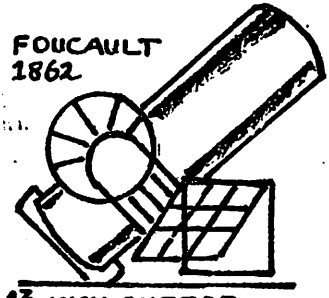
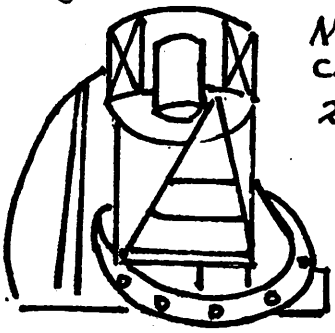
LOOKING AT THE SKY

THE GALAXIES

Look up on a dark night. You can see a hazy silvery cloud across the sky.
We call it the Milky Way.
Astronomers were puzzled by such cloudy patches of light.

Galileo discovered that the Milky Way was <u>not</u> just a hazy band of light.
It was made up of thousands and thousands of stars.
Telescopes became bigger and better.
More details could be seen. The astronomers could probe further into space.





MT PALOMAR
CALIFORNIA
200 INCH MIRROR

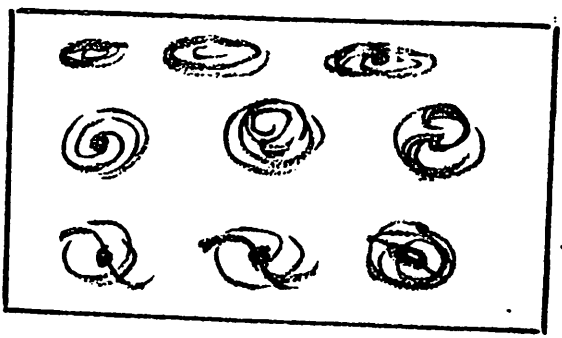
GALAXIAS

Galaxias is the Greek name for the Milky Way. The star cluster that our Sun and planets are part of is called the Galaxy.

We now know there are millions of other galaxies in space.

A famous astronomer named Edwin Hubble studied the galaxies in the 1920's.

He discovered that these great clusters of stars were generally one of three shapes.



— Elliptical

— Spiral

— Barred Spiral

There are a few galaxies that do not fit into these sets. These are called Irregular

Scientists try to sort and group things (Animals, Chemicals, Rocks —) You can see how astronomers also work like this.

PHOTOGRAPHING SPACE

Study these photographs of deep space. Which types of galaxy are these ?

The telescope used to take this photograph penetrated far into space.
Use a magnifier. Study the picture.
Can you pick out the different types of galaxies?

Can you think of any objects you know that the galaxy shapes remind you of?

LOOKING AT THE SKY.

SC

STAR BRIGHT

"The stars at night are big and bright."

Look at the night sky.
You will notice the stars are of different brightness.
Find the brightest star.
Look for the constellation - Orion

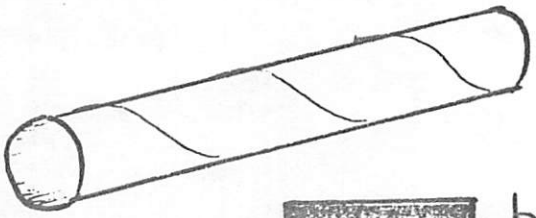
These three stars are known as Orion's belt

These three stars point south to the brightest star in the sky — Sirius

Why are some stars big and bright ?
Why are some faint pin points of light ⇒

SHINING BRIGHT

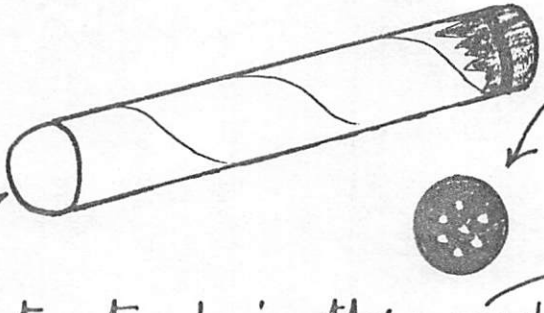
Here is something to make.
It will help test ideas about brightness.



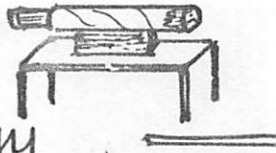
cardboard tub
eg: kitchen tow
roll — —

black paper

Fix round tube end with rubber band



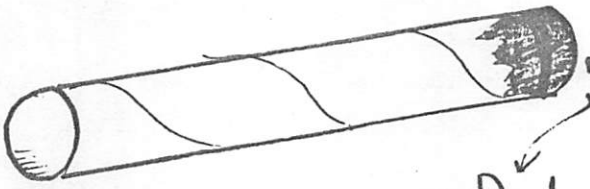
Use a pin
to pierce hole
in the paper



Put a torch in this end.
Place on a table — Move away
Try a bright light. Try a dull light. (shade the torch light with tissue paper.)
At what distances can you just make out the pin-points of light? Is it the same in each case?

BIG AND BRIGHT

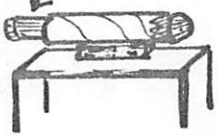
Make another tube



This time make different size holes in the black paper

Push through with a pin, a drawing pin, a compass point, a knitting needle.

Put the torch in position again.



Move away, record. Record the "stars" you see at different distances.

Try looking at the tube with the larger stars from a long way away. At the same time have the first tube near Compare observations

---

You should now be able to say – <u>why</u>. some stars are big and bright and some faint pinpoints of light. There is more than one reason. (Can you find <u>three</u>?)

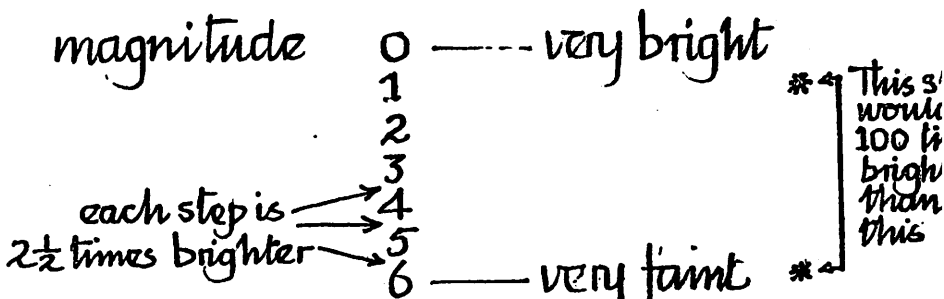
BRIGHTNESS

Astronomers measure star brightness on a scale.

A very bright star has a magnitude of 0

The faintest star that can be seen without a telescope has a magnitude of 6

The scale is like this:—



The scale is extended beyond 0 for exceptionally bright stars.

Sirius is — mag. — 1·45

The scale also extends beyond 6, when stars too faint to be seen can be picked out with binoculars.

Look at the night sky. Find Orion agai

Try to estimate the magnitude of brightness of each star.

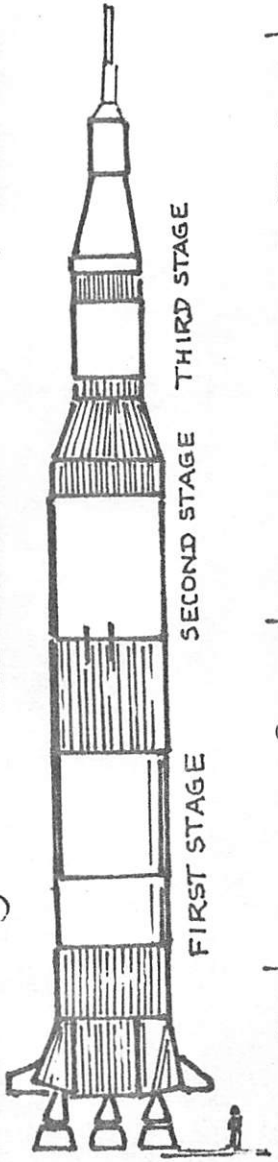
As a start this star is mag 1

(Your teacher will compare results with you)

 * SIRIUS mag −

ROCKETS AND SPACECRAFT

All this, is to get this part → The Spacecraft into space. The Rocket.



Throw a ball up into the air.
How high can you throw it? Try to make a measured guess.

Ask a small child to throw the ball up.
Ask an adult to throw as high as he can.

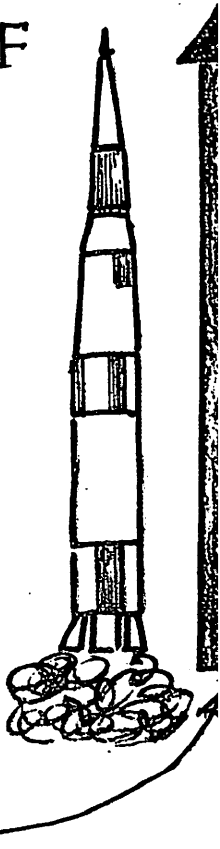
Try to make measured guesses of the heights.
What is it that changes how high the ball goes?
What pulls the ball back?

The rocket has to overcome the Earth's pull.

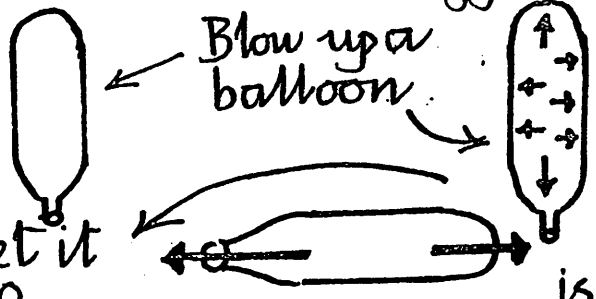
PUSH – BLAST OFF

The rocket burns fuel. This burning makes lots of hot gases. These burning gases rush out at the base of the rocket.

As they rush out in this direction the rocket shoots off in the opposite direction



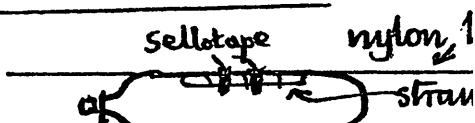
You can see this happen with a balloo



The gas (air) is pressing t escape

see how it is like the roc

Now try to control your 'rocket' flight. How far can you get it to travel ?



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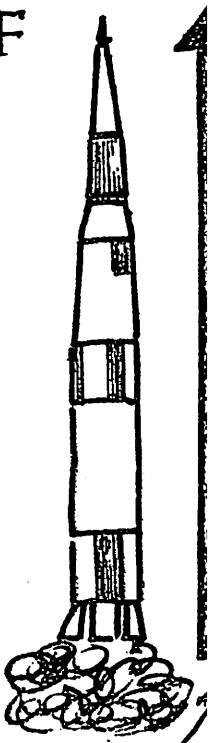

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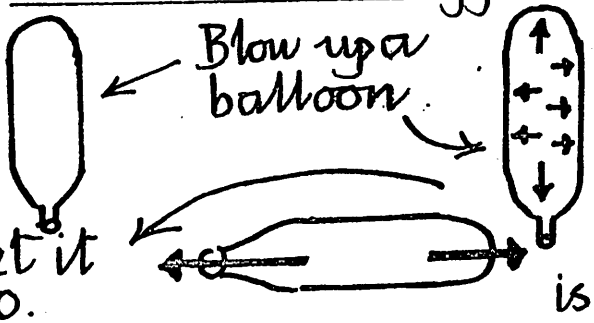

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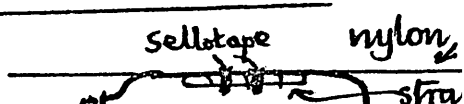
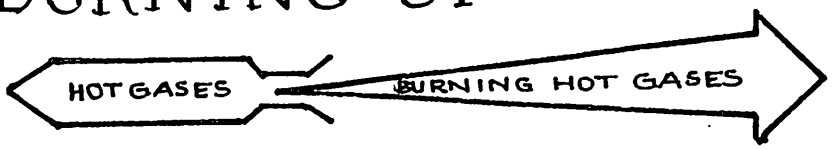


How far can you get it to travel?

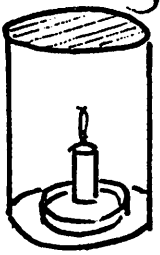
BURNING UP



Find out about burning.

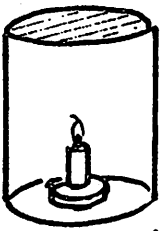
Do this experiment

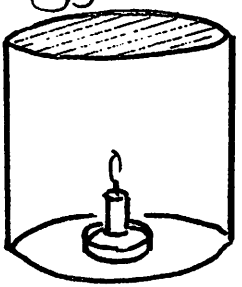
Light a candle



Cover it with a jar.

