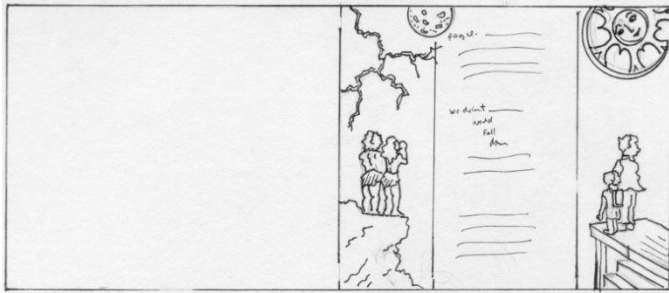


# Explosions in Thought: Ideas That Shook and Shaped Our World

(Each thumbnail precedes the related text)



## Opening Thoughts

People didn't always know  
What we know today  
What caused the night  
What makes the day?

We didn't know why a ball  
would  
fall  
down

Or why it bounced back up  
Once it hit the ground

We didn't understand the weather  
The wind, the snow and rain  
Didn't understand our bodies  
From our heart to our brain

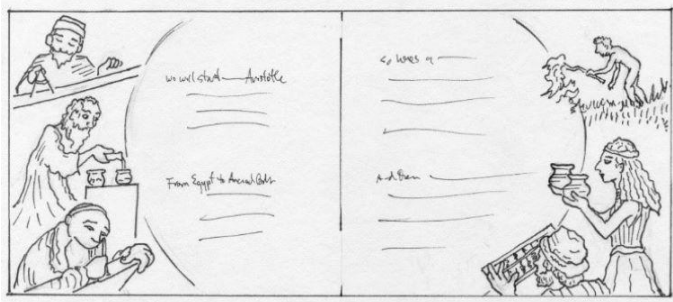


And what about motors  
Rockets, airplanes and flight  
Or what happens to time  
When we fly the speed of light?

It's all science, my friends  
It's how everything works  
From the edges of the universe  
To the center of the Earth

From the buttons that we push  
To the wheels that we turn  
There is more we can do  
With the more that we learn

And beyond all these reasons  
Are the possibilities you'll find  
When you see that all these wonders  
Fit into your mind

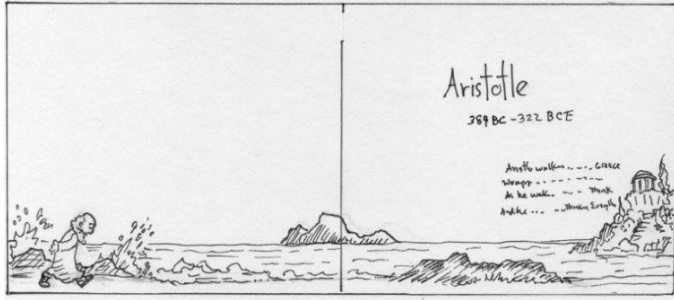


We will start with Aristotle  
Though there were many thinkers long ago  
From Hippocrates to Socrates  
Euclid and Plato

From Egypt to ancient Babylon  
India, China and Japan  
There were thinkers down in Africa  
Ever since our thoughts began

It took a lot of thinking  
And we thought it out so well  
And what we will think of next  
Only time can tell

So, here's a little story  
Of the thinking we have done  
And some of the amazing thinkers  
Since the thinking had begun



Aristotle

384 BCE – 322 BCE

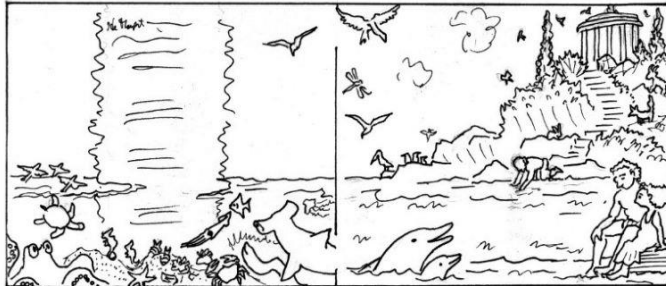
Aristotle walked the roads of ancient Greece

