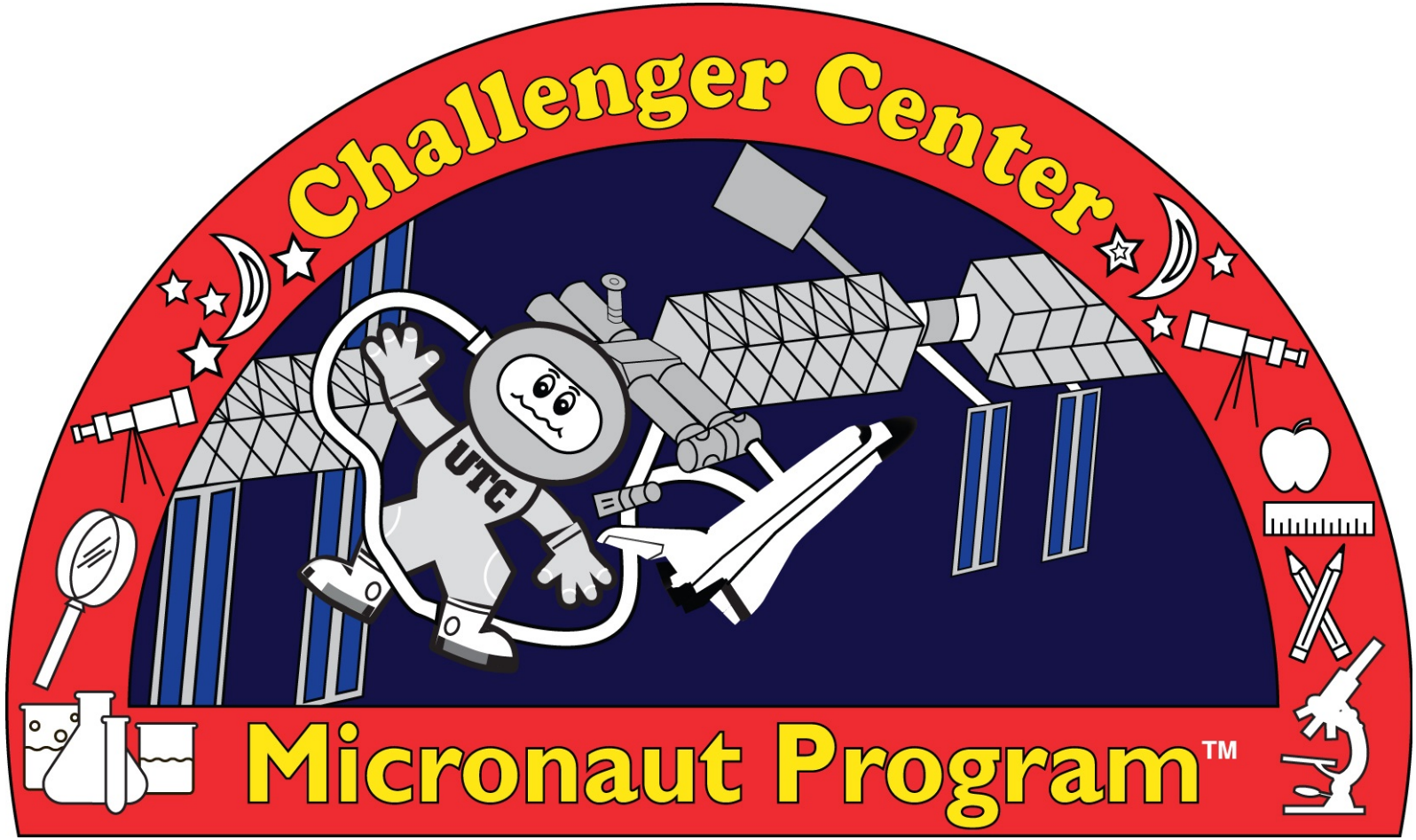


University of Tennessee Chattanooga

UNIVERSITY OF TENNESSEE AT CHATTANOOGA
CHALLENGER LEARNING CENTER

THE MICRONAUT™ PROGRAM

TEACHER'S GUIDE

Kindergarten through Fourth Grade

615 McCallie Avenue • Department 6406
Phone 423.425.4126 • Fax 423.425.2190

Table of Contents

Dear Classroom Educator,

Imagine for a moment your students are Micronauts aboard the International Space Station. One student is examining insects for radioactive contamination in the Isolation Chamber while another is assembling the solar array to convert the energy of the sun into electricity to power the Space Station. After the mission, your students will participate in extra venue activities called EVAs. In the Micronaut™ Technology EVA, your micronauts will construct NanoSat models and explore the day and night sky. In the Micronaut™ Orbit EVA, your students will explore the components of the Space Transportation System.

You can make this adventure a reality for your students through the UTC Challenger Center Micronaut Program™. This program is a standards-based guided exploration for students in Kindergarten through fourth grade that integrates the academic disciplines into a fun learning experience.

The Micronaut Program is designed to provide you and your students with an authentic encounter with science and space technology.

The Teacher's Guide was created as a tool to assist in classroom instruction as you prepare to implement an academically rich space science unit. Literacy is also addressed in each lesson of the guide through reading extensions.

You can learn more about this exciting elementary program by visiting our website at: http://www.utc.edu/ChallengerCenter .

The Challenger Center staff is ready to assist you as you plan your educational event. Please contact us at 423-425-4126.

We are looking forward to meeting you and your students.

The UTC Challenger Center Team

Mini Discovery Mission Overview

"Discovery, this is Houston. You are clear for transport to the International Space Station."

"Houston, this is Discovery. We are beginning our tasks."

Traveling 230 miles above the Earth's surface aboard the International Space Station, the Discovery crew continues the mission of the largest scientific cooperative program in history. This elite team of scientists, engineers, and mathematicians will engage in unique research using a variety of hands-on experiments to learn more about the planet Earth. The highly specialized crew will use their academic skills to investigate hazardous and non-hazardous materials and use problem-solving to protect the Solar Array. The crew will also manipulate scientific tools to collect, record, and analyze data relating to temperature, mass and sound. Crew members will work cooperatively to accomplish mission goals.

The Discovery mission ends with the crew's safe return to Earth where the teams share what they DISCOVERED.

The Mini Discovery Mission is one of the best ways to integrate academic disciplines in an activity that meets most learning styles.

Micronaut™ Mission
K-2 Station Descriptions

1. Measurement Using a Pan Balance

Weigh different objects using colored gram weights
Record data

2. Solar Array

Use different shapes to construct a puzzle
Protect the ISS from a meteoroid shower

3. Chemical Weigh Station

Find mass of chemical flasks using digital balance
Record data

4. Sound

Investigate sound vibrations with dancing rice
Investigate sound through different mediums
Identify and match sounds
Basic math operations

5. Solar System

Identify the planets
Arrange planets in proper order
Days orbit around sun, compare and order numbers

6. Thermometer / Microscope

Read the temperature using a thermometer
Match correct temperatures to the thermometer
Examine and investigate different objects using a microscope

7. Nuts and Bolts

Matching

8. Rock Sort / Bug Sort

Classify rocks according to color
Classify bugs according to physical characteristics
Observation

9. Microbe Identification

Identify non-hazardous and hazardous microbes
Match and problem solve for disposal
Number Inequalities

10. Bug Count / ISO

Basic counting
Classify bugs
Hand-eye coordination / manipulating a robotic arm to dispose a meteor shield

11. Exploring Magents

Discovery
Determine which objects are magnetic

12. Tangrams

Patterns and Shapes
Geometry
Puzzle

13. Weather Wizard

Inverstigating different types of clouds
Matching

14. Sink of Float

Identification
Discovery
Prediction

15. Solids and Liquids / Separate Mixures

Explore solids and liquids
Investigate mixtures

16. Evaporation

Explore wet/dry
Counting

17. Racing Ramps

Explore distances and different angles
Measuring height and length
Engineering

18. Electric Circuits

Explore open and closed circuits
Electricity

19. CSI

Explore differenent fingerprints
Process of elimination

Micronaut™ Mission 2-4
Station Descriptions

1. Measurement Using a Pan Balance
Weigh different objects using colored gram weights
Record data
Interpreting a bar graph (data log) classroom extension

2. Solar Array
Use different shapes to construct a puzzle
Protect the ISS from a meteoroid shower

3. Chemical Weigh Station
Find mass of chemical flasks using digital balance
Record data
Heaviest to lightest
Interpreting a bar graph (data log)

4. Sound
Investigate sound vibrations with dancing rice
Investigate sound through different mediums
Identify and match sounds
Basic math operations

5. Solar System
Identify the planets
Arrange planets in proper order
Auditory learning of planet facts
Days orbit around sun, compare and order numbers
Amount of gravity on each planet, size vs gravity

6. Thermometer / Microscope
Read the temperature using a thermometer
Match correct temperatures to the thermometer
Examine and investigate different objects using a microscope

7. Nuts and Bolts
Matching
Identification

8. Rock Sort / Bug Sort
Classify rocks according to color
Classify bugs according to physical characteristics
Observation

9. Microbes Identification
Identify non-hazardous and hazardous germs
Match and problem solve for disposal
Number inequalities

10. Bug Count / ISO

Basic counting
Classify bugs
Hand-eye coordination / manipulating a robotic arm to dispose a meteor shield

11. Rock Classification

Classify rocks according to color and magnetism
Observation
Draw Results

12. Exploring Magents

Discovery
Investigating polar ends
Determine which objects are magnetic

13. Tangrams

Patterns and Shapes
Geometry
Puzzle

14. Weather Wizard

Inverstigating different types of clouds
Matching

15. Sink of Float

Identification
Discovery
Prediction
Counting

16. Solids and Liquids / Separate Mixures

Explore solids and liquids
Investigate mixtures

17. Evaporation

Explore wet/dry
Cooling Techniques
Counting

18. Racing Ramps

Explore distances and different angles
Measuring height and length
Engineering

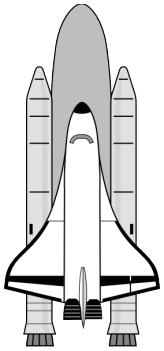
19. Electric Circuits

Explore open and closed circuits
Determine what is an inculator or a conductor
Electricity

20. CSI

Explore differenent fingerprints
Process of elimination

EVAs (Extra Venue Activities) Overview

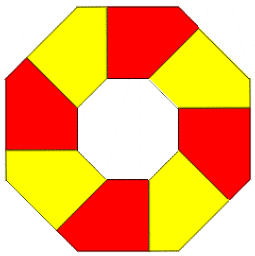


Micronaut™ in Orbit

Micronaut™ in Orbit is a hands-on event that addresses academic standards for grades K-4 using the Space Transport System and the theme of living in space.

The students will participate in the following:

- View a 1/20th scale model of the Space Transportation System
- Create their very own space transportation system model
- Participate in the Right Order Lesson to recreate the correct sequence in a real shuttle launch and landing
- Watch a video clip of an astronaut's daily routine in space

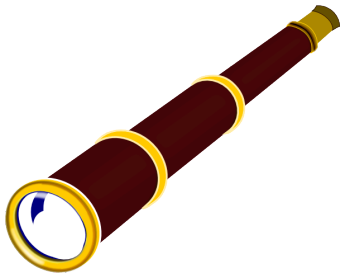


Micronaut™ Technology

Micronaut™ Technology is a hands-on event that addresses academic standards for grades K-4 using technology.

The students will participate in the following:

- Investigate the day and night sky
- Learn about satellites in space
- Build a NanoSatellite with geofix pieces (K-2)
- Buils a NanoSatellite using origami paper (2-4)

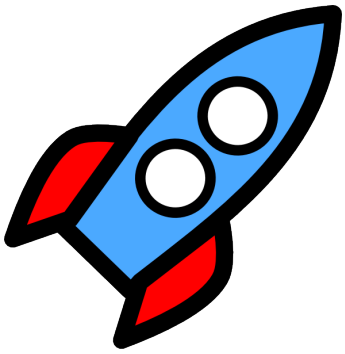


Telescopes Technology

Micronaut™ Technology is a hands-on event that addresses academic standards for grades K-4 using technology.

The students will participate in the following:

- Investigate mirror and lenses and demostrate reflection and refraction
- Learn about the differences between a telescope and a microscope
- Learn about the diufferent parts of a telescope
- Use telescopes to view objects in the sky
- For an additional cost, students can construct telescopes to take home



Micro Rockets

Micro Rockets is a hands-on event were students build and launch a straw rocket and graph the distance traveled.

The students will participate in the following:

- Investigate forces and motion
- Learn about units of measurements
- Understand how gravity effects falling objects
- Organize data on a graph and interpret the results

Moon Phases

Moon Phases is a hands-on modeling event were students model in pair sthe phases of the moon.

The students will participate in the following:

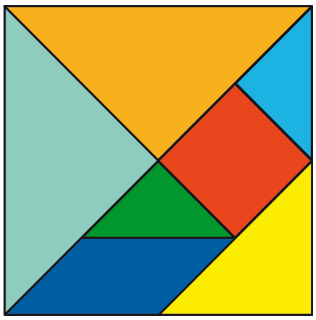
- Investigate the sun, earth, moon and their interactions with each other.
- Learn the four main moon phases (k-2)
- Learn the eight moon phases (2-4)
- Discuss each phase

Space Fishing

Space Fishing is a mathematics activtiy for students to fish out numbers and wite number sentences.

The students will participate in the following:

- Use numbers to create and solve number sentences
- Use manipulatives to observe, solve, and create number patterms and formulas
- Define missing addends

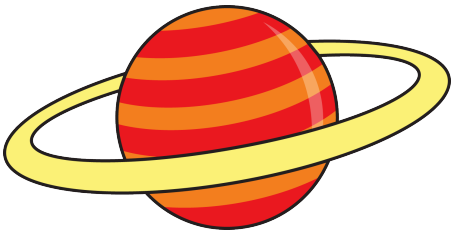


Micronaut™ to the Moon

Micronaut™ to the Moon is a geomtry activtiy for students to use tangrams to create a paper rocket.

The students will participate in the following:

- Learn how rockets take astronauts to the Moon and back – from liftoff to landing
- Work in pairs to put sequence cards in order based on what they learned
- Count and identify shapes
- Use tangram shapes to construct a paper rocket



Planet Walk

Planet Walk is a physcial activtiy for students to learn about the planets in our solar sytem. They will learn about the distance between each planet by using modeling.

The students will participate in the following:

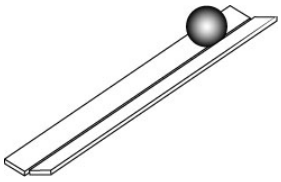
- Learn important facts and characteristics of each planet in our solar system
- Learn the relative size and distance of each planet in our solar system
- Learn and practice putting the planets in order from the sun

Stars

Stars is an investigation activtiy that guides the students into understanding stars and their life cycle.

The students will participate in the following:

- Learn important facts and characteristics about stars
- Learn important facts about constellations
- Create their own constellation (K-2)
- Create their own five point mathematical and symetrycal paper star (2-4)



Galileo's Ramp

Galileo's Ramp is an physics experiement for 3rd grade and up only. Students will test their hypotheseis about three falling objects of different masses.

The studnets will participate in the following:

- Learn about gravity and acceleration
- Work in teams to complete the full experiment
- Use the sciencetific method
- Graph data collected and anylize the results

Troubled Ladder

Troubled Ladder is mathematics activtity for 3rd grade and up only. Students will learn and use prior knowledge to complete fraction problems to build a ladder to the space lander.

The students will participate in the following:

- Use fractions in number sentences
- Work in pair to build a ladder
- Investigate advance fractions with using unlike denominators

Micronaut Program™
Keys to a Successful Visit

- ✓ Program Time at the Challenger Center, Arrive: 15 minutes prior to start time

- ✓ Classroom preparation

- ✓ Complete MicroComet Mission Manifest for each group (3^{rd} - 5^{th} grade only)

- ✓ Nametags – Station Assigned for groups doing MicroComet Mission

- ✓ Assign Chaperones – at least one with each group

- ✓ Make lunch plans – please inform UTC is you plan to eat at Scrappys Food Court or at the Crossroads Buffet

- ✓ The UTC Challenger Center is unable to provide free parking for personal vehicles. Bus parking is free. Chaperones need to allow an additional 20 minutes for parking at parking garage or street parking. UTC Parking Garage is located at the end of 5th street by McKenzie Arena. Any city street curb parking (limited during the fall and spring semesters) is free.

ACTIVITY 1
MISSION PATCH

Objective:

Students will identify attributes of mission patches. Students will use pictures, numbers and other symbols to design and draw their own mission patch.

Subject Area:

Language Arts, Social Studies, and Art

Materials:

Pictures of NASA Mission patches and / or actual mission patches

NASA Patches Website (see extension below)

Drawing supplies

Paper

Website http://spaceflight.nasa.gov

Procedure:

Teacher

1. Divide students into small groups.
2. Show students 2 or 3 different mission patches and explain how the symbols share the story of that particular mission.
3. If students are reading, instruct each team to read about two mission patch descriptions and to observe the symbols of the patches.
4. Student groups will discuss and design their own mission patch.
5. Using shapes, colors, images and words students will work together and create their patch.
5. Display team patches on the wall and allow students to look at each other's patches.

Reflection and Evaluation:

Students share their design interpretations with members of the class.

The teacher guides students in a class discussion about how pictures can tell a story.

Extension:

Research upcoming Shuttle Missions and their patches

http://www.abemblem.com/nasapatches/shuttle/sts107.html

Have students write a descriptive paragraph of their mission patch.

Reading:

True Books Space Stations by Diane M. and Paul Sipiera

Mission Patch Information

The Expedition 10 patch uses simple symbolism to describe the mission. The large Roman numeral "X," formed by the American and Russian flags, symbolize the joint nature of this mission, as well as the fact that this flight is the 10th mission to stay on the International Space Station.

The current configuration of the Space Station is next to the name of the Station Commander, NASA astronaut Leroy Chiao, while the Soyuz vehicle is placed next to the name of the Soyuz Commander, Russian cosmonaut Salizhan S. Sharipov. The single star and the black background signify this is a space mission.

The STS-114 patch design signifies the return of the Space Shuttle to flight and honors the memory of the STS-107 Columbia crew.

The blue Shuttle rising above Earth's horizon includes the Columbia constellation of seven stars, echoing the STS-107 patch and commemorating the seven members of that mission. The crew of STS-114 will carry the memory of their friends on Columbia and the legacy of their mission back into Earth orbit.

The dominant design element of the STS-114 patch is the planet Earth, which represents the unity and dedication of the many people whose efforts allow the Shuttle to safely return to flight. Commander Eileen Collins and Pilot James Kelly are named at the top of the insignia, with Mission Specialists Wendy Lawrence and Charles Camarda named below.

