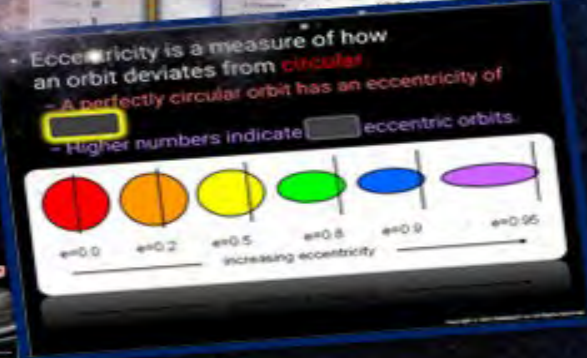
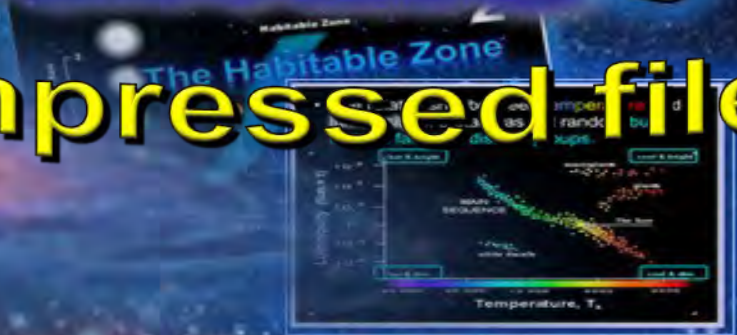
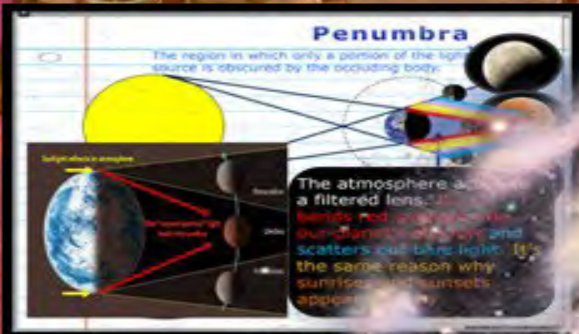


Astronomy Mega Bundle

Preview is a compressed file



7 Units

INTERACTIVE SLIDESHOWS

Name the types of galaxies below?

10



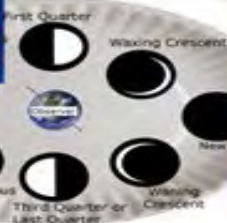
This is the name for a large cloud of gas and dust which can form stars and galaxies.

NEBULA

5

answer is...

Activity:



Which two should be switched between Earth and Venus?

6



Name A,B,C,D?

12

A Winter Solstice (Northern Dec 21st)

B Equinox March 20th

C Summer Solstice (Northern June 21st)

D Equinox September 20th

The type of star leftover when a star

is a very dense star made almost entirely of neutrons.

Neutron Star

an

Planet Earth	1 Facts
Mass	1 Earth Mass
Diameter	12,756 km
Distance from Sun	149.6 million km
Moons	1 The Moon
Age	4.54 billion years
Surface Temperature	15°C
Gravity	9.8 m/s²
Atmosphere	78% Nitrogen, 21% Oxygen, 1% Argon, CO2, etc.
Day / Night Cycle	24 hours
Year	365.25 days
Speed of Light	299,792,458 m/s



What is the name of this extinct volcano on Mars that's one of the largest mountains in the solar system?

Olympus Mons

17

Secure with Duct Tape

Fins need to be above nozzle, their bases should be parallel, organized a distance apart, Need 3+ fins, and limit their size to avoid unnecessary drag.

Tape Rigid Fins. Make them perpendicular to the ground. Evenly Spaced





Hundreds of pages

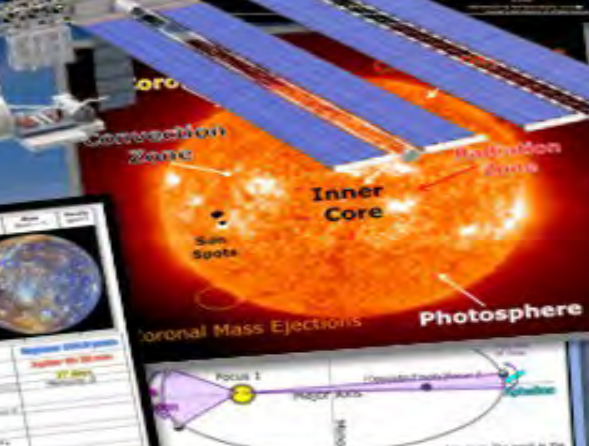
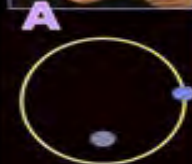
Activities, Projects, Assessments, All Built-in

- Plot the Star, Luminosity 10^4 Temp 3,000 (K)
- B = Red Giants, Cool and Bright



Word Bank: Summer Solstice, Winter Solstice, Spring Equinox, Fall Equinox, Summer Northern Hemisphere, Winter Northern Hemisphere, Spring Southern Hemisphere, Fall Southern Hemisphere

- Can you name the three below?



SlideSpark Science

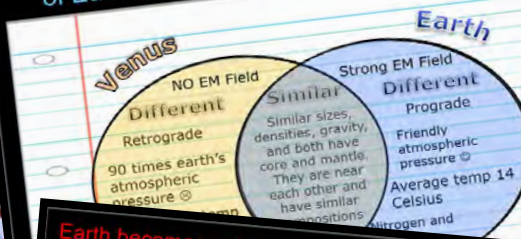


MIDDLE-LEVEL EDUCATIONAL RESOURCES

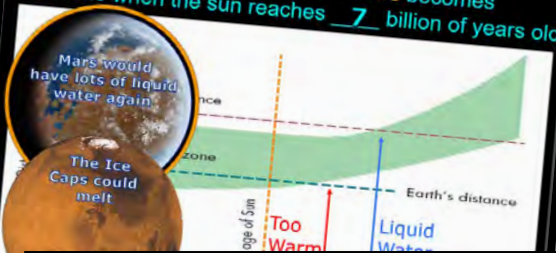
Interactive slideshows provide the roadmap for an amazing learning experience for students in grades 5-9. A Detailed set of work bundles chronologically follow the digital learning, providing a clear and intuitive roadmap to understanding. As the teacher or student advances through a slideshow, exciting hands-on activities, fantastic visuals, fill-in notes, review opportunities, video links, assessments, and much more are strategically placed throughout. Interactive learning unfolds step by step and supported by the work bundle to reach all types of learners. Everything you need to run to an amazing learning experience is provided in this one-of-a-kind science curriculum.

Each unit in the curriculum is designed to help teachers deliver the best possible learning experience for their students. Our interactive science slideshows are filled with questions and answers, important fill-in notes, hands-on activities, projects, games, built-in quizzes, and end of the unit assessment pieces. Students follow along with a work bundle that documents the entire learning experience for a fantastic review and assessment piece.

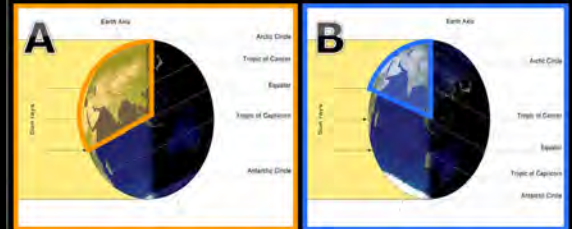
- Activity (Optional) Create a Venn Diagram of Earth and Venus.



Earth becomes uninhabitable when the sun reaches 6 billion of years old, and then Mars becomes habitable when the sun reaches 7 billion of years old.



- Which is **winter solstice** in the northern hemisphere and which is **summer solstice**?



Summer Solstice

Winter Solstice

- Therefore, earth-bound observers can never see the 'far-side' of the moon.

It takes about 27.3 Earth days for the moon to go around the earth once.

It takes the moon about 27.3 Earth days to rotate once.

Synchronous Orbit

Copyright © 2024 Middlebury College

● The habitable zone:

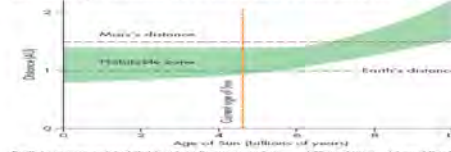
- The range of distances from a star where liquid water might pool on the surface of an orbiting planet.
- If a planet is too close to its parent star, it will be too hot and water would have evaporated. If a planet is too far from a star it is too cold and water is frozen.



Part 3 Inner Planetary Topics

the _____ zone:
● The range of distances from a star where _____ water might pool on the surface of an orbiting planet.
● If a planet is too close to its parent star, it will be too hot and water would have _____.
● If a planet is too far from a star it is too cold and water is _____.

When will the habitable zone change so that earth will become too hot, and Mars will become just right? Remember, our Sun will change as it moves through its life cycle?



Earth becomes uninhabitable when the sun reaches _____ billion of years old, and the Mars becomes habitable when the sun _____ billion of years old.
How far is the habitable zone from the Sun in A.U.? _____
How far away will the habitable zone be when the sun is 10 billions years old? _____ A.U.

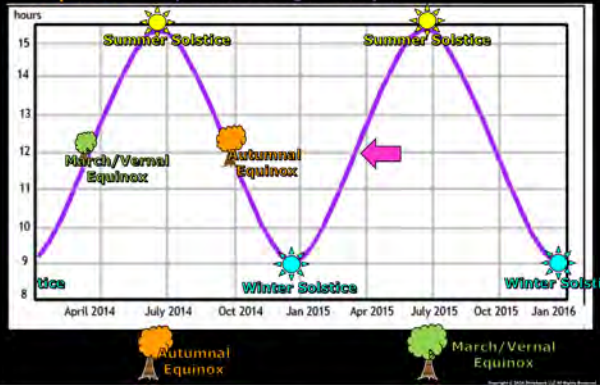
Please record the A.U.'s each planet is from the sun?

Sun	
Mercury	
Venus	
Earth	1.0 A.U.
Mars	
Jupiter	
Saturn	9.5 A.U.
Uranus	

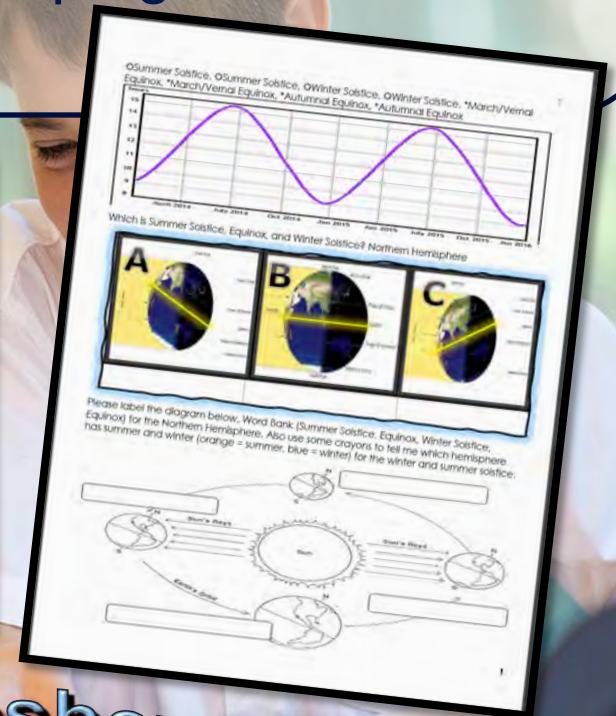
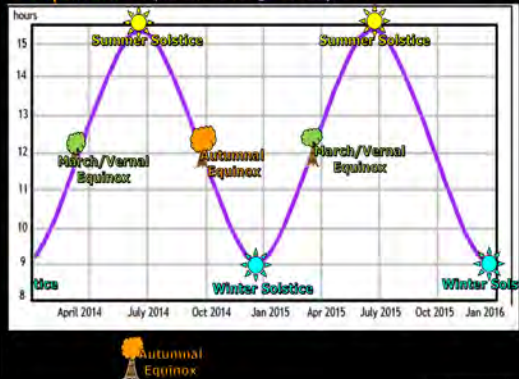
Red Slide Notes: Help students record important information in a fun and easy-to-understand way. Designed red-colored slides contain a few pieces of crucial information that students must record into their work bundle to complete the notes. Students will use these important notes throughout the work bundle.

The set-up of the slideshows are designed to make learning fun and interactive for students. With a mix of questions and answers, teachers can use these slides to get their students thinking and actively participating in their education. Plus, the answers are always revealed on the next slide, providing students with immediate feedback and helping teachers assess their understanding.

- When is the **March/Vernal** and **autumnal** equinox. Purple line is length of day in NYC



- When is the **March/Vernal** and **autumnal** equinox. Purple line is length of day in NYC



Next Slide

slideshow supports
Work Bundle

Lesson Planning

Daily lessons space exciting hands-on activities, red slide notes, video and academic links, projects, simulations, readings, built-in quizzes, and review opportunities throughout the slideshows. A typical day may have many different learning styles being targeted. Daily lesson planning becomes advancing through the slideshow roadmap the night before. Each lesson is roughly 50 minutes, but sometimes things can speed up or slow down. The best strategy is just to go at your classes own pace. The work bundle chronologically follows the interactive slideshow and you can always spend extra time assessing the quality of the writing within. If you don't quite finish a lesson, you can always pick it up the next day where you left off. The only real trick in timing is not starting a larger activity if you don't have the available time to complete. The slideshows have been designed to be a low stress, go at your classes own pace experience. Most activities are designed to be cost effective, using general materials that can be gathered from your local stores.



Example Part 3 Inner Planets

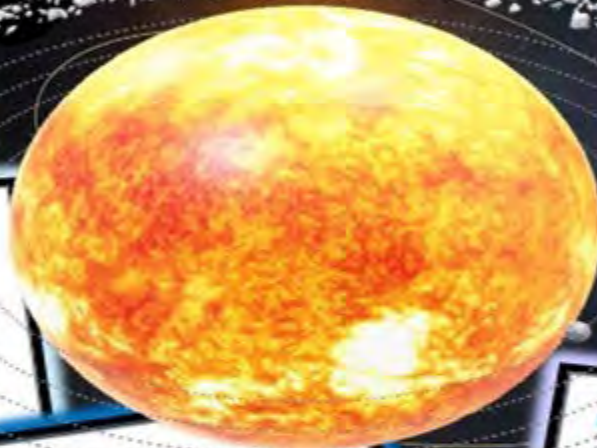
One clear, organized bundle guides students through notes, review, and assessments with ease.

Follow Along Work Bundle

Each science unit comes with several work bundles. The bundles should be printed before the unit begins and distributed to the students on the first day of the unit. The work bundles will be due shortly after the completion of the unit. The work bundle will become a resource for the review games, crossword puzzles, and will be collected for assessment. The work bundle follows the entire learning experience and will be used every day. They are chronological to the lessons and provide places to record fill-in notes, answer questions, collect data, graph and much more. An answer version is provided that can be distributed to your support professionals. A digital version of the work bundle and some writable .pdf versions are provided if you want to go paperless. These work bundles are perfect for students looking for an easy and organized way to track their progress and stay on top of their studies.

Astronomy

Work Bundle



Students are on their feet all day! Distance Run Back to the Sun

Distance Run Back to the Sun

Planet	Distance (AU)	Object
Sun	0.4 A.U.	Soft Ball
Venus	0.7 A.U.	Coarse Sand Particle
Earth	1.5 A.U.	BB
Jupiter	5.2 A.U.	BB
Uranus	9.5 A.U.	BB

Distance Run Back to the Sun

Planet	Distance (AU)	Object
Sun	0.4 A.U.	Soft Ball
Mercury	36 AU / 0 meters	Coarse Sand Particle
Venus	72 AU / 0 meters	BB
Earth	1 AU / 0 meters	BB

15 Pages

Sun and Stars



Part 2 Sun and Stars

Our Sun is a _____ dwarf main sequence G2 _____ located on the spiral arm of the Milky Way galaxy, situated far from the center and outer borders of the system, supplying the heat and light that sustain _____.

What shape is the Sun? _____ What color is the Sun? _____

Why is the sun brighter than the sky than some stars that are much larger than it?

The brightness of a star as seen from earth is called by _____ magnitude.

_____ magnitude is the brightness of a star if all stars were seen at the same distance.

Applying its magnitude to the apparent magnitude (brightness) an object would have at 10 _____ from present earth.



The surface temperature of the star determines the color of the star. What is the surface temperature of the star below?

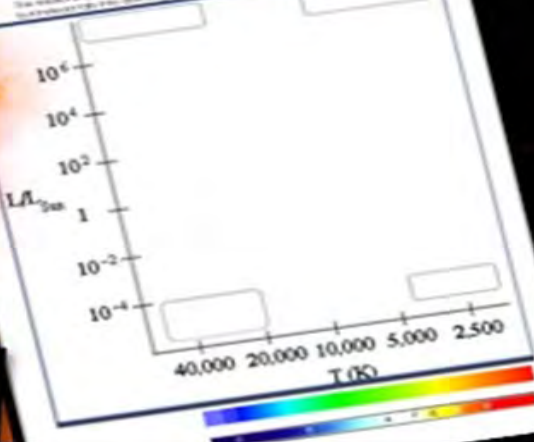
Blue _____ White _____ Yellow _____ Red _____

The Hertzsprung-Russell Diagram (HRD) is a graph showing the relationship between the absolute magnitude of stars against their color.

The temperature of a star as seen from earth is called its apparent _____.

The brightness of a star as seen from earth is called its apparent _____.

The relationship between temperature and luminosity of stars with temperature _____ luminosity is the _____ graph.



OH BE A FINE GIRL KISS ME

Class	Composition	Color	Temperature
O	Ionized and neutral hydrogen, ionized helium		
B	Neutral helium, ionized hydrogen		27,000-30,000 K
F	Ionized hydrogen, ionized helium		7,000-8,000 K
G	Neutral hydrogen, ionized helium		5,000-6,000 K
K	Ionized hydrogen, ionized helium		3,000-4,000 K
M	Neutral hydrogen, ionized helium		2,000-3,000 K

The stars are divided into 7 classes designated by the letters O, B, A, F, G, K, and M. The hottest stars _____ and _____ are _____.

Astronomers can tell the _____ of a star by looking at the type of light it emits. Very _____ stars (O and B stars) look blue to our eyes, and as stars get _____ they become _____.

_____ stars are on the _____ of the HRD.

Provide some information about the type of stars below.

_____ O _____ B _____ A _____ F _____ G _____ K _____ M

Part 3 Lesson 2 The HR Diagram

The Hertzsprung-Russell Diagram (HRD) is a graph showing the relationship between the absolute magnitude of stars against their color.

The temperature of a star as seen from earth is called its apparent _____.

The brightness of a star as seen from earth is called its apparent _____.

Provide some information about the type of stars below.



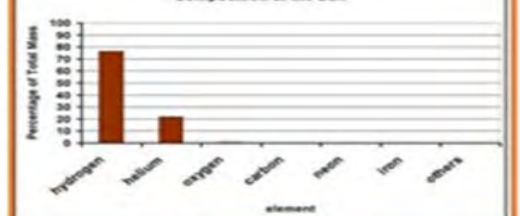
Light Element Greater Than Helium

The Sun is a star that _____ object in the solar system.

It contains more than _____ % of the total mass of the Solar System.

All _____ for our solar system comes from the Sun.

Provide answer the questions below.



The sun is primarily made of these two elements. Please estimate the % from the graph.

How much is left over for everything else?

The Sun is a _____ electrically charged particles.

Considered the fourth state of matter.

Nucleosynthesis _____ process where heavier _____ are created inside stars from hydrogen nuclei.

Helium is created depends on the size and _____ of the star.

Large stars may fuse carbon into _____ and magnesium, oxygen into _____, and silicon into _____.

This is the precursor to a supernova.

18 Pages

Inner Planetary Topics

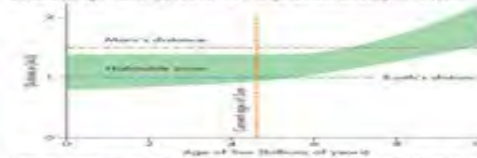
Work Bundle

Part 3 Inner Planetary Topics

Life Habitable Zone

- The range of distances from a star where water might pool on the surface of an orbiting planet.
- If a planet is too close to its parent star, it will be too hot and water would have evaporated.
- If a planet is too far from a star it is too cold and water would freeze.

When will the habitable zone change so that earth will become too hot, and Mars will become just a dry desert? Remember, our Sun will change as it moves through its life cycle.



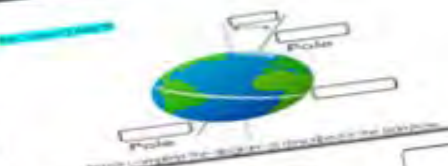
Earth becomes uninhabitable when the sun reaches _____ billion of years old, and the star becomes habitable when the sun _____ billion of years old.

How far is the habitable zone from the sun in A.U. at _____ billion years old?

How far away will the habitable zone be when the sun is 10 billion years old? _____ A.U.

Please record the A.U. for each planet from the sun!

Sun	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus
			1.0 A.U.				



1. Habitable zone

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Work Bundle



Post-Mortem: 2 weeks before Project Launch/Display

You will be given two grades for the project. The first grade will represent your planning phase which includes a poster demonstrating rocket design. Part of a rocket, research on an actual rocket, gravitational trajectory and more. The second grade is the actual construction of your rocket which you will practice, build and test on the full tank.

Your Poster must include the following:

Parts of a Rocket Pease label those Cone, Shoulder, Propulsion System, Fusile, Structure System, Fins, Stability, Center of Gravity	Aerodynamics / Forces associated with Rockets Newton's 3 Laws of Motion Force (How is it generated?) Pressure (How can you maximize it?) Weight (How can you minimize it?) Tell your rocket rotate for stability! External Forces (Lift, Weight, Drag, Thrust) 1 Right place / trajectory for launch!	History / Current Rockets Pease describe an actual rocket with its name on your poster Sketch of the Rocket, Design / features of that rocket, What did it do / what was its mission!
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Bonus (Do Last)
9/22/27/28

Orion's Arrow

Four Delta Fins for Stability

Trunked Pelican, Central of Center of Mass

Parabolic Nose Cone for Aerodynamics

Weight is the force of gravity acting on its mass, which includes the rocket itself, fuel, and any payload. Orion's Arrow weighs 1.457 kg.

Planned Vertical Launch and Trajectory

LIFT - To stabilize the rocket in flight.

Picture name A-J listed on the model below.

A=	B=	C=
D=	E=	F=

The journey... Record some info. Which is lunar landing, return home, launch, Touchdown!

Name some parts of the Apollo Modules below. What are they and what did they do?

Visit <https://www.nasa.gov/education/apollo/apollo.html>

21 Pages

21 Pages

Asteroids, Meteors, Meteorites, NEO's

Work Bundle

Part 5 Main Asteroid Belt

Asteroids are _____ objects that orbit the sun but are too small to be considered planets.

Please provide some information about Ceres and Vesta.



Meteoroid Space

Imagine you are a meteoroid in space. What is your name? Where are you? How big are you? How fast are you moving? How much energy do you have? Other info:

When you enter the atmosphere, how big was the impact? How much energy did the impact have? Other info:

Please provide some information about the crater below. What is so important about it?

Chicxulub Crater



Tunguska Event



Which one is an iron, stony, and stony-iron meteorite?

10 to 15% composed of the element iron with the remainder composed of nickel and trace elements.

They are composed of roughly equal amounts of nickel and iron. They are thought to have formed at the core-mantle boundary of their parent bodies.

Which is a meteor, meteorite, and asteroid?



13 Pages

Outer Planets Work Bundle



Part 6 Outer Planets Topics

Gas Giant: A large, dense planet, composed primarily of hydrogen and helium, with a small rocky core. It is the largest planet in our solar system. Gas giants are composed of hydrogen, helium, and other gases. They are also known as Jovian planets. The four gas giants in our solar system are Jupiter, Saturn, Uranus, and Neptune.

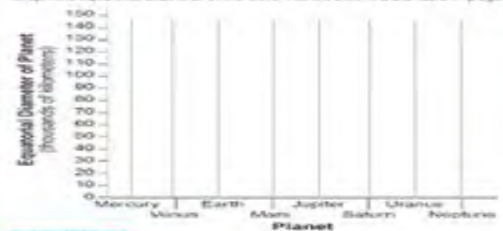
Table 1: Solar System Data

Planet	Distance from Sun (AU)	Mass (Earth masses)	Radius (Earth radii)	Orbital Period (years)	Surface Temp (°C)	Atmospheric Pressure (atm)	Escape Velocity (km/s)	Mean Density (g/cm³)
Mercury	0.39	0.055	0.38	88	160	10	4.2	5.4
Venus	0.72	0.815	0.95	225	460	90	10.4	5.2
Earth	1.00	1.00	1.00	365	15	1	11.2	5.5
Mars	1.52	0.339	0.53	687	-65	7	5.0	3.9
Jupiter	5.20	317.8	11.2	11.9	-110	100	59.5	1.3
Saturn	9.54	95.1	9.4	29.5	-175	100	35.5	0.7
Uranus	19.2	45.9	4.0	84.0	-215	100	21.3	1.2
Neptune	30.1	47.3	3.9	165	-210	100	23.5	1.6

Graph the Average Density of outer planets in (g/cm³)



Graph the Equatorial Diameter of the Outer Planets below. Data table 1st page.



Outer Planets Topics

Jupiter

Some facts about Jupiter:

- Twice as massive as all other planets combined.
- Four largest objects in sky.
- Gas giant (Giant) - as you go down.
- May have a small rocky core.
- Mainly Hydrogen and a bit of Helium.
- High Velocity.
- Cloud bands.
- Red Spot (Giant) - as you go down.
- 10 Moons or Satellites (2007).

Which of the choices below is a bogus fact about Jupiter? Bogus answer is:

- A) Twice as massive as all other planets combined.
- B) Four largest objects in sky.
- C) Gas Giant (Giant) - as you go down.
- D) May have a small rocky core.
- E) Mainly Hydrogen and a bit of Helium.
- F) High Velocity.
- G) Cloud bands.
- H) Red Spot (Giant) - as you go down.
- I) 10 Moons or Satellites (2007).

Which of the choices below is a bogus fact about Jupiter? Bogus answer is:

- A) Twice as massive as all other planets combined.
- B) Four largest objects in sky.
- C) Gas Giant (Giant) - as you go down.
- D) May have a small rocky core.
- E) Mainly Hydrogen and a bit of Helium.
- F) High Velocity.
- G) Cloud bands.
- H) Red Spot (Giant) - as you go down.
- I) 10 Moons or Satellites (2007).

Which letter below represents the outer planets? Why?

Planet	Diameter	Mass	Density
A	142,984	1.898 x 10 ²⁷	1.3
B	120,536	5.683 x 10 ²⁶	0.7

Density - The smaller the number the denser an object is.

Density = Mass / Volume

Density = Mass / Volume

Density = Mass / Volume

Density = Mass / Volume

Density = Mass / Volume

Density = Mass / Volume

Density = Mass / Volume

Density = Mass / Volume

Density = Mass / Volume

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Density = Mass / Volume

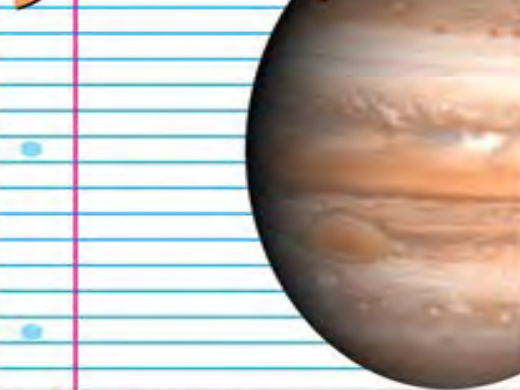
Density = Mass / Volume

Density = Mass / Volume

Density = Mass / Volume

Density = Mass / Volume

Jupiter

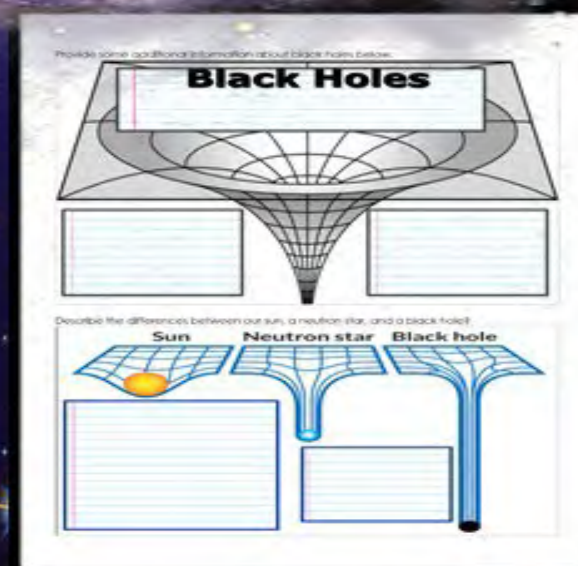
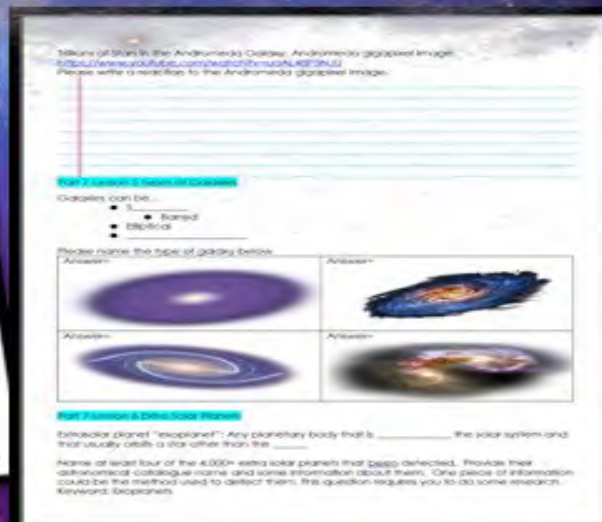
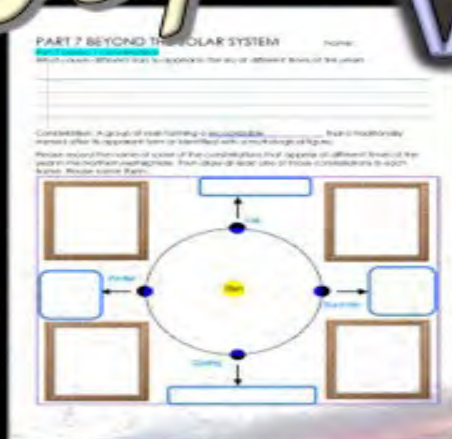


Optional: Calculate your weight on Jupiter. Remember, weight has to do with gravity, mass is constant. Multiply your weight by 2.5 = Weight on Jupiter (Jupiter has more gravity) and it's just gas. Imagine if it were rocky!