Wait and watch.
Record what happens.
Experiment with some different size jars.

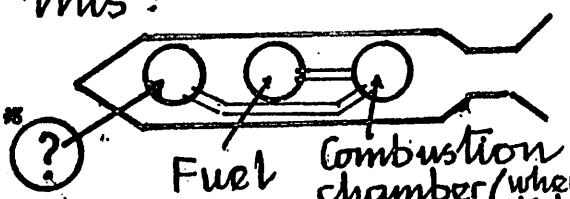




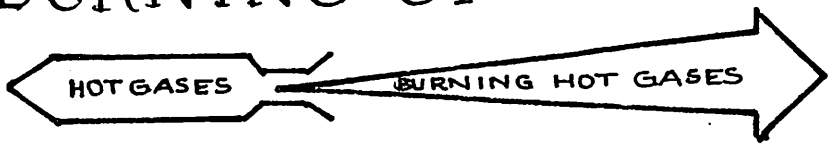
Wait, watch and time
Record your observations

A rocket motor has to burn in space.
What has your experiment to do with this?

What do you think must be in the first tank *(?)



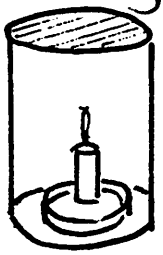
BURNING UP



Find out about burning.

Do this experiment

Light a candle



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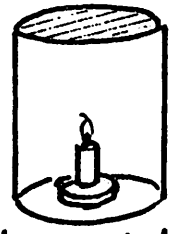

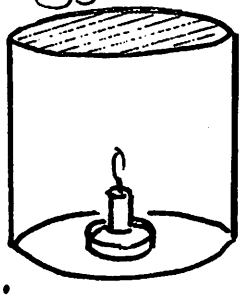

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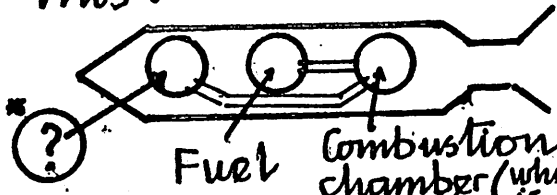
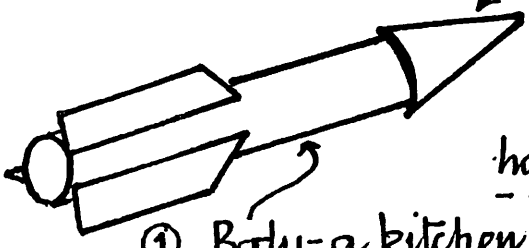


What do you think must be in the first tank ?

ROCKET LAUNCH

Make a model rocket.



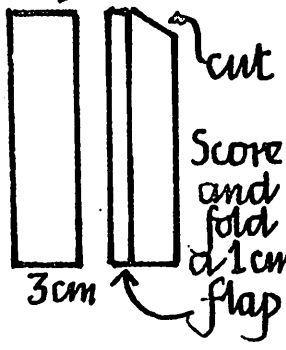
② nose cone

7cm

half circle of card – roll into cone shape and stick

① Body – a kitchen paper tower tube

⑤ Make three fins



③ Push plasticine nose weight into cone. ④ Stick nose cone to rocket body.

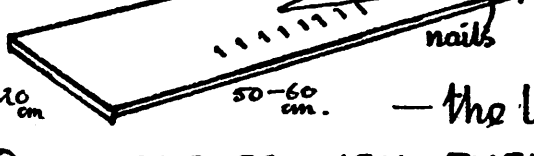
⑥ Stick the fins (by the flap) to the rocket body.

⑦ Use a paper clip to make a 'launch hook'

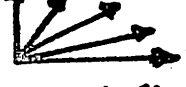
— bend — to this shape

push end into rocket body here. (make a hole, push through and pinch tight again) Secure inside and out with strong tape.

Make a launch pad.

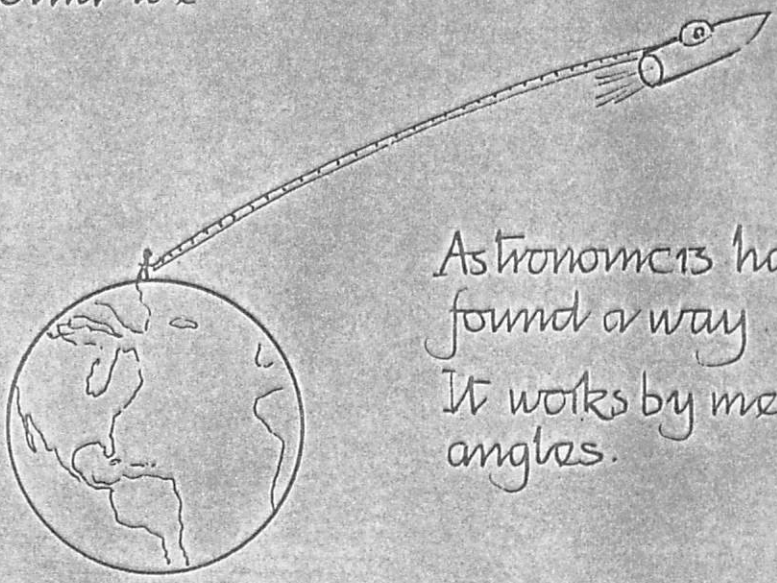


Launch your rocket at different angles. Which angle gives — the longest flight?



FAR AWAY-IO

The stars are far, far away.
It is difficult to even imagine how far.
How can we find out how far?
We could not really use a tape measure could we!

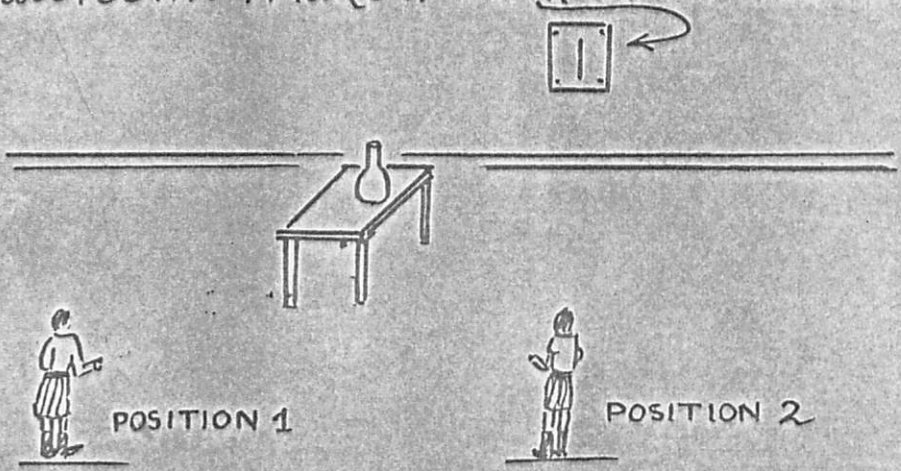


Astronomers have found a way
It works by measuring angles.

WORKING IT OUT

Measuring angles to stars depends on a simple observation. If you view an object from different places it will appear to change its position against its background.

Try it for yourself ——
Put an object on a table half way down the classroom. Make a mark on the wall behind



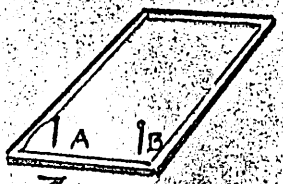
Look at the object in relation to the mark on the wall from, Position 1.
Now do this from Position 2.
What do you notice about the object and its position in relation to the background?

PARALLAX

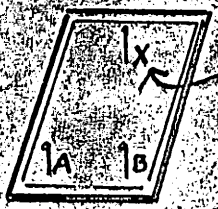
This movement in relation to a background is called parallax.

Now try using parallax for some accurate measurement.

Put a large sheet of paper on a drawing board.

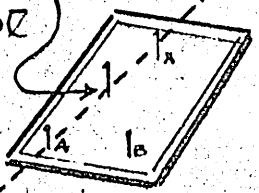


Put in two pins 20 cm apart One at place A, one at place B.

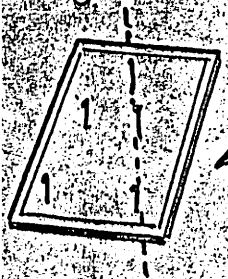


Put in another pin, at the other end. Call this place X.

Look from behind A, Line up pins A and X. Put in another pin in between and in line with these



Repeat lining up B and X

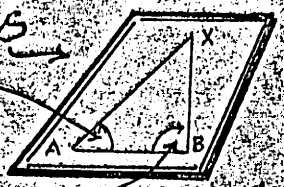


Draw the lines AB. AX and BX.

over—

USING PARALLAX

Your paper will look like this →



Measure these angles

Now draw the triangles again. Use a new sheet of paper. Use the data you have collected to draw your triangle

1. Draw line AB (20 cm)

2. Mark angle ABX and angle BAX

Draw in AX and BX.

3 Draw a line from X straight down to the line AB

Call this place Y

Measure the distance XY

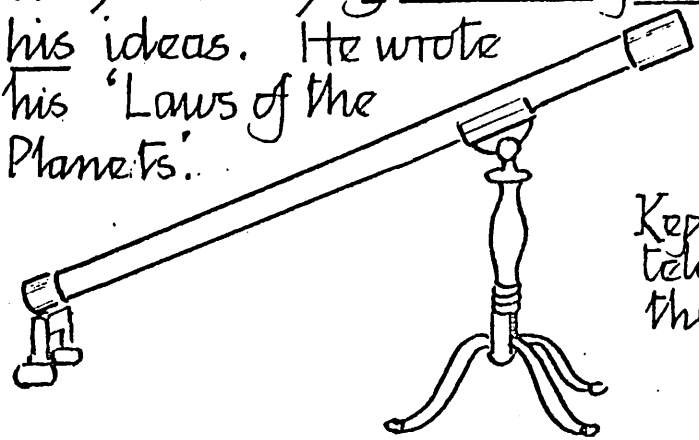
Is it the same distance as on the sheet you started with and stuck the pins in?

Can you begin to see how astronomers use such measurements to find the distances to stars? The unit FAR AWAY II will help you more.

5/13

THE WANDERERS

The word 'planet' means wanderer.
The first astronomers noticed the wanderers of the night sky. They were unlike the fixed stars.
The first astronomers thought the planets moved in perfect circles. They also noticed that they did not shine like the stars.
Stars shine because they are very hot.
How do the planets shine? Between 1609 and 1619 Johann Kepler made known his ideas. He wrote his 'Laws of the Planets'.



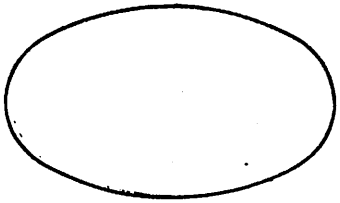
Kepler used a telescope like this.

THE PATHS

Kepler discovered that the planets did not move in circles

His "First Law of Planetary Motion" stated that; "Planets move around the Sun in elliptical paths."

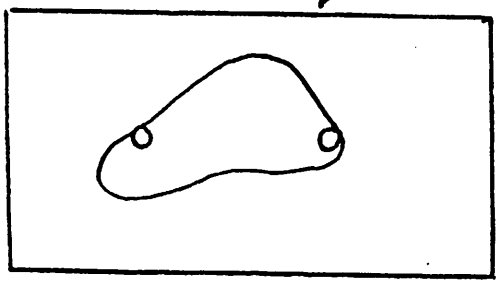
An ellipse is an oval shape

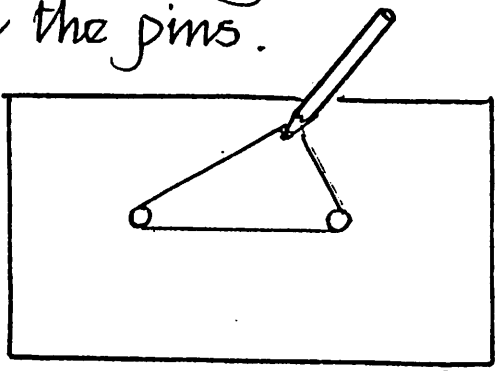


Here is how to draw an ellipse

Fix two drawing pins (25 cm apart) in a sheet of paper fixed on a drawing board.

Tie a piece of string 1 metre long into a loop. Fix it around the pins.





Put a pencil in the loop and pull it tight.

