Estimates are for a **12-student cohort**, not final quotes.

Format	Guide fee	Estimated cohort total
6-session pilot	$1,050	$2,975
8-session core	$1,400	$3,677
12-session advanced / extended	$2,100	$5,114

Eight-session allowances: kits and consumables $1,020**;reusableequipment**$600; launch supplies / logistics $450**;contingency**$207; Guide $1,400**.Total**$3,677, about **$306 per student**. Equipment reuse can reduce future cohort costs.

All totals remain allowances until kit, motor, consumable, equipment, logistics and site quotes confirm final pricing. For the six-session format, confirm separate launch timing, staffing and fee before approval.

Start with an eight-session, 12-student pilot. Confirm ages, readiness, exact kits and dates. Approve the final budget and written safety plan with permissions, adult supervision, emergency procedures and launch venue.

Required resources

Use the supplied manufacturer instructions for the exact **Estes model and compatible launch equipment**. Also consult:

- Estes education safety resources
- Current NAR Model Rocket Safety Code

Official links do not imply affiliation or endorsement. This lesson handoff is not flight certification, a reservation or a substitute for site approval and the current official safety requirements.