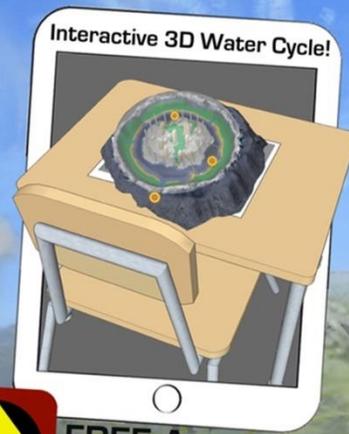




# THE ROCKWELL ADVENTURES™

# WATER CYCLE ENGINEER



**FREE Augmented Reality App!**



**FREE DIGITAL EDITION**

## **3D INTERACTIVE ADVENTURE!**

- Explore the Water Cycle At Two Moon Bases
- Immersive 3D Virtual Environments
- Correlated to State & National Standards
- Pre & Post Exploration Tests
- Water Cycle Design Challenge

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## A Letter From StoneOak Media

March 27, 2020

Dear Educators and Parents:

We at StoneOak Media wanted to take the time to send a message of hope (and help) to everyone facing the challenges that COVID-19 has brought into our collective daily lives.

We've heard from so many of you over the past few weeks, about the difficulties you're facing. Many of you are now spending a great deal of time at home with your children, as you follow the recommendations of government health officials, and attempt to socially distance yourselves from the broader community. Trying to remain productive under these circumstances, while also engaging your children and furthering their education can be a significant challenge! It's a challenge we would like to help address.

We've recently had a number of conversations internally, and with our long-time collaborators at Zappar, about how we could leverage our cutting-edge educational content to contribute in some way during this time of collective community sacrifice. To this end, we've decided to provide several of our products that can be readily distributed via electronic means, **FREE OF CHARGE** for the next few months. This workbook is one of those products. We've enabled the digital content associated with these books to be active through August 1st, 2020, which should hopefully be enough time for life everywhere to return back to a better level of normal.

We extend our thanks to the heroic efforts of medical staff across the globe, risking their lives to help contain this virus and minimize its impacts. Our thanks also goes out to the educators and parents who are working hard to provide a sense of normalcy to students everywhere. Like everything else, this too shall pass. When it does, and our children grow old and think back to this time, it is our hope that they do so with happy memories of time with family, time to relax, and even time to learn with some engaging content. We're happy to contribute in our own small way towards making this happen.

Thanks again for your support, and stay safe!

Sincerely,

The StoneOak Media Team!

# THE ROCKWELL ADVENTURES® WATER CYCLE ENGINEER FREE LIMITED TIME DIGITAL EDITION

ISBN: 978-0-9970192-2-3

vWCE\_5.0

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## Getting Started: Step 1) Install the Zappar Augmented Reality App



This lesson requires the use of the FREE *Zappar* Augmented Reality application for iOS/Android tablets and smart phones. Students will use this application to scan *Zapcodes* (the circular symbol at the top of certain pages) within this book, which will activate a variety of 3D content within the lesson. The digital content associated with the zapcodes included in this complimentary lesson will expire on August 1<sup>st</sup>, 2020.

## Getting Started: Step 2) Distribute and Print Lesson



**IMPORTANT:** To complete this lesson, distribute copies of this PDF to each student in your class. Ask that their parents print pages 6 - 24. Note that the answer key for this lesson is contained on page 4 and 5. . If you/they are interested, **StoneOakMedia.com** also has additional FREE easy to download and print resources that can be used to enhance this lesson.

## Getting Started: Step 3) Launch the Zappar App and Complete Lesson

Once students have printed pages 6 - 24 of this workbook, and installed the Zappar app, have them complete the mission using the following steps:

**1** Launch the Zappar app



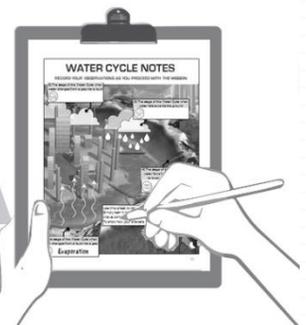
**2** Scan Zapcode



**3** Explore 3D Content



**4** Take Notes As You Explore nts



Visit us online at [www.StoneOakMedia.com](http://www.StoneOakMedia.com) for more exciting titles!

# WATER CYCLE NOTE SHEET: ANSWERS

(FOR TEACHERS)

## WATER CYCLE NOTES

RECORD YOUR OBSERVATIONS AS YOU PROCEED WITH THE MISSION

2) The stage of the Water Cycle when water changes from a gas into a liquid



**Condensation**

3) The stage of the Water Cycle when water falls towards the ground



**Precipitation**

4) The stage of the Water Cycle when water flows from where it initially fell to lower places where it pools



**Collection**

1) The stage of the Water Cycle when water changes from a liquid into a gas



**Evaporation**

Use this sheet to take notes as you go  
Simply tear it right out of this book  
We've completed the first entry for you  
To show how your answers should look



# QUIZ ANSWERS

(FOR TEACHERS)

1) WHICH STATEMENT BEST DESCRIBES THE WATER CYCLE? (Check the box)

- Water moving through pipes within a building
- The movement of water within our environment that makes clouds and rain
- Water currents moving within the ocean

2) IN WHICH STAGE OF THE WATER CYCLE DOES MOISTURE RISE?

**Evaporation**

3) IN WHICH STAGE OF THE WATER CYCLE DO CLOUDS FORM?

**Condensation**

4) IN WHICH STAGE OF THE WATER CYCLE DOES IT RAIN?

**Precipitation**

5) IN WHICH STAGE OF THE WATER CYCLE DOES WATER COLLECT?

**Collection**

6) WHAT ARE CLOUDS MADE OF?

**Clouds are a collection of droplets of water**

7) WHAT ROLE DOES THE HEAT PLAY IN THE WATER CYCLE?

**Heat provides the energy that makes the water cycle possible.  
It drives Evaporation, which is the first step of the water cycle.**

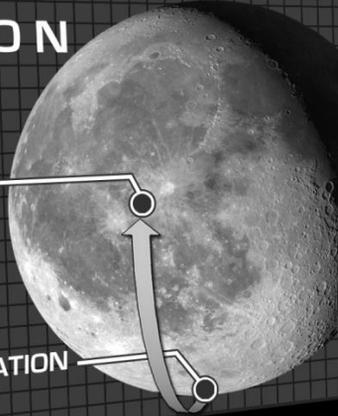
# THE ROCKWELL ADVENTURES

## WATER CYCLE ENGINEER

### THE MOON

STOP #2:  
NEW BASE UNDER  
CONSTRUCTION

STOP #1:  
SHACKLETON STATION  
(YOU ARE HERE)



Hi, I'm Chip Rockwell, and let me be the first to welcome you to the Moon! We've brought you here to work on a mission that will help us complete a nearby Moon base.

Our mission begins at this base at the south pole of the Moon. Once we complete our work here, we'll then travel to a new base further north to complete the rest of the mission.