Against the background of the Earth at night, the blue orbit represents the International Space Station (ISS). Mission Specialists Soichi Noguchi, Stephen Robinson and Andrew Thomas, who will work on the Station during spacewalks, are named on the orbit. The red sun on the orbit signifies the contributions of the Japanese Space Agency to the mission and to the ISS program. The multi-colored Shuttle plume represents the broad spectrum of challenges for this mission, including Shuttle inspection and repair experiments, and International Space Station re-supply and repair.

ACTIVITY 2

GOOD ENOUGH TO EAT

Objective:

Students construct an edible space shuttle model.

Subject Area:

Mathematics – Symmetry, Technology, Language Arts

Materials:

Carrots washed and cut in half lengthwise (1 per student) that represent the external tank

Celery (2 equal sized pieces per student) that represents the two solid rocket boosters

White bread (1 slice per student) that represents the orbiter

Peanut Butter, marshmallow cream, or soft cream cheese that acts as the glue
*** Determine if any student has a peanut allergy**

Plastic knives (1 per student)

Orbiter template on card stock

Paper plates (2 per student)

Paper towels

Crayons or markers

Chart paper

Model of the Space Shuttle (Lego Toys)

Pictures of the Space Transportation System

Earth Model

Procedures:

Teacher

- Prepare a paper plate for each student with the vegetables, bread, and peanut butter or alternative spread and a plastic knife.

- Show students a picture of the STS model. Review with students the background information on the Space Transportation System (STS) and ask students to name each part. Use the STS model to simulate a launch sequence.

- Discuss and compare part sizes. Name the tallest and the shortest part of the STS.

- Distribute the plates with the food materials to each student and tell them they are going to build the STS.

Student

1. Students examine the food parts. Students explore which food represents each STS part. The carrot represents the external tank. The celery represents the two solid rocket boosters. The bread represents the orbiter.

2. Students look at the parts and observe that the celery sticks are *equal* in length.

3. Students compare STS parts using the words *tallest* and *shortest*, and *taller* and *shorter*.

4. Students attach each part with peanut butter until all are in position and the STS is complete.

5. When STS models are complete, it is time to launch.

Teacher - Demonstrate how to launch the edible STS.

6. Students count down for lift off "…10, 9, 8, 7, to 1 and lift off!"

7. Students lift their STS model off the plate.

Teacher - Soon after lift off, simulate the separation of the solid rocket boosters (SRBs).

8. Students pull celery away from the bread and lay the celery back on the plate.

Teacher - Simulate the separation of the carrot external tank. Lay it back on the plate.

9. Students pull the carrot off and lay it back on the plate.

Teacher - Simulate the orbiter circling the Earth and then land the orbiter like a plane on the plate.

10. Students pretend their orbiter is flying in a circle around earth and then land like a plane on the plate.

Reflection and Evaluation:

Students draw, tell, and record the sequence of events using first, second, third, etc.

The teacher will check student work for accuracy in sequencing of events.

Math Extension:

Count the number of celery sticks in the class and then counting by 2's.

Discuss how the STS is symmetrical.

Health Extension:

Discuss healthy food choices as students eat the STS for a snack.

Language Arts Extension:

Students write a story paragraph explaining the launch sequence and read to the class.

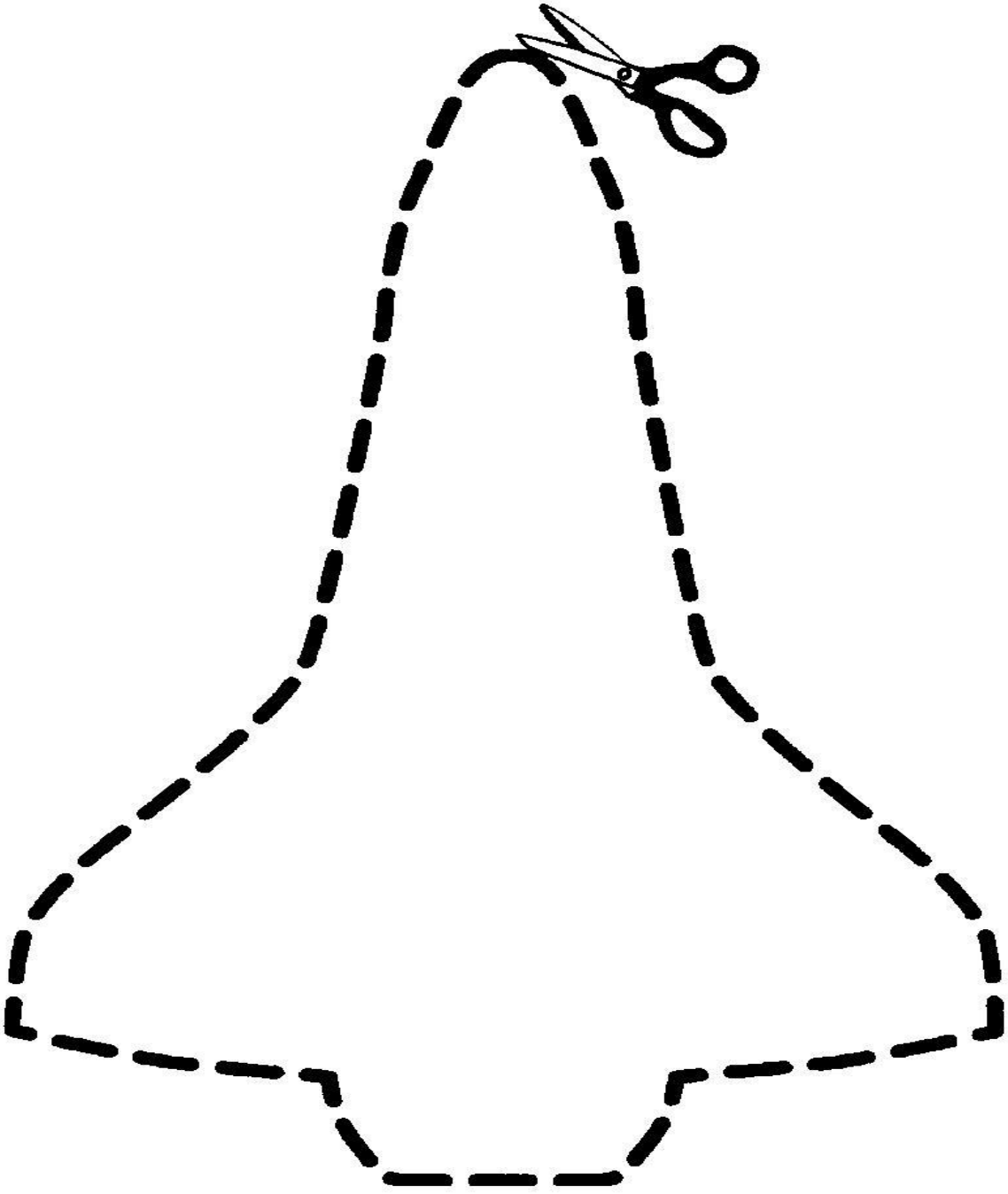
Reading:

The Space Shuttle by Jacqueline Langille and Bobbie Kalman

Best Book of Spaceships by Jan Graham

ACTIVITY 2

GOOD ENOUGH TO EAT



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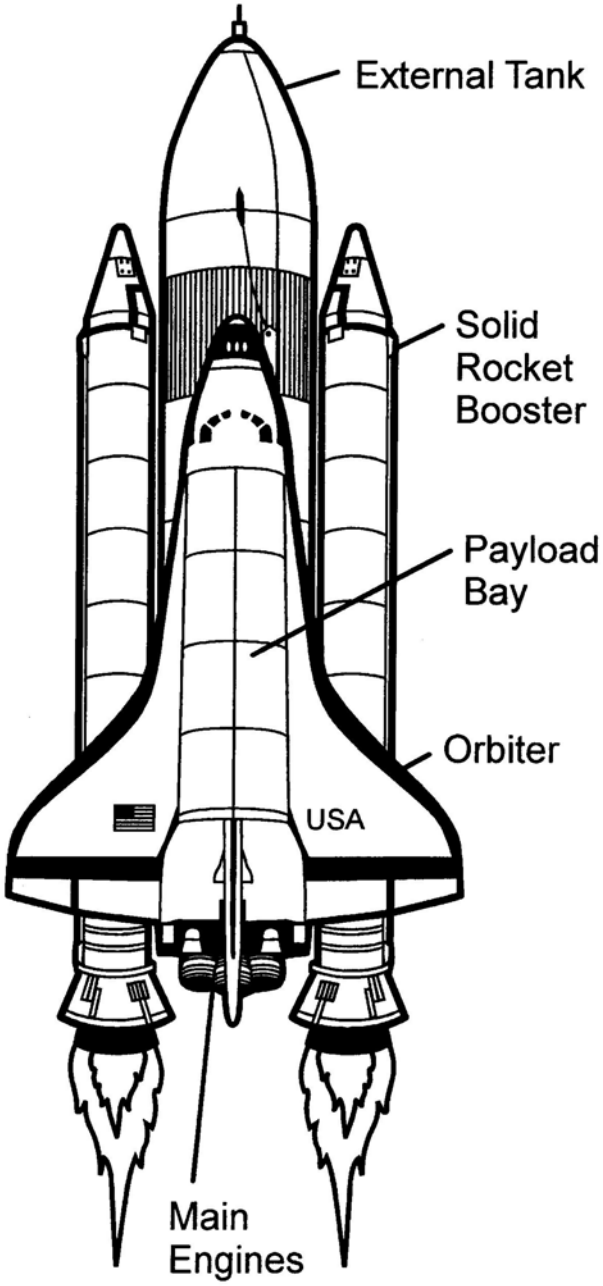

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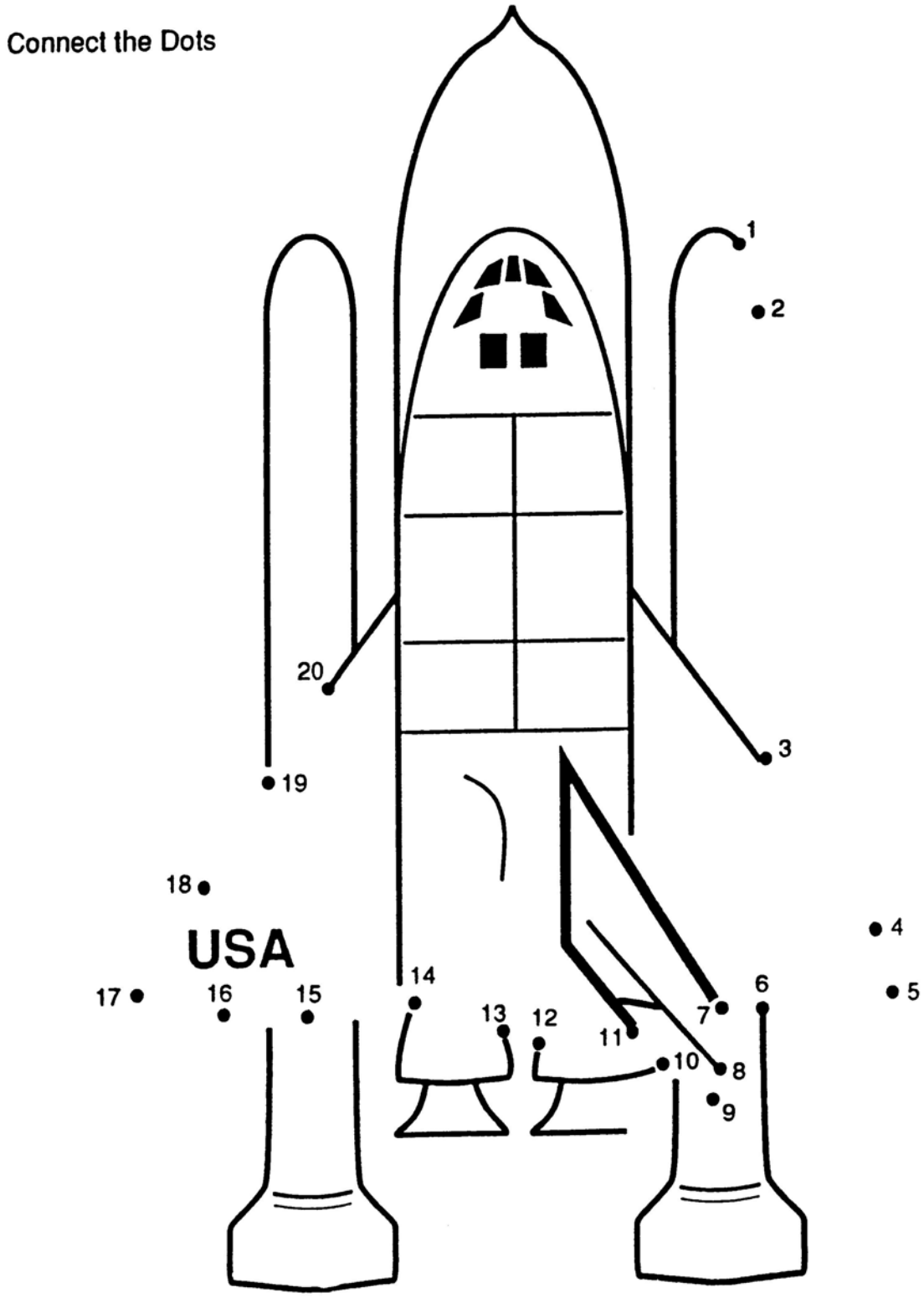


International Space Station

Orbiting the Earth at an average distance of approximately 407 kilometers, traveling 28,163 kilometers per hour, and orbiting the earth every 90 minutes, the International Space Station (ISS) represents the most complex international scientific endeavor in history. It is also the most ambitious construction project ever undertaken in space. Sixteen international partners, including the United States, Canada, Russia, Japan, Brazil, and the eleven nations of the European Space Agency, are working together, sharing resources and expertise, to build this orbiting research facility.

Construction of the ISS began in 1998. The station, when complete, will be 108.5 meters wide and 88.4 meters long. It will be approximately the size of two football fields placed side by side. The living and working areas will be about the size of three average American homes. The completed station will weigh approximately 453,000 kilograms.

Since there are no launch vehicles or rockets capable of carrying an object of this size into space at one time, the ISS must be constructed in space one component at a time. Individual components, such as laboratories, living areas, equipment and storage areas, and solar arrays, are carried into space by American and Russian launch vehicles and are pieced together by humans during space walks.

Giant solar arrays provide electricity for the space station. The electricity generated is enough to power about ten average American homes. Water will be recycled on the ISS. While astronauts float in this microgravity environment, they will find the station to be at “shirt sleeve” temperatures.

In 2000, the first international crew of three people went to live and work on board the station. Habitation of the space station marked the resumption of long-term human presence in space since the Mir space station. Crews, who live and work on the station for four to six months and perhaps eventually even longer, must be ferried back and forth to earth. The United States National Aeronautics and Space Administration (NASA) uses a reusable space transportation system (STS) to transport personnel, supplies, hardware, and station components to and from the ISS. Two different Russian rockets, the Proton and the Soyuz, take people, supplies, and parts to the ISS. In the future, a variety of new vehicles will visit the station to ferry crews and supplies.

The International Space Station is a working science laboratory in space. Experiments being conducted on board the ISS allow research in biology, chemistry, physics,

ecology, and medicine in a microgravity environment that may contain benefits for people on Earth.

ISS Completion

Building the ISS will take many years. Its construction will require more than 40 launches of the space shuttle, Proton, and Soyuz rockets. Assembling more than 100 space station components will require the use of technology and many hours of space walks by astronauts. When complete, scientific research will continue on the station for many years.

For more information on the International Space Station and the space shuttle, visit http://spaceflight.nasa.gov. Information on launches, missions, crews, and shuttle and station sightings is available at the Space flight website.

Space Transportation System

NASA's reusable space transportation system (STS) consists of several parts. One of the parts is the orbiter. The crew lives and works in the orbiter. There may be as many as seven people on a crew. The orbiter is the only part of the STS that orbits the earth. The orbiter needs special rockets to reach earth orbit. Two solid rocket boosters attach to the external tank. The external tank attaches to the orbiter and supplies fuel to the three main rocket engines at the aft end of the orbiter.

The payload bay of the orbiter stores new components bound for the space station. A docking port in the payload bay allows the orbiter to join, or dock, with the ISS. After docking, a robotic arm lifts a new piece or module out of the payload bay and attaches it to the station. Astronauts then perform space walks, or extravehicular activities (EVAs), to help attach new components to the ISS.

Russian Rockets

Two different Russian rockets also take people, supplies, and parts to the ISS. The Proton rocket sends pieces of the space station to space. In fact, the Proton rocket launched the first ISS component, the Russian built Zarya control module to space.

A smaller Russian rocket, the Soyuz, takes crews and cargo to and from the station. The crew, usually three people, travels in a small Soyuz capsule launched on a Soyuz rocket. When it arrives at the station, the capsule docks to a port on a Russian-built component. In addition, a Soyuz rocket launches a Progress spacecraft. The Progress does not carry people; it carries supplies, or cargo, to and from the station. The Progress also docks to a port on a Russian-built part of the ISS.

