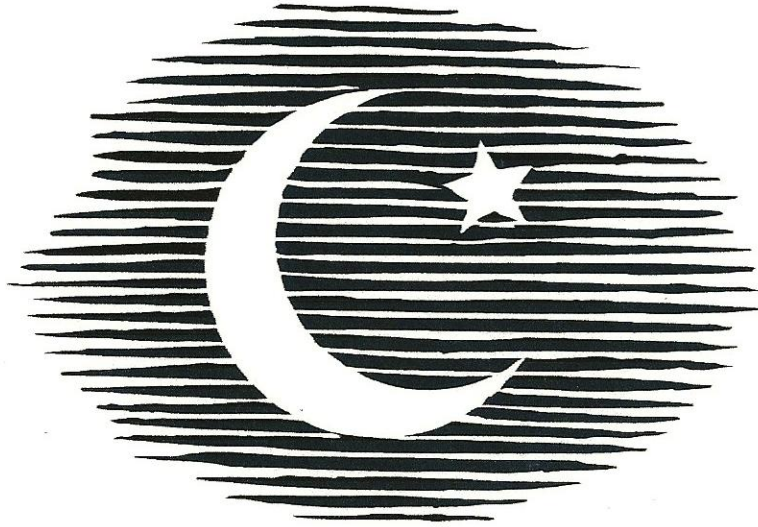
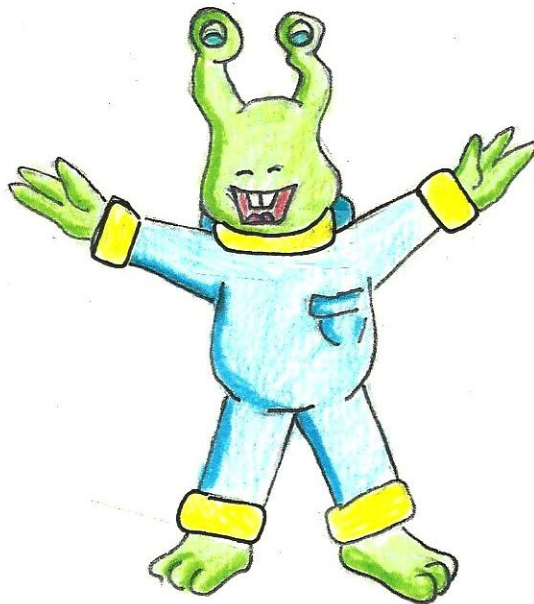