# MISSION

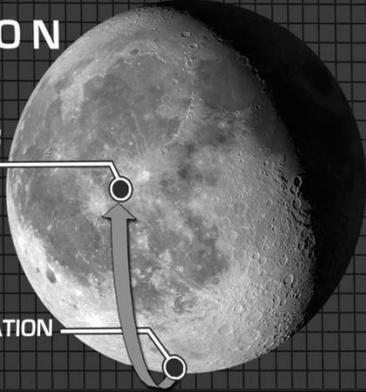
SCAN THIS PAGE TO ENTER THE BASE



## THE MOON

STOP #2:  
NEW BASE UNDER  
CONSTRUCTION

STOP #1:  
SHACKLETON STATION  
(YOU ARE HERE)



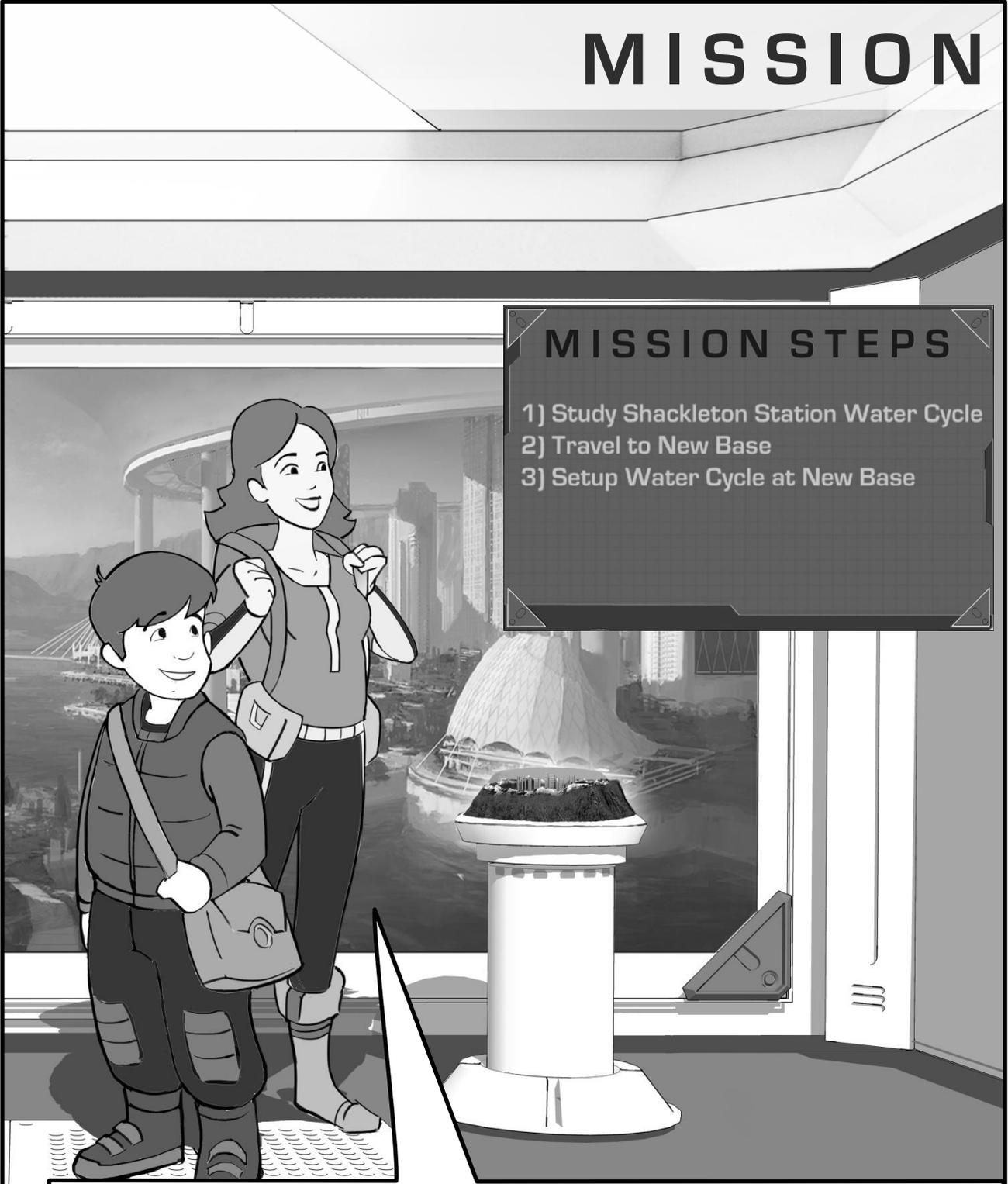
The name of this base is Shackleton Station. We've brought you to the control room for this base so you can see something called a "Water Cycle" at work.

Scan this zapcode to get a closer look at the base and its water cycle. Note Lake Luna and the clouds in the sky. Each are important components of the water cycle.

# MISSION

## MISSION STEPS

- 1) Study Shackleton Station Water Cycle
- 2) Travel to New Base
- 3) Setup Water Cycle at New Base



The term “water cycle” describes what happens when water changes form. It’s a process that moves water through the environment as clouds, rain, and much more.

This screen shows the steps of our mission. We’ll first study the water cycle at this base. Next, we’ll travel to a new base, where you’ll set up their cycle at the end of the mission.

# PRE-MISSION QUESTIONS

Answer each of the following questions, if you can.  
If you don't know an answer, simply leave it blank

1) WHICH STATEMENT BEST DESCRIBES THE WATER CYCLE? (Check the box)

- Water moving through pipes within a building
- The movement of water within our environment that makes clouds and rain
- Water currents moving within the ocean

2) IN WHICH STAGE OF THE WATER CYCLE DOES MOISTURE RISE?

3) IN WHICH STAGE OF THE WATER CYCLE DO CLOUDS FORM?

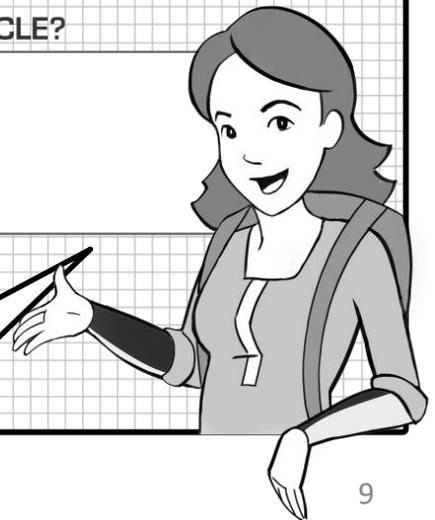
4) IN WHICH STAGE OF THE WATER CYCLE DOES IT RAIN?

5) IN WHICH STAGE OF THE WATER CYCLE DOES WATER COLLECT?

6) WHAT ARE CLOUDS MADE OF?

7) WHAT ROLE DOES THE HEAT PLAY IN THE WATER CYCLE?