Rocket History

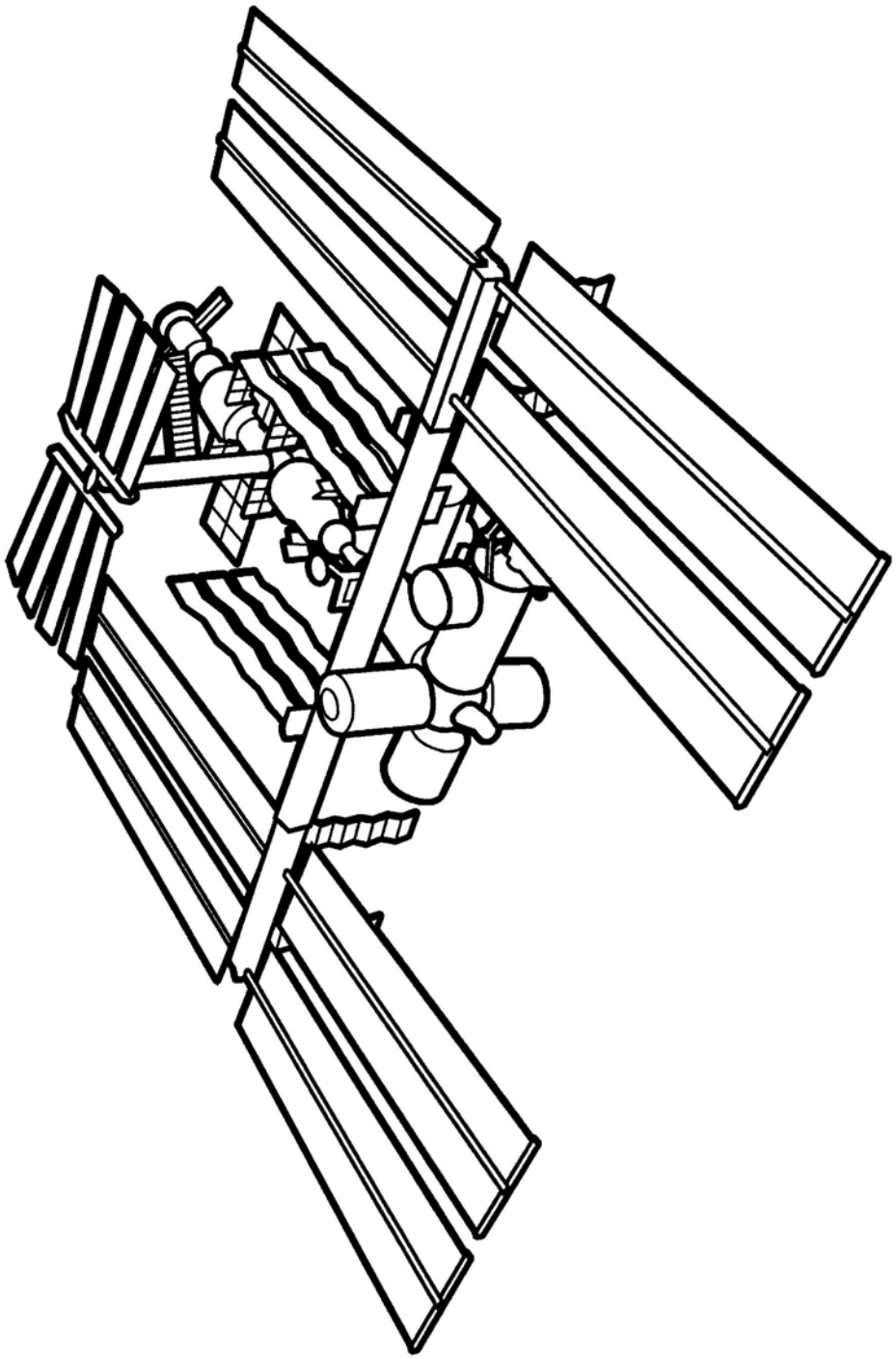
Although it is not clear when true rockets were first developed, historical records indicate that the Chinese developed simple rockets as early as the 13th century. They invented a form of gunpowder to create fireworks for special events. Eventually, the Chinese put gunpowder in a bamboo tube. When lit, this gunpowder-filled tube launched, creating a simple rocket.

More than 300 years ago, in the 17th century, scientists began to study rockets. Sir Isaac Newton (1642-1727) was a scientist who tried to explain how rockets work. He stated three scientific principles, called Newton's Laws of Motion, which describe the motion of objects, either on earth or in space. To successfully build rockets, scientists have to understand these laws.

Early in the 20th century, one of the scientists who conducted rocket experiments was an American named Robert Goddard (1882-1945). People call Goddard "the father of modern rocketry." His research helped give humans the ability to send rockets to space. As a result of the research of Newton and Goddard, modern rocket scientists are able to design and build sophisticated rockets like the space shuttle, the Proton, and the Soyuz.

For more information on the history of rockets and additional rocket activities, visit the NASA web site at www.nasa.gov.

International Space Station



ACTVITY 3

DANCING RAISINS

Objective:

Students will investigate the three states of matter using raisins.

Subject Area:

Science; Solids, Liquids, and Gases

Materials:

1 Clear Glass

6-8 Raisins per group

Clear Soda (Regular Sprite produces good results)

Student Data Log

Please note: This experiment mentions the "weight" of the raisin. Actually, the property in effect is buoyancy (the ability to float). In its natural state, raisins are not buoyant. After several minutes in a carbonated beverage, the raisins will start to "dance". While they are sitting on the bottom, you can see gas bubbles start to collect on them. When there is a sufficient amount of gas to make the raisins buoyant, they will rise. At the surface, some of the gas bubbles are exposed to the air and cause the bubbles to diffuse. Once a sufficient number have "popped", the raisin is no longer buoyant and will sink.

Procedure:

Teacher

Hypothesis:

Raisins are heavy enough to sink if you put them in water.

Direct the students to predict on their data log what will happen to the raisins in soda?

Discuss with students possible outcomes.

Give the students directions for conducting the experiment and completing the data log.

1. **Fill the glass half way with soda.**

2. **Add 6 to 8 raisins to the glass of soda.**

3. **Observe over the next few minutes. Describe what happens.**

4. **What matter do you observe that is a:**

   Solid?

   Liquid?

   Gas?

5. **How do you explain why the raisins are dancing?**

Reflection and Evaluation:

Students share with the class their explanations for the dancing raisins. The teacher will allow students to share what they have discovered about the nature of a solid, liquid and gas. Teacher checks data logs for accuracy.

Extension: Social Studies

Students explore the special relationship between a father and child by reading the book *Dancing with Daddy* by Willie Welch.

Reading:

How Do You Raise a Raisin by Pam Ryan

Dancing with Daddy by Willie Welch

ACTVITY 3

DANCING RAISINS

Student Data Log

1. Predict what you think will happen when you put the raisins in soda?

_____

_____

2. Fill the glass half way with soda.

3. Add 6 to 8 raisins to the glass of soda.

4. Observe the raisins for 2 to 3 minutes. Describe what happens.

_____

_____

5. What matter do you observe that is a:

Solid? _____

Liquid? _____

Gas? _____

6. Explain why the raisins are dancing?

_____

_____

ACTIVITY 4

HEARING IT ALL

Objective:

Students make a tool to investigate sound and learn that an ear cone uses a large surface area to direct more sound to the ear.

Subject Area:

Science Sound Waves

Materials:

1 large 11x14 piece of heavy paper or poster board per two students

Rulers

Masking tape

Crayons

Procedure:

Teacher

1. Engage students in a discussion about sound.
    - What do you think will happen to the sound I hear if I cup my hand to my ear?
    - Demonstrate to students how to cup the hand behind the ear.
    - Have students listen to sounds without cupping the ear with their hand.
    - Ask students to listen to sounds with their ear cupped and compare to listening to sounds without the ear cupped.
2. Students will work in groups of two.
3. Go over the instructions for constructing the cone ear.
    - Roll the paper into a loose, large cone shape. It should have a small opening at one end and a large wide opening on the other end.
    - Demonstrate the process.
    - Carefully tape each paper ear cone so it will hold its shape.
    - Decorate and personalize the large ear cones.
4. Have students test their ear cones inside and outside the classroom.
5. Instruct students to hold the ear cone up to the ear and listen. Move the ear cone in different directions: up, down, and side-to-side while you stand still and listen.
6. Have students talk loudly and whisper to another student using the ear cone.

Reflection and Evaluation:

Ask the students the following questions:

- What do you hear?
- Why does the ear cone make sound seem louder?

Extension:

Have students sit quietly in a large circle with their eyes closed. Pause. Ask what they think is making each sound they hear and the direction the sound is coming. Students can imitate the sounds they hear and draw pictures of what they think made the sounds.

Reading:

Did You Hear That? by Caroline Arnold and illustrated by Cathy Trachok

ACTIVITY 4

HEARING IT ALL

Student Data log

1. Listen to the sounds around you. Write three sounds you hear.

   _____

2. Predict what will happen to the sound you hear when you use your ear cone?

   _____

3. Listen to sounds with your ear cone. Describe what you hear.

   _____

4. Compare listening to sounds without the ear cone to listening to sounds with the ear cone.

5. What did you discover?

   _____

6. Does the ear cone make sound seem louder? Explain.

   _____

ACTIVITY 5
THE SOLAR SYSTEM

Objective:

Students will use Internet sources to learn about the planets

Subject Area:

Science, Technology, and Language Arts

Materials:

Computer with internet access

Solar System Pictures (pgs.33-34)

Cool Solar System Facts (pgs.37-39)

Internet site listed below:

http://ww.nasa.gov/audience/forkids/games/Games_Collection_archive_1.html

page 1 Solar System Game

page 2 Where Oh Where Does that Planet Go?

Page 3 Solar System Trading Cards

Procedure:

1. Write the websites on the board for students to see or have the website on the computer desktop before students arrive in the lab.

2. Students type in the website and scroll to the appropriate page to find the games and activities listed above.

3. Students will work with a partner at computer stations.

4. Use the information from the on-line activities to write a complete sentence about each planet on their data log.

Reflection and Evaluation:

Check student data logs for accuracy of planet placement. Students share with the class what they learned about the planets.

Extension:

Social Studies

Create a timeline of the history of space travel. Create a school fair using the theme of traveling through the Solar System the Final Frontier

Extension Math

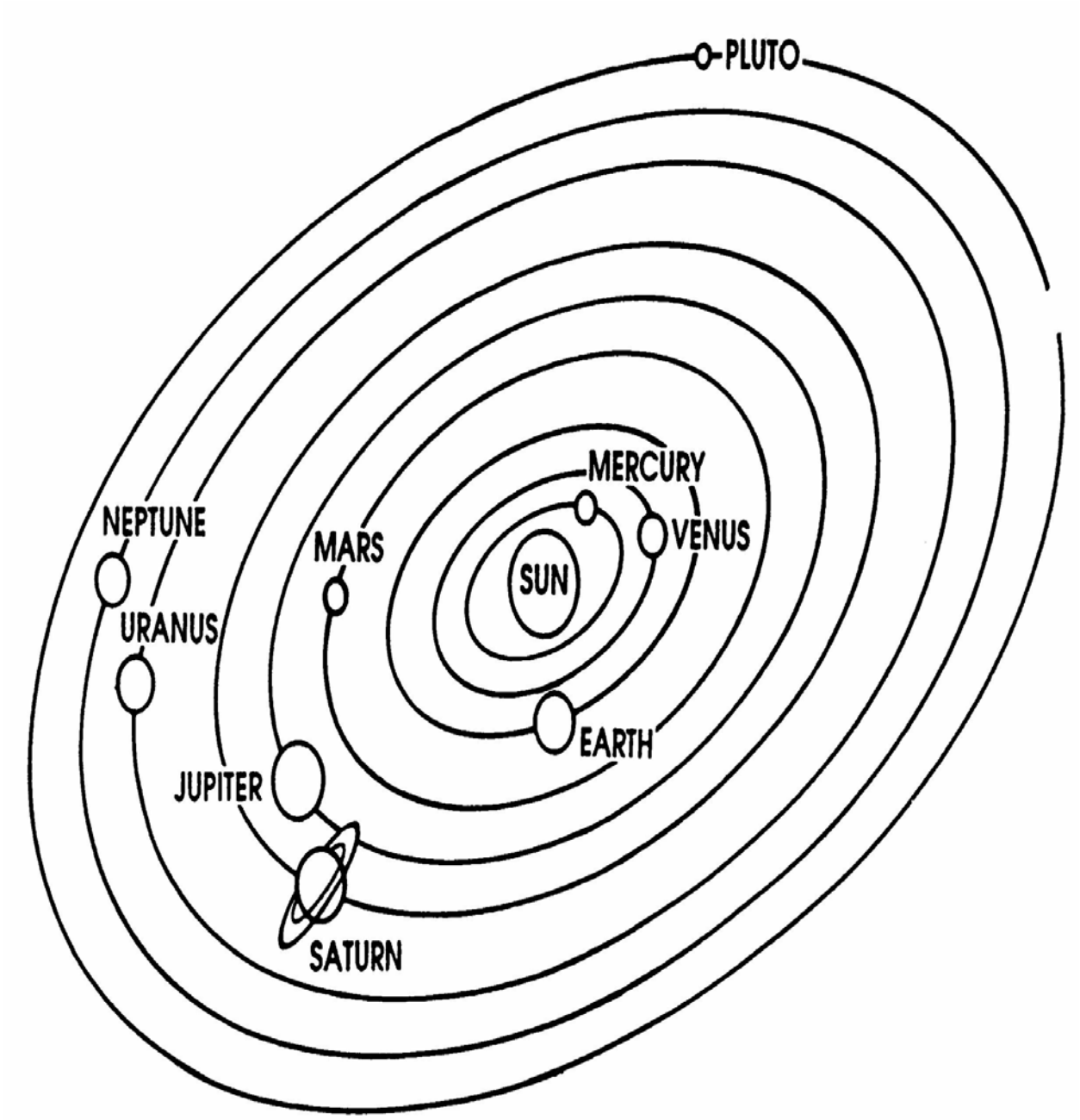
Compare planet features using Venn diagrams

Reading:

Big Bang! By Carolyn Cinami DeCristofano; Illustrated by Michael Carroll and Faraway Worlds by Paul Halpern.Ph.D. Illustrated by Lynette R. Cook

ACTIVITY 5

Where Oh Where Does that Planet Go Key

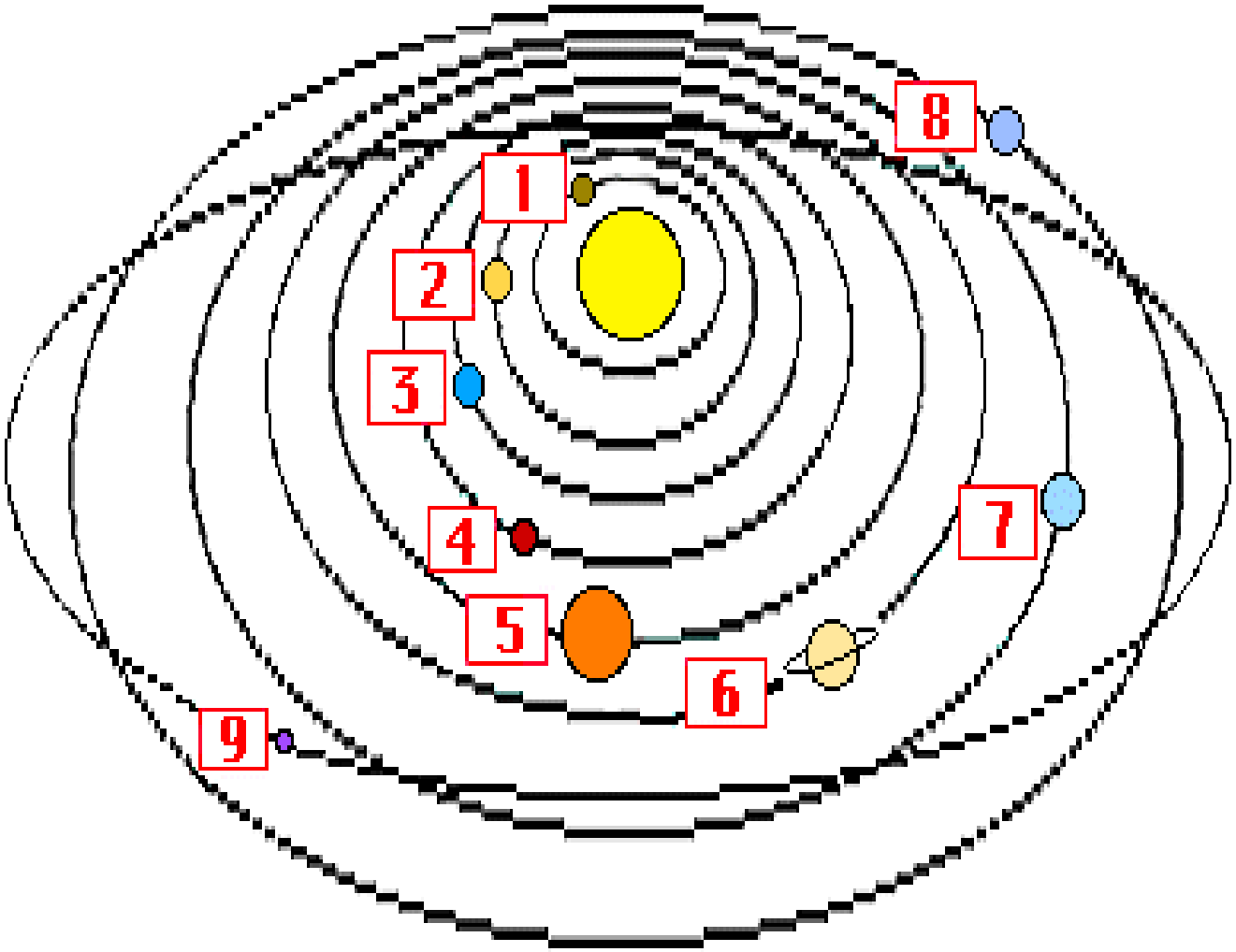


ACTIVITY 5

Where Oh Where Does that Planet Go?

Student Data Log

http://starchild.gsfc.nasa.gov/Images/StarChild/solar_system_level1/planet_go.gif



ACTIVITY 5

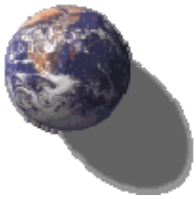
Solar System Planets

Student Data Log

MERCURY _____

VENUS _____

EARTH _____



_____

MARS _____

ACTIVITY 5

Solar System Planets (continued)

Student Data Log

JUPITER _____

SATURN _____

URANUS _____

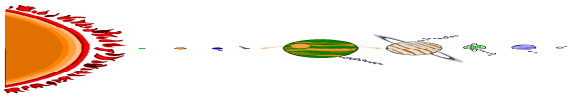
NEPTUNE _____

PLUTO _____

ACTIVITY 5

THE SOLAR SYSTEM

"Cool" Planet Facts



Mercury

1. Closest to the Sun
2. Rotates three times around its axis for every two orbits around the Sun
3. Sunrise to sun set is 88 days
4. Night is 88 days
5. There is no air and water and nothing will grow
6. Surface is hard and rocky with pitted craters covered with dust
7. Daytime temperatures are approximately 700°F/370°C
8. Nighttime temperatures are approximately -300°F/-185°C

Venus

1. Surface temperature 900°F/484°C
2. Heavy atmosphere that would crush us
3. Almost Earth's twin in mass, size, and composition
4. Carbon dioxide atmosphere and we would not be able to breathe
5. Lots of thunder storms
6. Lightning flashes about 25 times a second
7. Surface is flat with broken rocks

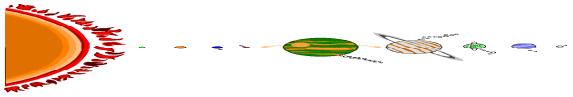
Earth

1. Has life
2. Atmosphere is 76% Nitrogen and 22% Oxygen, 2% other gases
3. Has water

Mars

1. Is known as the Red Planet (due to iron-oxide in soil)
2. Has seasons just like Earth
3. The atmosphere is thin and a spacesuit is needed to protect from radiation
4. Bitter cold –the temperature is -200°F/-129°C
5. Not much water on the planet
6. Many dust storms
7. Dusty pink sky
8. Olympus Mons-largest volcano in the Solar System- it is higher than Mt.Everest and its base would cover Missouri
9. Vallis Marineris – a giant equatorial rift (canyon) that if on Earth would stretch across the United States from the east coast to the west coast

THE SOLAR SYSTEM
"Cool" Planet Facts

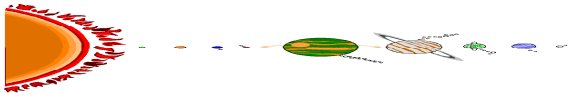


Jupiter
1. Largest planet –so large that in some ways it is like a small sun that never reached maturity
2. Jupiter is known as a gas giant. Its surface is not solid.
3. Jupiter has a Red Spot. Some say that this is an intense hurricane. Five Earths can fit in the Red Spot (five diameters that is).
4. Atmosphere is made of swirling clouds. These swirling clouds make the planet look like a striped beach ball.
5. Has 16 moons

Saturn
1. Second largest planet
2. Saturn's rings stretch two and a half times the distance from Earth to the Moon.
3. Rings are made up of ice and rock.
4. Atmosphere of clouds
5. Saturn has 20 moons. This planet has the most moons in the Solar System.
6. Not able to breathe on Saturn (atmosphere is mostly hydrogen)
7. High winds that would tear apart any living thing
8. No solid land

Uranus
1. Spins sideways- some scientists believe that something hit it when it was forming and turned it on its side.
2. Winter lasts for 42 years where the sun is not seen.
3. Summer/Spring lasts for 42 years where the sun is in the sky for 42 years
4. Atmosphere is poisonous (methane & ammonia)
5. No solid surface- the atmosphere gets thicker and thicker and changes from a gas to a liquid.
6. Gravity almost matches that of Earth but the atmosphere is too heavy to live on Uranus.