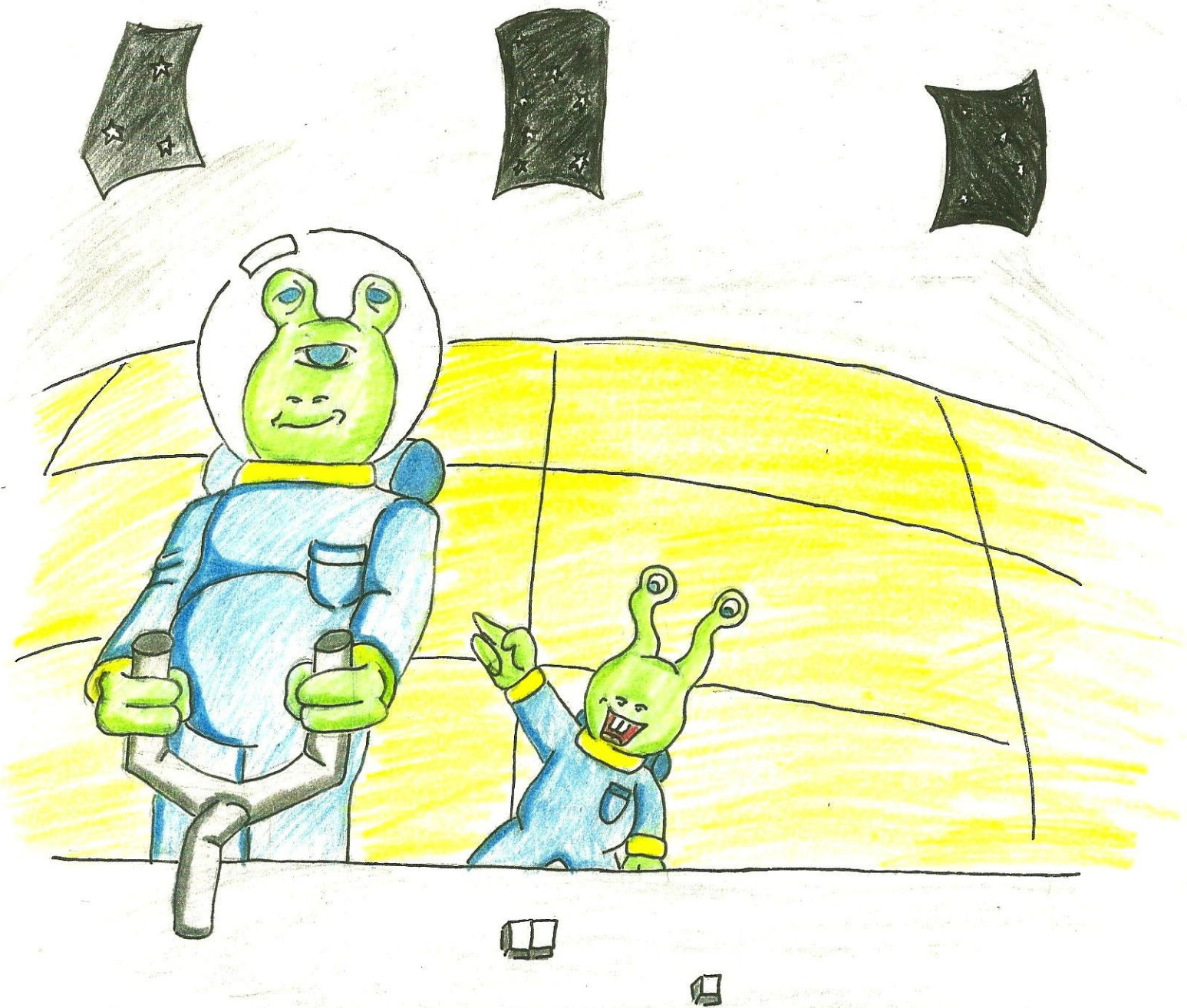
Little Zoldar



and the Phases of the Moon

By Ian Sacks





"Are we there yet?" asked Little Zoldar, his eyestalks quivering with excitement.

"Earth is just a few parsecs away," answered his *Grumpapa*, or "Father" as Zoldar had learned they were called on Earth.



Zoldar was anxious to get out of the spaceship. It had been a long voyage, and he was sure that Earth would be an interesting planet. There would be many new sites to see, and new places to explore.