To prepare for this exciting mission, we need to ask a few basic questions. These will gauge your knowledge of water cycles. Just follow these simple directions



# WATER CYCLE NOTES

RECORD YOUR OBSERVATIONS AS YOU PROCEED WITH THE MISSION

2) The stage of the Water Cycle when water changes from a gas into a liquid



3) The stage of the Water Cycle when water falls towards the ground



4) The stage of the Water Cycle when water flows from where it initially fell to lower places where it pools



1) The stage of the Water Cycle when water changes from a liquid into a gas



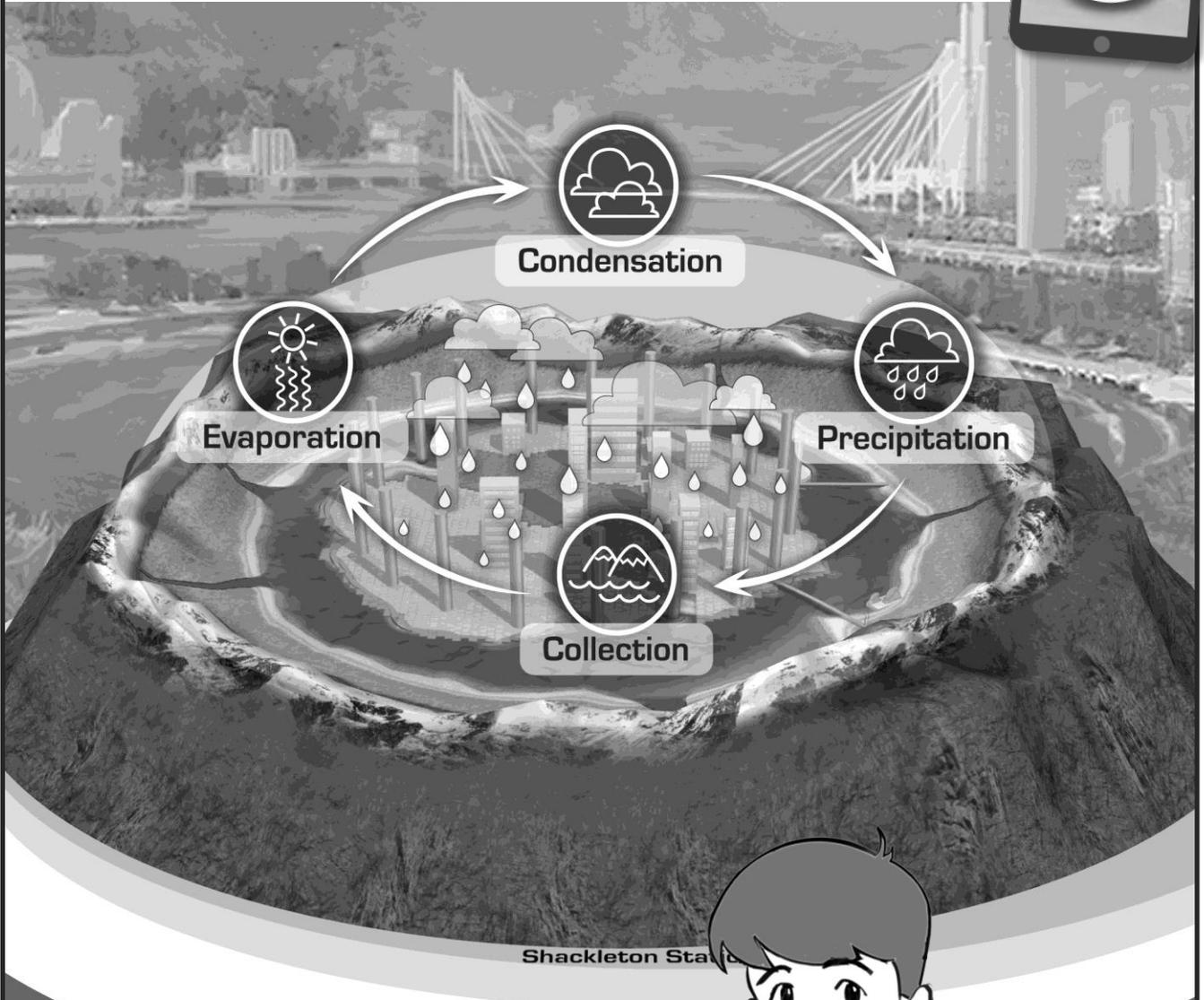
**Evaporation**

Use this sheet to take notes as you go through the mission. We've completed the first entry for you as an example.



# BASE TOUR

SCAN THIS PAGE TO LOAD THE 3D MODEL OF THE BASE



Shackleton Station

We'll start our mission with a tour of the water cycle here at Shackleton Station. We'll utilize this 3D model of the base for the tour. Scan the above zapcode to load the model.

The water cycle we have at this base works similarly to what happens to hot water in a sealed cup. As you can see, moist air rises and very quickly begins to collect on the lid.



# BASE TOUR

As these small droplets form on the lid of the cup, they grow in size and eventually get so large that they fall back down to the liquid below. In doing so they complete a full cycle; a water cycle.

The same cycle is at work in this base. Let's now examine each step of the water cycle in more detail. Be sure to take good notes as we go. There might be another quiz at the end!



# EVAPORATION

SCAN THIS PAGE AND TAKE NOTES



Now, let's zoom in and look a bit closer at the first step of the water cycle. The process begins with **Evaporation**. Heat plays an important role in this step.

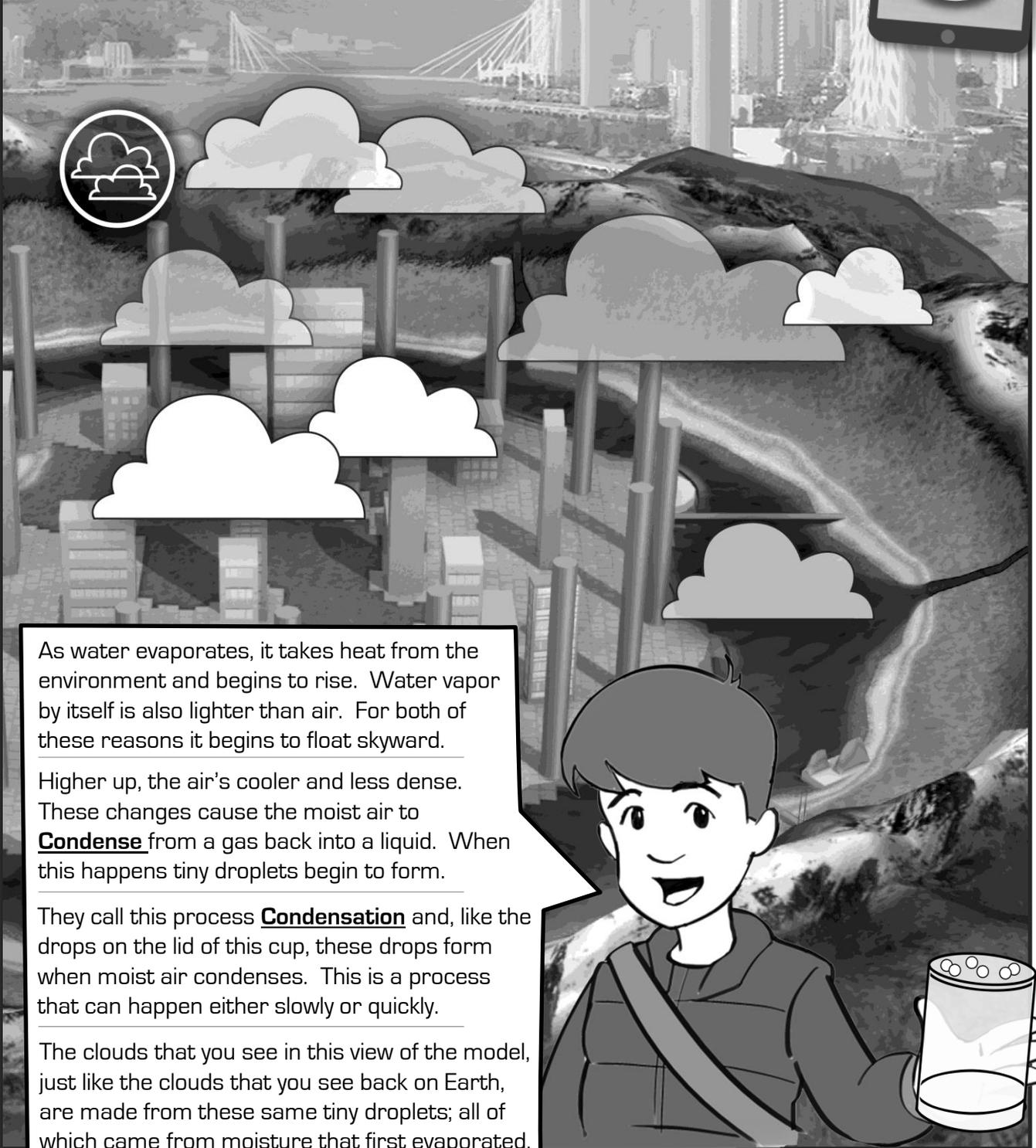
**Evaporation** happens when water changes form, from liquid to gas. In science, this transition is called a **Phase Change**. It's a rather straightforward concept.