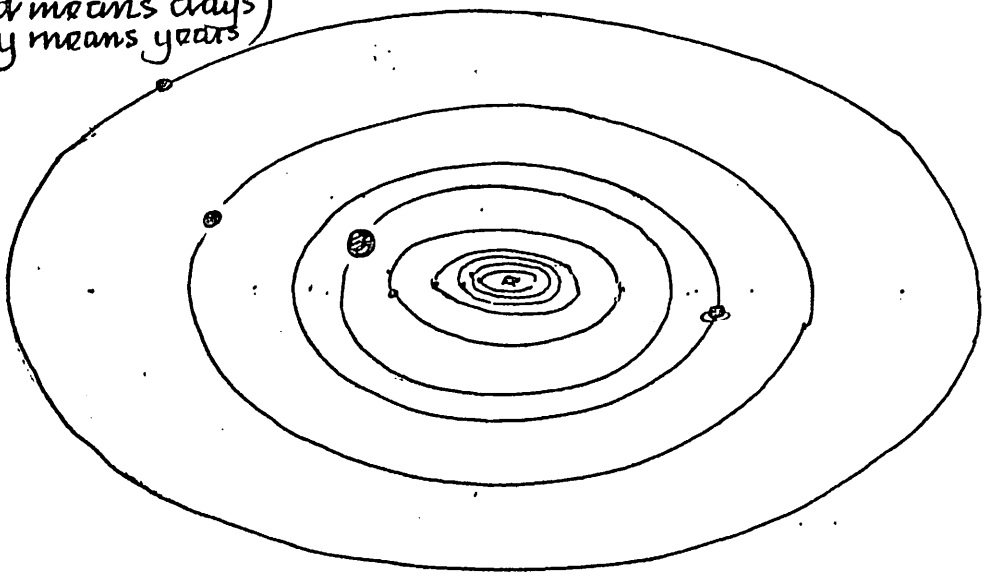
Draw a path keeping the string loop taut.

OF THE PLANETS

Like planet earth the other planets also orbit the Sun.

The table below shows how long each planet takes to journey round the sun.

(d means days
y means years)



MERCURY	VENUS	EARTH	MARS	JUPITER	SATURN	URANUS	NEPTUNE	PLUTO
88 d	224·7d	365·25d	687d	11·9 y	29·5y	84·0y	164·8y	247·7y

Each journey planet Earth makes we call a year.

You have a birthday each year.

How would birthday parties compare if you lived on Mercury — Jupiter — Pluto — ?

Draw a diagram of the planets and their orbits.

Mark their orbit times.

ALL ABOUT PLANETS

Astronomers use symbols for the planets

Which planet is represented by which symbol?

Which is the Red Planet?
Why is it so called?

Which are the Giant Planets?

Which planet was discovered by a mathematician?

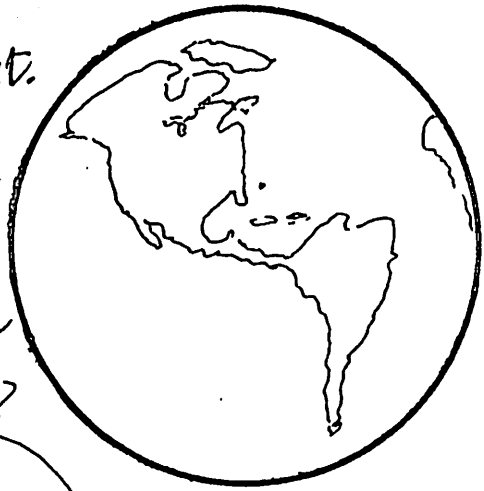
Which planet has moons, Io, Europa, Ganymede and Callisto?

Which planet did William Herschel discover from his observatory in Slough, Berkshire.?

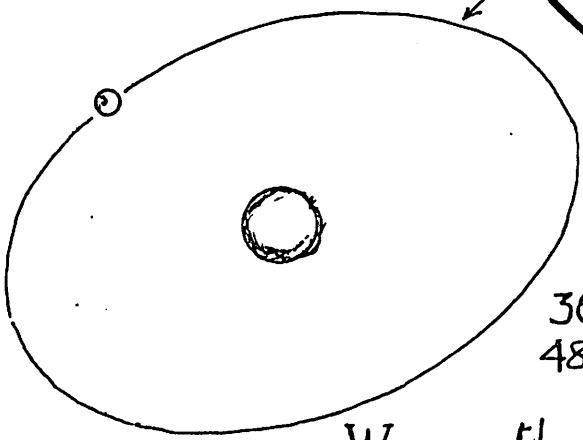
5C 5/13

PLANET EARTH

Our Earth is a planet.
It is one of nine
that journey round
the sun.



This movement round
the sun takes 1 year.

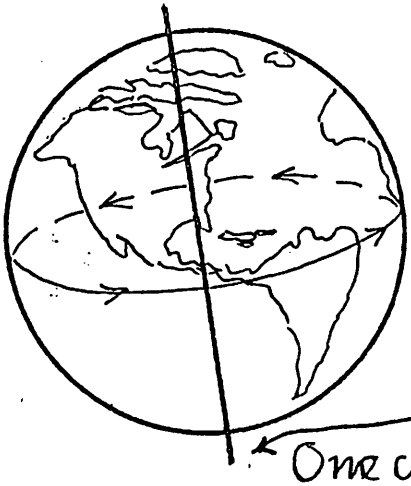


To be exact
it takes —
365 days 5 hours
48 minutes and 46 seconds.

We say there are 365 days
in a year.

What happens to the 5 hours, 48 minutes, 46 seconds?

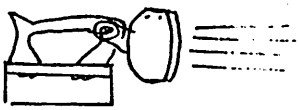
SPINNING ROUND



The Earth also spins like a top. It is spinning round on its own axis

SUN

One complete spin takes 24 hours.



TORCH OR LAMP (THE SUN)

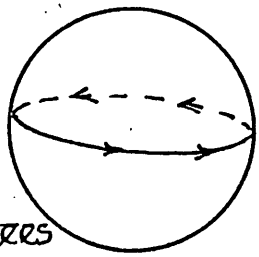
BALL (PLANET EARTH)

The part facing the Sun, is in daylight. The part facing away from the Sun is in night.

The Sun rises in the East. It sets in the West. Work out which way round the Earth spins.

A complete spin means that it has turned through a circle

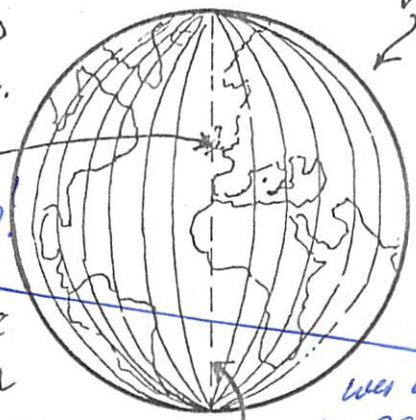
→ 360°



It takes 24 hours to do this. How many degrees will the Earth turn through in 1 hour?

SPINNING TIME

In 1884 an international meeting took place in Washington. Scientists met to work out the Earth's time zones. The result was to mark the globe and maps of the Earth with lines. They had to decide where to start the measuring from.



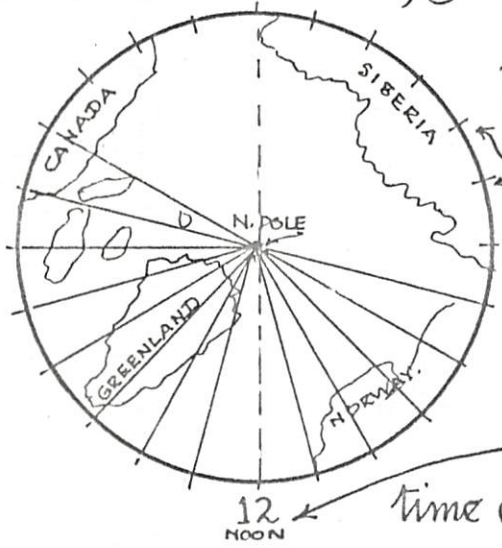
Greenwich in England was chosen. This was because there was an observatory. Lots of time measurements had been made from there. The line that passes through Greenwich is 0°.

NO

It was because the RGO had made a contribut to accurate time automat

---

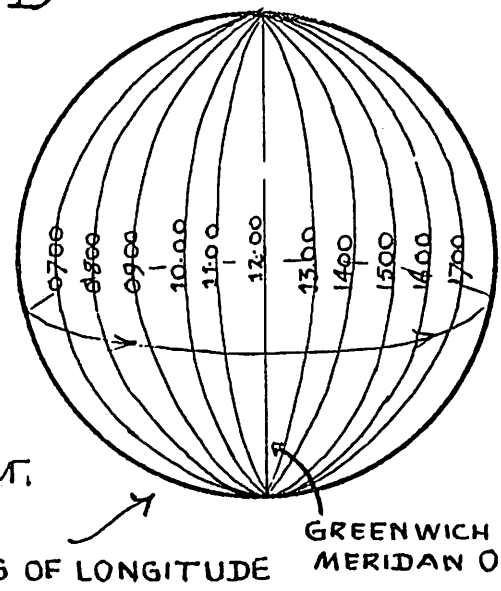
Mark out these lines, zones and times:-



Draw a circle.
The centre is the North Pole.
Use a protractor.
Measure every 15°
(Why - 15°?)
Draw lines that will mark the zones.
Mark midday at Greenwich Put the time every 15° around the world.

TIME AROUND

As the Earth spins zones pass from darkness into light. The spinning causes the day to pass. Time passes, every 15° turn takes 1 hour.



Places west of Greenwich have their day later than in England.

New York is about 75° west of Greenwich.

New York time is :-
$75° \div 15° = 5$
— 5 hours behind Greenwich

What time will it be in San Franciso which is 120° west of Greenwich?

Wellington, New Zealand is 175° east of Greenwich. What time will it be in Wellington when it is noon in Greenwich?

SC 5/13

LOOKING AT THE SKY

SC

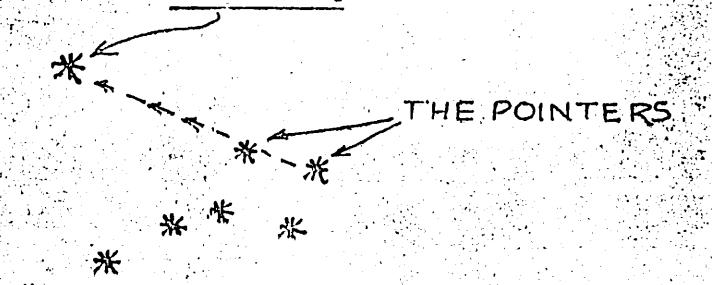
POLARIS —

GUIDE TO THE NORTH

One of the easiest groups of stars to find in the sky is the PLOUGH. Do you think the pattern is like a plough?

The North Americans call it the BIG DIPPER. A dipper is the ladle cowboys use for drinking. Perhaps you have seen one in a cowboy film?

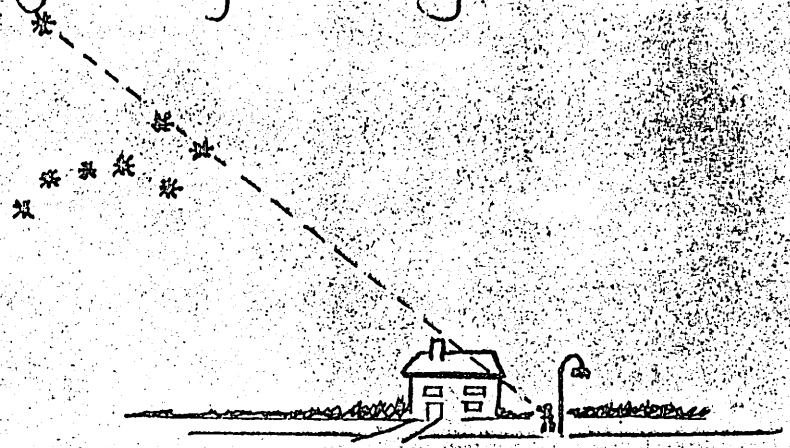
The PLOUGH is used to find the POLE STAR — POLARIS



Find the PLOUGH and POLARIS on a star map and in the night sky.

STAR PLOTTING.

Find and fix the position of POLARIS



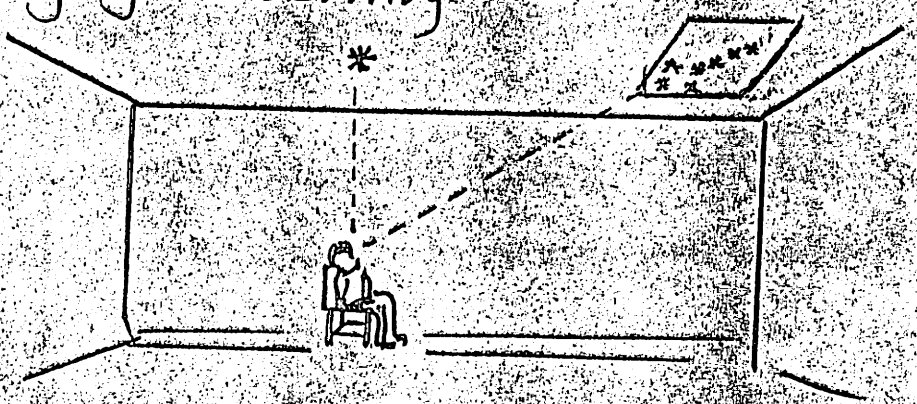
When you do this arrange yourself so that you lean against something, a lampost or a doorway. This will help steady you and fix your observation point. Further arrange yourself so that the star appears close to something, a chimney pot, a T.V. aerial or a pole for example.
Make a sketch record showing where POLARIS and other stars and constellations are in the sky. Record the time.
Go back one hour later and arrange yourself exactly as before.
Try to repeat again after another hour.
Do the stars appear to have moved?
Does POLARIS appear to have moved?

