Teacher Notes

Unit 5 · Rockets, Orbits & Missions · Ages 9–14. Each page works on its own. Mix levels freely: ★ Explorer (ages 9–10), ★★ Navigator (11–12), ★★★ Commander (13–14). Figures are rounded; gravity is shown relative to Earth.

Page	Activity	Level	Time	Materials / notes
2	Mission Briefing	★	15 min	Read aloud.
3	Rocket Anatomy	★/★★	25 min	Pencil. Stacking order is bottom to top.
4	Newton & Orbit Math	★★/★★★	35 min	Calculator.
5	Morse Code	★★	25 min	Pencil; optional tapping game.
6	Timeline	★/★★	25 min	Scissors, glue.
7	Spacecraft cards 1	★	20 min + play	Scissors.
8	Spacecraft cards 2	★	20 min + play	Scissors; blank cards for inventing spacecraft.
9	Rocket Numbers	★★/★★★	35 min	Calculator; plot the graph.
10	Straw Rocket Lab	★★	45 min	Paper, straws, tape, tape measure. Do outdoors.
11	Go / No-Go	★★★	25 min	The solution is unique.
12	Crossword	★★	20 min	No accents.
13	Launch Day	★	20 min	Scissors.
14	Create a Rover	★/★★	35 min	Colored pencils.
15	Unit Review	★–★★★	25 min	Quiz out of 20 points.
16	Mission Log	★	10 min	Self-assessment.

Figures are rounded. Dates and specifications are from NASA/ESA public sources.

Pages 2–9

Page 3

A–F: A **Launch abort system** · B **Orion capsule + service module** · C **Upper stage and adapter** · D **Core stage** · E **Solid rocket boosters** · F **RS-25 engines**. Stacking order: 1 **Solid rocket boosters** · 2 **Core stage** · 3 **RS-25 engines** · 4 **Launch vehicle stage adapter** · 5 **Upper stage (ICPS)** · 6 **European Service Module** · 7 **Orion crew capsule** · 8 **Launch abort system**. ★ **Launch abort system**.

Page 4

1) **The fastest path, a circle around Earth**. 2) **4,209 mi**; 2 × 3.14 × 4,209 = **26,446 mi**. 3) 26,446 ÷ 17,500 = **1.5 h** = **91 min**. 4) 24 ÷ 1.5 = **15.9** ≈ **16**. 5) **4.9 mi/s**.

Page 5 · Morse

1) **EARTH CALLING MARS** · 2) **ROVER LANDED SAFELY** · 3) **LIFTOFF IN TEN SECONDS**. SOS: **SOS**.

Page 6 · Timeline

1957 → **1961** → **1969** → **1977** → **1990** → **2000** → **2021** → **2022**. 1) **4**. 2) **53**; **Voyager (1977)**. 3) **26**.

Page 9 · Rocket numbers

1) 8,800,000 ÷ 5,750,000 = **1.5**; **1**. 2) 322 ÷ 100 = **3.2**. 3) 484 − 132 = **352 s**; 484 ÷ 60 = **8.1 min**. 4) **2,188 mph**. 5) 4 × 24 = **96 h**; 238,855 ÷ 96 = **2,488 mph**. 6) 25,000 ÷ 550 = **45**.

Pages 10–15

Pages 10–12

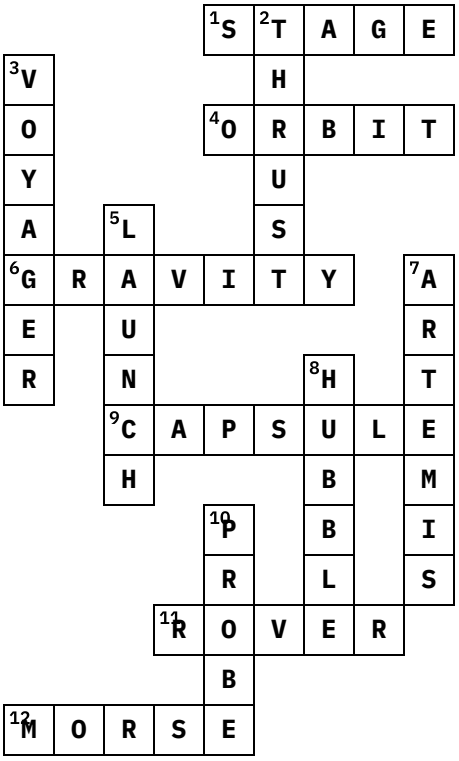
Page 10

Expected: 45° usually goes farthest. Repeating trials reduces random error.

Page 11 · Go / No-Go

Flight: **GO** · Guidance: **GO** · Propulsion: **NO-GO** · Weather: **NO-GO** · Range Safety: **GO** · Crew: **GO**. 1) **No — hold the launch**; **Propulsion**.

Page 12 · Crossword



Pages 13–15

Page 13 · Launch day

1. **The crew wakes up and eats breakfast.**
2. **The crew puts on their orange launch suits.**
3. **The crew rides to the launch pad.**
4. **The crew climbs into the Orion capsule.**
5. **Mission Control polls every station: Go or No-Go.**
6. **The countdown reaches T–10 seconds.**
7. **Boosters ignite: LIFTOFF!**
8. **The solid boosters separate (about 2 minutes up).**
9. **The core stage shuts down (about 8 minutes up).**
10. **Orion reaches orbit around Earth.**

1) **10**; **60**; **600**.

Page 15 · Review (20 points)

1. thrust **B**, orbit **D**, stage **A**, probe **C** (4). 2. **It moves sideways so fast that it keeps falling around Earth without hitting it** (2). 3. 1,440 ÷ 90 = **16** (2). 4. **SOS** (2). 5. **Sputnik → Apollo 11 → Hubble → Perseverance** (3). 6. **F** **T** **F** (3). 7–8. Open answers (2 points each).