Wrapped with robes

With sandals on his feet

As he walked along, he began to think

And he ended up thinking about everything



He thought about the animals

That crawled, walked, ran, swam and flew

And arranged them by the way they're shaped

And by the things they do

Some animals seem similar

They may crawl or walk the same

On two or four, six legs or more

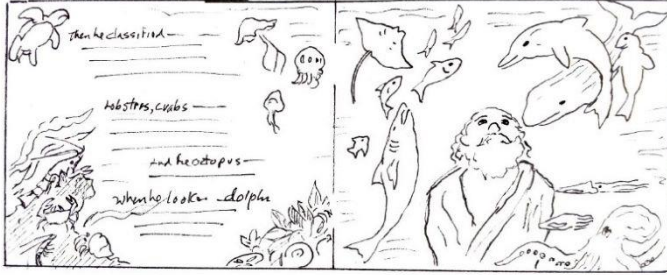
Or flap their wings to fly away

His favorite ones to study

Were the many creatures in the sea

Checking their legs and scales and shells and fins

For differences and similarities

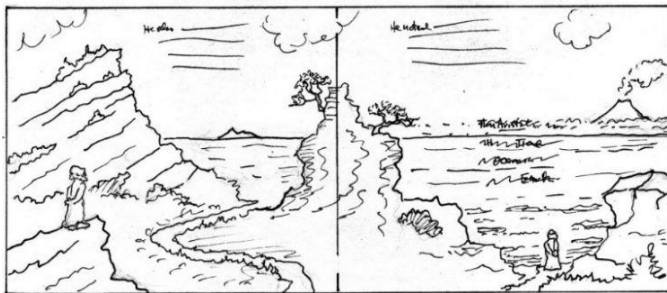


Then he classified these animals  
In a very clever way  
Arranging them by traits they share  
Which is the model used today

Lobsters and crabs seem much alike  
As do oysters, mussels and clams  
Fish share fins and gills and scales  
And fit into his plan

And the octopus, squid and cuttlefish  
Use suckers as their hands

When he looked at a dolphin  
He may have been the first to see  
That it's really not much like a fish  
It's more like you and me



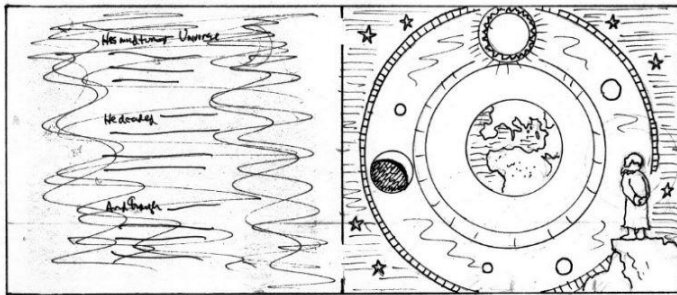
Aristotle also loved to study  
The land on which we stand  
To find the stories hidden in the rocks  
And the changes they command

He noted the many motions  
That are too slow to see  
Lakes can dry and islands rise  
While rivers shift through history

Then Aristotle concluded  
That everything we see will change

Even oceans die and mountains rise  
Nothing stays the same

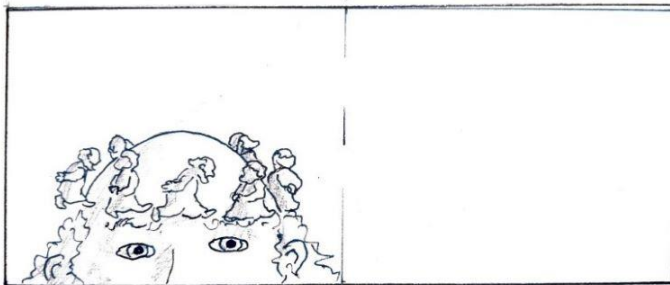
His mind turned toward the universe  
Toward the sun, planets, stars and moon  
What keeps the heavens in their place  
What causes them to move?



His mind turned toward the universe  
Toward the sun, planets, stars and moon  
What keeps the heavens in their place  
What causes them to move?

He thought the heavens would be different  
That nothing up there ever changed  
A place unlike the world below  
Pure and perfect, divine and strange

And though he thought so long and hard  
These thoughts, we know, weren't true  
And saying Earth is the center of the universe  
Was about the worst thing he could do



He loved to think about people  
What we do and what we say  
What we think and how we feel  
And how we choose to live each day

Is something true for everybody?  
Are there rules on how to live?