Your weight = _____ * 2.5 = _____ Weight on Jupiter

17 Pages

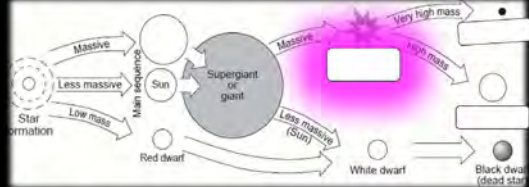
Beyond the Solar System Work Bundle



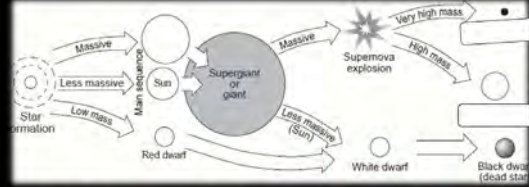
15 Pages

Built-in Questions and Assessments

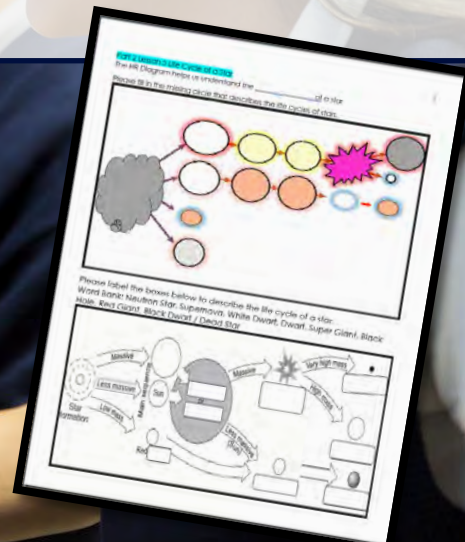
Many slides will have relevant terms covered with a box. When advancing through the slideshow an outline around the box will glow with a bright color. The next slide will make the box disappear. These slides allow the teacher to call upon students or table groups / check for understanding before advancing. The team at SlideSpark has found that using this technique helps to keep the students focused. Constantly recalling and reviewing information learned is necessary when moving through a large unit. The slideshows don't just give everything away for free. Students should be able to demonstrate knowledge before moving on. Some slides have full questions instead of just covered terms. In these slides, the teacher should encourage small group work. The teacher can then call upon one or two groups to share before advancing the slide. The next slide will always reveal the correct answer.



Word Bank: Neutron Star, Supernova,
White Dwarf, Super Giant, Dwarf,
Black Hole, Red Giant,
Black Dwarf / Dead Star



Word Bank: Neutron Star, Supernova,
White Dwarf, Super Giant, Dwarf,
Black Hole, Red Giant,
Black Dwarf / Dead Star



Review Game / Assessments

Each of the 11 Units concludes with a review quiz. Answers are provided in slideshow form so students can self assess. A blank template sheet is provided in the work bundle. Students can benefit from working together in small table groups with quiet communication. You can decide if you want to allow the use of work bundles or not. These are a nice review opportunity and get the students looking through their work bundles for the answers.



Inner Planetary Topics Quiz Game

Example Part 3

• Name the inner planets below?



B  Mercury



Sun
Mercury
Venus
Earth

0.4 A.U.
0.7 A.U.
1.0 A.U.
1.5 A.U.
5.2 A.U.
9.5 A.U.



• Venus is the hottest planet in the solar system because of the greenhouse effect.

5 Venus is incredibly hot 480°C because of its greenhouse gases.



On the next slide answer with the planets name or Astronomical Unit (AU) from the sun.



Which is incorrect of Mercury
A) Close to the sun with no moons

B) In the Sun the temperatures can reach 420°C .
C) In the shade, the temperatures can drop -173°C .
D) 88 day year (travels very fast)
E) 1407 hour day (Very Long Day)



- Which is, equinox, winter solstice, and summer solstice in the northern hemisphere?



**Winter
Solstice**

**Summer
Solstice**

Equinox

Which is winter in the Northern Hemisphere?

23.5°



**Summer
Southern
Hemisphere**

**Equator gets even
sunlight all year
round**

- Which is not true of the planet Earth

- A.) Only planet known to support life.
- B.) Complex system of land, water, and air.
- C.) **Largest of the inner planets.**
- D.) **Most dense planet in the solar system.**
- E.) Oceans (liquid water) can exist.
- F.) Atmosphere, 78% Nitrogen and 21% oxygen, shields from radiation and keeps the planet's temperature just right.

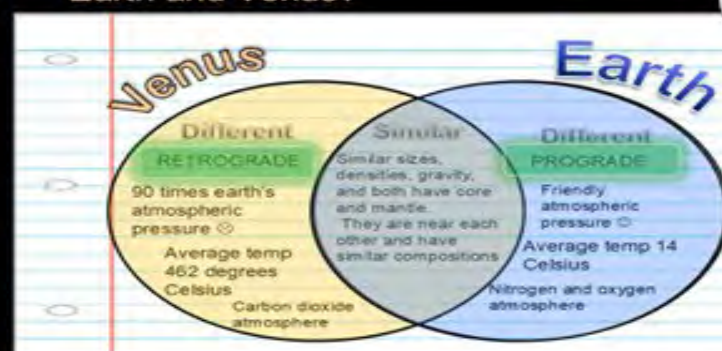
5.51 g/cm³

- Which of the following is not true of the planet Earth?

Giant Impact



- Which two should be switched between Earth and Venus?

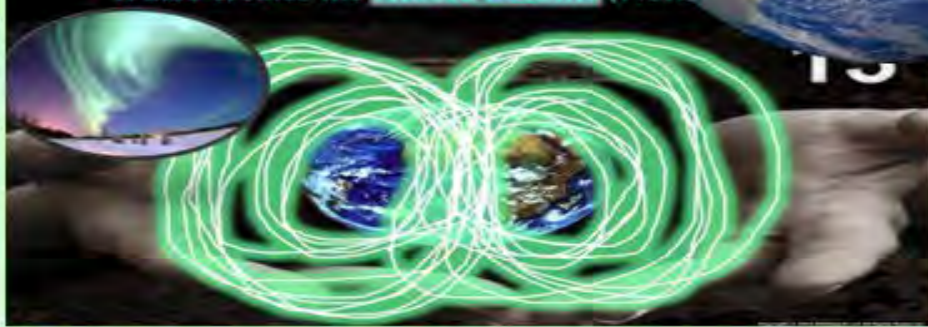


Name A and B?
Which one causes the larger tides?

15



- Earth has a strong **electromagnetic field** that protects the earth from charged particles from the sun.
- It also creates the **Aurora borealis** (Northern Lights).



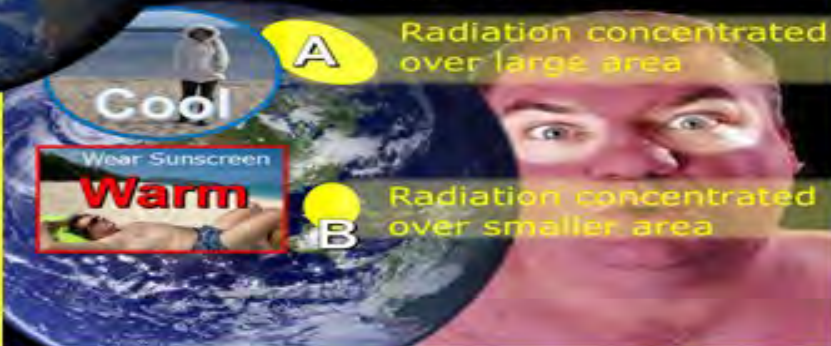
A First Quarter
B Waxing Gibbous

14

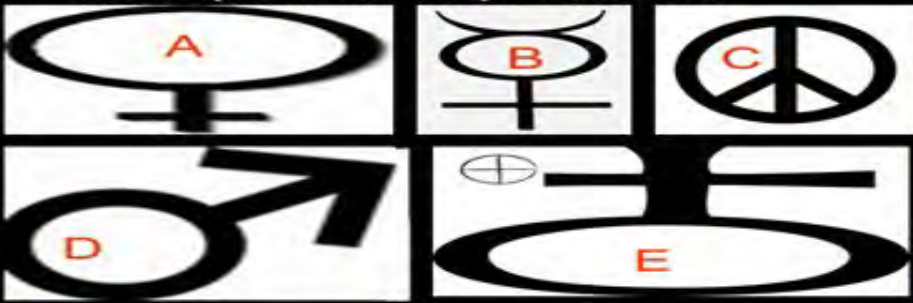


Which area of the planet has hot weather year round and which is cooler year round?

11



- Which symbol below represents Mars?



Name A, B, C, D?

12



- What are the names of these two moons on Mars?



- What is the name of this giant canyon on Mars that dwarfs the Grand Canyon?



- What's the name of these extinct volcanos on Mars.



- Identify the Lander and Rovers below?

Pathfinder

19



- The photograph below provides some evidence that this use to cover the Martian surface?



Activities

Our science activities are designed to help students explore and understand complex scientific concepts in an engaging and interactive way. Each science unit includes several hands-on activities that encourage students to collect data and think critically about the world around them. Our easy-to-follow slideshow provides detailed visuals, simple materials, and clear directions, making it easy for both students and teachers to navigate the activities.

• Meteor Impact pages in Work Bundle.

Meteor Impact Activity

Please read the material and complete the worksheet.

Small Meteorite

Drop Height (cm)	Crater Diameter (cm)	Crater Depth (cm)
25		
50		
75		
100		

Large Meteorite

Drop Height (cm)	Crater Diameter (cm)	Crater Depth (cm)
25		
50		
75		
100		

• Step #1! Parts of a Cr

– Drop the marble meteor meter into the tray of a record a detailed sketch bundle.

• Important note: Our impact angle will be 90°
Many impact craters can be at low angles.

We'll also measure the bulk of the distance of the ejecta (estimated)

• Example Diameter of Crater

Please graph the Diameter of the Crater for the large and small meteor below.

Drop Height (cm)	Large Meteorite Diameter (cm)	Small Meteorite Diameter (cm)
25	~6.5	~3.5
50	~7.5	~4.5
75	~8.5	~5.5
100	~9.5	~6.5

• Another Graph Possibility (Diameter)

Please graph the Diameter of the Crater for the large and small meteor below.

100 cm Drop
25 cm Drop
3 cm
1 cm

We'll measure from rim to rim (in cm) through the center of the crater

• Set-up of experiment.

- Create a sugar in pile on table about 2cm thick
- Drop a large and small meteorite (marbles or ball b) at different heights (25, 50, 75, 100 cm) one at a time
- Smooth crater between each drop.
- Measure diameter of crater and

Drop Height

Crater Diameter

How does the equation Force (mass times acceleration) relate to this activity? Be **bold** in your response.

The larger meteorite had more mass than the smaller meteorite so it impacted with greater force. The large impactor weighed 40 grams and created a diameter crater that was twice as large as the small impactor which was only 6 grams. The object with more mass had more force when dropped with the same acceleration $F=ma$

Force = mass * acceleration

Built-in Assessment

This unit contains built-in assessments that students answer in their work bundle. With the question revealed before the answer, the teacher can easily call on individual students or table groups to respond. These provide an effective and efficient way for teachers to assess student learning.

• Quiz Wiz! Name that phase of the moon.



6



6

Waning Crescent



Sketch in the boxes and then label the phases of the moon below from an earthbound observer.

Port a lesson: Phases of the Moon

Quiz Name the Phase of the Moon (Building the Alchemist)

1)	2)	3)
4)	5)	6)
7)	8)	9)
10)	11)	

Quiz in Work Bundle

Built-in Video Links

Our science education program is designed with the modern, multimedia learner in mind, and our video links are a perfect complement to our educational materials. These short clips are embedded into the slideshow at just the right places for a fantastic review. Whether you're studying biology, chemistry or physics, our video links are an excellent way to reinforce your learning.

• The Habitable Zone.

– https://www.youtube.com/watch?v=J04Yn&ab_channel=NASA



• Video Link! Mercury

– <https://www.youtube.com/watch?v=m3ZUhpisWeQ>



• Video Link! Formation of the Moon

– Longer Version (9 minutes)
– <http://www.youtube.com/watch?v=m8P5ujNwEwM>



• Video Link! Winter Solstice at Newgrange in Ireland (Optional)

– <http://www.youtube.com/watch?v=ngADMns8W78>



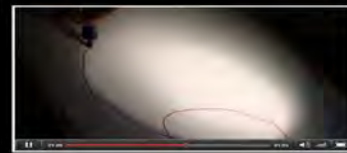
• Astrium Video Link! Venus

– <https://www.youtube.com/watch?v=vzqbN6z8ncc>



• Activity Link! Watch video and conduct activity if desired. (Optional)

– <http://www.guardian.co.uk/science/video/2012/nov/02/science-demonstration-changing-seasons-video1>



• Video! Launching of Rovers. Mostly animation of the actual mission. (www.maasdigital.com).



The set-up of the slideshows are designed to make learning fun and interactive for students. With a mix of questions and answers, teachers can use these slides to get their students thinking and actively participating in their education. Plus, the answers are always revealed on the next slide, providing students with immediate feedback and helping teachers assess their understanding.

- Which are bright nebulae and which are dark nebulae?



- Which are bright nebulae and which are dark nebulae?

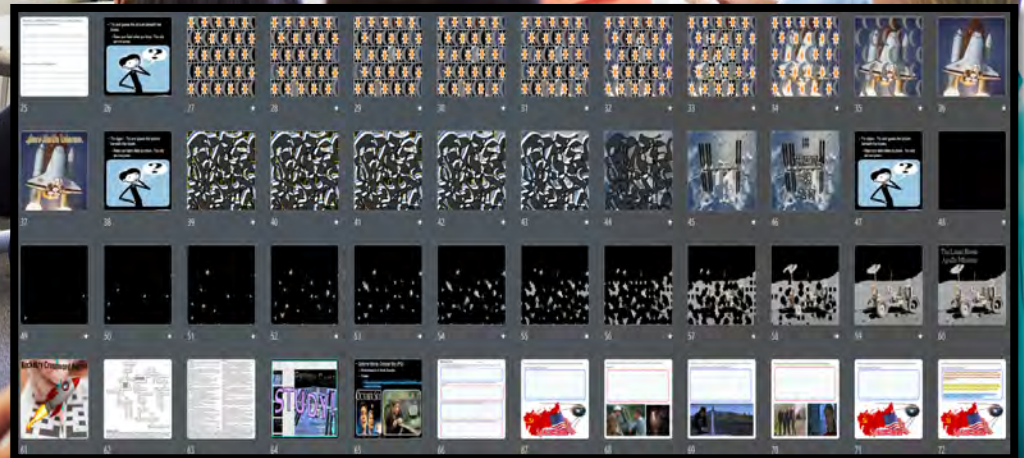
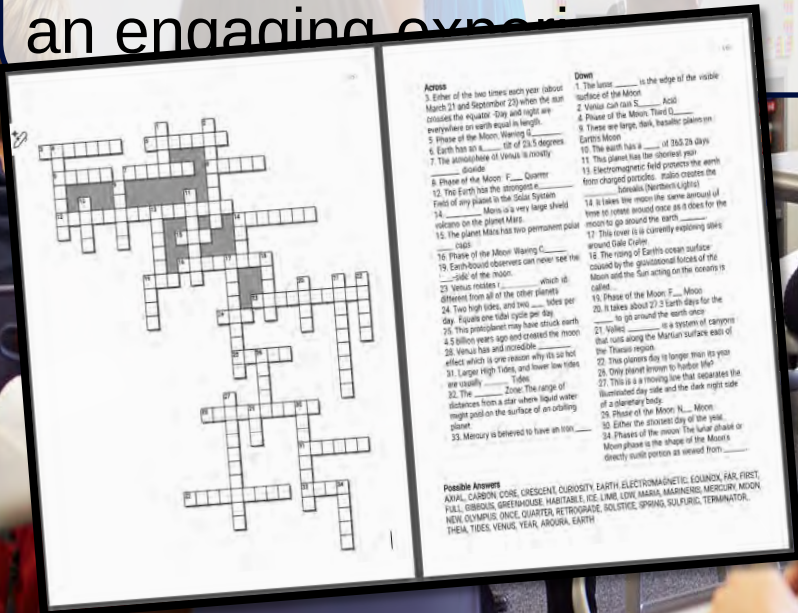


Next Slide

slideshow supports
Work Bundle

Games and Review

Games are a fantastic way for students to learn scientific concepts while having fun. We incorporate a variety of games into our curriculum, including interactive quizzes and puzzles that challenge students to think critically about the material. Our Hidden Box Games are a particularly popular feature, which conclude each unit by revealing a picture related to the topic. Students try to guess what the picture might be, making learning an engaging experience.



- Hubble's launch and deployment in 1990 marked the most significant advance in astronomy since Galileo's telescope.



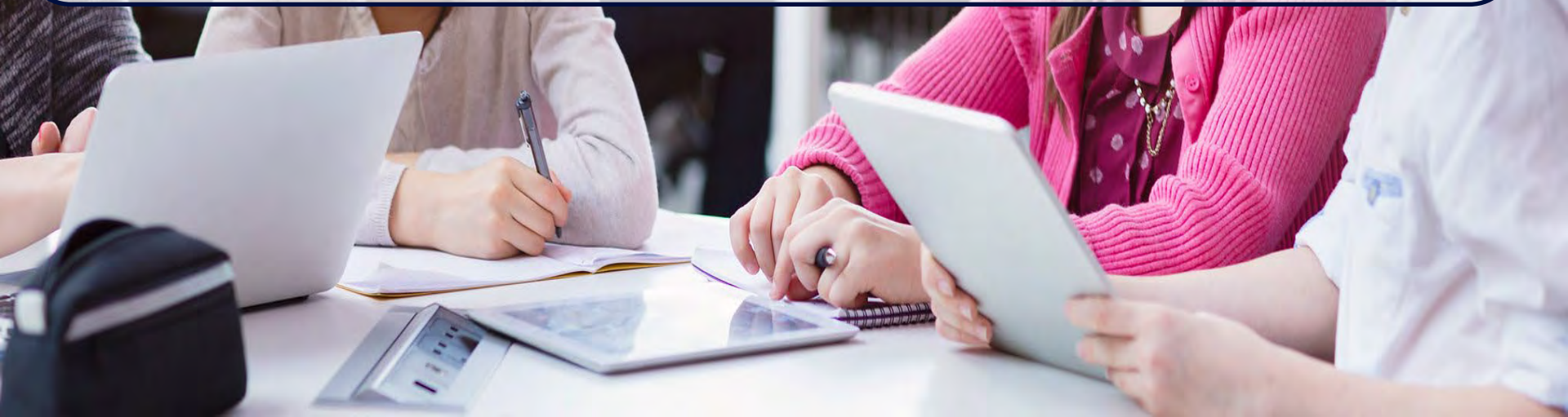
- Hubble's launch and deployment in 1990 marked the most significant advance in astronomy since Galileo's telescope.



The Owl - Each Part of the slideshow has a small clipart Owl hiding somewhere in a slide. The owl is incredibly small and blended into just the right slide. If a student spots the "Owl" they can raise their hand high into the air. When you call upon the student they can say "Owl" and be the student who spotted the Owl. Each PowerPoint Review game also has an owl hiding in it worth one point. Remind the students that they secretly write the word "owl" rather than yell it out during the review games. The Owl search is not included in every lesson. A slide at the beginning of the lesson will alert the students that today is an "Owl" day. Everything arrives editable so delete if you wish. You will find that some students will become the expert owl hunters in the group.

Google Classroom Compatible

Our digital learning programs are designed for students to learn science in a flexible and engaging environment. Our Google Classroom-compatible units provide a seamless learning experience whether your students are in the classroom or learning from home. Our step-by-step slideshows and student work bundles ensure that students can complete their work independently. The PowerPoint Slideshows and step-by-step work bundles can easily be loaded to your Google Drive and posted in your Google Classroom. These are great for daily lessons, students who need additional time, and for a student who was absent and looking to catch up in their work bundle.



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[Part 1 Lesson 1 Introduction ...](#)

Google Slides



[Part 1 Lesson 2 Planetary M...](#)

Google Slides



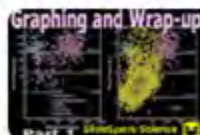
[Part 1 Lesson 3 Distances S...](#)

Google Slides



[Part 1 Lesson 5 Review Game](#)

Google Slides



[Part 1 Lesson 4 Graphing Wr...](#)

Google Slides



[Part 2 Lesson 5 Life Cycle o...](#)

Google Slides



[Part 2 Lesson 2 HR Diagram](#)

Google Slides



[Part 2 Lesson 1 The Sun](#)

Google Slides



[Part 2 Lesson 9 Solar Lunar ...](#)

Google Slides



[Part 2 Lesson 10 Review Ga...](#)

Google Slides



[Part 2 Lesson 7 Optional Su...](#)

Google Slides



[Part 2 Lesson 3 Inside the S...](#)

Google Slides



[Part 2 Lesson 4 Solar Flares](#)

Google Slides



[Part 2 Lesson 6 Solar Syste...](#)

Google Slides



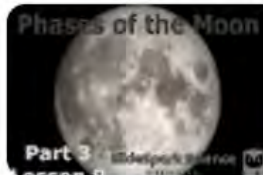
[Part 2 Lesson 8 Shadows Su...](#)

Google Slides



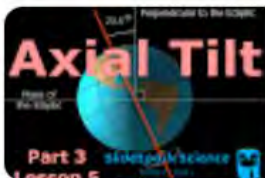
[Part 3 Lesson 2 Mercury](#)

Google Slides



[Part 3 Lesson 9 Phases of M...](#)

Google Slides



[Part 3 Lesson 5 Axial Tilt](#)

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[Part 3 Lesson 3 Venus](#)

Google Slides



[Part 3 Lesson 7 EM Field](#)

Google Slides



[Part 3 Lesson 4 Earth and M...](#)

Google Slides



[Part 3 Lesson 8 Phases of M...](#)

Google Slides



[Part 3 Lesson 10 Phases Quiz](#)

Google Slides



[Part 3 Lesson 1 Inner Planets](#)

Google Slides



[Part 3 Lesson 6 Solstice Equ...](#)

Google Slides



[Part 3 Lesson 11 Tides](#)

Google Slides



[Part 3 Lesson 12 Mars 1](#)

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[Part 3 Lesson 13 Mars 2](#)

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[Part 2 Lesson 10 Review Ga...](#)

Google Slides



Part 4 Lesson 4 Space Shutt...

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Part 4 Lesson 1 Mission to t...

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Part 4 Lesson 3 Gravity Roc...

Google Slides



Part 4 Lesson 2 Water Rock...

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Part 4 Lesson 7 3rd Law of ...

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Part 4 Lesson 6 2nd Law of ...

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Part 4 Lesson 9 Review Game

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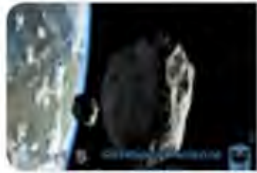
Part 4 Lesson 5 Newtons 1st...

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Part 4 Lesson 8 Rocketry Wr...

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Part 5 Lesson 3 NEOs

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Part 5 Lesson 6 Review Game

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Part 5 Lesson 5 Research an...

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Part 5 Lesson 2 Tunguska Ev...

Google Slides



Part 5 Lesson 4 Impact Lab

Google Slides



Part 6 Lesson 3 Jovian Moons

Google Slides



Part 6 Lesson 1 Gas Giants

Google Slides



Part 6 Lesson 5 Ice Giants

Google Slides



Part 6 Lesson 4 Saturn

Google Slides



Part 6 Lesson 7 Review Game

Google Slides



Part 6 Lesson 6 Outer Solar ...

Google Slides



Part 6 Lesson 2 Jupiter

Google Slides



Part 6 Lesson 7 Review Game

Google Slides



Part 7 Lesson 4 Pulsar Neut...

Google Slides



Part 7 Lesson 8 Review Game

Google Slides



Part 7 Lesson 7 Big Bang

Google Slides



Part 7 Lesson 3 Spacetime

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Part 7 Lesson 5 Galaxies

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Part 7 Lesson 2 Speed of Li...

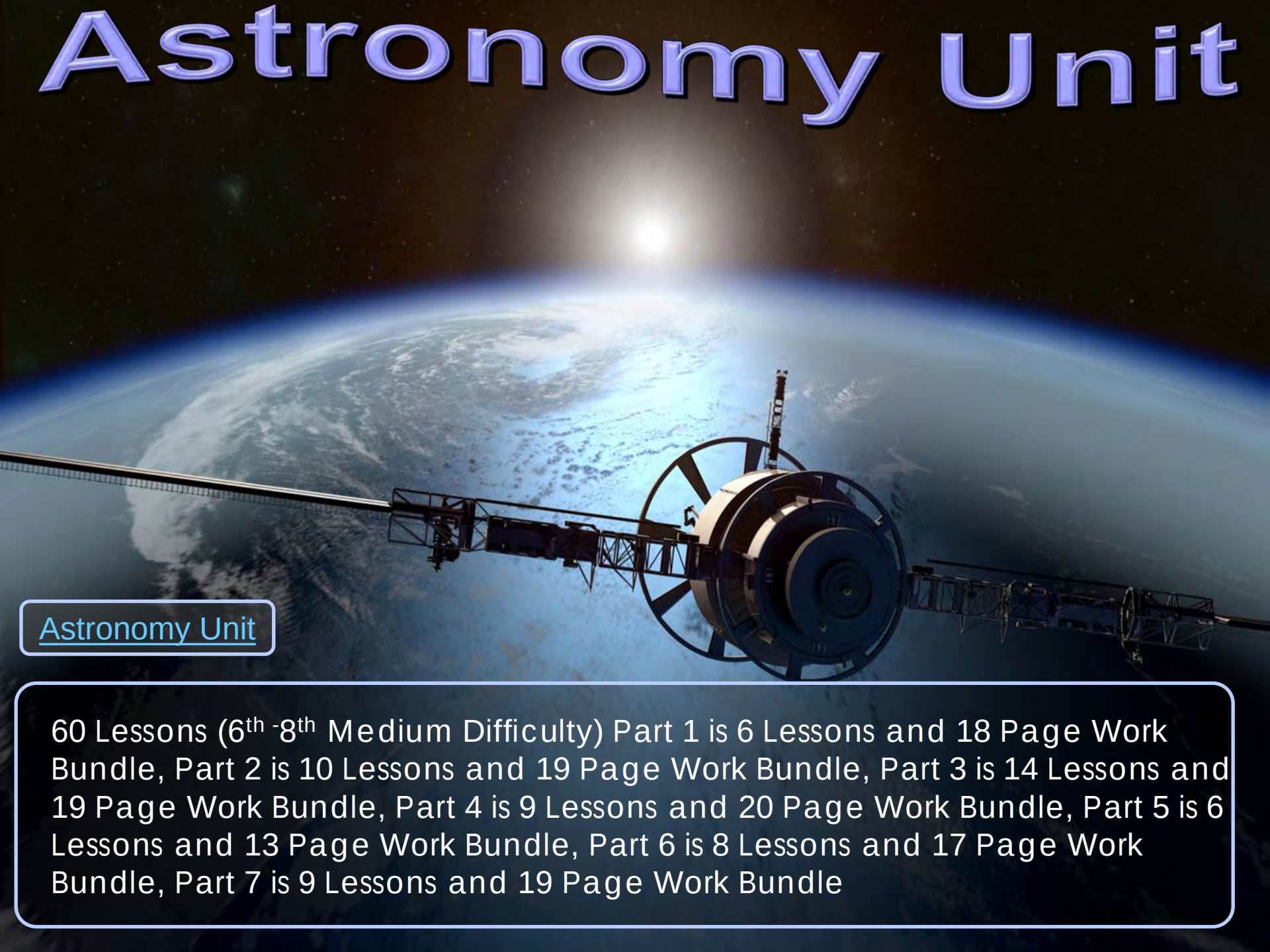
Google Slides



Part 7 Lesson 6 Exoplanets

Google Slides

Astronomy Unit

The background of the slide is a photograph of the Earth from space, showing the blue horizon and white clouds. A bright sun is visible in the upper center, creating a lens flare effect. In the foreground, a portion of a satellite or space station is visible, featuring a large circular dish and various structural elements.

Astronomy Unit

60 Lessons (6th -8th Medium Difficulty) Part 1 is 6 Lessons and 18 Page Work Bundle, Part 2 is 10 Lessons and 19 Page Work Bundle, Part 3 is 14 Lessons and 19 Page Work Bundle, Part 4 is 9 Lessons and 20 Page Work Bundle, Part 5 is 6 Lessons and 13 Page Work Bundle, Part 6 is 8 Lessons and 17 Page Work Bundle, Part 7 is 9 Lessons and 19 Page Work Bundle

Part 1: Astronomy Unit : Introduction to Astronomy, Copernicus, Heliocentrism, Galileo, Kepler's Laws of Planetary Motion, Ellipse, Perihelion, Aphelion, Orbits, Orbital Velocities, Eccentricity, Calculating Eccentricity, Astronomical Units, Distances in the Solar System, Graphing Planetary Data, Order of the Planets, Box Game Review, Crossword Puzzle, End Unit Assessment with Answer Version so Students can Self-Assess.