THE SOLAR SYSTEM
"Cool" Planet Facts



Neptune

1. Was discovered in 1846
2. It moves so slowly around the sun that it has not completed an orbit since it was discovered. Yet, spins fast on its axis (sometimes called a spinning top)
3. Has several thin rings
4. Atmosphere is mostly hydrogen, ammonia and methane gasses that give the planet its blue color.
5. Has a liquid surface much like an ocean
6. Has a heavy atmosphere
7. High winds approximately 100mph
8. Thick cloud cover
9. Great Dark Spot- Some say this is a hurricane.

Pluto

1. Discovered in 1930 (only planet discovered by an American astronomer)
2. Unusual orbit-it exchanges position with Neptune
3. Orbit is more elliptical that any other planet in our Solar System
4. Surface is made of ice and rock- some describe the planet as a dirty ice-skating rink.
5. Temperature is -400°F
6. Pluto has one moon named Charon. Charon is almost the same size as Pluto.

ACTIVITY 6

ROCKET RHYMES AND SONGS

Objective:

Students use rhymes, chants, songs, and creative movement to practice rhyming words.

Subject Area:

Social Studies, Language Arts, Music

Materials:

- Chart paper
- Sentence strips
- International Space Station picture
- Soyuz picture
- Small rocket drawing
- Crayons or markers
- Craft sticks (5 per student)
- Glue or glue sticks
- Pictures of rockets (www.nasa.gov)

Procedure:

1. Write the songs, rhymes, and chants on chart paper or sentence strips for students to read as they sing.
2. Draw, color, and laminate the ISS and rockets for later use.
3. Make a teacher set of five rockets cut out and glued to craft sticks to show students.
4. Make copies of small rockets so that each student has a set of five
5. Students color and cut out their five rockets and glue them to a craft stick.
6. Introduce one song, chant, or rhyme at a time. Hum the tune to the song so the students can get the tune.
7. Repeat the song substituting the new words.
8. Develop movements to go along with the song.
9. Everybody sing and dance!

Extension:

Simple addition and subtraction in counting rockets as they liftoff.

Reading:

Blast Off! A Space Counting Book by Norma Cole and Illustrated by Marshall Peck III

Wood-Hoopoe Willie by Virginia Kroll and illustrated by Katherine Roundtree

ACTIVITY 6 ROCKET RHYMES AND SONGS (continued)

Songs

Tune: *Have You Ever Seen a Lassie?*

Did you ever see a rocket
A rocket, a rocket?
Did you ever see a rocket go
This way and that?
Go this way and that way, go
This way and that way,
Did you ever see a rocket go
This way and that?

Repeat the song, Substitute the word "station" for the word "rocket". Hold and move a drawing of a Proton or Soyuz rocket or the ISS while singing the song.

Tune: *I'm a Little Teapot*

I'm a little rocket,
Tall and thin,
Here is my nose cone.
Here is my fin.
When I get all fired up,
Launch begins,
Watch me rise
And see me spin!

Develop movements to accompany the song.

Tune: *Twinkle, Twinkle Little Star*

Rocket, rocket in the sky
Flying fast and flying high,
Off to find the ISS
What's in it? Can you guess?
Rocket, rocket in the sky,
Flying fast and flying high.

Substitute the words "Proton", "Soyuz" or "shuttle" for the word "rocket". Develop movements to accompany the song. Hold and move a drawing of a Proton, Soyuz, shuttle or the ISS while singing the song.

Chants and Rhymes

I'm a little rocket *(child squats)*
Pointing toward the sky *(points arms upward)*
4…3…2…1 *(repeat slowly)*
Blast off! Fly! *(Springs into the air)*

---

5 little rockets ready to zoom,
The first one says, "There's not enough room."
It starts its engine; ready to fly,
Looks at the others and
Waves good-bye

4 little rockets
3 little rockets
2 little rockets
1 little rocket

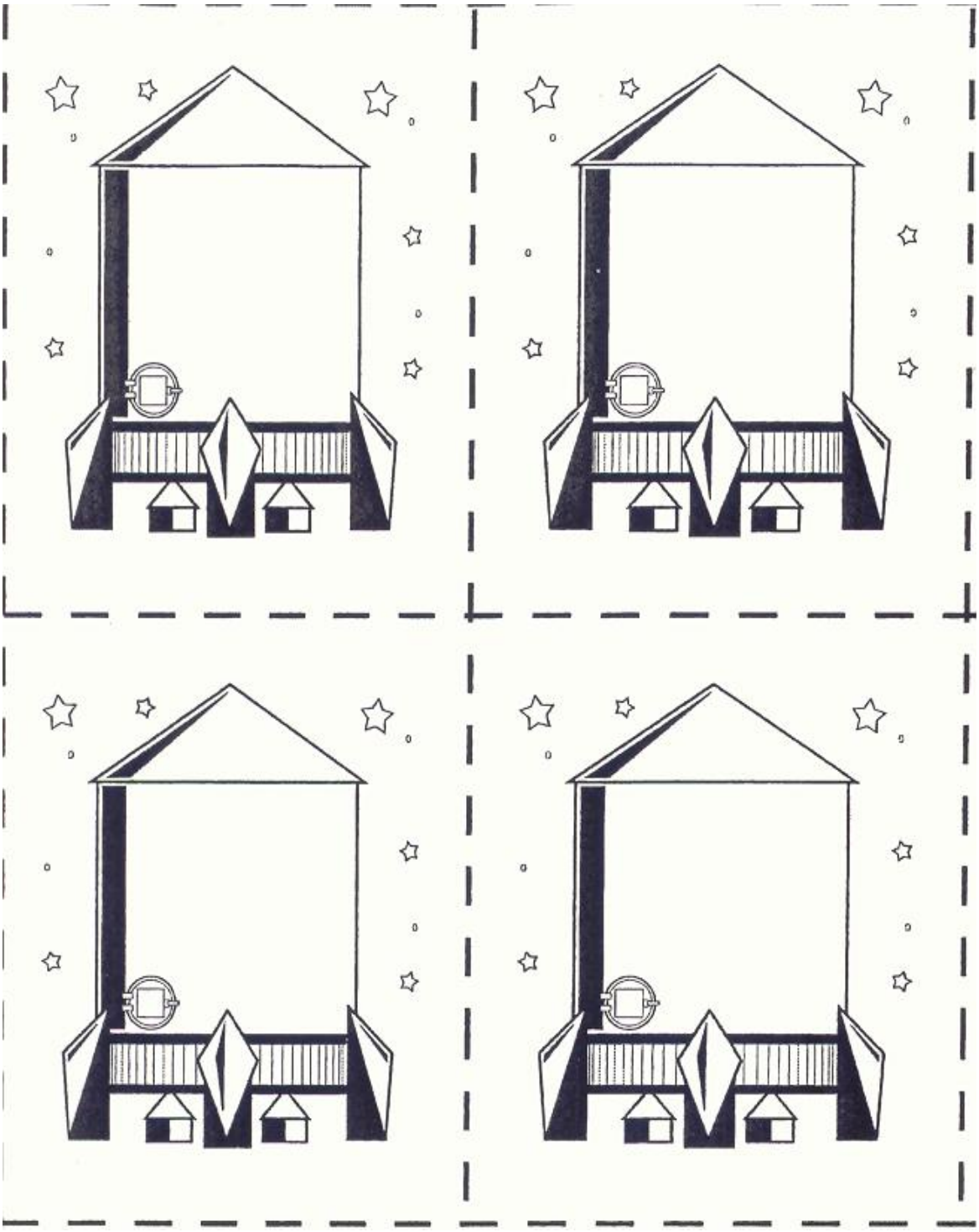
Students may use their fingers or five copies of the small rocket to represent the five rockets in the rhyme. Have students color, cut out the rockets, and glue them to wooden craft sticks. Discuss the simple subtraction problems in this rhyme. Have students create movements to go with the words in the rhyme.

Many nations,
Build a station,
A science place,
A home in space,
Where people stay,
And work each day

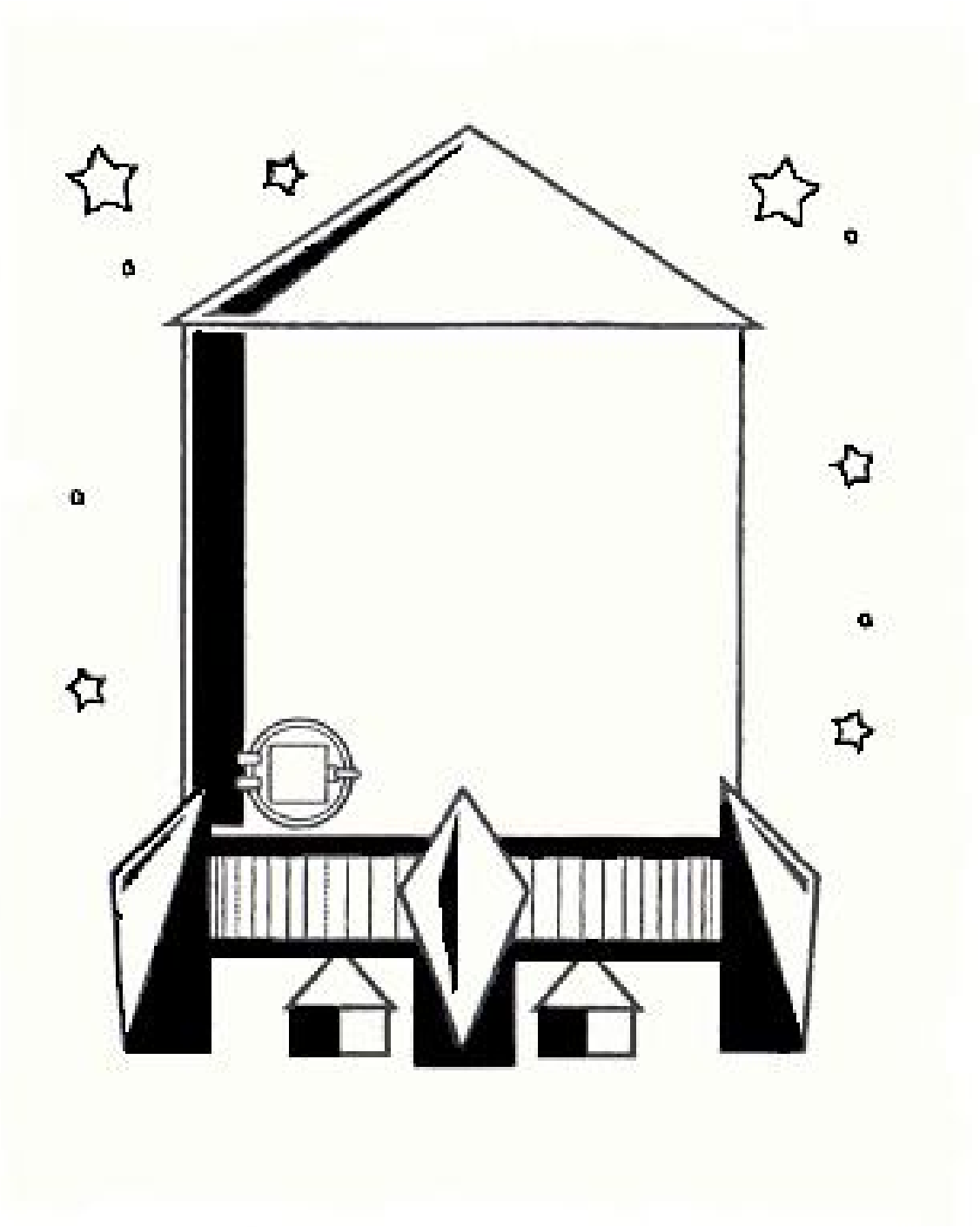
ACTIVITY 6

ROCKET RHYMES

TANGRAM ROCKETS



ACTIVITY 6
ROCKET RHYMES
TANGRAM ROCKET



ACTIVITY 7
PENCIL PERIMETERS

Objective:

Students explore linear measurement using pencils.

Subject Area:

Math and Science

Materials:

Pencil and paper

Rulers

User pencils

Yardsticks

Procedures:

Teacher Questions:

1. What do you think would happen if we laid out all the pencils in this room from end to end?
2. How far would they go?
3. Could we make a line with them across the classroom?
4. Do you think they would go out into the hall?
5. Write down on a large piece of paper the class's predictions.
6. Have students estimate the length of the classroom pencils.
7. Record the estimates.
8. Have the class gather all the pencils in the room and lay them out end to end.
9. Measure with yardsticks and rulers.
10. Discuss and record using student made graphs to illustrate results.
11. Compare the results with the estimates.
12. Discuss why there may be differences.

Extension:

Sort and categorize all the pencils by color and length.

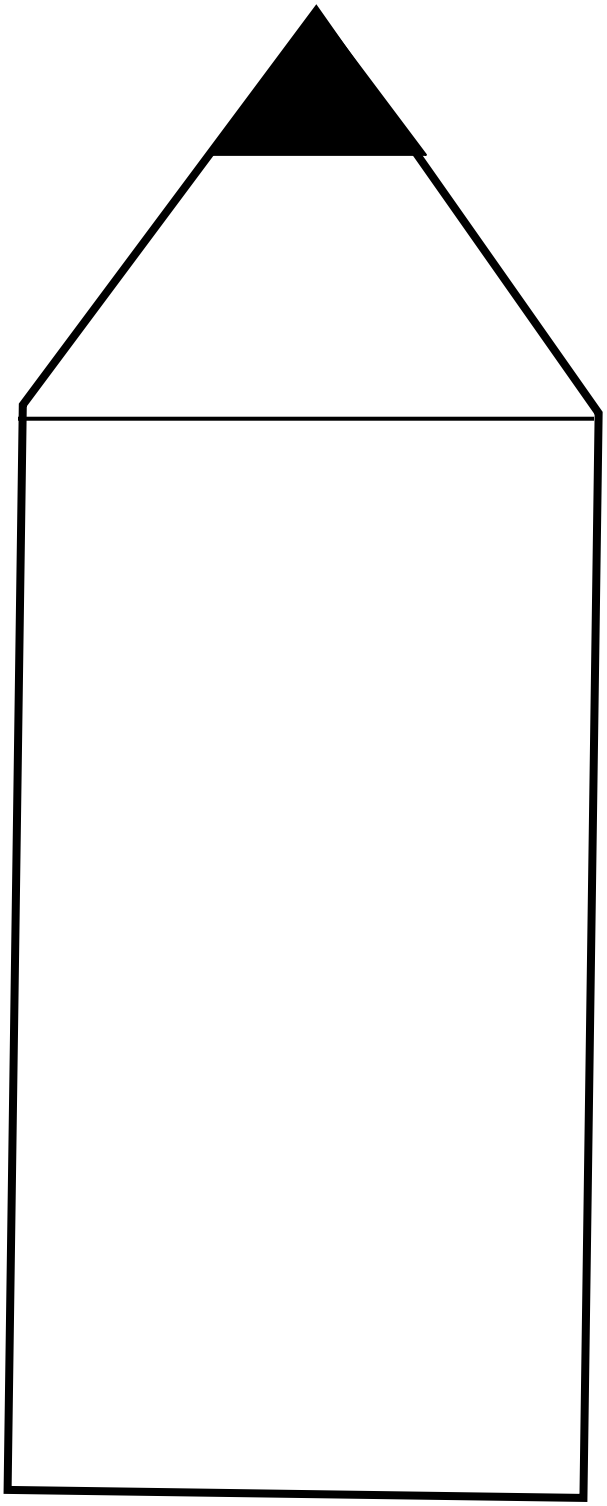
Reading:

How Much Is a Million by David Schwartz

Activity 7

Pencil Perimeter Template

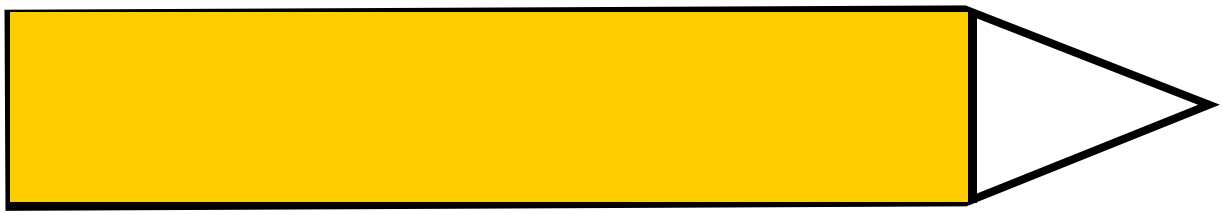
Student Data Log



Activity 7 Pencil

Perimeter

Student Data Log



1. Predict how many pencils it would take placed end to end on the floor to measure the length of the entire classroom. Record your number here: _____

2. Your teacher will help the class lay out all the pencils to measure the actual length of your classroom.

3. Count all the pencils lined up on the floor. Record the number here: _____

4. Measure the length of your pencil using your ruler. Record your answer in centimeters here: _____

5. Measure the length of the pencil template on your data log with your ruler. Record your answer in centimeters on the data log.