WHAT IS HAPPENING?

Lay on your back or sit and look straight up.

Arrange yourself exactly under a mark or an object on the ceiling — POLARIS

Draw the pattern of THE PLOUGH on a piece of paper. Pin this near the edge of the ceiling.



Where is POLARIS, where is THE PLOUGH, with reference to you? Turn on the spot. Turn through 90°. Where is POLARIS, where is THE PLOUGH. Go on turning and making this observation.

You represent PLANET EARTH. What were you doing? What was happening to POLARIS and to THE PLOUGH?

FINDING NORTH

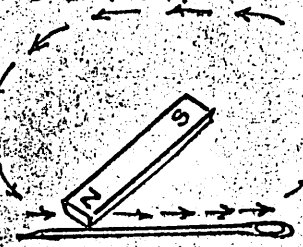
POLARIS always appears in the one place, over the NORTH POLE.
It acts as a direction pointer.
Sailors and travellers have used POLARIS throughout the centuries to find their way.

Another direction pointer is the compass.

Get a compass.
Use it to mark NORTH and SOUTH, EAST and WEST on the playground.

A compass is a magnet that is free to turn. It is then pulled and pushed by the magnetic force of the EARTH.
It then points NORTH – SOUTH.

Make your own compass.
Magnetise a needle.
Stroke it in one direction, with a strong magnet.



Use a piece of sticky tape to fix onto a slice of cork

Float this in a bowl of water. Compare with your compass and POLARIS sighting.

SC 5/13

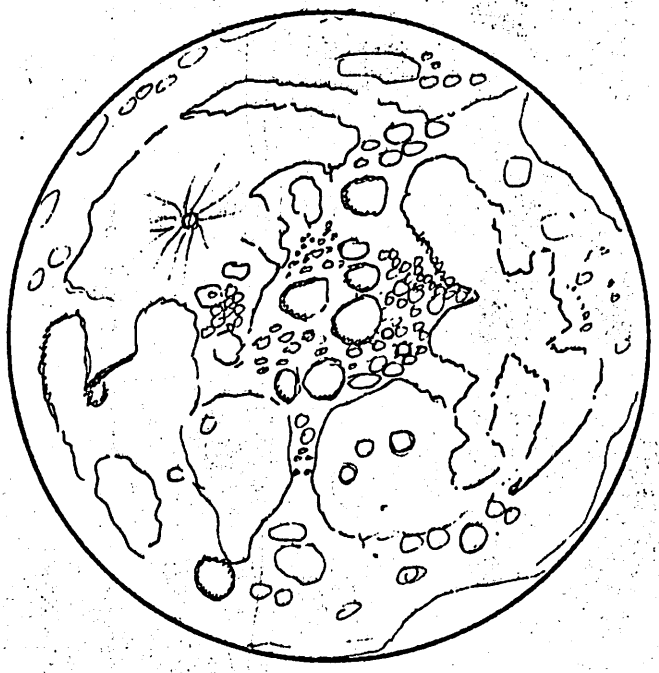
TIME. p30.31
INVESTIGATIONS. 2.15.16

18 Some help available if the clerechs are [illegible]

LOOKING AT THE SKY

SC

THE MOON



Moon Facts

Distance from Earth 384,000 km

It is about $\frac{1}{4}$ the diameter of Earth.

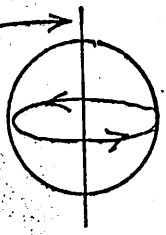
Its gravity is about $\frac{1}{6}$ of Earths

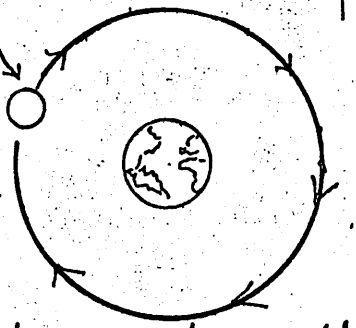
Its mass is about $\frac{1}{81}$ that of Earths.

The moon is our nearest neighbour in space.
It can be seen clearly with the naked eye. With binoculars a wealth of details will become visible. Do try to use binoculars or a telescope to look at our Moon.

MOON-SPINS

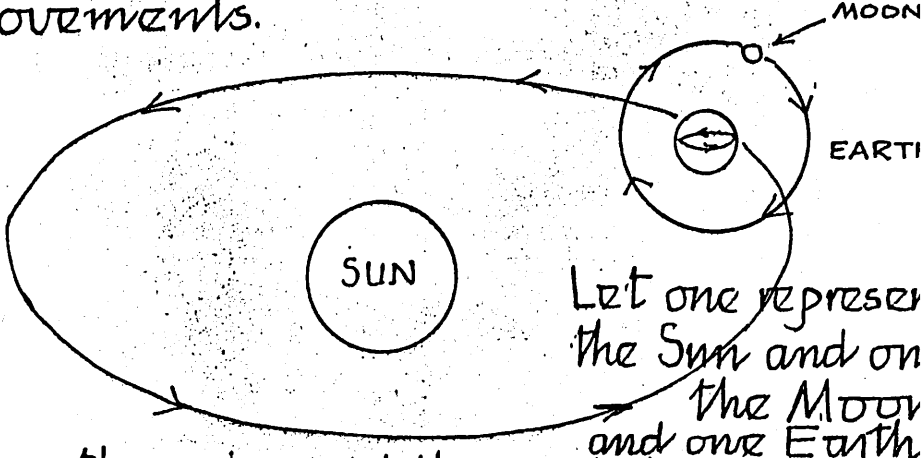
The Moon spins on its axis like a top.
The Moon also revolves around our Earth.





Both Earth and Moon journey round the Sun.
The time of the Moon's spin, means that it always shows the same side to our Earth.

Three friends could show these movements.

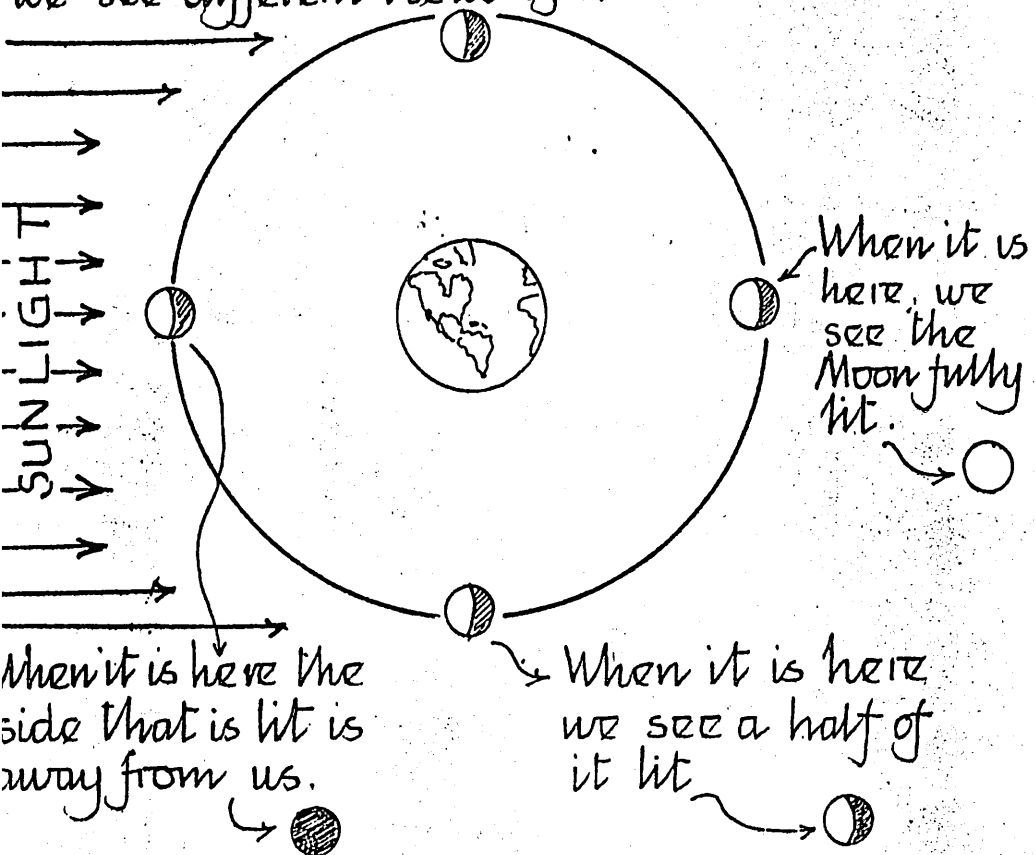


Let one represent the Sun and one the Moon and one Earth

Show the spins and the revolving.
Find how long these take (Use your reference books - encyclopedias - -)

MOON VIEWS

As the Moon moves around our Earth we see different views of it.



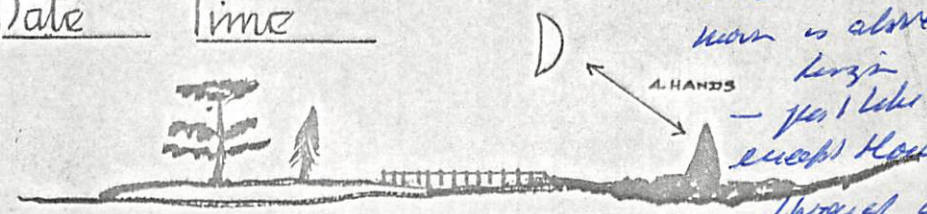
We speak of seeing a 'full' moon, a 'new' moon, a 'crescent' moon, a 'gibbous' moon. Draw the above diagram. Mark where these moons are seen:-

MOON WATCHING

Make some moon observations
— Where is it in the sky?
— What view was seen?

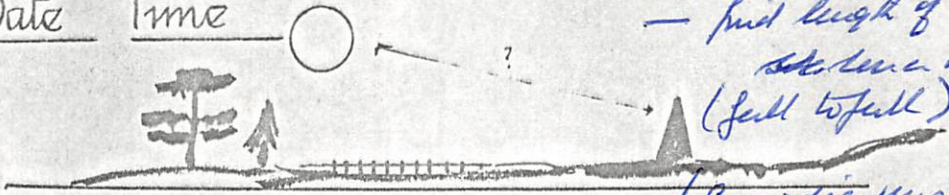
Keep a diary record for a month :—

Date Time



Date Time
Cloudy. Moon not visible.

Date Time



Date. Time.
Forgot to look.

Careful observations and records are important in science.