Part 2: Astronomy Unit: The Sun, Absolute Magnitude, Apparent Magnitude, Parsec, Stellar Classification / Spectra, Hertzsprung Russell Diagram, Composition of the Sun, Nuclear Synthesis, Layers of the Sun, Solar Flares, Coronal Mass Ejections, Carrington Event, Life Cycle of a Star, Blackhole, Neutron Star, Solar System Formation, Shadows, Sun Dials, Eratosthenes, Graphing Shadow length, Solar Eclipse, Lunar Eclipse, Path of Totality, Box Game Review, Crossword Puzzle, End Unit Assessment with Answer Version so Students can Self-Assess

Part 3: Astronomy Unit: The Habitable Zone, Important data about Mercury, Venus, Earth, Venn Diagram of Earth and Venus, Moon Formation Theories, Earth's Axial Tilt, Seasons on Earth, Equinox, Solstice, Earth's EM Field, Aurora borealis, Synchronous Orbit of the moon, Features of the moon, Phases of the Moon (with OREOS), Tides, Neap Tide, Spring Tide, Tidal Cycle, Reading a Tide Chart, Mars, Features on Mars, Moons of Mars, Rover Exploration, Missions Past and Future, End Unit Assessment with Answer Version so Students can Self-Assess

Part 4: Astronomy Unit: Rocketry, Apollo Missions, Parts of the Saturn V Rocket, Apollo Modules, Parts of a Rocket, Water Bottle Rockets, Newton's Laws, Lift, Drag, Thrust, Weight, Law of Gravitation, Einstein and Gravity, Spacetime, Space Shuttle Program, International Space Station, Future in Space, Box Game Review, Crossword Puzzle, End Unit Assessment with Answer Version so Students can Self-Assess

Part 5: Astronomy Unit : Main Asteroid Belt, protoplanet Ceres, Vesta, Meteors, Meteorites, Asteroids, Bolides, Chicxulub Crater, Tunguska Event, Chelyabinsk meteor, Craters, Parts of a Crater, Crater Impact Activity, NEO's, Torino Scale, Box Game Review, Crossword Puzzle, End Unit Assessment with Answer Version so Students can Self-Assess

Part 6 Astronomy Unit: The Outer Planets, Gas Giants, Ice Giants, Density of Outer Planets, Jupiter, Red Spot, Composition of Outer Planets, Jovian Moons, Saturn and its Moons, Uranus and its Moons, Neptune and its Moons, The Kuiper Belt, Demotion of Pluto, Oort Cloud, Comets, Box Game Review, Crossword Puzzle, End Unit Assessment with Answer Version so Students can Self-Assess

Part 7: Astronomy Unit: Constellations, Hubble Space Telescope, Spitzer Space Telescope, Speed of Light, Nebulas, Types of Nebulas, Galaxy, Type of Galaxies, Gravity, The Special Theory of Relativity , Blackholes, Neutron Stars, Spacetime, Pulsars, Quasars, Exoplanets, Hubble Deep Field, Beyond the Solar System, Black holes, Exoplanets, The Big Bang, Evidence for the Big Bang, Box Game Review, Crossword Puzzle, End Unit Assessment with Answer Version so Students can Self-Assess

What are two possible outcomes if Super-Earth like are in our galaxy?

Neutron Star

During powered flight, the propellants of the propulsion system are constantly being exhausted from the nozzle. This creates a cloud.

Penumbra

The region of shadow only a portion of the light source is obscured by the obscuring body.

The atmosphere is a filtered lens.

Eccentricity is a measure of how an orbit deviates from circular.

Eccentricity circular orbits has an eccentricity of 0.

Higher numbers indicate more eccentric orbits.

The Habitable Zone

The relationship between temperature and luminosity of a star sets not random but instead has distinct groups.

Cooler Warmer Really Hot

Which star has the hottest core?

7 Units

7 Units

Hundreds of pages

Hundreds of pages

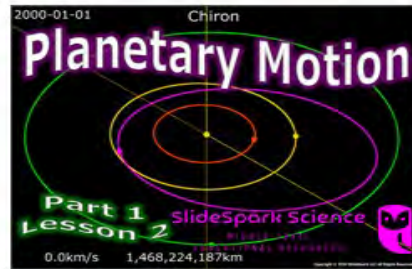
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Introduction to Astronomy, Copernicus, Heliocentrism, Galileo, Kepler's Laws of Planetary Motion, Ellipse, Perihelion, Aphelion, Orbits, Orbital Velocities, Eccentricity, Calculating Eccentricity, Astronomical Units, Distances in the Solar System, Graphing Planetary Data, Order of the Planets, Box Game Review, Crossword Puzzle, End Unit Assessment with Answer Version so Students can Self-Assess

Part 1: Astronomy Unit



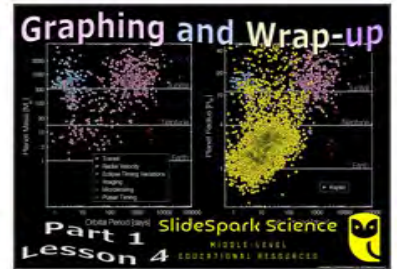
Part 1 Lesson 1 Introduction Kepler



Part 1 Lesson 2 Planetary Motion



Part 1 Lesson 3 Distances Solar System



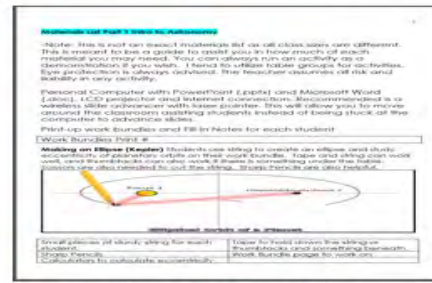
Part 1 Lesson 4 Graphing Wrap Up



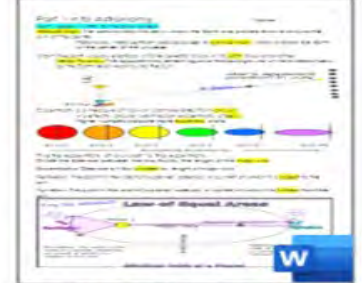
Part 1 Lesson 5 Review Game



Part 1 Lesson 6 Review Game Answers



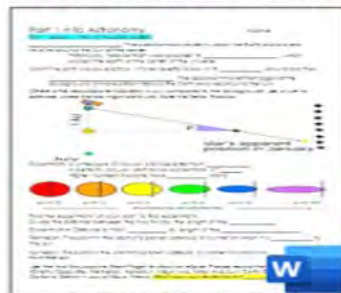
Part 1 Materials List Intro to Solar System



Part 1 Work Bundle Answers



Part 1 Work Bundle Digital



Part 1 Work Bundle Print



Part 1 Work Bundle Writable pdf

Planetary Motion Unit

- The terms below are a measurement of how an orbit deviates from circular.

- A perfectly circular orbit has an **eccentricity** of zero.
- Higher numbers indicate more eccentric orbits.



10

- Kepler's three laws of planetary motion can be described as follows:

- An imaginary line drawn from the center of the sun to the center of the planet will sweep out equal areas in equal intervals of time.
- (The Law of Equal Areas)

Note how the planets velocity increases when it's closer to the sun



- Galileo Galilei (1564-1642)

- Italian physicist, mathematician, astronomer, and philosopher.
- Played a major role in the Scientific Revolution.
- His achievements include improvements to the telescope, astronomical observations, and support for Copernicanism.



against the background of more distant stars as the Earth revolves around the Sun.

The Earth revolves around the Sun

Instruments

$$9.5 \text{ cm} / 20 \text{ cm} = .47 \text{ eccentricity}$$

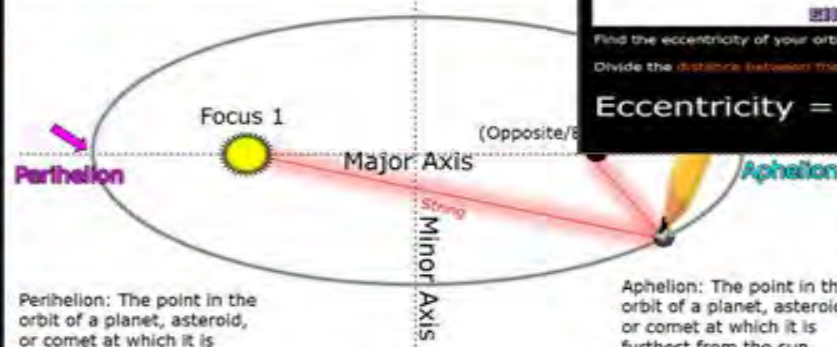


Perihelion: The point in the orbit of a planet, asteroid, or comet at which it is closest to the sun.

Elliptical Orbit

Find the eccentricity of your orbit. To find eccentricity, divide the distance between the two foci by the length of the major axis.

$$\text{Eccentricity} = \frac{\text{Distance between foci}}{\text{Length of major axis}}$$

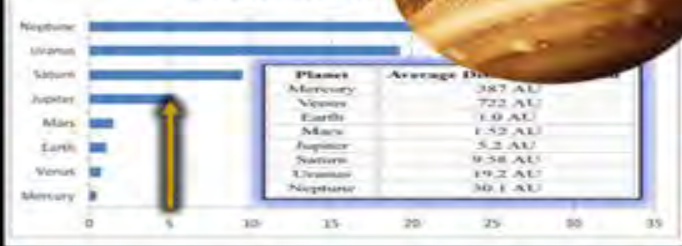


Perihelion: The point in the orbit of a planet, asteroid, or comet at which it is closest to the sun.

Aphelion: The point in the orbit of a planet, asteroid, or comet at which it is furthest from the sun.

Elliptical Orbit of a Planet

Distances of Planets in Astronomical Units



of the universe.

Geocentric Model Heliocentric Model



Earth=Center



Sun=Center

6 Lessons

Interactive Slideshows

Earth's Heliocentric Revolution

Read the text and answer the questions below. What did they contribute to astronomy? They will require some research. Use the slideshows and additional research.

Galileo, in full Galileo Galilei (1564-1642)

Italian natural philosopher, astronomer, and mathematician who made fundamental contributions to the sciences of motion, astronomy, and the scientific method. His formulation of (circular) inertia, the law of falling bodies from leaning towers, and trajectories marked a change in the study of motion.

He brought into the sciences where experimentation became a method. He improved the telescope and pioneered Copernican heliocentrism. His belief eventually resulted in the Roman Inquisition process against him and he spent the rest of his life in prison, although he did sneak some papers out of his house now and again.

Michal Kopernik (1473-1543)

Polish astronomer who proposed that the planets have the sun as the fixed point, and that Earth is a planet which, besides orbiting the sun every year, this is called the heliocentric or the sun centered system. He also recognized that the earth turns once daily on its own axis and that slow long term changes in the direction of this axis account for the precession of the equinoxes (precession).

Johannes Kepler (1571-1630)

German astronomer who discovered three laws of planetary motion. He recognized that the planets move in elliptical orbits with the sun at one focus. He recognized that the time necessary to move across any one of its planetary orbits is proportional to the area of the sector between the central body and that one "equal Area Law".

He also recognized that there is an exact relationship between the squares of the planets' periodic times and the cubes of the radii of their orbits, the "harmonic law". Kepler paved the way for future astronomers including Isaac Newton.

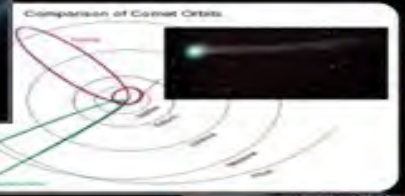
The Milky Way is also traveling through space

This should be you!
You are moving
At 1.3 million miles per hour right now!

The Cosmic Background Explorer satellite in 1989 and 1990, suggest that our galaxy is moving at 600 kilometers per second (1.34 million miles per hour)!

The laws of planetary motion can be follows:

comets are even more elliptical in the center of the sun being located at (The Law of Ellipses)



- Answer the questions with one of the words below.
- A.) Orbit B.) Ellipse C.) Circular D.) Perihelion
- E.) Aphelion F.) Focus G.) Heliocentrism H.) Major Axis

This planets orbit is at its...

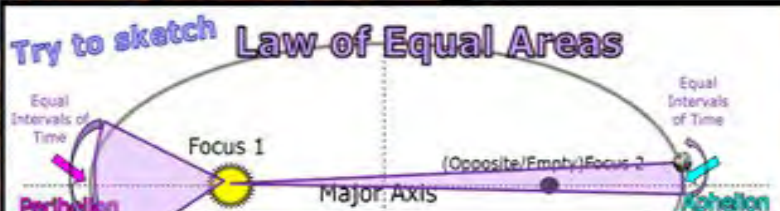
Celestial Object	Mean Distance from Sun (million km)	Period of Revolution (Earth years)	Period of Revolution (Earth days)	Eccentricity of Orbit	Equatorial Diameter (km)	Mass (Earth = 1)	Density (g/cm ³)
SUN	—	—	27 d	—	1,392,000,000	333,000.00	1.4
MERCURY	57.9	88 d	58 d	0.206	4,879	0.06	5.4
VENUS	108.2	224.7 d	224.7 d	0.007	12,104	0.82	5.2
EARTH	149.6	365.26 d	365.26 d	0.017	12,756	1.00	5.5
MARS	227.9	687 d	687 d	0.093	6,794	0.11	3.9
JUPITER	778.4	11.9 y	4,333 d	0.048	142,984	317.83	1.3
SATURN	1,429.7	29.5 y	10,759 d	0.054	120,536	95.16	0.7
URANUS	2,871.0	84.0 y	30,688 d	0.047	51,118	45.91	1.2
NEPTUNE	4,494.3	164.8 y	60,190 d	0.009	49,528	17.15	1.8
EARTH'S MOON	384,400	27.3 d	27.3 d	0.055	3,476	0.01	3.3



1 day on Venus = 243 Earth days
1 year on Venus = 225 Earth days

Which planets day is longer than its year?
Which planets have roughly the same length of their days?

Neptune 164.8 years
Jupiter 11.9 years
27 days
Mercury 88 d
Venus and Earth 224.7 d
Mercury by 1403 km
Earth 12,756 km
Saturn 142,984 km
Venus 12,104 km



Perihelion: The point in the orbit of a planet, or comet at which closest to the sun.

- Can you name the three below?



Which one improved the telescope and had to recant his belief in heliocentrism?

Notes, Activities, Keys, Assessments, Games, and more all built-in



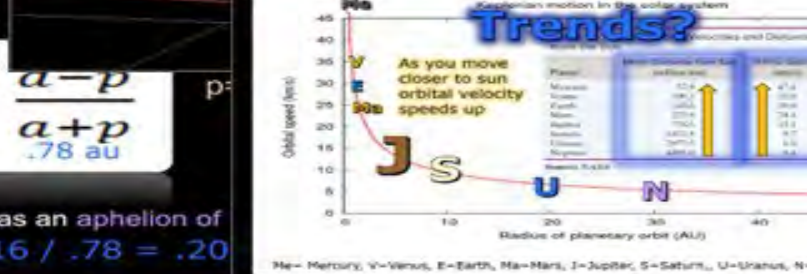
- Name this early German astronomer (1571-1630), mathematician, and astrologer.
 - He is a key figure in the 17th-century scientific revolution
 - Best known for his laws of planetary motion.



Eccentricity = $\frac{\text{Distance between the two Focus Points}}{\text{Length of the major axis}}$



- Please graph the orbital velocity of each planet below.



Mercury has an aphelion of .31 au. $.16 / .78 = .20$

What's the eccentricity of Mercury (note: it will always be between 0 and 1)

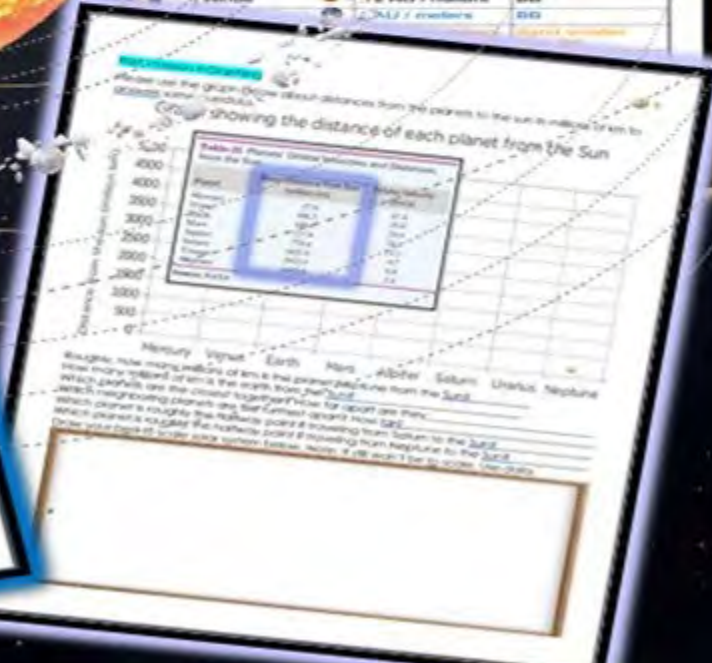
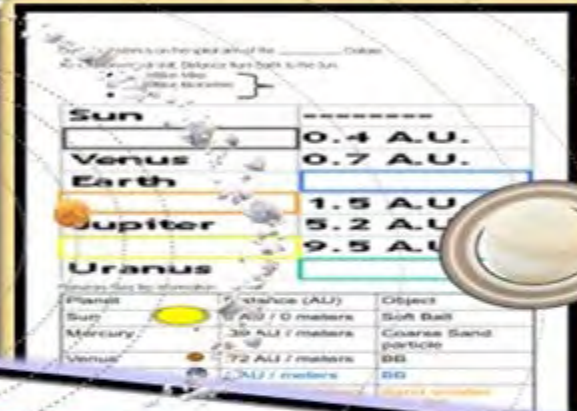
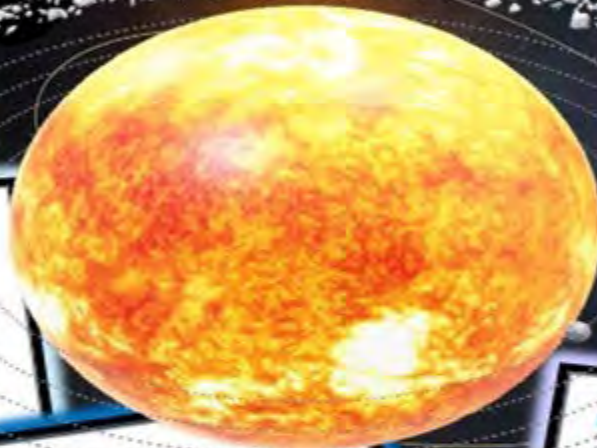
Kepler used simple mathematics to formulate three laws of planetary motion.

- Kepler's First Law stated that planets move in **elliptical paths** around the Sun.
- Kepler's Second Law, planets move proportionally faster in their orbits when they are closer to the Sun.
- Kepler's Third Law explained the relationship between the distance of a planet from the Sun and the amount of time it took to orbit the Sun. Together these laws of celestial mechanics revolutionized astronomy.



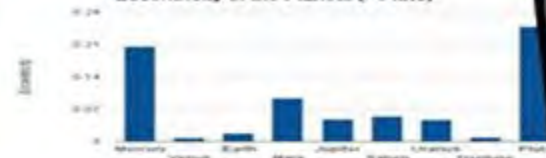
Planet	Aphelion	Perihelion
Mercury	.47	.31
Venus	.73	.72
Earth	1.02	.98
Mars	1.67	1.52
Jupiter	5.46	4.95
Saturn	10.12	9.2
Uranus	20.118	18.319
Neptune	30.44	28.32

$$e = \frac{a-p}{a+p}$$



Part 1 Review Game

Eccentricity of the Planets (Photo)



Which planet has the most eccentric orbit?
 Which planet has the least eccentric orbit?
 What's the eccentricity of...
 Mars
 Pluto
 Neptune

How do you calculate

$$e = \frac{a-p}{a+p}$$

$$e = \frac{a-p}{a+p}$$

$$e = \frac{a-p}{a+p}$$

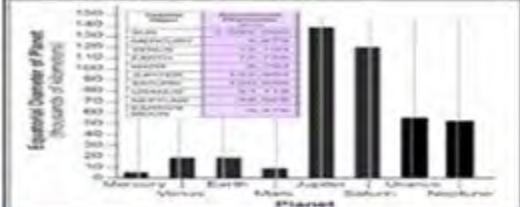
Please calculate the eccentricity between (a and b) of the planets in the solar system. Given the aphelion and perihelion, the distances in the boxes are, use the formula below. One planet will be incorrect. Which one will it be?

$$e = \frac{a-p}{a+p}$$

$$e = \frac{a-p}{a+p}$$

$$e = \frac{a-p}{a+p}$$

Planet/Comet	Aphelion	Perihelion	Eccentricity
Mercury	69.8 AU	46.0 AU	0.206
Venus	108.9 AU	68.7 AU	0.007
Earth	152.1 AU	147.1 AU	0.017
Mars	249.1 AU	206.3 AU	0.093
Jupiter	5.45 AU	4.95 AU	0.048
Saturn	10.07 AU	9.03 AU	0.054
Uranus	20.11 AU	18.31 AU	0.047
Neptune	45.54 AU	44.22 AU	0.01



Which planet has the largest equatorial diameter?
 Which planet has the smallest equatorial diameter?

Which two planets are roughly the same size?

How much larger is Venus than our own moon?

What object in the solar system has by far the largest diameter? Compare the inner planets equatorial diameter to the outer planets. How are the differences?

Part 1 Review Game

1-20 = 5 pts
 21-30 = 10 pts
 31-40 = 15 pts
 41-50 = 20 pts

NAME	SCORE	NAME	SCORE	NAME	SCORE	NAME	SCORE
1)		6)		11)		16)	
2)		7)		12)		17)	
3)		8)		13)		18)	
4)		9)		14)		19)	
5)		10)		15)		20)	

Final Question: Which planet is the most eccentric?

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Across

- The ratio of the squares of the periods of any two planets is equal to the ratio of the cubes of their average distance from the sun.
- Johannes Kepler (1571-1630) described that the orbits of the planets were not the perfect circles described by Copernicus but were flattened circles we call ellipses.
- Galileo (1564-1642) Italian physicist, mathematician, astronomer, and philosopher. Played a major role in the Scientific Revolution. His achievements include improvements to the telescope, astronomical observations, and support for Copernicanism.
- What object in the solar system has by far the largest diameter?
- This planet is 1 AU from the Sun.
- Eccentricity = Distance from focus to length of major axis.
- This planet has the slowest orbit around the sun.
- Second Planet in the Solar System.
- Our Solar System is in the spiral arm of the Milky Way Galaxy.
- This planet has the fastest orbit around the sun.
- 4th Planet from the Sun.
- Third Planet from the Sun.
- 7th Planet from the Sun.
- This planet has an aphelion of 73 AU and perihelion of 72 AU and eccentricity of 0.01.
- This planet is roughly 30AU from the Sun.

Possible Answers

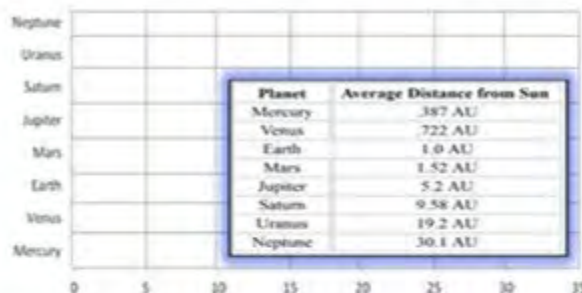
APHELION, ASTRONOMICAL, COPERNICUS, DISTANCE, DIVIDED, EARTH, EARTH, ECCENTRICITY, GALILEO, JUPITER, JUPITER, KEPLER, MARS, MERCURY, MERCURY, MILKYWAY, NEPTUNE, NEPTUNE, ORBIT, PERIHELION, SATURN, SUN, URANUS, VENUS, VENUS

Down

- Who (1473-1543) correctly placed the sun at the center of the solar system but believed the orbits of the planets to be perfect circles?
- The path (usually elliptical) of one celestial body in its path around another.
- AU = Astronomical Unit, Distance from Earth to the Sun.
- First Planet from the Sun.
- This is a measure of how an orbit deviates from circular.
- The point in the orbit of a planet, asteroid, or comet at which it is closest to the sun.
- The point in the orbit of a planet, asteroid, or comet at which it is furthest from the sun.
- 4th Planet from the Sun.
- 5th Planet from the Sun.
- This planet has aphelion of 5.45 AU and perihelion of 4.95 AU.



Distances of Planets from Sun in Astronomical Units



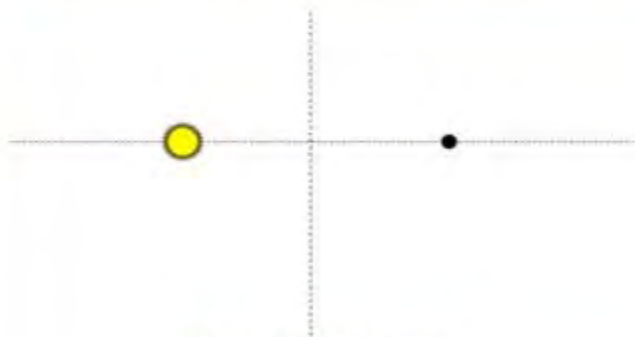
Which planet is furthest from the sun? How many AU is it from the sun?
 Roughly, how many AU's is Jupiter from the sun?
 Why is Mercury less than 1 AU?
 How many AU's is the earth from the sun?
 Roughly, how many AU's is the earth from the planet Jupiter?
 Which planets have the furthest distance between them? Roughly, how far?

Solar System Data

Celestial Object	Average Distance from Sun (millions)	Period of Revolution (days) (years)	Period of Rotation at Equator	Eccentricity of Orbit	Equatorial Diameter (km)	Mass (Earth = 1)	Density (g/cm ³)
SUN	—	—	27 d	—	1,392,000	333,000.00	1.4
MERCURY	57.9	88 d	59 d	0.206	4,879	0.05	5.4
VENUS	108.2	224.7 d	243 d	0.007	12,104	0.82	5.2
EARTH	149.6	365.26 d	23 h 56 min 4 s	0.017	12,756	1.00	5.5
MARS	227.9	687 d	24 h 37 min 23 s	0.093	6,794	0.11	3.9
JUPITER	778.4	11.9 y	9 h 55 min 30 s	0.048	142,984	317.83	1.3
SATURN	1,406.7	29.5 y	10 h 14 min	0.054	120,536	95.16	0.7
URANUS	2,871.0	84.0 y	17 h 14 min	0.047	51,718	14.54	1.3
NEPTUNE	4,498.3	164.8 y	16 h	0.009	48,526	17.10	1.8
EARTH'S MOON	384,400 km	27.3 d	27.3 d	0.055	3,476	0.01	3.3

Which planet has longest period of revolution? How many earth years is that?
 Which planet has the shortest day? (period of rotation)
 How long is one day on the sun?
 Which planet has the most eccentric orbit?
 Which two planets are roughly the same size? (Equatorial Diameter)
 How many earth masses equal the mass of Jupiter?
 Which is larger, the moon or Mercury?
 Which planet has the highest density?
 Which planet could float in water? (has a density of less than 1.0 g/cm³)
 Which planet's day is longer than its year?
 Which planets have exactly the same length of their day?

Elliptical Orbit of a Planet



Part 1: Lesson 3 Planetary Distances

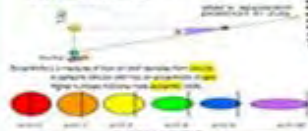


Name the planet / other (not to scale). Can you sketch in the Main Asteroid Belt? Feel free to add in more (asteroids) as we explore the solar system and learn more.
 Please use the data sheet to graph the distances of the planets from the Sun in AU's, and at least one other form of data from the data sheet.

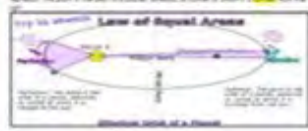
Part I into Astronomy

Name: _____

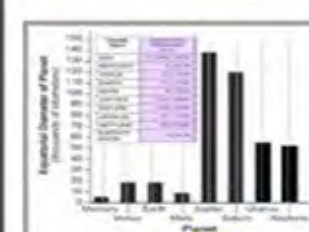
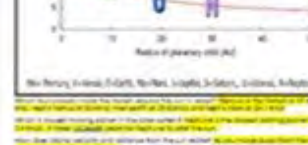
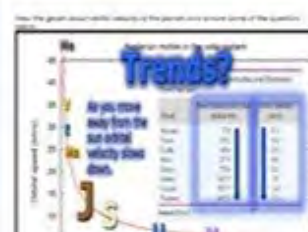
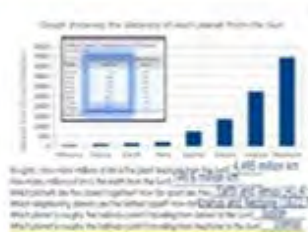
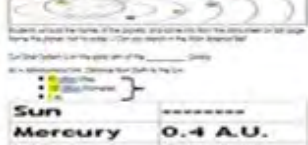
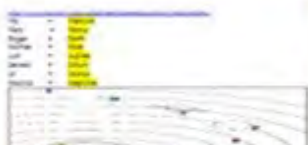
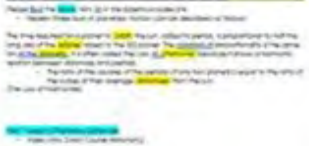
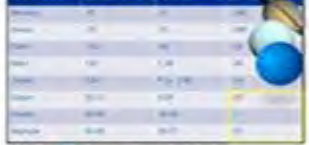
Newton's Law of Universal Gravitation
The gravitational force between two objects depends on the mass of the objects and the distance between them.
Mathematically, $F = G \frac{m_1 m_2}{r^2}$, where F is the gravitational force, G is the gravitational constant, m_1 and m_2 are the masses of the objects, and r is the distance between them.