6. Use your pencil ruler to measure the length of other objects in the room.

7. Your foot _____

   A book _____

   A piece of paper _____

ACTIVITY 8
WEIGH STATION

Objective:

Students develop algebraic reasoning skills by looking for patterns to determine the weight of objects.

Subject Area:

Mathematics – Puzzles and Problems

Materials:

Digital balance scale

Objects of different shapes

Weight Scale Student Sheets

Pencils

Procedure:

1. Students work in pairs to find the weight of each block.
2. Record answers on the data logs.
3. Look for patterns to solve each problem.
4. Tell your partner how you solved the problem.
5. List the steps you followed in order to find the weight of each block.
6. Describe through a paragraph how you solved the problem.
7. What patterns did you observe?
8. How does seeing a pattern help you figure out what an object weighs?

Extension:

Science

Demonstrate the proper procedure for using a digital balance scale to find the mass or weight of a variety of different shaped objects. Have students take turns weighing the different objects.

Reading:

The M&M's Brand Color Pattern Book by Barbara Barbieri McGrath and Illustrated by Roger Glass

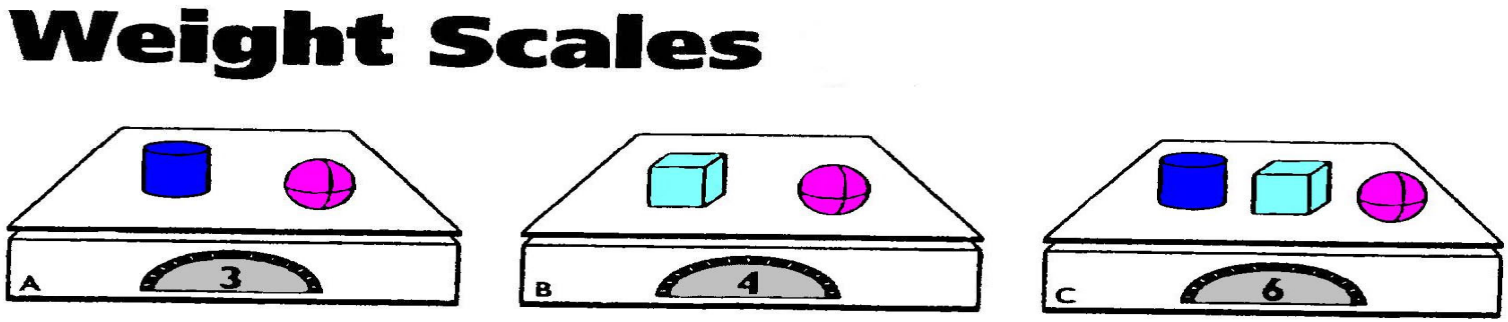
Sir Cumference and the Sword in the Cone by Cindy Neuschwander and Illustrated by Wayne Geehan

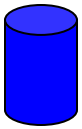
ACTIVITY 8

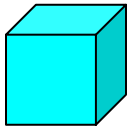
WEIGH STATION

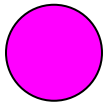
Student Data Log

Find the weight for each object on the scales below:



The blue cylinder weighs  **_____ grams (g).**

The turquoise cube weighs  **_____ grams (g).**

The pink sphere weighs  **_____ grams (g).**

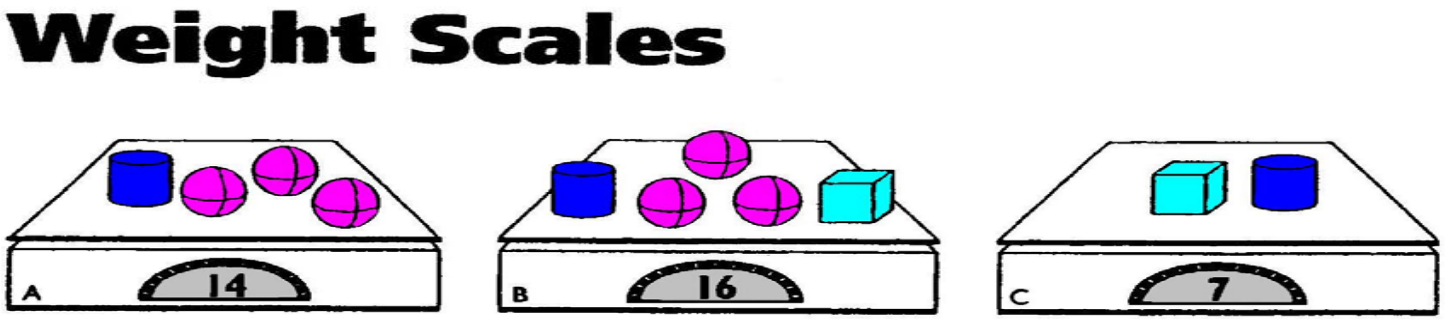
Describe how you solved the problem. _____

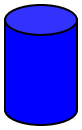
ACTIVITY 8

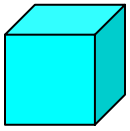
WEIGH STATION

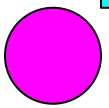
Student Data Log

Find the weight for each object on the scales below:



The blue cylinder weighs  **_____ grams (g).**

The turquoise cube weighs  **_____ grams (g).**

The pink sphere weighs  **_____ grams (g).**

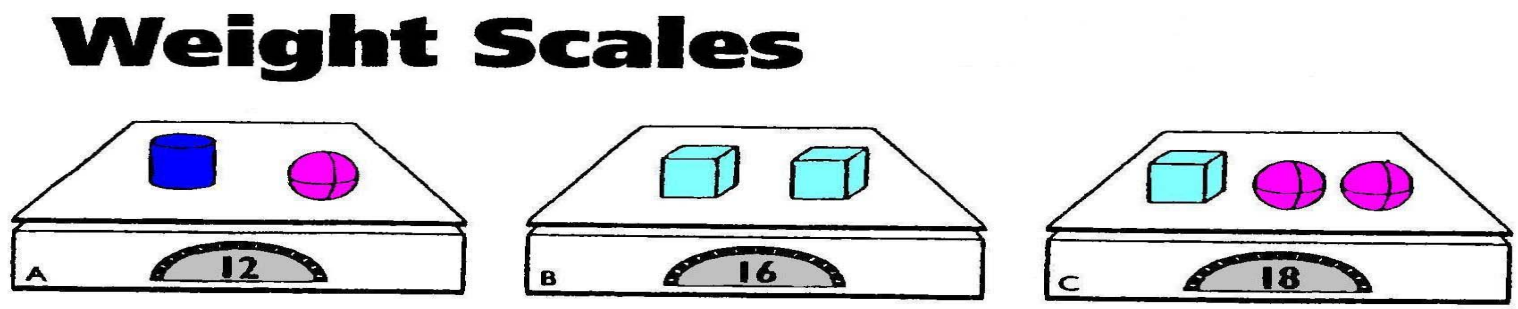
Do you see a pattern? Explain _____

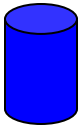
ACTIVITY 8

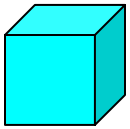
WEIGH STATION

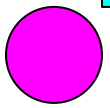
Student Data Log

Find the weight for each object on the scales below:



The blue cylinder weighs  **_____ grams (g).**

The turquoise cube weighs  **_____ grams (g).**

The pink sphere weighs  **_____ grams (g).**

How did you solve the problem? _____

ACTIVITY 9
GLITTER GERMS

Objective:

Students use glitter to create a simple experiment to show how easily germs can spread and learn about the importance of washing their hands.

Subject:

Health, Science

Materials:

Glitter (5 different colors)

5 flat containers for each group (shoe box tops or paper plates could be used)

5 paper towels or white cloths for each group

Procedure:

1. Students will work in groups. This activity is set up for five members to each group.

2. Fill each container with a different color of glitter. Ask each student in a group to choose one of the colors of glitter.

3. Help each student spread the white cloth or paper towel on each table.

4. Group members take turns placing one hand flat (palm side down) into the glitter.

5. Then have students shake hands firmly with the all the other members of the group.

6. After all group members have shaken hands rub off as best you can the different colors of glitter from your hands onto the white cloths or paper towels.

7. What colors of glitter are on the cloths or paper towels?

   _____
   _____

8. Were you able to get all the glitter off of your hand?

   _____
   _____

9. Do you see more of one color on the paper towel?

   _____
   _____

10. What does this investigation reveal about the ways germs are spread?

    _____
    _____
    _____
    _____
    _____

11. What did this experiment teach you about the importance of washing your hands?

    _____
    _____
    _____
    _____
    _____

Extension:

Invite the school nurse to participate in this activity to share expertise. Students participate in a proper hand washing exercise.

Reading:

Germs Make Me Sick by Melvin Berger and illustrated by Marylin Hafner.

The Germ Busters by Rosemary Wells and illustrated by Jody Wheeler

ACTIVITY 10
BUG-GO

Objective:

Bug-go is designed to help the students learn to identify some arthropods such as insects while learning which insects are beneficial and learn interesting facts about others. The game should be played similar to Bingo.

Please note: The Bug-Go game and information sheets contain pictures and information not only insects but also other arthropods.

Subject:

Science

Materials:

- Arthropod Information Sheets and instructions
- Bug-go Player Game Cards
- Insect (Flash cards)
- Insects card pictures for the overhead
- Prizes
- Box or container to draw insect cards
- Card markers such as pennies or plastic disks

Procedure:

The information sheets contain a list with information about each of the insects and other arthropods on the Bug-go cards. The list can be cut apart and placed in a box or large envelope for students to pick the insects.

Play the game by drawing a slip of paper with the insect name and information from the box. Depending on the age of the players, you may want to show a picture of the insect. If an insect is present on a student's card, they cover it with a marker.

Students win when they have "bug-go," that is when they have covered insects in a row either vertically or horizontally.

The flash cards are line drawings of the insects which can be printed and made into flash cards or overheads to help the students recognize them.

Extension:

Counting, sorting, and classifying the bug pictures according to physical characteristics.

Take a nature walk to observe insects in their natural environment.

Reading:

The Icky Bug Alphabet Board Book by Jerry Pallotta and illustrated by Ralph Masiello

Face-to-Face with The Ant by Luc Gomel Photographs by Remy Amann and Dominique Stoffel.

Arthropod Information Sheets

Bumble Bee - (Order - Hymenoptera) Bumble bees are larger than most bees. They have a hairy abdomen with at least some yellow markings. They are very important pollinators. An elongated mouth-part enables them to pollinate red clover, which no other bee can. Bumble bees usually build their nests underground. During the winter, the queen survives alone in the nest and starts a new colony in the spring. Bees can be easily distinguished from wasps by the pollen baskets on their legs and their hairy bodies.

Flea - (Order - Siphonaptera) Fleas are pests of dogs, cats, and livestock. With their piercing, sucking mouth parts, they will bite humans, too. The large hind legs are good for hopping on and off their animal meal. Their legs, which can jump a relatively long distance, are good for changing hosts, and the comblike appendages help the insects resist being brushed out of hair. Because their bodies are flattened, they can move easily between the animal's hairs.

Adult fleas lay all of their eggs (up to 50 per day) on pets or other animals. The immatures or larvae are very tiny wormlike creatures, and can be present on fabric, carpet, or outdoors. Fleas generally do not prefer humans; however, they may try to feed on humans if they have been starved for a long period of time. Fleas have also been known to carry diseases such as black plague (from fleas that usually infest rats), although there is not a lot of risk of those diseases in the United States at this time.

Chigger - (Class Arachnida, not Insecta) Chiggers are the larvae of a family of mites that are sometimes called red bugs. The adults are large, red mites often seen running over pavement and lawns. Chiggers are extremely small (0.5 mm) and are difficult to see without magnification. Adult chiggers have eight legs like spiders and other Arachnids. The six-legged larvae are hairy and yellow-orange or light red. They are usually found outdoors in low, damp places where vegetation is rank and grass and weeds are overgrown. Some species also infest drier areas, however, making it difficult to predict where an infestation will occur.

Chiggers overwinter as adults in the soil, becoming active in the spring. Eggs are laid on the soil. After hatching, the larvae crawl about until they locate and attach to a suitable host. The larvae do not burrow into the skin, but inject a salivary fluid which produces a hardened, raised area around them. Body fluids from the host are withdrawn through a feeding tube. Larvae feed for about 4 days and then drop off and molt to nonparasitic nymphs and adults. Chiggers feed on a variety of wild and domestic animals, as well as humans. The life cycle (from egg to egg) is completed in about 50 days. Most people react to chigger bites by developing reddish welts within 24 hours. Intense itching accompanies the welts, which may persist for a week or longer if not treated. Bites commonly occur around the ankles, waistline, armpits, or other areas where clothing fits tightly against the skin. Besides causing intense itching, chigger bites that are scratched may result in infection and sometimes fever. Chiggers in North America are not known to transmit disease. Regular mowing and removal of weeds and brush make areas less suitable for chiggers and their wild hosts. (Information from University of Kentucky ENT- 58 Invisible Itches by Dr. M. Potter.)

Velvet Ant - (Order - Hymenoptera) The velvet ant is actually a medium-sized wasp that is often found in lawns or pastures. These solitary wasps, as the name implies, are densely covered with hair. Males have wings, but females are wingless, and are sometimes confused with ants. Ants, however, have elbowed antennae and a "hump" in the constriction between the thorax and abdomen. Velvet ants are either

shades of brown or red and black, and females will sting if encountered. These wasps are sometimes called "cow killers" because their sting is so painful that is seems powerful enough to kill a cow! Velvet ants are parasites of other wasps and bees that develop in soil, or paper or wood nests. The female velvet ant will enter a nest, kill the owner by stinging her, and lay her eggs on the owners' larvae in the nest cells. The velvet ant egg will hatch into a larva and feed on the other (host) larvae.

Millipede - (Class - Diplopoda, not Insecta) Millipedes cannot hurt people. They do look similar to centipedes (their sometimes dangerous relatives), but with two big differences: millipedes have chewing mouthparts and they have two pairs of legs for each body segment (centipedes have only one pair of legs per segment). You should be careful if you choose to handle a centipede as their bite can be painful.

Millipedes are scavengers, feeding on either living or decaying plant parts near the forest floor. Many species are able to give off a foul smelling fluid that is toxic to insects, but won't do any damage to humans.

Dragonfly - (Order - Odonata) Dragonflies are some of the largest insects. They are beneficial insects—preying on smaller insects such as mosquitoes and crop pests. Dragonflies knew about fast food long before humans; they hold their prey in their legs and munch while flying. Zipping along at speeds up to 35 miles per hour, dragonflies are often found near and over ponds or streams.

The immature stage of this insect lives underwater in streams and lakes and feeds on aquatic insects and other arthropods. Immatures of some of the larger species even feed on small fish. The aquatic stage cannot hurt humans either.

Despite old folktales that claim they sew up your ears or your lips, they do not attack humans. If you happen to catch one (good luck!) and are holding onto it, it might pinch, but it cannot break the skin.

Cockroaches - (Order - Blattodea) Cockroaches have been hated and feared for centuries. However, they do not have any biting or stinging ability. While historically they have been associated with dirty conditions, they can be found in any type of structure. Because cockroaches can be found in filthy areas as well as clean areas, they pose a threat to human health by carrying disease-causing bacteria onto surfaces or into food in the home when they move from one place to another. Roaches like to live in rooms of the home that have high humidity such as the bathroom and especially the kitchen where food crumbs maybe present. Roaches usually stay hidden during the day and come out at night in search of food. People may also develop increasingly severe allergies to cockroaches themselves with continued exposure.

Praying Mantis - (Order - Mantodea) Praying mantises are predators of several crop and garden pests. Although they look quite menacing, they do not have the ability to hurt humans. In fact, they may make good pets as long as they are well fed with smaller, soft-bodied insects, and water is available. Otherwise, they are best left in a garden, working at keeping pests away. Adult mantises and the nymphs will feed on aphids, beetles, bees, butterflies and even each other! Their excellent hunting ability may be helped by the fact that praying mantises, unlike other insects, can turn their heads 180 degrees.

In the fall, you can find their egg casing glued to sticks and sometimes on the sides of buildings. In the spring, the eggs will hatch releasing the new baby praying mantises.

Lacewing - (Order - Neuroptera) Lacewings are interesting-looking insects which, as adults and larvae, are considered beneficial because they are predators of pest insects.

Both adults and larvae will eat aphids, thrips and mites. They will not hurt humans. However when touched, they may release an unpleasant odor. Green lacewings are very common and can be found in most types of vegetation. They have large, metallic yellow eyes and pale green iridescent wings. Lacewing eggs are laid at the end of very slender stalks, which makes them very easy to distinguish.

Walking stick - (Order - Orthoptera) Walking sticks are well named. That's exactly what they look like! They can be brown or dark green and are easily camouflaged in trees and on other plants. They are plant feeders and have no ability to hurt humans. They make great pets. Be sure to provide them with plenty of plant material that they will eat. Don't worry if your walking stick should loose a leg, he can grow a new one!

Grasshopper - (Order - Orthoptera) Grasshoppers are grass feeders that normally want nothing to do with humans. When handled, they may regurgitate a brown liquid as a scare tactic, and may pinch with their mandibles (jaws), but their jaws are not strong enough to do any damage. Other than that, they do not pose a threat but can cause damage to vegetable and field crops. Grasshoppers can usually be found feeding on the leaves and stems of plants during the day. In the fall, most grasshoppers lay their eggs in the soil. The eggs will hatch in the spring and nymphs immediately start feeding on plants.

The large back legs of the grasshopper are great for jumping and traveling. Grasshopper populations can grow to large numbers and can move long distances.

Japanese Beetle - (Order - Coleoptera) The Japanese beetle is often confused with the larger June beetle. Japanese beetles are metallic blue-green with copper colored wing covers. They can be identified by the tufts of white hair along their abdomen. These tufts of hair are not present on the June beetle.

Japanese beetles were imported into the United States in 1913. The adult beetles and the grubs (an immature beetle found in the soil) are pests. Adults feed on almost everything from roses to fruit trees to soybeans. The immature stage or grubs can be in the soil feeding on plant roots.

May beetles, June beetles and Japanese beetles belong to a very closely related group of beetles called scarabs. People in Egypt thought scarabs were good luck. Beetles may fly into and land on people. They cannot hurt humans, although if you catch them and won't let them get away, they may give a slight pinch.

Cicada - (Order - Hemiptera) Cicadas are large, distinctive creatures that are common in late summer and make very loud, unnerving noises, especially when disturbed. They do not feed as adults, and other than making noise, will not bother people.

Cicadas lay their eggs in twigs or small branches of trees and shrubs. Once hatched the nymphs will drop to the ground and burrow into the soil. There they will molt several times before coming above the ground for their final molt. You can often find the skin of the final molt of the cicada attached to a tree or building. The two most common types of cicadas are the dogday cicadas which has a two or four year life cycle and the periodical cicadas that have either a 13 or 17 year life cycle.

