Plants
PS31-533

(10) 12

Michael Plasmeier 1/28

1. Nonvascular Plants are plants without water conducting tishue. These plants are small and live in moist invironment. They are mosses and liverworts.

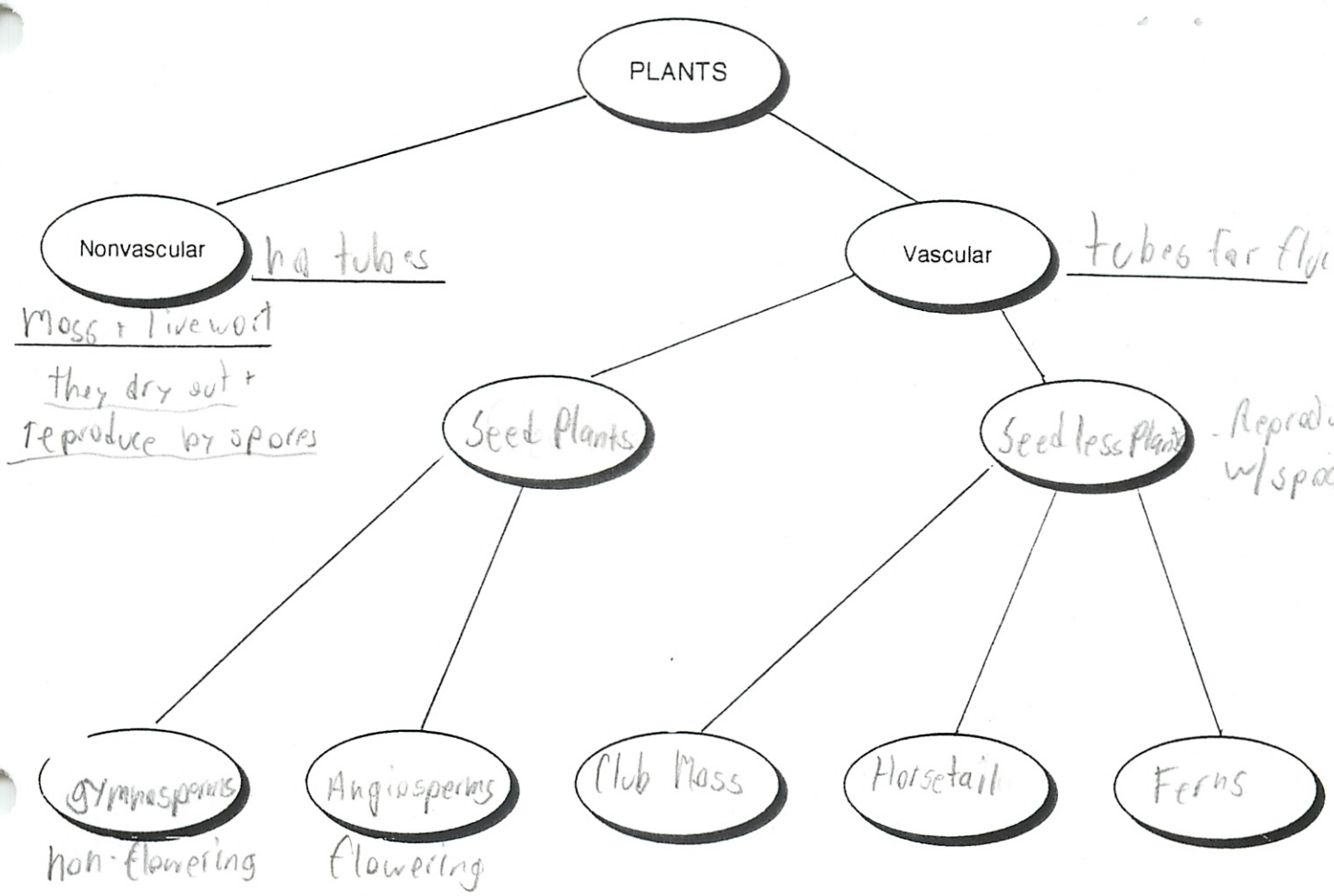
2. Vascular Plants are plants that have water conducting tishue, that help move water, minerals, and food molocues throughout their bodies. These are plants like horsetails and ferns.

3. Gymnosperms are plants which have "naked seeds." The seeds are not produced in an ovary. These are plants like conifers, Cycads, and ginko trees.

4. Angiosperms are plants who have covered seeds. The seeds are formed in an ovary. They are called flowering plants and are the largest and most divence group of plants. Orange tree, grasses and palm trees are all Angiosperms.

Plant Kingdom

Very Important



Gymnosperms - name means naked seed, most are conifers (form cones) most are evergreen with needles, they are tallest + oldest plants in the world, pine + spruce, ginko, redwood

Angiosperms - name* Covered seed, most common land plants today, all form flowers, w/ seeds in fruit, includes 99% of plants that I eat

Michael Plasmeier

Don't Need

GENETIC CHARACTERISTICS

Purpose:
Examine six characteristics for each member of your group. Record the results in the table below.

Class of 22

	You	Scott 1	Greg 2	Mike 3	Carlton 4	Lindsay 5
A. Hand folding						
15 Left over right	✓	✓	✓	✓		
7 Right over left					✓	✓
B. Handedness						
1 Left handed		✓				
21 Right handed	✓		✓	✓	✓	✓
C. Hairline						
6 pointed						
16 straight	✓	✓	✓	✓	✓	✓
D. Tongue Rolling						
18 Can	✓	✓		✓		✓
4 Can't			✓		✓	
E. Ear Lobe						
17 Hanging		✓	✓	✓	✓	✓
5 Attached	✓					
F. Thumb						
17 Regular	✓	✓	✓	✓	✓	✓
5 Hitchhikers						

KINGDOM COMPARISONS

Very Imp

	Movement	Cells (Mult)	food (Photosynthesis)	Vascular System	Reproduce	Examples
I. MONERAN	No	Single	Some	No	Cell-Division	Bacteria + Cyano-bacteria
II. Protist						
A. Plant-like Algae	"	Most / Some	Yes	No	"	Volvox + Brown algae "kelp" forests seaweed
B. Animal-like Protozoans	Yes	Single / "	No	"	"	Amoba + Paramecia
III. Fungus	No	Most	"	~~Yes~~ No	Spores	Bread mold (haphae) mushroom / yeast
IV. Plant						
A. Nonvascular	"	multi	Yes	No	"	Moss Liverwort
B. Vascular						
1. Seedless	"	"	"	Yes	"	Club moss ferns horsetails
2. Seed plants						
a. Gymnosperms	"	"	"	"	most in Seeds (cones)	Conifers + ginko
b. Angiosperms	"	"	"	"	" (Fruit)	oranges + many things we eat
V. Animals						
A. Invertebrates	Yes	"	No	Most Yes	flower Most Lay eggs	insects, clams, Jessly fish
B. Vertebrates						
1. Fish	"	"	"	Yes + Cold Blooded	"	Sharks + eels + gold fish
2. Amphibians	"	"	"	Yes + Cold Blooded	Jelly-like eggs	Frogs + Salamanders
3. Reptiles	"	"	"	"	Dry Eggs (hard)	lizards + snakes + crocidiles
4. Birds	"	"	"	Warm blooded	Hard Shelled	
5. Mammals	"	"	"	Yes Warm Blooded	Most live	Us!

INTRODUCTION TO OWLS AND OWL PELLETS:

When one animal catches another for food it is called a *predator*, and the animal that it catches is called its *prey*. Hawks, eagles, and owls are predators. Their prey includes many animals from small insects to rats, rabbits, and skunks. Some even feed on fish and other birds. In addition to being predators, hawks, eagles, and owls are in a special group called *raptors*. Raptors are birds that catch their prey with the long claws on their feet.

Hawks and eagles use their sharp beaks to pick the meat from their prey, just as you would pick the meat from a piece of chicken. But owls swallow their prey whole, bones and all, in one bite. When an owl swallows a field rat, it is like you swallowing a 15 pound hamburger in one gulp!

Hawks and eagles hunt during the day. They use their amazing eyesight to spot prey such as mice. A hawk can see a mouse as easily as you or I can see a dog.

Owls hunt at night. They see as well as hawks and eagles, but they also see very well in low light. But on nights when it is too dark to see very far, they can find prey by listening. Owls have two ear holes hidden beneath their feathers. There is one just behind each eye. The feathery depressions around each eye act as funnels. They direct the sound into the ears just as a satellite dish directs signals into a receiver. Owl's ears are so precise, they can catch a mouse in total darkness, just by hearing it's footsteps in the grass. The owls are so quiet that the mice never hear them coming.

After an owl swallows its prey, special chemicals in the stomach break down the meat so that the owl's body can use it for energy. But the hair and bones of the prey cannot be used and the owl must get rid of them. Since the owls do not have teeth, the bones could not be chewed up to pass through the body. So the bones must be spit back out. But if bare bones were spit out of the stomach they might get caught in the owl's throat and choke it. So owls do something very different from other animals. Their stomach muscles press the hair of the prey around the bones to make a cushioned ball with the bones packed inside. This ball of hair and bones is called a *pellet.*

Owl pellet kits usually contain pellets from Barn Owls. Barn Owls are medium-sized, white and bronze owls that live all over the world. They often nest in hollow trees, caves, silos, and old church steeples, but they are especially fond of old barns.

In North America, Barn Owls typically feed on mice, shrews, voles, and field rats. They sometimes eat crayfish, insects, small rabbits, and birds such as blackbirds. One Barn Owl will eat several mice and rats per night. A Barn Owl that is raising young may catch 10 to 15 mice a night for each young owl. When you multiply this by six, eight, or even ten young owls, plus the two parents, you can see that one Barn Owl family can catch a lot of mice and rats. For this reason, many farmers put up Barn Owl nest boxes near their fields.

HOW DO BARN OWLS MAKE PELLETS?

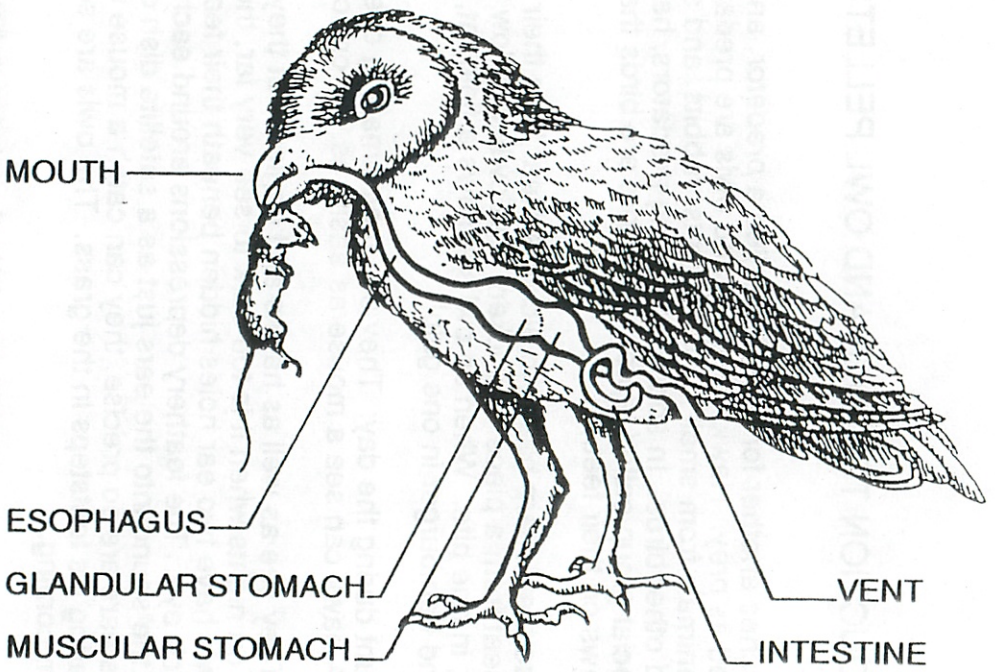
Barn Owls do not have teeth to chew prey. Some large prey may be torn into smaller pieces before they are swallowed, but usually the Barn Owl will swallow them whole, in one bite. This is how Barn Owls eat shrews, mice, voles, and most rats.

Since owls do not have teeth, the bones cannot be ground into small pieces that pass through the body, as in wolves and bobcats. Instead, the prey is completely broken apart by chemicals in the stomach called enzymes. Along with pressure from the stomach muscles, this separates the fleshy portions from the bone and hair.

Muscular parts in the stomach prevent the bones and hair from going any further, but they allow the digested, fleshy portions to enter the intestine. This is where the nutrients are collected and sent out to the rest of the body. These nutrients include proteins, carbohydrates, vitamins, and water- all of the things that the owl needs to make energy and continue living.

Some of the digested material that enters the Intestine is not needed. This material, along with other waste collected throughout the body, is ejected from the vent. This pasty, white material is known as urea. It is very rich in nitrogen and similar to urine in mammals, only thicker.

The bones and hair that were left in the stomach must also be expelled. This is done through the mouth. Since the bones are no longer surrounded by flesh, they could get stuck in the throat. To prevent this, the stomach packs the bones in the hair. This slick, soft package is then regurgitated as what we call an owl pellet.



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OWL PELLET Lab

Name Michael Plasmeier

Owl pellets are undigested remains of prey swallowed by the owl. The soft parts of the prey are dissolved and passed on to the the intestine for absorption, and the hard non-digestable parts (bones, teeth, fur, feathers are compressed in the gizzard and spit out through the mouth.

The Common Barn Owl provides most of the pellets for study in classrooms. It feeds in early morning and early evening and usually produces one or two pellets per day. These pellets have been fumigated and dried to eliminate any insects and odor, then wrapped for preservation.

Procedure:

✓1. Measure the length and width of your pellet and record below.

length - 5cm width - 2.5cm

✓2. Dissect the pellet by first breaking off a piece using your fingers. Roll a piece of fur between your thumb and forefinger, feeling for hard pieces, which will be bones.

✓3. Use probes and tweezers if necessary Separate the bones into various types using the bone pictures provided.

4. Measure the bones identified below, record their lengths, then glue them on the paper provided.

5. What is the total number of prey organisms found in your pellet. (Count skulls.)

Total number _____

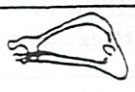
6. Identify the prey you have found using the skull diagrams provided.

Prey found _____

Measure the bones you find that compare to those below.

Length _____

Lower Mandible



Scapula _____

Humerus 9.5 _____

Radius/Ulna _____

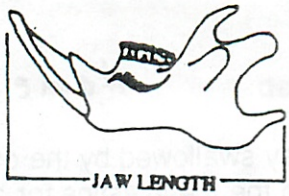
Pelvis Length _____

Femur _____

Fibula / Tibia 9 _____

Vertebrae _____

HOW TO MEASURE THE JAW



TOOTH TYPES

	RAT	VOLE	MOUSE	SHREW	BIRD
SKULL AND JAW					
JAW LENGTH MILLIMETERS	17-30	15-20	10-15	7-14	15-40
TOOTH TYPE	LOBED	ANGLED	LOBED	POINTED	NONE

5. Most pellets contain a Vole *(Microtus)*. Obtain the **"Vole Stick Sheet"** from your instructor, identify the individual bones of the vole skeleton, and paste/tape the bones in the appropriate places. If your pellet does not contain a vole, you should be able to get the different bones from someone else in the class that has found 2 or more voles in their pellet or from the extra bones the class may have. If your instructor wishes for you to reconstruct the vole skeleton, first identify the bones as above, then secure the bones together using a toothpick to apply the glue.
6. Answer the questions below.

QUESTIONS

1. What are owl pellets? _____
2. How are owl pellets formed? _____
3. Do only owls produce pellets? _____
4. What important information can be obtained from owl pellets? _____
5. In reference to your classroom data, what kind of prey seems to be most abundant? _____ Least abundant? _____
6. Is it possible that the prey identified from the pellets does not reflect the true mammal population in the wild? Why or why not? _____
7. Assuming that the barn owl regurgitates one pellet per day, how many prey items would the owl that produced your pellet consume per year? _____
8. During the nesting season the young need an enormous amount of food for growth. If the nest contains three young and each of the young eat five mice per night for a month and the two adults eat four per night, how many mice would the parents have to capture in 30 days? _____

UNIT 2 Reading Activity Name Michael Plasmeier

A. Directions: Read the article on page 142, "**Mary Lieras: Zookeeper**", and answer the following questions.

10

1. Where is the zoo at which Mary works? in San Diego

2. What are some of the jobs of a zookeeper?
   a. Animals need to be fed
   b. cages need to be cleaned
   c. to maitane exibits
   d. monitor the animals
   e. keep detailed records of the animals
   f. catch and transport animals

3. What is a **bioclimatic zone**? A bio climate zone is a place where all the animals of a certain species lives. It might be cages together or 1 big field.

4. Describe some reasons people believe that animals should be kept in zoos.
Some reasons that people think animals should be kept in Zoos is that some habitats are dissipearing and they can learn about the animals.

5. What are some arguments people might make against keeping animals in zoos?
Some reasons that animals should not be kept in Zoos is that it is not right to cage animals, and have them only be with members of their kind.

6. What is your opinion? I don't know I am sort of devided on the ishue

(over)

B. Directions - Read page 143 "**Worms that Get Under Your Skin**" and answer the questions.

1. What areas of the world are most affected by Guinea worms? Africa, India, and the Middle East are most affected by the worm

2. The larvae (immature stage) of the Guinea worm lives inside a water flea. Look closely at the picture of the water flea on page 143 in the orange inset. You can see the worm larva inside the flea. Do you think that the worm larvae are **parasites** on the fleas? **Explain**.

Yes, because the worm is getting transportation and the flea has extra weight to carry.

3. How does the worm larva get into a human? The worm gets inside of the human when the human drinks the worm that lives in the flea that lives in the water.

4. Where, in the human, does the worm grow to adulthood? The worm grows near to the skin.

5. How long can the worms grow? The worms grow to 1m!

6. How do the females reproduce? The females reproduce by forming a blyster that breaks in water and it releces 2 million eggs.

7. How does the worm get out of a human? The worm exits by crawling out of the skin. This takes a month and (hurts bad.)

8. How do some humans try to get the worms out? Some people try to get the worm out by the worm around cloth.

9. What can be done to control Guinea worm infections? To control the worm you can filter or boiling the water you drink. (Also try to keep the blister from bursting in public water.

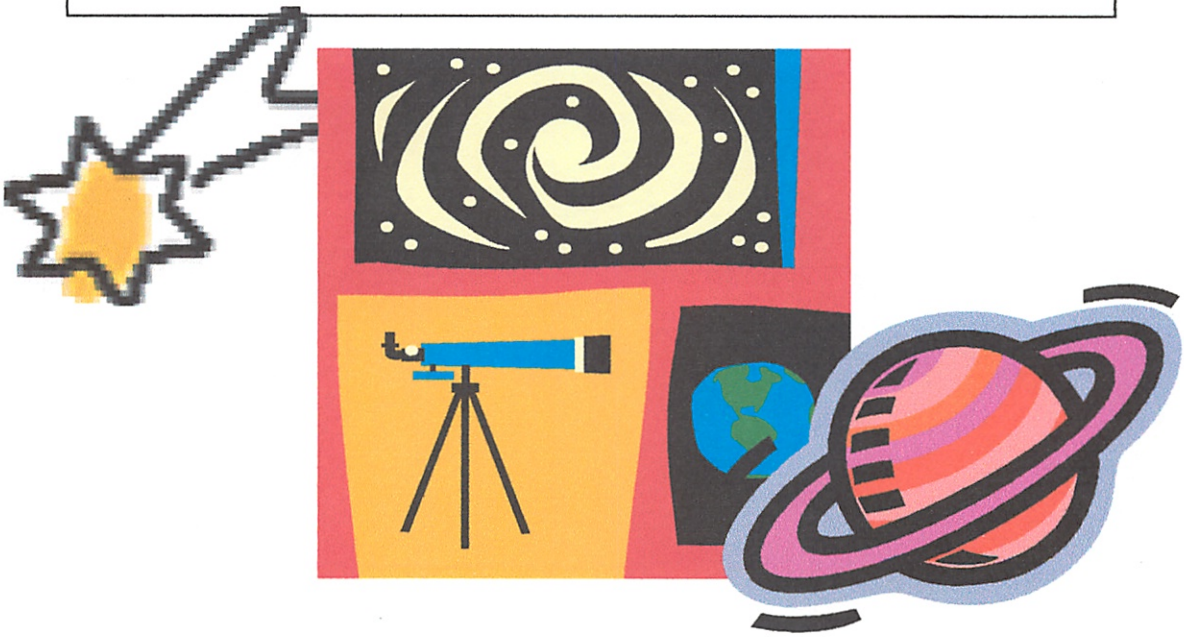
10. Pesticides in the water would help kill many worms. What are some problems with this type The pesticides would harm the crops and might not work. I don't think you need a fly to carry the worm.

Science

Unit 7

Towards the

stars



Science

Unit 7

Towards the Stars

Michael Blasmeier

Astronomy Pre Quiz

1. There is no gravity in space. True or False. Explain.
(or little)
There is no gravity in space because the planets core is far away.

2. Astrology and Astronomy are the same thing. No, they are (horoscopes)
not, Astrology is fortune telling using the stars (Astronomy studies it)

3. Arrange these in order from closest to farthest from the Earth.

stars Pluto the Sun the Moon

Moon, Sun, Pluto, stars

4. What causes the phases of the moon? That is, why is it sometimes not a full circle?
The phases are the refelection of the sun off the moon the moon turns.

5. From Earth, you always see the same side of the moon. True or False. Explain.
True
False, doesn't it rotate around the earth?

6. Most of the stars you see are about the same distance from the Earth. True or False.
False

7. Some constellations can be seen only in certain seasons. (true or false) Explain.
True the earth faces different parts of space during the seasons

8. In what season is the Sun closest to Earth? Winter

9. Ancient cultures (Greeks, Romans, etc...) could not tell the difference between stars and planets. true or false. Explain. True
? That is a history question not a science question.

10. The moon and the Sun both orbit around the Earth. True or False.
False, Thats what Gallao thought

Michael Blasmeier

5 Moon facts

p5138

(10)

#1. The moon is beleved to have a small iron core.