Newton's Law of Universal Gravitation
The gravitational force between two objects depends on the mass of the objects and the distance between them.
Mathematically, $F = G \frac{m_1 m_2}{r^2}$, where F is the gravitational force, G is the gravitational constant, m_1 and m_2 are the masses of the objects, and r is the distance between them.



Kepler's 3 Laws of Planetary Motion
1. The orbits of the planets are ellipses, with the Sun at one focus.
2. A line segment joining any planet and the Sun sweeps out equal areas in equal times.
3. The square of the orbital period of a planet is proportional to the cube of the semi-major axis of its orbit.



Kepler's 3 Laws of Planetary Motion
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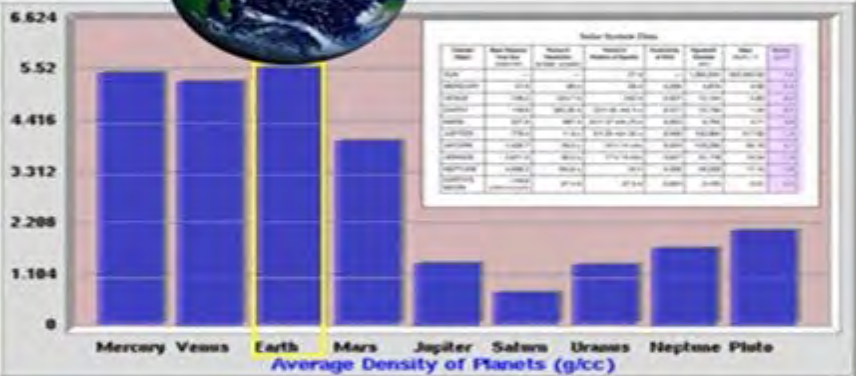


Astronomy

Quiz Game

- Which planet in our solar system is the **densest** and which is the **least dense**?

16

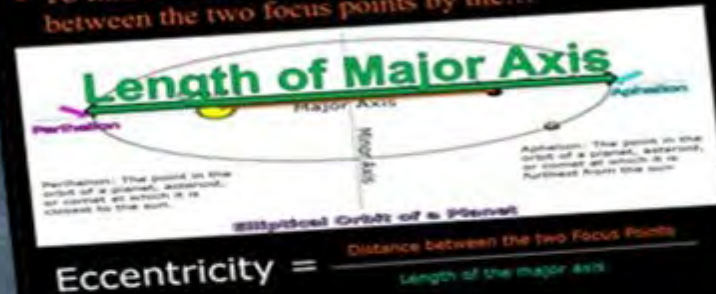


- This is the name for the path (usually one celestial body in its revolution around another).



- To find eccentricity, you divide the distance between the two focus points by the...

12



- The terms below are a measurement of how an orbit deviates from circular.
 - A perfectly circular orbit has an **eccentricity** of zero.
 - Higher numbers indicate more **eccentric** orbits.



What's the perihelion and aphelion of planet earth?

Aphelion: Furthest from sun
152 million

Perihelion: Closest to the sun
147 million

11

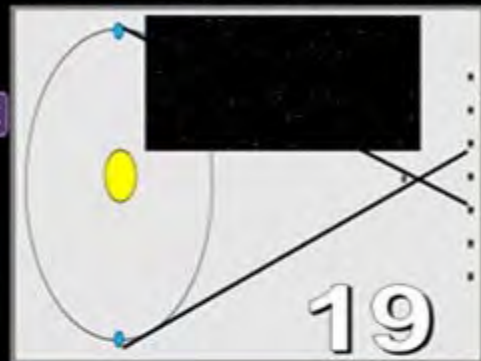
- Our solar system (The Sol System) is on the on spiral arm of this galaxy?



18

- This is the name for the apparent movement against the background of more distant stars as the Earth revolves around the Sun.

- A.) Equinox
- B.) Aphelion
- C.) Stellar Parallax
- D.) Perihelion
- E.) Harmonic Function



19

- The earth is approximately this far from the sun?

- 93 Million Miles
- 150 Million Kilometers
- 1 AU

} Same



Final Question

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- This is a unit of measurement, it's the distance from The Sun to Earth.
It equals= 149,598,000 kilometers

This image is not accurate!



20

- Which is not one of Kepler's three laws of planetary motion?

9

- A.) The path of the planets about the sun is elliptical in shape, with the center of the sun being located at one focus. (The Law of Ellipses)
- B.) A planetary body will always have a highly elliptical orbit as it travels around the sun. (The Law of Eccentricity)

The planets in our solar systems are only slightly elliptical. Most have eccentricity of less than 0.1 (Mercury has the most).



- Planetary motion.

- A line between a planet and the Sun covers equal areas in equal times.



8

- Name this Italian physicist (1564-1642), mathematician, astronomer, and philosopher.

- Played a major role in the Scientific Revolution.
- His achievements include improvements to the telescope, astronomical observations, and support for Copernicanism.

3



- Galileo helped improve this device?

- Originally invented by Spectacle makers Hans Lippershey & Zacharias Janssen and Jacob Metius in the Netherlands (1608).



4

- Planetary motion.

- Planets move in orbits shaped like an ellipse.
- A.) Circle
- B.) Orbit
- C.) Ellipse
- D.) Egg
- E.) Penhelion



7

the idea of heliocentrism that planets revolved around a stationary sun.

Galileo recanted his beliefs and spent the rest of his life under house arrest.

Heliocentrism

5



- Kepler's three laws of planetary motion can be described as follows:



– The ratio of the squares of the periods of any two planets is equal to the ratio of the cubes of their average distances from the sun.

- (The Law of Harmonies)

15

- Eccentricity can also be calculated by this equation.

$$e = \frac{a - p}{a + p}$$

a = aphelion
b = perihelion

30.44 - 29.77 au .67
30.44 + 29.77 au 60.21

Neptune has an aphelion of 30.44 au, and perihelion of 29.77 au. $.67 / 60.21 = .011$

What's the eccentricity of Neptune? **e=.011**

(note: It will always be between 0 and 1)

14

- Which planet / dwarf planet has the highest and lowest eccentricity?



13

- Which letter below is the correct order of the planets in our solar system from the Sun outward?
 - A.) Mercury, Venus, Mars, Earth, Saturn, Jupiter, Neptune, Uranus
 - B.) Venus, Mercury, Earth, Mars, Saturn, Jupiter, Neptune, Uranus
 - C.) Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune
 - D.) Mars, Mercury, Venus, Earth, Jupiter, Saturn, Uranus, Neptune
 - E.) Mercury, Venus, Earth, Jupiter, Xena, Uranus, Neptune

1

Part 2: The Sun, Absolute Magnitude, Apparent Magnitude, Parsec, Stellar Classification / Spectra, Hertzsprung Russell Diagram, Composition of the Sun, Nuclear Synthesis, Layers of the Sun, Solar Flares, Coronal Mass Ejections, Carrington Event, Life Cycle of a Star, Blackhole, Neutron Star, Solar System Formation, Shadows, Sun Dials, Eratosthenes, Graphing Shadow length, Solar Eclipse, Lunar Eclipse, Path of Totality, Box Game Review, Crossword Puzzle, End Unit Assessment with Answer Version so Students can Self-Assess

Part 2: Astronomy Unit



Part 2 Lesson 1 The Sun



Part 2 Lesson 2 HR Diagram



Part 2 Lesson 3 Inside the Sun



Part 2 Lesson 4 Solar Flares



Part 2 Lesson 5 Life Cycle of Stars



Part 2 Lesson 6 Solar System Formation More



Part 2 Lesson 7 Optional Sun Song



Part 2 Lesson 8 Shadows Sun Dials



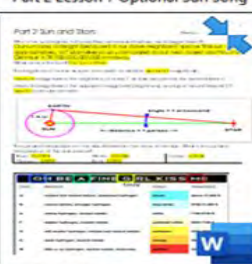
Part 2 Lesson 9 Solar Lunar Eclipse



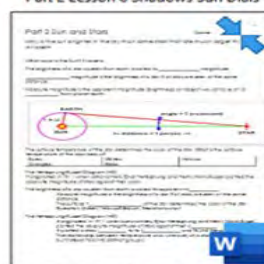
Part 2 Lesson 10 Review Game



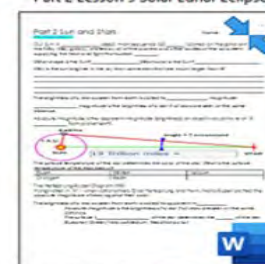
Part 2 Lesson 11 Review Game Answers



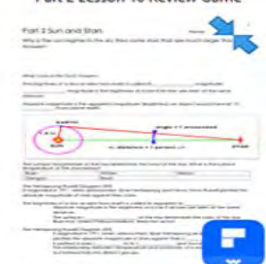
Part 2 Work Bundle Answers



Part 2 Work Bundle Digital



Part 2 Work Bundle Print



Part 2 Work Bundle Writable pdf

Sun and Stars Unit

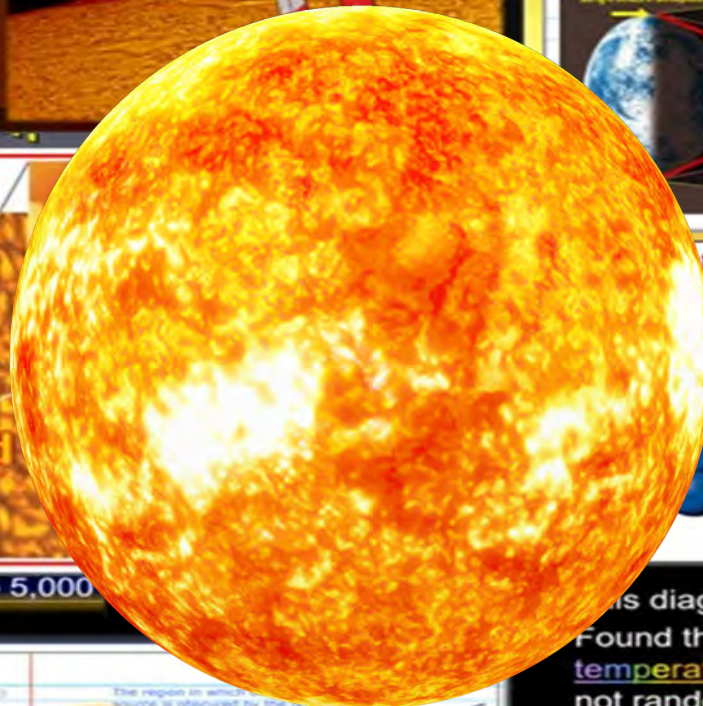
• Nucleosynthesis

- Process where heavier elements are created inside stars from hydrogen nuclei.



- Solar prominence: The stretching out of gas components to a length that can reach thousands of kilometers on the surface of the sun.

Their causes are uncertain but probably involve magnetic forces.



Photosphere



Sun Spots

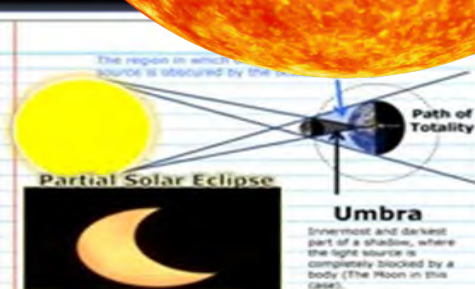
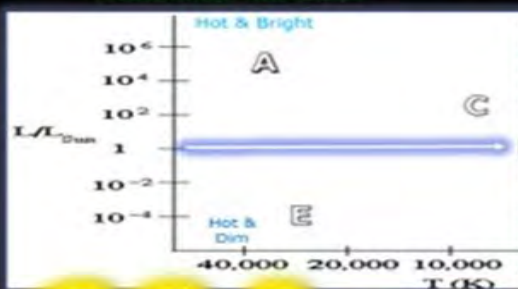
Cool Video (26 seconds) Benard Cells, Convection

Benard

Chromosphere

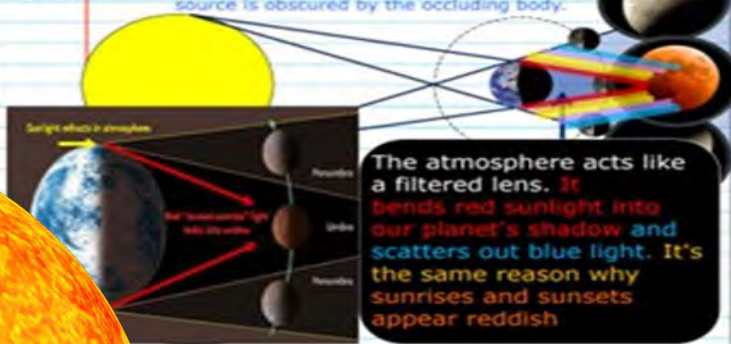
3000 km thick and the temperature (light emitted)

- Plot the Star. Luminosity 1, Temp 5,000
- What color will it be?



Penumbra

The region in which only a portion of the light source is obscured by the occluding body.



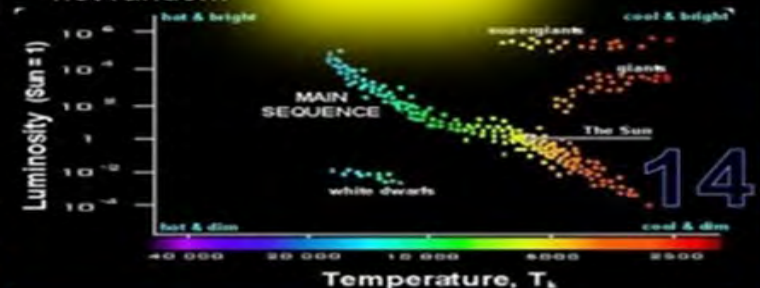
The atmosphere acts like a filtered lens. It bends red sunlight into our planet's shadow and scatters out blue light. It's the same reason why sunrises and sunsets appear reddish

Lighter Elements



This diagram... **Hertzsprung-Russell (HR)**

Found that the relationship between **temperature** and **luminosity** of a star was not random



11 Lessons

14

Interactive Slideshows

Solar Flares and CME's



- Which is true of the Hertzsprung-Russell Diagram (HR)?
- A) Tracks the orbits of stars in the galaxy
- B) Identifies how far away the stars are from each other
- C) Was critical in the formation of the heliocentric model of our solar system
- D) It plotted Luminosity to a stars temperature and found trends
- E) This diagram is outdated and no longer used because Hipparchus cataloged the first stars in 129 BC.



Plot the Star. Luminosity vs. Temp 40,000 (K)

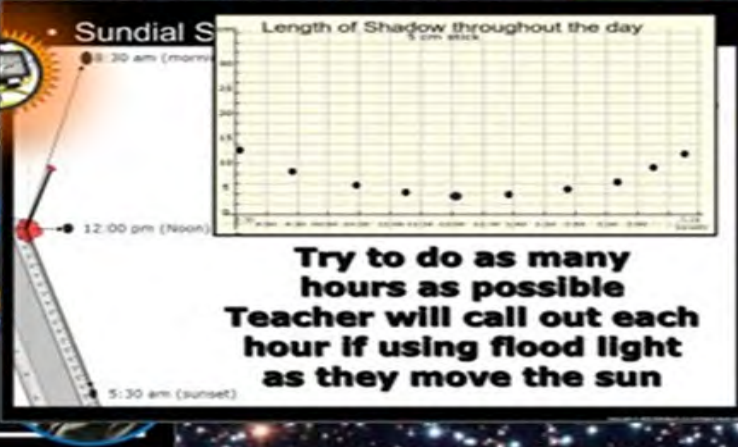


The Carrington Event, September 1, 1859

- A giant solar storm hit earth disrupting all electronics (telegraph) and lit up the sky.
- If that event happened today the earth would be thrown into chaos without technology.



- The sun changes slowly over time converts Hydrogen into Helium at



Red and Brown Dwarf Class M
 2,200 to 3,800 degrees Kelvin

White Dwarf Class O
 100,000 Kelvin.

SUN
 G Class Star, Temps above 5,000K

Follow Along Work Bundle

18 Pages

Activities, Notes, Keys, Assessments, and more all built-in

• The Hertzprung-Russell Diagram (HR)

- It originated in 1911 when astronomers, Einar Hertzsprung and Henry Norris Russell plotted the absolute magnitude of stars against their color.

Plotted Luminosity to a stars Temperature



- What are two possible outcomes that can occur to a **Super Massive Star** as it gets close to the end?



13

- What are the names for these features on the surface of the Sun?



9

1/50 of a circle $\rightarrow$ 5 000 stadia (~800 km)
 $\therefore$ 1 circle $\rightarrow$ 50 $\times$ 5 000 stadia
 $=$ 250 000 stadia (~40 000 km)

$$\frac{7.2^\circ}{360^\circ} = \frac{800 \text{ km}}{X \text{ km}}$$

$$\frac{1}{50^\circ} = \frac{800 \text{ km}}{X \text{ km}}$$

$$X \text{ km} = 50 \times 800$$

$$40,000 \text{ km}$$

Center of the Earth
Actual circumference is...

- The Sun is white.
 - It may appear yellow because of atmospheric scattering.



- The brightness of a star as seen from earth is called its **apparent magnitude**.

- Absolute magnitude is the brightness of a star if all stars are seen at the same distance.



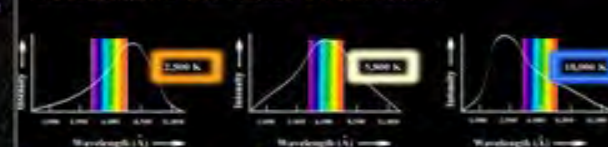
A medium-sized, main sequence G2 star located on the spiral arm of the Milky Way, and orbited by all of the planets and other bodies in the Sol System,

Formation begins and gravity causes the nebula to contract. ...

Gravity pulls in the mass of the nebula in, then starts spinning, then the disk forms (planetary solar disk)

Gravitational energy gets converted to thermal energy (heat); gets so hot, then nuclear fusion, then the sun is born.

- The surface temperature of the star determines the color of the star.



Cooler Warmer



Colors are exaggerated

Really Hot



Sun and Stars



Part 2 Sun and Stars

Our Sun is a _____ dwarf main sequence G2 _____ located on the spiral arm of the Milky Way galaxy, situated far from the center and outer borders of the system, supplying the heat and light that sustain _____.

What shape is the Sun? _____ What color is the Sun? _____

Why is the sun brighter than the other stars? _____

The brightness of a star as seen from earth is called by _____ magnitude.

_____ magnitude is the brightness of a star if all stars were seen at the same distance.

Applying its magnitude to the apparent magnitude (brightness) an object would have at 10 _____ from planet earth.



The surface temperature of the star determines the color of the star. What is the surface temperature of the star below?

Blue _____

Yellow _____

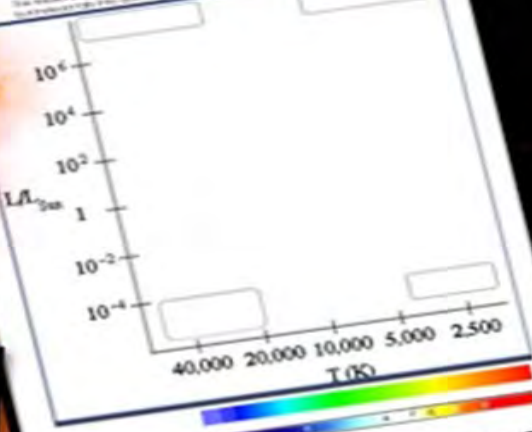
Orange _____

The Hertzsprung-Russell Diagram (HRD) is a graph that plots _____ when astronomers first developed it. Our Hertzsprung and Henry Norris Russell plotted the absolute magnitude of stars against their color.

The temperature of a star as seen from earth is called its _____.

The temperature of a star as seen from earth is called its _____.

The relationship between temperature and luminosity of stars with temperature _____.



OH BE A FINE GIRL KISS ME

Class	Composition	Color	Temperature
O	Ionized and neutral hydrogen, ionized helium		
B	Neutral helium, ionized hydrogen		
F	Ionized hydrogen, ionized helium		
G	Neutral hydrogen, ionized helium		
K	Ionized hydrogen, ionized helium		
M	Neutral hydrogen, ionized helium		

The stars are divided into 7 classes designated by the letters O, B, A, F, G, K, and M. The hottest stars _____ and the _____ are the coolest _____.

Astronomers can tell the _____ of a star by looking at the type of light it emits. Very _____ stars (O and B stars) look blue to our eyes, and as stars get _____ they become _____.

_____ stars (K and M stars) look red to our eyes, and as stars get _____ they become _____.

_____ stars (G stars) look yellow to our eyes, and as stars get _____ they become _____.

Provide some information about the type of stars below.

O	B	A	F	G	K	M

Part 3 Lesson 2 The HR Diagram

The Hertzsprung-Russell Diagram (HRD) is a graph that plots _____ when astronomers first developed it. Our Hertzsprung and Henry Norris Russell plotted the absolute magnitude of stars against their color.

The temperature of a star as seen from earth is called its _____.

The temperature of a star as seen from earth is called its _____.

Provide some information about the type of stars below.

Provide some information about the type of stars below.

Provide some information about the type of stars below.

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Provide some information about the type of stars below.

Light Element Greater Than Helium

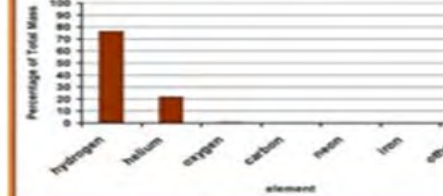
The Sun is a star that _____ object in the solar system.

It contains more than _____% of the total mass of the Solar System.

All _____ for our solar system comes from the Sun.

Please answer the questions below.

Composition of the Sun



The Sun is primarily made of these two elements. Please estimate the % from the graph.

How much is left over for everything else?

The Sun is a _____ electrically charged particles.

Considered the fourth state of matter.

Nucleosynthesis _____

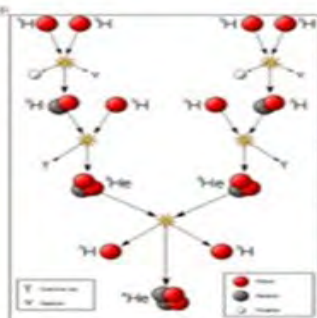
Process where heavier _____ are created inside stars from hydrogen nuclei.

Helium is created depends on the size and _____ of the star.

Large stars may fuse carbon into _____ and magnesium, oxygen into _____, and silicon into _____.

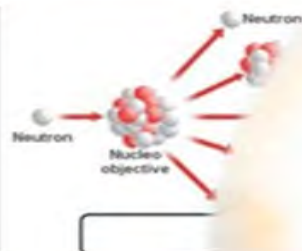
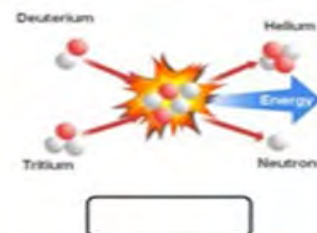
This is the precursor to a supernova.

18 Pages



Where does the energy in our solar system come from? A strong answer should reference use the picture on the left.

Which is fusion, and which is fission?



Part 2 Lesson 4 Solar Flares and More

When is it okay to directly look at the sun?

Solar flare: A sudden eruption of intense high-_____ radiation from the sun's surface.

Solar prominence: the stretching out of _____ components to a length that can reach thousands of kilometers on the surface of the sun.

Sunspot: A _____ darker spot on the sun.

Associated with an increase in _____ field. They are regions of reduced surface temperature caused by concentrations of field flux that inhibit convection.

Flare: the action or process of flowing or flowing out.

A coronal mass ejection (CME) is a massive _____ of solar above the solar corona or being released into space.

Please fill in the Venn Diagram below as described.



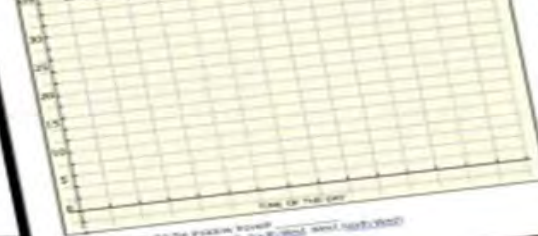
Which one is more disruptive to life on planet earth?
Which one moves through space faster?
Both CME's and Solar flares occur here?

Part 2 Lesson 4 Solar Flares and More

A sunspot is a darker spot on the sun. It is caused by the _____ of the sun's magnetic field. Add a correct adjective to the space below: What time of day could the sun be in the _____ and why?



Make the "instrument" of the sun in the sky available for the activity.
Length of Shadow throughout the day



Part 2 Lesson 4 Solar System Formation: Size of Stars, Center of Mass

Our own solar system was believed to have formed from the remains after a giant star _____ (Supernova).

Our Sun and solar system formed from a solar _____ (Gas and Dust cloud). About _____ billion years ago. Called the nebular hypothesis.

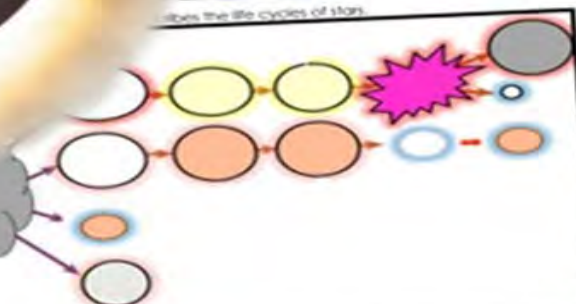
How did the solar system form? Use the picture for steps 1-4.



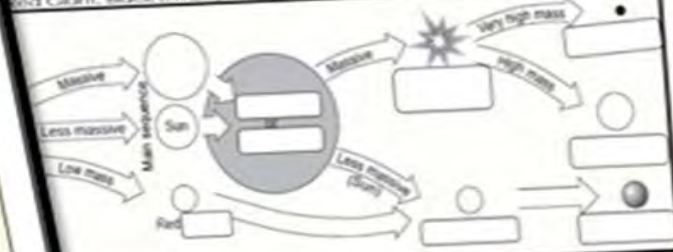
1
2
3
4/5

What is the biggest object in the universe? Explain _____

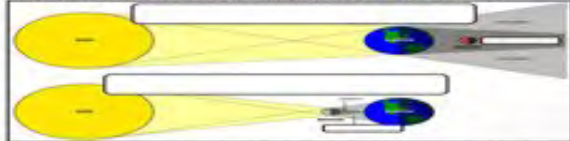
_____ of a star
describes the life cycles of stars.



Label the boxes below to describe the life cycle of a star.
Basic: Neutron Star, Supernova, White Dwarf, Dwarf, Super Giant, Black Dwarf, Black Dwarf / Dead Star



Which is a solar and which is a lunar eclipse? Label them. Remember



Why is a lunar eclipse often called a blood moon? Explain and add information to the picture below! Get out your colored pencils to show me.

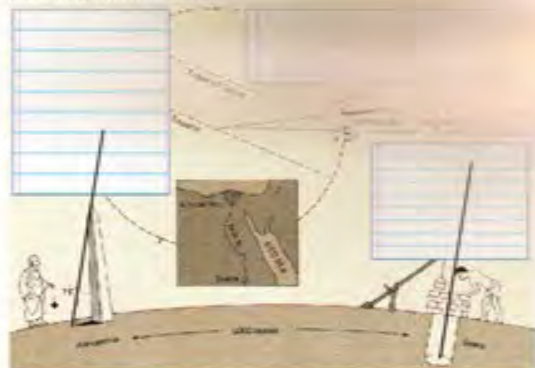


When is the next lunar eclipse and solar eclipse in or near your state? Record the dates and times below. Let's make an effort to check one out sometime.

Is it the sun that moves across the sky or is the earth rotating?

Which way does the sun travel vs. the shadow?

What is so special about Eratosthenes?



Part 2 Review

1-20 = 5 pts
21-25 = bonus = 1 pt
Society with owl in
Final Question = 3 pts

STAIR LOGS				
1)	4)			
2)	7)			
3)	8)	13)	18)	23)
4)	9)	14)	19)	24)
5)	10)	15)	20)	25)

Final Question Wager: 25 Answer:

2020/05/05 10:00 AM

What is the Sun?

What is the Sun?

What is the Sun?

What is the Sun?

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What is the Sun?

What is the Sun?

The region in which only a portion of the light source is obscured by the obscuring body.

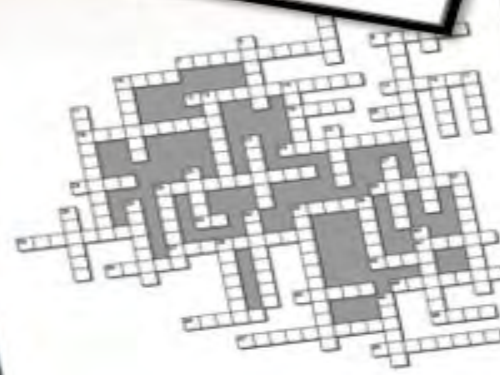


Innermost and darkest part of a shadow, where the light source is completely blocked by a body (The Moon in this case).



The region in which only a portion of the light source is obscured by the obscuring body.

Innermost and darkest part of a shadow, where the light source is completely blocked by a body (The Earth in this case).



SUN & STARS

Quiz Game

- The brightness of a star as seen from earth is called its **apparent magnitude**.
- Absolute magnitude** is the brightness all stars are seen at the same distance.

This star is extremely bright but also **FAR AWAY**



This star is close

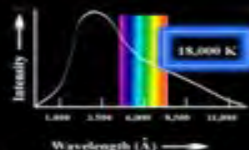
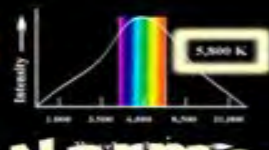
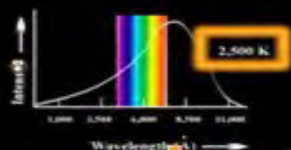


What is the Sun?