Centipede - (Class - Chilopoda, not Insecta) Centipedes are not actually insects but are closely related to insects. They have long flattened bodies, with at least 15 pairs of legs, and fangs, which can inflict a painful bite.

Centipedes can be distinguished from the similar but harmless millipedes by having fangs (instead of chewing mouthparts), and one pair of legs per body segment (versus

two pairs of legs per body segment in millipedes).

Swallowtail Butterfly - (Order - Lepidoptera) Swallowtail butterflies can often be easily recognized by the small tails at the tips of their back wings. The Giant Swallowtail, which is black with yellow markings, is the largest butterfly in the United States and Canada. There are over 500 species of the swallowtail worldwide.

Butterflies and moths are very beautiful and graceful creatures. When caught, they will probably put up a fight by fluttering their wings, which can be unnerving but is not harmful. If a butterfly lands on a person, it is possible that it just wants a sip of sweat, which contains salts that butterflies need. Their mouthparts are only modified to suck nectar and other liquids, and they will not bite or sting.

Tick - (Class - Arachnida, not Insecta) Ticks are arachnids since they have 4 pairs of legs. They can be found in wooded areas, or fields with tall grass. Ticks are very small, and many are hard to see. Ticks spend their time waiting for a mammal, such as a dog, deer or yourself to pass close enough for them to hitch a ride. Once on board, the female tick bites and buries her head in the flesh; swelling with the blood of the host. When entering an area that may be infested with ticks, the best way to keep from getting bitten is to tuck pant legs into socks, and to wear loose-fitting clothing. Ticks are dangerous because of the diseases (Lyme disease, Rocky Mountain spotted fever, etc.) they may carry. Ticks often do not attach immediately, but walk over the skin until they come to a tight place, such as around the waist or wherever clothing is tight on the body. Check yourself or have someone else check you for ticks as often as you can, so you can remove them before they bite. If a tick does attach to the skin, do not try to pull it off with your fingers, because the mouthparts may break off underneath the skin. It is better to use a clean pair of tweezers, grasping the tick as close to the front of the head as possible, to pull the tick off with its mouthparts intact.

Blister Beetle -(Order - Coleoptera). The name blister beetle comes from the fact that this beetle's blood contains a substance called cantharadin which will cause blisters if it comes in contact with skin or is swallowed. You should always wear gloves if removing blister beetles from a plant by hand. They can be especially harmful, even fatal, if eaten by livestock.

Blister beetles may be solid black or gray. They can also have yellow stripes. They feed on vegetable plants such as tomatoes, potatoes, beans and peppers.

The female adult blister beetle lays her eggs in the ground. Once hatched, the larvae will feed on the eggs of grasshoppers and bees.

Mosquito - (Order - Diptera) Mosquitoes are very well-known human pests. Only the females bite since they need blood to reproduce. Male mosquitoes feed on nectar. The saliva that is injected while the mosquito inserts her mouthparts under the skin is what causes a mosquito bite to itch. In other parts of the world, mosquitoes are a major problem because they spread diseases such as malaria and yellow fever.

Mosquitoes are found most frequently near water, although they can travel a fair distance looking for hosts. Besides lakes and streams, mosquitoes breed in any pool of water, such as bird feeders, puddles and old tires.

Mosquitoes are eaten by birds, fish and dragonflies.

Stink Bug - (Order- Hemiptera) Stink bugs are truly stinky. As a defense mechanism, they will secrete a fluid with a foul odor. This insect has stink glands on its underside. Stink bugs are harmless but do cause considerable damage to flowers, trees, and crops. With their piercing-sucking mouth

parts, they suck liquid from plants. Some species however do feed on other insects such as beetles and caterpillars.

The body of the stink bug is shaped like a shield with a small head. The stink bug's head has antennae with five segments.

Damselfly - (Order - Odonata) Damselflies are often mistaken for their larger relatives, dragonflies. Both of these insects are often found near water since they both lay their eggs in water and feed on aquatic insects. However, damselflies are poor fliers compared to the dragonfly. Damselflies also rest with their wings folded together above their body.

Termites - (Order - Isoptera) A colony of termites will include wingless workers, soldiers that have large heads and powerful jaws and reproductives, the queen and the king. Termites are virtually the same width from end to end and have straight antennae. If wings are present, they will have four wings of equal size and length.

To create new colonies, in the spring, winged males and females swarm from the colony. Termites are famous for the damage they can do to wood structures. The protozoa living in their digestive tract enables them to eat wood. Termites live in the soil and build tunnels to the wood above.

Water strider - (Order - Hemiptera) The water strider actually walks on water. This insect has two short front legs that are used for grasping prey. The longer middle and hind legs allow them to use the surface tension of the water as means of staying above the water. The water strider feeds on smaller insects and in turn, becomes a source of food for fish and birds.

Leaf-footed Bug - (Order - Hemiptera) This insect's name may come from the shape of its back legs. The adults and nymphs can be found feeding on the foliage and fruits of plants such as peaches, beans, tomatoes and potatoes. When captured or threatened they will release an odor that helps protect them from their enemies. The leaf-footed bug is sometimes called a squash bug. The true squash bug however does not have the flattened leaf shaped legs and is a major pest of curcurbits such as cucumbers, squash and pumpkins.

Bedbug - (Order - Hemiptera) You don't want a bedbug in your bed! These oval-shaped insects want to suck your blood. Active only at night, both the males and females will bite, piercing the skin and injecting their saliva. The saliva will cause the bite to itch and/or swell. Once they are full of your blood, which takes only a few minutes, the bedbug crawls away to hide. Bedbugs not only feed on humans but also birds and other mammals. Bedbugs like many other insects can produce an odor that once you smell it, you will remember it.

Ground Beetle - (Order - Coleoptera) Where would you find a ground beetle? Running along the ground, of course. Ground beetles hide during the day under leaves, logs, or stones and come out at night to feed. There are hundred of species of ground beetles and they are of many different shapes, sizes, and colors. Many ground beetles feed on other insects and are considered beneficial insects. Most of the ground beetles are flattened and will have grooves or small holes running down the hard front wing covers. You will have to look quickly to see the ground beetles since they are fast runners.

Weevil - (Order - Coleoptera) Weevils are easily recognized by their elongated snouts. Weevils have a chewing mouth that is located at the tip of the snout. The long snout allows weevils to puncture and feed beneath the surface of fruit. They also feed on leaves. The most famous weevil is probably the boll weevil which is a major

pest of cotton. All weevils belong to the order of beetles.

House Fly - (Order - Diptera) The house fly and its relatives make up a very large and very diverse family of insects (Muscidae). The house fly is not only a pest but can spread diseases such as typhoid fever. Flies love to share your food. Since the house fly can only feed on liquids, it first salivates on the solid food then sucks up the food with its sponge-like mouth parts. It is difficult to swat the house fly because it can fly up to 30 miles per hour and can react to movement five times faster than we can.

Flies are generally associated with being around garbage. This may be because they like to lay their eggs in rotting organic matter. If you look closely at rotting material you may see the larval stage of the fly, also called a maggot.

Syrphid Fly - (Order - Diptera) The syrphid fly is also called the flower fly. You may be able to recognize this insect on your card by the three large bands across its abdomen followed by smaller incomplete bands. The adult syrphid fly is metallic green with yellow abdominal bands. They are great fliers and can dart about quickly and stop on a dime. They are also often seen hovering in mid air. Adults can frequently be found around flowers feeding on pollen and nectar. The syrphid fly will not sting or harm humans. In fact, the larval stage of this insect is of great value in pest control. The larvae look like small blobs, similar to a slug, and feeds on aphids, ants, and immature termites.

Colorado potato beetle - (Order - Coleoptera) The Colorado potato beetle has an oval-shaped body which is yellow with black stripes on the wing covers. There are dark dots just behind the head. The adult and larval stages of this insect feed on potatoes, tomatoes, peppers and eggplants. Potato beetle eggs are laid on the underside of leaves and resemble tiny orange footballs. The larva stage looks very different from the adult. They look like small orange humps with black heads and legs. There are two rows of black spots on each side of the hump.

The adult beetles spend the winter in the soil and can be a major pest in a home garden.

Grub - (Order - Coleoptera) A grub is the larval stage of a beetle. The life cycle of beetles is complete metamorphosis - egg, larva, pupa and adult. Beetles lay their eggs which hatch into a larva called a grub. Looking like plump worms, grubs will have a visible head and three pairs of legs. The grub on your card resembles the larval stage of a June beetle.

Carpenter Ant - (Order - Hymenoptera) The carpenter ant builds a nest by hollowing out wood from dead trees, stumps or even an old house. The carpenter ant is about twice the size of the black ant. They also live in colonies complete with workers (all females), a few males, and a queen. The queen, who is much bigger than a worker, produces all the young and can live for as long as 25 years.

Carpenter ants feed on other insects and are attracted to sweets. They do bite but cannot sting. Do not confuse this ant with a termite. Ants have a thin waist and have elbowed antennae.

Saturniid Moth - (Order - Lepidoptera) Saturniid moths are large with thick bodies. Their wings are often colorful and strikingly marked. They are members of the family Saturniidae. The saturniid moth on your card is the Polyphemus moth. It has an eyespot marking on each wing. The adult moth is reddish brown and can be found in wooded areas.

Adult saturniid moths have non-functioning mouth parts and do not feed. The caterpillar stage feeds on trees and shrubs. Caterpillars of the Saturniidae family may burrow into the ground and form a pupa while others

spin silk cocoons. The silk from the cocoons of some species is used commercially.

Convergent Lady Beetle - (Order - Coleoptera) Lady beetles are also called ladybugs and their correct name is ladybird beetle. The name can be traced to the middle ages when these beetles were dedicated to Our Lady the Virgin Mary.

The ladybug on your card is the convergent lady beetle. Its hard front wings (elytra) are red with 12 spots, 6 on each. There are several other species of lady beetles present in Kentucky. They can be white, yellow, pink, orange, red or black, and usually have spots.

The ladybug is widely used in biological pest control. Ladybug adults and larvae feed on the eggs of other insects and soft-bodied insects such as aphids, scales, whiteflies and caterpillars. Larvae do not resemble the adult ladybug. They look similar to tiny black alligators and are spiny, with bright spots. Although they look dangerous, ladybug larvae, like the adults, are harmless to humans. Their defense mechanism against predators is to secrete an odorous, distasteful fluid out of their joints when disturbed.

Scout Cat - (Family - Felidae, Species-*Felis spectator*) This shy but ferocious cat can be found throughout Kentucky. You will most likely find him in a field checking for weed, insect and disease problems on crops. You will recognize him by the sweep net he carries to use in taking insect counts and a hand-lens to help him identify diseases and weeds. The letters IPM will also appear on his shirt. He is the official mascot of the Kentucky Integrated Pest Management (IPM) Program. The IPM program provides educational training and information to all Kentuckians so that they can make a wise decision when deciding if they need to use a pesticide.

Much of the information provided on the following pages was taken from University of Kentucky Department of Entomology Extension Publications. These publications are available at the UK Department of Entomology web page: (http://www.uky.edu/Agriculture/Entomology/enthp.htm). Other books that can provide more information and be useful in insect identification include:

American Nature Guide's Insects by George C. McGavin

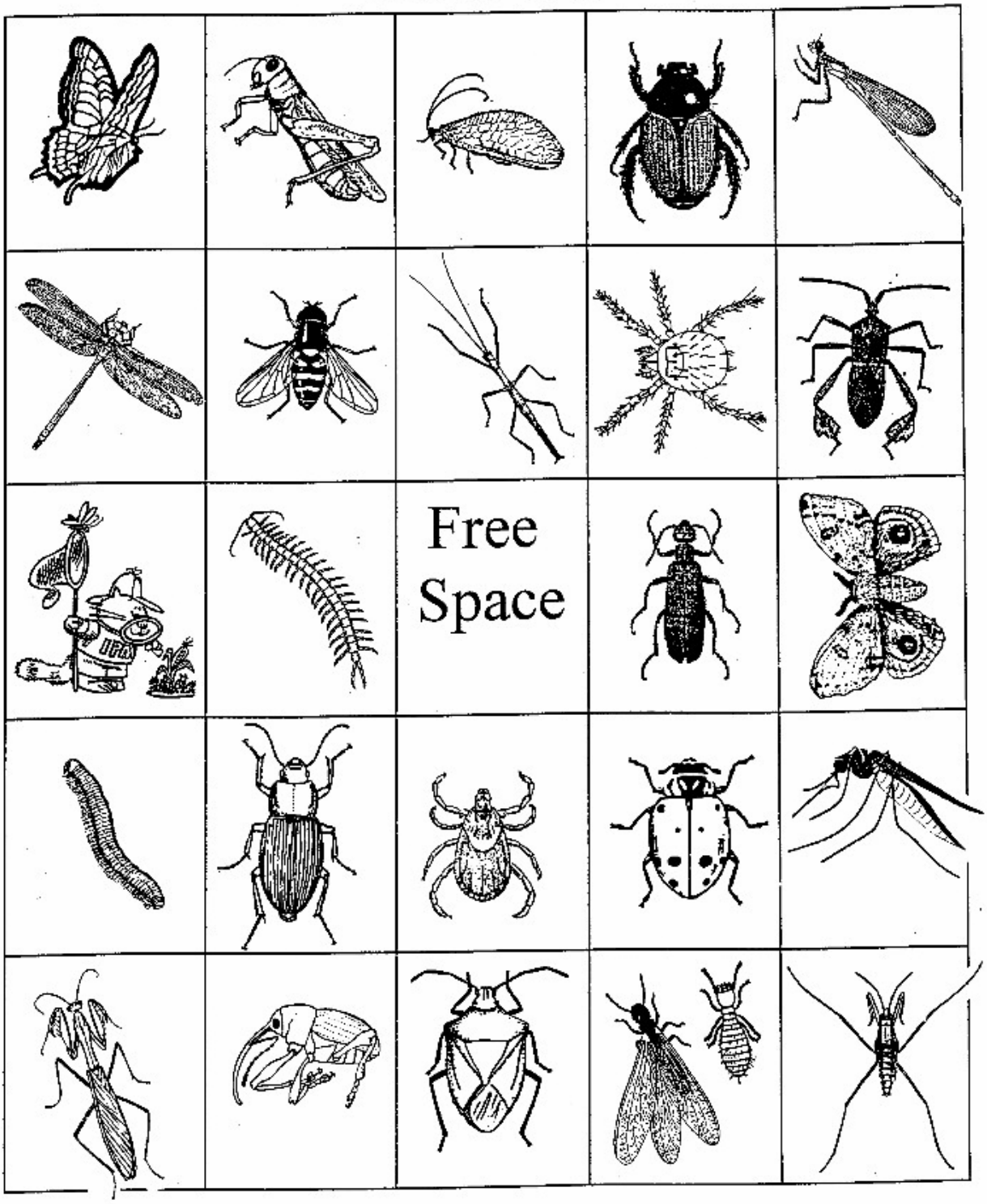
Simon & Schuster's Guide to Insects by Dr. Ross H. Arnett, Jr. and Dr. Richard L. Jacques, Jr.

Rodale's Color Handbook of Garden Insects by Anna Carr

A Golden Guide to Insects by Herbert S. Zim and Clarence Cottam

National Audubon Society First Field Guide Insect, by Christina Wilsdon

BUG-GO



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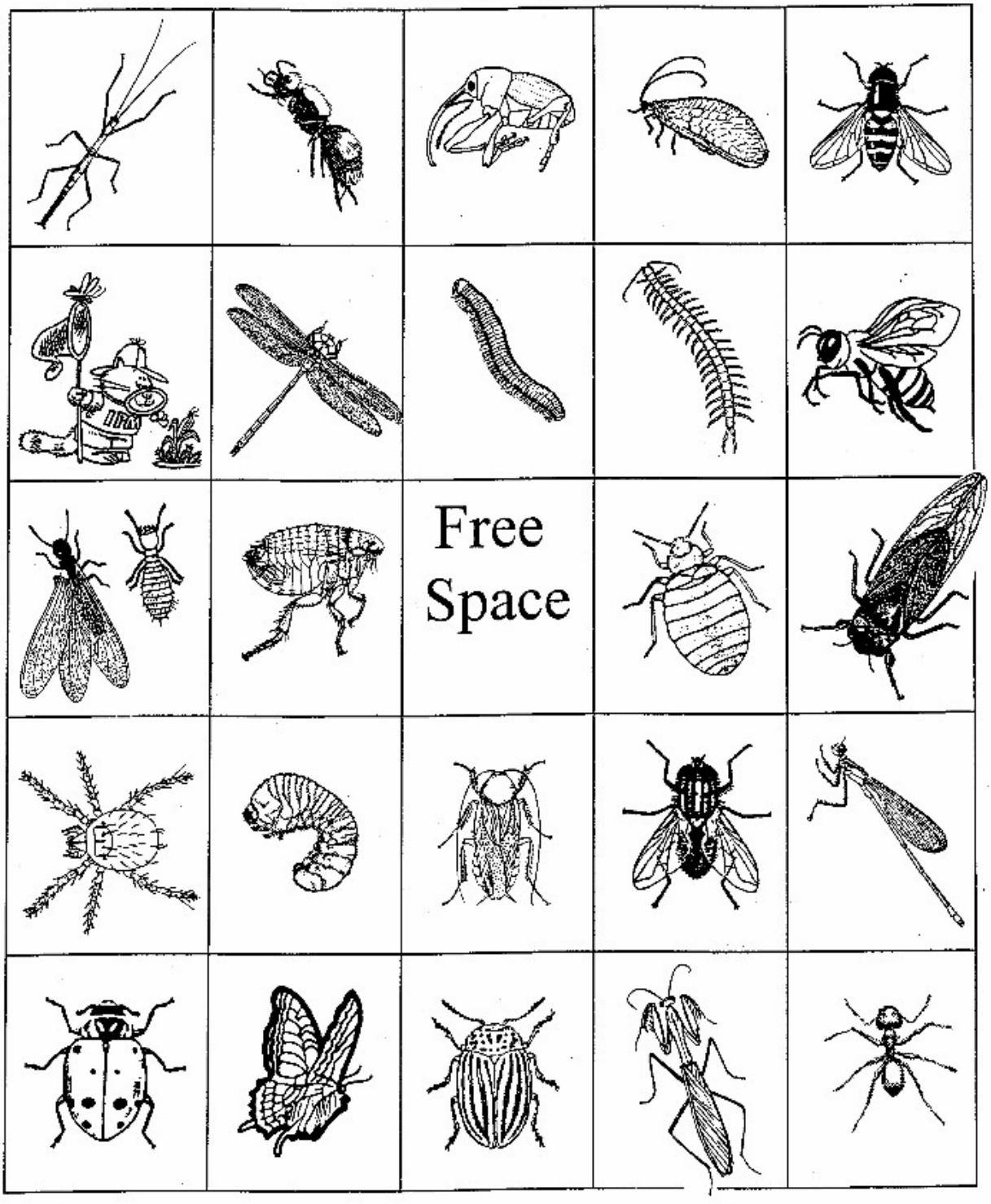