Is there an order we can follow?  
Is there a voice that speaks within?

And what about the thing we call "soul"  
Some part untouched by time  
Is this life tied to our body?  
Or, perhaps, tied to our mind

From one thought to another  
All this thinking never quit  
We call Aristotle a philosopher  
For thinking thoughts like this

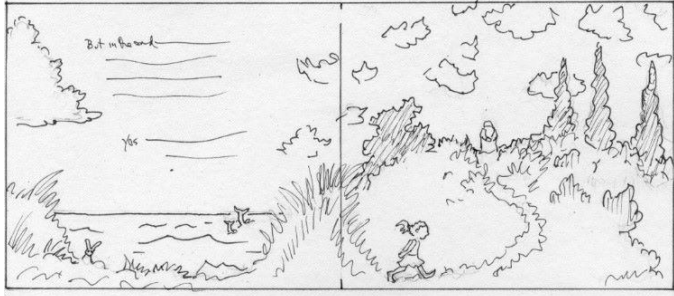


He even thought about the way to think  
And the way to think things through  
And how to organize the thoughts we have  
To see if they are true

We call this thinking "logic"  
He made rules for all to use  
Like following a path of careful steps  
Toward conclusions we can prove

Some people skip these simple steps  
In deciding what is true  
But the only thing they're proving  
Is the fact that they are fools

Yes, Aristotle had so many thoughts  
And many more than these  
Sometimes his thoughts were right on track  
Sometimes his tracks would weave

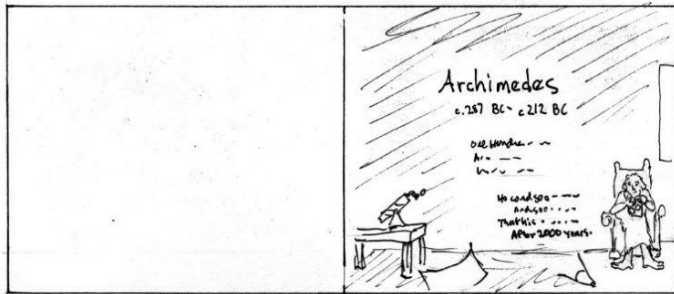


But now, it's sad, I have to add  
That science was burdened by his name  
For 1500 years, people lived in fear  
And could not question what he claimed

It's hard to blame him for this error  
It began when he was dead  
I think he would have loved the other new thinkers  
And welcomed what they said

But in the end, the greatest thing  
That his thinking was to do  
Was to say you can understand anything  
If you only think it through

(Yes, all these thoughts were started way back when  
And now come down to you)

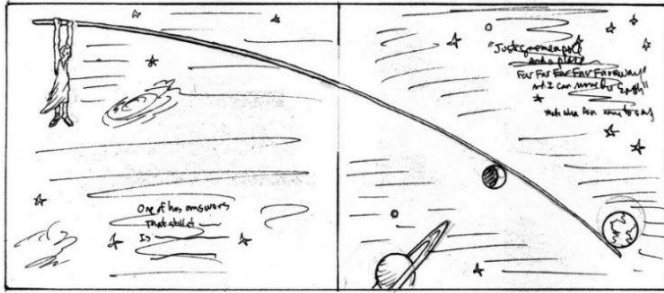


Archimedes      c.287 BCE – c.212 BCE

One hundred years later  
Archimedes came along  
With thinking so clever  
So powerful and strong

He could look at a problem  
And see it so clear

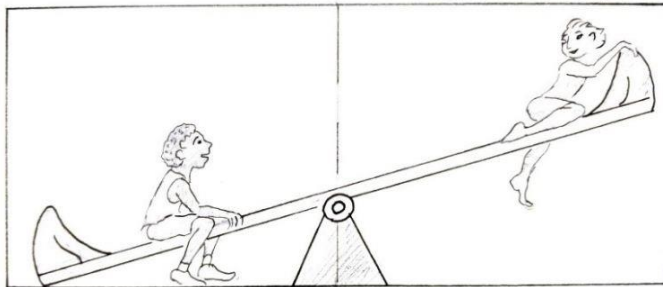
That his answers still stand  
After two thousand years



One of his answers  
That still stands today  
Is how to move any object  
No matter what it weighs