#2 The fine dust on the moon is caused by lots of small pebbels hitting the surface to slowly break up the rock.

#3 There is a 270°C temperature difference on the moon.

#4 The dust was once thought of to be so thick, that a spaceship would sink in it.

#5 The moon has no athmosphere to protect the planet.

5 Moon Origins

Michael Plosmeier p 5/34 (10) 2/10

1. The moon might have been a small planet brought in by the earth's gravity

2. Matter from the earth broke off to form the moon. This left a hugh depression nowed called the Pacific Ocean.

3. The moon and the earth formed at the same time from matter that was swerling around in space

4. Little pieces of rock and other debri that was orbiting the earth came together.

5. A big piece of matter the size of Mars hit the earth and propelled mater into the sky that latter formed the moon.

Michael Plasmeier

Chapter 19 **ASTRONOMY** Exploration #2 (p.433-435)

I. **Aristotle** - Greek Thinker (384 B.C.-322 B.C.)

A. Believed that all matter in the universe was made up of 4 elements:

1. earth
2. air
3. fire
4. water

B. Earth was surrounded by 8 spheres

C. The eight spheres were:

1. Moon
2. Sun
3. 5 known Planets
4. Stars

D. He believed that seasons were caused by the corkscrew motion of the sun higher or lower in the sk,

E. Aristotle's ideas were accepted as fact for over 2000 years, until new theories appeared in the 16th and 17 centuries A.D.

F. Aristotle's idea about the Earth as the center of the universe is known as a "**geocentric model**."

II. **Aristarchus** - Greek Astronomer (3rd century B.C.)

A. He suggested a theory that earth and other planats rotate around the sun as the sun was the center of the universe

1. He believed that the Earth and other planets revolved around the Sun
2. This idea is known as a "**heliocentric model**," which means Sun center earth retover ~~around the sun~~
3. He believed that day and night were caused by the earth is rotating on its axis

4. He believed that the Sun was much farther and bigger than previously thought.

5. Aristarchus' ideas were ignored by most people.

III. **Ptolemy** - Greek Astronomer (about 100 A.D.)

A. His ideas were most similar to the "geocentric model" of Aristotle

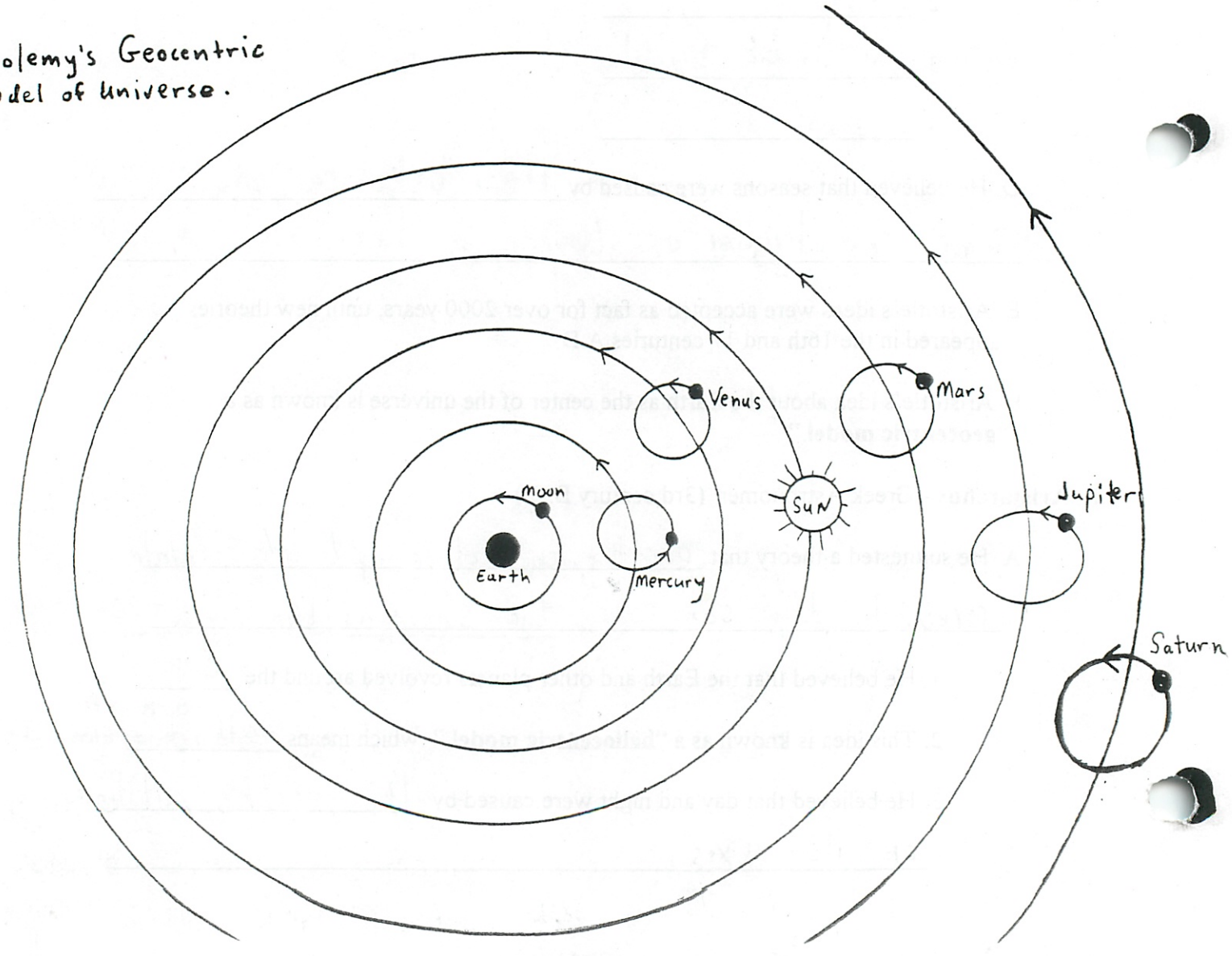
1. He believed that the Sun moved around the earth

2. He tried to explain "retrograde motion" of planets where they seem to "loop around" and seem go backwards

3. Ptolemy explained this planetary motion by proposing that each planet moved in a small circle as it orbited the Earth.

4. These ideas were also believed to be true for over 1500 years.

Ptolemy's Geocentric Model of Universe.



michael Plasmeier

Chapter 19 ASTRONOMY Review

Feb 18 Test Week to know This/This

I. Definitions

A. Astronomy - the study of the stars and things in sky
Aristarkos

B. Heliocentric model - the sun being the center of the universe
Aristotal + Ptlomey

C. Geocentric model - the earth being the center of the universe
Retrograde motion; when it appeares to go backwards

II. Heavenly Motions-

A. The **Sun**:

1. Appears to rise in the East and set in the West each day.

2. Is an average size star in our galaxy, which is known as the ~~sun~~ Milky Way (?)

3. Is highest in the sky during what season? ~~Winter~~ summer
Closest = Winter

B. The **Earth**:

1. Is the 3rd planet from the Sun.

2. Rotates in 24 hrs. causing day and night.

3. Revolves around the Sun in 365 1/4 days, which is our year.

4. Is tilted on its axis as it revolves around the Sun. This tilt causes ~~day + night~~ seasons

C. **Planets**:

1. Look very much like stars when seen by the naked eye.

2. There are 9 planets in our solar system. (Counting the earth.)

3. Ancient astronomers recognized planets were different from the stars partly because of planetary motion which showed ~~them~~ the planets in different constellations each night + planets seemed to move backwards

IV. The **Moon**:

A. is made of rock and iron.

B. Describe the atmosphere, water and life on the moon. none of all

C. Describe the gravity of the moon. 1/6 that on earth

D. Give 3 theories of the Moon's origin. (1) a meteor hit earth matter broke off (2) the moon formed at the same time and w/ the same matter of the earth. (3) The moon was a small planet captured by the earths gravety

Know #5

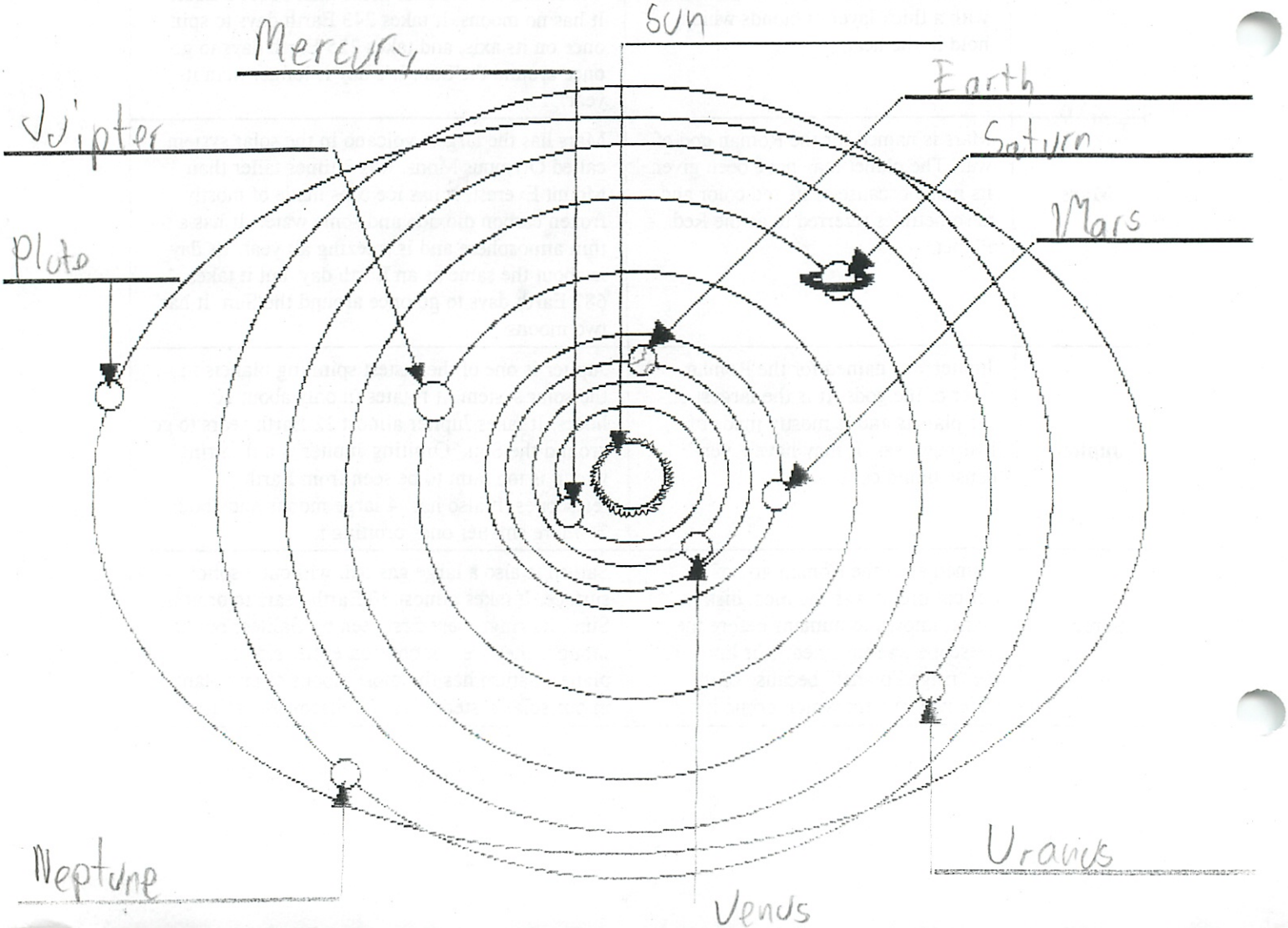
Michael Plasmier

MEET THE PLANETS

This chart is filled with fun and unusual facts about the Solar System. Study the chart to complete the exercises that follow.

Body	Fast Facts	Did You Know?
SUN	The Sun is not a planet. It is a star just one out of 100 billion in our Milky Way galaxy. It holds our nine planets in orbit around it by its powerful gravitational force.	The Sun is a giant ball of burning gas (75% hydrogen,, 25% helium and about 0.1% metals.) It has been burning for 4.5 billion years and enough fuel remains for it to keep shining for about another 5 billion years. It contains 99% of all the matter in our Solar System.
Mercury	Mercury is the closest planet to the Sun. It is only a little larger than ~~our~~ Our moon. It zips around the Sun in just 88 days. It has no moon. It was named after the Roman messenger god with wings on his feet.	Even though Mercury flies around the Sun quickly, it rotates slowly on its axis. It takes almost 59 days for Mercury to spin once around. It has the greatest variability in surface temperature. It ranges from over 427°C when facing the sun and dips to as low as -185°C when facing away.
Venus Earth	Named after the Roman goddess of love and beauty, Venus is the brightest object in the night sky. It is similar to Earth in size. It is covered with a thick layer of clouds which hold in the heat.	Venus is the hottest planet with temperatures at the surface reaching 460°C and pressure 90 times greater than on Earth. No probe landing on Venus has survived for more than about 2 hours. It has no moons. It takes 243 Earth days to spin once on its axis, and takes 225 Earth days to go once around the Sun. It's day is longer than its year!
Mars	Mars is named for the Roman god of war. The planet may have been given its name because of its red color and is sometimes referred to as the Red Planet.	Mars has the largest volcano in the solar system, called Olympus Mons, it is 3 times taller than Mount Everest. Mar. It has ice caps made of mostly frozen carbon dioxide and some water. It has a thin atmosphere and is freezing all year. Its day is about the same as an Earth day, but it takes 687 Earth days to go once around the Sun. It has two moons
Jupiter	Jupiter was named for the Roman ruler of the gods. It is the largest of the planets and is mostly made of hydrogen gas. It may have a very dense liquid core.	Jupiter is one of the fastest spinning planets in the solar system. It rotates in only about 10 hours. It takes Jupiter almost 12 Earth years to go around the Sun. Orbiting Jupiter is a thin ring which is too faint to be seen from Earth telescopes. It also has 4 large moons and about 24 more smaller ones orbiting it.
Saturn	Named after the Roman god of agriculture, it was the most distant planet known to humans before the telescope was invented. It is know as the "ringed planet" because of the wide ring system which orbits it.	Saturn is also a large gas ball without a solid surface. It takes almost 30 Earth years to orbit the Sun. Its rings were first seen by Galileo, but he thought they were moons on either side of the planet. Saturn has the most moons of any planet in our solar system, with 30 discovered so far.

Body	Fast Facts	Did You Know?
Uranus	Uranus was named after the ~~Roman~~ Greek god of the heavens. It was discovered in 1781 by a British astronomer. It is another giant gas ball, which has thin rings around it.	Uranus spins sidewise as it rotates around the Sun in 84 Earth years. It has one pole which faces the Sun for 42 years, while the other is in darkness for the same time. It is composed of mostly hydrogen and has 21 known moons.
Neptune	Neptune was named for the Roman god of the sea. It is the last gas ball planet and was discovered in 1846. It is made of mostly methane gas, and has thin rings and at least 8 moons.	Neptune takes almost 164 Earth years to revolve around the Sun. It takes light from Neptune about 4 hours to get to Earth. It is the farthest planet we have flown space probes past. Although it is much larger than Earth, because it is all gas, Neptune's gravity is almost the same as the Earth's.
Pluto	Pluto was named for the Roman god of the underworld. The smallest, coldest planet in our solar system, it is a ball of rock and ice.	Pluto was discovered in 1930 and has the most angled orbit around the Sun of all the planets. It takes 248 Earth years to go around the Sun. For 20 years of its orbit, it is closer to the Sun then Neptune. Pluto has one moon which is half the size of Pluto. It is the only planet not visited by a space probe.



Name Michael Plasmeier

Date 2/20

Answer the following questions using the chart.

1. If you were staying on Mercury for one week, how long would that be in Earth days? 413 days

2. Why does Mercury's temperature vary so greatly? It varies because Mercury is close to the sun + takes long to rotate has no atmosphere

3. Why can't we ever expect to explore Venus with astronauts? We can't expect because the pressure and temperature is too great

4. What is so unusual about the length of a day on Venus? The lenght of a day is longer then a year

5. Why is Mars one of the only planets we probably CAN someday hope to visit?
It is close, has a thin atmosphere and might have water is solid not too hot

6. Why do you think it takes Mars longer to go around the Sun than it takes Earth?
It is farther away

7. Why can't astronauts ever hope to walk on Jupiter? It is made of gas too much preasure

8. Hydrogen is an explosive gas on Earth. If we sent a bomb to Jupiter, do you think we could blow it up? Why or why not?
No oxgen
Yes it might blow up, or the gas might be too thick with no other matter around

9. Why didn't the ancient sky observers know that Saturn had rings around it?
The rings were too faint + too far

10. How many of the planets are known to have rings around them? ? 4

11. Which planet is sometimes is farther from the Sun then Pluto? Neptune

12. Why do you think it takes so long for Pluto to go once around the Sun? It is so far away from the sun

13. If you were a Plutonian, and today was your birthday, in what **Earth** year would you have been born?
~~1983~~ 1756

Michael Plasmeier

Astronomy Internet Links

There are many websites that have interesting Astronomy information. I have created a list of some interesting and easy to use sites. To access these sites, please follow the following steps.

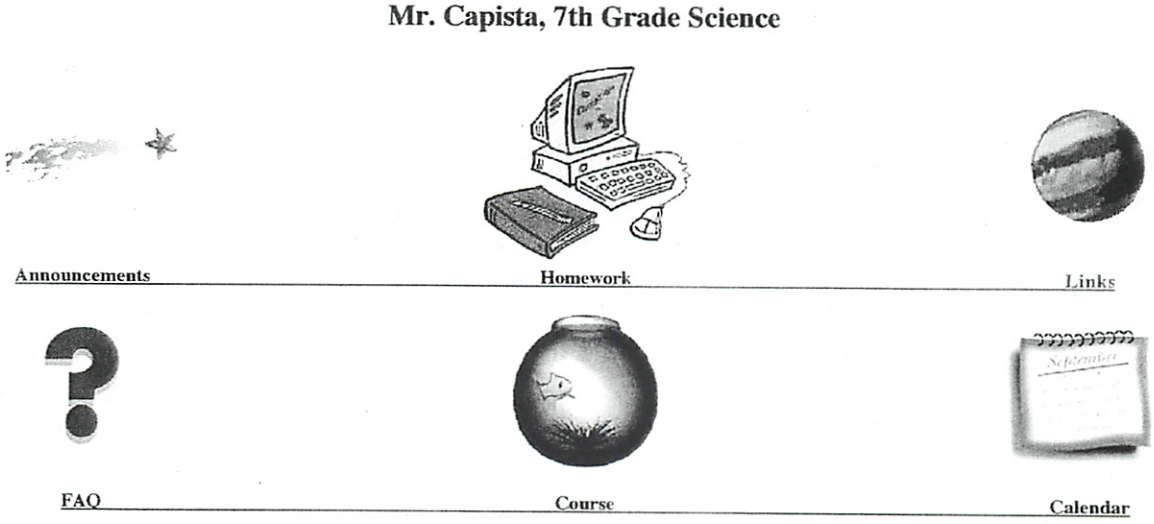
1. Go to Haverford Middle School Website at:

   http://www.haverford.k12.pa.us/hms/

2. Click on the **Teacher Pages.**

3. Click on **Seventh Grade**

4. Click on **Mr. Capista.** This will bring you to my web page which will look like:



5. Click on the spinning planet (Jupiter) which say **Links** below it. This will bring you to the websites I have selected. Try visiting some of them to see what they are like.

6. For a **sky chart** of constellations, planets, sun and moon for Havertown on any day, visit the site called **Heavens Above**, which is number 1 on my list. To get to the star chart, scroll down to **ASTRONOMY** and select "**whole sky chart**." You can change the times, days or size of the map. Before printing it, make sure to select "black on white" - or else you will use up lots of black ink.

7. Look for positions of the moon and the planets. If you change the day to later in the week, you can watch how the moon will move through the constellations over time.

Science Quiz Chapter 19

Name Michael Plasmeier
Date 2/18

A. For # 1-4 Choose a Greek Scientist from those listed below. You may use a name more than once.

ARISTOTLE **ARISTARCHUS** **PTOLEMY**

1. Aristarchus Believed in a "heliocentric model" of the universe.
2. Aristotle Believed all matter was made of 4 elements.
3. ptolemy Explained retrograde motion of planets by assuming that they moved in small circles as they orbited Earth in larger circles.
4. Aristarchus Believed Earth's rotation caused day and night.

53 A+

B. Answer the following true/false questions by writing TRUE or FALSE on the line.

great

1. T The Sun appears to rise in the east and set in the west each day.
2. F The Sun is lowest in the sky during the Summer.
3. F It takes Earth 7 days to revolve around the Sun.
4. F Our solar system has 10 planets (counting the Earth.)
5. F Today we believe a geocentric model of the universe is most logical.
6. T We always see the same side of the moon from Earth.
7. F Aristarchus' ideas about the universe were considered to be true for about 1500 years after he died.

C. Answer the questions on lines provided.

1. Describe a "geocentric model" of the universe. A geo centric model is where the earth is the center of the universe.

2. Describe two theories about the origin of the moon.

1. The moon was a small planet trapped by the earth's gravety. 2. A planet or more slammed into the earth sending matter to the sky. The matter then lumped together to form the moon

(OVER)

3. Describe the moon's gravity. 1/6 that on earth

4. How could ancient astronomers recognize planets as different from the stars?

They would see the planets seem to move across the sky

5. Describe the atmosphere of the moon. No atmosphere

Extra Credit (3 points)

Describe how Aristotle would have explained the speed of falling objects and why they fell the way they did.