B

D

- The surface temperature of the star determines the color of the star.
- Which star has the hottest surface temperature?



Cooler **Warmer**



Colors are exaggerated

Really Hot

- Why is the sun brighter in the sky than some stars that are much larger than it?

1

Our close neighbor

93 million miles

147 million km

Away

Big Difference

Closest star

Proxima Centauri

39,900,000,000,000

km away.

4.24 light-years away

- What is one way a new nebula can form?

Stellar Ejections 15

Also
Supernova

Can aid in Nebula formation (some debate)

- A formation process of a star often begins with a Nebula. A Nebula is a...

- A.) Largest Object in the Universe
- B.) A Superheated Blackhole
- C.) A Supernova
- D.) A dense cloud of gas and dust
- E.) Cannot be determined

11

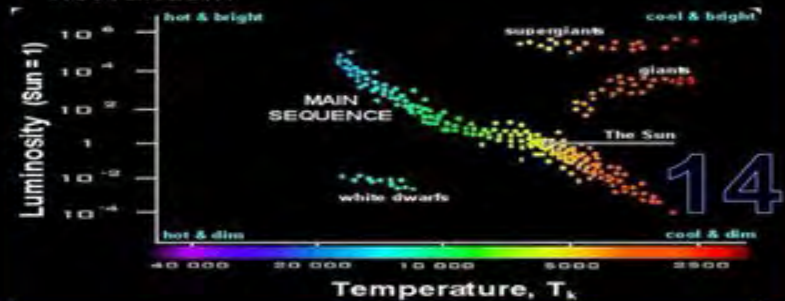


- What are two possible outcomes that can occur to a **Super Massive Star** as it gets close to the end?



13

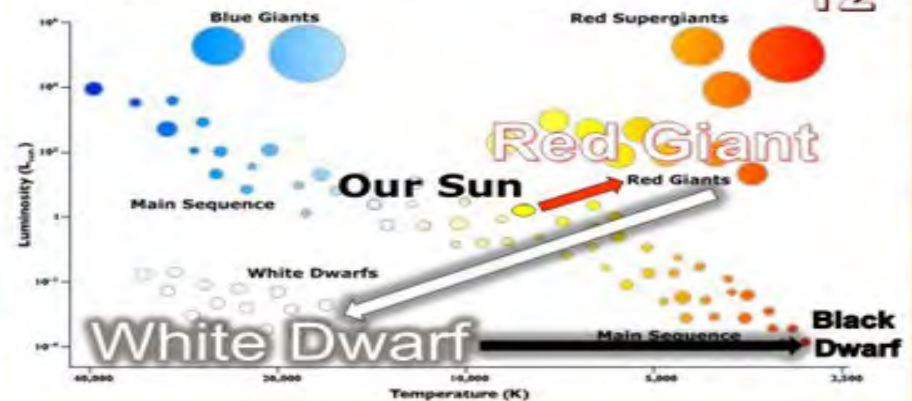
- This diagram... **Hertzsprung-Russell (HR)**
- Found that the relationship between **temperature** and **luminosity** of a star was not random



14

- What is going to happen to our sun? What two types of stars will it turn into?

12



- Name this process? The Sun is primarily composed of these two chemical elements?



- The state of matter that best represents the Sun is a...

- A.) Gas
- B.) Solid
- C.) Liquid
- D.) Plasma
- E.) Cannot be determined.



7 answer is...

- What are the names of these features circled below?



- What are the names for these features on the surface of the Sun? Associated with an increase in magnetic field.

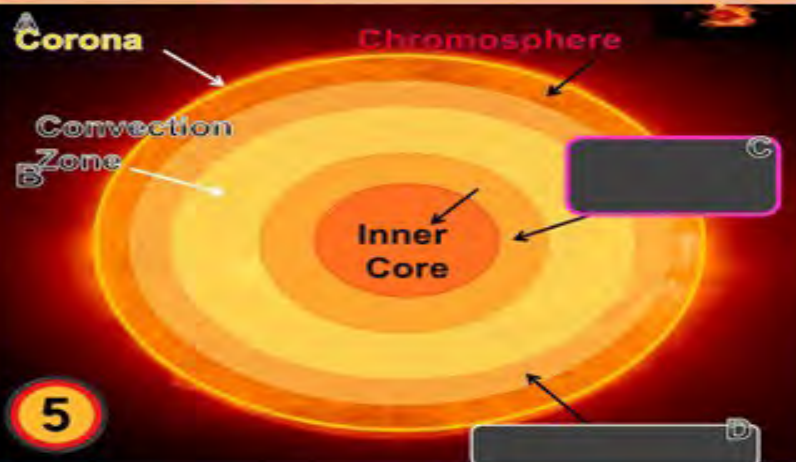


- The Sun makes up this percent of our solar system by mass?

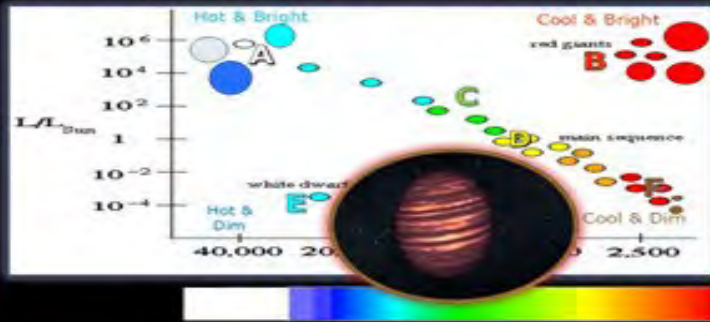
- A.) 50%
- B.) 99.8%
- C.) 25%
- D.) 1%
- E.) Cannot be determined



6



- Plot the Star. Luminosity 10^{-4} , Temp 2,500 (K)
- F = Cool and Dim Main Sequence Stars



- Name this event as seen from planet earth?

19

Solar Eclipse



- The sun rises in the **East**, and sets in the **West**. The shadows travel in the opposite direction.
- When are the shadows the longest and shortest?

17

East
Sunrise **West to East**
Noon
(Short Shadows) **West**
Sunset

- What is this called? Name A and B?

Lunar Eclipse

18



- What is the name for the shaded region that travels across the surface of the Earth during a solar eclipse?

20

Path of Totality



What causes
the apparent movement
of the Sun across the sky?

16



Part 3: The Habitable Zone, Important data about Mercury, Venus, Earth, Venn Diagram of Earth and Venus, Moon Formation Theories, Earth's Axial Tilt, Seasons on Earth, Equinox, Solstice, Earth's EM Field, Aurora borealis, Synchronous Orbit of the moon, Features of the moon, Phases of the Moon (with OREOS), Tides, Neap Tide, Spring Tide, Tidal Cycle, Reading a Tide Chart, Mars, Features on Mars, Moons of Mars, Rover Exploration Missions Past and Future

Part 3: Astronomy Unit



Part 3 Lesson 1 Inner Planets



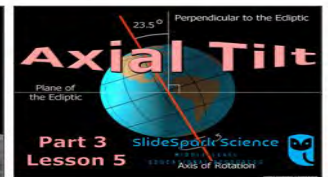
Part 3 Lesson 2 Mercury



Part 3 Lesson 3 Venus



Part 3 Lesson 4 Earth and Moon



Part 3 Lesson 5 Axial Tilt



Part 3 Lesson 6 Solstice Equinox



Part 3 Lesson 7 EM Field



Part 3 Lesson 8 Phases of Moon 1



Part 3 Lesson 9 Phases of Moon 2



Part 3 Lesson 10 Phases Quiz



Part 3 Lesson 11



Part 3 Lesson 12



Part 3 Lesson 13



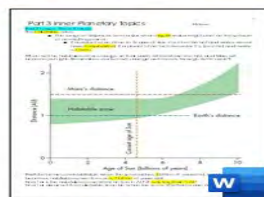
Part 3 Lesson 14



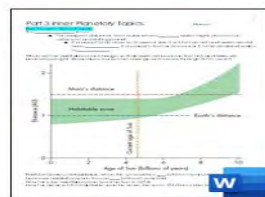
Part 3 Lesson 15



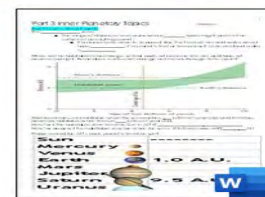
Part 3 Materials List



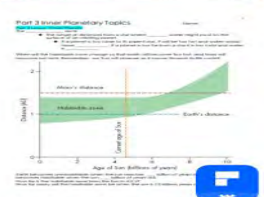
Part 3 Work Bundle Answers



Part 3 Work Bundle Digital



Part 3 Work Bundle Print



Part 3 Work Bundle Writable pdf

Inner Planetary Topics Unit

Preview is a compressed file

life to thrive, much more than simply being a planet with a lot of water.

Earth is Amazing for Life!

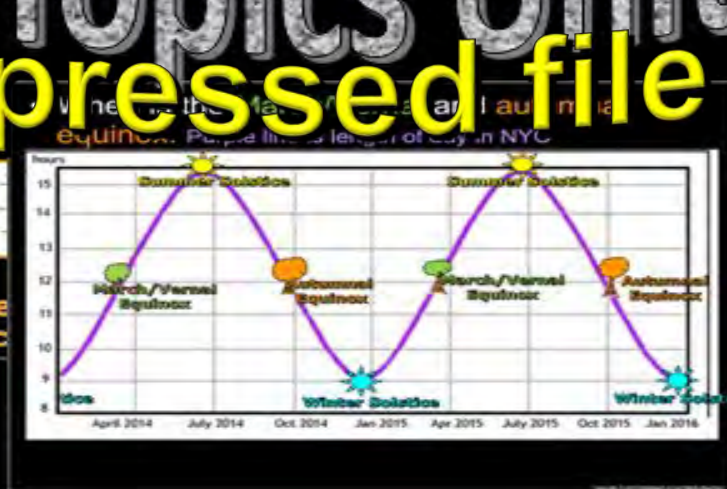
Our planets has exact amount of everything on this page, which combined allows for a thriving planet

Which is equinox, winter solstice, or the summer solstice? Which hemisphere, and which is summer solstice?

A **B** **C**

Equinox

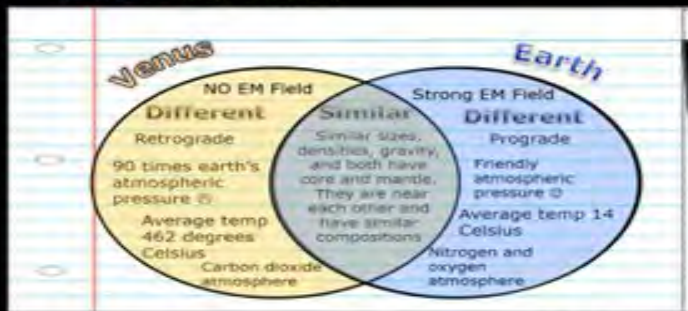
Winter Solstice **Summer Solstice**



- Earth's axis is currently tilted 23.4 degrees, or about halfway between its extremes.
 - This angle is very slowly decreasing in a cycle that spins about 41,000 years. It was last at its maximum tilt about 10,700 years ago and will reach its minimum tilt about 9,800 years from now.



- Activity (Optional) Create a Venn Diagram of Earth and Venus.



- What planet am I? I am about .7 AU from the sun.



Which planet rotates opposite of all the others?

Mercury Venus Earth Mars

prograde retrograde prograde prograde

called retrograde

Can we have four volunteers stand up and spin. The second planet (Venus) should spin in retrograde to the others?

Get Earth Facts

Orbital Circumference
Distance from Sun at km and au
Temperature (C)
Gravity
Orbital Period

Work Bundle

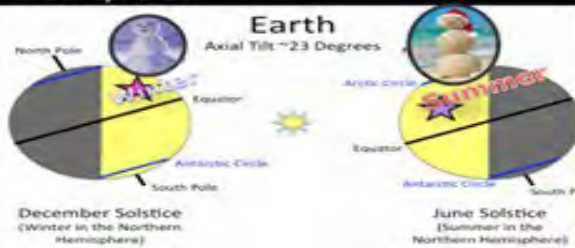
Gas
Solid
Liquid

Interactive Slideshows

• Activity! Phases of the Moon with OREOS



• Is the **Summer** or Winter in the Northern Hemisphere?



Which area of the planet has hot weather year round and which is cooler year round?



Spring Tide

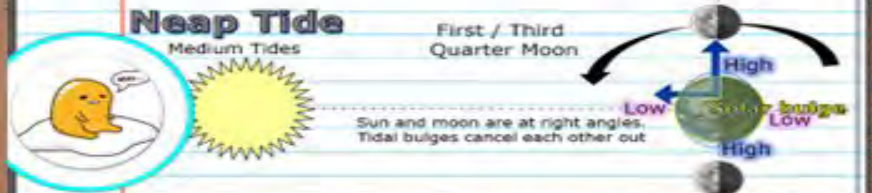
Larger high tides and lower low tides



Neap Tide

Medium Tides

First / Third Quarter Moon



• Which is **winter solstice** in the northern hemisphere and which is **summer solstice**?



Summer Solstice

Winter Solstice

Earth becomes uninhabitable when the sun reaches **6** billion years old, and then Mars becomes habitable when the sun reaches **7** billion years old.

The Sun will grow into a red giant in about a billion years and earth will no longer be habitable



- It takes the moon the same amount of time to rotate around once as it does for the moon to go around the earth once.
- Therefore, earth-bound observers can never see the far side of the moon.

It takes about **27.3** Earth days for the moon to go around the earth once.



It takes the moon about **27.3** Earth days to rotate once.

27.3

- Venus is the hottest planet in the solar system because of the greenhouse effect.

Venus is incredibly hot because of its greenhouse effect.

Let's take care of our climate

Venus is an example of what happens when climate goes really wrong

15 Lessons

Follow Along Work Bundle

Part 3 Inner Planetary Topics

1. The distance from the Sun to the planets is measured in Astronomical Units (AU). 1 AU is the distance from the Sun to Earth. The distance from the Sun to Mars is 1.52 AU. The distance from the Sun to Venus is 0.72 AU. The distance from the Sun to Mercury is 0.39 AU.

Inner Planetary Data

Planet	Distance from Sun (AU)	Distance from Sun (km)	Mass (kg)	Radius (km)	Surface Temp (°C)	Atmosphere
Mercury	0.39	57,909,176	3.30 × 10 ²²	2,439	167	None
Venus	0.72	108,208,464	4.86 × 10 ²⁴	6,052	464	CO ₂
Earth	1.00	149,597,870	5.97 × 10 ²⁴	6,371	15	N ₂ , O ₂
Mars	1.52	227,939,200	6.42 × 10 ²³	3,780	-63	CO ₂

Venus

Venus is the second planet from the Sun. It is the hottest planet in the solar system. It has a thick atmosphere of carbon dioxide. It has a surface temperature of 464°C. It has a radius of 6,052 km. It has a mass of 4.86 × 10²⁴ kg. It has a distance from the Sun of 108,208,464 km. It has a distance from Earth of 41,000,000 km. It has a distance from Mars of 41,000,000 km. It has a distance from Jupiter of 55,000,000 km. It has a distance from Saturn of 108,000,000 km. It has a distance from Uranus of 257,000,000 km. It has a distance from Neptune of 454,000,000 km. It has a distance from Pluto of 701,000,000 km.

Earth

Earth is the third planet from the Sun. It is the only planet known to have life. It has a thick atmosphere of nitrogen and oxygen. It has a surface temperature of 15°C. It has a radius of 6,371 km. It has a mass of 5.97 × 10²⁴ kg. It has a distance from the Sun of 149,597,870 km. It has a distance from Venus of 41,000,000 km. It has a distance from Mars of 41,000,000 km. It has a distance from Jupiter of 55,000,000 km. It has a distance from Saturn of 108,000,000 km. It has a distance from Uranus of 257,000,000 km. It has a distance from Neptune of 454,000,000 km. It has a distance from Pluto of 701,000,000 km.

Earth's Rotation

Earth rotates on its axis. The axis is an imaginary line that passes through the center of the Earth. The axis is tilted at an angle of 23.5 degrees. The Earth rotates once every 24 hours. This rotation causes day and night.

Earth's Revolution

Earth revolves around the Sun. The Sun is the center of the solar system. Earth orbits the Sun in a circular path. It takes 365 days for Earth to complete one revolution around the Sun. This revolution causes the seasons.

Earth's Seasons

Earth has four seasons: Spring, Summer, Autumn, and Winter. The seasons are caused by the tilt of the Earth's axis. When the axis is tilted towards the Sun, it is Summer. When the axis is tilted away from the Sun, it is Winter. When the axis is perpendicular to the Sun, it is Spring and Autumn.

Earth's Climate

Earth has a diverse climate. The climate is determined by the latitude, longitude, and altitude. The climate is also affected by the greenhouse effect. The greenhouse effect is the process by which the Earth's atmosphere traps heat from the Sun. This process keeps the Earth warm enough to support life.

Earth's Surface

Earth's surface is covered by water and land. The water is in the form of oceans, seas, and lakes. The land is in the form of continents and islands. The surface is also covered by mountains, hills, and valleys.

Earth's Interior

Earth's interior is divided into three layers: the crust, the mantle, and the core. The crust is the outermost layer. The mantle is the middle layer. The core is the innermost layer. The core is made of iron and nickel. The mantle is made of silicate rocks. The crust is made of various types of rocks.

Earth's History

Earth has a long history. It is estimated to be 4.5 billion years old. The first life forms appeared on Earth about 3.5 billion years ago. The first dinosaurs appeared about 230 million years ago. The first humans appeared about 200,000 years ago.

Earth's Future

Earth's future is uncertain. It is possible that Earth will be destroyed by a meteorite impact or a nuclear war. It is also possible that Earth will be colonized by humans. The future of Earth depends on the actions of humans.

Earth's Resources

Earth has many resources. These include water, land, and minerals. These resources are essential for life. It is important to use these resources wisely. We should not waste them. We should also protect them from pollution.

Earth's Environment

Earth's environment is the natural world. It includes the air, water, and land. The environment is affected by human actions. We should protect the environment. We should not pollute it. We should also conserve it.

Earth's Society

Earth's society is the human world. It includes the people, the culture, and the economy. The society is affected by human actions. We should improve the society. We should not destroy it. We should also build it up.

Earth's Culture

Earth's culture is the human world. It includes the art, the music, and the literature. The culture is affected by human actions. We should enrich the culture. We should not destroy it. We should also build it up.

17 Pages

Activities, Notes, Keys, Assessments, and more all built-in

- Which one is Phobos, and which is Deimos?



- The earth is slightly larger, but the two are very close.

– Densities are also similar and both have a similar gravity. Both have a magnetic field!

EM = Electromagnetic

Scientists assume that the core of Venus exists based on calculations of its density. The density of Venus is only a little less than the density of Earth.

No EM Field
Slow Rotation

Strong EM Field

- One of the biggest differences of this rover is that it has a nuclear battery instead of solar panels.

– Can work day and night, summer and winter.

– many new tools including a laser to open



- Venus is the closest planet to earth.

It makes its closest approach to Earth about once every 584 days, when the planets catch up to one another. On average, it is 25 million miles away at this point.



Word Bank: Summer Solstice, Winter Solstice, Perihelion, Aphelion, Spring Equinox, Fall Equinox, Summer Northern Hemisphere, Winter Northern Hemisphere, Spring Northern Hemisphere, Fall Northern Hemisphere



Measuring the distance between the Sun and the planets

Provide some information about the planets Mercury and Venus below.

Planet	Distance from Sun (AU)	Distance from Earth (AU)	Distance from Mars (AU)	Distance from Jupiter (AU)	Distance from Saturn (AU)	Distance from Uranus (AU)	Distance from Neptune (AU)
Mercury	0.39	0.61	0.46	3.12	5.20	6.38	7.78
Venus	0.72	0.28	0.38	3.87	5.94	7.18	8.58
Earth	1.00	0.00	0.52	4.84	6.86	7.94	9.38
Mars	1.52	0.52	0.00	3.12	5.20	6.38	7.78
Jupiter	5.20	4.84	3.12	0.00	1.90	2.97	4.39
Saturn	9.54	8.74	7.94	5.20	0.00	1.07	2.07
Uranus	19.20	18.18	17.14	13.13	7.94	0.00	1.07
Neptune	30.06	29.08	28.00	21.09	13.13	7.94	0.00

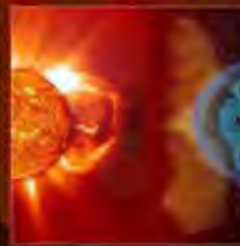
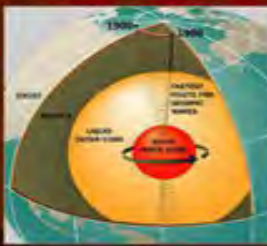
- The habitable zone:

- The range of distances from a star where liquid water might pool on the surface of an orbiting planet.

- If a planet is too close to its parent star, it will be too hot and water would have evaporated. If a planet is too far away, it's too cold and water is frozen.



- The spinning inner cores of solid and liquid iron creates a giant electromagnetic field around our planet. Without it, earth is...



Sun
Mer

Planet	Distance from Sun (A.U.)
Venus	0.7 A.U.
Earth	1.0 A.U.
Jupiter	5.2 A.U.
Saturn	9.5 A.U.
Uranus	19.2 A.U.

Inner Planetary Topics

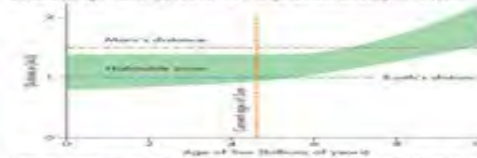
Work Bundle

Part 3 Inner Planetary Topics

Part 3 Inner Planetary Topics

- The range of distances from a star where water might pool on the surface of an orbiting planet.
- If a planet is too close to its parent star, it will be too hot and water would have _____.
- If a planet is too far from a star it is too cold and water would have _____.

When will the habitable zone change so that earth will become too hot, and Mars will become just a dry desert? Remember, our Sun will change as it moves through its life cycle.



Earth becomes uninhabitable when the sun reaches _____ billion of years old, and the star becomes habitable when the sun _____ billion of years old.
How far is the habitable zone from the sun in AU? _____ AU
How far away will the habitable zone be when the sun is 10 billion years old? _____ AU
Please record the AU's each planet is from the sun!

Sun
Mercury
Venus
Earth
Mars
Jupiter
Saturn
Uranus

1.0 A.U.



Celestial Object	Mean Distance from Sun (million km)	Period of Revolution (Earth days)	Period of Revolution (Earth years)	Distance from Sun (AU)	Distance from Sun (AU)	Distance from Sun (AU)
SUN	—	—	—	—	—	—
MERCURY	57.9	88 d	0.24	0.39	0.39	0.39
VENUS	108.2	224.7 d	0.61	0.72	0.72	0.72
EARTH	149.6	365.26 d	1.00	1.00	1.00	1.00
MARS	227.9	687 d	1.88	1.52	1.52	1.52
JUPITER	778.4	11.9 y	9.94	5.20	5.20	5.20
SATURN	1,426.7	29.5 y	9.94	9.54	9.54	9.54
URANUS	2,871.0	84.0 y	17.15	19.19	19.19	19.19
NEPTUNE	4,496.3	164.8 y	16.11	30.07	30.07	30.07
EARTH'S MOON	149.6	27.3 d	27.3 d	0.005	3.476	0.01

Part 3 Lesson 2 Mercury

Provide some information about the planets Mercury and Venus below.

Mercury

Distance: _____ (million kilometers) or _____ (AU)

Diameter: _____ (km) (1,000 miles)

Mass: _____

Density: _____ (g/cm³)

Gravitational Force: 1/3 of the Earth's mass of the Moon

Rotation: _____ (days, 55 hours)

Revolution: _____ (days)

Temperature: 100 K (____ °C) - 700 K (____ °C)

Orbit Eccentricity: 0.2

What other oddities, factsoids, and neat pieces of information can you provide about Mercury?

Planet Earth

Distance: _____ (million kilometers) or _____ (AU)

Diameter: _____ (km) (1,000 miles)

Mass: _____

Density: _____ (g/cm³)

Gravitational Force: 1/3 of the Earth's mass of the Moon

Rotation: _____ (days, 55 hours)

Revolution: _____ (days)

Temperature: 100 K (____ °C) - 700 K (____ °C)

Orbit Eccentricity: 0.2

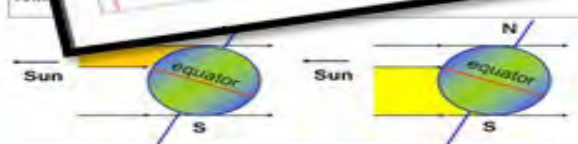
What other oddities, factsoids, and neat pieces of information can you provide about Earth?

17 Pages

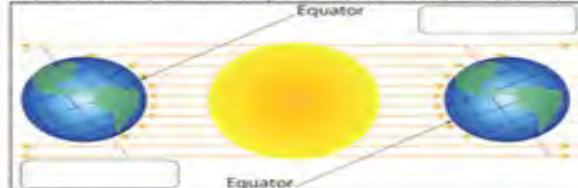
¹ See, for example, the discussion of the effects of the merger between Swissair and Lufthansa in the *Swissair/Lufthansa* decision.

[illegible]

Which
Answer



Which is the Northern and Southern Hemisphere? Which is winter? And which is Summer?



Five tit of five quart's each _____ degrees

- Summer = Northern Hemisphere is tilted into _____ direct light
- Winter = Northern Hemisphere is tilted _____ from the direct light

Part 3: Learning & Motivation / Education

Source: Either the _____ day of the year (winter solstice) or the _____ day of the year (summer solstice-June 20, winter solstice Dec 21st)

When is the summer and winter solstice, and the March/Vernal and Fall/Autumnal equinoxes below. The line represents the length of the day in New York City. There's two for each so cross off from the word bank below.

Equinox: Either of the two times each year (about March ____ and September ____) when the sun crosses the equator.

- (Day and night are everywhere on earth) : _____ in length.

Fig. 12. January 2004. (a) Daily precipitation (mm) and (b) daily streamflow (m³/s) at the outlet of the catchment.

The spinning inner cores of solids and liquid _____ create a giant electromagnetic field around our planet!

Earth's magnetic field, also known as the _____ field, is the magnetic field that extends from the Earth's interior out into space.

- It interacts with the _____, a stream of charged particles emanating from the Sun.

Electrodeposition: Best protects the earth from charged particles.

It also creates the _____ (Northern lights)

Spread iron filings all around the planet below or on a display plate and then you can show what you see here.

from below, the page place a magnet beneath the earth and record the magnetic field that is created with the hot things. — Note: Don't get iron things in your eye.

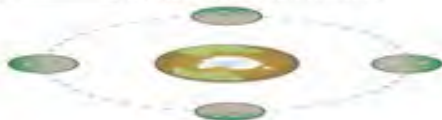


How far away is the moon? If you're measuring the center-to-center distance from the Earth to the Moon, the distance would be about [384,400 km](https://www.nasa.gov/300001main/earth-moon-distance).

Why did we only see one side of the moon? If takes the moon the same amount of time to rotate around _____ as it does for the moon to go around the _____ once.

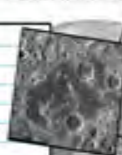
Therefore, earthbound observers can never see the far side of the moon.
It takes about _____ Earth days for the moon to go around the earth once.

IF-63 _____, OREGON. Describe below as shown in the slideshow.



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Maria



Introduction



Libra



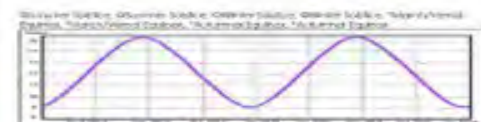
Highlands



Figure 4. Change in mean $\delta^{15}\text{N}$ of NH_4^+ and NO_3^- in the water column and in the sediments of the Tiber River (1990–1994).

Please fill the boxes. The label of the element is the name of the element that is _____, followed by the atomic number.

- The large phosporoglycolate shuntase gene is located directly at the chloroplast position, whereas the small gene is located on the nuclear genome.



Study's Strengths/Weaknesses, Objectives, and Weight Subtotal (Statistical Significance)



Applied about the diagram below. Most April (summer) Solstice, Equinox, Winter Solstice. Drawing for the Northern Hemisphere. May use a 2nd example to help the which hemisphere they summer and winter change - summer 2nd - winter for the winter and summer solstice



Inner Planetary Topics Quiz Game

• Name the inner planets below?

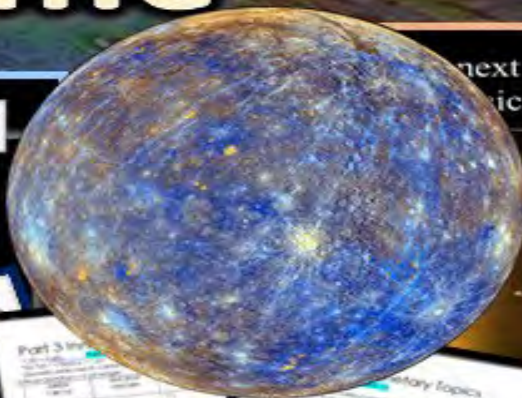


B  Mercury



Sun
Mercury
Venus
Earth

0.4 A.U.
0.7 A.U.
1.0 A.U.
1.5 A.U.
5.2 A.U.
9.5 A.U.



next slide answer with the planets name or
Astronomical Unit (AU) from the sun.



Which is incorrect of Mercury
Close to the sun with no moons

A) In the Sun the temperatures can reach 420 C.
B) In the shade, the temperatures can drop -173 C.
C) 88 day year (travels very fast)
D) 1407 hour day (Very Long Day)

• Venus is the hottest planet in the solar system because of the greenhouse effect.

5 Venus is incredibly hot 480°C because of its greenhouse gases.



Mass of star relative to Sun



- Which is, equinox, winter solstice, and summer solstice in the northern hemisphere?



