RDL JR

2025 Official Challenge Manual

MOONBASE

2025 RDL Jr. MOONBASE - Official Field

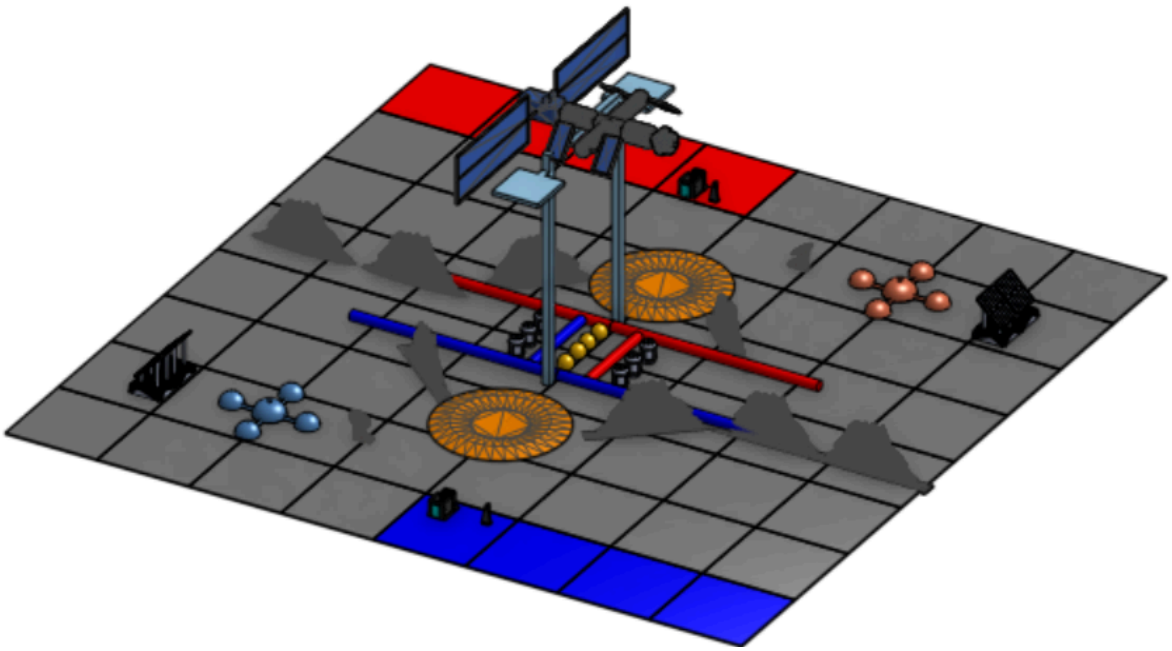

Figure #1. RDL Jr. MOONBASE Field

Three Laws of Robotics

1. *A robot may not injure a human being or, through inaction, allow a human being to come to harm.*

2. *A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.*

3. *A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.*

~Isaac Asimov

And one more….

4. *A robot may not intentionally injure another robot unless the action or inaction conflicts with the First, Second, or Third Laws.*

~ Scooter Willis (Creator of RDL)

Sponsors

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Revisions Date	Page	Notes

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Introduction

Creativity and innovation are key elements to advancing the fields of science, technology, engineering, and mathematics (STEM) into the future. Robot Drone League Junior (RDL Jr.) has been designed to provide students with open-ended challenges that allow for creation and innovation by engaging in hands-on design, engineering, and programming of interactive robots and drones. Students are presented with the opportunity to develop real-world connections to classroom learning. Working with robots in a collaborative game format can be a very powerful tool to engage students and enhance math and science skills through hands-on, student-centered learning. Through participation in RDL Jr, students can develop the essential life skills of teamwork and collaboration, as well as critical thinking, project management, and communication required to become the next generation of innovators and problem-solvers in our global society. The 2025 RDL Jr. MOONBASE Challenge, presented by STREAMWORKS, is designed to inspire students to develop a lifelong passion for learning and pursuing educational and career opportunities in STEM fields by implementing real-world STEM-related problems that require innovative and critical thinking to find solutions.