We would say that heavier matter had more earth in it. The earth would want to fall to where its most perfect state was. That would be the center of the earth. Lighter objects have more air in them so the air also wants to go to its most perfect state (up in the sky) so the air and earth "battle" or who gets to go the the most perfect state. Earth wins so the object falls. The air still wants to go up, so a object with more air falls slower

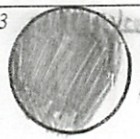
+3 good

Michael Plasmeier

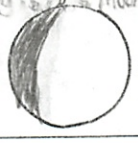
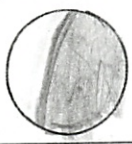
Moon Chart

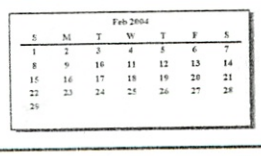
February 2004

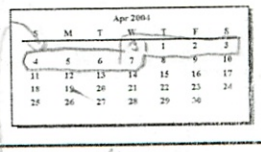
Sun Mon Tues Monthly Planner Th. Fri Sat

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20 New Moon	21
22 	23 	24 	25 	26 	27 	28 
29 						

March 2004

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 	2 	3 	4 	5 	6 
7 	8 	9 	10 	11 	12 	13 
14 	15 	16 	17 	18 	19 	20 
21 	22 	23 	24	25	26	27
28	29	30	31			





Printed by Calendar Creator for Windows on 2/22/2004

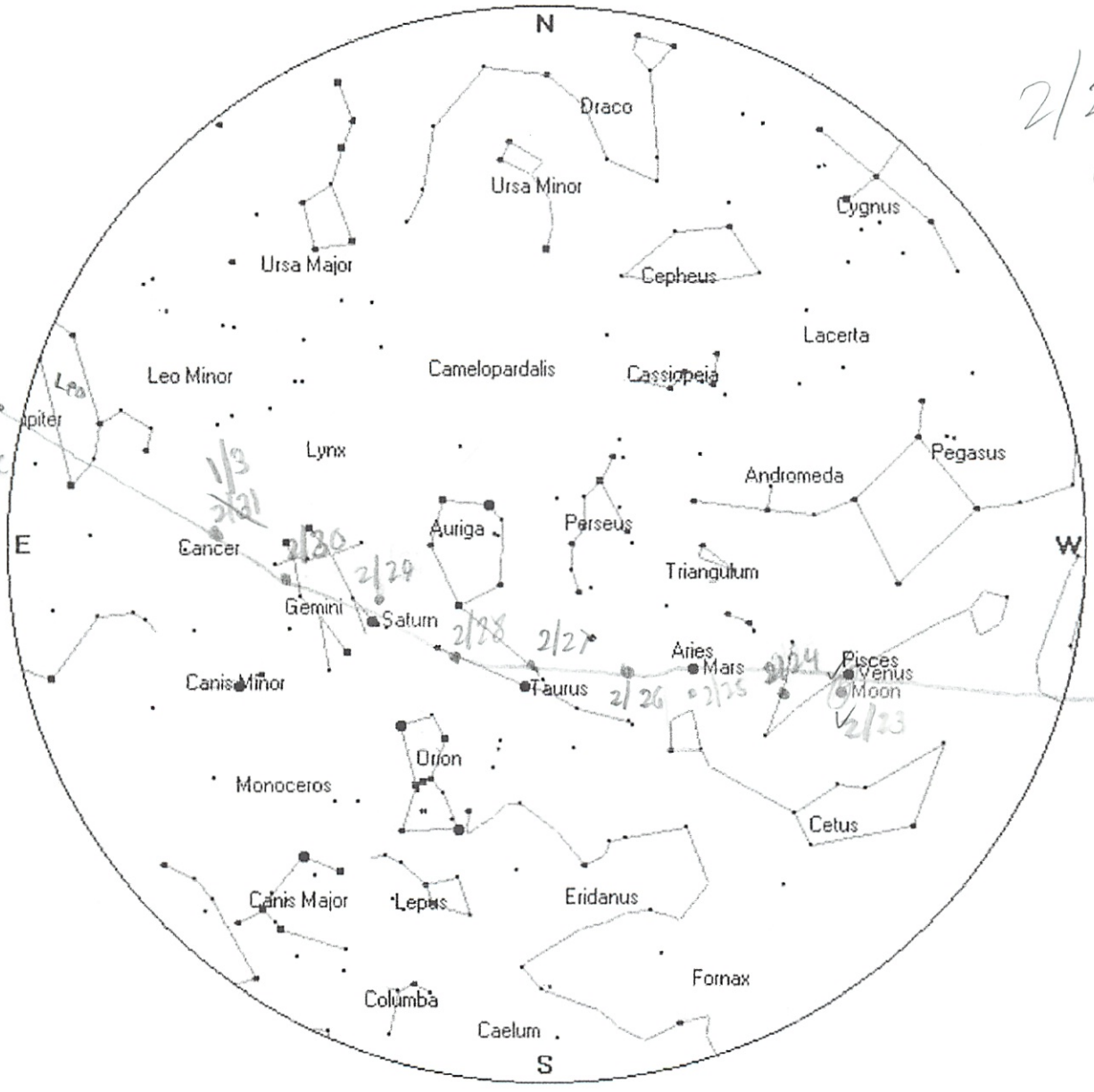
Vacation

Moon cycle = 27.3 days

Waxing moon: growing moon

Waning moon: growing smaller

Sky Chart



2/23/04
6:11 PM

Plane of Ecliptic

Date/Time (Local Time)

Year: 2004 + - Month: 2 + - Day: 23 + - Hour: 18 + - Minute: 11 + -

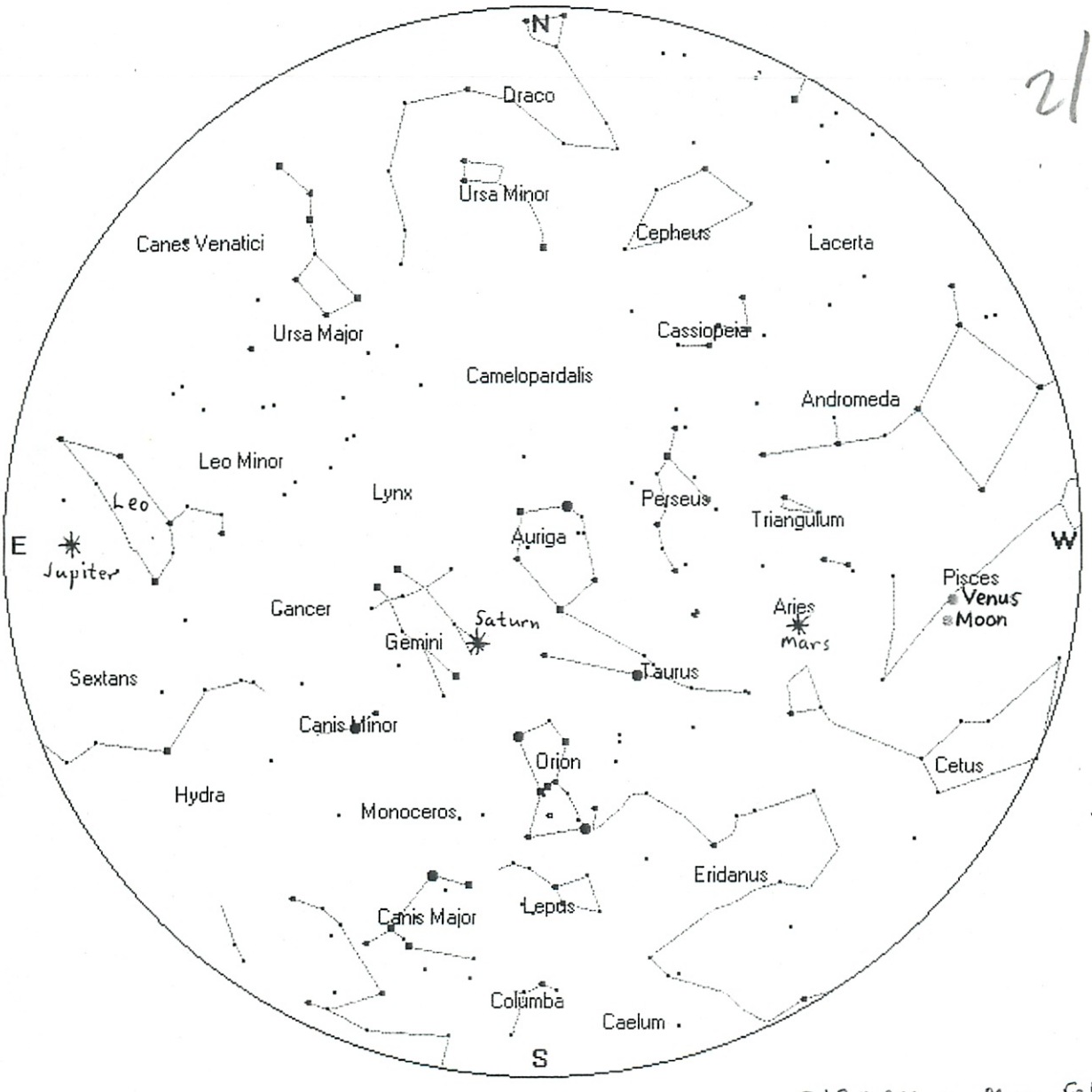
Other options

Lines ☑ Names ☑ | Black on white ◉ Coloured ○ | Size: 600

Submit

Sky Chart

2/23/04
7:30PM



7:30 pm - Mon. Feb 23, 2004

Date/Time (Local Time)

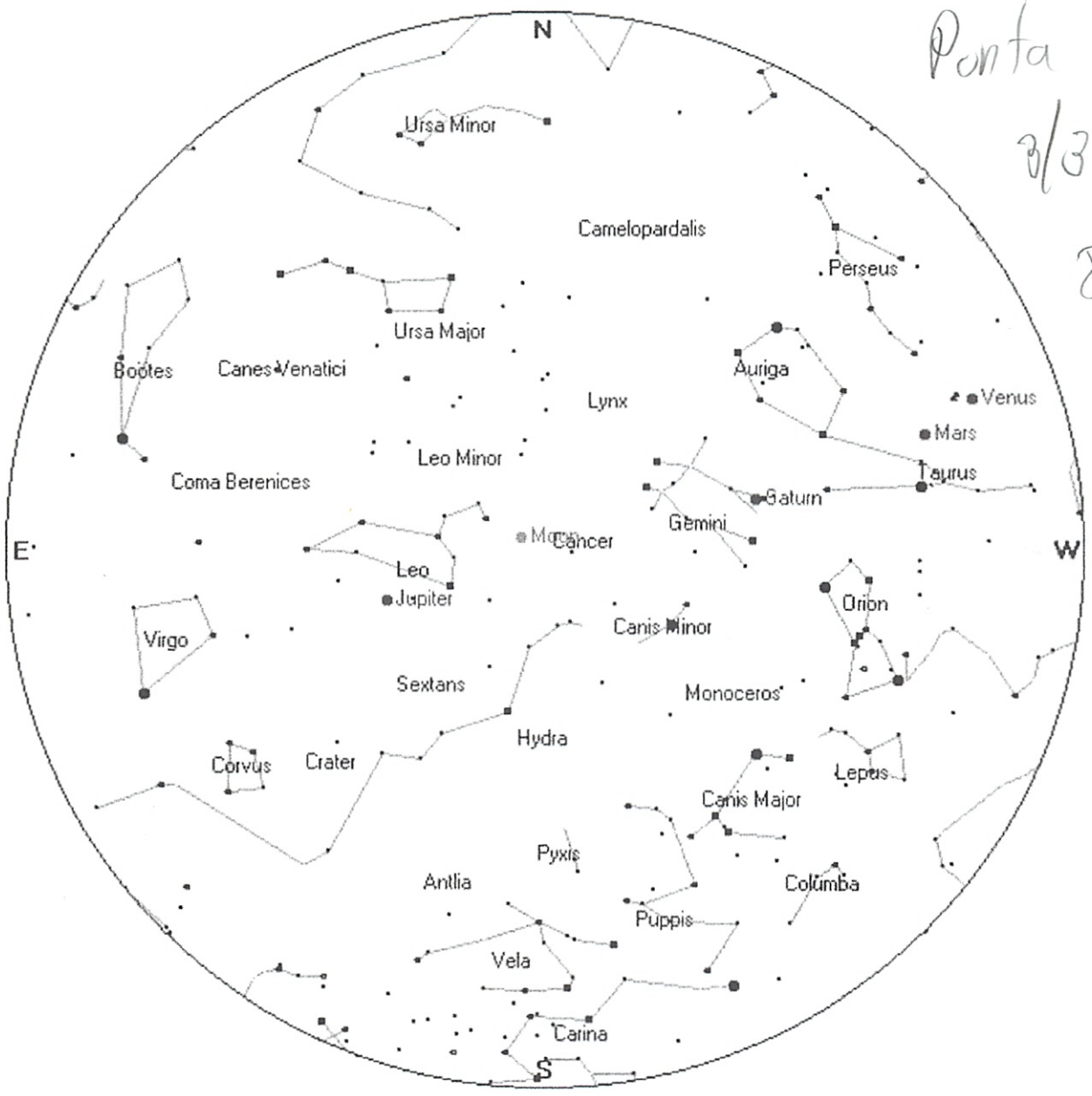
Year: 2004 + - Month: 2 + - Day: 23 + - Hour: 19 + - Minute: 30 + -

Other options

Lines ☑ Names ☑ | Black on white ◉ Coloured ○ | Size: 600 | Submit

Sky Chart

Punta Cana
3/31/04
8:00 PM



Date/Time (Local Time)

Year: 2004 + - Month: 3 + - Day: 31 + - Hour: 21 + - Minute: 0 + -

Other options

Lines ☑ Names ☑ | Black on white ◉ Coloured ○ | Size: 600

Submit

pS152-154

Michael Plasmeier (10) 2/24

1. Galileo
   In 1609 Galileo used his telescope to look at the sky.
   He made very important discoveries
   He saw mountains on the moon and 4 moons of Jupiter.
2. Isaac Newton
   He made the 1st refelcting telescope, that uses mirrors not lenes
   This telescope let him see better.
   The worlds larged telescope is a refelcting telescope in Hawii
3. Radio Telescopes
   ((telescope that collects radio waves that stars emit.
   little radio waves are lost unlike light we can see.
   Scientist have linked telescopes making them seem as big as the earth.

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PLOT THE PLANETS

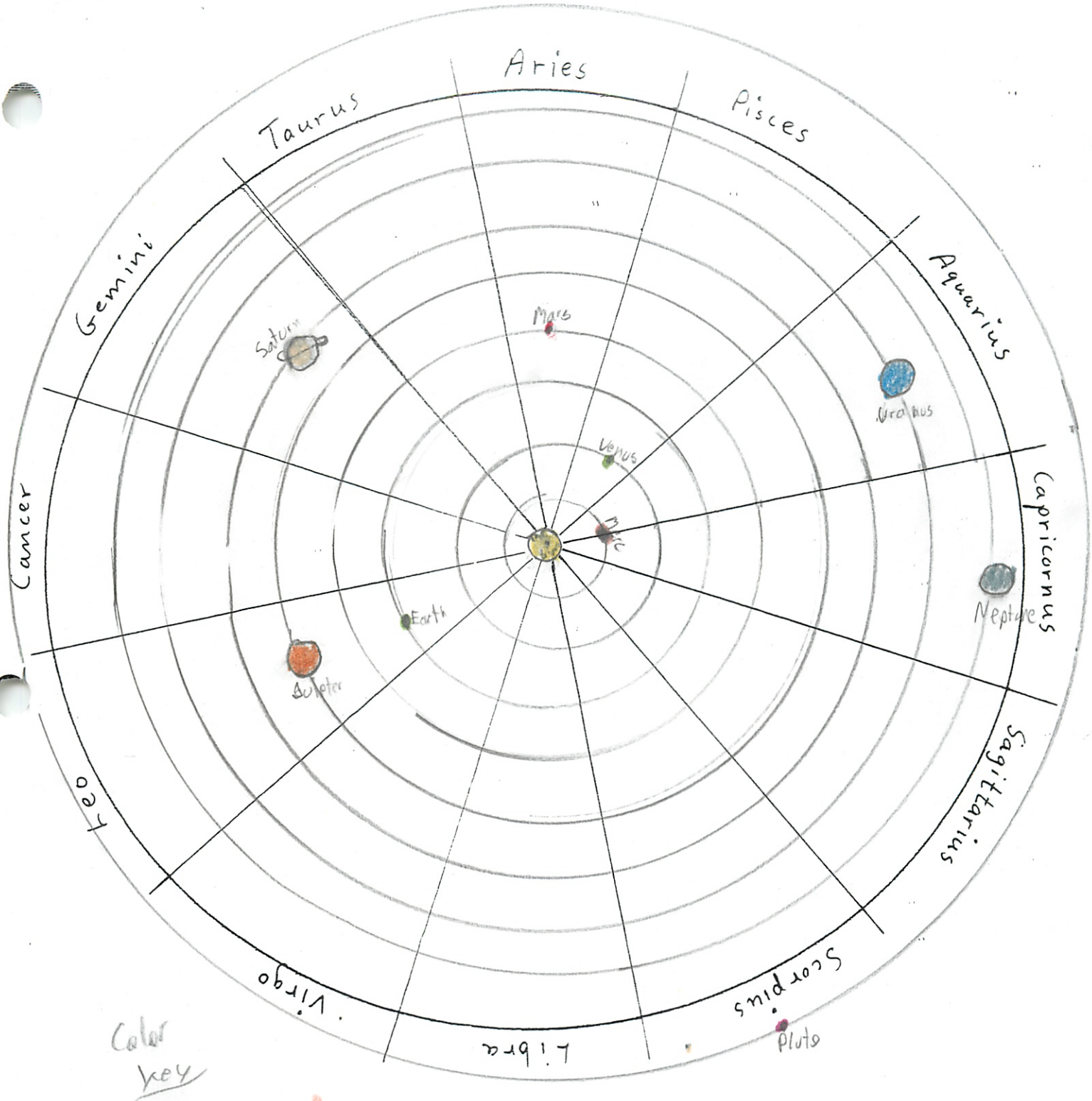
1. The Sun is at the center of the diagram

2. The constellations at the edge are known as the zodiac, and the Sun, moon and planets all "appear" to move through them during the year.

3. Using the chart below, draw circles with your compass to represent the orbits of the planets: ~~Mercury, Venus, Earth, and Mars~~. The orbits should be measured from the center (Sun) and drawn ~~to scale~~ using the measurements given on the chart.

4. After drawing the orbits, draw small circles to represent the planets in their proper constellations.

Planet	**Position on the Ecliptic**	**Distance from Center (cm)**
Mercury	Capricorn / Aquarius	1 cm
Venus	Pisces	2 cm
Earth	Leo	3 cm
Mars	Aries	4 cm
Jupiter	Leo	5 cm
Saturn	Gemini	6 cm
Uranus	Aquarius	7 cm
Neptune	Capricorn	8 cm
Pluto	Scorpio	10 cm



Color key

Mercury
Venus
Earth
Mars
Jupiter
Saturn
Uranus
Neptune
pluto
The Sun

Michael Plasmeier

Kepler's Puzzle

(10) good

p 449

2/26

Kepler was an astronmer who tried to make a shape the planet rotated around the sun. He at first tried to have the planets go around in perfect circles. However, no matter how hard he tried no perfect circles would work. He tried a ellipse or a non-perfect circle and that worked. He did not like ellipse because he thought that circles were perfect and nature was perfect. The ellipse help Kepler discover that the planets are held by a planets gravitational pull.