Just give me a pole that's long enough  
And a place to stand far, far, far, far away  
And I can move the Earth  
That's what Archimedes came to say

It's the law of the lever  
And Archimedes would then describe  
The exact weights and lengths and strengths it takes  
That mathematics could decide



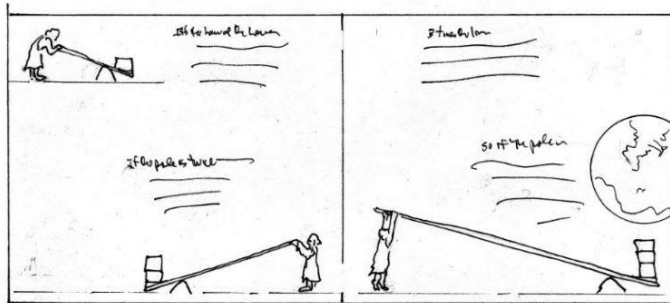
A seesaw is a sort of lever  
On which two people sit  
If they change their positions along the bar  
They can change the way they lift

Sit someone near the center  
She'll seem lighten up  
Then if she crawls out to the end  
She'll tend to lift you up

When Archimedes thought about these things  
He could see mathematics was at play



With every little change of length  
Changed the weight something seemed to weigh

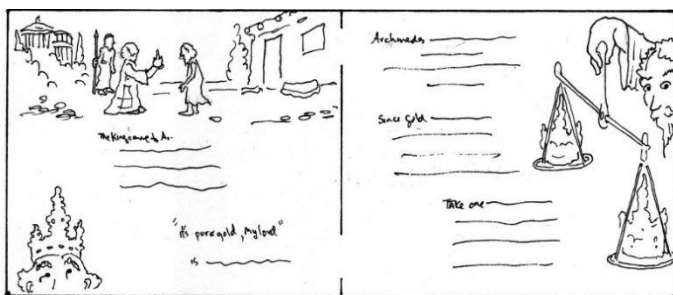


So, take a pole that's twice as long  
You can move it with half the strength  
This proportion will always stay the same  
With every change of length

Three times the length; 1/3 the strength  
You'll find is all you need  
Take a pole that's 10 times longer  
One-tenth will do the deed

Another way to think of it  
And a good reason to think things through  
One person could now move something  
That once took ten to do

So, if the pole is long enough  
You could move this Earth on which we stand  
But you would have to stand across the universe  
In some strange and distant land



One day, the king came to Archimedes  
With a problem on his head  
Was his crown, in fact, made of solid gold  
Or mixed with silver, tin or lead?

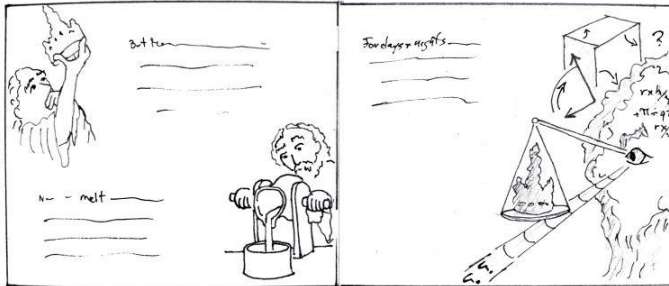
For, you see, "It's pure gold, my lord"

Is what the crown-maker had said

Archimedes had two great thoughts  
To send him on his way  
The first said that he could prove the crime  
By how much the crown would weigh

Because gold was heavier than the rest  
Archimedes came to realize  
To find out the answer/That the way to find the answer  
Compare its weight to its size

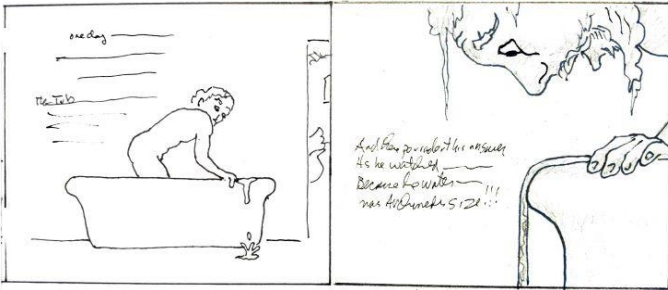
Take one crown made of gold  
And an identical crown of silver, tin or lead  
The gold crown would be heavier  
Yep, that's what Archimedes said