**Winter
Solstice**

**Summer
Solstice**

Equinox

Which is winter in the Northern Hemisphere?

23.5°



**Summer
Southern
Hemisphere**

**Equator gets even
sunlight all year
round**

- Which is not true of the planet Earth

- A.) Only planet known to support life.
- B.) Complex system of land, water, and air.
- C.) **Largest of the inner planets.**
- D.) **Most dense planet in the solar system.**
- E.) Oceans (liquid water) can exist.
- F.) Atmosphere, 78% Nitrogen and 21% oxygen, shields from radiation and keeps the planet's temperature just right.

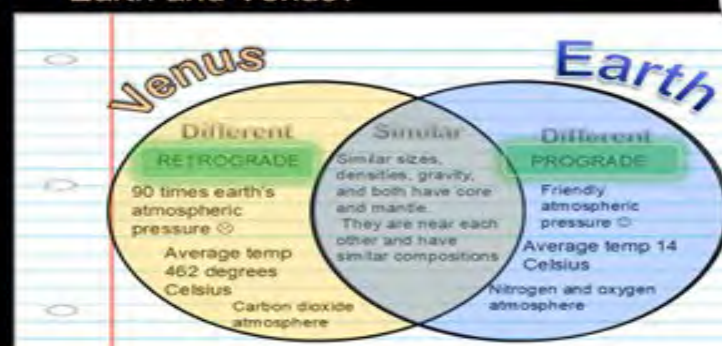
5.51 g/cm³

- Which of the following is not true of the planet Earth?

Giant Impact

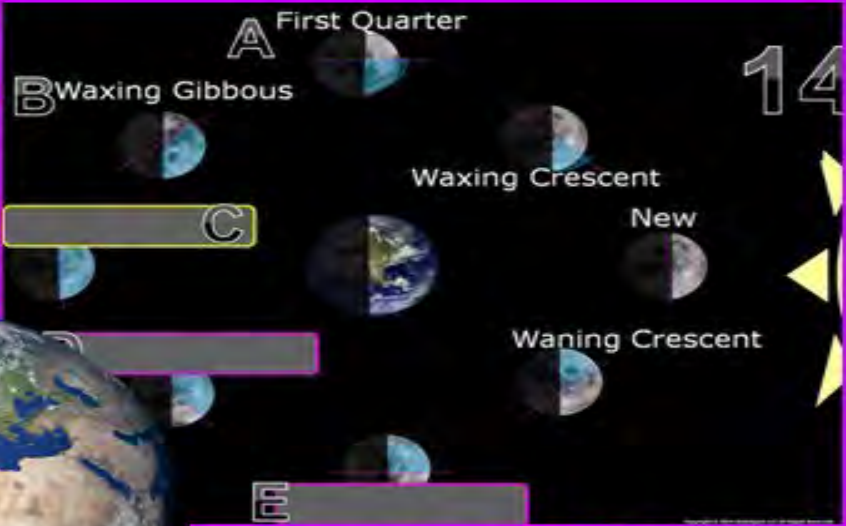


- Which two should be switched between Earth and Venus?

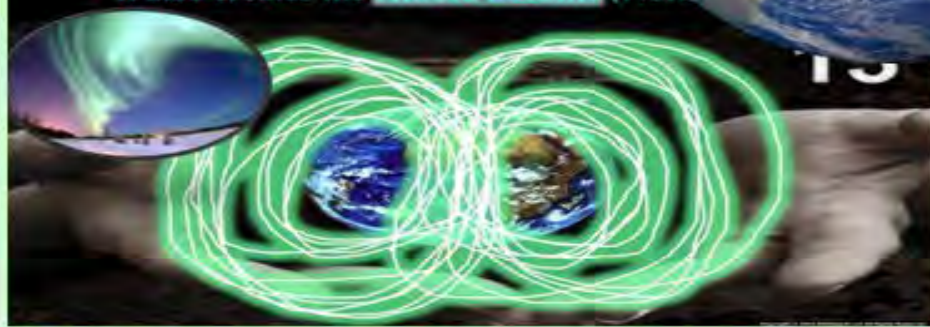


Name A and B?
Which one causes the larger tides?

15

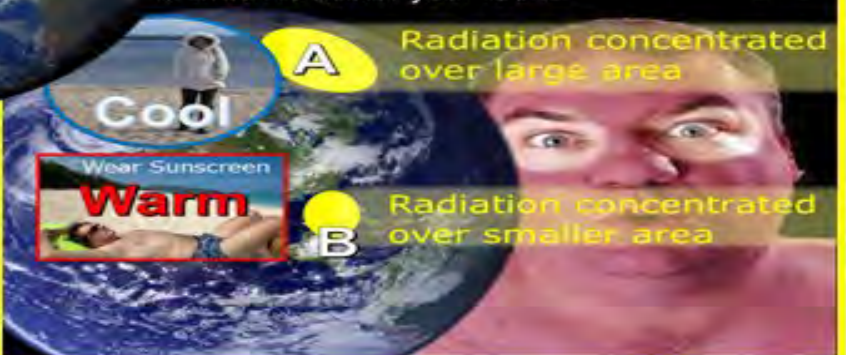


- Earth has a strong **electromagnetic field** that protects the earth from charged particles from the sun.
- It also creates the **Aurora borealis** (Northern Lights).

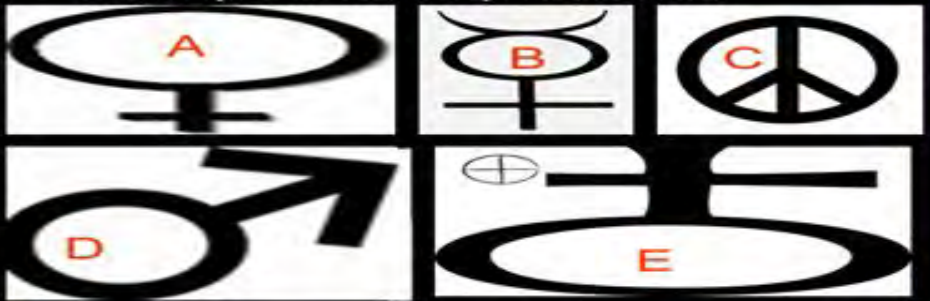


Which area of the planet has hot weather year round and which is cooler year round?

11



- Which symbol below represents Mars?



Name A, B, C, D?

12



- What are the names of these two moons on Mars?



- What is the name of this giant canyon on Mars that dwarfs the Grand Canyon?



- What's the name of these extinct volcanos on Mars.



- Identify the Lander and Rovers below?

Pathfinder

19



- The photograph below provides some evidence that this use to cover the Martian surface?



Astronomy Unit Part 4: Rocketry, Apollo Missions, Parts of the Saturn V Rocket, Apollo Modules, Parts of a Rocket, Water Bottle Rockets, Newton's Laws, Lift, Drag, Thrust, Weight, Law of Gravitation, Einstein and Gravity, Spacetime, Space Shuttle Program, International Space Station, Future in Space

Part 4: Astronomy Unit



Part 4 Lesson 1 Mission to the Moon



Part 4 Lesson 2 Water Rockets Gravity



Part 4 Lesson 3 Gravity Rocket Built Cont



Part 4 Lesson 4 Space Shuttle ISS



Part 4 Lesson 5 Newtons 1st Law



Part 4 Lesson 6 2nd Law of Motion



Part 4 Lesson 7 3rd Law of Motion



Part 4 Lesson 8 Rocketry Wrap Up



Part 4 Lesson 9 Review Game



Part 4 Lesson 10 Review Game Answers



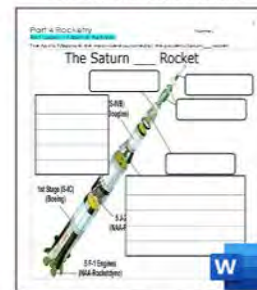
Part 4 Materials List



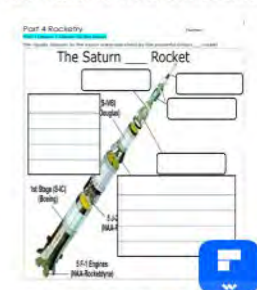
Part 4 Work Bundle Answers



Part 4 Work Bundle Digital



Part 4 Work Bundle Print

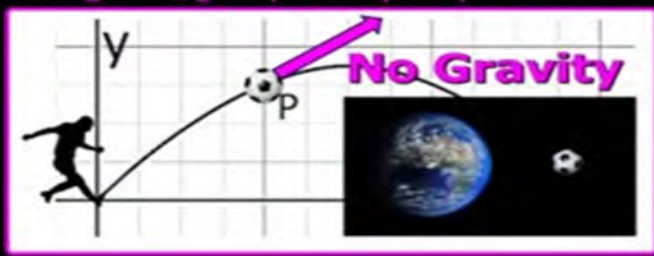


Part 4 Work Bundle Writable pdf

Rocketry Unit

Preview is a compressed file

- From class we know that rockets accelerate them downward from their otherwise straight-line, gravity-free trajectory.



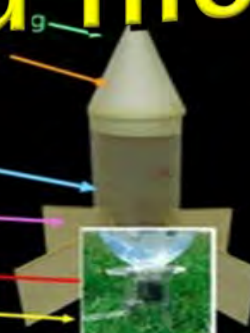
Lightweight Payload

Fuel / Propellant
1/3 filled with
water and add
detergent?

Sturdy Fins

Nozzle

Air Pump to add
pressure



Anatomy of the Saturn Rocket



Anatomy of the Saturn Rocket



Led by the United States...

- The ISS draws upon the scientific and technological resources of 16 nations: Canada, Japan, Russia, 11 nations of the European Space Agency and Brazil.



- Gravity:** The force of attraction between all masses in the universe.

Gravity⁶



Part 1 Video Saturn V Rocket

<https://www.youtube.com/watch?v=8dpkmUJl8xU>



Interactive Slideshows

What is the equation for gravity?

$F = G \frac{m_1 m_2}{d^2}$

Newton's Law of Gravitation
For two masses displaced a distance apart, the gravitational force of attraction of one mass on the other is directly proportional to the product of the two masses and inversely proportional to the square of the distance between them.

- Take a virtual tour of the ISS at...
– <https://esamultimedia.esa.int/multimedia/virtual-tour-iss/>



- Lift and Drag – Two aerodynamic forces

- What is gravity reading link?
– <https://spaceplace.nasa.gov/what-is-gravity/en/>

Note: A quiz will follow. Take some notes on your work bundle

Command Module
Lunar Module (LM)

Michael Collins

Buzz Aldrin

2nd

- NASA recommends 50 PSI with a maximum of 90 PSI
– PSI and other safety information can be found...
– <https://www.qrc.nasa.gov/www/k-12/rocket/BottleRocket/safety.htm>



Nosecone to limit drag
Lightweight Payload
Fuel / Propellant

We will be using water rockets and air pressure. PSI = pounds per square inch

A measure of pressure
physical force exerted on or against an object
something in contact with it

Pounds per square inch (PSI) is the pressure that results when a 2-pound force is applied to a unit area of 1 square inch

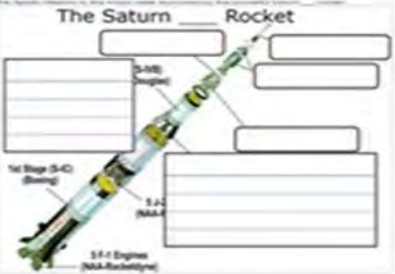
NASA recommends 50 PSI for water rockets

Metric Version: A pascal is a pressure of one newton per square meter, or, in SI base units, one kilogram per meter per second squared. 50 PSI= 344.7 kilopascal kPa

Follow Along Work Bundle

Part 1 Rocketry

The Saturn Rocket



Part 2 Rocketry



Part 3 Rocketry



Part 4 Rocketry



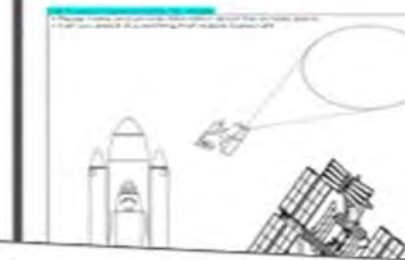
Part 5 Rocketry



Part 6 Rocketry



Part 7 Rocketry



Part 8 Rocketry



Part 9 Rocketry



Part 10 Rocketry



Part 11 Rocketry



Part 12 Rocketry



Part 13 Rocketry



Part 14 Rocketry



20 Pages

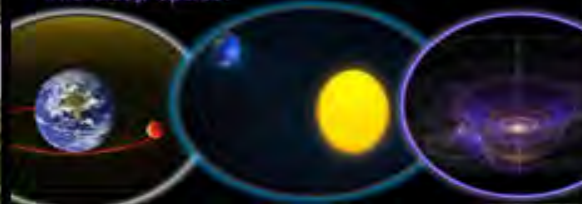
Activities, Notes, Assessments, Keys, And much more all built-in

- Activity! Listening to an historic event that captivated the world. (7:50 minutes in)
 - "The Eagle has landed."
 - <http://www.youtube.com/watch?v=5Q53J5RGk3o>

Short on time, start at 6 minutes in...



- Gravity of the earth keeps the moon from going into deep space... **gravity of the sun keeps the earth in orbit...** and gravity of our galaxy keeps the solar system from heading into deep space.



The Apollo spacecraft had three parts.

A Command Module with a cabin for the three astronauts.
Only part that landed back on Earth.

Service Module which supported the Command Module with propulsion, electrical power, oxygen and water. Just tanks etc. Astronauts didn't enter.

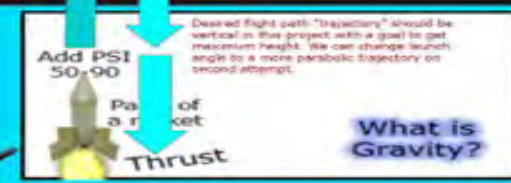


The Lunar Module (LM) Eagle separated from the command module

- Anything that has **mass** also has gravity. Objects with more mass have **4** gravity. Gravity also gets weaker with **5**. So, the closer objects are to each other, the stronger their gravitational pull is



- Trajectory is the path that a projectile makes through space under the action of given forces such as thrust, wind, and gravity.



Lunar Module descent Stage: It had a rocket and legs for landing on the moon. It stayed behind while the Ascent Stage blasted off.

Lunar Module Ascent Stage: This was where the astronauts lived. It contained a propellant tank, a main engine, and a Command Module.

Service Module: This was a mother ship, where the astronauts and the Apollo Lunar Module lived. It brought the astronauts back to Earth. It contained a main engine, a main engine, and a main engine.

- Law of Gravity $F = G M m / r^2$
 - Gravity is an attractive force between two bodies, which depends only on the mass of the two bodies (M and m) and inversely on the square of the separation between the two bodies.



1

Gravity is an attractive force between two bodies, which depends only on the mass of the two bodies (M and m) and inversely on the square of the distance between the two bodies.

(If you double the mass of the earth, its gravitational force will become twice as big. If you get 3 times further away from the earth, its gravitational force will be 3 times weaker.)

[illegible]

The term "**hushabye**" has been used in parts of Europe to refer to the music itself, "hushabye music" and in some places they are also referred to as "hushabye waltzes" (perhaps implying dancing as the term refers to a **serenade** in other places).

The authors gratefully acknowledge the technical assistance of the staff of the National Center for Human Genome Research, National Institutes of Health, Bethesda, Maryland, for the preparation of the manuscript.

energy of a compressed and gas-like form of water when you compared with the water to which the water molecules are usually

being a little overconfident, and to one of the suggested methods that might help with this is using a decision support system.

The model on the right side of the table is highly specific, with the hypothesis that the change in atmospheric pressure, the

right. Identifying the right data. The right data is a considerable challenge for all in position to generate or manage

For volume of water, the initial gas
For water, the resulting gas before
Each water is equal, then it is

[illegible]

Typically, launch products stay flat for longer than the second offering.

As the program is used in the future, the National Transportation Institute will continue to monitor the program and will report on the results of the program.

Student is typing words into own machine

The copious output which listing the number of dogs euthanized, and justified the number of more children, assuredly shocked.

However, after stabilizing the cause, the vessel to be removed, they will also make it go off at a significantly higher velocity than would be achieved by the ground, possibly damaging the vessel or adjacent structures upon landing. The methodology of the release is a procedure or other recovery system will have one which regulates the pressure to lift the structure when designing rockets. Rubber bumpers, bumper zones, and other launch structures can be utilized to minimize damage or injury caused by a falling rocket.

In the type of custom-made rollers, where the roller heads is not perfectly positioned, its fast rotation can cause the roller to wear off the vertical axis. The roller again needs to spin by straightening the line, which reduces off-axis wear.

Another simple and effective solution is a straight cut-off section from another pipe. To do this, it is placed behind the rocket nozzle with some tension down, or plastic tubing. The water exiting the nozzle will not be able to pass through the section, but the water will be contained.

[illegible]

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Water contains varying considerable amounts of energy and can be dangerous if inhaled. Inadvertently in 8 cases of faulty work at fish or mollusc culture. Certain safety procedures is followed by aquaculture workers must be followed.

- [illegible]

1



Identify the force or forces between (a) _____ in the diagram. This force pulls or pushes, the _____ the force of attraction.

Identify the force by which a person or other body (object) is held in _____ the force of gravity acts on the person or object around the sun.

Anything that isn't the grass (doesn't walk more than grass grass)

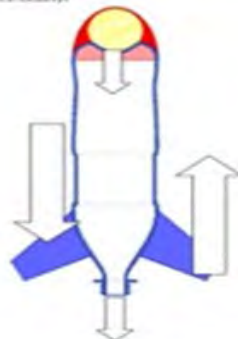
As a reader, you should be _____ the most evidence through the text.
 (This reader should follow a rubric.)

During powered flight the properties of the propulsion system are constantly being

Right depends on these forces – the _____ force should be greater than the _____ force
but that is the obvious truth

_____ The path that a projectile makes through space under the action of forces, such as gravity, wind, and so forth.

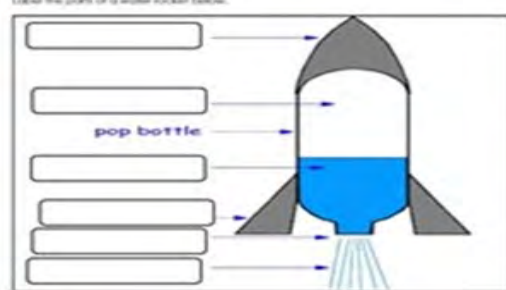
© 2004 Blackwell Publishing Ltd, *Journal of Internal Medicine* 255: 103–110



- As water rocks are capable of breaking down upon impact, they should never be used to pry, pry, pry, or pry.
- Tobacco goggles or a face shield are typically used.
- A typical two-liter soda bottle can generally reach the pressure of 100 psi (690 kPa) safely, but pressurizations must be made for the eventuality that the bottle unexpectedly ruptures.
- Gum used to put together parts of water rocks must be suitable to use in ponds, in the water, or in the "hot" water of the boiler, which will then be put into circulation, and can then be found in the water, in the water, in the water.

Using model rockets is a relatively safe and inexpensive way for students to learn the basics of forces and the response of a vehicle to external forces. A model rocket is subjected to two main forces: thrust and drag, or the upward force and the opposing force, or two very different types of motion. One of the best and simplest types of rocket that is student appropriate is the probe, or water rocket. The water rocket system consists of two main parts, the launcher and the rocket.

1. *Journal of Management Studies*, 1996, 33, 1, 1-15.



ROCKETRY

Quiz Game

This is the general name for the rockets used during the Apollo Missions?



Saturn Rockets

1

- We will be using water rockets and air pressure. **PSI** = pounds per square inch

4

A measure of pressure
A physical force exerted on or against an object by something in contact with it



PSI

The pascal (symbol Pa) is the SI derived unit of pressure used to quantify internal pressure

NASA recommends

- Which parts landed on the Moon?

2



Lunar Module

- Which is not true of the Apollo Missions?

3

- A.) They ran from 1961 to 2009
- B.) Six manned landings on the Moon were achieved.
- C.) The Apollo 13 Flight never made it to the moon but landed safely back on Earth.
- D.) Apollo 17 was the last flight to the moon.
- E.) Apollo also spurred advances such as telecommunications and computers.

- Gravity:** The force of attraction between all masses in the universe.

Gravity

6



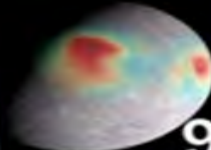
- If you double the mass of the earth, its gravitational force will become **twice** as big; if you get 3 times further away from the earth, its gravitational force will be **3 times weaker**.

Twice
Three



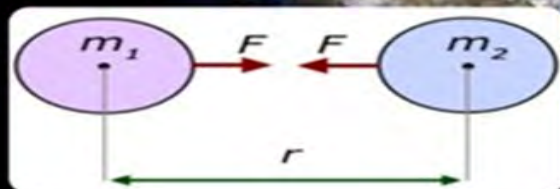
- Anything that has **mass** also has gravity. Objects with more mass have **more** gravity. Gravity also gets weaker with **distance**. So, the closer objects are to each other, the stronger their gravitational pull is

Mass
More Gravity
Distance



9

Gravity is...
Two objects
interacting with
each other



8

- This is the path that a projectile makes through space under the action of given forces such as thrust, wind, and gravity.

Trajectory



The more mass the objects have, the the force of attraction

7



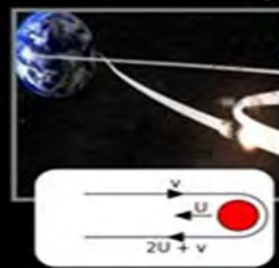
• What was the name of this spacecraft that can launch into orbit and return to Earth and be reused

14



SPACE SHUTTLE

- In rocketry we can use gravity to speed up an object and change directions.
- This is called a...
- A.) Gravity Assist
B.) Warp Speed
C.) Lunar Test
D.) Aldrin Maneuver
E.) Max Boost
- 11



- This feature on the top of your rocket allows it to be more aerodynamic / offering the least resistance through the air.
- 13



Nose Cone

- Led by the United States, this draws upon the scientific and technological resources of 16 nations: Canada, Japan, Russia, 11 nations of the European Space Agency and Brazil.

The International Space Station (ISS)

15



- During powered flight, the propellants of the propulsion system are constantly being exhausted from the nozzle. This creates **Thrust**!



- There is generally no friction in space. A space vehicle will travel in the same direction at the same speed until acted upon by a force. This is an example of...

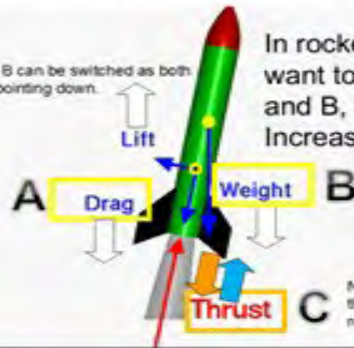
- A.) Newton's First Law of Motion
- B.) The Speed of Light
- C.) Quantum Force Theory
- D.) An impossible calculation
- E.) Warp Speed



Name A, B, and C?

17

Note: A and B can be switched as both arrows are pointing down.



In rocketry, you want to limit...A and B, and Increase C.

Note: Downward thrust causes the rocket to lift.

Gravity is the force by which a planet or other body draws objects **toward** its center. The force of gravity keeps all the planets in orbit around the sun. Anything that has **mass** also has gravity. Objects with **more** mass have more gravity. Gravity also gets **weaker** with **distance**.



- Name the parts of a simple rocket? (1 pt each)

18



- Newton's Second Law $F=ma$ stands for...

- A.) Force = Momentum times altitude
- B.) Force = Measurement of Mass
- C.) Flight = Multiple times Angle
- D.) Force = Mass times Acceleration
- E.) This is not one of Newton's Laws

19



- Please finish Newton's 3rd Law

– For every action there is an equal and opposite reaction.



Part 5: Main Asteroid Belt, protoplanet Ceres, Vesta, Meteors, Meteorites, Asteroids, Bolides, Chicxulub Crater, Tunguska Event, Chelyabinsk meteor, Craters, Parts of a Crater, Crater Impact Activity, NEO's, Torino Scale,

Part 5: Astronomy Unit



Part 5 Lesson 1 Main Asteroid Belt



Part 5 Lesson 2 Tunguska Event



Part 5 Lesson 3 NEO's



Part 5 Lesson 4 Impact Lab



Part 5 Lesson 5 Research and Wrap Up



Part 5 Lesson 6 Review Game



Part 5 Lesson 7 Review Game Answers



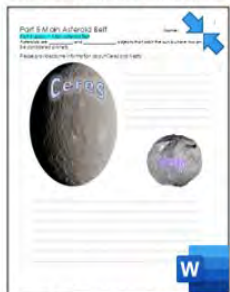
Part 5 Materials List



Part 5 Work Bundle Answers



Part 5 Work Bundle Digital



Part 5 Work Bundle Print



Part 5 Work Bundle Writable pdf

Asteroids, Craters, NEO's

Preview is a compressed file



- Asteroids are rocky and metallic objects that orbit the sun but are too small to be considered planets.



- Which is Ceres and which is Vesta?

A
Vesta

Cere

- Lake Manicouagan, Canada
— 212 million years old.



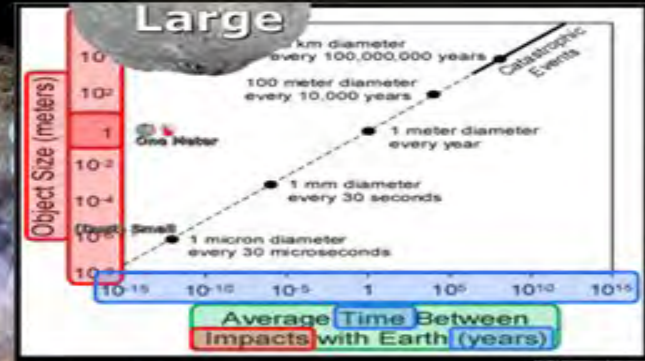
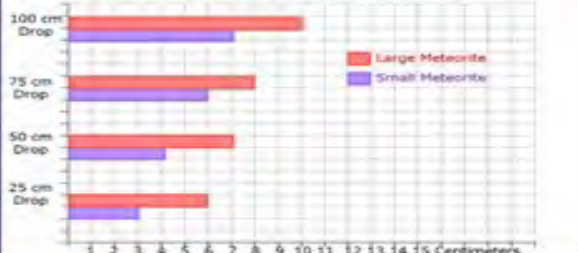
- Vesta Protoplanet

Protoplanet: A large body of matter in orbit around the sun or a star and thought to be developing into a planet.

Planetary Embryo

- Example Diameter of Crater

Please graph the Diameter of the Crater for the large and small meteor below.



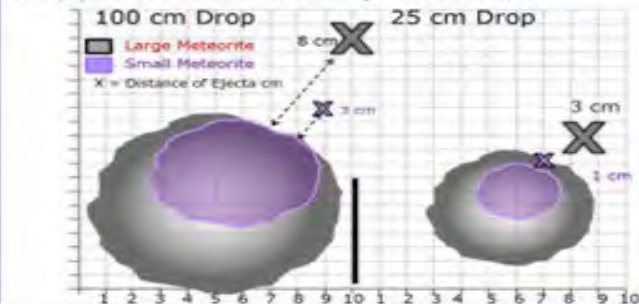
- Meteorite: Space matter that has fallen to the earth's surface from outer space.



Interactive Slideshows

• Another Graph Possibility (Diameter)

Please graph the Diameter of the Crater for the large and small meteor below



- Craters can be found on earth, but most craters are eroded away by wind and water.
- Small meteors also burn up in our atmosphere.



- There are three main types of meteorites.

– Iron, Stone, and Stony-Iron

Stony-Irons: They are composed of roughly equal amounts of nickel-iron and stone. They are thought to have formed at the core/mantle boundary of their parent bodies.

Stony: They are composed of the same materials as stony-iron meteorites, but with a higher proportion of stone.

Stone: Once formed part of the outer crust of a planet or asteroid. Contain small, colorful, grain-like inclusions known as "chondrules." These tiny grains originated in the solar nebula, and therefore pre-date the formation of our planet and the rest of the solar system.

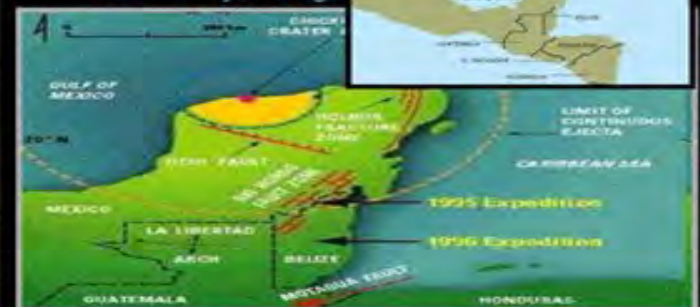


• NEO's: Near Earth Objects

- (Comets and asteroids that come very close to Earth.)

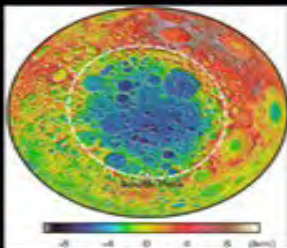


• Chicxulub Crater – 65 million years ago



- The largest known impact basin in the solar system is the...

– South Pole-Aitken Basin on far-side of the moon, 3.9 billion years ago. During Late Bombardment



Asteroid 2004 MN4 will come close to Earth on April 13, 2029, but it will not hit.

– (It's a Friday the 13th ... Ohhh)



Small (dust size to coin) piece of ... hits the earth's atmosphere and



Follow Along Work Bundle

Part 1: Main Asteroid Belt

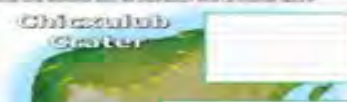
Where do most asteroids live? In the main asteroid belt between Mars and Jupiter.



Ceres
Vesta

Chicxulub Crater

Where did the dinosaurs go?