For additional information, please contact:

Dennis Courtney

Executive Producer | Robot Drone League

CEO | STREAMWORKS

dcourtney@streamworkseducation.org

Please visit www.robotdroneleague.com

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STREAMWORKS

Challenge Overview

RDL Jr. 2025 Challenge: MOONBASE

Establishing the Next Frontier

Dear Robot Drone League Jr. Competitors,

Welcome to the **2025 Robot Drone League Jr. Challenge: MOONBASE!** 🚀

This year, you'll take part in an exciting space adventure inspired by NASA's **Artemis program**—a mission to send astronauts back to the **Moon** and build a place for them to **live and work**! But that's not all—NASA is also using what they learn on the Moon to help astronauts travel even **farther**—all the way to **Mars**! 🌕➡️🚀➡️🔴

Your Mission

Just like real astronauts and engineers, your team will use **robots and drones** to complete **important tasks** to help build and support a **MOONBASE**. Imagine astronauts living on the Moon, doing experiments, and even collecting resources to help future space explorers. Your job is to make sure their base is **ready and working!**

How Artemis Helps Us Explore Space

NASA's **Artemis program** isn't just about going back to the Moon—it's about **staying** there! Astronauts will need special technology and teamwork to survive. There will even be a space station called **Gateway** orbiting the Moon, and some of your robot and drone challenges will connect to its important job!

It's Time to Launch!

Now, it's your turn to **think like an engineer!** You'll design, build, and test **robots and drones** to complete your MOONBASE mission. Just like NASA's team, you'll need **great ideas, problem-solving skills, and teamwork** to succeed.

Are you ready to take on the challenge? 🌟
Let's make history—**one small step for RDL Jr., and one giant leap for space robotics!**

Good luck, teams! The **MOONBASE Challenge** starts now! 🚀

Sincerely,

Dennis M. Courtney

Dennis Courtney
Executive Producer RDL | RDL Jr.
CEO STREAMWORKS Education

How to Play MOONBASE!

Goal of the Game

Your mission is to complete as many tasks as possible in just five minutes! The first one minute is special—it's called the autonomous period, where your robot moves on its own.

The game takes place on a big indoor field, split into two equal sides, like a mirror. Each side belongs to a team: Red Team or Blue Team. Your job? Score more points than the other team!

During the last minute of the game, all the pieces become free to grab, and you can even cross to the other team's side to score more points!

Teams & How Matches Work

🔴 Red Team vs. 🔵 Blue Team

- **Each team has 4 to 6 players working together at the control station.**
- **Teams are picked randomly at the start of the competition.**
- **You will play multiple matches against different teams.**
- **Each time you score points, your team's total goes up!**

At the end of all the matches, teams are ranked based on their scores. The team with the highest score wins and becomes the RDL Jr. Alliance Champion! 🏆

Now, get ready to launch your robots and have fun! 🚀

🚀 MOONBASE MISSION: HELP BUILD A BASE ON THE MOON! 🌕

Welcome to your MOONBASE mission! Your team's robot and drone must work together to help astronauts live and work on the Moon. Get ready for an exciting challenge where you will **build, explore, and complete tasks** just like real space engineers! 🚀

🌟 Mission Goals 🌟

Your robot and drone will need to:

- 🏠 **Build the MOONBASE** – Set up homes, power panels, and satellites for astronauts.
- 🔎 **Explore for Resources** – Find ice and special moon rocks that help make oxygen and rocket fuel!
- ⚡ **Power Up the Base** – Connect power lines and satellites to keep everything running.
- 🆘 **Deliver Emergency Supplies** – Fly medical kits and water to astronauts in need.
- 🛰️ **Dock & Transfer Cargo** – Use your drone to interact with a special space station.

🏗️ MISSION Task #1: Build the MOONBASE!

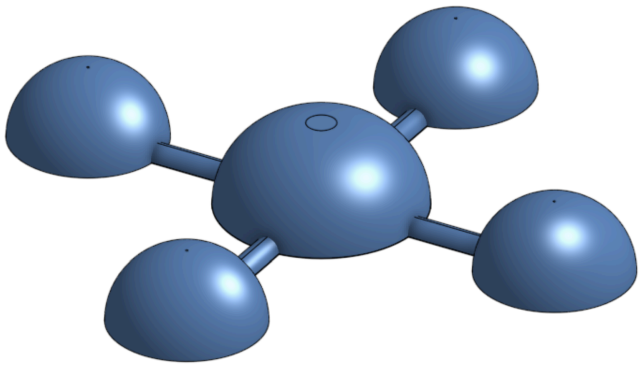

Fig #2. MOONBASE Biospheres

(Earn up to 600 points!)
Your robot or drone will place important base parts where they belong:
✔️ **Tiny Moon Homes** – Place 4 small Biospheres near the big Biosphere Pod.