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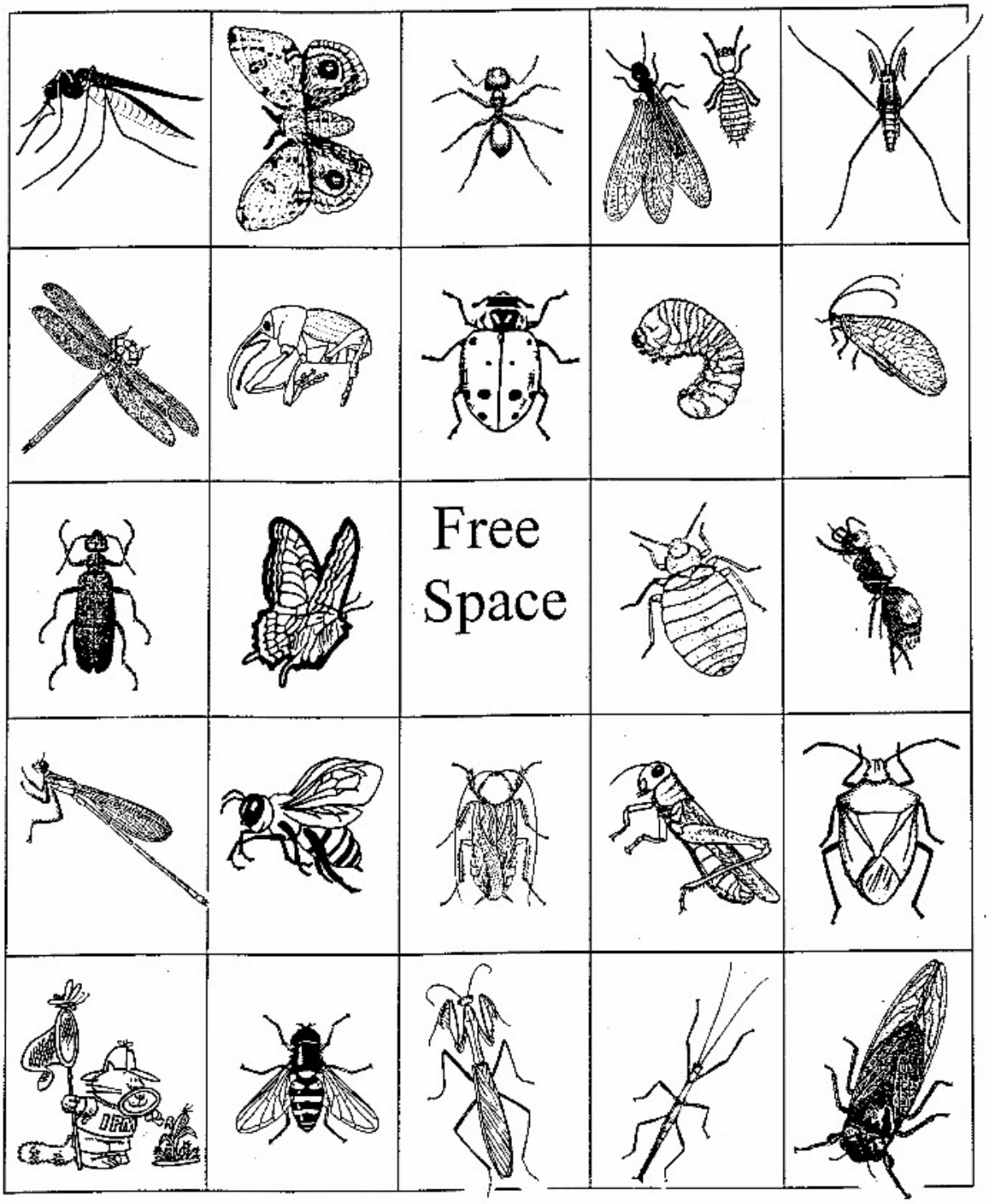

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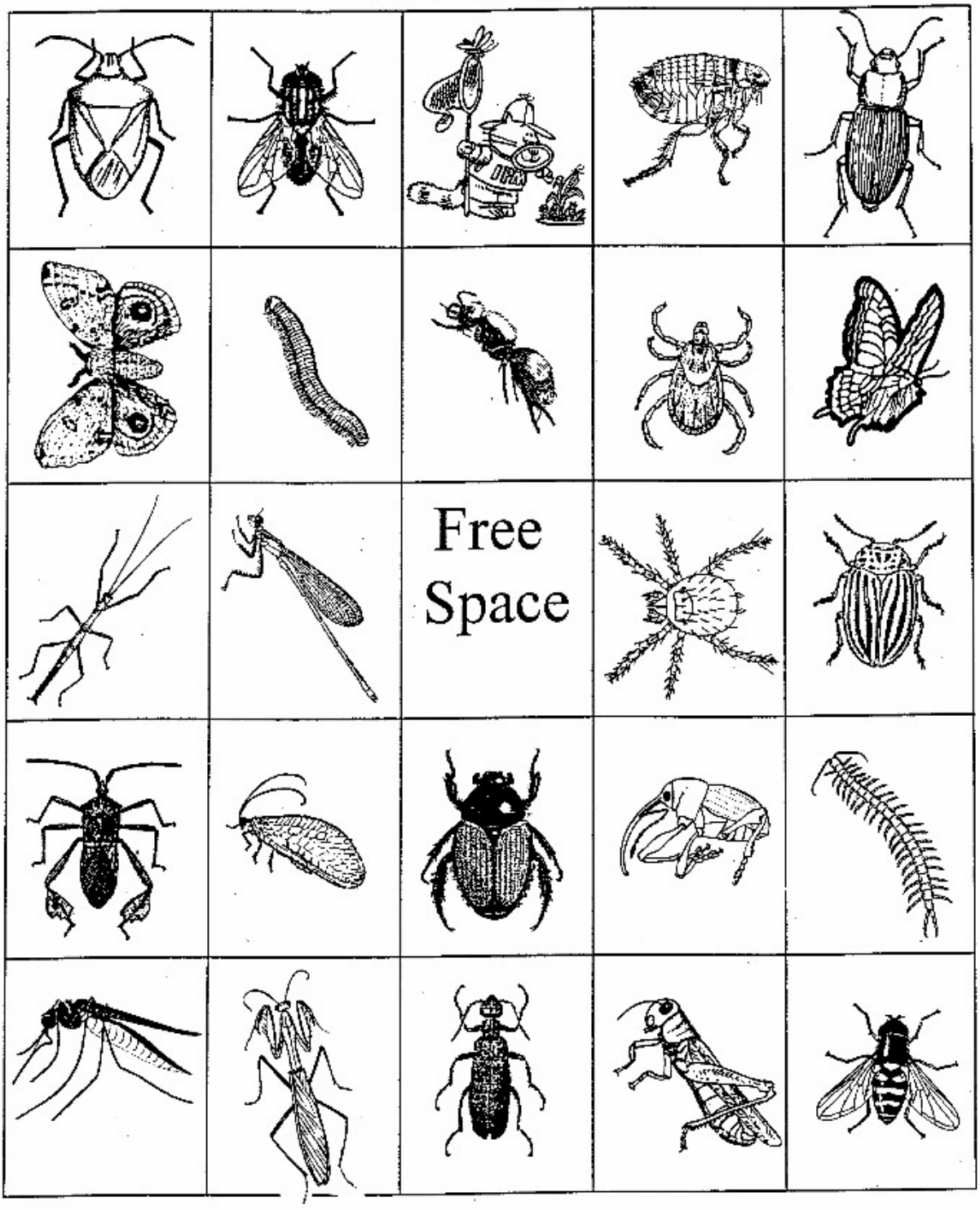

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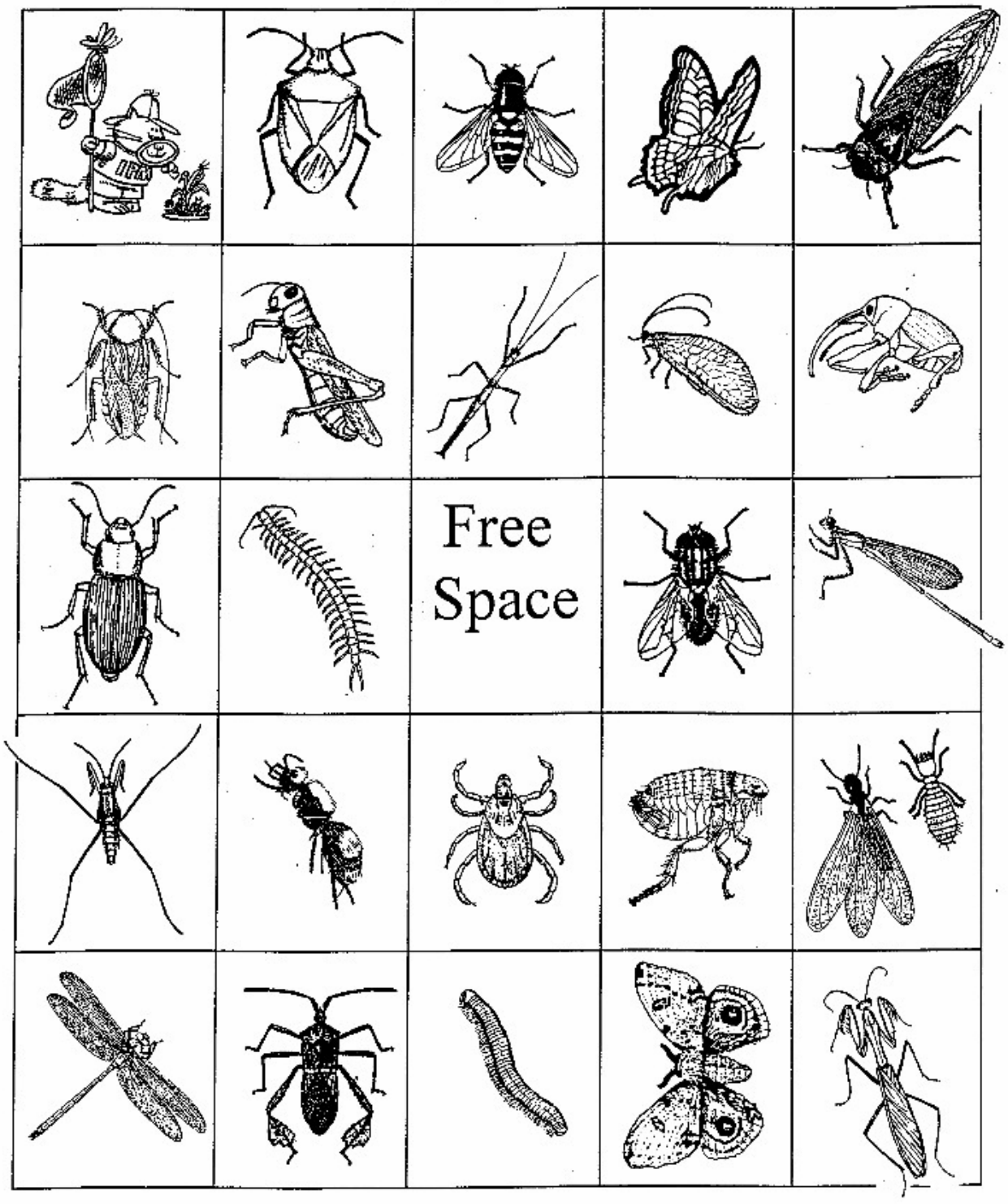

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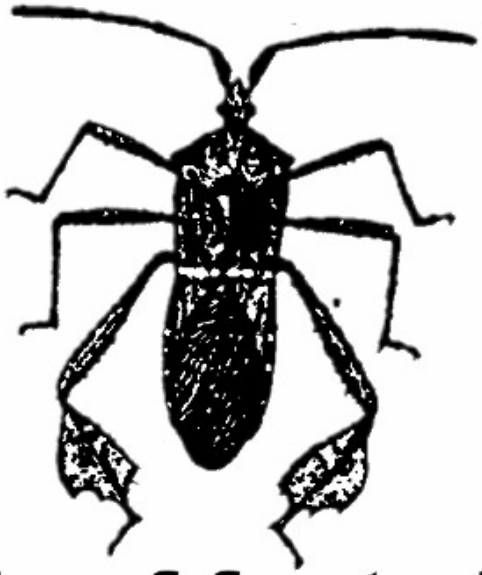
Swallowtail Butterfly

Dragonfly

Scout Cat



Leaf-footed Bug

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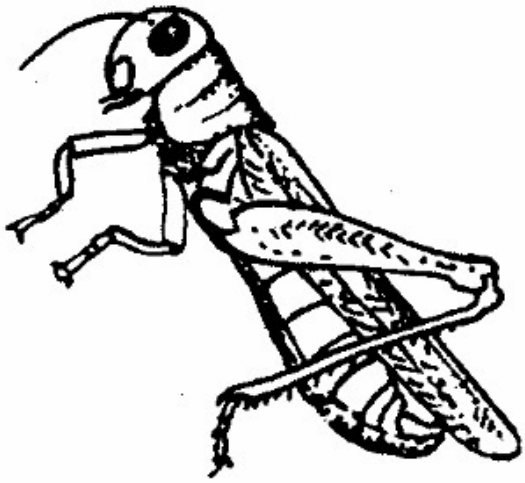
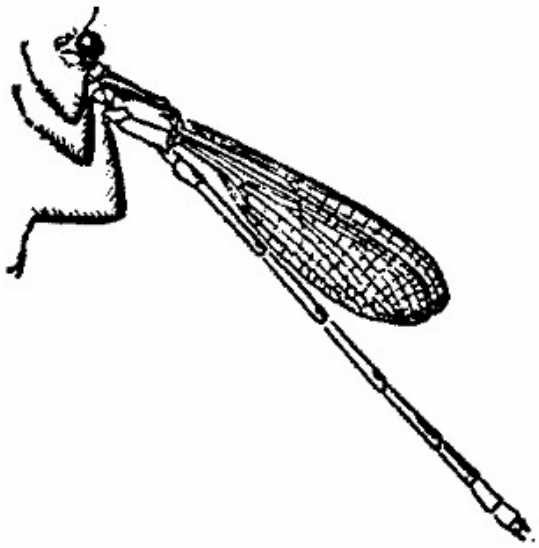
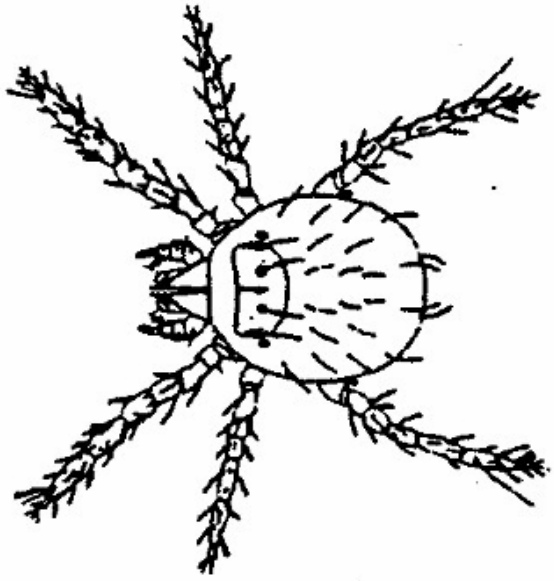


Grasshopper



Damselfly



Chigger

Syrphid Fly

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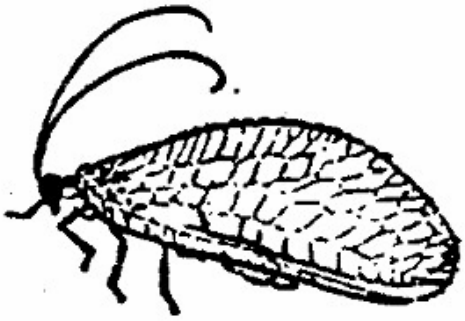
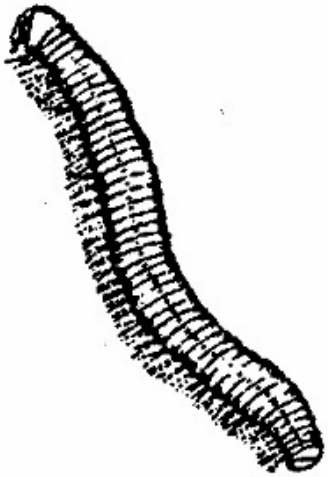
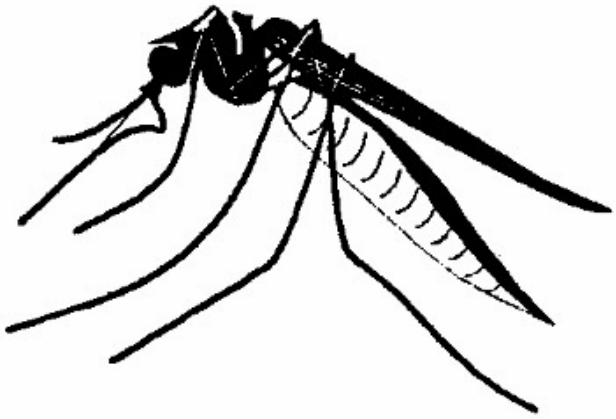