But then there was the problem  
How to calculate the size  
With its twists and turns and filigree  
That no measurements could decide

Now, he could melt the crown into a pot  
To measure out its size  
But if the crown had been solid gold  
That could mean Archimedes' swift demise

For days and nights, he wrestled  
On the battlefield in his mind  
Until the answer that tumbled out  
Was the simplest one to find



That day the answer came to him  
 As he climbed into his bath  
 As his thoughts were swimming all around  
 Tangled in measurements and math

His tub was filled with water  
 It was filled up to the brim  
 And as Archimedes lowered down  
 The water rose up above the rim

And there poured out his answer  
 As he watched the water rise  
 Because the water that poured on the floor  
 Was Archimedes' size

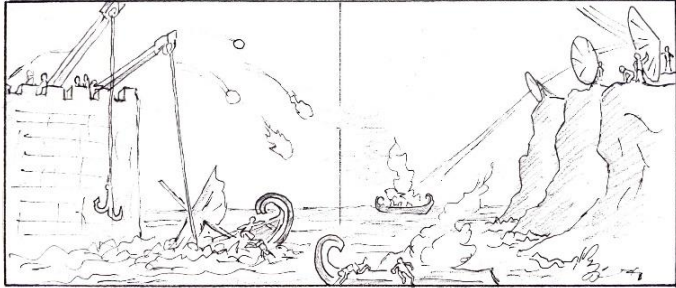


He leapt up without thinking  
 And ran naked down the street  
 Shouting, "Eureka!" (that means, "I've got it!")  
 To everyone he'd meet

He could take a pot of water  
 And lower the king's crown down  
 Then measure the water that rises up  
 To find the volume of the crown

The size of any object  
 Equals the size of the water it displaced  
 Sometimes the simplest answers  
 Are the ones we have to chase

Well, then he proved the crown was lighter  
Than a gold crown should have been  
And the crown-maker was quickly caught  
And that was the end of him

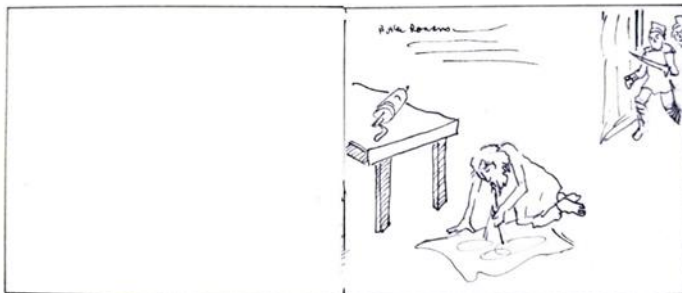


When Archimedes was getting old  
A great war was going on  
Rome was attacking his city of Syracuse  
With ships countless, fierce and strong

Rome was a mighty power  
But no matter how hard they fought  
They still could not conquer  
The strength of one man's thoughts

For three long years he battled Rome  
In many clever ways  
He torched its ships within the harbor  
With lenses arranged to focus  
the sun's bright and burning rays

A great arm reached over the harbor  
Tied to pulleys on the land  
He could flip the ships and sink them  
With the strength of human hands

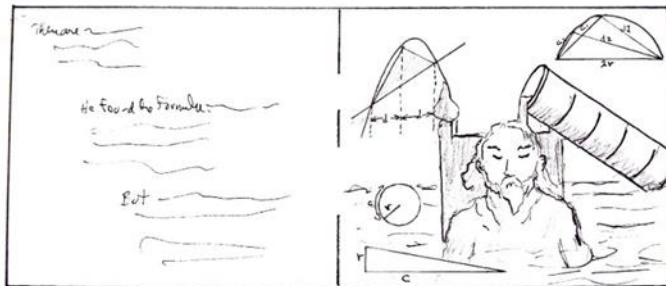


But the Romans were relentless  
And finally stormed into the land

Then killed poor Archimedes  
Before he had a chance to stand

Even the Roman king was saddened  
Knowing that Archimedes was truly great  
And held a parade to honor him  
Though his praise came much too late