Be Careful! The biosphere pods contain magnets and will attach to the main structure when in close vicinity (< 25.4 mm).
✔️ **Solar Panels** – Set up two special panels to collect sunlight and generate power for the MOONBASE.
✔️ **Communications Satellite** – Attach a computer chip to the satellite to help astronauts communicate!

Points:

- 🚀 **Autonomous Mode:** 100 points per correct placement.
- 🕹️ **Teleop Mode:** 50 points per correct placement.
  (No points for halfway placements!)

⚡ MISSION Task #2: Power Up & Communicate!

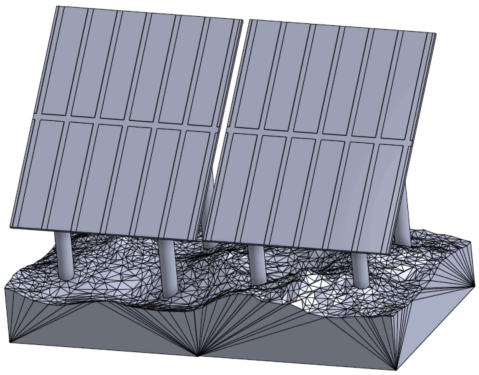

Fig. #3 Ground Solar Panel Array

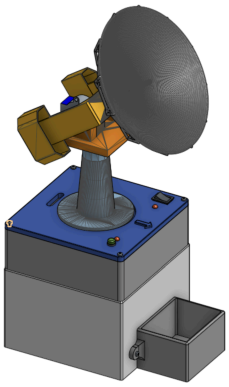

Fig. #4 Satellite Communications

(Earn up to 500 points!)
Your robot or drone will connect power and communication cables to bring MOONBASE to life! The plugs contain magnets and will attach to the main structures when in close proximity (<25.4 mm).
✔️ **Power Cable** – Connect the solar panels cable plug to the Biosphere Pod

to turn on the lights!
✔️ **Satellite Link** – Attach the communication cable plug so astronauts can talk to each other and HQ!

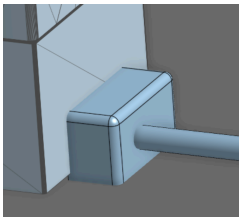

Fig. #5 Antenna Cable Connector

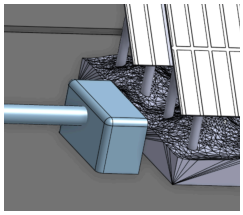

Fig. #6 Solar Cable Connector

✔️ **Encrypt Messages** – Insert a special microchip to protect astronaut messages.

Points:

- 🚀 **Autonomous Mode:** 150-200 points per task.
- 🕹️ **Teleop Mode:** 75-100 points per task.

Fig. # 7 Microchip

🛰️ MISSION Task #3: Aerial Survey & Marking

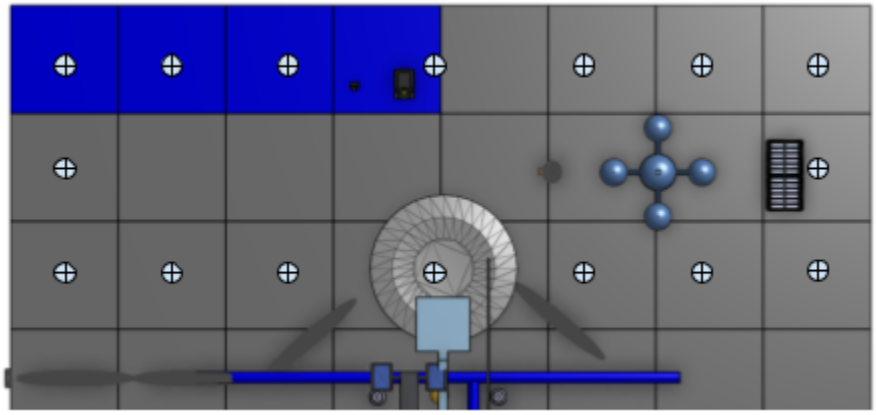

Fig. #8 Aerial Survey Waypoints

(Earn up to 600 points!)
Your drone will **fly over the Moon**, scanning for good places to set up new astronaut bases!
✔️ **Fly the Survey Route** – Your drone must follow a set path in the sky.
✔️ **Mark Locations** – Drop markers in good spots for future explorers!

Points:

- 🚀 **Autonomous Mode:** 200 points per correct flyover/marker.
- 🕹️ **Teleop Mode:** 50 points per correct flyover/marker.