Evaporation takes place in bodies of water like Lake Luna, in soil, and in plants – any place with moisture. Evaporation from plants is called **Transpiration**.

Heat drives the process of evaporation. Heat also determines its rate. Higher levels of heat cause water to evaporate more quickly, speeding up the overall water cycle.

# CONDENSATION

SCAN THIS PAGE AND TAKE NOTES



As water evaporates, it takes heat from the environment and begins to rise. Water vapor by itself is also lighter than air. For both of these reasons it begins to float skyward.

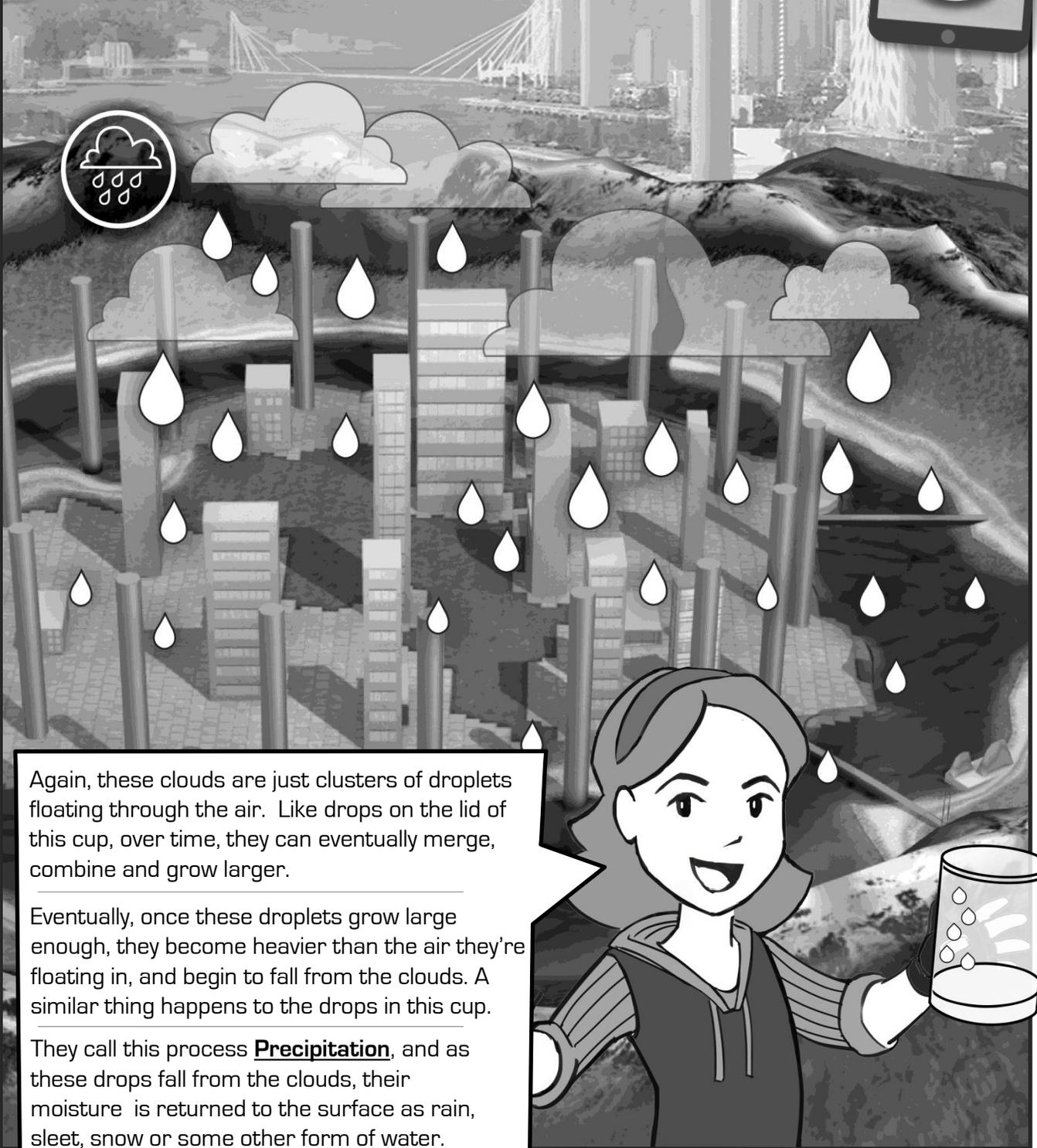
Higher up, the air's cooler and less dense. These changes cause the moist air to **Condense** from a gas back into a liquid. When this happens tiny droplets begin to form.

They call this process **Condensation** and, like the drops on the lid of this cup, these drops form when moist air condenses. This is a process that can happen either slowly or quickly.

The clouds that you see in this view of the model, just like the clouds that you see back on Earth, are made from these same tiny droplets; all of which came from moisture that first evaporated.