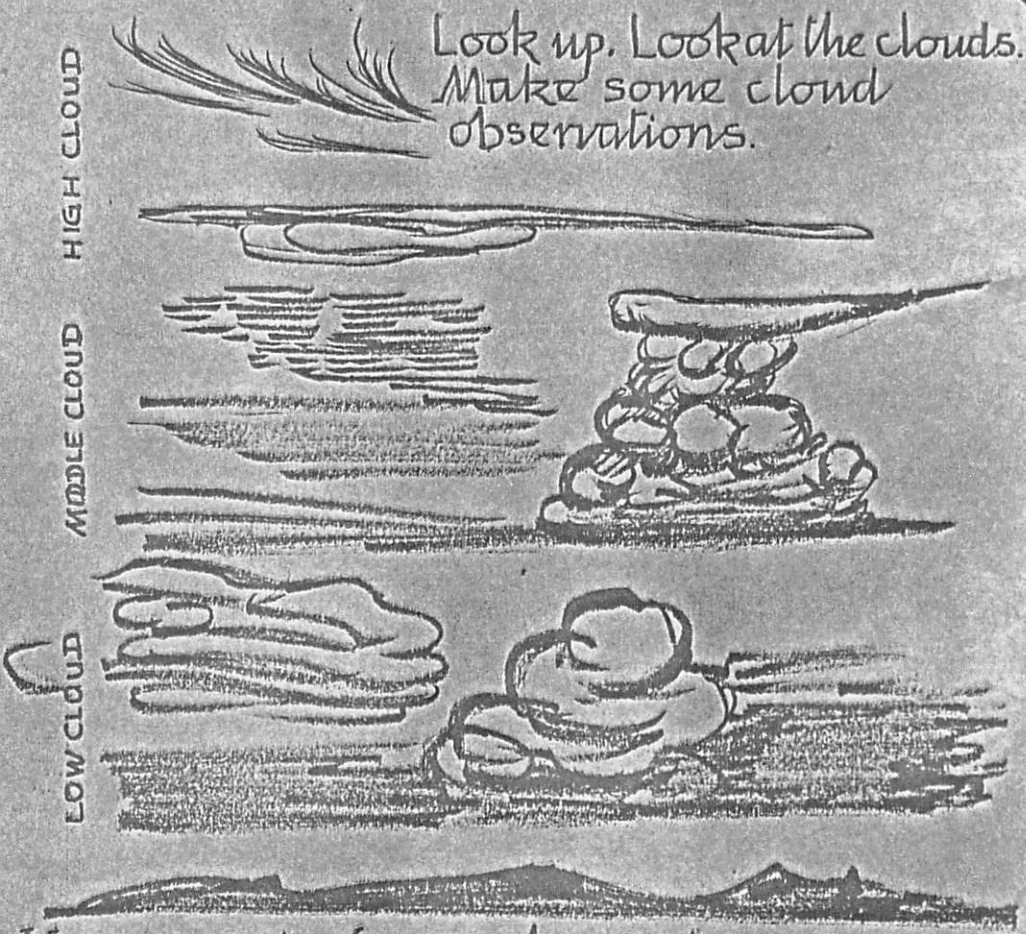
SC 5/13

LOOKING AT THE SKY

SC

CLOUDS

Look up. Look at the clouds. Make some cloud observations.



Keep records of your observations :-

DAY+ DATE	TIME	COLOUR	'SHAPE'	DESCRIPTION
	(SUNSET IS A GOOD TIME)			

(You could use words or drawings)

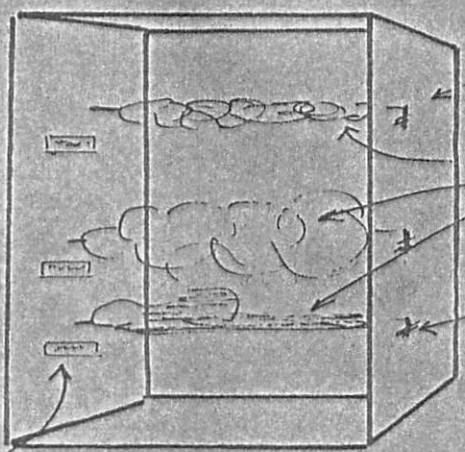
KINDS AND COLOURS

"Red sky at night, shepherd's delight"
"Red sky in the morning, shepherd's warning"
There are many old sayings like these.
Perhaps you know some?

Sky colour has always helped man to forecast the weather.

Keep a record of sky colours.
You could paint pictures

Here is another idea :-



The different types of clouds have special names.

Add these details to your model.

HOW MUCH?

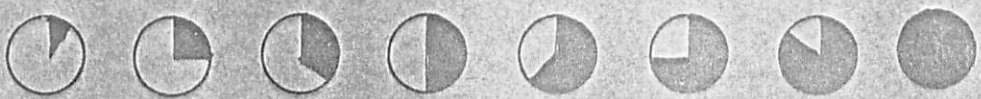
Some days we have clear blue skys. 'Not a cloud in the sky'. Other days it is overcast. We cannot see any blue or if it is night, any stars.

Weather observers use the fraction family of $\frac{1}{8}$'s to describe how much sky is covered by cloud

 means a clear sky

 means a cloud covered sky.

The 'in betweens' are shown like this.



$\frac{1}{8}$ $\frac{2}{8}$ $\frac{3}{8}$ $\frac{4}{8}$ $\frac{5}{8}$ $\frac{6}{8}$ $\frac{7}{8}$ $\frac{8}{8}$

OF THE SKY IS COVERED.

Add some estimates of cloud cover to your observations

How do these observations link with weather observations?

— sunny, showery, rainy, stormy?

THE CHANGING SKY

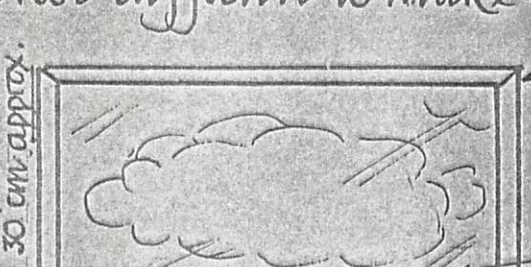
Which kinds of clouds appear to be higher in the sky?

Do different kinds of clouds move across the sky at different speeds?

Do all clouds move in the same direction as the wind is blowing?

To help answer such questions a <u>cloud reflector</u> is a valuable aid.

It is not difficult to make:—



Place your reflector in the same spot each day. You will then be able to make observations of the same piece of sky day by day.

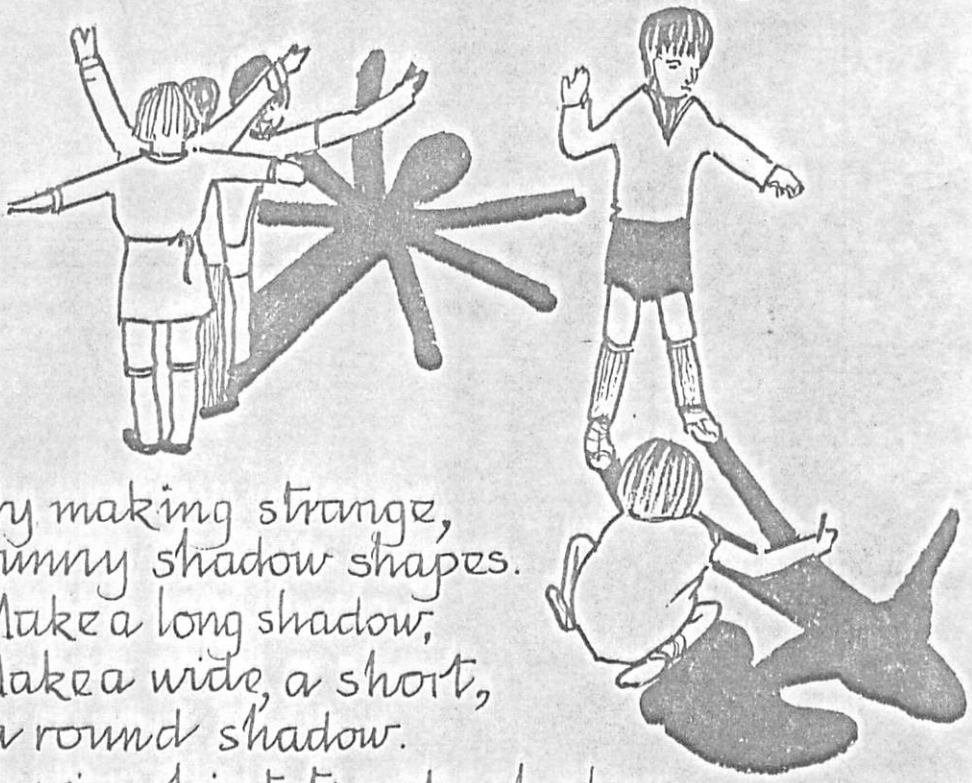
Watch out for the Sun. Danger to Eyesight.

LOOKING AT THE SKY.

SC

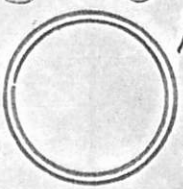
SUN AND SHADOW

On a bright sunny day we get clear shadows. Try shadow making.



Try making strange, funny shadow shapes.
Make a long shadow,
Make a wide, a short, a round shadow.

Try using objects to make shadows.



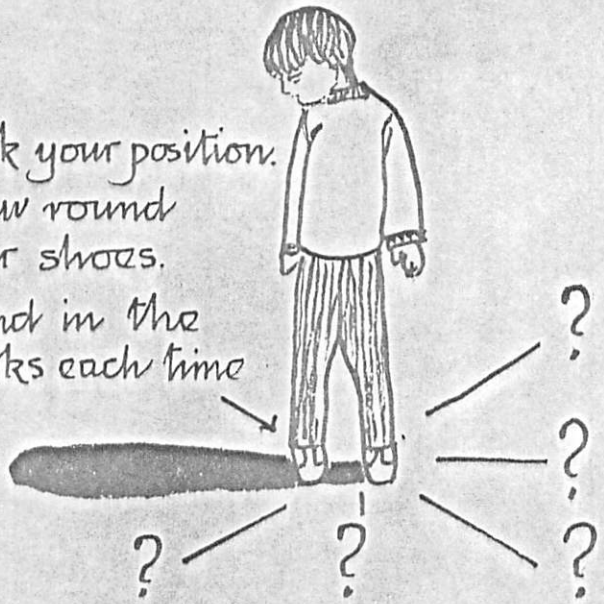
A Hoop

An Umbrella.

Make the largest and the smallest shadow. What are they like?

LONG AND SHORT

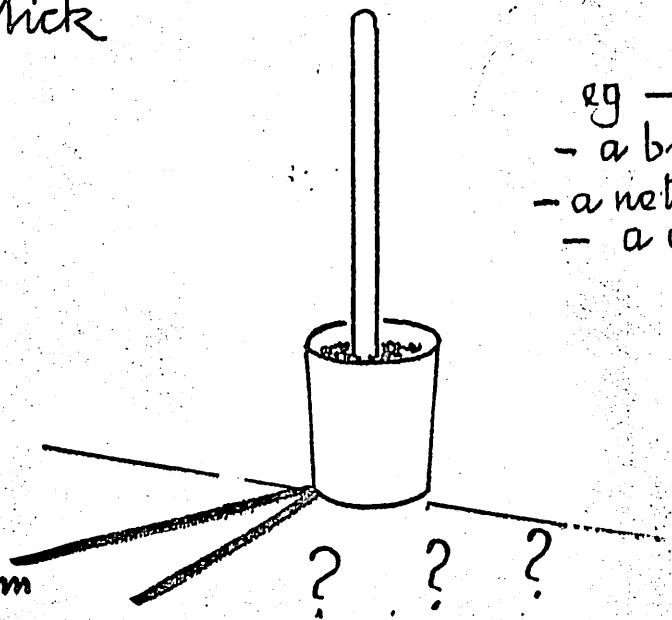
Stand straight and tall outside.
Make a shadow.



The shadow will change during the day. Why?
When will it be longest? When will it be shortest? Which way will it point? Find out. Draw round your shadow, at the start of school, mid morning, lunch time, mid afternoon and at the end of school.

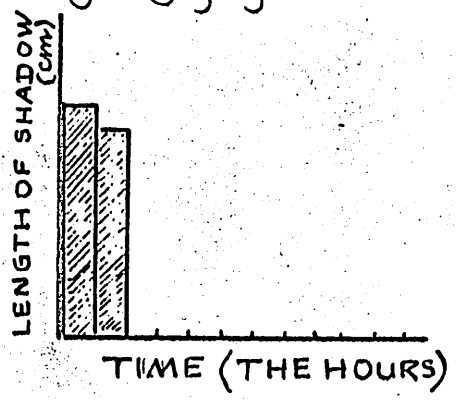
SHADOW CLOCKS.

We can use shadows to tell the time.
It will be more accurate if you use a stick



eg —
- a broom handle
- a netball post
- a cane

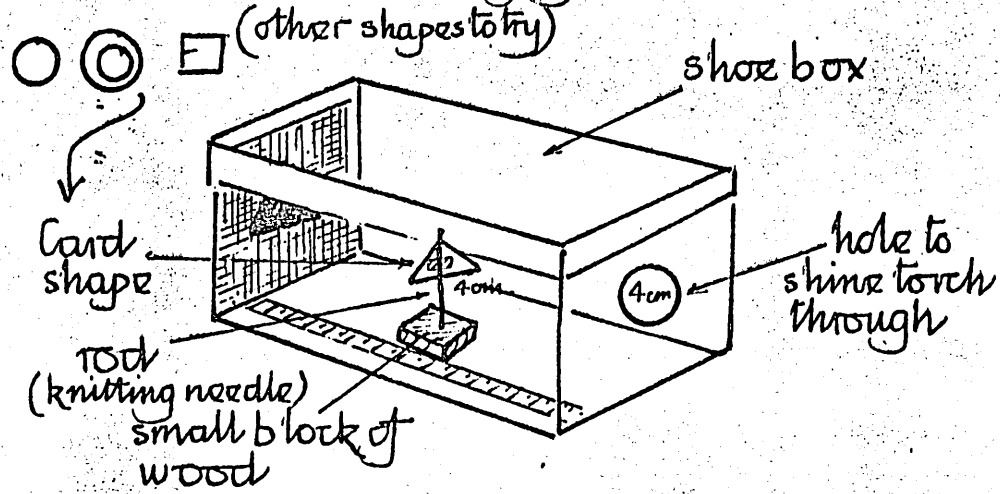
Mark, and measure the length of each shadow on the hour
Use strips of paper to show the results.