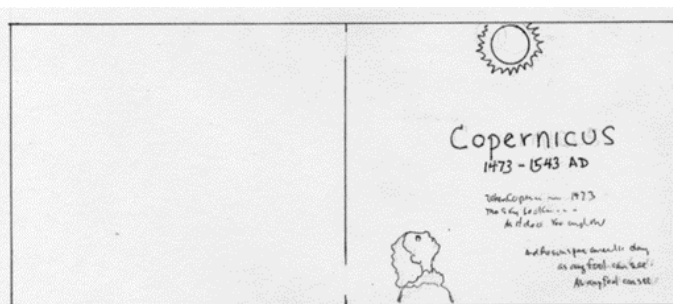
As we look through our proud history  
Let us never consider or pretend  
When counting all the great thoughts we've had  
That war was ever one of them



There are many tales of Archimedes  
So many thoughts that he would find  
There are tales of mathematics  
That would open in his mind

He found the formula for the area of a circle  
And of the surface of a sphere  
And for too many other shapes and forms  
To try to mention here

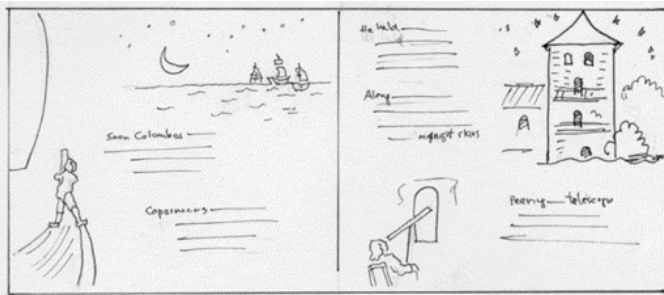
But we must say goodbye to Archimedes  
Waving deep into the past  
But there is a way to say hello  
For his thoughts will always last



# Nicolaus Copernicus

1473 CE– 1543 CE

When Copernicus was born  
Back in 1473  
The sky looked about the same  
As it does to you and me  
(And the sun spins around Earth each day  
As any fool can see)

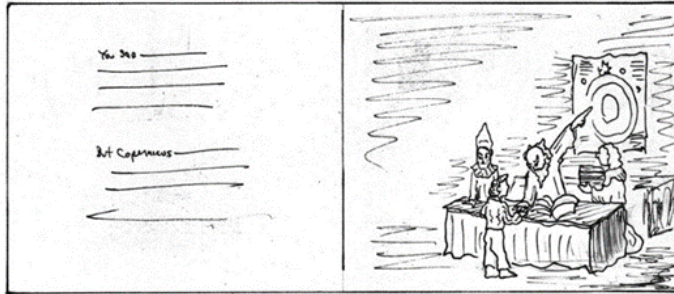


Soon Columbus would set sail  
With Magellan close behind  
How to steer their ships by the midnight stars  
Was on every merchant's mind

He held important jobs throughout his life  
Quite successful in that age  
But it's the things he did alone at night  
That placed him on this page

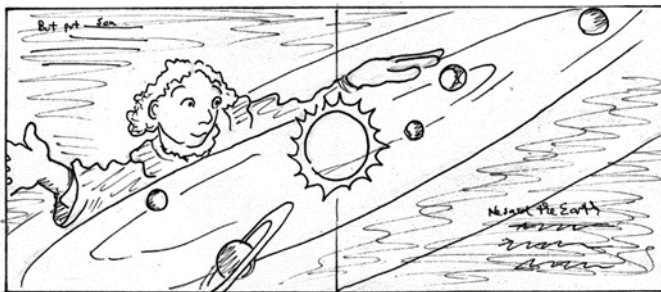
Alongside all this busy life  
Brewed his scientific mind  
Exploring the wonders of the universe  
As he watched the midnight skies

Peering through a telescope  
He tracked the planets through the night  
Tracing the paths that each one flew  
Mapping the mystery of their flight



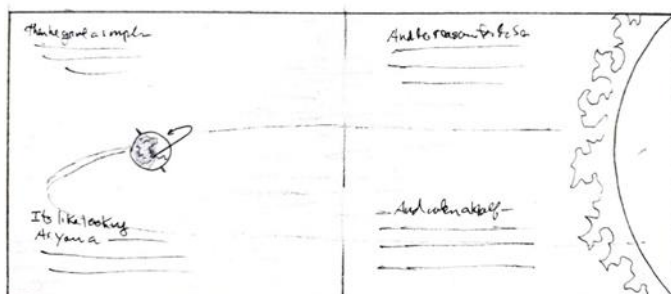
You see, people still believed back then  
 That Earth was the center of the sky  
 With the sun, stars and planets circling 'round  
 And to doubt that was a crime