# PRECIPITATION

SCAN THIS PAGE AND TAKE NOTES



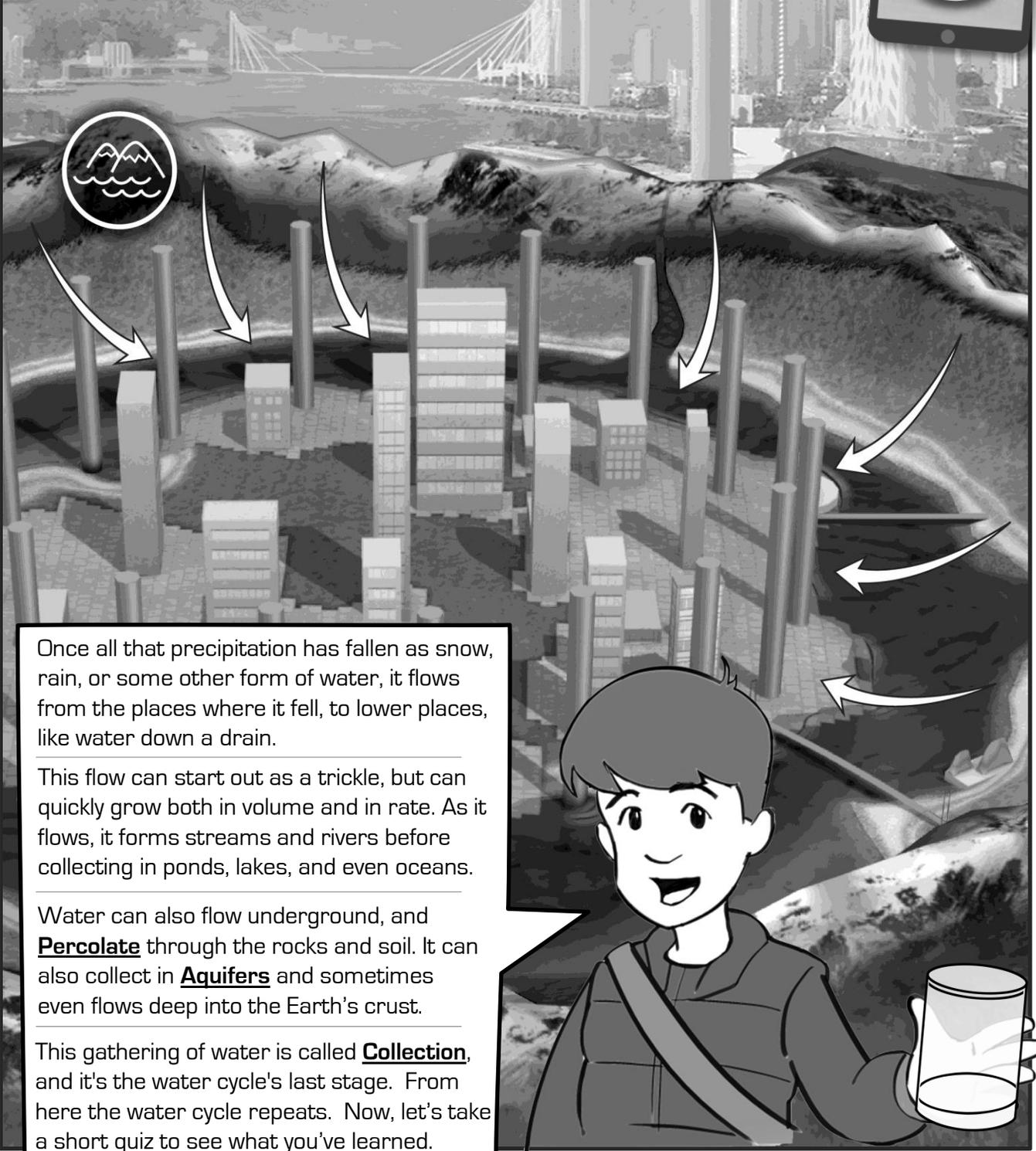
Again, these clouds are just clusters of droplets floating through the air. Like drops on the lid of this cup, over time, they can eventually merge, combine and grow larger.

Eventually, once these droplets grow large enough, they become heavier than the air they're floating in, and begin to fall from the clouds. A similar thing happens to the drops in this cup.

They call this process **Precipitation**, and as these drops fall from the clouds, their moisture is returned to the surface as rain, sleet, snow or some other form of water.

# COLLECTION

SCAN THIS PAGE AND TAKE NOTES



Once all that precipitation has fallen as snow, rain, or some other form of water, it flows from the places where it fell, to lower places, like water down a drain.

This flow can start out as a trickle, but can quickly grow both in volume and in rate. As it flows, it forms streams and rivers before collecting in ponds, lakes, and even oceans.

Water can also flow underground, and **Percolate** through the rocks and soil. It can also collect in **Aquifers** and sometimes even flows deep into the Earth's crust.

This gathering of water is called **Collection**, and it's the water cycle's last stage. From here the water cycle repeats. Now, let's take a short quiz to see what you've learned.

# POST-MISSION QUESTIONS

Refer to your notes and answer each question

1) WHICH STATEMENT BEST DESCRIBES THE WATER CYCLE? (Check the box)

- Water moving through pipes within a building
- The movement of water within our environment that makes clouds and rain
- Water currents moving within the ocean

2) IN WHICH STAGE OF THE WATER CYCLE DOES MOISTURE RISE?

3) IN WHICH STAGE OF THE WATER CYCLE DO CLOUDS FORM?

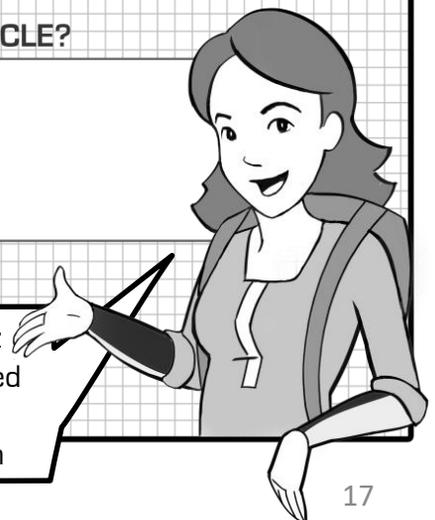
4) IN WHICH STAGE OF THE WATER CYCLE DOES IT RAIN?

5) IN WHICH STAGE OF THE WATER CYCLE DOES WATER COLLECT?