Try to do this again during the different months of the year.

A SHADOW BOX

Make a 'shadow box' to investigate shadows more deeply



Cast a shadow exactly the same size as the shape.
Can you make it larger, – twice, three times as big? (Can you make it smaller?)
Rotate the shape. How does the shadow change

Try the shadow making with solid shapes.

These could be made from balsa wood.

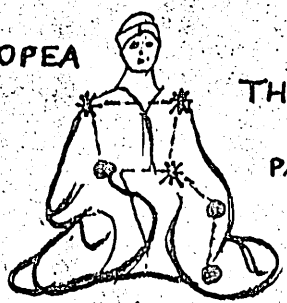
Start with the shape at the end of the box. Move it forward in steps of 1 cm.
Measure the shadow.

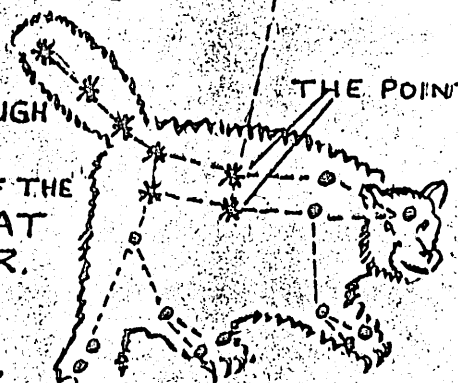
SC 5/13

TIME. p.9.-11
EARLY EX. p4-13

THE STARS
—ON THE MOVE

The night sky shows us thousands of stars dotted against the blackness. Look closely and we make out groups of stars making patterns.
These star patterns are called constellations. People used their imagination and saw figures, animals and shapes in the constellation patterns.



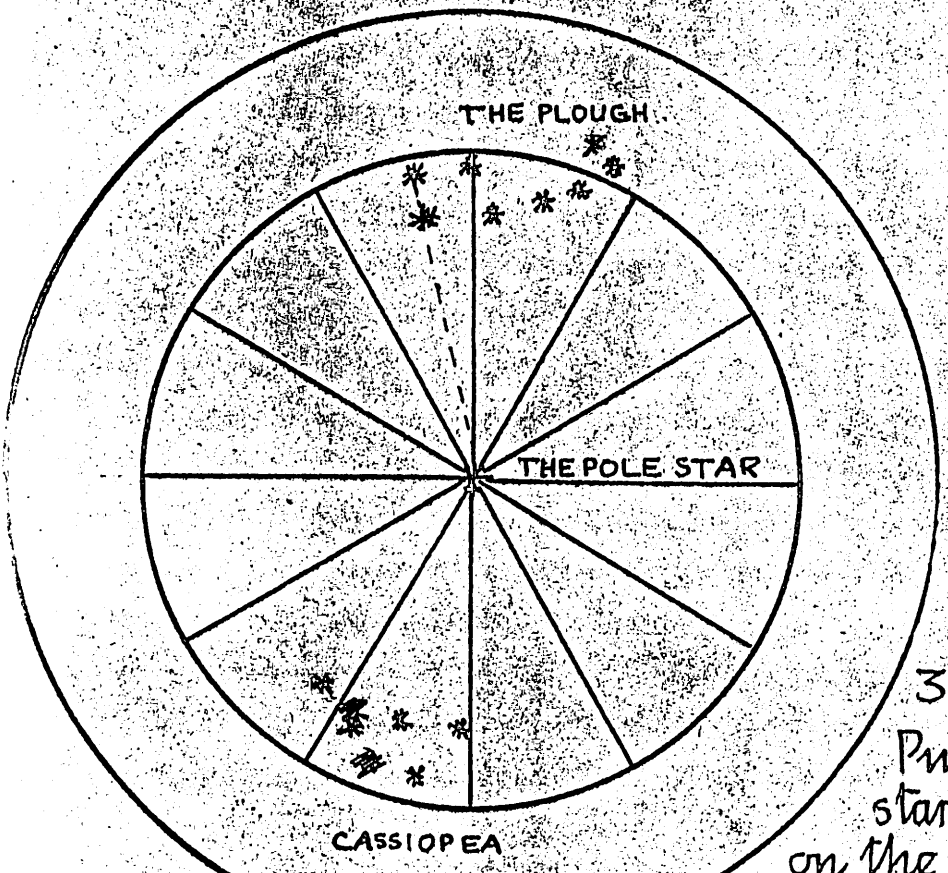


These are two of the well known constellations.
These star patterns can help us chart how the stars 'move' in the sky. →

MAKING A STAR CHART

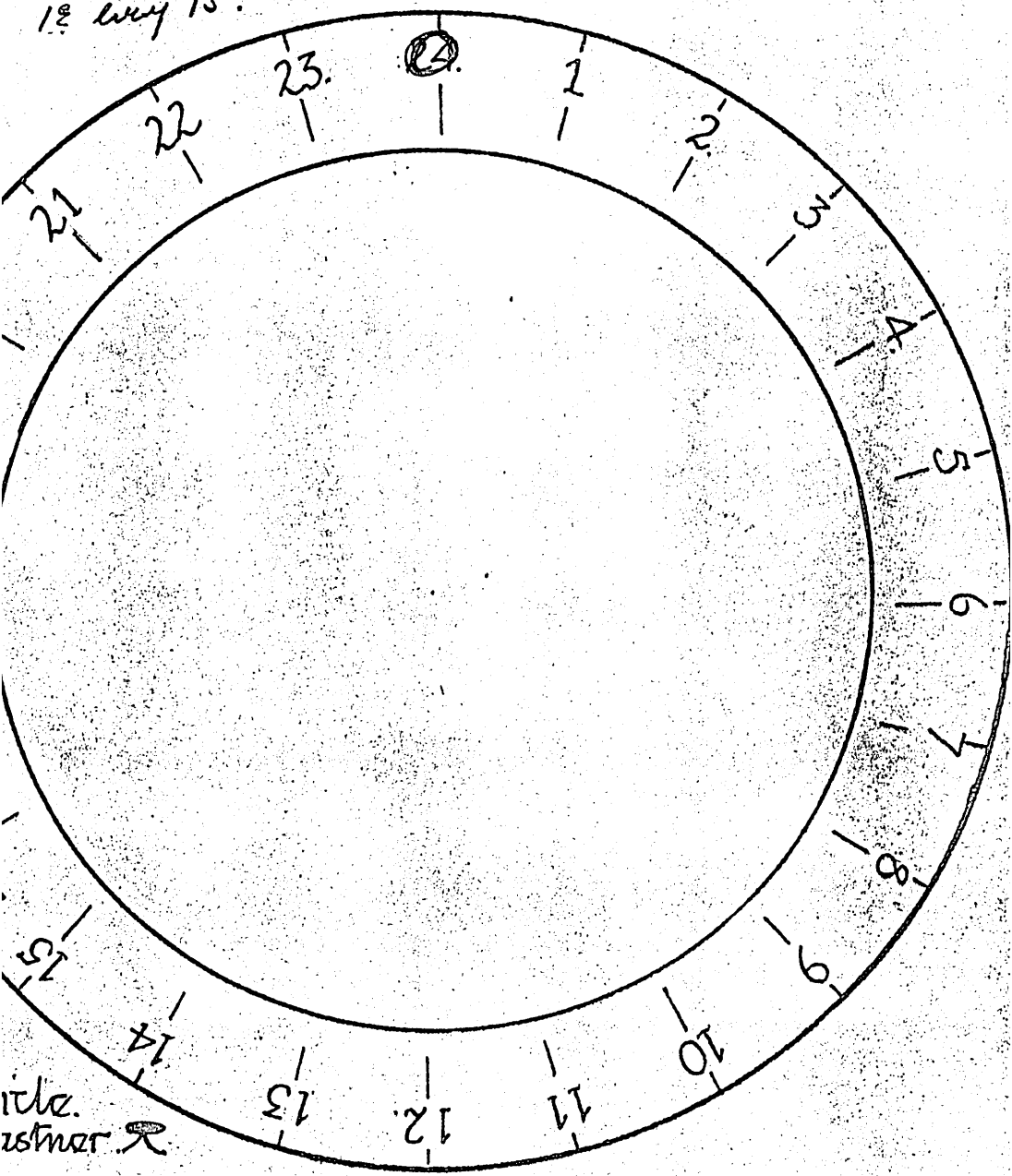
Make your own chart of the constellations.

1 Draw a 15 cm diameter circle on card.
Cut it out.
Now draw a 10 cm diameter circle on this card
Mark out 30° sectors with a protractor.
The Pole Star is at the centre.
The chart shows Cassiopea and The Plough in relation to the Pole Star. Mark these.



3
Put th
star cir
on the cloc
Fix with a pa

2 Draw a 20 cm diameter circle on card.
Cut this out. Draw a 15 cm circle on this.
Mark a 24 hour clock on the outer edge.
1 every 15°



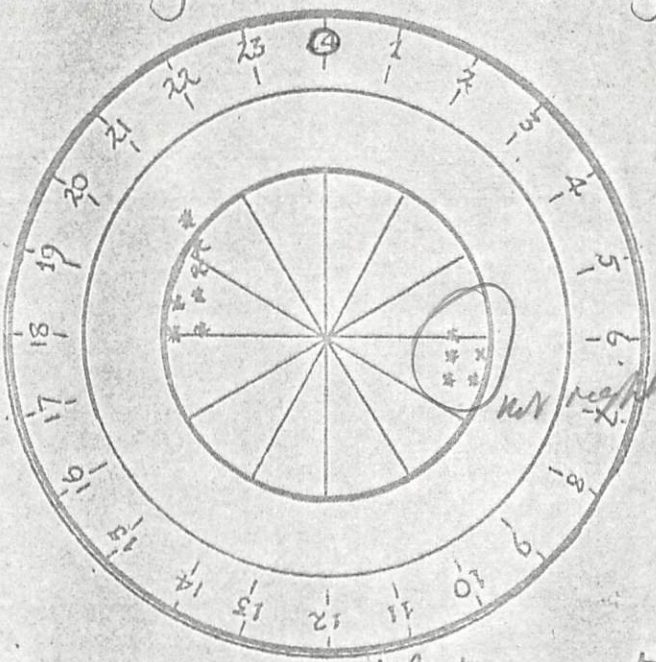
ircle.
astmer

USING THE STAR CHART

You will need to use your star chart on a clear night. Winter is a good time as it gets dark early.

Put the chart in a place where you can keep it fixed. A window sill might do.

Find the Plough. Note the time and arrange the constellation against the time.



For example if it is 1830 hours you put the Plough alongside 1830. on the clock circle.

Where is it at 1930 hours?

Where is it at 2030 hours?

What seems to be happening?

Can you find other constellations to mark on your star chart?

Other constellations?