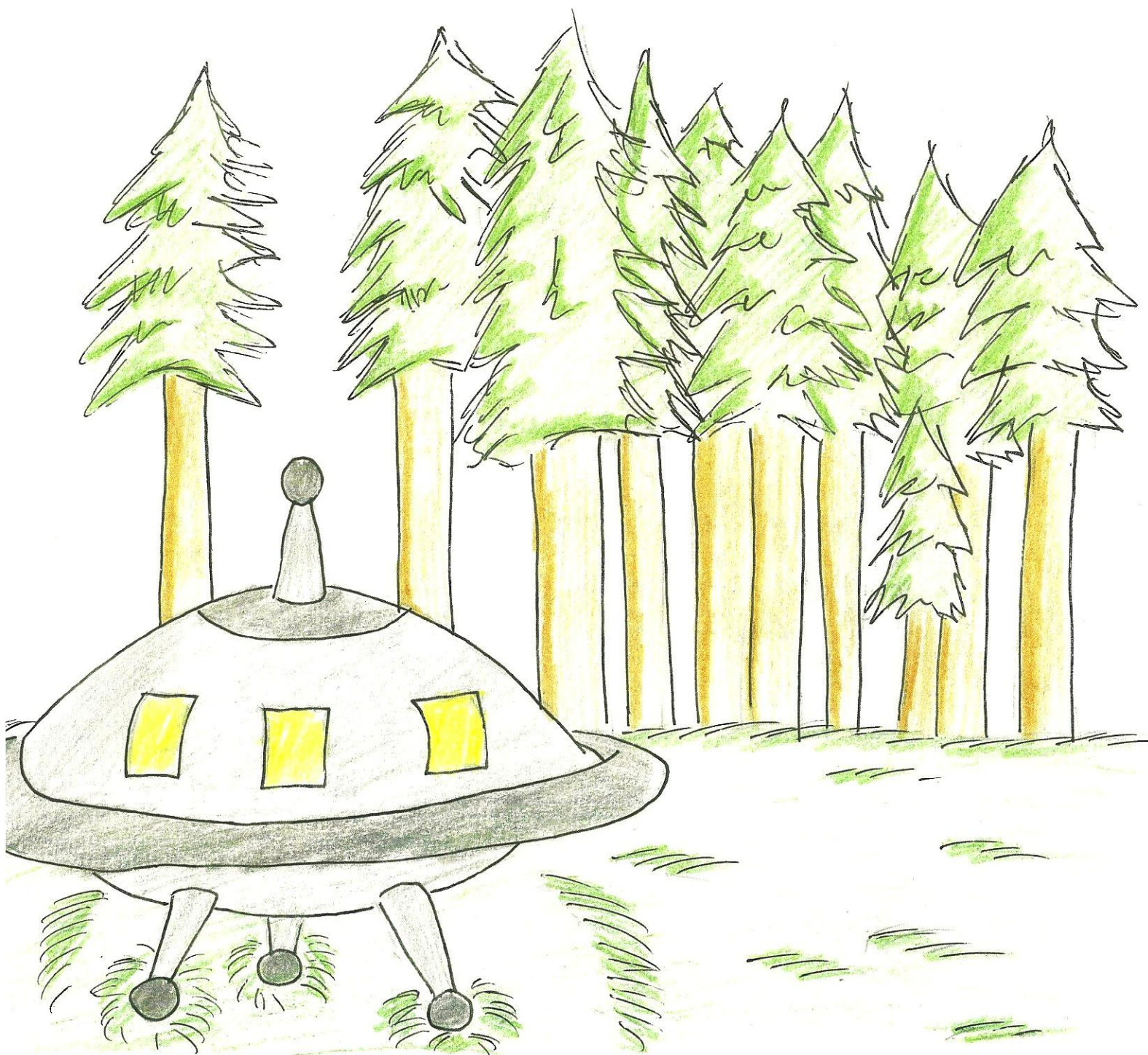


Although he would never admit it, Zoldar was tired from his journey, and his *Grumpapa* soon found him fast asleep. As Zoldar slept, he dreamt of all the things he would do on Earth.

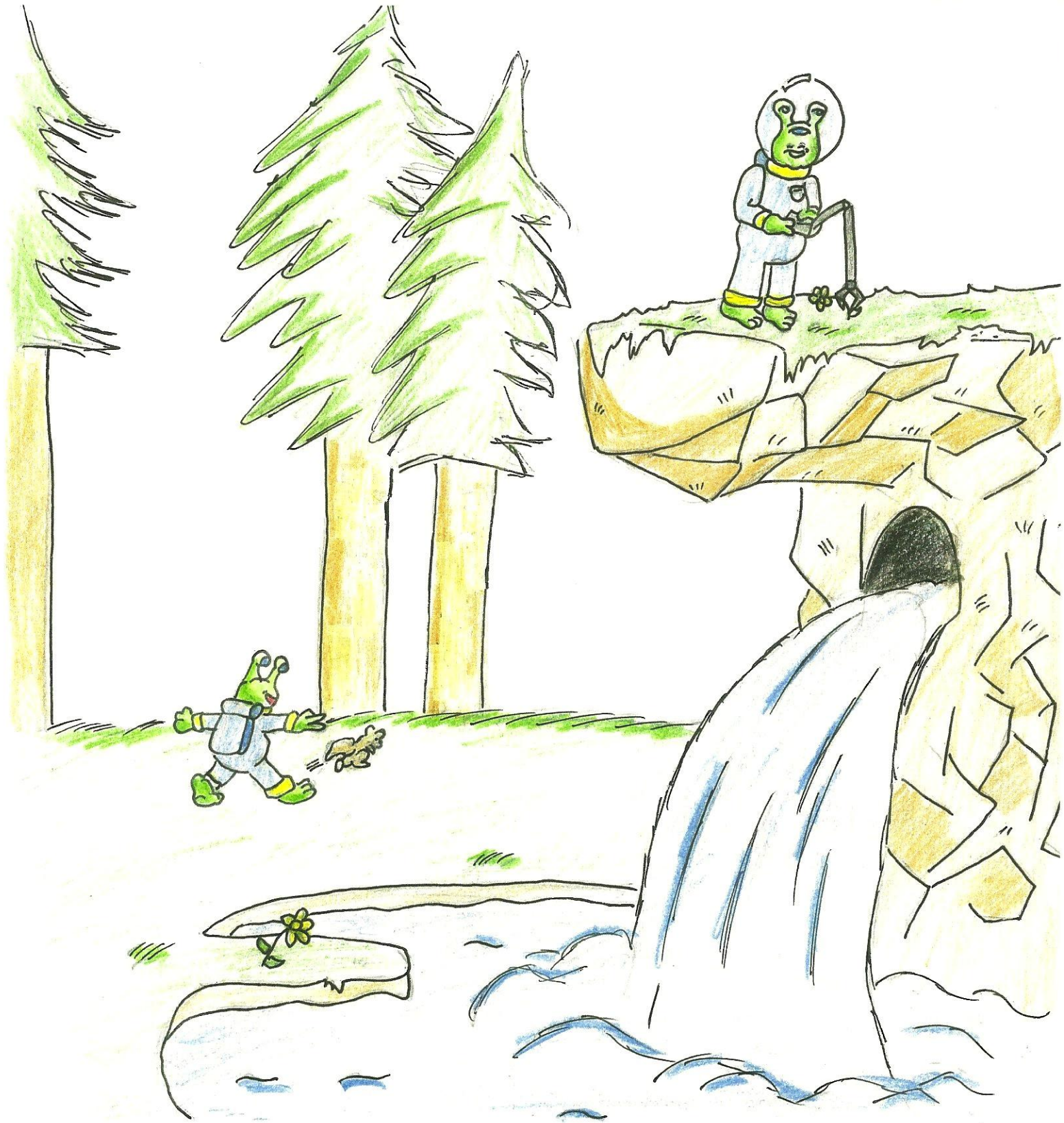


Finally, the long awaited announcement came, shaking Zoldar from his nap.