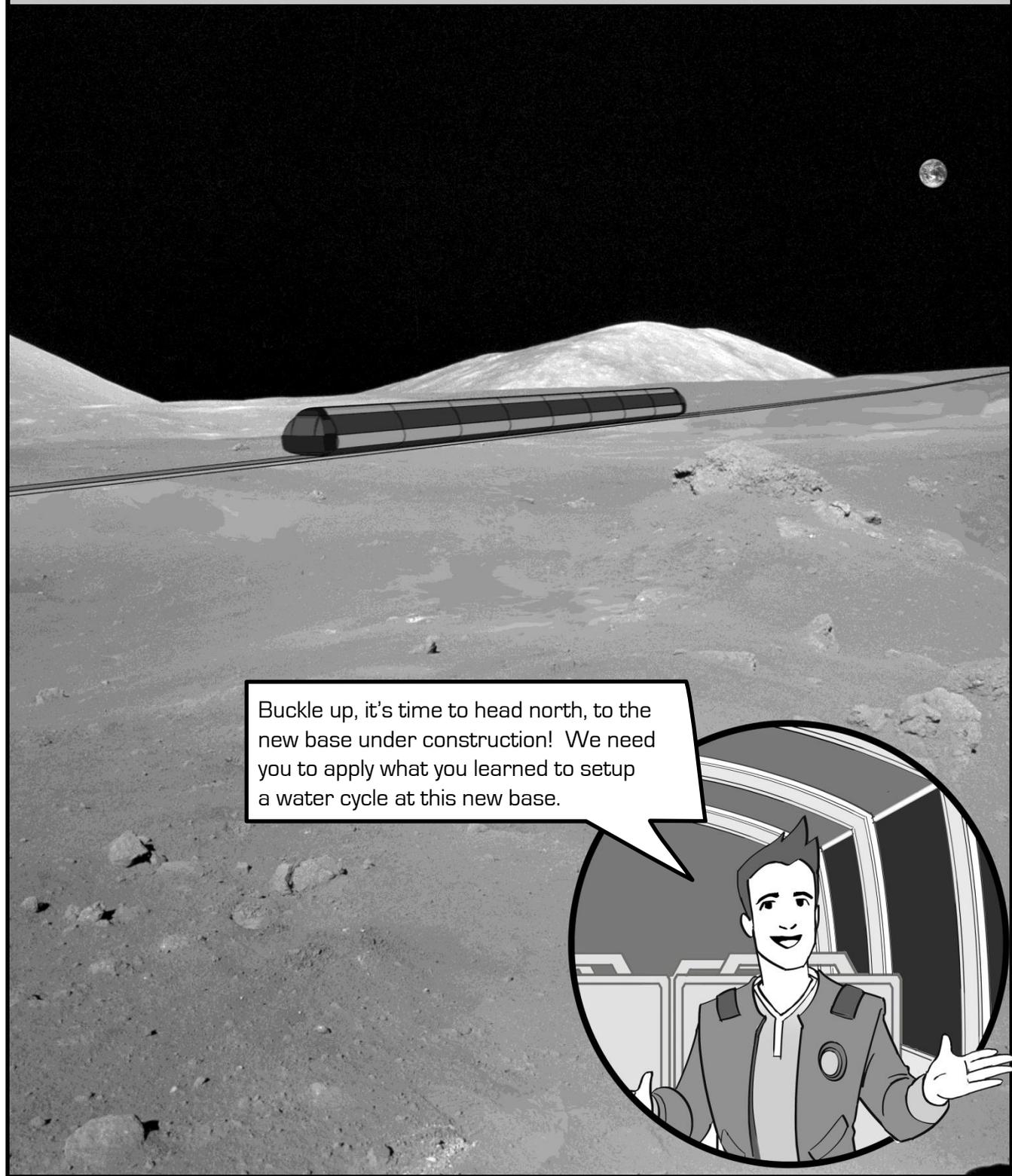
6) WHAT ARE CLOUDS MADE OF?

7) WHAT ROLE DOES THE HEAT PLAY IN THE WATER CYCLE?

Alright, it's time to retake the quiz  
To see how much you have learned  
Refer to the notes that you took  
And answer each question in turn



# TRAVEL TO NEW BASE



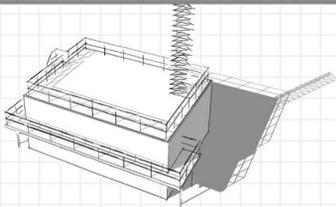
Buckle up, it's time to head north, to the new base under construction! We need you to apply what you learned to setup a water cycle at this new base.

# MOON STATION NUBIUM

**AIRLOCK 01**  
MOON STATION NUBIUM

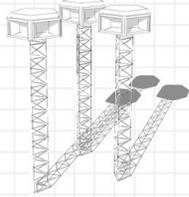
C1

## BASE SETUP EQUIPMENT



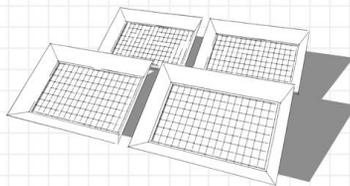
### CONTROL BUILDING

Controls Equipment & Water Cycle Speed



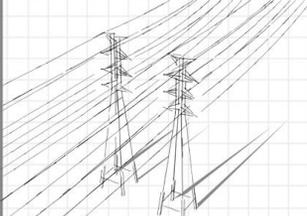
### LIGHTS

Produces Light For Base



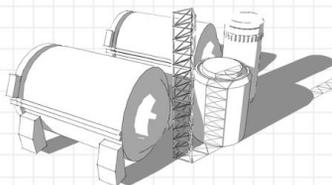
### HEATERS

Heats Inside of Base



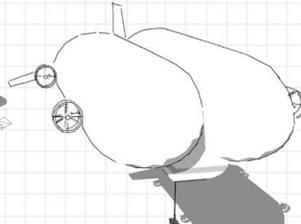
### POWER LINES

Distributes Power



### POWER PLANT

Produces Power

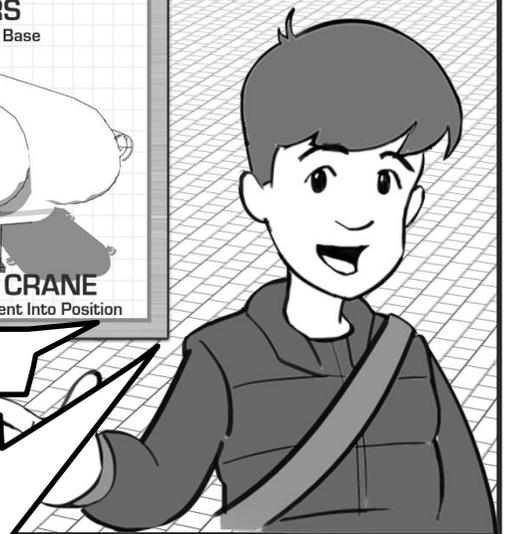


### BLIMP CRANE

Moves Equipment Into Position

Welcome to Moon Station Nubium!

You can use the equipment on this page as you sketch your design for this base. Feel free to include other things you can think of that will start warming up this frozen cavern.





# NUBIUM STATION WATER CYCLE DESIGN COMPUTER

SCAN THIS PAGE TO ENTER THE BASE, THEN COMPLETE YOUR DESIGN BELOW

Large empty rectangular area for drawing or sketching.

YOUR  
NAME: \_\_\_\_\_



Scan that zapcode to enter the airlock, then explore the main part of the dig. Next, use the area above to sketch the setup needed to warm this space, and start the water cycle.