🔬 MISSION Task #4: Deploy Tools & Sensors

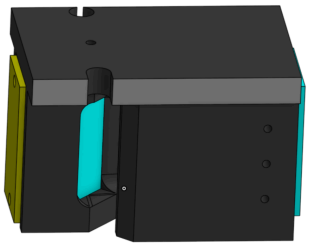

Fig. #9 Mass Spectrometer

Fig. #10 Space Drill

(Earn up to 800 points!)
Your team will **drop special tools and sensors** to help scientists study the Moon. Sensors and tools are available at the drive station and may be preloaded onto the robot or drone prior to the start of the match.
✔️ **Place Spectrometer Sensors** – These help scan moon rocks for valuable materials!
✔️ **Deploy Drilling Tools** – Drop tools that astronauts will use to dig into the Moon!

Bonus Points if you place tools **directly touching the markers** placed in the craters where the lunar minerals are located!

Points:

- 🚀 **Autonomous Mode:** 100 points per correct placement (+100 bonus).
- 🕹️ **Teleop Mode:** 50 points per correct placement (+50 bonus).

🌑 MISSION Task #5: Mining & Moon Rock Collection!

Fig. #11 Ice

Fig. #12 Moon Rock

Fig. #13 Helium

Fig. #14 Gold

(Earn up to 5,300 points!)
Your robot will **dig up and collect** important materials for astronauts! All game elements are affixed with velcro.
✔️ **Ice** – Found in craters, this ice can turn into drinking water!
✔️ **Titanium Moon Rocks** – Super strong rocks that help build space stations!
✔️ **Helium** – A special gas used for making power.
✔️ **Gold** – A rare and valuable metal found deep in Moon Rock Alley!

Points:

- 🚀 **Autonomous Mode:** 50-1,000 points per item.
- 🕹️ **Teleop Mode:** 10-150 points per item.

🛰️ MISSION Task #6: Lunar Gateway Space Station Operations

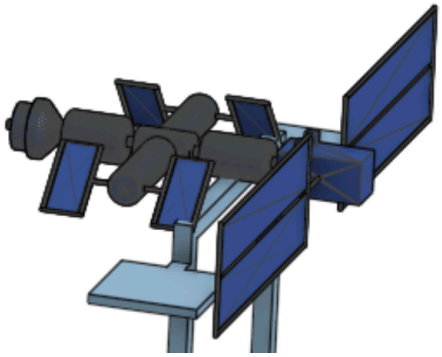

Fig. #15 Lunar Gateway Space Station

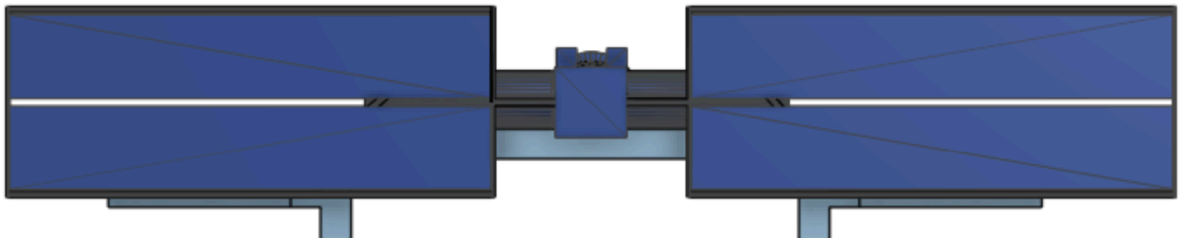

Fig. #16 LGS Solar Array Panels

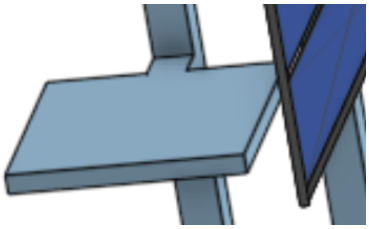

Fig. #17 LGS Docking Platform

Fig. #18 Microchip

Fig. 19# Emergency Supplies

(Earn up to 4,500 points!)
Your drone will **work with the Lunar Gateway**, a space station that orbits the Moon!
✔️ **Inspect Solar Panels** – Check solar panels for damage! Be sure to fly a one time slow inspection maneuver and identify damaged areas of the panels. Don't forget to let the RDL Jr official at the drive station know the action your drone pilot is performing.
✔️ **Dock the Drone** – Land your drone safely for 5 seconds.
✔️ **Encrypt microchip** – Ensure your microchip is attached to the drone and once landed, the encryption starts automatically (Encryption = green lights

illuminates in approximately 5 seconds).
✔️ **Emergency Supply Drop** – Activate the emergency supplies delivered from the LGS and deliver medical kits and water to astronauts! . Once on the lunar surface, the supply pods will need to be moved to the assigned scoring zones at MOONBASE or within the scoring zones at the alliance stations.
Points:

- 🚀 **Autonomous Mode:** 200-300 points per task.
- 🕹️ **Teleop Mode:** 50-100 points per task.
  (Bonus stunt points for a cool drone flip when leaving the station!)