Michael Plasmeier

Study
Very Imp

CHAPTER 20 – ***"The Earth Moves"***

1. Constellation- A group of stars that form a pattern
2. Zodiac - The 12 constellation in the plane of the ecliptic
3. Plane of the ecliptic - The path or level that the planets the sun, the moon and the stars move on.
4. Revolution - The movement of a plant around the sun (ellipse)
5. Rotation - A planet spining on its axis.
6. Solar system - The sun the planets, and everything that orbits the sun
7. Copernicus (1473-1543) - A polish who proposed the heile-centric thory
8. Galileo (1564-1642) - One of the 1st to study sky w/ telescope. Saw phases of Venus, Moons of Jupter. Saw craters + mts on moon.
9. Retrograde motion - Planets appear to go backwards
10. Winter Solstice - 1st day winter; nath pole points away from Winter
11. Summer Solstice - 1st day summer, north pole points towards sun
12. Vernal Equinox - 1st day Spring; equal day + night
13. Autumnal Equinox - 1st day fall, equal day + night
14. Johannes Kepler (1571-1630) - German astronmer, discovered planets moved in ecliptical pattern
15. Ellipse - oval or a squashed circle
16. Isaac Newton- A scientist who invented the refelcting telescope

No Dates but need position

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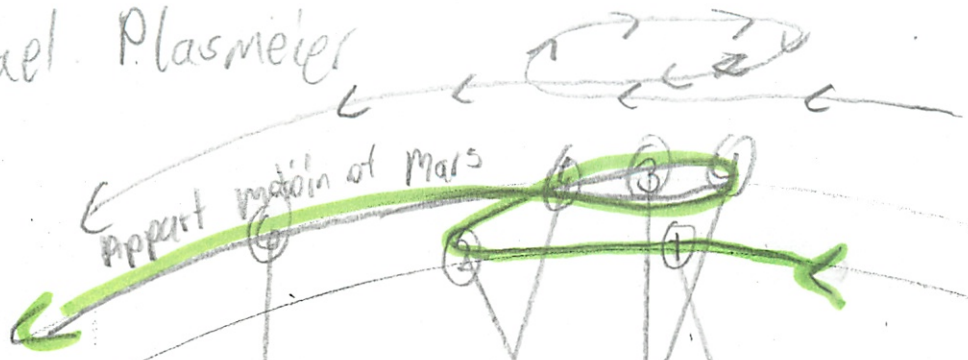
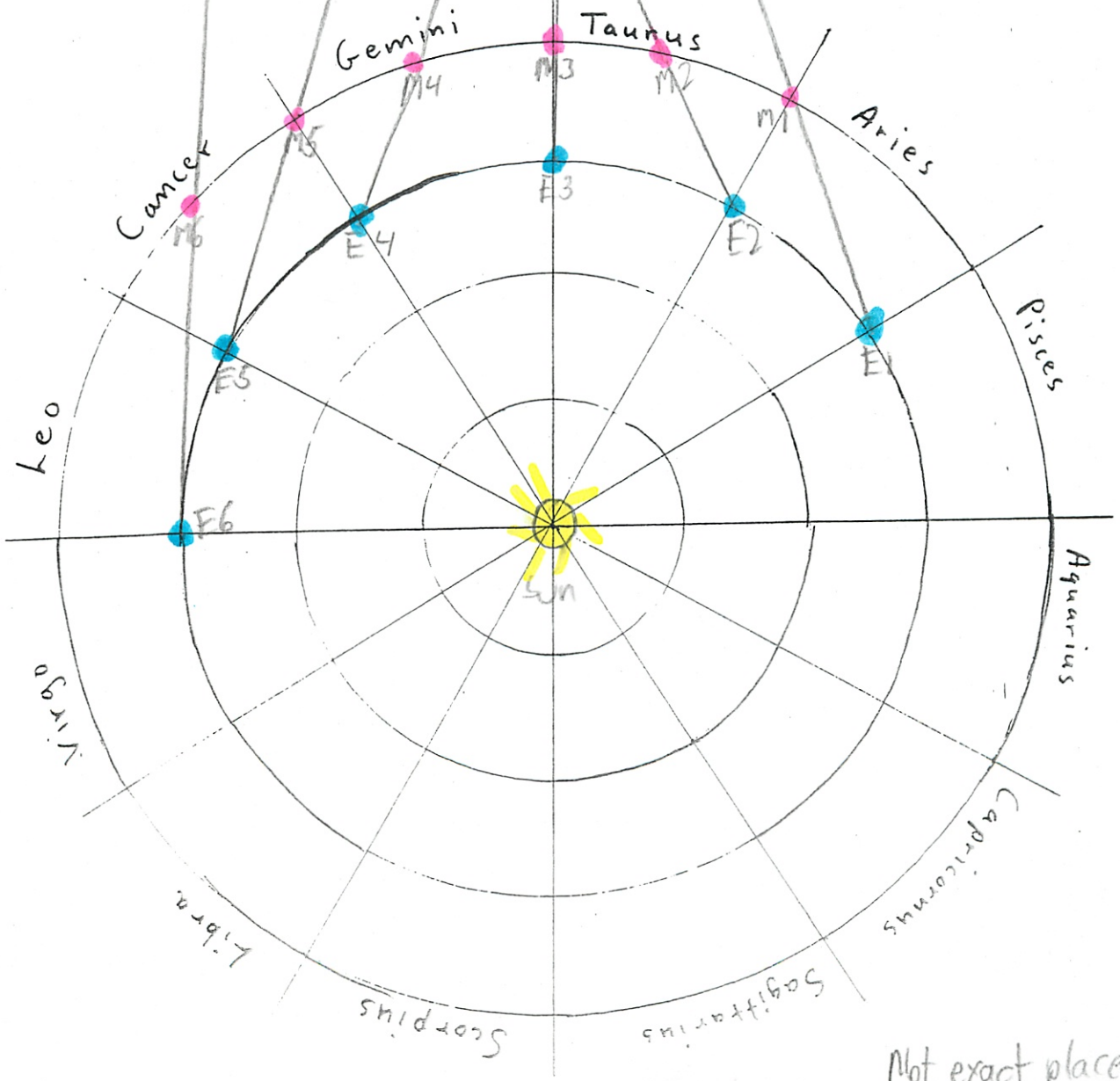


Retrograde Motion

Earth goes faster so Mars seems to go backwards



Not exact places

SEASONS

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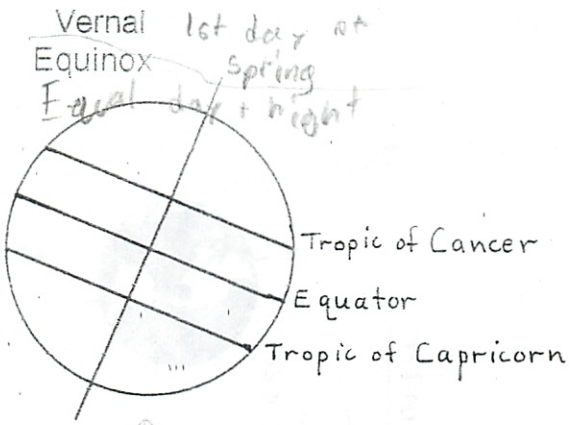
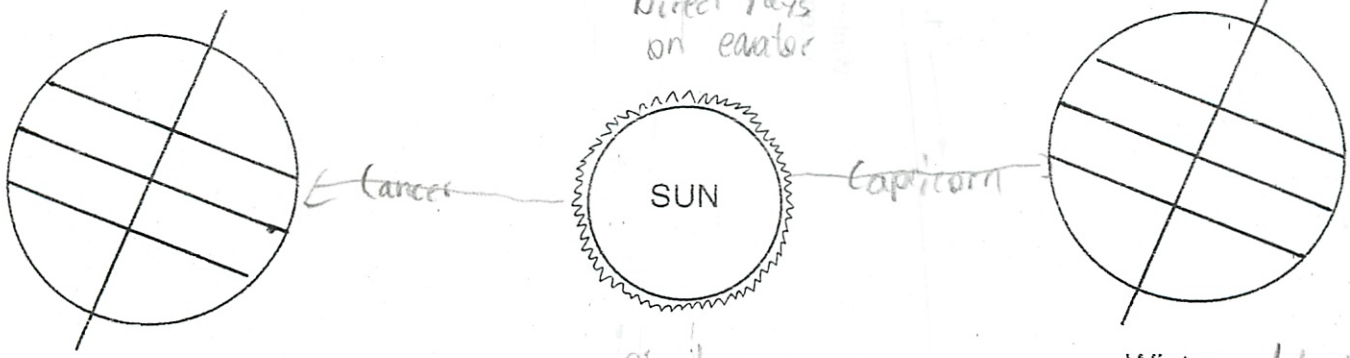


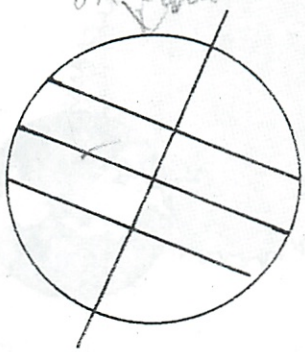
Direct rays on equator



Summer Solstice — 1st day Summer

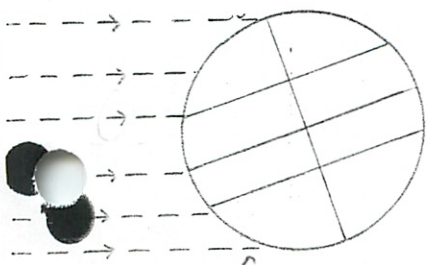
Winter Solstice — 1st day Winter

Direct rays on equator

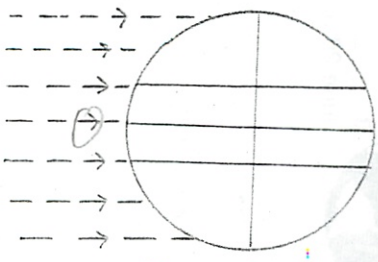


Autumnal Equinox — 1st day of Fall

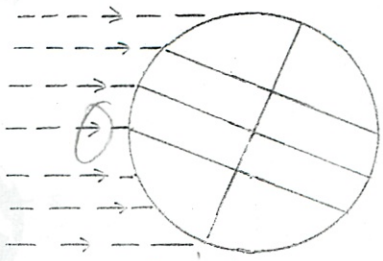
See back for 3-D



Summer solstice



Equinoxes

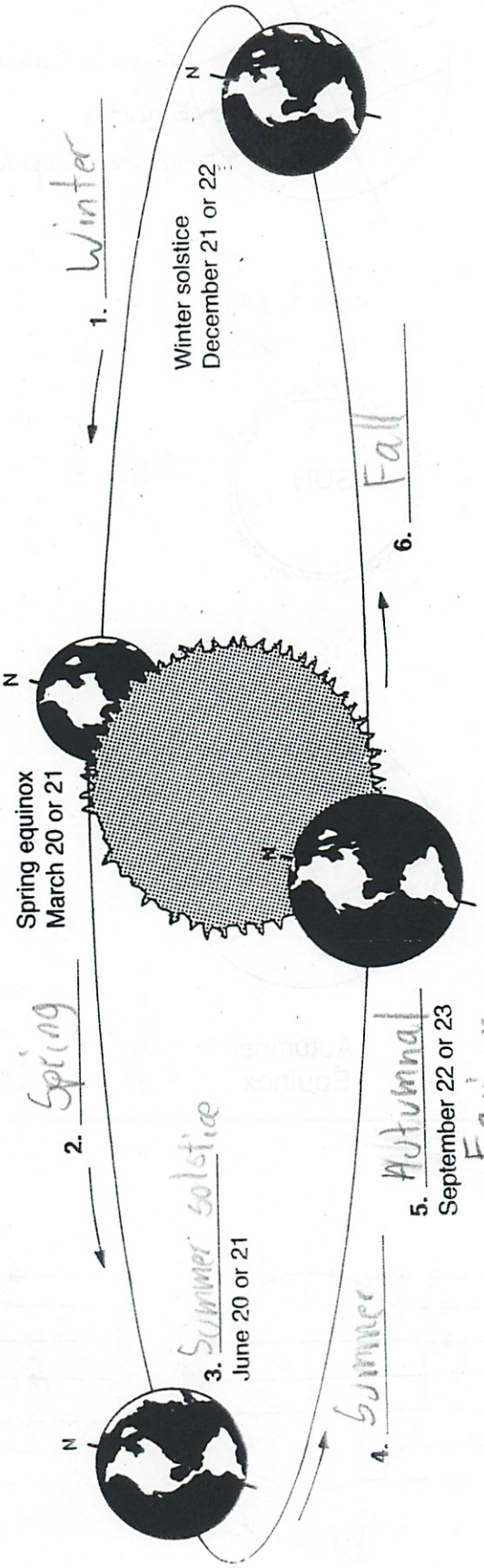


Winter solstice

Name _____ Date _____ Class _____

Chapter 20
Transparency Worksheet

The Seasons



Michael Plasmeier

The Four Seasons

A. Goal: Determine the number of days in each season for the year _____

B. Materials: Calendar for the current year.

C. Procedure:

1. Using the information below and your calendar, count the number of days in each season and record them on the chart.

2. Answer the questions and complete the diagram.

D. Season Date:

SEASON	BEGINS	# OF DAYS
Winter	December 22, 2003	89
Spring	March 20	93
Summer	June 21	93
Fall	September 22	91

last day of Fall - December 21, 2004

Total days 366

1 10 31 29 19 = 89

12 30 31 20 = 93

10 31 31 21 = 93

1/4 31 30 21 = 91

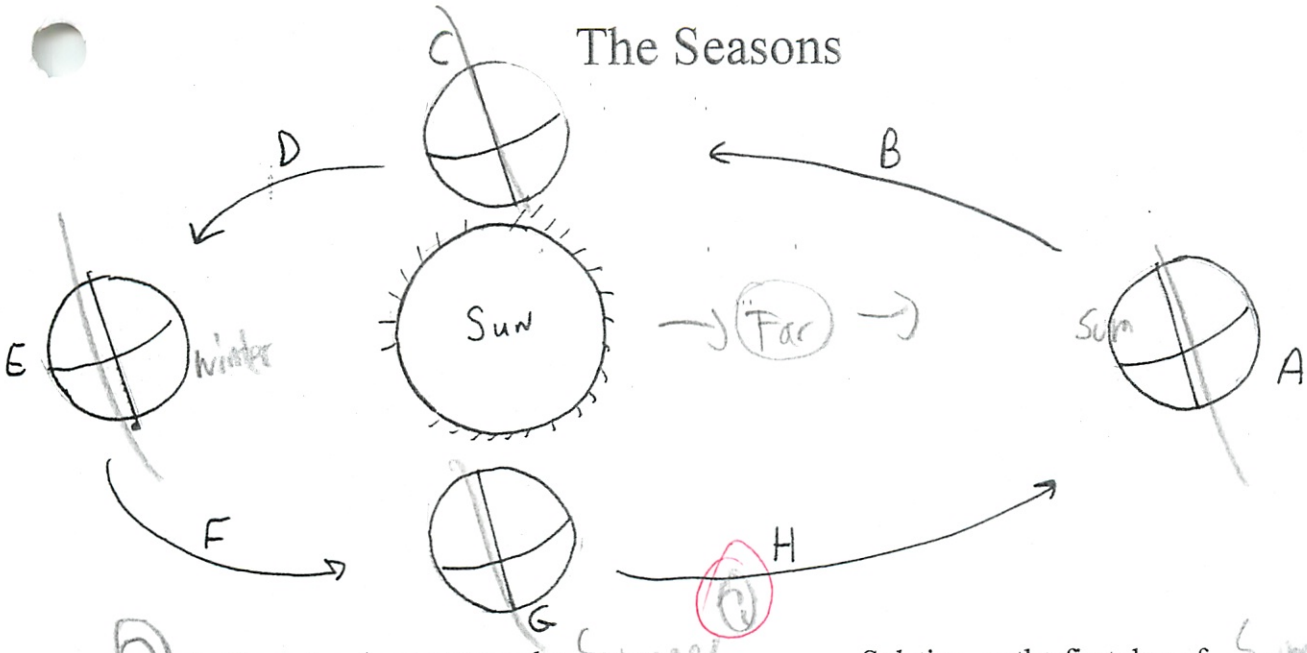
89 93 93 91 = 366

E. Questions:

1. Are the number of days the same in all seasons? No

2. Can you think of a reason why? The tropics ~~may not be equally spaced or the roundness of the days. It might also be~~ is because the distance of the sun + earth changes Earth moves faster when closer to sun due to ellipt

The Seasons



1. The letter A represents the Summer Solstice, or the first day of Summer

2. What season is indicated by the arrow at B? Summer

3. Letter C represents the ~~Vernal~~ Autumnal Equinox, or first day of Fall

4. Letter D is what season? fall

5. Letter E is the Winter Solstice, or first day of Winter.

6. Letter F is what season? Winter

7. Letter G is the Vernal Equinox, or first day of Spring.

8. Letter H is what season? Spring

9. During what season (s) is the Earth closest to the Sun? Winter

10. During what seasons is the Earth moving fastest around the Sun? B or H / part F

11. Give 2 reasons why the Earth is warmer in Summer than in Winter?

more direct rays

longer day night

Name Michael Plasmeier Date _____ Class _____

EXPLORATION 3

Chapter 20 Exploration Worksheet

Investigating an Ellipse, page 450

Your goal	to answer the question, Why does the brightness of Mars vary?	Safety Alert!

You Will Need

- a sheet of corrugated cardboard or a stack of several sheets of cardboard
- unlined paper
- 2 pushpins
- a 40 cm piece of string
- a metric ruler

What to Do

1. Press the pushpins into a sheet of unlined paper that has been placed on top of the cardboard. Loosely tie the string around the pushpins, as shown in the photograph below.

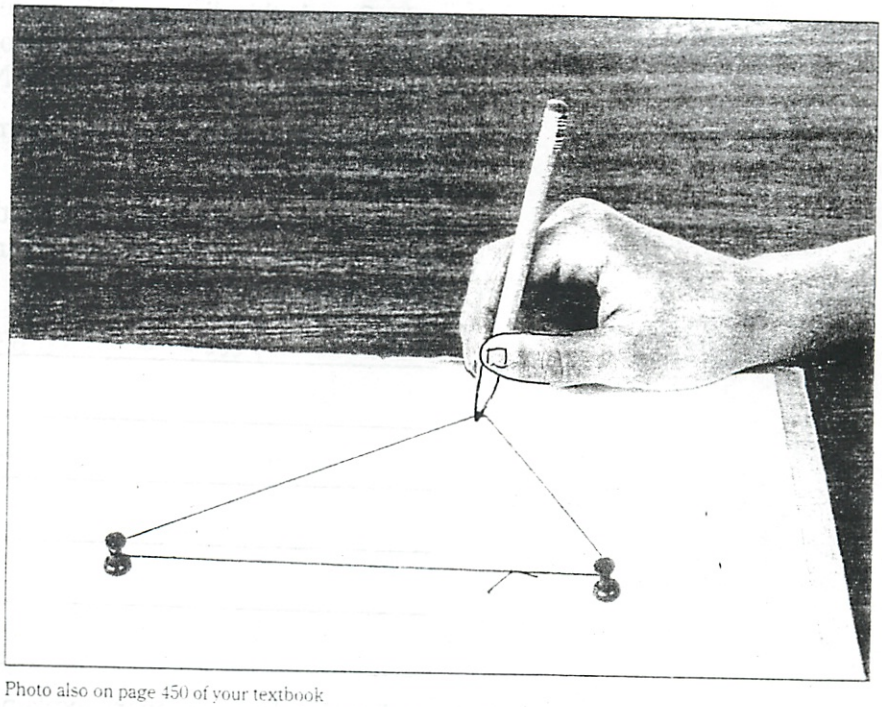


Photo also on page 450 of your textbook

Place a pencil through the string and trace out an ellipse. Your tracing is the shape that planets travel as they orbit the Sun. Using the same piece of string, can you make ellipses with different shapes? How?

Move Pins

Chapter 20

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Name _____ Date _____ Class _____

2. Measure the long axis of several ellipses. What is the relationship between the positions of the pushpins and the shape of the ellipse? How must the pushpins be positioned to make a circle?

Pins closer = more of a circle + bigger

Put pins on top of each other

3. At the position of one of the pushpins, draw a diagram representing the Sun. This location is a focus of the ellipse. (The plural of focus is *foci*. An ellipse has two foci.) When Earth is closest to the Sun, it is 147 million kilometers from the Sun. At this distance, it is winter in the Northern Hemisphere. At its farthest distance, it is 152 million kilometers from the Sun. Earth reaches this position during the summer in the Northern Hemisphere.

   a. Place this information on your diagram. Label the summer and winter positions of Earth.

   b. How do you explain that when Earth is closest to the Sun, it is winter in the Northern Hemisphere? (Think of what you found out at Position 1 in Exploration 2.)

North pole is tilted away from sun = winter
- less direct rays
- shorter day light hrs

4. How does Kepler's discovery explain why Mars changes in brightness as seen from Earth?

It changes distance in between

5. Through his observations, Kepler made another discovery about planets moving in their elliptical orbits: The planets do not move at constant speeds. A planet's speed increases as it gets closer to the Sun. Compare the speed of Earth in its orbit during spring, summer, fall, and winter. If Earth's orbit were circular, what might you infer about its speed?

Moving faster in fall + winter because of longer distance

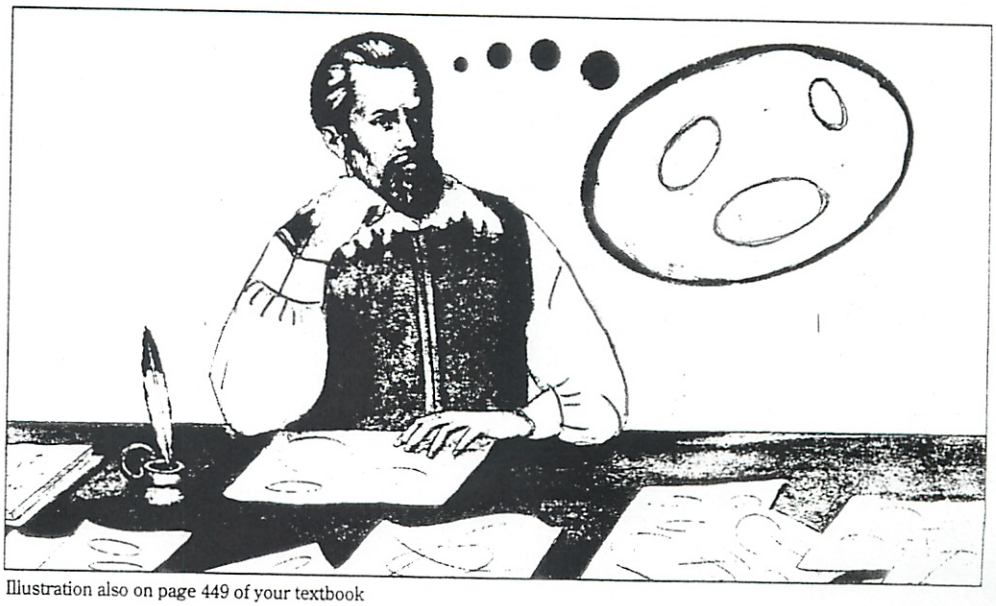

Illustration also on page 449 of your textbook

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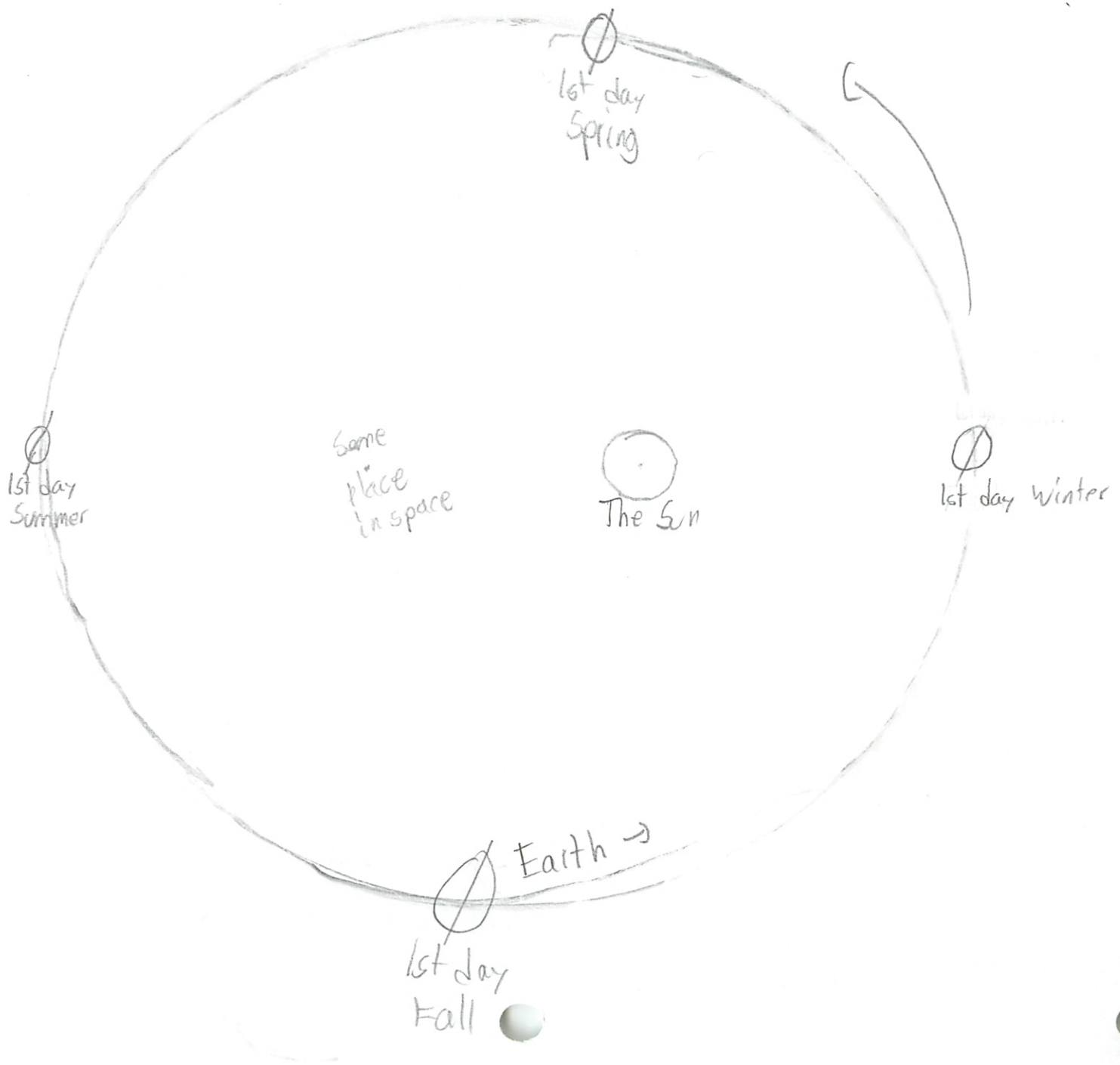