# EARTH NEWS NETWORK



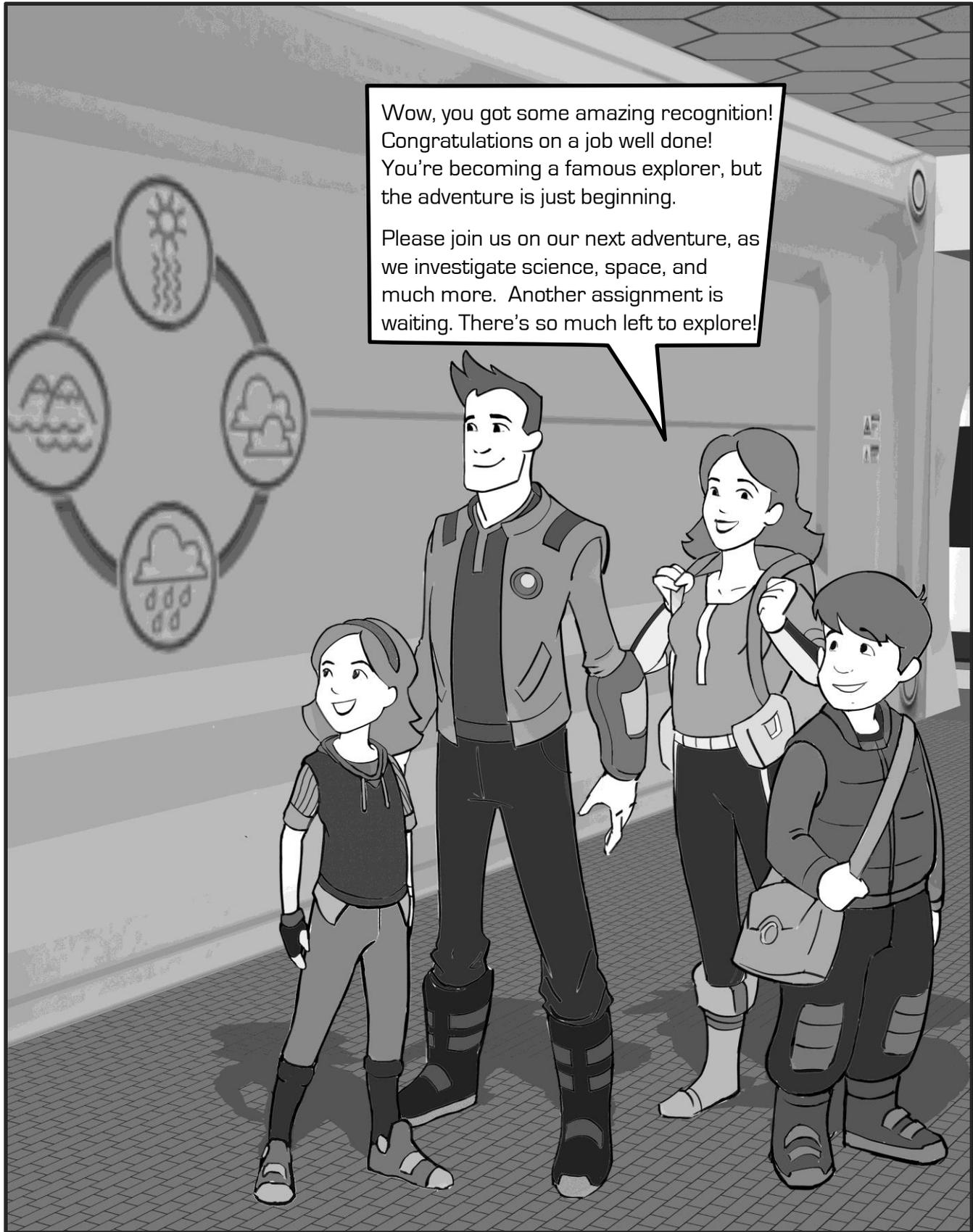
# TOP STORY!

Thanks for your help on this mission, and for the fantastic base you've designed! Colonists will be arriving shortly, and I know they'll love what you've put together!

Hey look, there's a message from Earth! It just came up on that screen. It looks like some kind of urgent news story! Scan that zapcode to learn more.

Wow, you got some amazing recognition!  
Congratulations on a job well done!  
You're becoming a famous explorer, but  
the adventure is just beginning.

Please join us on our next adventure, as  
we investigate science, space, and  
much more. Another assignment is  
waiting. There's so much left to explore!



# BOOK FACTS & RESEARCH

## GLOSSARY OF TERMS

**Aquifers:** A body of rock containing gaps or holes, capable of storing water that flows into it.

**Percolate:** To filter gradually through rock or other material that has small spaces or holes in it.

**Phase Change:** To change from one state of matter (solid, liquid, or gas) to another without a change in chemical composition.

**Transpiration:** The process through which plants absorb water through their roots, and give off water vapor through their leaves.

### Water Cycle Stages:

**1) Evaporation:** The stage in the Water Cycle when water changes from a liquid into a gas.

**2) Condensation:** The stage in the Water Cycle when water changes from a gas into a liquid.

**3) Precipitation:** The stage in the Water Cycle when water falls towards the ground.

**4) Collection:** The stage of the Water Cycle when water flows from where it initially fell to lower places where it pools

## About the Moon and Moon Bases Featured in This Book

**The Moon:** The Moon is the closest celestial body to the Earth. Nearly as large as Mercury, the Moon's surface is a dangerous place. The Moon's equator regularly experiences temperature swings ranging from -298° Fahrenheit (-183° Celsius) at night, to 224° Fahrenheit (106° Celsius) during the day.

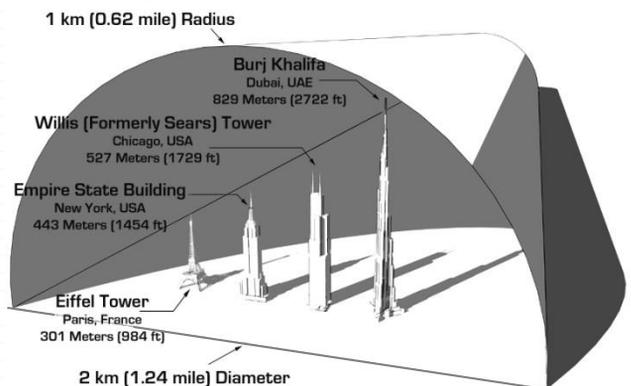
Moreover, Earth based telescopes regularly observe flashes of light on the Moon's surface caused by the thousands of meteoroids that impact there every year.

**Base Design - Going Big Underground:** Because conditions on the Moon's surface are so dangerous, the fictitious Moon bases featured in this book are either buried or built underground. To better understand the feasibility of building Moon Station Nubium, we consulted with the Department of Mining Engineering at the Colorado School of Mines (CSM). The question we posed to them was:

"What is the size of the largest underground chamber that could hypothetically be built on the Moon?". CSM eventually put us in touch with Rocscience Inc., a maker of geotechnical modeling software. Rocscience graciously agreed to build a hypothetical simulation to attempt to answer the question. Their conclusion was that "... It is in the realm of possibility that a circular cavern that is a few kilometers in diameter could exist if it was deep enough [0.5 - 1 km]." Similarly, when checking the general feasibility of building the 1 meter thick dome over Shackleton Station, we worked with Dr. Rhett Allain of Southeastern Louisiana State

University. Dr. Allain helped facilitate the construction of roof load calculations for the columns featured in the illustrations for this base. The feedback we received from each of these parties provided the guidance we used to help bring the bases within this book to life.