Chicxulub Crater

Chicxulub Crater

Where did the dinosaurs go?



Chicxulub Crater

Chicxulub Crater

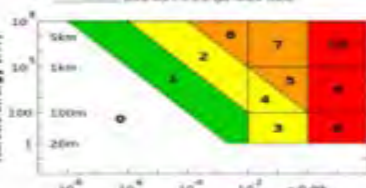
Where did the dinosaurs go?



Chicxulub Crater

Chicxulub Crater

Where did the dinosaurs go?

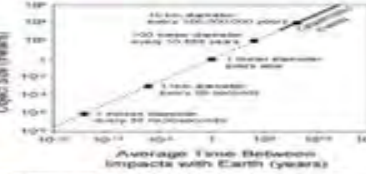


Kinetic Energy (MJ)

Probability of Impact

Chicxulub Crater

Where did the dinosaurs go?



Average Time Between Impacts with Earth (Years)

Average Size of Impactor (meters)

Chicxulub Crater

Where did the dinosaurs go?



Chicxulub Crater

Chicxulub Crater

Where did the dinosaurs go?



Chicxulub Crater

Chicxulub Crater

Where did the dinosaurs go?



Probability of Impact

Chicxulub Crater

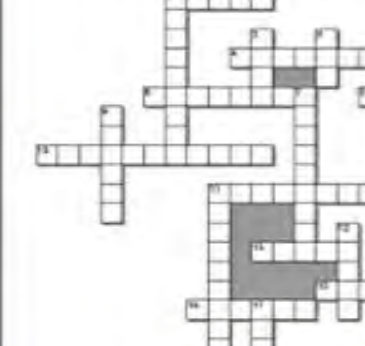
Where did the dinosaurs go?



Chicxulub Crater

Chicxulub Crater

Where did the dinosaurs go?



Chicxulub Crater

Chicxulub Crater

Where did the dinosaurs go?



Chicxulub Crater

Activities, Notes, Assessments, Keys and more all built-in

• The Torino Scale

- A scale for categorizing the impact hazard associated with Near-Earth Objects (NEOs).
- Combining probability statistics and known damage potentials into a single threat value.



- Why do large meteorites often have more damage potential than smaller ones?
 - A.) Large meteorites travel faster.
 - B.) Large meteorites have more mass.
 - C.) Large meteorites are made of iron.
 - D.) Large meteorites explode in the air.
 - E.) Large meteorites spin as they travel.

$$F=ma$$

19



• Tunguska event (1908).

- A (comet or meteorite) exploded just above the surface of the earth causing a massive explosion.



• Name this famous crater in Arizona?

- It was from an impactor about 50,000 years ago.



• Chelyabinsk Asteroid. February 15th, 2013

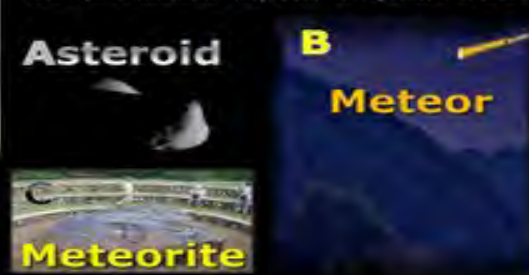
- Injured 1,200 people in Chelyabinsk, Russia.
- Created a supersonic shockwave that collapsed roofs and blew out windows.
- Parts of the asteroid exploded 42 miles above the ground.

The "Asteroid" is really A bolide.
Bolide: A large meteor that explodes in the atmosphere.

- A layer of Iridium can be found across the globe in rock layers around 65 million years ago, K-T (Pg) Mass Extinction Event.
- Iridium is found on Meteorites.



- Which is an asteroid, meteorite, and meteor?



• Tunguska event (1908).

- A (comet or meteorite) exploded just above the surface of the earth causing a massive explosion.



Asteroids, Meteors, Meteorites, NEO's

Work Bundle

Part 5 Main Asteroid Belt

Asteroids are _____ objects that orbit the sun but are too small to be considered planets.

Please provide some information about Ceres and Vesta.



Meteoroid Space

Imagine you are a meteoroid. What would you see? Name of Crater: _____ Location on Earth: _____ When did the impactor hit? How big was the impactor? Energy of the impactor: _____ Other info: _____

When did the impactor hit? How big was the impactor? Energy of the impactor: _____ Other info: _____

Please provide some information about the crater below. What's so important about it?

Chicxulub Crater



Which one is an iron, stony, and stony-iron meteorite? _____
 Which is a meteor, meteorite, and asteroid? _____

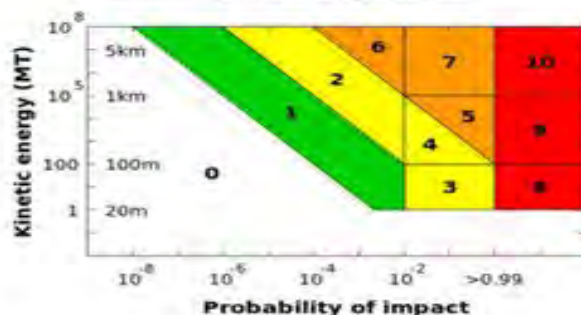


Part 3: Lesson 180A

NEO's: N (Comets and asteroids that come very close to Earth.)

The Torino Scale

- A scale for categorizing the impact associated with Near Earth Objects (NEOs).
- Combining threat and known potential into a single threat value.



What is the threat value of a 5 meter sized object with 10% probability of impact?
 What is the threat value of a 1 kilometer sized object with 50% probability of impact?
 What is the threat value for a 5 km sized NEO that has 9.99 probability of impact?
 What is the threat value for a 100 m sized NEO that has 10^-4 probability of impact?

Visit the reading of Asteroid 2011 AG5

<https://www.nasa.gov/feature/big-asteroid-2011-ag5-threat-earth.html>

When could it hit?

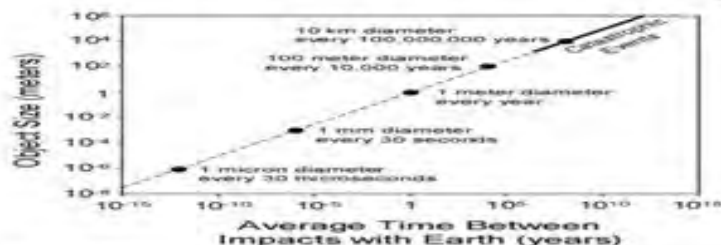
Is the earth in danger if it hits us? Consider its mass and composition. Are there known values?

What are the odds of impact? Are you worried?

Part 3: Lesson 180B

Meteor Impact Activity

Please label the Impact Crater below as described in the slideshow.



- How often do smaller meteoroids and millimeter (mm) sized earth's atmosphere?
- How often do smaller meteoroids 1 micron in diameter enter earth's atmosphere?
- How large does the object need to be to cause a catastrophic event?
- The Tunguska impactor may have been 100 meters. How often does an impact of this magnitude occur?
- The Chicobut impactor may have been 10 km in diameter. How often do impacts of this size occur? What happened 65 million years ago?

Are large or small impacts more common? Explain below using data:

Small Meteorite

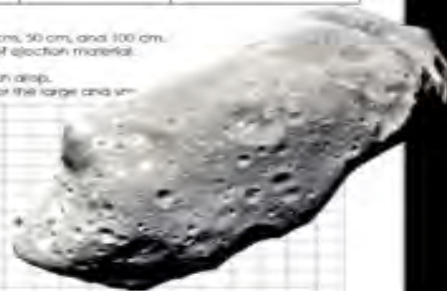
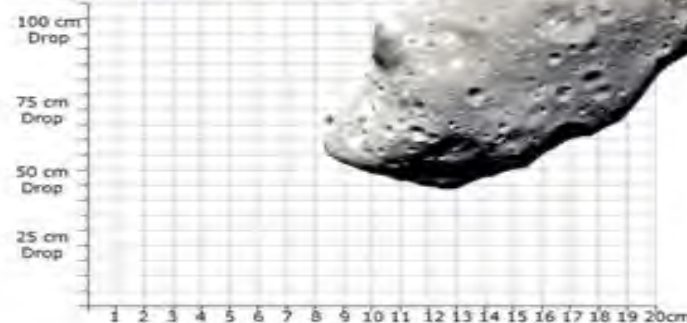
Height (Centimeters)	Mass of Meteor	Diameter of Crater	Distance of Ejecta (cm)
25cm			
50cm			
75cm			
100cm / 1m			

Large Meteorite

Height (Centimeters)	Mass of Meteor	Diameter of Crater	Distance of Ejecta (cm)
25cm			
50cm			
75cm			
100cm / 1m			

Procedure:

Drop meteorite from a height of 5 cm, 25 cm, 50 cm, and 100 cm. Collect diameter of crater and distance of ejecta material. Record data on spreadsheet. Break out and clean surface before each drop. Please graph the Diameter of the Crater for the large and small



Part 5 Main Asteroid Belt

Activity 1: Asteroid Belt

Answer the **QUESTIONS** that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

Answer **QUESTIONS** that appear after each activity and the **QUESTIONS** that appear at the end of the activity.



Ceres is the largest object in the asteroid belt. It is about the size of the planet Pluto. It is a rocky body with a thin layer of ice on its surface. It is the only object in the asteroid belt that is round enough to be considered a planet.

Vesta is the second largest object in the asteroid belt. It is about the size of the planet Pluto. It is a rocky body with a thin layer of ice on its surface. It is the only object in the asteroid belt that is round enough to be considered a planet.



QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

Activity 2: Tunguska Event

Answer the **QUESTIONS** that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

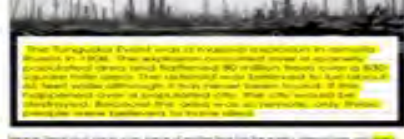


QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

Activity 3: Dwarf Planet Ceres

Answer the **QUESTIONS** that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

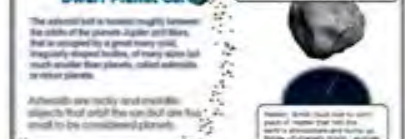


QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

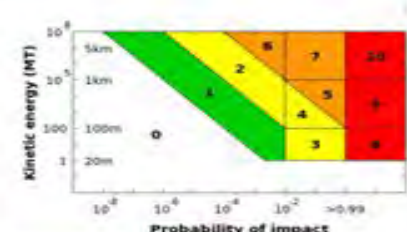
Activity 4: Dwarf Planet Ceres

Answer the **QUESTIONS** that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

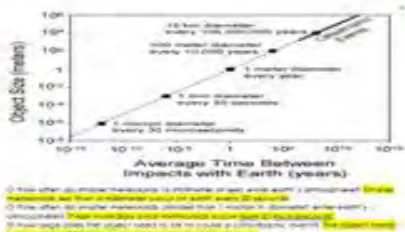


QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

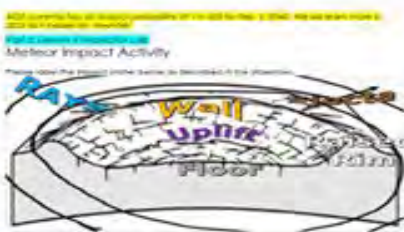
QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.



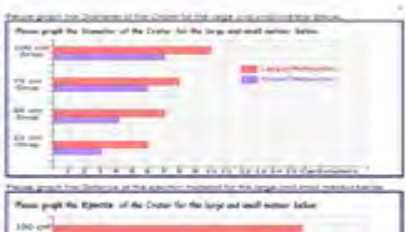
QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.



QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.



QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.



QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

Activity 5: Asteroid Belt

Answer the **QUESTIONS** that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

Activity 6: Asteroid Belt

Answer the **QUESTIONS** that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

Activity 7: Asteroid Belt

Answer the **QUESTIONS** that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

Activity 8: Asteroid Belt

Answer the **QUESTIONS** that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

QUESTIONS that appear after each activity and the **QUESTIONS** that appear at the end of the activity.

Asteroids, Meteors, Meteorites, NEO's

Quiz Game

- This is the name for rocky and metallic objects that orbit the sun but are too small to be considered planets.



1

- This is the name for space matter that has fallen to the earth's surface from outer space.



5

meteorite

Cores

3

Freshwater Ice and
maybe liquid mantle

- This is the second largest object by both mass and volume in the asteroid belt with a minor-planet designation:
 - It constitutes an estimated 9% of the mass of the asteroid belt and also has the largest mtn in the solar system.



4

- The Main Asteroid Belt lies between these two planets?



2

Jupiter

Mars

- Name this famous crater in Arizona?
— It was from an impactor about 50,000 years ago.

Meteor Crater or Barringer Crater

6



- A layer of Iridium can be found across the globe in rock layers when the dinosaurs went extinct. When did this impactor hit the earth? Iridium is found on Meteorites.



- Name this crater whose impactor may have contributed the extinction of the dinosaurs?

7

Chicxulub Crater



- This is an extremely bright meteor, especially one that explodes in the atmosphere.

9



- This event occurred in (1908) over remote Siberia where a comet or meteorite exploded just above the surface of the earth causing a massive explosion.

10



THE TUNGUSKA EVENT

- This is a piece of matter that hits the earth's atmosphere and (burns up).



- This meteor exploded in the air above Russia February 15th, 2013

- Injured 1,200 people
- Created a supersonic shockwave that collapsed roofs and blew out windows.
- Parts of the asteroid exploded 42 miles above the ground. Some parts landed in a lake.
- Weighed 10 tons and was traveling at 45,000 mph



Chelyabinsk Meteor



- NEO's stand for O O O
- (These are comets and asteroids that come very close to Earth.)

NEO's



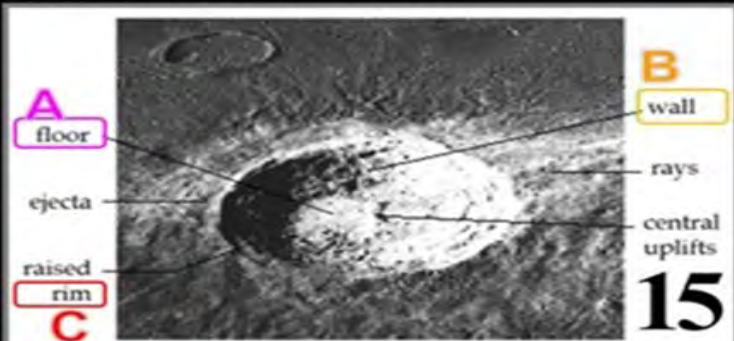
13

- This is a scale for categorizing the impact hazard associated with (NEOs).

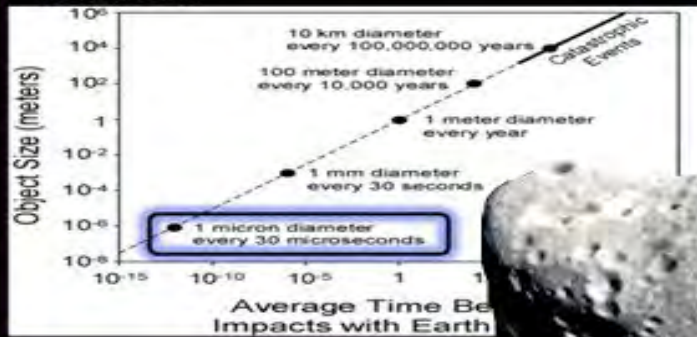
- Combining probability statistics and known damage potentials into a single threat value.



- Please name the terms below?



- What size meteorites enter our atmosphere most often?



- There are three main types of meteorites. 20

– Which is **iron**, **Stone**, and **Stony-Iron**

Stony-Irons: They are comprised of roughly equal amounts of nickel-iron and stone. They are thought to have formed at the core/mantle boundary of their parent bodies.

Iron: 90 to 99% composed of the element iron with the remainder composed of nickel and trace elements.

Stone: Once formed part of the outer crust of a planet or asteroid. Contain small, colorful, grain-like inclusions known as "chondrules." These tiny grains originated in the solar nebula, and therefore pre-date our planet and the rest of



Large meteorites often have more potential than smaller ones?

Large meteorites travel faster.

Large meteorites have more mass.

Large meteorites are made of iron.

Large meteorites explode in the air.

Large meteorites spin as they travel.

19

$$F=ma$$

- What is the threat value on the Torino Scale?

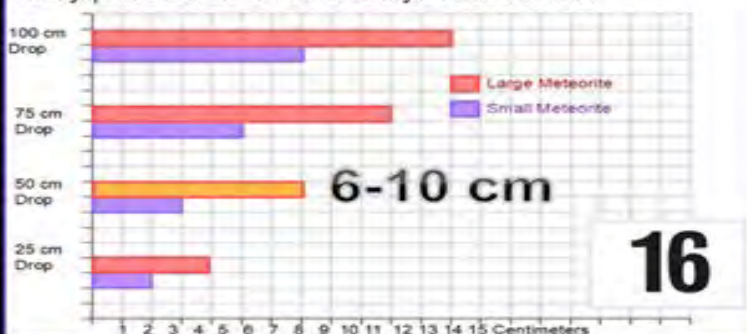
– A 5 km size object with a very high probability of impact. **Threat Level 10**



17

- Predict the diameter of the missing crater

Please graph the Diameter of the Crater for the large and small meteor below.



16

- Craters can be found on earth, but most craters are eroded away by wind and water.
- Small meteors also burn up in our atmosphere.



Part 6 of Astronomy Unit: The Outer Planets, Gas Giants, Ice Giants, Density of Outer Planets, Jupiter, Red Spot, Composition of Outer Planets, Jovian Moons, Saturn and its Moons, Uranus and its Moons, Neptune and its Moons, The Kuiper Belt, Demotion of Pluto, Oort Cloud, Comets

Part 6 Astronomy Unit



Part 6 Lesson 1 Gas Giants



Part 6 Lesson 2 Jupiter



Part 6 Lesson 3 Jovian Moons



Part 6 Lesson 4 Saturn



Part 6 Lesson 5 Ice Giants



Part 6 Lesson 6 Outer Solar System



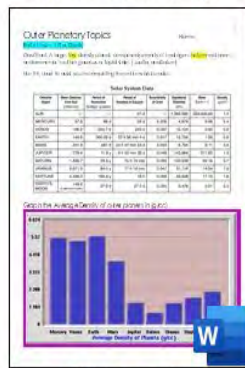
Part 6 Lesson 7 Review Game



Part 6 Lesson 8 Review Game Answers



Part 6 Lesson 9 Space Expo Project



Part 6 Work Bundle Answers



Part 6 Work Bundle Digital



Part 6 Work Bundle Print

Interactive Slideshows

- Saturn's core is...

- A.) Very cold
- B.) Extremely Hot

10

- Saturn's interior, reaching 11,700 °C radiates 2.5 times more energy into space than it receives from the Sun.



Bar graph of the distance of each planet from the Sun in Astronomical Units.



- Name this region of space beyond the Solar System that theoretically contains about one trillion inactive comets.

20 Oort Cloud



- Video (Optional) Saturn Crash Course.

- <https://www.youtube.com/watch?v=E8GNde5nCSg>



- Triton

- Coldest place in solar system -391 degrees F
- Rotates opposite of planet, only place in SS

Called retrograde



Saturn is about 95 times more massive than planet Earth. It weighs 95.15 times more than Earth. 6.4 pounds more?

Be aware, Mass is not the same as size. The density of Earth is 5.52 g/cm³, while the density of Saturn is 0.687 g/cm³.



Learn more + differences between mass and weight at... <http://www.exploratorium.edu/ronh/weight/>

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- Which is Dione
- A= Rhea



- Neptune
- Outermost planet.
- Orbits sun 165 Earth Years



Shares orbit with 3 Trojan Asteroids. A trojan is a small celestial body that shares the orbit of a larger one, remaining in a stable orbit.



17 Pages

[illegible]

Activities, Notes, Keys, Games Assessments, and more all built-in

• Uranus

The Other Planets



– Tipped on side (Early Comet Strike?).

Rings



Uranus is rolling around in its orbit.

See simulator at:
http://soft.it.edu/classes/phys301/lectures/gas_planets/Seasons_Nav.swf

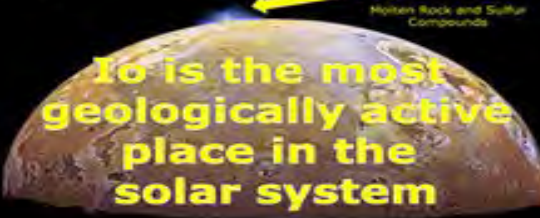
- **Ice Giants:** A giant planet composed mostly of astronomical ices including water, methane, oxygen, carbon, nitrogen, and sulfur, and smaller than a gas giant.

• (Uranus and Neptune)

• Io –

Supervolcano
Molten Rock and Sulfur Compounds

Io is the most geologically active place in the solar system



Copyright © 2004 Holt Rinehart & Winston

• Uranus

- 3rd Largest Planet
- Takes 84 Earth years to orbit sun.
- Methane absorbs red and reflects blue.



Copyright © 2004 Holt Rinehart & Winston

• Jupiter's Red Spot

- 2 Earth's would fit inside
- Storm has been raging for 400 years.
- It's a storm that becomes larger by consuming other storms.



Studies have shown it's getting smaller every year.

Copyright © 2004 Holt Rinehart & Winston

- If the planet wasn't cool enough, it may also rain diamonds which then float in a dense liquid layer forming "diamondbergs" made of uncut diamonds.



Learn more about how these planets may be able to rain diamonds at:
<http://www.sciencemag.com/impact/news/03/raining-diamonds-made-neptune-and-uranus-16096459/>

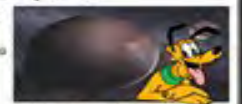
• Questions for Article (On Next Slide)

- Who made this decision?
- What disqualifies Pluto and qualifies a planet?

Pluto loses status as a planet

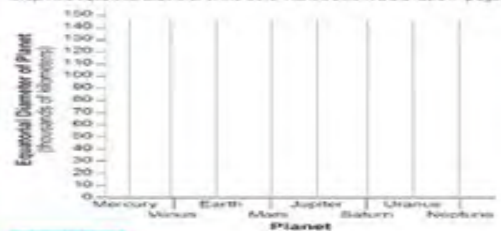
Astronomers have voted to strip Pluto of its status as a planet. About 2,500 scientists meeting in Prague have adopted historic new guidelines that see the small, distant world demoted to a secondary category.

The researchers said Pluto failed to dominate its orbit around the Sun in the same way as the other planets.



Pluto was discovered in 1930 by US astronomer Clyde Tombaugh. [See more details.](#)

A collage of celestial bodies including Saturn, Jupiter, Earth, and various moons and asteroids, set against a background of lined paper.



Some facts about Jupiter:

- Twice as massive as all other planets combined.
- Fourth largest object in sky.
- Gas Giant (Giant's _____ on your gas-driven)
- May have a small rocky _____
- Mostly Hydrogen and a bit of Helium.
- High Velocity _____ cause bandings
- Ring Sport (Giant's _____)
- _____ + P Moons or Satellites (2021)

Which of the choices below is a bogus fact about Jupiter? Jupiter answers to: A.) Twice as massive as all other planets combined. B.) Fourth brightest object in sky. C.) Gas Giant (Gerts, denser as you go down) D.) Milky Way (Gerts, denser as you go down) E.) Mostly Nitrogen and D. of Oxygen. F.) High Velocity Winds, Loose Bandings G.) Red Giant (Gerts, Denser) H.) 99% Helium or Sulfurites	Which of the choices below is a bogus fact about Jupiter? A.) Twice as massive as all other planets combined. B.) Fourth brightest object in sky. C.) Gas Giant (Gerts, denser as you go down) D.) Milky Way (Gerts, denser as you go down) E.) Mostly Nitrogen, and Helium. F.) High Velocity Winds, Loose Bandings G.) Red Giant (Gerts, Denser) H.) 99% Helium or Sulfurites
---	--

Which of the choices below is a bogus fact about Jupiter?

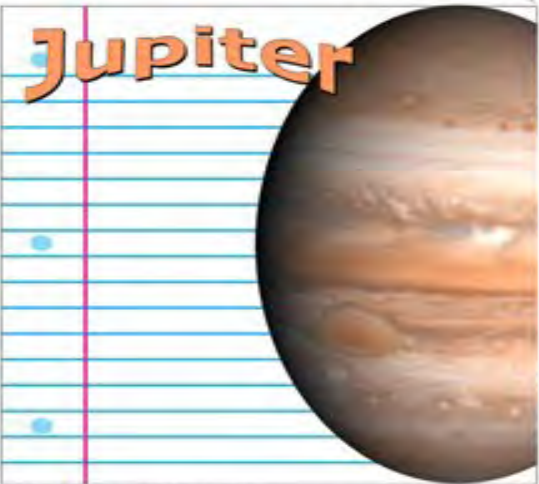
- A.) Twice as massive as all other planets combined.
- B.) Fourth-brightest object in sky.
- C.) Gas Giant (less denser as you go down).
- D.) May have a small rocky core.
- E.) Mostly Hydrogen and Helium.
- F.) High velocity winds, lucky bandings.
- G.) Red Spot (Giant Storm).
- H.) 4 Moons or Satellites.

[illegible][illegible]

Graph the Average Density of outer planets, in g/cm^3



Jupiter



• Multiply your weight by 2.5 = Weight on Jupiter (large mass more gravity) and it's just gas. Imagine if it were rocky!

Find the bogus term below!

• Io - - A.) Rotten orange with acne. - B.) Tidally active (no water, sulfur). - C.) Volcanically inactive. - D.) No impact craters because of volcanic dust.	• Ganymede - A.) Smallest moon of Jupiter - B.) Larger than Mercury, less mass - C.) Silicate rock, water ice, iron - D.) Heavily cratered - E.) Only moon with magnetosphere - F.) Thin oxygen layer in atmosphere
• Europa - A.) Made of smooth white ice. - B.) No craters (water seeps up) - C.) Liquid water under ice (life?) - D.) Many cracks in the ice - E.) Gas core under the sea of ice.	• Callisto - A.) Frozen water and dust - B.) Geological Dead - C.) Only moon known to have life - D.) 4th Moon of Jupiter

Saturn Part 5 Lesson 4 Saturn

- _____ of Moons (274+ Moons)
- Not very _____ (can float in water).
- Similar in composition to Jupiter
- Hydrogen 75% and Helium 25%
- Just missed becoming a star
- Has rings (A, B, and C etc.)
- Billions of particles from dust to meters long
- Mostly _____ and _____

Pick one Saturn obscure moon and record some info about it. Just google Saturn's Moons!



Please name the Jovian Moons and provide some information about each.



Jovian Moons

Ice Giants: A giant planet composed mostly of astronomical _____ including water, methane, oxygen, carbon, nitrogen, and sulfur, and smaller than a gas giant.

- (Uranus and Neptune)

Uranus Part 4 Lesson 3 Ice Giants

- _____ Largest Planet
- Takes _____ Earth years to orbit sun.
- Methane absorbs red and reflects _____
- Winds of _____ km/hr.
- Tipped on _____ (Early Comet Strike).
- _____ moons, 5 large, 22 small.
- Dubbed an ice giant, since 80% or more of its mass is made up of a fluid mix of water, _____ and _____ ice.

Which is bogus of Uranus?

- A.) Largest Planet
- B.) Takes 84 Earth years to orbit sun.
- C.) Methane absorbs red and reflects blue.
- D.) Winds of 700 km/hr.
- E.) Tipped on side (Early Comet Strike).
- F.) 27+8 Moons, Many named after William Shakespeare characters, and Alexander Pope's Poems.

Which is bogus of Uranus?

- A.) 3rd Largest Planet
- B.) Takes 84 Earth years to orbit sun.
- C.) Methane absorbs blue and reflects red.
- D.) Winds of 700 km/hr.
- E.) Tipped on side (Early Comet Strike).
- F.) 27+8 Moons, Many named after William Shakespeare characters, and Alexander Pope's Poems.

Neptune

- _____ planet.
- Orbits sun _____ Earth Years
- Made of mostly hydrogen 80% and some Helium 19%
- Also Methan Rock, Methane, Water, Ammonia
- Winds of _____ mph
- 4 faint rings
- _____ Moons

Which is bogus of Neptune?

- A.) Innermost gas planet.
- B.) Orbits sun 165 Earth Years
- C.) Methan Rock, Methane, Water, Ammonia
- D.) Soft winds of 200 mph
- E.) 4 faint rings.
- F.) 14 Moons

Which is bogus of Neptune?

- A.) Outermost gas planet.
- B.) Orbits sun 165 Earth Years
- C.) Methan Rock, Methane, Water, Ammonia
- D.) Soft winds of 12 mph
- E.) 4 faint rings.
- F.) 14 Moons

_____ and the Giant Red Spot below.



Part 4 Lesson 3 Jovian Moons

Distance from the Sun in Astronomical units.
 Please provide some information about Jupiter below. • Size. • rotational period. • year. • name the Jovian moons. • composition. • temp. • Other facts.

OUTER PLANETS

Quiz Game

• Saturn's core is...

- A.) Very cold
- B.) Extremely Hot

10

• Saturn's interior, reaching 11,700 °C radiates 2.5 times more energy into space than it receives from the Sun.



• Name this moon on Jupiter?

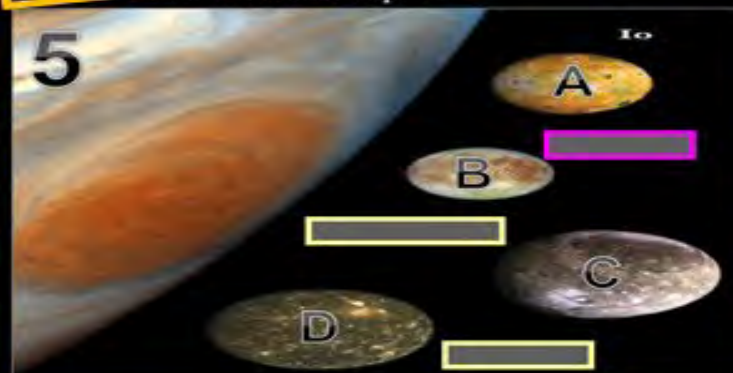
4

- Largest moon in solar system
- Larger than Mercury, less mass
- Silicate rock, water ice core
- Heavily cratered
- Only moon with magnetosphere
- Thin oxygen layer in atmosphere

Ganymede

These moons of Jupiter?