1st day
Spring
1st day
Summer
Same
place
in space
The Sun
1st day Winter
Earth →
1st day
Fall

Michael Plasmeier

Science Chapter 21 **EXPLORING THE SOLAR SYSTEM** (pages 454-459)

A. Science Log Questions (p. 454)

1. The might have been called this because they were bright and had a long tail that looked like hair.
2. The trip would probbly take 4 years. You would see other planets and the astroid belt along the way. Depends on when you go.
3. It is similar because it revolves around the sun + rotates on its axis. Human will live on other planets but is covering and protection. They already live in the Space Station

Vocabulary Words:

1. Meteor- A piece of rock or iron that may enter the earths atmosphere
2. Meteorite - A meteorite that reches the surface of the Earth
3. Crater - A hole in the ground formed by Meteorite
4. Comet - A large mass of frozen ice, gasses, pebbles, dust that orbits the sun
5. Asteroid - Large rock or boulder that orbits the sun. Asteroid Belt between Mars + Jupiter

p476 Stars

4/10

1. What is a red giant?

A large red star near the end of its life. When smaller star nears the end of its life, it expands to a red giant. Then the star collaspes to a white dwarf.

2. How are netron stars and black holes formed?

Netron stars are formed when big stars turn into super giants and then collapse. The smallest netron star is a very dence piece of matter. When an even bigger star collaps a black hole forms where not even light can escape.

3. What is a super nova?

A super nova occures when a big star collaps into it self at the end of its life. A super nova is visable for 1-2 years and comes after a red giant

4. How do stars produce the light and energy they give off?

Stars produce energy because the great preasure make H and other elements blow up and in a nuclear reaction

-Sort of forgot this one, I am doing this 1½ after you taught it.

5. What is the eventul fate of the sun?

Our sun will eventuly increase in size to become a red giant. It will then collapse to a white dwarf.

6. What is the relasionship between the mass of a star and how it will end.

The relasionship is that a large star will end as a supernova and then turn to a netron star or black hole. A small star will end only as a bite dwarf.

Michael Blasmeier

Science Chapter 21 Assignment ***PLANETARY COLONIZATION***

Read about Venus (page 464) as well as information on other planets from the chart on page 465.

1. Describe reasons that scientists think **Mars** is the most logical planet for human colonies. In your description, include problems that would prevent colonies on planets other than Mars.

Mars is a good choice because Mars is the closest, most earth-like planet. Venus is too hot. Jupiter and the other gas planets there is nowhere to land on. Pluto is too far away and too cold. Mars also has frozen water and a small athmosphere.

2. Why should we want to establish colonies on other planets?

We would want to establish colonies for many reasons. First is research we may develope new medicin with the materials found there. Second, we could launch spaceships off there were less gravity is required. 3rd, we would do it because we can.

Michael Plasmeier

COMETS **What Are They?** (page 458-459)

A. Comet makeup:

1. Ice masses made of dust, frozen gasses
2. Tail forms as Vapor when the gases turns to steam near the sun
3. Seen by Earth observers when the gas glows and the partacps reflect and scatter light of the tail near the Sun

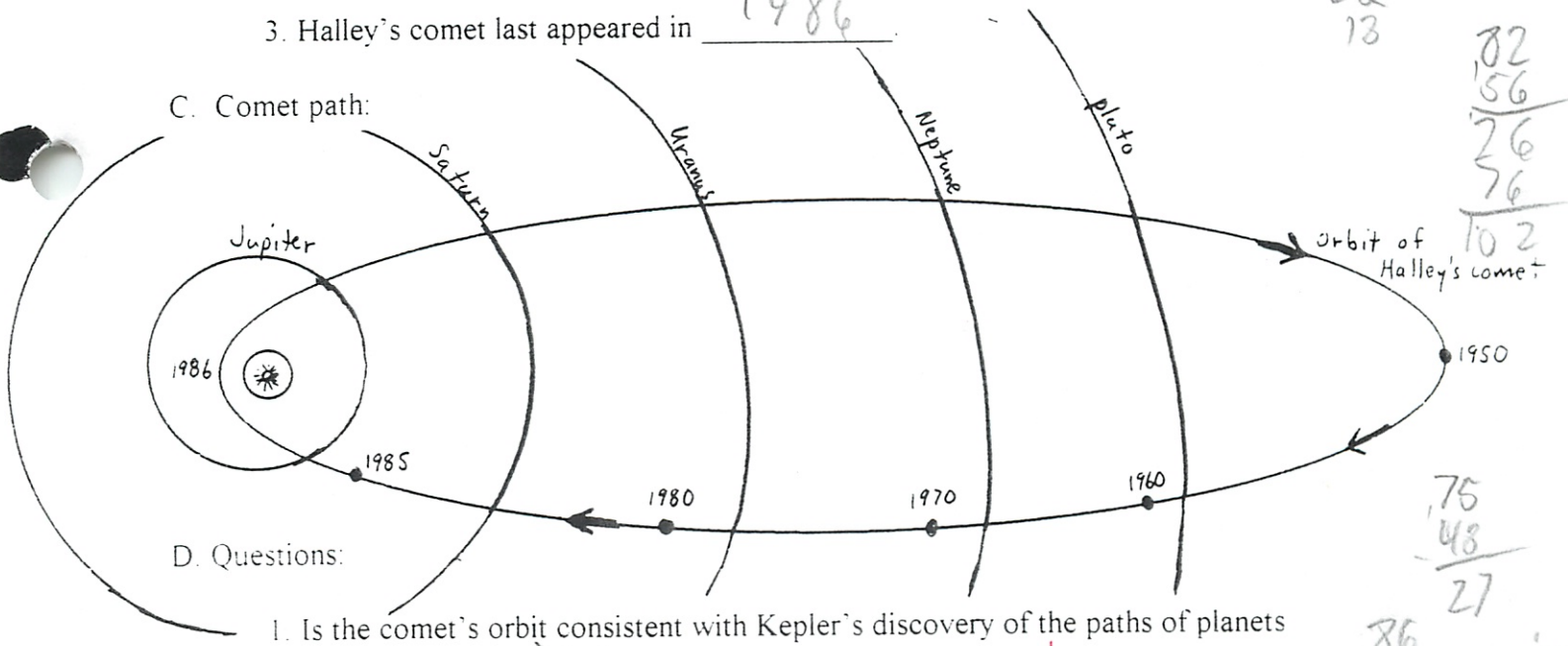
B. Edmund Halley (1656-1742)

1. Observed comet in 1682 and predicted its return 76 years later. 82 + 76 = 158
2. The comet returned as predicted in 1758 but Halley did not live to see it.

   (How old would he have been if he had lived to see it? 102) 86 − 58 = 28 → 13

3. Halley's comet last appeared in 1986. 82 + 56 = 138 → 76 + 76 = 152 → 102

C. Comet path:



D. Questions:

1. Is the comet's orbit consistent with Kepler's discovery of the paths of planets around the sun? Yes
2. At what point in orbit does the comet travel fastest? close to sun In 1950 (curves)

   Slowest? In 1970-1980 (straight part) far from sun

3. When will Halley's comet reappear to the unaided eye? ~~2066~~ 2062
4. Why can't it be seen with the naked eye now? It is to faint + far away, no tail

1975 − 48 = 27

1986 − 48 = 38 → 2028 + 38 = 2066

Comets
p459

Michael Plasmeier 10 3/8

1. Does the comets orbit apper to be constint with what Kepler said?

Yes it is similar to what Kepler said The comet travles in a very elecpical orbit around the sun.

2. Where in its orbit does the comit travel the fastest? the slowest?

faster: closer to sun

The comet travels the fastest when it is ~~goes around the bends, especially~~ near the sun. The comit goes the slowest when it goes ~~almost straight~~. straight

3. When will Halley's comet be seen again on earth?

The comet should come in about 62 years. 2062

4. Why can't you see Halley's comet with the naked eye?

You can't see it because it is too far away from earth

Michael Bloemer

Chapter 21 **SPACE EXPLORATION Outline**

I. Satellites - objects orbiting Earth or other celestial bodies.

A. **Sputnik I** (1957) - Worlds 1st satellite, launched by Russians

B. **Explorer I** (1958)- 1st sussful US satilight launch

C. Hundreds of satellites have been launched into Earth orbit in the last 40 years.

1. Up until early 1980's, all satellites were launched on rockets.

2. Rockets are still used to launch some satellites, however, the U.S. uses the Space shuttle for most launches today.

II. Manned Exploration

A. Yuri Gagarin (1961) - 1st human in space, Russian cosmonaut, made 1 earth orbit

B. **Mercury Program** (Early 1960's) - The US 1st manned Space program, each flight carried 1 astronauts

1. Alan Shepard (1961) - 1st american in space, made a 15 min sub-orbital flight

2. John Glenn (1962) - 1st Ameridn in orbit, orbited 3 times

C. **Apollo Program** (Mid 1960's - early 1970's) - The US program to land humans on the Moon.

1. Moon landing (1969) - Apollo 11 landed 2 astronauts on the moon

2. Neil Armstrong - 1st man on moon

3. Other moon flights - Were 6 different missions to the moon Apollo 11, 12, 14, 15, 16, 17

D. Space Shuttle (1980's - present) - Also known as STS (Space Transportation System). It is used to carry a variety of payloads into space. It can also carry astronauts and scientists in a space lab wherein experiments may be carried out.

1. Liftoff is like a rocket, but landing by gliding

2. Designed to be a reusable, reliable spacecraft.

3. The Space Shuttle cannot operate outside earth's orbit

E. Space Stations - Orbiting laboratories occupied by various sets of astronauts.

1. Mir - Russian SS, opperated for many years

2. Future plans - ISS (International Space Station)

III. Unmanned probes - to explore planets w/o humans

A. Flybys - flys bye planets, taking pictures

B. Orbiters - it orbits a planets for moping, checking temps.

C. Landers - land on a planet and takes soil analization

D. All planets in our Solar System have been explored by probes except Pluto

Name Michael Plasmeier

Would You Live in Space? (page 12 -18)

Science World Jan. 22, 2001

1. How do astronauts sleep aboard the ISS?
They zip up in sleeping bags + wear eyeshades
2. How does the ISS generate electricity? Through 3 large solar panels
3. How fast does the ISS fly around the Earth? 5 miles per second
4. How many astronauts will live in ISS at one time? 3
5. How far above the Earth does ISS orbit? 250 miles above
6. What are some physiological (health) problems that occur when astronauts are in space for a long period of time?
Bone loss (calcum) and muscle loss because of no walking
7. What is the food like? Dried / mostly solid
8. How is toilet water recycled? Dried or through electrict separation
9. What kind of wastes are dumped into space from the ISS? hydrogen gas
10. How much did the ISS cost to build and how many countries contributed to it?
16 nations 60 billion
11. The ISS costs millions of dollars each year to keep it functioning. Do you think we should continue to commit this much money to it? If yes, why?
Yes we are learning new things from this and it is better than spending it in Iraq

SPACE EXPLORATION TIME LINE

Create a time line of space exploration which includes dates (in a different color) and short descriptions of the following events. Use your text book (pages S154 – S156) and the handout, "**Space in Time**". For each event, place the date (year only) on the left followed by a short phrase describing the event. Draw a horizontal line after each event.

E 1900 1. Tsiolkovsky

20's 2. Goddard

40's 3. World War II German Rockets and rocket scientists

50's 4. Sputnik

5. Laika

6. Explorer I

7. Luna I

60's 8. Yuri Gagarin

9. Alan Shepard

10. John Glenn

11. Apollo 8

12. Apollo 11

13. Apollo 17

70's 14. Salyut 1

15. Skylab

16. Voyager 1 and 2 launches

17. Space Shuttle Columbia launch

80's 18. Voyager 2 Uranus pix

19. Challenger explodes

20. Voyager 2 Neptune flyby

21. Space Telescope

90's 22. Galileo probes

23. International Space Station

24. Columbia Shuttle lost

2000 25. Mars Rover

See front of book

Time Line is due on Wed

Name: _____

SPACE IN TIME

The race to explore space is recent! Most of it has happened in the last 50 years. Read the timeline below to learn about the events and people that have taken us to the moon and beyond. Then answer the questions that follow.

1926 Mar. 26—U.S. scientist Robert H. Goddard, "the father of the space age," launches the world's first liquid-fuel rocket. The rocket, fueled by gasoline and liquid oxygen, travels only 56 meters (184 feet).

1957 Oct. 4—The space race begins as the then Soviet Union sends up the first satellite, *Sputnik*, into Earth's orbit. It circles the planet for three months.

1958 Jan. 31—The first U.S. satellite, *Explorer 1*, is launched after an unsuccessful attempt in December 1957. It makes the first scientific discovery in space—the Van Allen radiation belts (bands around Earth that contain high-energy protons and electrons).

1959 Jan. 2—The then Soviet Union launches the *Luna 1* space probe, the first human-made object to fly past the moon and orbit the sun. Four days into the flight, its batteries run out and scientists lose contact with the craft.

1961 April 12—Soviet Yuri Gagarin (YOUR-ee Gah-GAH-rin) is the first cosmonaut in space, orbiting the Earth in a 108-minute flight aboard *Vostok 1*.

May 5—Astronaut Alan Shepard becomes the first American in space, completing a 15-minute flight in the spacecraft *Freedom*, soaring 115 miles above the Earth. (John Glenn orbits Earth eight months later.)

1962 Dec. 14—The *Mariner 2* space probe becomes the first space probe to visit and collect data from another planet, passing within 34,760 kilometers (21,600 miles) of Venus.

1963 June 16—Soviet cosmonaut Valentina Tereshkova (Va-len-TEEN-ah Ter-esh-COVE-ah) becomes the first woman in space, orbiting Earth 45 times over 71 hours in *Vostok 6*.

1965 July 14—The U.S. probe *Mariner 4* makes the first successful flyby of Mars, sending back the first close-up Martian photos from 55,700,000 kilometers (34,610,000 miles) away.

1968 Sept. 15—The unmanned Soviet *Zond 5* makes the first round-trip flight to the moon in seven days, though it doesn't land on the moon's surface.

Dec. 21—The three astronauts on *Apollo 8* are the first humans to orbit the moon and see its "far side," the side farthest from Earth.

1969 July 20—Astronaut Neil Armstrong becomes the first person to walk on the moon, spending 2 hours, 31 minutes on the surface. The *Apollo 11* mission takes eight days.

1971 April 19—The first space station, *Salyut 1*, is launched by the then Soviets. The three cosmonaut die when their spacecraft leaks air during reentry in June.

1972 Apollo 17 - last manned moon landing

1973 Skylab - America's first space station is launched. It proves that humans can live and work in space for extended periods of time. Skylab remains in Earth's orbit for six years. It is inhabited by three separate three-person crews that live there for periods of one to three months.

1977 Voyagers 1 and 2 are launched toward exploration of the outer giant planets.

Name: _____

1979 Sept. 1—The U.S. *Pioneer 11* makes the first flyby of Saturn, sending back close-up photos.

1981 April 12—The U.S. space shuttle *Columbia*, the world's first reusable spacecraft, is launched into orbit with a crew of two pilots.

1983 June 13—Eleven years after its launch, U.S. probe *Pioneer 10* flies out of our solar syste becoming the first spacecraft to do so.

June 18—Sally Ride is the first U.S. woman in space, serving as a mission specialist on the space shuttle *Challenger*. She helps to launch communications satellites and test the shuttle's remote manipulator arm.

1986 Jan. 24—U.S. *Voyager 2*, launched August 20, 1977, makes the first flyby of Uranus.

Jan. 28—U.S. space shuttle *Challenger* explodes 73 seconds after liftoff, killing all seven crew members including teacher Christa McAuliffe.

Feb. 20—The then Soviets launch the central section of *Mir*, the first permanently inhabited space station. (Cosmonaut Valery Polyakov completes a space endurance record—a 437-day, 18-hour mission aboard *Mir*, in 1995.)

1989 Aug. 24—U.S. *Voyager 2* makes the first flyby of Neptune, coming within 3,100 miles of the "gas giant" planet.

1990 April 25—The U.S. space shuttle *Discovery* deploys the Hubble Space Telescope, which sends back blurry pictures. The primary mirror is curved improperly. (Shuttle astronauts service Hubble in December of 1993, installing corrective optics.)

1995 **Galileo** probes (launched in 1989) reach Jupiter and spend months orbiting the giant planet. A small probe is released and parachutes into the thick atmosphere of Jupiter, sending back information for several hours before being destroyed by the pressure and heat of the gases.

1998 The first parts of the **International Space Station** are launched by a Russian rocket and the U.S. Space Shuttle. They are linked in space by astronauts from the Shuttle on numerous space walks.

2003 **Columbia** Shuttle is lost on re entry into the Earth's atmosphere due to loss of heat absorbing tiles which were knocked loose on launch. Seven astronauts are killed.

2003 **Mars Rovers** are launched for 2004 landing on Mars in search of evidence of water which may have flowed on Mars in the past.

Create a Timeline

Space Exploration Timeline

Michael Plasmier

early 1900's | 1920 | 1930 | 1940 | 1950 | 1960

Early 1900's - Tsiolkovsky
1st person to study rockets for space travel
planed 1st rocket w/ People in space
rocket had liquid fuel
never built rocket

1926 - Robbert Goddard
"Father of space age"
1st liquid fuel rocket launch

20

No Important Advancements

June

Early 40's - WW2 Rockets
Germans use rockets to send missiles
End of War: US + Russia capture German Scientists

1957 - Sputnik
1st Satlight
By Russians
Orbited 3 mts

1957 - Laika
1st animal in space
aboad Sputnik 2

1958 - Explorer 1
1st American Satlight
makes 1st Space discovery
-Van Allen radiation belt

1959 - Luna 1
1st object fly past moon
to orbit sun
lost power after 4 days

Create a Timeline

1960 | 1970 | 1980 | 1990 | 2000 | Future

1961 - Yuri Gagarin
- 1st person in space
- Russian Cosmonaut
- orbits earth 1x

1961 - Alan Shepard
- 1st American in space
- only makes a 15 min trip
- doesn't orbit earth

1961 - John Glen
- 1st American in orbit

1968 - Apollo 8
- 1st 3 humans to orbit moon

1969 - Apollo 11
- 1st mission to the moon
- Neil Armstrong 1st person on moon
- 8 day mission

1771 - Salyut 1
- 1st Space spation by Soviets

1772 - Apollo 17
- last maned moon landing

1773 - Skylab
- 1st US spacestation in orbit 6 years
- inhabited by 3 crews

1777 - Voyager 1+2
- 2 satlights to study planets
- 1: visited: Jupiter + Saturn
- 2: visited: same + Uranus + Neptune
- still going in outer space

1981 - Space Shuttle Columbia
- 1st reusble space craft launched 1st w/ only 2 people
- Space shuttles still flying this one blew up in 2003

1986 - Voyager 2 Uranus
- not suppose to go this far
- took a cresent pic.