But Copernicus could clearly see  
 That this didn't make much sense  
 Some planets seemed to stop and turn around  
 It was all a big fat mess



But, place the *sun* into the center  
 As the planets circle ring by ring  
 Then their motion took a simple path  
 As we watch each planet spin

He said Earth is just a planet  
 On its own path 'round the sun  
 Are we really less than special  
 If we're not the center one?

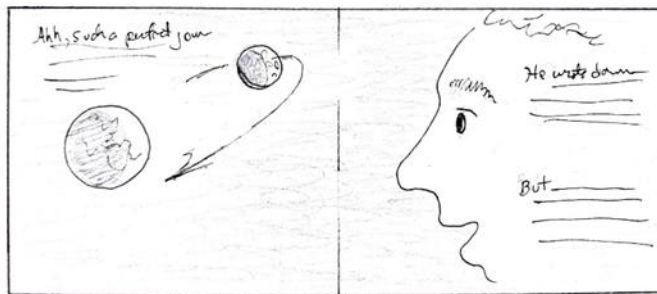


Then he gave the perfect reason  
Why the sun moves overhead  
It's our **Earth** below that's spinning 'round  
One spin each day, he said

It's like looking at a building  
As you're slowly driving by  
You could think the buildings moving  
But, I think, your thoughts have lied

And the reason for the seasons?  
He said Earth is tilting as it spins  
And when the north tilts toward the sun  
Its summertime then begins

And when a half a year has passed  
Earth is halfway round the sun  
Now the south is tilting toward our star  
And the north's winter has begun

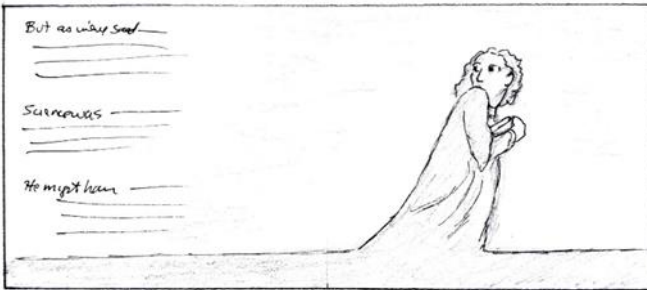


Ahhh, such a perfect journey  
With one friend still by our side  
Yes, the moon is left to circle us  
As we waltz within the sky

He wrote down everything he found  
Though not every thought was true  
Thinking the sun was the center of the universe  
And that the stars would never move

But it was a giant leap, you see  
And he sent us on our way  
Describing things we'd seen for years  
Yet never could explain

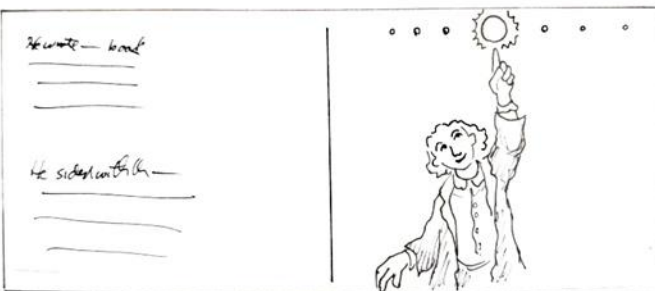




But as we've said, he must be cautious  
When taking such a view  
To challenge old and worn-out thoughts  
By thinking something new

Science was not considered  
As a doorway to the truth  
They laid their reasons in religion  
Even if science held the proof

He might have been protected  
By his positions and his friends  
But did not feel safe within a world  
Where the facts were forced to bend



He wrote his thoughts into a book  
Published the day on which he died  
Leaving it for everyone to look around  
And see what they decide

He had sided with the planets  
Jupiter, Saturn, Venus, Earth, Mercury and Mars  
Because the truth that he could clearly see  
Would take us to the stars

(no one knew about Uranus at that time)