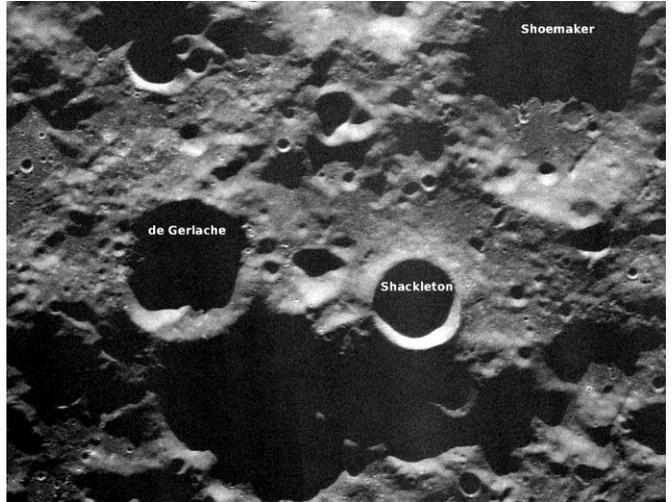
### Underground Cavern Proportions



# BOOK FACTS & RESEARCH

## About the Moon and Moon Bases Featured in This Book (continued)

**Shackleton Station:** In the Rockwell Adventures series, Shackleton Station is located near the real-life Shackleton Crater at the Moon's south pole. Shackleton Crater is a place of great interest to scientists and lunar mission planners. Many suspect that a fortune in water ice can be found there. Over billions of years, countless asteroids and comets have collided with the Moon's surface, many depositing ice in the process. Given the Moon's high day time temperatures, any ice exposed to the Sun quickly evaporates. Ice that lands in shaded areas, however, doesn't melt. Because of Shackleton Crater's position at the South Pole, and because it is so deep, large portions of it are permanently cast in shadow. This is why scientists believe that large amounts of water might be found there. Once harvested, this water could be used to make colonies like the stations featured in this book, a reality.



**Radar Image of the South Pole of the Moon**  
Image courtesy Jean Luc Margot

**Nubium Station:** Nubium is the Latin word for "Cloud". This fictitious base is located near the real-life Mare Nubium, or "Sea of Clouds" region on the near side of the Moon. Mare Nubium is one of many maria, or low lying darker areas on the Moon's surface. Lunar maria are comprised of material deposited from ancient volcanic eruptions that occurred roughly 3 to 4 billion years ago. In the Rockwell Adventures series, several bases are located within these maria regions. Mare Nubium, and Nubium Station are roughly 1,300 miles (2,092 km) from the Moon's south pole. That makes for a long train ride!

**Global Warming & The Water Cycle:** Numerous scientific studies have shown that the Earth has been gradually getting warmer over the past few hundred years. These studies have also shown that the pace of this warming is accelerating. If the Earth does continue to warm, what effect do you think this will have on the water cycle?



**NASA/Goddard Space Flight Center**  
Scientific Visualization Studio

Additional Resources Available At [StoneOakMedia.com](http://StoneOakMedia.com)

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Solar System Expedition

**THE ROCKWELL ADVENTURES' WATER CYCLE ENGINEER**

**2018-2019 SCHOOL YEAR**

- Explore the Water Cycle At Two Moon Bases
- Integrate 3D Virtual Environment
- Correlated to State & National Standards
- Pre & Post Exploration Tests
- Water Cycle Design Challenge

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Water Cycle Engineer

**3D PRINTABLE STEM KIT WIND TURBINE CHALLENGE**

**3D ENGINEERING CHALLENGE**

- Students Research, Build, Test, and Complete With Custom Blade Designs
- Learn the Engineering Design Process
- 3D Print an Unlimited Number of Turbines
- Correlated to State & National Standards

Wind Turbine Challenge

**3D DESIGN CHALLENGE PLANETARY OUTPOST**

**DESIGN YOUR BASE IN 3D**

- Design Bases in 3D Using SketchUp
- Learn the Engineering Design Process
- Students Choose Design Challenges on 5 Missions at 2 Planets, in 5 Roles
- Correlated to State & National Standards

Planetary Outpost

## STEM FOCUSED SCHOOL WORKSHOPS

**THE ROCKWELL ADVENTURES SOLAR SYSTEM EXPEDITION**

**2018 CLASSROOM EDITION**

- Explore & Measure The Planets
- Land Probes On Each Planet's Surface
- Space Colony Design Challenge
- Pre & Post Exploration Tests
- Correlated to State & National Standards

Solar System Expedition Student Presentation

**3D PRINTABLE STEM KIT WIND TURBINE CHALLENGE**

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Wind Turbine Challenge Student Presentation

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Accelerating STEM Education Using Augmented Reality

**FREE WEBINARS!!!**

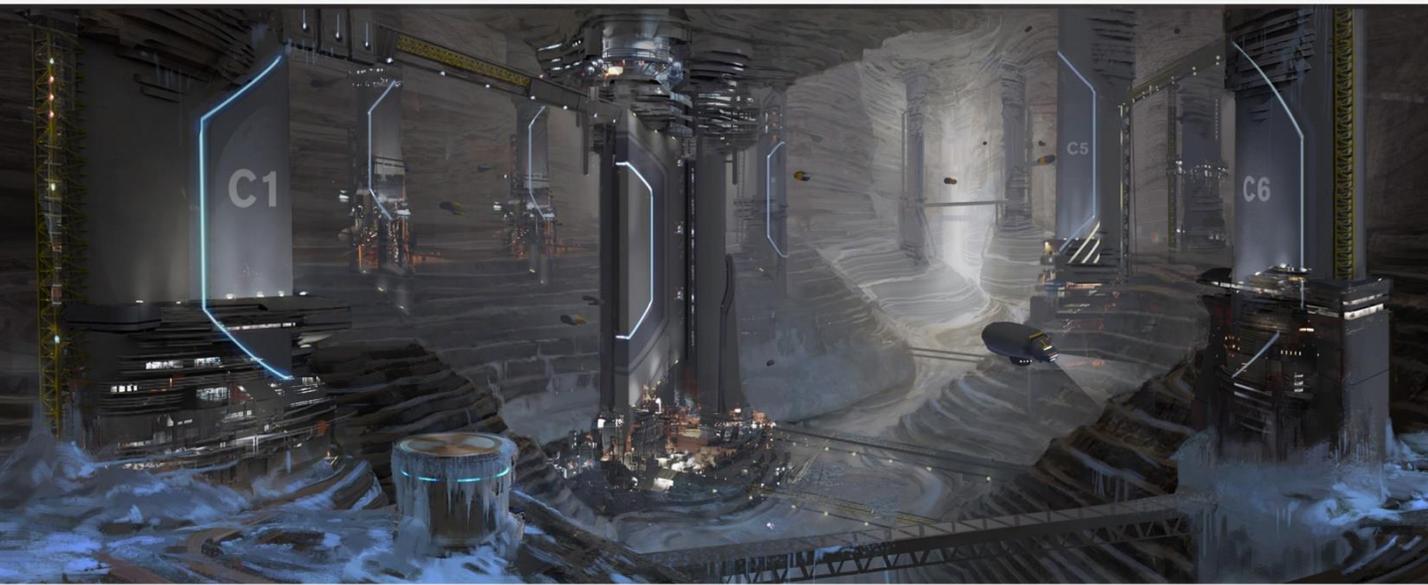
Low Cost, Easy To Use 3D Design & 3D Printing Resources for STEM!

Low Cost 3D Design & 3D Printing Resources for STEM

# WATER CYCLE ADVENTURE



Join the Rockwell family on their mission to setup a water cycle at a newly built Moon base. This fun-filled STEM-focused activity book teaches students basic facts about the water cycle, and challenges them to apply what they've learned when setting up this new environment.



Explore and Setup The Water Cycle At a Futuristic Moon Base

ISBN: 978-0-9970192-2-3



StoneOak Media®



Zappar

Moon: NASA's Goddard Space Flight Center  
Scientific Visualization Studio

Water Cycle: National Geographic