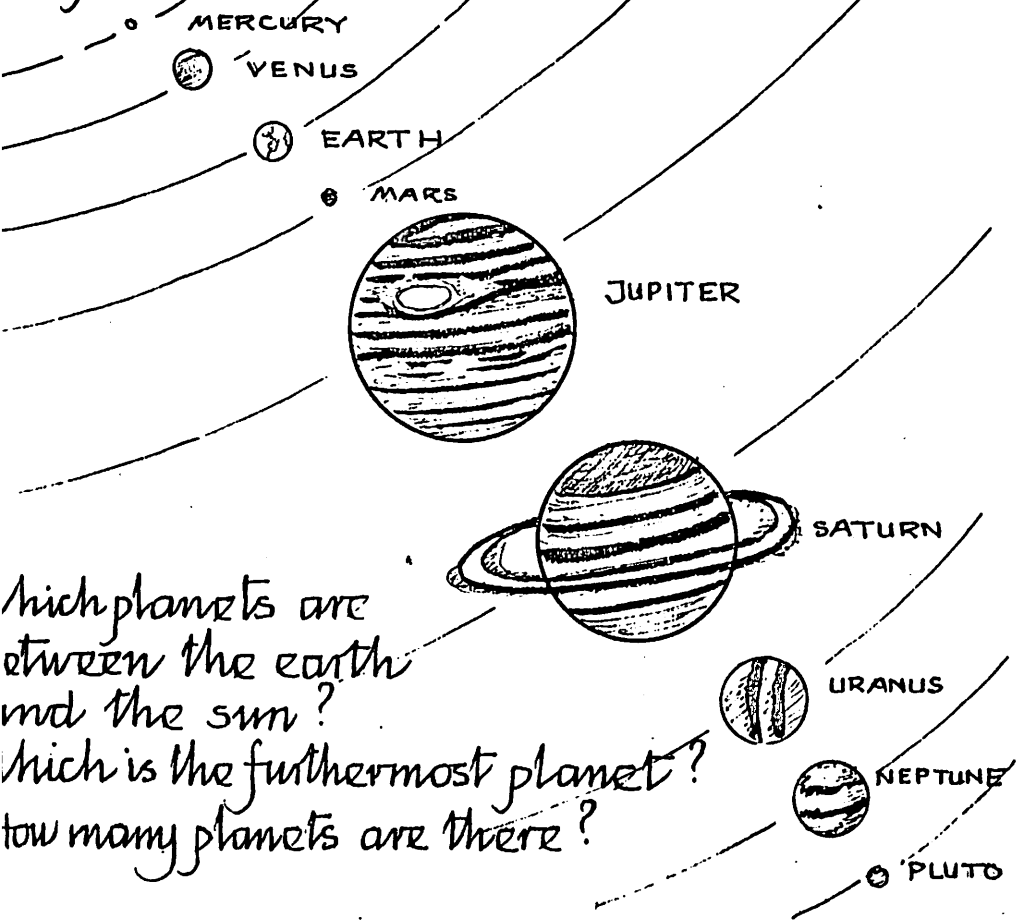
SC 5/13

LOOKING AT THE SKY

SC

THE PLANETS

The name planet means wanderer.
The planets are not like the stars. They appear to move across the night sky.
The planets move in orbit around our sun.



Which planets are between the earth and the sun?
Which is the furthermost planet?
How many planets are there?

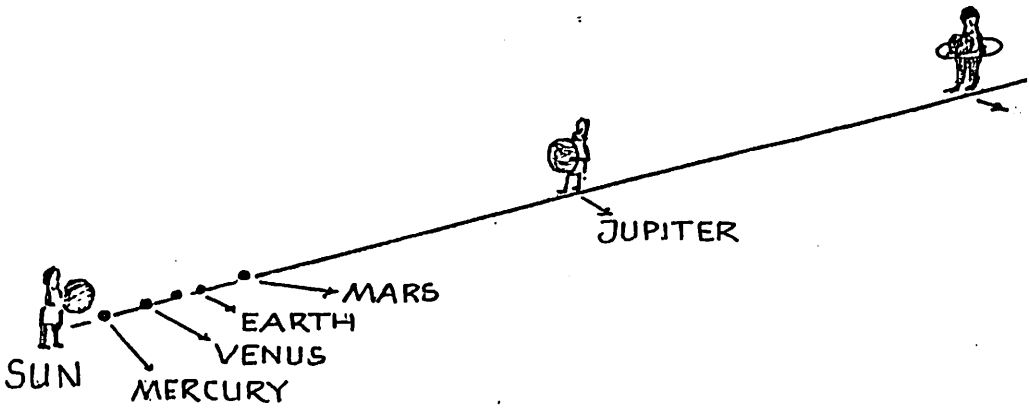
TO THE PLANETS

Blast off! We are in our space ship

If we could make this journey we would
(Venus is the nearest planet to Earth.)
The distances in space are immense
from the sun. The figures are mil

MERCURY	VENUS	EARTH	MAR
58	108	150	22

To help understand these figures, you and
Measure out the distances to a scale.
(You could paint a large picture
of the planet to hold up at its
position)

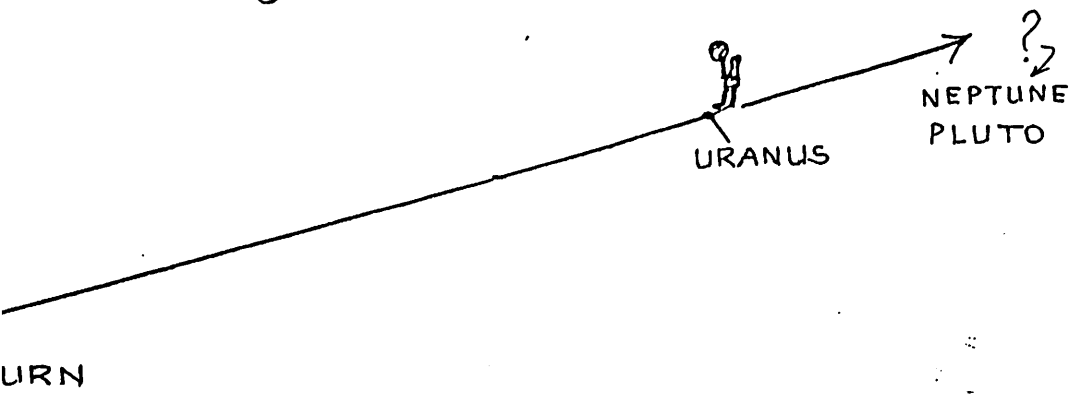


ound for Venus.
have to travel 42 million kilometres.

is table shows the distances of the planets,
ns of kilometres.

JUPITER	SATURN	URANUS	NEPTUNE	PLUTO
778	1427	2870	4497	5900

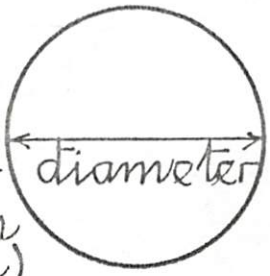
me friends pretend to be the planets.
.et 1 cm represent 1 million kilometres.



URN

HOW BIG ?

The Sun is approximately 1,400,000 kilometres in → diameter
(This is 109 times larger than Earth)



This table shows the diameter of the planets in relation to our Earth.
(It will tell you how many times larger or smaller than Earth a planet is)

MERCURY	VENUS	EARTH	MARS	JUPITER	SATURN	URANUS	NEPTUNE	PLUTO
0·4	1	1	0·5	11	9·4	3·7	3·5	0·5

Find ball shapes to fit this scale.
Start with a pea to represent Earth.
You will have to find something less than half the size of a pea to represent Mercury.
(You can try seeds  fruits  balls.)

Arrange them along your distance line

On this scale the Sun will be 109 times larger than Earth.
What can you find to represent the Sun?

SC 5/13

CHARTING THE SUN

Where is the sun at different times of the day?

DANGER. NEVER LOOK AT THE SUN
IT IS SO BRIGHT.
IT CAN BLIND.

Chart how the sun seems to move in the sky.
The way you can do this will depend on which way your classroom faces.

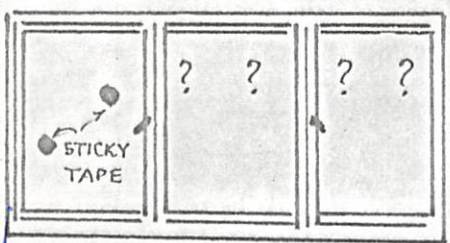
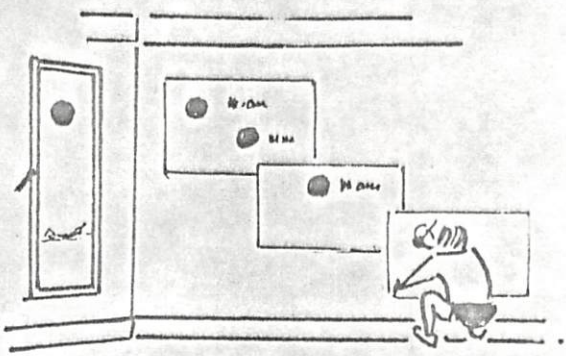


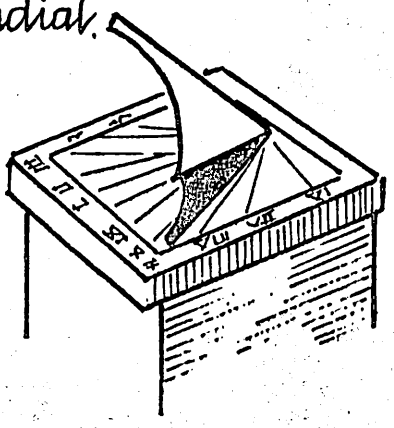
Chart the sun across the window



Or, mark the window and chart the shadow.

A SUNDIAL

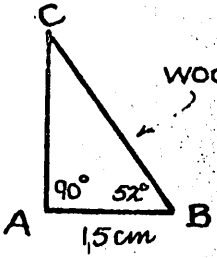
You can also chart the sun's apparent movement with a sundial.

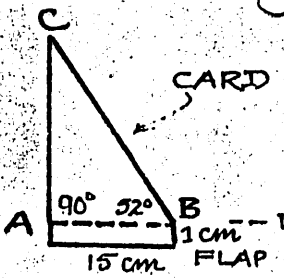


You can tell the time with a sundial.

Here is how to make a sundial.

Mark and cut out a triangle. You can use thin wood or stiff card.

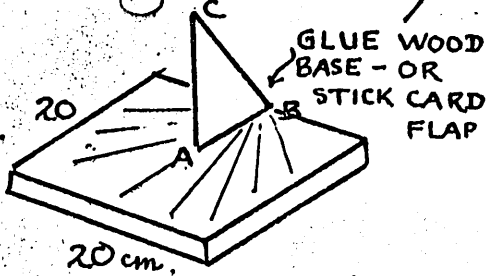




THIS SHAPE IS THE GNOMON OF THE SUNDIAL.

Angle B is the latitude at which the sundial is to be used. Look this up in an atlas. (It is 52° for London.)

Use a 20 cm. square of wood or card for a base.



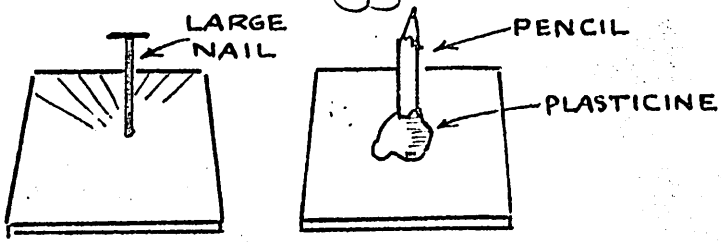
Set the dial with BA pointing exactly north.

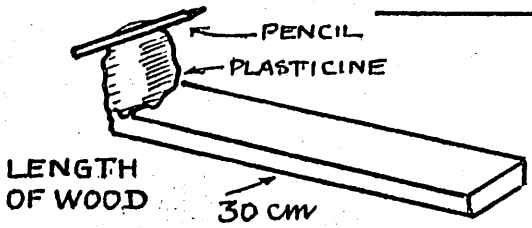
Mark in the shadow of the gnomon every hour.

MORE SUNDIALS.

It is interesting to invent other kinds of sundials

Here are some suggestions.

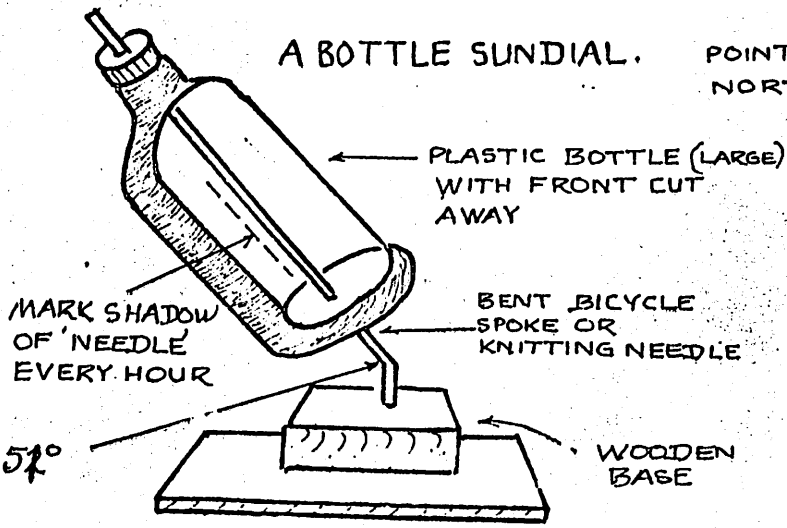




This is a model of a sundial used by the Egyptians

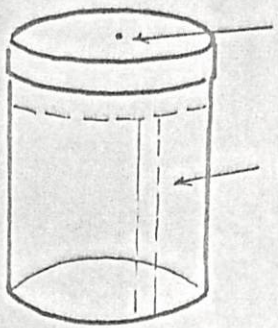
Point it towards the east in the morning. Turn it to point west at noon.

A BOTTLE SUNDIAL.