5



• This is the name for a large, low-density planet, composed primarily of hydrogen, helium, methane, and ammonia, in either gaseous or liquid state.

Gas Giant

1



Please record 2 solid pieces of information about Jupiter's Red Spot

- 2 Earth's would fit inside
- Storm has been raging for 400 years.
- It's a storm that becomes larger by consuming other storms.

3



- Name these two moons of Saturn?

8

Rhea

Dione



- Which of the choices below is a bogus fact about Jupiter? **Bogus answer is...**

- A.) Twice as massive as all other planets combined.
- B.) Fourth brightest object in sky.
- C.) Gas Giant (Gets denser as you go down)
- D.) May have a small rocky core.
- E.) Mostly Hydrogen and Helium.**
- F.) High Velocity Winds cause bandings
- G.) Red Spot (Giant Storm)
- H.) 79+? Moons or Satellites

2

- Saturn's rings are primarily composed of...

- A.) Hydrogen and Helium
- B.) All Rocks and Debris
- C.) Methane Gas
- D.) Tidally Active Sulfur
- E.) Mostly Ice**

7



THE ICE IS VERY REFLECTIVE

- This moon has liquid lakes of methane on it.
- The only known place in our solar system.

9

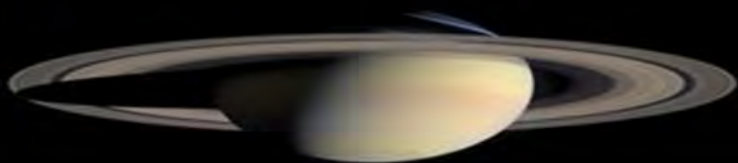


Titan

- What is the density of Saturn?

- A.) 5.52 g/cm³ Earth
- B.) 0.687 g/cm³ Saturn**
- C.) 1.638 g/cm³ Neptune
- D.) 1.326 g/cm³ Jupiter
- E.) 17 AU's ?

6



- What famous person characters are the moons of Uranus named after? (Just one needed)

– Also name at least one moon of Uranus.

15



- Which is not correct of Uranus?

A.) Winds of 700 km/hr.

B.) 27 moons

C.) Has Methane which absorbs red and reflects blue.

D.) Tipped on side (Early Comet Strike) which creates extreme seasons.

E.) The first planet observed by Ancient Greeks.

13

Discovered
March 13, 1781

- It takes Uranus ____ years to orbit the sun?

– A.) 1 Earth year

– B.) 7 Earth years

– C.) 84 Earth years

– D.) 798 Earth years

– E.) 100,000,000 Earth years

12



- Uranus is sometimes dubbed a **Ice Giant** since 80 percent or more of its mass is made up of a fluid mix of water, methane, and ammonia **ices**.

14

Ice Giant

- Uranus the ____ largest planet

– A.) 1st Largest planet

– B.) 2nd Largest planet

– C.) 3rd Largest Planet

– D.) 5th Largest planet

– E.) Cannot be determined



- Name each planet based on its symbol below?

A



Saturn

B



Neptune

C



Jupiter

D



Uranus

Name this demoted planet and reclassified Dwarf Planet?

Pluto

18

- Name the disk-shaped region beyond the orbit of Neptune.

- Much larger and more massive than the asteroid belt.
- Objects are made of mostly frozen water, methane, and ammonia.

Kuiper Belt

19

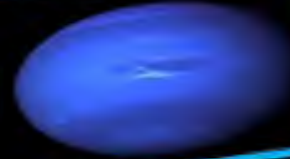
- Name this region of space beyond the Solar System that theoretically contains about one trillion inactive comets.

20 Oort Cloud

- Which fact is bogus from the list below about Neptune?

- A.) Outermost gas planet.
- B.) Orbits sun 165 Earth Years.
- C.) Softest winds in the solar system at 12 mph.
- D.) 4 faint rings.
- E.) 13+2 Moons.

16



Composition of Neptune is....

- Coldest place in solar system -391 degrees F
- Rotates opposite of planet, only place in SS
- Has an atmosphere (Nitrogen)

17

Triton



Astronomy Unit Part 7: Constellations, Hubble Space Telescope, Spitzer Space Telescope, Speed of Light, Nebulas, Types of Nebulas, Galaxies , Type of Galaxies, Gravity, The Special Theory of Relativity , Blackholes; Neutron Stars, Spacetime, Pulsars, Quasars, Exoplanets, Hubble Deep Field, Beyond the Solar System, Black holes, Exoplanets, The Big Bang, Evidence for the Big Bang

Part 7: Astronomy Unit



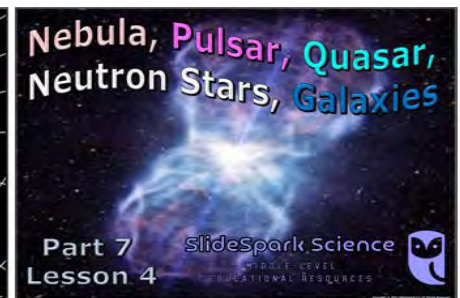
Part 7 Lesson 1 Constellations Hubble



Part 7 Lesson 2 Speed of Light More



Part 7 Lesson 3 Spacetime



Part 7 Lesson 4 Pulsar Neutron Star galaxy



Part 7 Lesson 5 Galaxies



Part 7 Lesson 6 Exoplanets



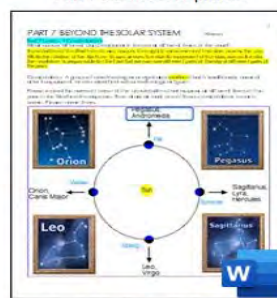
Part 7 Lesson 7 Big Bang



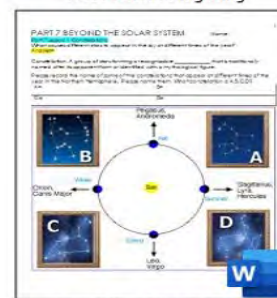
Part 7 Lesson 8 Review Game



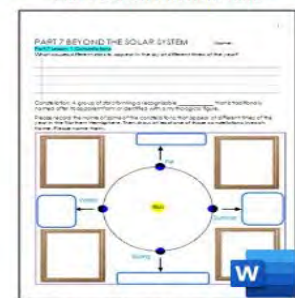
Part 7 Lesson 9 Review Game Answers



Part 7 Work Bundle Answers



Part 7 Work Bundle Digital



Part 7 Work Bundle Print

Beyond the Solar System Unit

Preview is a compressed file

Nebulae: Large clouds of gas and dust which can form stars and galaxies

- Nebulae are divided into two categories (Bright and Dark)
 - Bright nebulae are close to stars.
 - Dark nebulae are not close to stars and are visible when a bright nebula is behind them.



- This is the name for a large cloud of gas and dust which can form stars and galaxies.

- Super-Earth GJ 1214b is an example of a...

13

Extrasolar Planet
or Exoplanet



- A light-year is a unit of distance.
- It is the distance that light travels in one year (9,500,000,000,000 kilometers).
- Light moves at a velocity of about 300,000 kilometers (km) each second in a vacuum.

- Name two methods for detecting extra solar planets?
 - Transit method, radial velocity method, and direct imaging method.

A

Transit Method

B

Radial Velocity Method

C

Direct Imaging

14

gravitational field.

- A region of spacetime from which gravity prevents anything, including light, from escaping.

A black hole is anything but empty space. Rather, it is a great amount of matter packed into a very small area.

Not empty!

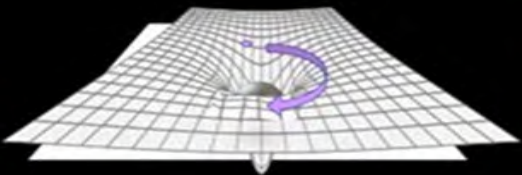


Interactive Slideshows

- Which is the Spiral Galaxy from the below? Answer: D



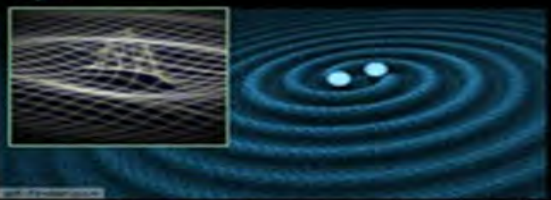
- Activity! Spacetime.
 - 3) Toss in lots of small marbles with an orbital velocity so they orbit the "Sun/ Shotput"



- What causes different stars to appear in the sky at different times of the year?
 - There are two major motions affecting the Earth:
 - The earth's rotation around its axis, and its rotation around the Sun (revolution).



- Gravitational Wave: Disturbances or ripples in the curvature of spacetime, generated by accelerated masses, that propagate as waves outward from their source at the speed of light.



- Which is a Quasar, Pulsar, and Neutron Star



Black Holes

A black hole is a region of spacetime where gravity is so strong that nothing, including light or other electromagnetic waves, has enough energy to escape it. The theory of general relativity predicts that a sufficiently compact mass will deform spacetime to form a black hole.

Our Milky Way Galaxy probably has a Super Massive Black Hole at its center. Maybe millions of more black holes exist in our galaxy.

Dying Stars Lead to Stellar Black Holes. Black holes are the most mysterious objects in the universe, but produce gravitational waves.

Black Holes

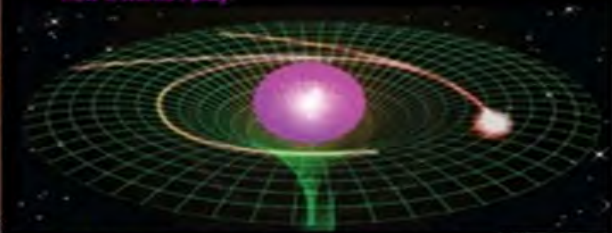
- Video (Optional) Crash Course Astronomy Black Holes.

– <https://www.youtube.com/watch?v=qZWPBKU>



- Warping the Fabric of Space and Time.

<https://lab.nationalmedals.org/gravity/>
 1) How does an objects mass and distance change gravitation?
 – Change the mass and distance of celestial bodies. 5 minutes how it works / play.



- It's been serviced in space five times and been in use for more than 25 years.
 - It has changed our view of the universe and our place within it.



Follow Along Work Bundle

PART 7 BEYOND THE SOLAR SYSTEM

Black Holes

General Theme
The Universe is...
BIG FAST

15+ Pages

Visuals

Space Expo Rubric

15+ Pages

Activities, Notes, Keys, Assessments and more all built-in

- The James Webb Space Telescope is a space telescope currently conducting infrared astronomy.

- Equipped with high-resolution and high-sensitivity instruments, allowing it to view objects too distant, or faint for the Hubble Space Telescope.



Supermassive S
It warps the fabric of space time

Not even light can escape.

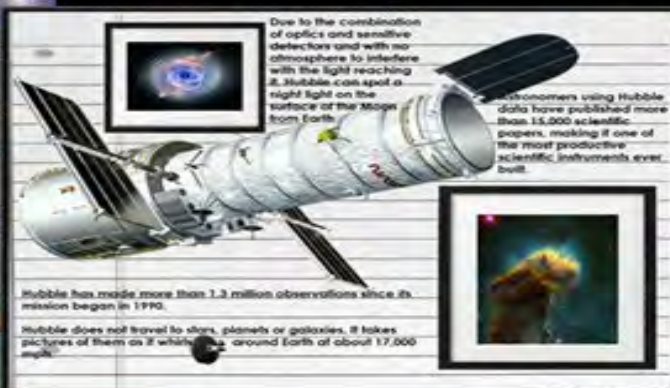
Increasing Mass

- Neutron Star: Type of star leftover when a star collapses.

Very small and dense star made almost completely of neutrons.



- Don't think of the expansion as just headed away from each other.
- Space is expanding, and the galaxies go along for the ride.



named after its apparent form or identity with a mythological figure.



on the spiral arm of the Milky Way.

Galactic Year

How many Galactic Years has our solar system experienced?

- A.) 200,000,000
- B.) 2,000
- C.) 20
- D.) 2

225-250 million years

Name this very important device?

Hubble Space Telescope



which is a *Blue, Newton Star, and Quasar*

which is a *Blue, Newton Star, and Quasar*

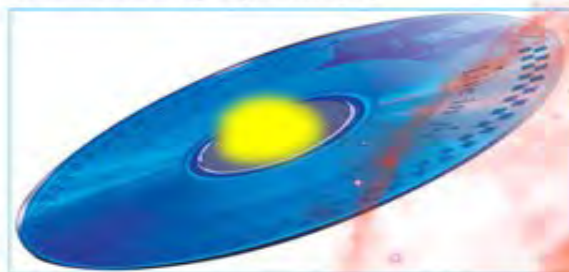
Answer	Answer
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Given a large number of stars, one can't just take the universe

- Hundreds of _____ of them.

Please label this old CD with a gumdrop as if it were a galaxy.



What type of Networks are below?

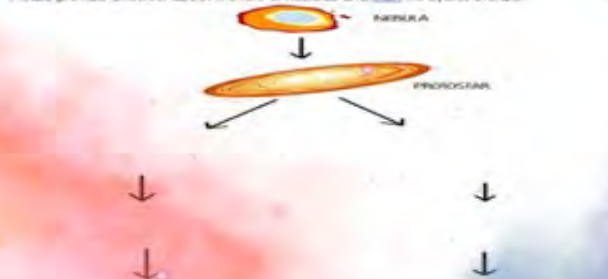
Answer:



Answer:



Please provide a review about the role of nebulae and their life cycles of stars.



Question: I frequently take the measure of my... and look...

...and extremely old

less than 1000 ft. above the surface of the water in this

[illegible]

General relativity describes that _____ and _____ are actually different aspects of the same thing: space-time. Gravity is the bend in space-time. Gravity is _____ ripples and waves in the fabric of space and time.

[illegible]

Visit Gravity Simulator, Warping the Fabric of Space and Time. Create all of the examples: <https://rob.northeastern.edu/rob/gravity/>

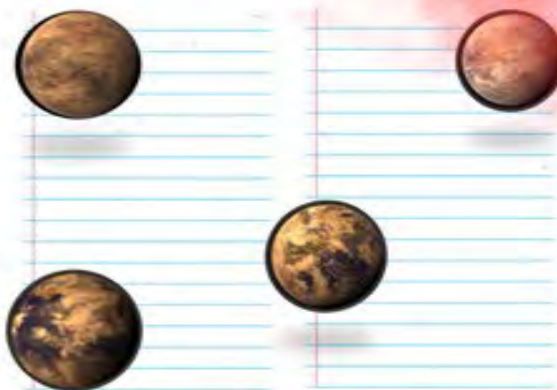
- 1) Create a Solar System (Gravity!) Change the mass and distance of celestial bodies. 5 minutes how it works.
- 2) Create a Sun. Lay out lots of small objects and then put something massive in the middle. What happened?
- 3) Create a Sun, with orbiting Earth, and orbiting Moon.
- 4) Create a model of our solar system 6 planets Needs a Large Planet (Jupiter and Saturn)
- 5) Create a binary System of two stars. Create a binary System of two stars with at least two planets. Orbital day, year, orbital day, year.
- 6) Create a black hole! It's pretty hard to make a lot of mass.

Page 2 Lesson 4 Review Questions, Answers, Discussion

Neighbour 1 (people) clipped off	and	which can form	and
Neighbour 1 (people) clipped off	and	which can form	and

- Networks are divided into two categories (fixed and flex)

Bright nebulae are close to stars.
Dark nebulae are not close to stars, and only visible when a bright nebula is



Name the method of detection for finding exoplanets! There's more if you want to research



Across

3. S. _____ Galaxies: These are the most common type of galaxy.
5. A region of space resulting from the collapse of a star with an extremely high gravitational field.
6. Extremely bright masses of energy and light.
9. The Big _____ is a clipped version of the constellation Ursa Major the Big Bear.
11. _____ Star: Type of star leftover when a star explodes.
14. A black hole is a region of s. _____ from which gravity prevents anything, including light, from escaping. A blackhole is anything but empty! Rather, it is a great amount of matter packed into a small area.
15. General relativity describes that space and _____ are actually different aspects of the same thing -space-time.
16. Gravity: The force tugging between two bodies depends on how massive each one is and how f. _____ apart the two lie.
17. A nebula can form s. _____
18. It is the distance that _____ can travel in one year. (9,500,000,000,000 kilometers.)
20. The _____ shift of Galaxies is one evidence of the Big Bang.
21. The name of the north star is _____ it's the brightest star of the constellation - Ursa Minor.
22. _____ Space Telescope. Since its 1990 launch, it has changed our fundamental understanding of the universe.
23. Large cloud of gas and dust which can form stars and galaxies.

Possible Answers

ANDROMEDA, BIGBANG, BLACKHOLE, BRIGHT, CONSTELLATION, DIFFER, EXOPLANET, FAR, GALAXY, GRAVITY, HUBBLE, LIGHT, MICROWAVE, NEBULA, NEBULAE, NEUTRON, POLARIS, PULSAR, QUASAR, RED, SPIRAL, STARS, TIME, SPACETIME

Down

1. Two objects exert a force of attraction on one another known as g. _____
2. The _____ Theory: The cosmic explosion that is hypothesized to have marked the origin of the universe.
4. _____ (usually spinning) neutron star that emits radio waves, usually in narrow beams.
7. This is the closest galaxy to the Milky Way.
8. Constellation: A group of stars forming a recognizable pattern in the sky named after its apparent form or identified with a mythological figure.
10. E. _____ for short: Any planetary body that is outside the solar system and that usually orbits a star other than the Sun.
11. Dark _____ are not close to stars and only visible when a bright nebula is behind it.
12. One of the signs of the Big Bang is Cosmic Microwave Background has been accurately measured by orbiting detectors.
13. These nebulae are close to stars.
19. Large group of stars, gas, and dust that constitute the Universe.

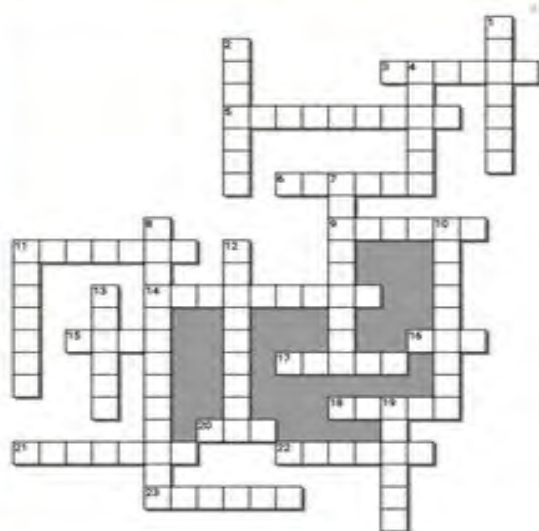
Part 7 Review Game

1-20 = 5 pts. **Part 7 Review Game**
 *20-25 = bonus = 1 pt. **Secretly write owl in correct space = 1 pt. Score**
 Final Question = 5 pt. **Answer**

STAR LIFE STAR EXIST	SUPERS AND WAVES	OUTER LIMITS	SUPER SIZED	ROCK BOTTOM Bonus round 1 pt each
13	42	111	149	*21
25	43	132	179	*22
60	435	149	109	*23
10	145	199		*24
102	130	208		*25

Owlman Waiver **15 Answer**

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Part 7 Review Game

The Big Bang Theory: The cosmic _____ that is hypothesized to have marked the origin of the Universe.

Help Sheldon draw his drawing board with some information about the Big Bang Theory! <http://www.youtube.com/watch?v=9R7299GGo>



General Theme

The Universe is...

BIG

FAST

OLD

FAR

Powerful

Beyond the Solar System

Quiz Game

Which is moving? The earth

1



Answer is...

Name these two very important devices?

Hubble Space Telescope



James Webb
Space Telescope

answer is...

- This is the name for a large cloud of gas and dust which can form stars and galaxies.

5

NEBULA

answer is...

light-year is a unit of distance. It is...

- A.) The distance it takes light to travel to the earth from the sun. Roughly 146 million kilometers.
- B.) The time it takes for the earth to travel around the sun in one year
- C.) It is the distance that light can travel in one year. (9,500,000,000,000 kilometers.)
- D.) The distance to our closest neighbor star Alpha Centauri.

and the answer is

Name the types of galaxies below?

10



Barred



Irregular



Elliptical



Spiral

Name this constellation?

Ursa Major

2



To find the
North Star

Also known as the Great Bear and Charles' Wain and Big Dipper and the Plough.

- This is the type of star leftover when a star collapses.
 - Very small and dense star made almost completely of... **Neutrons**

8

Neutron Star



answer is...

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- This is the name for a large group of stars, gas, and dust that constitute the Universe.
 - Large = Hundreds of billions of stars.

GALAXY

9

answer is...

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- This is a region of space resulting from the collapse of a star with an extremely high gravitational field.
 - A region of spacetime from which gravity prevents anything, including light, from escaping.

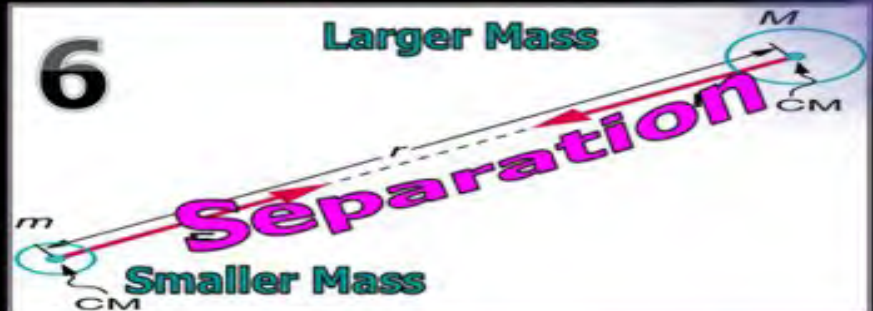


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- Law of Gravity $F = G M m / r^2$
 - Gravity is an attractive force between two bodies, which depends only on the mass of the two bodies (M and m) and inversely on the square of the separation between the two bodies.

6

Larger Mass



Name the Galaxy we live in?

The Milky Way

Galactic Disc

12

- Name two methods for detecting extra solar planets?

– Transit method, radial velocity method, and direct imaging method.

A

Transit Method



B

Radial Velocity Method



C

Direct Imaging



14

What is this, it takes
of hundred million years?

A Galactic Year

- This is the cosmic explosion that is hypothesized to have marked the origin of the Universe.

15

THE BIG BANG THEORY

answer is...

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- Super-Earth GJ 1214b is an example of a...

13

Extrasolar Planet or Exoplanet

Answer is...

Antares

Image of GJ 1214b and Antares

- This is a rapidly spinning neutron star that emits radiation, usually radio waves, in narrow beams.

PULSAR

answer...

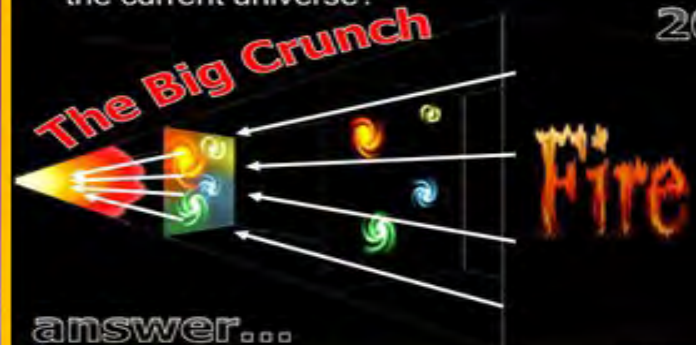
- The second law of thermodynamics reminds us that the fate of the universe could be...?
 - A.) The universe will eventually run out of energy. Everything will become lifeless and frozen at some point.

ICE

- Which comment below is completely bogus about the Big-Bang Theory?
 - A.) As the Universe expanded and cooled some of the elements that we see today were created.
 - B.) The cosmic forces in the universe have been increasing in size and scale as described by increasing radiation.
 - C.) The redshift of distant galaxies means that the Universe is probably increasing.
 - D.) The Cosmic Microwave Background has been accurately measured by orbiting detectors.

answer is...

- What's the name for this possible ending to the current universe?



- True or False? The atoms that make up your hand were once part of a star that exploded?



- Using information gathered from the WMAP satellite, the universe is believed to be how old?
 - A.) 157 thousand years old
 - B.) 57.6 Trillion years old?
 - C.) 57 Billion years old?
 - D.) 13.75 Billion years old?
 - E.) The WMAP satellite is a government conspiracy.



Curriculum Guide

Number of Lessons in each unit (50 min, daily lessons) and difficult rating scale / intended grade level.

 =Easier,

 = More difficult,

 =Most difficult

Earth Science Units	Daily Lessons	Intended Grade	
Geology Topics Unit	60 Lessons	6-8 medium difficulty	
Weather and Climate Unit	40 Lessons	6-8 medium difficulty	
Astronomy Unit	60 Lessons	6-8 medium difficulty	
Weathering, Soil Sciences	28 Lessons	5-7 easier	
Rivers and Water Quality	25 Lessons	5-7 easier	
Water Molecule Unit	20 Lessons	5-7 easier	
Biogeochemical Cycles Unit	16 Lessons	5-7 easier	

Earth Science Curriculum

SlideSpark Science

MIDDLE-LEVEL
EDUCATIONAL RESOURCES



Entire Water Unit

27 Lessons

Rivers, Lakes, Water Quality Unit

20+ Lessons

7 Units • 250 Lessons

Interactive Slideshows with Chronological Work Bundles
Hundreds of Pages, Activities, Projects, Videos, Academic Links, Assessments, Games & Keys All Built-In for Seamless, Ready-to-Go Learning

Biogeochemical Cycles

17 Lessons

GEOLOGY Mega Bundle

6 Parts, 60 Lessons

Weathering, Soil Science, Ice Ages, Glaciers Unit

5 Parts 36 Lessons

Interactive Slideshows Follow Along Bundles

Weather and Climate Mega Bundle

40 Lessons

7 Units

Astronomy Mega Bundle

60 Lessons

7 Units

Grades 5-10

Life Science Units

Life Science Units	Daily Lessons	Intended Grade	
Ecology Feeding Levels Unit	13 Lessons	5-6 easier	
Ecology Interactions Unit	30 Lessons	5-6 easier	
Ecology Abiotic Factors Unit	13 Lessons	5-6 easier	
Botany Unit	50 Lessons	5-7 easier	
Evolution and Natural Selection	40 Lessons	5-7 easier	
Taxonomy and Classification	50 Lessons	6-8 medium difficulty	
Infectious Diseases Unit	30 Lessons	7-9 more difficult	
DNA and Genetics Unit	42 Lessons	8-10 most difficult	
Human Body Systems Unit	85 Lessons	6-8 medium difficulty	
Cell Biology Unit	30 Lessons	8-10 most difficult	

Life Science Curriculum

SlideSpark Science

MIDDLE-LEVEL
EDUCATIONAL RESOURCES



Interactive Slideshows Follow Along Bundles

10 Units of Study



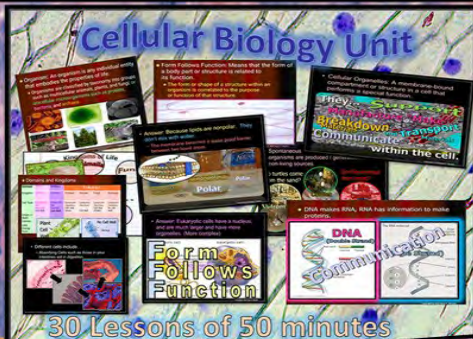
Botany Unit



Human Body Systems Unit



Cellular Biology Unit



Infectious Diseases



DNA and Genetics Unit



Taxonomy and Classification Unit



Ecology Interactions Unit



Ecology Feeding Level Full Unit



Ecology Abiotic Factors Unit



Physical Science

	Daily Lessons	Intended Grade	
Laws of Motion and Machines Unit	33 Lessons	8-10 most difficult	
Matter Energy and the Environment	58 Lessons	7-10 medium difficulty	
Atoms and Periodic Table Unit	44 Lessons	8-10 most difficult	
Science Skills Unit	30 Lessons	5-7 medium difficulty	

[Physical Science Curriculum](#)

[Entire SlideSpark Science Curriculum](#)



Physical Science Curriculum

SlideSpark Science

MIDDLE-LEVEL
EDUCATIONAL RESOURCES



Science Skills Unit

5 Parts, 30 Lessons

Physical Science Curriculum,
4 Units • 165 Lessons of 50
mins, Interactive Slideshows
with Chronological Work
Bundles, Hundreds of Pages,
Activities, Labs, Projects,
Video & Academic Links,
Assessments, Games, Keys,
All Built-In for Seamless
Ready-to-Go Learning

Thousands of Interactive Slides

67 Pages of Follow Along
Work Bundle

Assessments, Games,
Video Links, and more

Everything you need to run an
amazing learning experience

Interactive Slideshows Follow Along Bundles

Grades 7-10

Laws of Motion and
Simple Machines Unit

33 Lessons

With Follow Along
Work Bundles

63 Pages

Assessments, Activities,
Projects, and so much more

Atoms and Periodic Table Unit

6 Parts, 44 Lessons

Thousands of Interactive Slides

Follow Along Work Bundle

103 Pages, with Labs,
quizzes, more, all built-in

Exciting Activities, Questions,
Videos, All built-in

Matter and Energy and the Environment Unit

58 Lessons

Interactive Slideshows

with Follow Along Work Bundles

125 Pages

Activities, Assessments,
and more, all built-in

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Sincerely,

Support@slidespark.net



SlideSpark Science

MIDDLE-LEVEL
EDUCATIONAL RESOURCES



[SlideSpark Science on TpT](#)