1986 - Challanger Explosion
- 73 sec after launch
- kills 7 people +
- the first citizen in space
- -something about "O" rings

1989 - Voyager 2 Neptune
- -not suppose to go that far
- -last planet it visited
- -saw the Great Dark Spot

1990 - Space Telescope
- -Hubble Telescope
- -Needs to be fixed
- -takes pictures w/o Earths atmosphere

1995 - Galileo Probes
- -to Jupiter
- -releces a smaller probe that enters athmosphere

1998 - International Space Station
- -first pieces still being built
- -many countries contribute to it

2003 - Columbia Disaster
- -shuttle blew up on re-entering
- -due to hoat tile lost

2004 - Mars Rovers
- -2 twin rovers
- -look for water
- -in operation now

Michael Plasmeier

Chapter 21 Check for Understanding

1. What event launched the "space race" between the Soviet Union and the U.S. in 1957? The Cold War or 1st probe by Russia

2. What was the 1st living organism launched into space? dog Liaka or Belka

3. What American scientist is considered the "father of rocketry?" ~~Von Bion~~ Robert Goddard

4. What U.S. space program was the 1st to carry a man into space? ~~Vanguard~~ Mecury

5. What reusable spacecraft has been used in the U.S. for the last 20 years to carry astronauts and cargo into space? Space Shuttle

6. How many astronauts walked on the moon during each Apollo mission? 2

7. Who was Neil Armstrong? 1st man on moon

8. What is the ISS? International Space Station

9. How is a meteor different from a meteorite? A meteorite is a meteor that hits the ground or planets

10. What do planetary probes do? They are un-maned explores of other planets

11. Planets and comets orbit around the Sun in what type of path? Elliptical

12. Why can't the Space Shuttle land on the Moon? It was not desined to, no downward facing retro rockets

Chapter 21 Quiz

Name Michael Pearman

Date 3/12

A. Choose answers from the words on the right.

1. Used by the U.S. for launches of most satellites today. C
2. World's first satellite. E
3. U.S. space program that landed men on the moon. A
4. Country that put the first man in space. G
5. First man to walk on the moon. H
6. Used to explore farthest planets. D

A. Apollo
B. Alan Shepard
C. Space Shuttle
D. unmanned probes
E. Sputnik
F. United States
G. Russia
H. Neil Armstrong
I. Explorer

50

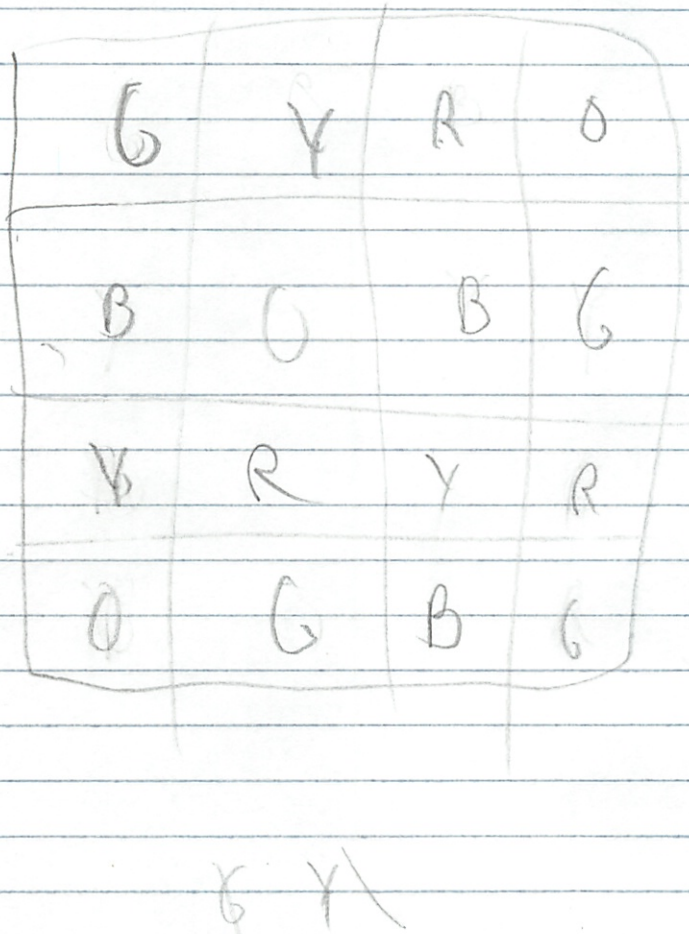
A+

great

Answer the following questions on the lines provided.

1. Describe the difference between a meteor and a meteorite. A meteorite is a meteor that hits the ground.
2. What are comets made of? Ice, Frozen gasses, dust, rocks
3. What is an asteroid? a rock that orbits the sun
4. Why does the moon have more craters than the Earth? The moon has no athmospher leting in more meteors which form craters
5. What is Edmund Halley famous for? 1st perdicting that comets come every ~ years and orbit sun
6. In their orbit around the Sun, at what point do comets move fastest? They move the fasted when they are closets to the sun
7. What is the shape of a comet's orbit? Eliptical like others
8. What is a planetary probe? A unmaned object that flys to and exains other planets.
9. During the 1960's, the U.S. space programs were aiming toward what goal?
To put a man on the moon
10. Why is Mars considered to be the most likely planet for colonization? It is close, has ice cap, not too hot or cold

4 Square



4G
3R
3B
3O
3Y

G Y

Terra Nova Practice Test
Answer Sheet

Name Michael Pleasant

1. C
2. ~~A~~ B - Meant to write this
3. D
4. ~~D~~ A
5. C
6. C
7. D
8. ~~B~~ C
9. A
10. C
11. ~~B~~ A
12. D
13. A
14. B
15. C
16. D
17. C
18. A
19. B - Don't Count
20. C (D) - Don't Count

21. B
22. A
23. C
24. A
25. B
26. B
27. C
28. ~~B~~ A
29. A
30. B
31. B
32. C
33. D
34. A
35. ~~D~~ A - Had it 1st - Look at North + South
36. B
37. B
38. B
39. ~~D~~ D - Right too
40. B

38
-6
32

Michael Plasmeier + Brandon

DESIGN A MARTIAN

What to do

You will design a Martian to fit the eight life characteristics and the environment of Mars.

Step 1 - Read the Encyclopedia article and answer the ten questions on the paper provided. .

Step 2 - Form a group of 2-3 people to brain storm ideas about your Martian's characteristics. This will create a list of ideas that reflect your answers to the questions on the worksheet provided.

Step 3 - Start sketching the Martian. Two drawings of your Martian will be required for this assignment. One of the drawings will be done as the cover of a *National Geographic Magazine*. It will include the yellow border of the cover, the title of the magazine, and an article to accompany the drawing.

The second drawing will show the Martian doing something, and an explanation of the activity in the drawing.

Step 4 - Final draft of the article.- The report should be written in the first person (using pronouns such as "I" and "we.") Your report should explain how you and your group discovered the Martian and all the information you learned about it. The article should be about one side of paper,written or typed.

The report must have a title and be in double column format.

Final report is 3 pages and will be due on _____

Scoring Rubric

Cover - - - -10 pts (picture 7, title 3)

Article - - - - 30 pts (title 3, content 27)

Inside pix - -10 pts (caption 3, picture 7)

Name Michael Plasmeier
Date 3/23

MARS ENVIRONMENT

Use the Encyclopedia article and other resources to answer the following questions before designing your Martian.

1. Gravity - ? less then earth, because Mars is half size of Earth
2. Average distance from the Sun - 141 million miles
3. Orbital Period - (length of year) - 687 days
4. Rotational period - (length of day) 24 hrs 37 min
5. Temperature range - -191°F (-) -24°F, up to 63°F
6. Atmospheric gases - mostly carbon dioxide, nitrogen, argon, oxygen, carbon monoxide, neon, krypton, xenon
7. Polar ice caps composition- may have water, look white
8. Soil conditions - dust, sand, rocks, limanite
9. Exposure to the Sun's radiation - ? more then earth, no atmosphere

Environment
- dark areas - go in and out
- deep crayons
- large volcanos
- polar caps - look white, may have water, grows
- not much atmospher preasure
- season 2x long

Design Characteristics of all living things (Even Martians?)

Design a living Martian organism to fit the facts about the environment presented in the encyclopedia article. Your design must take into consideration all of the characteristics of live things.

1. How does your Martian get the energy it needs to grow, reproduce, etc. Absorbs nutrients soil + turns to energy
2. Does your Martian move around? Yes
   a. Why does it move? To get to different soil + water
   b. How does it move? The spikes curl up and the spickes spring out fast making it jump like a bouncy ball. rolls It can also walk as baby
3. How does your Martian protect itself from the cold? Thick layer of blubber
4. Does your Martian need water? All life on earth need water. Where and how would it get the water it needs.. Yes, It walks on ice, spikes heat up make holes in ice to weaken it, then bed + heat melts it and skin absorbs
5. What is your Martian's life span? 5 years
6. What size is your organism. Does it grow? How does it change its form Starts small grows bigger to 1m radius
7. How does it reproduce? Seeds, eggs, dividing, live births, budding? Feet Some spikes break off, for new (budding) Don't grow back
8. How and why does your Martian respond to its environment?

In addition you should make up a story about how you met or saw the Martian, where you met and how you felt about the meeting.

Vol. 187, NO. 9

NATIONAL GEOGRAPHIC

Change title Page

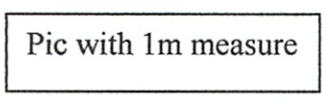
Life on Mars

By: Michael Plasmeier with and Brandon Hall

2nd Draft

"We opened the door and there they were." I am talking about the stunning discovery ~~the~~ that we made on Mars. These were ~~Creatures~~ that were never before seen by anyone, not even on film. We called these strange creatures we discovered Urcheggas because sometimes they are egg-shaped, other times they are like a spiky bouncy ball. Their scientific name is *Micholus Brandous*, after us, their finder.

The se creatures at their adult form are 1m in diameter.



accross They are a big spiky ball that bounces around the landscape of Mars. When they are in their baby form, babies they are a totally different The little ones have non-spiky egg shape, ~~with~~ eyes and feet.

I will tell Now how we discovered them.

As we were the first humans ever to step land on Mars, so we saw them first. ~~Is all started~~ when we landed ~~our capsule~~ and opened the door. We were shocked to see these All of Urcheggas bouncing around. We wounded what they were, and how they came here. But most we wondered why they were never seen before in pictures sent back by probes.

Make Gray

By
Michael Plasmeier
and
Brandon Hall

We tried to take a picture of these Urcheggas them, to show the people on earth. However, the photo did not come because of their strange case of being out. That is why, if you read the reporters papers, they said that we were making this all up. This was to see how the creatures look, Not so. See the drawling Brandon made on one of a following the other pages.

Now I will describe the little egg creature itself. I will start at it's baby form. The little eggs grow off the discarded feet of an adult. The grow into babies like before, are an non-spiky egg shape, with eyes and feet. These colored blue eggs waddles around Mars, navigating with their eyes. To drink, the critters lay their tongues on the frozen ice, and their body heat melts the ice. Their tongues then absorb the water. To eat, a baby Urchegga waddles around and tries to catch a spiky big Urchegga. The little ones aren't very efficient at catching their pray, but once the have one they eat it real slowly fast. What is strange, is that other Urcheggas don't bother or try to steal food from others.

Now, we have also found what is probably probable the biggest organism change in history. At one point in a baby Urchegga's life, another of its kind pulls off their friend's feet. The feet are then left behind to born into another Urchegga. The now feet-less Urchegga will then take a few days to change from an egg shape to a circle. They will change from blue to purple. Also, the eyes and mouth will fall off. Then the biggest change of all, the multi-purpose spikes will begin to grow. of the transforming Urchegga

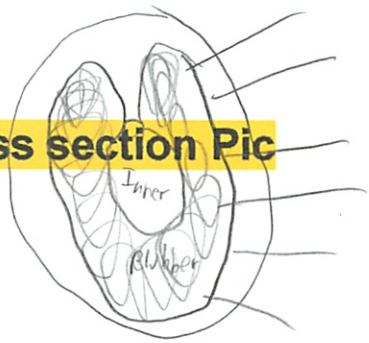
Gray

Diagram?

The new adult shaped Urchegga, uses it spikes to do a lot. It uses them to bounce across the reddish landscape, and to bounce. This happens as the spikes bend together then spring out. This forces propels the Urchegga upwards and sends it bouncing across the reddish Mars landscape. Pic An Urchegga can travel large distances like this. An Urchegga can also curve down its spikes to roll like a ball. It appears that this animals doesn't have a top or dominate side.

A ball shaped Urchegga gets its food in many ways. First, it can absorb nutrients from the rocks. It is also apparent that an adult Urchegga gets some food for its stored fat from when it was young. To get water, an adult Urchegga puts it spikes over the ice and chemicals in the spikes melt the ice. The spikes then seem to absorb the water. To protect itself from the cold and solar radiation, an adult Urchegga has a thick layer of blubber . Here is a cross section picture of one we found split in half.

Cross section Pic



So, that's the story of this amazing creature, an Urchegga, the only living thing on Mars. We still wonder why it is camera shy, and how it got here.

(Please note: No Urcheggas were harmed during our exploration)

- ❑ Any other characteristics should be included?
- ❑ Change line spacing back to 1

2 colons

1st Person

Life on Mars

by ~~Michael Brandon~~ Sta
Michael ~~Brandon~~
w/ Brandon

In a stunning discovery ~~X~~ NMSA astronauts Michael + Brandon, ~~X~~ find ~~X~~ life ~~X~~ ~~found~~ on Mars. The creature we found is being called Vicheggo and its scientific name is Micholus Brandas The creature at its adult age is 1m in diameter spike ball, The ~~was~~ discovered ~~when~~ ~~NASA~~ Michael + ~~Brandon~~ we discoved the creater essentully a where the 1st humans ever to land on Mars. ~~They~~ we opened the capsuls door and discoved lots of these happy creatues bouncing around. At 1st we were amazed. Why were these here? How did they get here? Also we were wondering why they weren't seen before?

The 1st ~~thing~~ thing we decided to do was take a picture to report our discovried, Unfortunlitly like before the photos didn't come out. Brandon pointed it out that they couldn't be photographed, I wish I was as smart as him. At 1st the people on the ground couldn't beleve our discovery, However when

They saw us pickinking up the children, they knew we couldn't be acting. At 1st we thought there was 2 creatures because the kids and the adults are very different. Then we relized they were the same.

I will 1st start describing the kids- They grow from the severed off feet of the now adult Urcheggas. They are ~~spikeless~~ spike-less, egg shapped creatures with feet. These blue eggs waddel around on feet and navigate w/ eyes. To drink they lay their tounges on ice and wait for the water to melt. To eat the little eggs waddel around and try their best to catch a big spiked Urchegga. They aren't very effeciant at getting the big spike balls. We have found probley the biggest Change of form in an animal to date. At 1 time doing the Urcheggs' life, a different Urcheggs pulls off the feet of its friend. The feet are left

on the ground and will grow to a new egg. The the feet-less egg will loose its eyes and mouth and turn purple. Multipurpase spikes grow out of the animal. The ~~new spiky creature~~ uses its spikes to bounce across the reddish landscape. The spikes bend down and then quickly recoil to propell the ball upward. Then the Urchegga bounces like a bouncy ball. The Urchegga can also pull in its spikes and just roll downhill. It appears that these animals don't have a top side.

turns → ball shape

adult form Urchegga

The ball shapped adult Urchegga gets its food in ~~many~~ 2 ways. First, it seems like the animal can absorb chemicals from the rocks. It is also apparent that an Urchegga uses some of the food from its when it was young egg-shapped

Scene

Definitions

Michael Plasmeier

10

3/29

1. Binary Stars: A double star, 2 stars rotate around them - selfs. From long distances they appear to be 1 star. The closest example is Sirds

2. Variable Star: A star that changes in brightness. This may occure for many reasons. 1 is that the gases expand and contract. Another occures when binary stars ellecp each other to become brighter. Another example is that solar flares seem to make the star brighter

3. Super Nova: A burst of engry that makes a star explode. A regular nova occurs when a star gives off a burst of eneagry making them occure brighter for a few days or years.

4. Galaxy: A large collection of stars. They are held toghter by gravety and ours is 100,000 light years accross. In the center the stars are closer then at the outside. We are on one of the outside arms. There are lots of different types of galaxies.

5. Black Holes: A very massive object that sucks away other matter. It then holds the matter so tight, that not even light can escape. They are formed when large stars collaps. Scients have not really observed these objects.

Michael Plasmeier

Chapter 22 "Earth's Place in the Universe" (pages 473-479)

I. Messages from the Stars

A. The Sun

1. The sun is an average star.
2. There are many other stars that are bigger and brighter than the sun.
3. Stars are made up of mostly hydrogen gas with some helium
4. They produce energy by fusing hydrogen with helium which releases lots of energy in form of light + heat
5. The same processes release energy in hydrogen bombs

B. Betelgeuse - once a Supergiant Star

1. It was a bluish, massive star about 20 times the size of the Sun
2. Now it is near the end of its life after burning for 10 mil years (not a bil)
3. It is now a red supergiant which is cooler then before
4. It will someday collapse on itself from the force of gravity and explode outward into a Super Nova
5. What remains of the star will be a dense netron star
6. It may possibly become a ~~neutron star~~ black hole if the collapsing mass is big enough.
7. Black holes are called "black" because the gravity is so strong that even light cannot escape.

C. Our Star (the sun)

1. Is not big enough to end its life as a Supernova
2. Our star will ~~contract~~ expand in size as it dies to form a ~~white~~ red ~~dwarf~~ giant

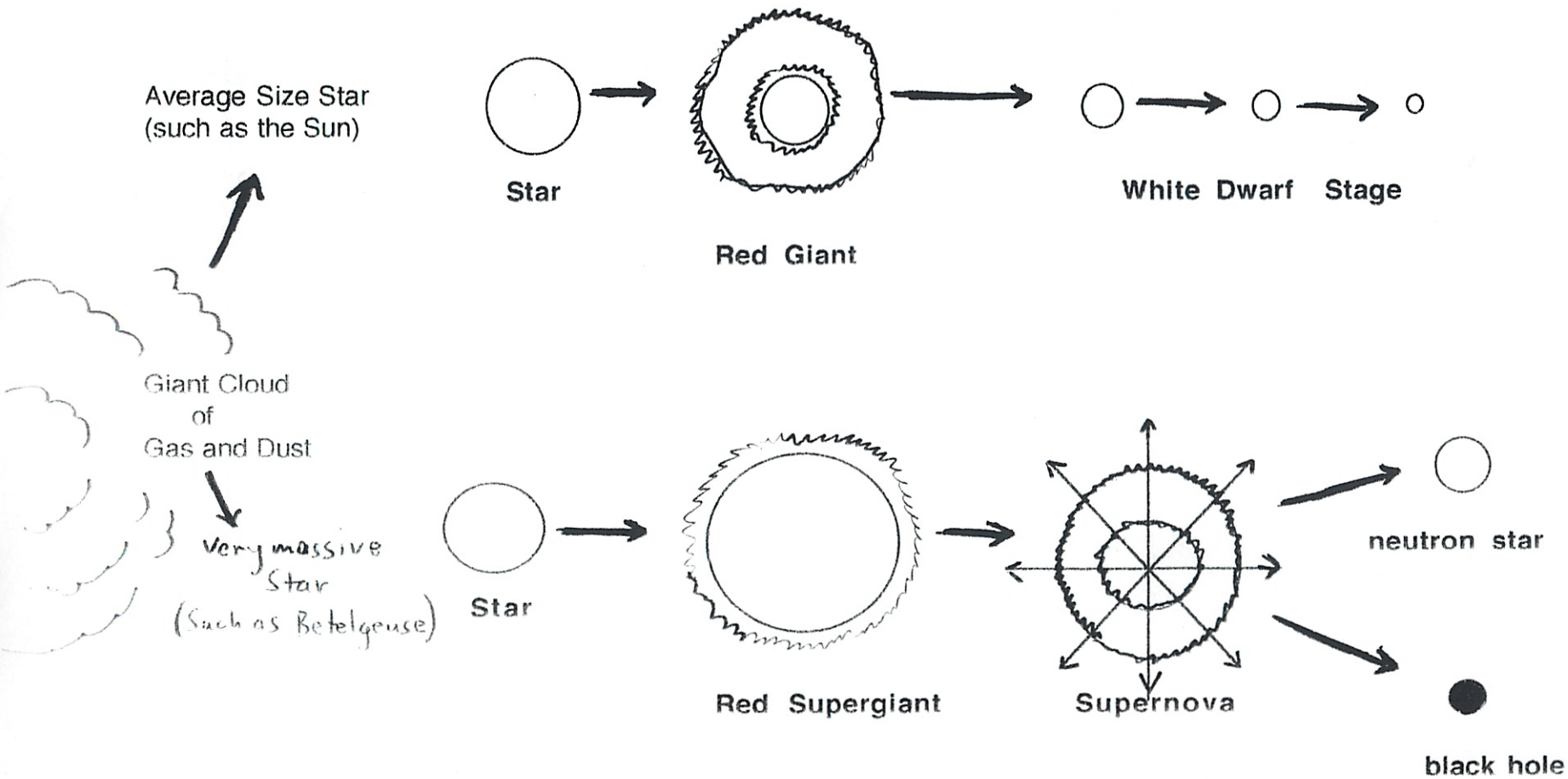
3. When the Sun becomes a Red giant, and expands greatly in size, our ocean and atmosphere will boil up

4. Eventually our Sun will become a white dwarf as its fuel gets used up.

5. This will happen about 5 ~~mil~~ bil years

6. We say that the Sun is about one-half the way through its life since it has been burning for 4.5 bil and will go for about another 5 bil

EVOLUTION OF STARS - Chapter 22



Describe what will eventually happen to the Sun and how it will affect life on Earth. The sun will eventually expand to a red giant. Then all life will burn off the earth. Then the sun will contract to a white dwarf. The earth will be a cold rocky planet.

Michael Plasmeier

Stars and Galaxies Questions Use pages 474-485 and S146-S151

1. What determines the sequence of events in a star's life? The size of the star determines the sequence of events in a star's life.

2. What happens to the remains of a supernova? The remains of a super nova collaps to either a neutron stoor of a black whole.

3. Can a star become a black hole without exploding as a supernova? I don't think so, it needs to be big enough to explode to form a black hole

4 How are stars born? Star are born from old super novas and other materal.

5. How does a star become a red giant? A star uses up all its gases and then expands.

6 How does a red giant become a white dwarf? A red giant becomes a white dwarf when it explodes upon its self.

7 What causes a supernova? the same way a white dwarf is formed, except the star is larger,

8 Name the four types of galaxies and describe how you think it got its name.

a. Spiral - a spiral ball of stars that go around in a spiral

b. barred - it has different bands of color

c. elliptical - they are shaped like an eclipse - all in the center

irregular - not many no shape or pattern

9. How do you think our galaxy got its name ?

Our galaxy got its name because the plane of the ecpltic looked milky and a way accross the sky.

Michael Plasmeier
5/1/2004
P.D.:5

What led to the tragedy of the Apollo 1 fire, and what changes came after it?