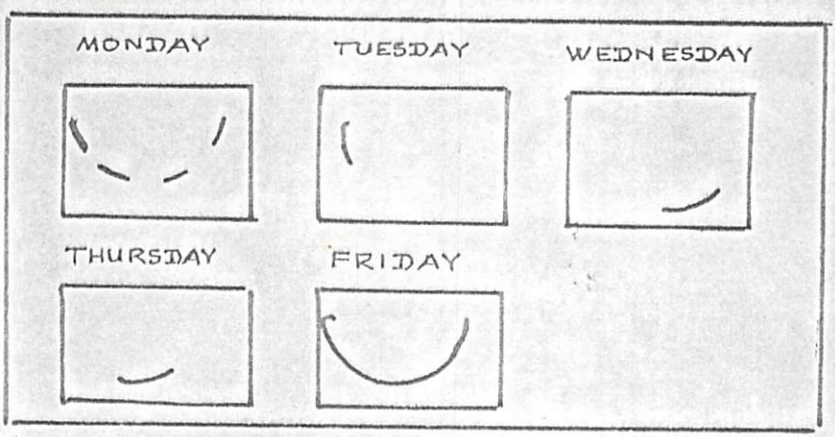
A SUNSHINE RECORDER

You will need a large, deep tin.
Make a small hole (pin prick size) in the centre of the lid.
Line the inside with light sensitive paper



For best results set your light sensitive paper over S.

Put the tin outside where the sun can shine through the hole.



What do your records tell you? What can you say about the amount of sunshine? What can you say about how the sun 'moves'?

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TIME p 12-13 — p 33.

Do this exp every day marking with ✓ if light sensitive paper

Possible Title

1. Looking Glass. Using Binoculars — limited field

LOOKING AT THE SKY

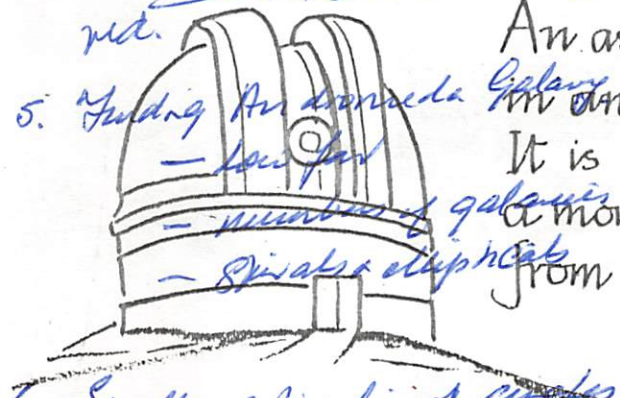
THE ASTRONOMER—

2. Grin I — blue stars, red stars, brightness of stars.

TELESCOPES

3. Grin II — Orion Nebula glowing gas — flowers like interstellar matter.

4. Grin III — ages of stars, old, (Like Sun) young like Orion Nebula stars like blue



5. Finding An Andromeda Galaxy
   — how far
   — number of galaxies
   — Distance telescope

An astronomer works in an observatory. It is usually high on a mountain and away from big cities, - why?

6. Simple estimate of angles — fingers, hand spans.

One of his most important tools is

7. the telescope. distances by measuring angles — backsight, sextant.

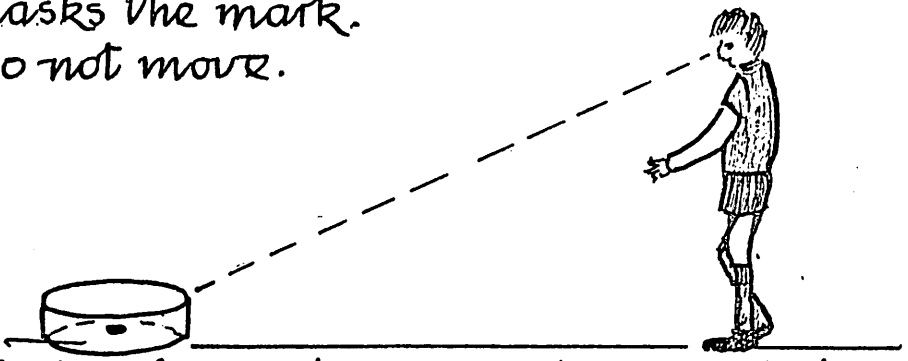
8. A telescope uses altitude of pole star
   altitude of Sun.
   latitude by its height. — Greenwich time
9. lenses or mirrors to gather the light from distant stars.
   Navigation II time of rising of stars
   time of rising of Sun if you know clock
10. Find out about how lenses and telescopes work

Healing by the Sun. — vernal equinox
years. — outside, inside.
unusual medical
how much heat?

11. Clusters of stars — Pleiades — near Orion.
    Hyades
12. Variable stars — Algol compare with nearby stars.

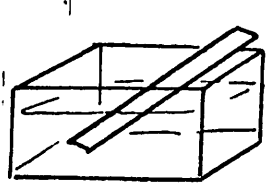
BENDING LIGHT

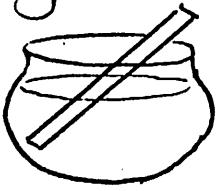
Make a mark on the bottom of a 'washing up' bowl. Place the bowl on the floor. Walk away until the rim of the bowl just masks the mark.
Do not move.



Get a friend to pour water into the bowl.
What do you see ?

Place a ruler in a glass tank or bowl.





Fill the tank with water.

Look at the ruler. Look from all sides — above and below. What do you see ?

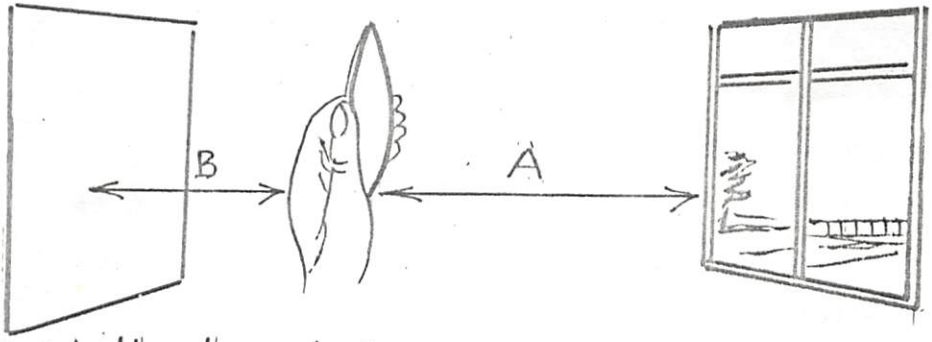
You have seen light being bent.
As the light passed through air then water it was bent.

LENSES

This bending of light also happens when light passes through air then glass.
This is put to use in specially shaped pieces of glass called lenses.

Different shape lenses bend light in different ways.

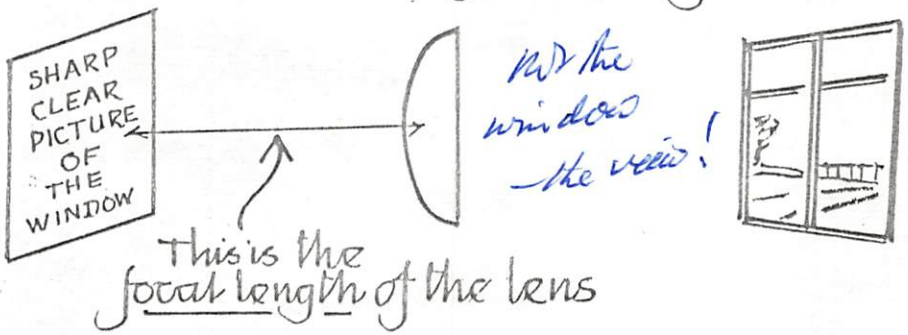
Get a lens.



Hold the lens between a window and a piece of white card. Move to and fro until you get a sharp 'picture' of the window.
Measure distance A and distance B.
What size is the 'picture'? Which way up is it?
Try other lenses. Are these distances and observations different?

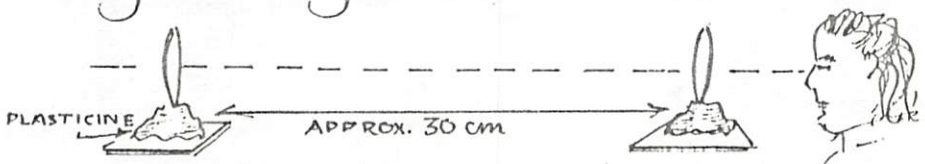
A TELESCOPE

To make a telescope two lenses are needed.
You need to know the focal length.

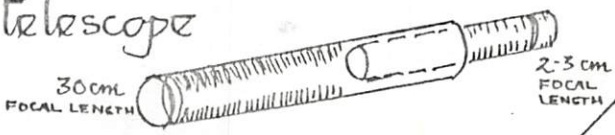


One lens should be about 5 cm diameter and have a focal length of not less than 30 cm.
The other should have a focal length of 2–3 cm.

The lenses must be held at the same height. They must be in line.



Move the lens to and fro until you see a sharp picture.
Mark and measure the distances carefully.
Try mounting the lenses in card tubes to make a telescope

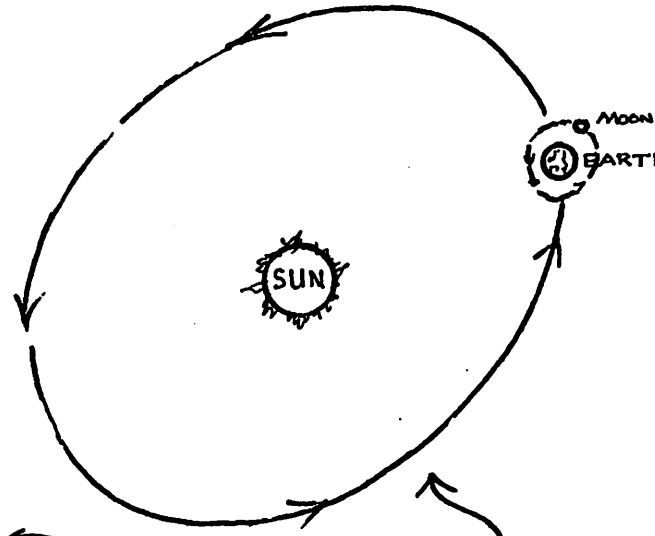


THE YEAR

"Thirty days hath September,
All the rest I can't remember,
There hangs a calendar
upon the wall,
Why bother me at all."

Do you know the real rhyme that helps you to remember the days in each month?

January	31
February	28
March	31
April	30
May	31
June	30
July	31
August	31
September	30
October	31
November	30
December	31
Total =	



What has this to to with this ?

THE CALENDAR

Our calendar has grown from the work of the early astronomers.

Our year is 365 days — ?

If we are exact, and use our astronomical observations we find the earth takes 365 days, 5 hours, 48 minutes 46 seconds to journey round the sun!

It is an odd length of time to divide between the months.

We take the year as 365 days. We put the 5hrs. 48min, 46sec. together every fourth year. This makes a year of 366 days — A leap year.

This still does not make things exactly right. There are still odd 'little bits' of time that mount up. Find out how this is put right on the centurial years.

Make a chart to explain how the months of the year got their names

January — named after the Roman double faced god - Janus. (who looked back to the past and forward —)

October — 'Oct' means eight - so !!!!?

A NEW CALENDAR

Look at this year's calendar.
On which day of the week will your birthday be? Find which day Christmas Day will be.
Look at last year's calendar. Look at next years.
Are the days the same? In which year will your birthday be on the same day as it is this year?

Here is a new calendar.
It is called The World Calendar

January						
S	M	T	W	T	F	S
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				

February						
S	M	T	W	T	F	S
			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		

March						
S	M	T	W	T	F	S
					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

April						
S	M	T	W	T	F	S
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				

May						
S	M	T	W	T	F	S
			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		

June						
S	M	T	W	T	F	S
					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

July						
S	M	T	W	T	F	S
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				

August						
S	M	T	W	T	F	S
			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		

September						
S	M	T	W	T	F	S
					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

October						
S	M	T	W	T	F	S
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				

November						
S	M	T	W	T	F	S
			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		

December						
S	M	T	W	T	F	S
					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

If this calendar was in use, your birthday would be on the same day each year.
Look carefully at this calendar.
Compare it with an ordinary calendar.
List the differences.
Why do the days not change year by year on the World Calendar?
Many people think this would be a good idea, to use. What do you think?

DAYS AND DATES.

There are many special days during a year. There are birthdays, holidays, anniversaries and festivals.

There are also days that are special to astronomers.

Some of these are :-

March 21/22
June 21/22
September 21/22
December 21/22

} Find out what is special about these dates. Draw diagrams, that will show the positions of the Earth and Sun. Add explanations to explain the importance of the dates.

G.M.T. ↔ B.S.T.

There is a change on the third Sunday in April. The change is reversed on the first Sunday in October.

What does all this mean?

Why is it done ?