📚 MISSION Task #7: STEM Challenge!

(Earn up to 1,000 points!)
Astronauts need smart problem-solvers! Your team will **answer space-themed STEM questions** from the mission control screen located at the alliance drive station.

Points:

- 🚀 **Autonomous Mode:** 200 points per correct answer.
- 🕹️ **Teleop Mode:** 100 points per correct answer.

🚀 Are You Ready for the Challenge?

You are part of a special astronaut team that will **build, explore, and keep MOONBASE running**! Get your **robot and drone ready**, follow the mission plan, and **work as a team** to complete as many tasks as possible. 🌕✨

Good luck, space explorers! 🛰️🏆

Robot Drone League Jr. Competition Rules (Student Version)

Autonomous Period

The match lasts for 5 minutes. The first 60 seconds are called the "Autonomous Period." During this time, teams cannot control their robots or drones by device or controls. Instead, teams must use pre-programmed movements to complete tasks. Teams earn points for any successful actions their robot or drone completes on its own. If something goes wrong during the autonomous period, robots and drones will NOT be reset.

Teleop Period

After the Autonomous Period ends, the next 4 minutes are called the "Teleop Period." During this time, team members can control their robot or drone using remote controls. Even though human control is allowed, teams can still use automatic programming if they want.

Team & Game Setup

Team Organization

- **Teams can have as many members as they want, but only six people can be in the driver's station at one time.**
- **There are special areas for teams to watch the game and a separate pit area for working on robots and drones.**

Drive Stations

- **The drive station is the area where teams control their robots and drones.**
- **Each team must pick a "Drive Station Captain" to help with strategy and talk to officials.**
- **Robots and drones must start in their designated spots and bring collected objects to the drive station for points.**
- **No one is allowed to reach into the game field—doing so will result in a penalty.**

League Guidelines

Season Schedule

- **The Robot Drone League Jr. season runs from early fall through spring.**
- **Teams must be guided by teachers or mentors, but only students are allowed to build, program, and compete with their robot and drone.**
- **RDL Jr recommends weekly team meetings and snacks!**

Team Showcase Video

- **Teams must submit a 5 to 7-minute video by March 1, 2026 to qualify for Nationals. Regional videos must be submitted one week prior to the event date.**
- **The video should show off the team's robot, drone, and any extra tools (like grippers or hooks).**
- **Teams should also talk about how they raised money, helped their community, and managed their projects.**
- **Teams can include up to 10 pages of extra documents, like engineering notebooks or reports.**
- **Teams are encouraged to be creative and demonstrate maximum STEM FUN!**

Engineering Notebook (Required)

- **Each team must keep an engineering notebook that records everything they do during the season.**
- **The notebook should include designs, outreach efforts, budgets, and what they learned.**
- **It must have the team number and school name on the front.**
- **Only one notebook per team can be submitted, and it must be turned in before the competition ends.**

Safety Rules

General Safety

- **Safety is the most important rule at RDL Jr. events!**
- **No one can reach into the game field.**
- **Mentors cannot coach during a match.**
- **All players in the driver's station must wear:**
    - **Closed-toe shoes**
    - **Safety glasses (required!)**

    - **Hair tied back**
    - **No loose clothing or jewelry**

Robot & Drone Safety Checks

- **Every robot and drone must pass a safety check before competing.**
- **Teams will receive a safety sticker once their robot and drone pass inspection.**
- **Unsafe robots or drones will not be allowed to compete.**

Robot Rules

- **Robots must be a certain size (dims to be announced) and have no exposed wires.**
- **Robots must have an ON/OFF switch.**
- **No sharp edges or hydraulic systems allowed.**
- **Pneumatic (air-powered) systems must have a pressure limit of 50 PSI.**

Drone Rules

- **Drones must meet size limits (dims to be announced).**
- **Propellers must be protected by covers.**
- **Drones must be programmed safely.**
- **When not in use, propellers should be removed.**

Game Play & Penalties

Team Members

- **Only students in the driver's station can control robots or drones.**
- **No outside help is allowed during the match.**
- **If a robot or drone breaks, an RDL Jr. official will return it to the driver's station.**