50
50
100

The Apollo 1 fire will always be remembered as a great scar in the nation's space program. Three astronauts gave their lives for the race to the moon. A fire broke out during a launch test, on January 27, 1967. Lt. Col. Virgil I. "Gus" Grissom, USAF; Lt. Col. Edward H. White II, USAF; and Navy Lt. Roger B. Chaffee, all died as they were not able to exit their burning spacecraft. NASA after this tragedy, made some changes to the command module and the procedure for tests after this accident.

A+
very nicely done!

January 27, 1967 started out as a normal day at Cape Kennedy's Launch Complex 34 for doing a plug-out test on Spacecraft 012, for Mission AS-204. The three astronauts aboard the spacecraft and the over a thousand people waiting on the ground had two basic objectives to accomplish. The first was to see if the spacecraft still worked with all of the cables and Ground Support Equipment disconnected. The second was to test the astronaut's emergency exit procedures at the end of the test of the test. The cabin would be pressurized with highly-explosive pure oxygen, the standard procedure.

Throughout the day there were minor problems. One astronaut thought the cabin smelled like sour milk, and there were many communication problems, before the plugs were

pulled. [However, these are now not thought to be related to the accident.] At 6:31:04.7 p.m. EST, the day turned bad. "There is a fire in here." Looking back there were other possible sources of the fire, and indicators of when it started. At 6:30:39 EST, a sensor reported crew movement. At 6:30:50 EST, a cable was touched, indicating more movement. At 6:30:54.8 EST, a power surge occurred. Any of these could or more indicate a fire. After the fire was reported there was a lot of crew movement inside the cabin. During the investigation afterward, they found that the crew had started to open the hatch. Finally, at 6:31:22.4 EST, all data transmissions were lost from the cabin.

The fire stated and spread for several reasons. The most believed source of fire was the electrical wiring in and near the ECS or Environmental Systems Control unit. That unit had been removed and replaced several times before, and was known to be faulty. Once the fire started it quickly grew to a fireball in the pure oxygen environment. The astronauts could not open the hatch because of the pressure inside. It even tock rescuers on the ground 5 minutes to open the hatch through all of the smoke. Also, it took 10 minutes after the fire for the firemen to arrive, and 15 minutes for doctors to come. These were just some reasons the fire started and continued to devastate the whole cabin.

This took all too long, and it could have been prevented on several fields. First, if proper quality control issues existed on the ECS and wiring. Second, if there would be a way to release the pore sure and open the door. Finally, the fire wouldn't have spread so fast, if the cabin had not been filled with pure oxygen.

NASA made several changes in response to this accident. They started by putting less unnecessary stuff inside the cabin, especially stuff that will catch fire. They also put in new wiring and covered the wires, so they couldn't be easily broken or striped of their protective covering. NASA also installed a better ECS, and had better quality control process for dealing with parts inside the spacecraft. The agency also modified the hatch somewhat, to open easer, even under pressure. Most importantly however, NASA changed the atmosphere in the cabin. The gasses inside are now more earthlike with added nitrogen. These changes however, added more then 1,400 valuable pounds to the spaceship.

After these changes, NASA made some others too. The space agency also made some other changes on the ground. The towers were modified to better fit emergency operations. The communications system was also modified because of other problems not relating to the fire. They also made 3 unmanned flights after the fire. Very importantly, NASA paid more attention to test they made, as this fire was shown before in a full scale test mock-up.

The Apollo fire was certainly a scar in the country's space program. The fire started most likely from an electrical spark, and we have never determined the exact point the fire started. NASA has made some changes to prevent this form happing again, but we will never forget the 3 astronauts, Grissom, White, and Chaffee, who all died in this tragic fire.

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Re Search Report

Michael Plasmeier
4/28/2004
P.D.:5

- To edit
- Do Works cited

What led to the tragedy of the Apollo 1 fire, and what changes came after it?

Extra Space

The Apollo 1 fire will always be remembered as a great scar in the nation's space program. Three astronauts gave there lives for the race to the moon, when a fire broke out during a launch test, on January 27, 1967. Lt. Col. Virgil I. "Gus" Grissom, USAF; Lt. Col. Edward H. White II, USAF; and Navy Lt. Roger B. Chaffee, all died as they were not able to exit their spacecraft fast enough. NASA after this tragedy, made some changes to the command module and the procedure for tests after this accident.

January 27, 1967 started out as a normal day at Cape Kennedy's Launch Complex 34 for doing a plug-out test on Spacecraft 012, and Mission AS-204. The three astronauts aboard the spacecraft and the over a thousand people waiting on the ground had two basic objectives to accomplish. The first was to see if the spacecraft still worked with all of the cables and Ground Support Equipment disconnected. The second was to test the astronaut's emergency exit procedures at the end of the test of the test. The cabin would be pressurized with highly-explosive pure oxygen. the standard procedure

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the day turned bad

Looking back, there were other possible sources of the fire.

change to actual words

- To edit
- Do Works cited

a sensor reported

~~was a report of~~ crew movement. At 6:30:50 EST, a cable was touched, indicating movement. At 6:30:54.8 EST, a power surge occurred. After the fire was reported there was a lot of crew movement inside the cabin. During the investigation afterward, they found that the crew had started to open the hatch. At 6:31:22.4 EST, all data transmission was lost from the cabin. The people ~~on the ground and in~~ the tower tried desperately to open the door, even through the smoke around them. In 5 minuets they had the door open, and ~~then~~ astronauts were dead.

Any of these could indicate a fire

Back outside,

they saw the

The fire stated and spread for several reasons. The most believed source of fire was the electrical wiring in and near the ECS or Environmental Systems Control unit. That unit had been removed and replaced several times before, and was known to be faulty. Once the fire started, it quickly grew to a fireball in the pure oxygen environment. The astronauts could not open the hatch because of the pressure inside. It tock rescuers on the ground 5 minutes to open the hatch. Also, it took 10 min after the fire for the firemen to arrive, and 15 for doctors to come. These were just some reasons the fire started and continued.

through the smoak

minutes

minutes

to devestate the whole cabin

This took all too long, and it could have been prevented on several fields. First, if proper quality control issues existed on the ECS and wiring. Second, if ~~emergency exit procedure worked~~. Finally, the fire wouldn't have spread so fast, if the cabin had not been filled with pure oxygen.

There was a way to relase preasure and open the door

NASA made several changes in response to this accident. They started by putting less unnecessary stuff inside the cabin, especially stuff that will catch fire. They also put in new wiring and covered the wires, so they couldn't be easily broken. NASA also installed a better ECS, and had better quality control process for dealing with parts. The agency also modified the hatch somewhat, to open easer, even under pressure. Most importantly however, NASA changed the atmosphere in the cabin. The gasses inside are now more-earthlike with added nitrogen. These changes added more then 1,400 valuable pounds to the spaceship.

After these changes, NASA made some others too. The space agency also made some other changes on the ground. They made 3 unmanned flights afterward. The towers were modified to better fit emergency operations. The communications system was also modified because of other problems not relating to the fire. Very importantly, NASA paid more attention to test they made, as this fire was tested before in a full scale mock-up.

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Michael Plasmeier
4/27/2004
P.D.:5

2 x Space

What led to the tragedy of the Apollo 1 fire, and what changes came after it?

The Apollo 1 fire will always be remembered as a great scar in the nation's space program. Three astronauts gave there lives for the race to the moon, when a fire broke out during a launch test, on January 27, 1967. Lt. Col. Virgil I. "Gus" Grissom, USAF; Lt. Col. Edward H. White II, USAF; and Navy Lt. Roger B. Chaffee, all died as they were not able to exit their spacecraft fast enough. NASA after this tragedy made some changes to the command module and the procedure for tests after this accident

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Throughout the day there were minor problems. One astronaut thought the cabin smelled like sour milk, and there were many communication problems, before the plugs were pulled. [However, these are now not thought to be related to the accident.] At 6:31:04.7 p.m. EST, there was a vocal report of fire. Before that, at 6:30:39 EST, there was a report of crew movement. At 6:30:50 EST, a cable was touched, indicating movement. At 6:30:54.8 EST, a power surge occurred. After the fire was reported there was a lot of crew movement inside the cabin. During the investigation afterward, they found that the crew had started to open the hatch. At 6:31:22.4 EST, all data transmission was lost from the cabin. The people on the ground and in the tower tried desperately to open the door, even through the smoke around them. In 5 minuets they had the door open, and then astronauts were dead.

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This took all too long, and it could have been prevented on several fields. First, if proper quality control issues existed on the ECS and wiring. Second, if emergency exit

procedure worked. Finally, the fire wouldn't have spread so fast, if the cabin had not been filled with pure oxygen.

NASA made several changes in response to this accedient. They started by putting less stuff inside the cabin, especily the stuff that catches fire. They put in new wiring and put in a better ECS, They also added metal to cover the wires. Nasa also creaced the quality control of the space craft, NASA looked into the possibily of haveing jelled water to put out fires in space. ~~In addition an extra oxygen supply was added, so the~~ The hatch was also modified to open more easyly. Most importantly, they made the athmosph more earth like by adding nigtrogen. These changes added more then 1,400 valuble pounds to the ship.

→ After this NASA made some other changes. They made 3 more unlounched missions before they sent humans back in space. The towers were modified to better let emergancy equiptment in. The communication system was modified because of the problems unrelated to the fire. Very importantly, NASA paid more attenison to tests, because this very conditon had been tried before in a full scale mock-up.

→ The Apollo 1 fire was sirtehly a scar in the space program. The fire started from an ellectrical spark, and we haven't found exactly where it started. NASA made changes to prevent this from happening again, but we will never forget →

The 3 astronauts, Grissom, White, and Chaffee,

Outline

4/26

1. Intro.
Topic Apollo fire cause + changes
- 1st sentance about how it was a tragedy
- electrical problem
- fire (Date) Jan 27 1967
- People not out (Names) Virgil Grissom, Roger Chaffee
- Changes. Edward White

2. Body

1. Fire
- ~~Never found Fire + cause~~
- power serge 6:30:54,8 EST
30:39 see people move
30:58 cable tactged
- 31:22.4 - data loss
- 31:04.7 people told of fire
? min ; sec mili
- ~~After~~ fire lots of move
- People started oping hatch
- fire started pouring out
- plug out test - fire before was problematic before
2. Causes ECS one cause
communication problem before test
Cabin smell sour milk
5 min to open hatch
Docs take 5 min to come
flash fire
Spark,
electrical fire
electral short circuit
~~pure oxygen~~

BE2613 QP100413

3. ~~Changes~~

- less stuff inside (esp. stuff that causes fire)
- nigtrogen mix - biggest changes
- project on hold
- new wiring
- better ECS + quality control
- case in wires
- change hatch
- new changes = 1,900 lbs to ship

3. Changes

- 3 un man launches 1st
- test must be relized as dangeres
- modify tower
- communication system
- ~~get docs in sinc~~
- listen to fire test
- ~~[illegible]~~
- check wires
- jelled water put out fire
- ~~extra oxygen supply~~
- launch facilities modified

3. Closing

Apollo fire was tragity
electrical fire
haven't found cause
made changes
Alwas remember astrenouts

Michael Plasmeier

SCIENCE RESEARCH PROJECT

Purpose - The seventh grade research project is part of a process to build language arts skills. Many inexperienced students think at first that writing a research project means looking up a topic in a single book or encyclopedia and copying down the information exactly as the author wrote it. This is not the appropriate way to complete a research report. This guide and your science teacher will lead you through the research process. Your research report will contain the following parts and be graded as shown.

1. Choosing a research question and identifying a list of key words. - 5 Points
2. Taking notes from resources (at least 3 different sources) ----------10 pts
3. Writing an outline ----------10 pts
4. Writing a rough draft of the paper ----------15 pts
5. Writing a rough draft of the work cited page. ----------10 pts
6. Writing the final draft of the paper and work cited page ----------50 pts

Total ---100 pts

- Power Lib

These items will be collected and graded periodically during the project.

The finished research paper must be 1.5 - 2 typed pages (or 2 - 3 handwritten) .

2 x Spdre

You must use at least 3 sources of information, only one of which should be an encyclopedia. A magazine article would be a good addition to your resources.

Step 1 - Choose a research question from the list provided or you may come up with one of your own. You must get the topic approved by the teacher.

Step 2 - Before you head to the library you need to think about key research words. Key words will direct you once you actually are ready to look for information. Look at the example below:

Question - *What evidence do scientists have to support the theory that dinosaurs became extinct because a large meteorite hit the earth?*

The key words in this question are "**dinosaur**", "**extinction**", and "**meteorites**." You might look for these words in an encyclopedia, book index or guide to magazine sources.

- their changes
- water
- interpret

hq.nasa.gov/office/pao/History/Apollo204

RESEARCH TOPICS - ASTRONOMY

1. What were ancient Greek ideas about the universe?

2. What are advantages and disadvantages of different kinds of amateur telescopes?

3. What evidence suggests life may have existed on Mars.

4. What led to the tragedy of the Apollo 1 fire and what changes came after it?

5. What was learned by Voyager probes which explored Jupiter?

6. What was learned by Voyager probes which explored Saturn?

7. What was learned about the moon from the Apollo missions?

8. How did Copernicus develop his heliocentric theory?

9. How did Galileo influence thinking on Astronomy during his lifetime?

10. How did Kepler change ideas on planetary motion?

11. What was learned from Viking missions to Mars?

13. How could colonies on the moon be established?

14. What are the goals of the International Space Station?

15. What were the achievements of Robert Goddard?

16. How did Werner von Braun influence the US space program after World War II?

17. What was achieved by the German rocket programs of the 1940's?

Combine

18. What were the accomplishments of the Mercury Space Program?

19. What were the accomplishments of the Gemini space Program?

20. What was Skylab and what was learned from it?

21. How did our Solar System form?

22. What is the Galileo probe and what are its goals?

23. What future planetary probe missions are planned?

Web Nasa (1)

"Apollo-1 (204)." Nasa Web History. Ed. Steve Gacker. 1 Feb 2003. Nasa. 14 Apr. 2004 (http://www.hq.nasa.gov/office/pao/History/Apollo204).

Changes
- Block 2 spacecraft (recomandations included)
- less stuff inside (esp stuff that catches fire
- quick oping hatch
- jellied water to estinguish fires
- emergy oxygen in cabins
- launch towered changed for quick exit
- Biggest change
  - different mix of air in cabin

Bord found condition very harmful as
- it takes
  - 5 min to open hatch
  - 8-9 min for fire fighters
  - 12 min first doctor

never found spefic cause of fire
there was a power surge at 23:30:54.8
23:30:39 - people move around
23:30:58 cable torched
23:31:22:4 - loss of data
fire fighters took awile to come
23:31:04.7 - Verble warning of fire
23:30:45 - No crew movement
After fire - lots of movement
pilot started hatch oping procedure
comand module culture
3 sec latter tranmissions stoped →

2

fire poured out of module
Some people evacuated

(Stop notes: off topic)

- Recomindations ↑ Findings

1. (F) - no cause ever discovered
(R) most probable cause was electrical arc (?) in sector - 4+2. Near floor in lower forward section of left hand equitment bay, where Environmental Control System (ECS) leads to oxygen panal. No sabatoge detected

2. (F) In side lots of flamable stuff
(R) Get rid of it

3. (F) After fire → athmosphere becomes toxic quickly
- Crew dies

4. (F) door couldn't be opend in time
(R) Has to be quicker

5. (F) Tests not related to be dangerous
- emergy people not on-site
- equitment not ment to use in smoke,
- tower too many doors + sharp curves
(R) be more secure
- better training equipment
- tower be modified

3

6. (F) Communications bad on ground
(R) Change ground communication system

7. (F) Documents not in sync
Papers not relesed early enought (1/26/67)
(R) Publish final verison earlier
Give it to everyone

8. (F) Fire was very close to a full-scale mock-up
(R) Use the info from the tests

9. (F) The air was 100% oxygen very dangerous
(R) safty be reconsidered by tests
: try using a 2-gas atmosphere (test)

10. (F) The ECS had problems + was frequent installed + removed
Coolant was combustable
no fire protection dosing feauters
wires - faulty
(R) Check wires
put in extra oxygen + (i.e extigers

11. (F) Some un athorize materials
Spaceship still hold things to do
rat raters not in the loop
(R) better cordinate w/ contracters

Get things actully done

Source: This document taken from the Report of Apollo 204 Review Board
NASA Historical Reference Collection, NASA History Office, NASA Headquarters, Washington, DC.

3. Events From Initiation Of The T-10 Minute Hold At 23:20 GMT Until The Report Of Fire

From the start of the T-10 minute hold at 23:20 GMT until about 23:30 GMT there are no events that appear to be related to the fire. The major activity during this period was routine troubleshooting of the communications problem. The records show that except for the communications problem, all systems were operating normally during this period. There were no voice transmissions from the spacecraft from 23:30:14 GMT until the transmission reporting the fire which began at 23:31:04.7 GMT (6:31:04.7 p.m. EST).

During the period beginning about 30 seconds before the report there are indications of crew movement. These indications are provided by the data from the Biomedical Sensors, the Command Pilot's live mike, the Guidance and Navigation System and the Environmental Control System.

There is, however, no evidence as to what this crew movement was or that it was related to the fire.

The biomedical data indicate that just prior to the fire report the Senior Pilot was performing essentially no activity (or was in the baseline "rest" condition) until about 23:30:21 GMT when a slight increase in pulse and respiratory rate was noted. At 23:30:30 GMT the electrocardiogram indicates some muscular activity for several seconds. Similar indications are noted at 23:30:39 GMT. The data show increased activity but are not indicative of an alarm type of response. By 23:30:45 GMT, all of the biomedical parameters had reverted to the baseline "rest" level.

Beginning at about 23:30 GMT, the Command Pilot live microphone transmitted brushing and tapping noises which are indicative of movement. The noises were similar to those transmitted earlier in the test by the live mike when the Command Pilot is known to have been moving. These sounds end at 23:30:58.6 GMT.

Any significant crew movement results in minor motion of the Command Module. This motion is detected by the Guidance and Navigation System and is indicative of crew movement; however, the type of movement cannot be determined. Data from this system indicate a slight movement at 23:30:24 GMT with more intense activity beginning at 23:30:39 GMT. More movement begins at 23:31:00 GMT and continues until loss of data transmission during the fire.

Increases of oxygen flow rate to the crew suits also indicate movement. All suits have some small leakage. This leakage rate varies with crew positions. Earlier in the Plugs-Out Test, the crew reported that a particular movement, the nature of which was unspecified, provided increased flow rate. This is also confirmed from the flow rate data records. The flow rate shows a gradual rise at 23:30:24 GMT which reaches the limit of the sensor at 23:30:59 GMT.

There is a variation at 23:30:50 GMT in the signal output from the gas chromatograph cable (the gas chromatograph was not installed in the Command Module). When the gas chromatograph is not connected, the cable acts as an antenna. Thus, changes in the electromagnetic field within the spacecraft are sensed when the cable is approached closely, touched or moved or voltage fluctuations occur in

other equipment. Variations found in the signal level from the gas chromatograph cable at earlier times in the test have been correlated with either crew movement or voltage transients when equipment was turned off or on at these earlier times. The variation at 23:30:50 GMT, may have resulted because it was touched or approached by the crew since there does not appear to be any voltage transient condition at this time which could have given the observed signal.

A significant voltage transient was recorded at 23:30:54.8 GMT. The records show a surge in the AC Bus 2 voltage.

Several other parameters being measured also showed anomalous behaviour at this time. There was a 1.7 second dropout in signal from the C-band decoder and transmitter outputs, a brief dropout of the VHF-FM carrier, a fluctuation in the rotation controller null outputs and a fluctuation in the gas chromatograph signal.

4. Events From The Report Of Fire Until Crew Removal

The events that occurred during this period can be comprehended most readily by examination of Enclosure 2, Enclosure 3, Enclosure 4 and Enclosure 5. These enclosures show a sketch of Launch Complex 34, the Space Vehicle in the service tower and the interior of a mock-up of a Command Module detailed reconstruction of Spacecraft 012.

Beginning at 23:31:04.7 GMT (6:31:04.7 P.M. EST), the crew gave the first verbal indication of an emergency - a fire in the Command Module was reported.

Emergency procedures called for the Senior Pilot, occupying the center couch, to unlatch and remove the hatch while retaining his harness buckled. A number of witnesses who observed the television picture of the Command Module hatch window during this stage of the fire discerned motion that suggest that the Senior Pilot was reaching for the inner hatch handle. The Senior Pilot's harness buckle was found unopened after the fire, indicating that he initiated the standard hatch-opening procedure. Data from the Guidance and Navigation System indicate considerable activity within the Command Module after the fire was discovered. This activity is consistent with movement of the crew prompted by proximity of the fire or with the undertaking of standard emergency egress procedures.

Personnel located on adjustable level 8 (A-8) adjacent to the Command Module responded to the report of the fire. The Pad Leader ordered crew egress procedures to be started and technicians started toward the White Room which surrounds the hatch and into which the crew would step upon egress. Then the Command Module ruptured.

All transmission of voice and data from the spacecraft terminated by 23:31:22.4 GMT, three seconds after rupture. Witnesses monitoring television showing the hatch window report that flame spread from the left to the right side of the Command Module and shortly thereafter covered the entire visible area.

Flames and gases flowed rapidly out of the ruptured area, spreading flames into the toroidal space between the Command Module pressure vessel and heat shield, through access hatches and into levels A-8 and A-7 of the service structure. These flames ignited combustibles, endangered pad personnel, and impeded rescue efforts. The burst of fire, together with the sounds of rupture, caused several pad personnel to believe that the Command Module had exploded or was about to explode. Pad personnel fled from the immediate area.

Source: This document taken from the Report of Apollo 204 Review Board
NASA Historical Reference Collection, NASA History Office, NASA Headquarters, Washington, DC.