Lacewing



Millipede



Mosquito

Japanese Beetle

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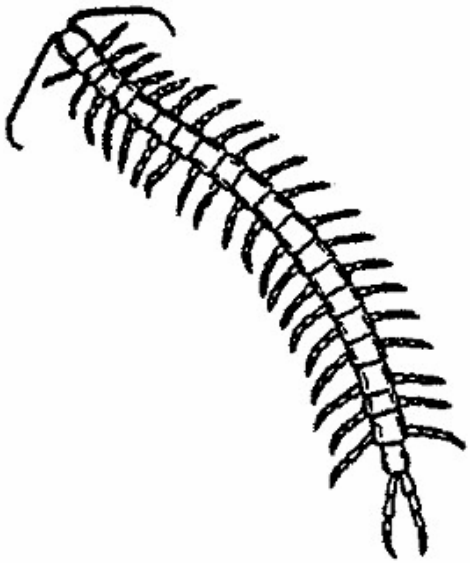
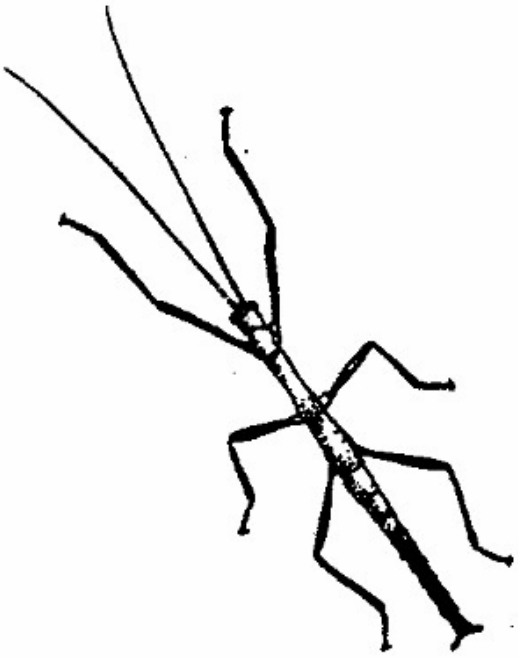
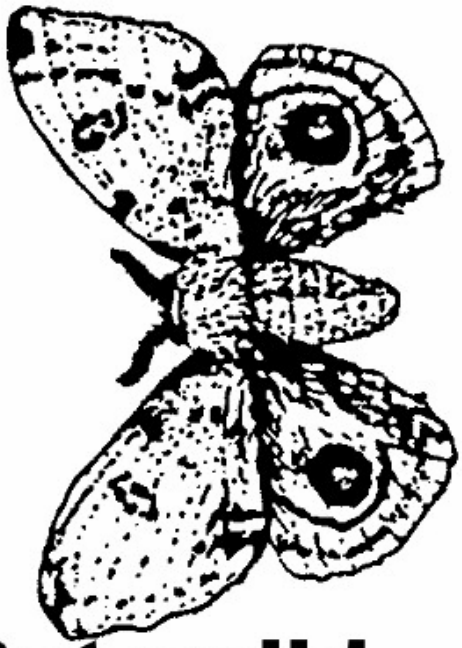


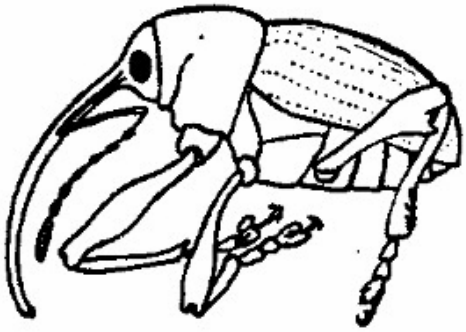
Centipede



Walkingstick

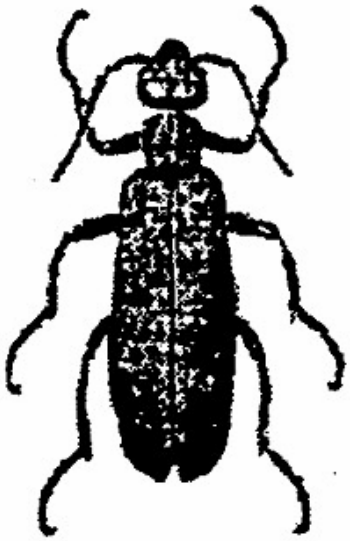


Saturniid Moth

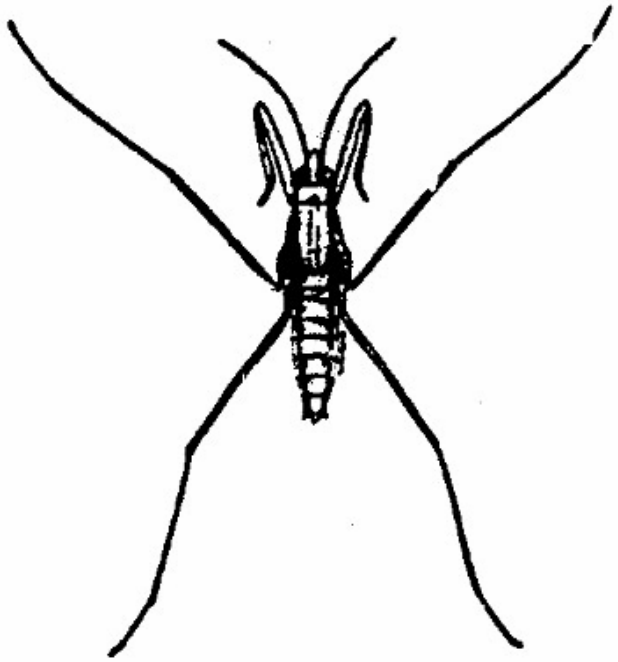


Weevil

http://www.uky.edu/Agriculture/IPM/teachers/bug-go/bug-go.htm



Blister Beetle

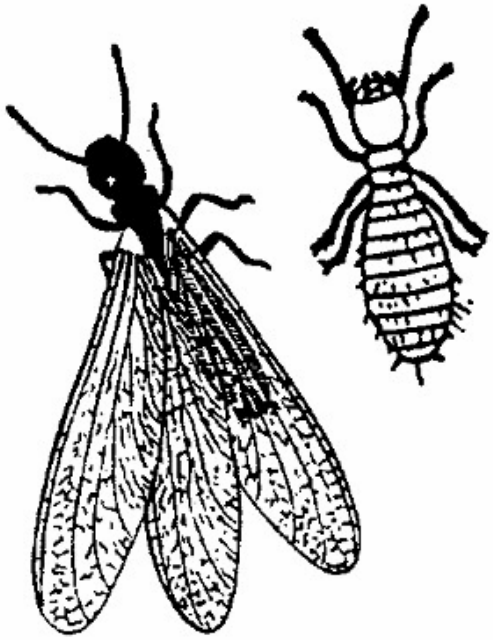


Water Strider

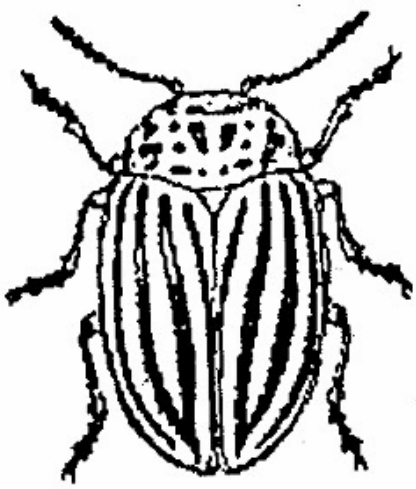
Stink Bug

Tick

http://www.uky.edu/Agriculture/IPM/teachers/bug-go/bug-go.htm



Termites



Colorado Potato Beetle

Grub

Flea

http://www.uky.edu/Agriculture/IPM/teachers/bug-go/bug-go.htm

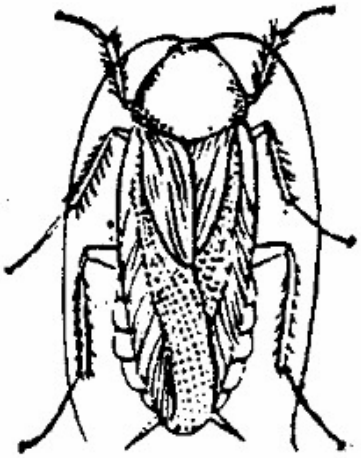
Carpenter Ant

Bumblebee

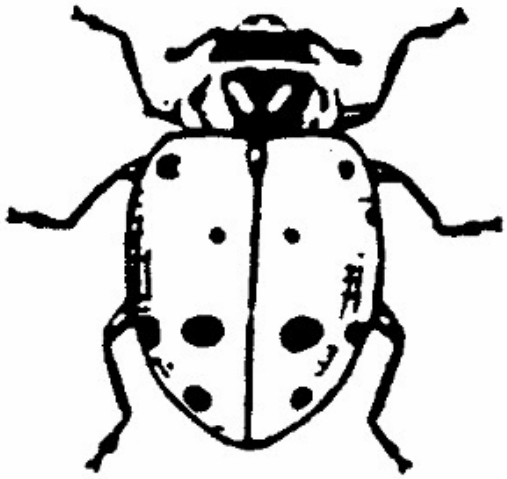
Cicada

House Fly

http://www.uky.edu/Agriculture/IPM/teachers/bug-go/bug-go.htm

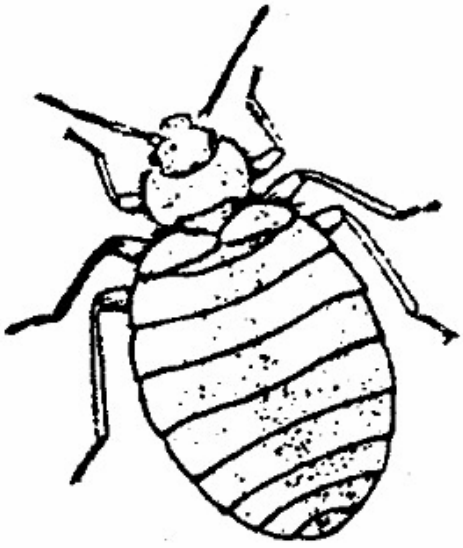


Cockroach



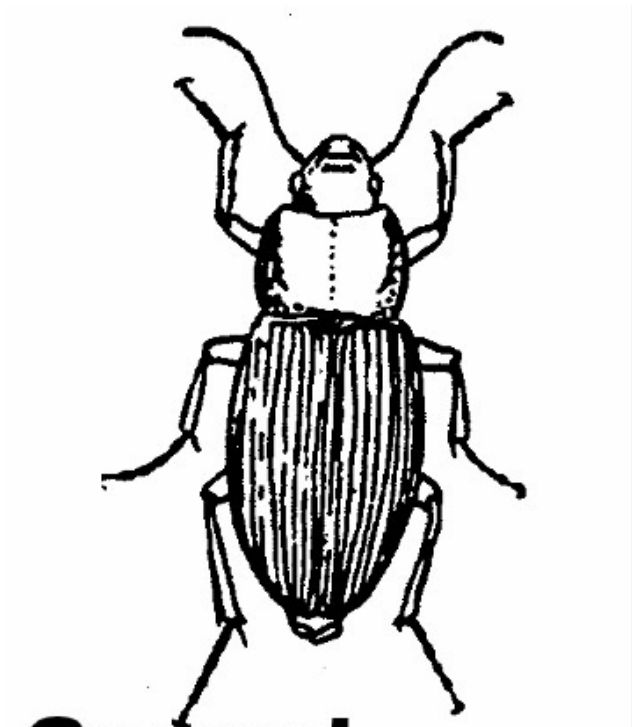
Convergent Lady Beetle

Velvet Ant



Bed Bug

http://www.uky.edu/Agriculture/IPM/teachers/bug-go/bug-go.htm



Ground Beetle

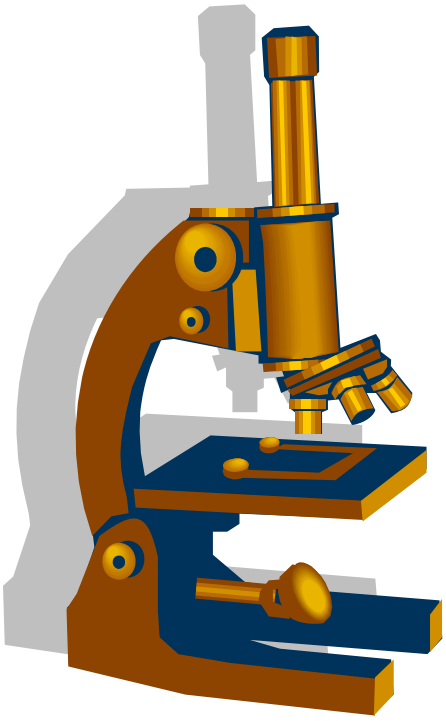
Scout Cat

Scout Cat

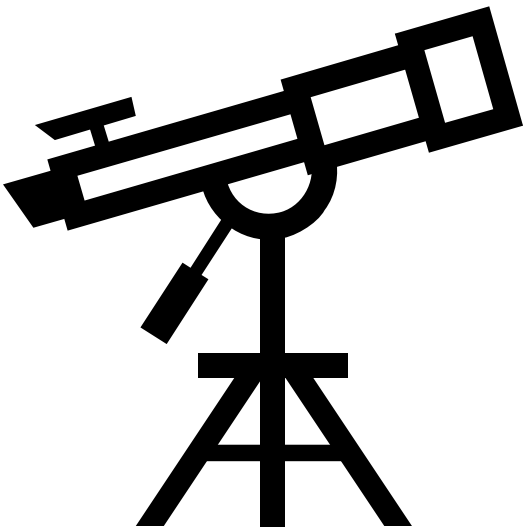
Praying Mantis

http://www.uky.edu/Agriculture/IPM/teachers/bug-go/bug-go.htm

SCIENTIFIC TOOLS PAGE

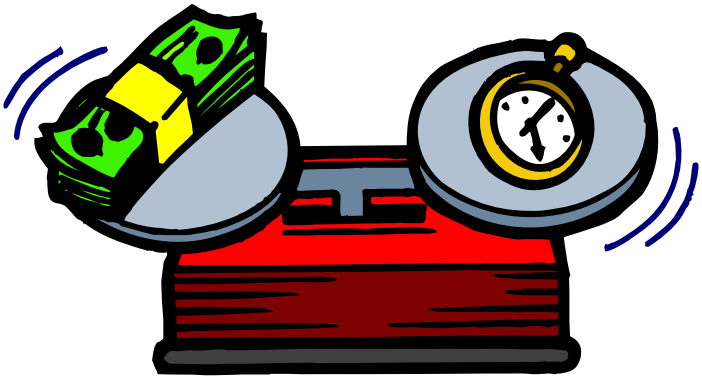


Microscope

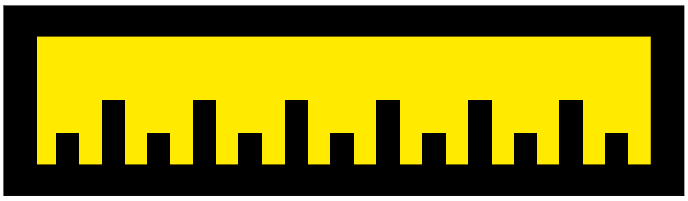


Telescope

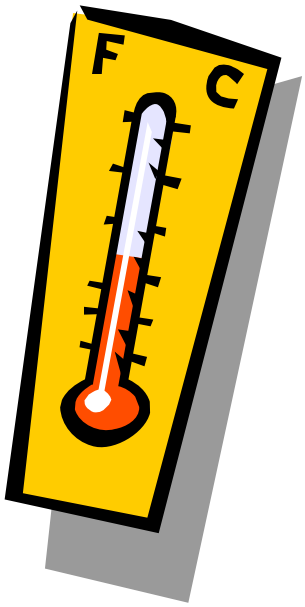
Magnifying Glass



Balance



Ruler



Thermometer

Calculator

Beakers

Gloves

Glossary

Air filter – *n.* a porous material through which air is passed to separate out matter

Arthropod – *n.* of the phylum of invertebrates with segmented bodies and jointed limbs such as insects

Astronaut – *n.* a person trained to work and travel in space

Balance – *v.* to arrange so that one set of elements equals another

Chemical – *n.* a substance obtained by a chemical process

Compass – *n.* a device for determining direction by means of a magnetic needle swinging freely and pointing to magnetic north

Data – *n.* factual information

Digital balance – *n.* a weigh device providing a read out in numerical digits

Dispose – *v.* to get rid of

Estimate – *v.* to give an opinion or judgment, to calculate approximately

External Tank – *n.* large orange tank filled with liquid hydrogen and oxygen used to power the main engines of the space shuttle

Extravehicular Activity (EVA) – *n.* a spacewalk outside the space vehicle

Fungus – *n.* a major group of organisms that lack chlorophyll

Gas – *n.* state of matter that does not have a definite volume or a definite shape

Germ – *n.* one causing disease

Gram – *n.* a small weight, metric unit of mass that is equal to 1/1000 kilogram

Gravity – *n.* force of attraction between any two objects

Halite – *n.* a colorless or white mineral sometimes called rock salt

Hazardous – *adj.* dangerous

Identify – *v.* to associate, to find out the origin, nature, or definitive elements of, to consider as similar or identical

International Space Station – *n.* orbiting science laboratory built by sixteen nations

Isolation – *n.* separate from others

Length – *n.* the distance from one point to another

Liquid – *n.* state of matter that has no shape and definite volume

Magnetic – *adj.* having an unusual ability to attract

Magnify – *v.* to enlarge in appearance

Mass – *n.* the amount of matter in an object

Microgravity – *n.* very little gravity in space

Mission – *n.* the assigned tasks and objectives of a spacecraft or a crew

Mixture – *n.* two or more substances physically combined

National Aeronautics and Space Administration (NASA) – *n.* the United States government agency that oversees space exploration

Non hazardous – *adj.* not dangerous

Olivine – *n.* a greenish silicate mineral

Orbit – *n.* the path an object follows around another object

Orbit - v. to revolve around

Orbiter – *n.* the re-useable part of the space shuttle that carries people and cargo to space

Radioactive – *adj.* disintegration of atomic nuclei

Robotic Arm – *n.* mechanical device operated by the astronauts to lift and move cargo

Rocket – *n.* a vehicle used to transport equipment and people into space

Satellite – *n.* a celestial object that orbits another object

Solar – *adj.* of the sun

Solar array – *n.* solar cells connected together in satellite panels that convert sun light into electrical energy

Solid – *n.* state of matter that has definite shape and definite volume

Sort – *v.* to put in a certain place according to kind

Symmetry – *n.* if a line can be drawn through the figure so that the part on one side of the line is exactly the same as the part on the other side of the line the figure has symmetry

Telescope – *n.* a tool for viewing distant objects

Temperature – *n.* degree of hotness or coldness of something

Thermometer – *n.* tool used to measure degree of hotness or coldness

Virus – *n.* a large group of submicroscopic infectious agents

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EG-2002-02-001-JSC

Cosmic EdVentures: Exploring Earth's Neighborhood, Challenger Center for Space Science Education, 1997

Our Mission to Planet Earth: A Guide to Teaching Earth System Science, National Aeronautics and Space Administration

Project Learning Tree: Environmental Education Activity Guide, Pre K-8, 8th ed., American Forest Foundation, 2001

Science & Technology for Children, Carolina Biological Supply Company

Websites:

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Charlesbridge Publishing – http://www.charlesbridge.com

Cosmic EdVentures – http://www.challenger.org/teachers/lessons/cosmiced.cfm

National Aeronautics and Space Administration, International Space Station - http://spaceflight.nasa.gov/station

National Aeronautics and Space Administration, products – http://spacelink.nasa.gov/products

Project Learning Tree – http://www.plt.org

Wacky Web Tales - http://www.eduplace.com/tales/c/cinquains.html

Storybooks – http://msnucleus.org/membership/guide/storybooks.html

Acknowledgements

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