Team Pit Area

- **Each team gets a special "Pit Area" to work on their robot and drone.**
- **Testing is not allowed in the Pit Area—there will be a separate practice zone.**

Scoring & Challenges

- **Each team should have a Scoring Captain to track points.**
- **If there's a scoring mistake, the Scoring Captain can ask two officials to review it.**

- **Only students can request a scoring review—adults cannot help.**

Game Setup & Field Reset

- **Teams have 3 minutes to set up before a match and 3 minutes to clean up afterward.**
- **Officials reset the field between matches.**

Penalties

- **Yellow Card = Warning for breaking rules.**
- **Red Card = 50-point deduction + team sits out next match.**
- **Serious violations (like cheating or unsafe behavior) can lead to disqualification.**

Examples of Penalties

- **Blocking another robot or drone on purpose = Yellow Card**
- **Crashing a drone into another team's robot on purpose = Red Card**
- **Messing with another team's controller = Immediate Disqualification**

Mentorship Rules

Mentor Guidelines

- **Mentors can teach students but cannot build the robot or drone for them.**
- **Mentors, parents, or adults cannot work on a robot during a competition.**
- **If a judge sees an adult helping too much, the team could be disqualified from awards.**

Final Thoughts

The 2025 RDL Jr. MOONBASE Challenge is designed to be fun and exciting! However, rules might be updated throughout the season to keep things fair and clear. Be sure to check for updates and always follow the rules of safety, fairness, and teamwork!

Awards

Professors Champions Award – Awarded to the top team that encompasses the overall best in competition, both on and off the challenge field. Awarded to the team demonstrating the best of community outreach that helps to promote STEM learning in an individual community. An engineering notebook and team Showcase video are required for award consideration.

The following factors are taken into consideration for this prestigious award:

Challenge field scores

Team Showcase presentation

Community Outreach

Tournament Professionalism

Collaborative Spirit

Top Score Award – Awarded to the 1st place team based solely on scores finalized at the end of the challenge field play.

Engineering Award – Awarded to the team that best demonstrates innovation in design and provides best evidence of documented engineering practices to a panel of SME professionals. An engineering notebook and team Showcase video is required for award consideration.

Judges Award* – Awarded to the team that best demonstrates team grit and tenacity no matter the scoreboard. *Note* (This award is optional and awarded at the discretion of the Head Judge).*

Top Dog Award – Awarded to the team demonstrating the highest competition autonomous scores.

Top Rookie Award – Awarded to the best of the best Rookie team competing in their first RDL season. An engineering notebook and team Showcase video is required for award consideration.

Scoring rubrics can be found online at www.robotdroneleague.com

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Sample STEM Questions for RDL Jr.

1. What does an astronaut do?
A. Flies airplanes on Earth
B. Explores space and works on spacecraft
C. Builds houses
D. Teaches music

Answer: B. Explores space and works on spacecraft

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2. Which planet is known as the "Red Planet"?
A. Mars
B. Saturn
C. Mercury
D. Neptune

Answer: A. Mars

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3. What do astronauts wear to stay safe in space?
A. Pajamas
B. Raincoats
C. Space suits
D. Lab coats

Answer: C. Space suits

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4. Which tool helps scientists see stars and planets far away?
A. Microscope
B. Telescope
C. Periscope
D. Sunglasses

Answer: B. Telescope

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5. What do we call the big group of stars, planets, and space dust we live in?
A. Solar System
B. Jungle

C. Ocean
D. Continent

Answer: A. Solar System

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6. Which planet has rings around it?
A. Earth
B. Saturn
C. Mars
D. Venus

Answer: B. Saturn

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7. What does the Moon do?
A. Stays still and never moves
B. Spins and orbits Earth
C. Floats on the ocean
D. Lights up the Sun

Answer: B. Spins and orbits Earth

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8. What is a rocket used for?
A. Driving on roads
B. Taking people and tools into space
C. Flying like a bird
D. Sailing in the ocean

Answer: B. Taking people and tools into space

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9. Who was the first person to walk on the Moon?
A. Albert Einstein
B. Neil Armstrong
C. Buzz Lightyear
D. Sally Ride

Answer: B. Neil Armstrong

Robot Drone League Standards Alignment

For a complete listing of state curriculum standards and alignment with the Robot Drone League annual STEM challenge, please visit RDL Curriculum Standards.

Don't see your state curriculum alignment standards?
Email us at dcourtney@streamworkseducation.org for additional information.