Findings, Determinations And Recommendations

In this Review, the Board adhered to the principle that reliability of the Command Module and the entire system involved in its operation is a requirement common to both safety and mission success. Once the Command Module has left the earth's environment the occupants are totally dependent upon it for their safety. It follows that protection from fire as a hazard involves much more than a quick egress. The latter has merit only during test periods on earth when the Command Module is being readied for its mission and not during the mission itself. The risk of fire must be faced; however, that risk is only one factor pertaining to the reliability of the Command Module that must receive adequate consideration. Design features and operating procedures that are intended to reduce the fire risk must not introduce other serious risks to mission success and safety.

1. FINDING:

- There was a momentary power failure at 23:30:55 GMT.
- Evidence of several arcs was found in the post-fire investigation.
- No single ignition source of the fire was conclusively identified.

DETERMINATION:

The most probable initiator was an electrical arc in the sector between -Y and +Z spacecraft axes. The exact location best fitting the total available information is near the floor in the lower forward section of the left-hand equipment bay where Environmental Control System (ECS) instrumentation power wiring leads into the area between the Environmental Control Unit (ECU) and the oxygen panel. No evidence was discovered that suggested sabotage.

2. FINDING:

- The Command Module contained many types and classes of combustible material in areas contiguous to possible ignition sources.
- The test was conducted with a 16.7 pounds per square inch absolute, 100-percent oxygen atmosphere.

DETERMINATION:

The test conditions were extremely hazardous.

RECOMMENDATION:

The amount and location of combustible materials in the Command Module must be severely restricted and controlled.

3. FINDING:

- The rapid spread of fire caused an increase in pressure and temperature which resulted in rupture of the Command Module and creation of a toxic atmosphere. Death of the crew was from asphyxia due to inhalation of toxic gases due to fire. A contributory cause of death was thermal burns.
- Non-uniform distribution of carboxyhemoglobin was found by autopsy.

DETERMINATION:

Autopsy data leads to the medical opinion that unconsciousness occurred rapidly and that death followed soon thereafter.

4. FINDING:

Due to internal pressure, the Command Module inner hatch could not be opened prior to rupture of the Command Module.

DETERMINATION:

The crew was never capable of effecting emergency egress because of the pressurization before rupture and their loss of consciousness soon after rupture.

RECOMMENDTION:

That the time required for egress of the crew be reduced and the operations necessary for egress be simplified.

5. FINDING:

Those organizations responsible for the planning, conduct and safety of this test failed to identify it as being hazardous. Contingency preparations to permit escape or rescue of the crew from an internal Command Module fire were not made.

- No procedures for this type of emergency had been established either for the crew or for the spacecraft pad work team.
- The emergency equipment located in the White Room and on the spacecraft work levels was not designed for the smoke condition resulting from a fire of this nature.
- Emergency fire, rescue and medical teams were not in attendance.
- Both the spacecraft work levels and the umbilical tower access arm contain features such as steps, sliding doors and sharp turns in the egress paths which hinder emergency operations.

DETERMINATION:

Adequate safety precautions were neither established nor observed for this test.

RECOMMENDTIONS:

- Management continually monitor the safety of all test operations and assure the adequacy of emergency procedures.
- All emergency equipment (breathing apparatus, protective clothing, deluge systems, access arm,

etc.) be reviewed for adequacy.
- Personnel training and practice for emergency procedures be given on a regular basis and reviewed prior to the conduct of a hazardous operation.
- Service structures and umbilical towers be modified to facilitate emergency operations.

6. FINDING:

Frequent interruptions and failures had been experienced in the overall communication system during the operations preceding the accident.

DETERMINATION:

The overall communication system was unsatisfactory.

RECOMMENDATIONS:

- The Ground Communication System be improved to assure reliable communications between all test elements as soon as possible and before the next manned flight.
- A detailed design review be conducted on the entire spacecraft communication system.

7. FINDING:

- Revisions to the Operational Checkout Procedure for the test were issued at 5:30 p.m. EST January 26, 1967 (209 pages) and 10:00 a.m. EST January 27, 1967 (4 pages).
- Differences existed between the Ground Test Procedures and the In-Flight Check Lists.

DETERMINATION:

Neither the revision nor the differences contributed to the accident. The late issuance of the revision, however, prevented test personnel from becoming adequately familiar with the test procedure prior to its use.

RECOMMENDATIONS:

- Test Procedures and Pilot's Checklists that represent the actual Command Module configuration be published in final form and reviewed early enough to permit adequate preparation and participation of all test organization.
- Timely distribution of test procedures and major changes be made a constraint to the beginning of any test.

8. FINDING:

The fire in Command Module 012 was subsequently simulated closely by a test fire in a full-scale mock-up.

DETERMINATION:

Full-scale mock-up fire tests can be used to give a realistic appraisal of fire risks in flight-configured spacecraft.

RECOMMENDATION:

Full-scale mock-ups in flight configuration be tested to determine the risk of fire.

9. FINDING:

The Command Module Environmental Control System design provides a pure oxygen atmosphere.

DETERMINATION:

This atmosphere presents severe fire hazards if the amount and location of combustibles in the

9. FINDING:

The Command Module Environmental Control System design provides a pure oxygen atmosphere.

DETERMINATION:

This atmosphere presents severe fire hazards if the amount and location of combustibles in the Command Module are not restricted and controlled.

RECOMMENDATIONS:

- The fire safety of the reconfigured Command Module be established by full-scale mock-up test.
- Studies of the use of a diluent gas be continued with particular reference to assessing the problems of gas detection and control and the risk of additional operations that would be required in the use of a two-gas atmosphere.

10. FINDING:

Deficiencies existed in Command Module design, workmanship and quality control, such as:

- Components of the Environmental Control System installed in Command Module 012 had a history of many removals and of technical difficulties including regulator failures, line failures and Environmental Control Unit failures. The design and installation features of the Environmental Control Unit makes removal or repair difficult.
- Coolant leakage at solder joints has been a chronic problem.
- The coolant is both corrosive and combustible.
- Deficiencies in design, manufacture, installation, rework and quality control existed in the electrical wiring.
- No vibration test was made of a complete flight-configured spacecraft.
- Spacecraft design and operating procedures currently require the disconnecting of electrical connections while powered.
- No design features for fire protection were incorporated.

DETERMINATION:

These deficiencies created an unnecessarily hazardous condition and their continuation would imperil any future Apollo operations.

RECOMMENDATIONS:

- Review of specifications be conducted, 3-dimensional jigs be used in manufacture of wire bundles and rigid inspection at all stages of wiring design, manufacture and installation be enforced.
- Vibration tests be conducted of a flight-configured spacecraft.
- The necessity for electrical connections or disconnections with power on within the crew compartment be eliminated.
- Investigation be made of the most effective means of controlling and extinguishing a spacecraft fire. Auxiliary breathing oxygen and crew protection from smoke and toxic fumes be provided.

11. FINDING:

An examination of operating practices showed the following examples of problem areas:

- The number of the open items at the time of shipment of the Command Module 012 was not known. There were 113 significant Engineering Orders not accomplished at the time Command Module 012 was delivered to NASA; 623 Engineering Orders were released subsequent to delivery. Of these, 22 were recent releases which were not recorded in configuration records at the time of the accident.
- Established requirements were not followed with regard to the pre-test constraint list. The list was not completed and signed by designated contractor and NASA personnel prior to the test, even though oral agreement to proceed was reached.
- Formulation of and changes to pre-launch test requirements for the Apollo spacecraft program were unresponsive to changing conditions.
- Non-certified equipment items were installed in the Command Module at time of test.
- Discrepancies existed between NAA and NASA MSC specifications regarding inclusion and positioning of flammable materials.
- The test specifications was released in August 1966 and was not updated to include accumulated changes from release date to date of the test.

DETERMINATION:

Problems of program management and relationships between Centers and with the contractor have led in some cases to insufficient response to changing program requirements.

RECOMMENDATIONS:

Every effort must be made to insure the maximum clarification and understanding of the responsibilities of all the organizations involved, the objective being a fully coordinated and efficient program.

Description of Test Sequence And Objectives | Chronology From T-10 Minutes | History Of The Accident | Investigation And Analysis |

Updated February 3, 2003
Steve Garber, NASA History Web Curator
For further information E-mail histinfo@hq.nasa.gov

Source: NASA Historical Reference Collection, NASA History Office, NASA. Headquarters, Washington, DC.

Excerpts from The Apollo 204 Report

NASA Response To Findings, Determinations, And Recommendations Of Apollo 204 Review Board

In addition to the extensive system, subsystem, and component studies on the Apollo spacecraft made by the Apollo 204 Review Board, NASA undertook a detailed analysis of the entire Apollo program and its management. This included a comprehensive review of each deficiency noted by the Board and its supporting panels to identify and initiate corrective action in those areas noted. In addition to identifying and taking actions to improve crew safety, this review, because of its extraordinary depth and analysis, should result in substantial improvements to many other aspects of the Apollo program.

Many changes have been made in the Apollo program because of the accident and are discussed in parts 6, 7, and 8 of the hearings. The astronauts have had and will continue to have a direct hand in all planning and changes for the Apollo command module and no manned flights have been or will be attempted in the Apollo program until the astronauts, in the light of their newly acquired technical information, are completely satisfied with all aspects of the Apollo system.

Sunstantial changes in the management of the Apollo program have been made both in the agency and in the prime contractor's effort.

Some of the more important procedure and hardware changes that have been initiated by NASA follow:

Procedures

1. All tests taking place in 100 percent pure oxygen environments are now defined as hazardous.
2. Responsibility for test procedures at the Kennedy Space Center and the Manned Spacecraft Center has been redefined.
3. An Office of Flight Safety has been established independent of the flight program office at both the headquarters and field centers to rview all aspects of design, manufacturing, test, and flight from a safety standpoint.
4. Emergency-type training is now required for test support personnel and the launch pad is required to be equipped with appropriate fire fighting and rescue equipment.

Spacecraft and Facility Modifications

1. All manned flights will be in the Block II spacecraft, the design of which already incorporates many of the changes recommended by the Apollo 204 Review Board.
2. A significant change has been instituted in the approach to the selection and placement of materials inside the command module. This change, which severely restricts and controls the amount and location of combustible material in the command module, is more significant than any other improvement resulting from the accident.
3. A new quick-opening hatch to be installed on all Block II spacecraft is being developed.

4. Provision has been made in the spacecraft for a fire extinguishing capability using jellied water.
5. An emergency oxygen supply system has been provided for the flight crew in the event they are separated from their suits.
6. The launch facilities have been modified to accommodate the quick-opening hatch and expedite flight crew exit through the service structure in the event of fire.

One Hundred Percent Pure Oxygen Environment

NASA has defined all tests taking place in 100 percent pure oxygen environment as hazardous. While NASA has reconfirmed by detailed review that the inflight cabin atmosphere, outside the Earth's atmosphere, should continue to be 100 percent oxygen at 5 p.s.i.a., it has modified the command module systems on the launch pad. Should full scale flammability tests indicate a need to change to an air atmosphere for ground operations, NASA will implement this capability. However, the dual gas cabin atmosphere, while reducing the fire hazard, creates other risks such as the risk of the astronauts getting the "bends" if their cabin pressure is reduced quickly.

NASA Status Report

NASA submitted to the committee on January 8, 1968, a report on the status of actions taken on the Apollo 204 Review Board Report as of December 28, 1967. This document is printed as part 8 of the committee's hearings on the Apollo accident. This status report shows that NASA has made substantial progress in adopting and implementing the findings, determinations, and recommendations of the Apollo 204 Review Board and its task panel.

For further information contact Roger D. Launius, NASA Chief Historian, roger.launius@hq.nasa.gov

The Apollo Mission Tragedy

TRAGEDY AND RECOVERY 1967

Nestled beside an umbilical tower, surrounded by a service structure, and encased in a clean room at Cape Kennedy's Launch Complex 34, spacecraft 012 sat atop a Saturn IB on Friday morning, 27 January 1967. Everything was ready for a launch simulation, a vital step in determining whether the spacecraft would be ready to fly the following month. During this "plugs out" test, all electrical, environmental, and ground checkout cables would be disconnected to verify that the spacecraft and launch vehicle could function on internal power alone after the umbilical lines dropped out.

By 8:00 that morning, a thousand men, to support three spacesuited astronauts--Virgil Grissom, Edward White, and Roger Chaffee--were checking systems to make sure that everything was in order before pulling the plugs. In the blockhouse, the clean room, the service structure, the swing arm of the umbilical tower, and the Manned Spacecraft Operations Building, this army of technicians was to go through all the steps necessary to prove that this Block I command module was ready to sustain three men in earth-orbital flight. Twenty-five technicians were working on level A-8 of the service structure next to the command module and five more. mostly North American employees, were busy inside the clean room at the end of the swing arm. Squads of men gathered at other places oil the service structure. If interruptions and delays stretched out the test, as often happened, round-the-clock shifts were ready to carry the exercise to a conclusion. Throughout the morning, however, most of the preparations went smoothly, with one group after another finishing checklists and reporting readiness.

After an early lunch, Grissom, White, and Chaffee suited up, rode to the pad (arriving an hour after noon), and slid into the spacecraft couches. Technicians sealed the

pressure vessel inner hatch, secured the outer crew access hatch, and then locked the booster cover cap in place. All three astronauts were instrumented with biomedical sensors, tied together on the communications circuit, and attached to the environmental control system. Strapped down, as though waiting for launch, they began purging their space suits and the cabin atmosphere of all gases except oxygen--a standing operating procedure. (2)

STALKED BY THE SPECTRE

For almost a year, the Grissom crew had watched its craft go through the production line, test program, and launch pad preparations. After participating in a multitude of critiques, reading numerous discrepancy reports, and going through several suited trials in the spacecraft in altitude chambers at Downey and the Cape, Grissom's group had learned almost all the idio- syncracies of spacecraft 012. The astronauts knew, if not every nut and bolt, at least the functions of its 88 subsystems and the proper positions for hundreds of switches and controls inside the cockpit. They also knew that the environmental unit had been causing trouble. Indeed, Grissom's first reports on entering the cabin were of a peculiar odor--like sour milk.

As all traces of sea-level atmosphere were removed from the suit circuit and spacecraft cabin, pure oxygen at a pressure of 11.5 newtons per square centimeter (16.7 pounds per square inch) was substituted. The crew checked lists, listened to the countdown, and complained about communications problems' that caused intermittent delays. The men could speak over four channels, either by radio or telephone line, but the tie-in with the test conductors and the monitors was complicated and troublesome. Somewhere there was an unattended live microphone that could not be tracked down and turned off. Other systems, Grissom's crew noted, seemed to be operating normally. At four in the afternoon, one shift of technicians departed and another came on duty.

Near sunset, early on this winter evening, communications problems again caused a delay, this time for ten minutes, before the plugs could be pulled. Thus, the test that should have been finished had not really started, and an emergency egress practice was still to come. The crew was accustomed to waiting, however, having spent similar long hours in trouble-plagued training simulators. About 6:30, Grissom may have been thinking about the jest he had played on Riley McCafferty by hanging a lemon on the trainer.

Donald Slayton sat half a kilometer away at a console in the blockhouse next to Stuart Roosa, the capsule communicator. On the first floor of the launch complex Gary W. Propst, an RCA employee, watched a television monitor that had its transmitting camera trained on the window of the command module. Clarence A. Chauvin, the

Kennedy Space Center test conductor, waited in the automated checkout equipment room of the operations building, and Darrell O. Cain, the North American test conductor, sat next door. NASA quality control inspector Henry H. Rogers boarded the Pad 34 elevator to ride up to the clean room. There, at the moment, were three North American employees: Donald O. Babbitt, pad leader; James D. Gleaves, mechanical technician; and L. D. Reece, systems technician. Reece was waiting to pull the plugs on signal. Just outside on the swing arm, Steven B. Clemmons and Jerry W. Hawkins were listening for Reece to call them to come and help. All of these men and several others in the vicinity at 6:31 heard a cry over the radio circuit from inside the capsule: "There is a fire in here.

Stunned, pad leader Babbitt looked up from his desk and shouted to Gleaves: "Get them out of there!" As Babbitt spun to reach a squawk box to notify the blockhouse, a sheet of flame flashed from the spacecraft. Then he was hurled toward the door by a concussion. In an instant of terror, Babbitt, Gleaves, Reece, and Clemmons fled. In seconds they rushed back, and Reece and Clemmons searched the area for gas masks and for fire extinguishers to fight little patches of flame. All four men, choking and gasping in dense smoke, ran in and out of the enclosure, attempting to remove the spacecraft's hatches.

Meanwhile, Propst's television picture showed a bright glow inside the spacecraft, followed by flames flaring around the window. For about three minutes, he recalled, the flames increased steadily. Before the room housing the spacecraft filled with smoke, Propst watched with horror as silver-clad arms behind the window fumbled for the hatch. "Blow the hatch, why don't they blow the hatch?" he cried. He did not know until later that the hatch could not be opened explosively." Elsewhere, Slayton and Roosa watched a television monitor, aghast, as smoke and fire billowed up. Roosa tried and tried to break the communications barrier with the spacecraft, and Slayton shouted furiously for the two physicians in the blockhouse to hurry to the pad.

In the clean room, despite the intense heat, Babbitt, Gleaves, Reese, Hawkins, and Clemmons, now joined by Rogers, continued to fight the flames. From time to time, one or another would have to leave to gasp for air. One by one they removed the booster cover cap and the outer and inner hatches--prying out the last one five and a half minutes after the alarm sounded. By now, several more workers had joined the rescue attempt. At first no one could see the astronauts through the smoke, only feel them. There were no signs of life. By the time firemen arrived five minutes later, the air had cleared enough to disclose the bodies. Chaffee was still strapped in his couch, but Grissom and White were so intertwined below the hatch sill that it was hard to tell which was which. Fourteen minutes after the first outcry of fire, physicians G. Fred Kelly and Alan C. Harter reached the smoldering clean room. The doctors had difficulty removing the bodies because the spacesuits had fused with molten nylon inside the spacecraft.

As anguished officials gathered, the pad was cleared of unnecessary personnel, guards were posted, and official photographers were summoned. All through the night, physicians labored to complete their grim task. After the autopsies were finished, the coroner reported that the deaths were accidental, resulting from asphyxiation caused by inhalation of toxic gases. The crew did have second and third degree burns, but these were not severe enough to have caused the deaths.

Most persons who had been connected with the space program in any way remember that the tragedy caught them by surprise. In six years of operation, 19 Americans had flown in space (7 of them, including Grissom, twice) without serious injury. Procedures and precautions had been designed to foresee and prevent hazards; now it was demoralizing to realize the limits of human foresight. Several other astronauts had died, but none in duties directly associated with space flight. Airplane crashes had claimed the lives of Elliot See, Charles Bassett, and Theodore Freeman. These were traumatic experiences, but the loss of three men during a ground test for the first manned Apollo flight was a more grievous blow.

Memorial services for the AS-204 crewmen were held in Houston 30 January, although their bodies had been flown north from Kennedy for burial. Grissom and Chaffee were buried in Arlington National Cemetery and White at the Military Academy at West Point. Amid these last rites, a similar tragedy took the lives of two men in an oxygen-filled chamber at Brooks Air Force Base in San Antonio. Airman 2/c William F. Bartley and Airman 3/c Richard G. Harmon were drawing blood samples from rabbits when a fire suddenly swept through the enclosure. The spacecraft and chamber tragedies pinpointed the dangers inherent in advanced space-simulation work.

The accident that took the lives of Grissom, White, and Chaffee was heartrending, and some still insist totally unnecessary; but NASA had always feared that, in manned space flight, danger to pilots could increase with each succeeding program. Space flight officials had warned against undue optimism for years, pointing out that any program that large inevitably took its toll of lives--from accident, overwork, or illness brought on by the pressures of such an undertaking. Man was fallible; and a host of editorial cartoons reiterated this axiom for several months after the fire. One, by Paul Conrad in the Los Angeles Times, showed the spectre of death clothed in a spacesuit holding a Mercury spacecraft it one hand, a Gemini in the other, and with the smoldering Apollo in the background. It was captioned "I thought you knew, I've been aboard on every flight."

While preaching the need to promote quality workmanship, NASA managers had relied on their contractors to invoke effective measures. NASA executives knew they

Internet 2

www.arlingtoncemetery.net/apollo.htm

was a plug out test - no wires
a thousand people helping on ground (technicians)
every astronot had two circuts through the ECS
only oxygen in cabin
know that ECS was malfunting
1 crew said first cabin smelled like sour milk
was comunications problems
Before plugs pulled, verble report of fire
People in tower took 6 min to open hatch
in 12 min doctors started trying to get dead bodies out
Then they posted guards and cleared the people out
autospy reports people died because of toxic athmosphere
another fire like this at air force base (100% oxygen)

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Info Dump
Site 3

↑ "NASA Sets aside day to honor astronauts." S'AS Discover 29 Jan 2004. ProQuest, 22 Apr 2004 (see key).
Dunn, Marcia,

During countdown test
Jan 27, 1967
3 dead

Book Research 1

Ency

"Apollo Fire, Apollo Program, Crewed Spaceflights, Space exploration." The Encyclopedia Americana. 2000 ed.

Jan 27

Grissom, White, Roger B. Chaffee - astronauts
was flash fire
test
project then on hold
changes -> less combustibles
new wiring
pot metal on to protect wires
hatch changed
although weight added 1,400 lbs to ship

Book 2

Sipiera, Diane M and Paul P. Sipiera. Project Apollo. New York: Children's Press, 1997.

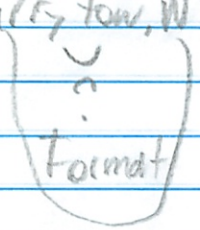
Spark caused fireball
Jan 27
was major setback
made craft fire proof
filled oxygen + nitrogen
Apollo was filled w pure oxygen
After 3 unmaned launches, did it again

Book 3

Sci Series

"Apollo Mission." Exploring Earth's Space Science. Ed. Donald R. Franceschetti. Tarrytown, NY: Marshall Cavendish, 2002. 35-39

Jan '67



Virgil Grissom, Roger Chaffee, Edward White

electrical fire

10 months, program halted

no more highly explosive pure oxygen

Book 4

"Space Exploration." World Book Encyclopedia. 1998 ed.

Jan 27 1967
flash fire → sealed capsule
electrical short circuit problem
pure oxygen → cause to burn fiercely