"WE'RE HERE!"



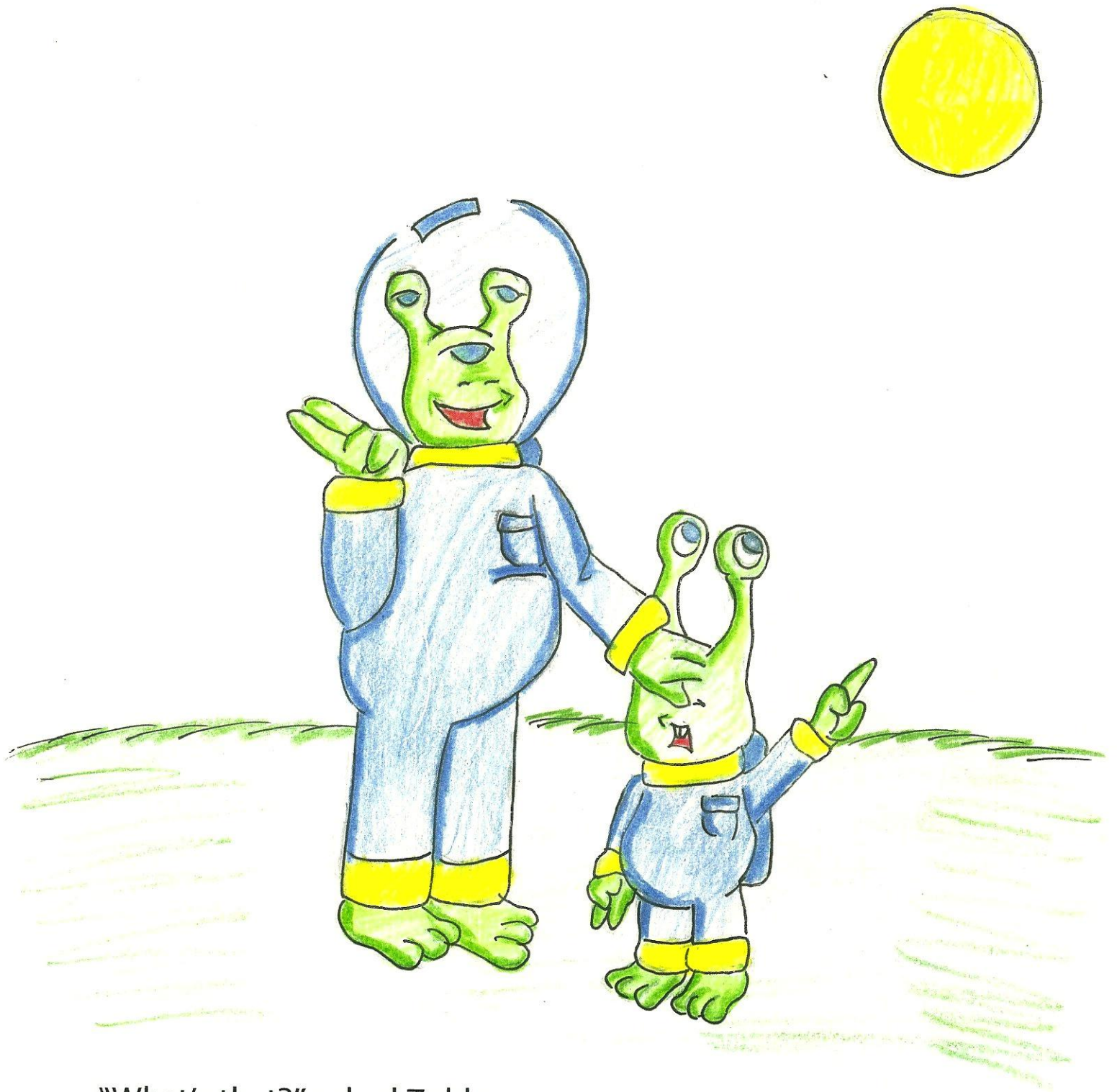
The ship landed in a grassy clearing. All around him, Zoldar could see tall brown towers with green sprouts. He had never seen anything like it.



Zoldar spent the day exploring, while his *Grumpapa* gathered information. He found rocks and small creatures. He climbed and ran and chased.

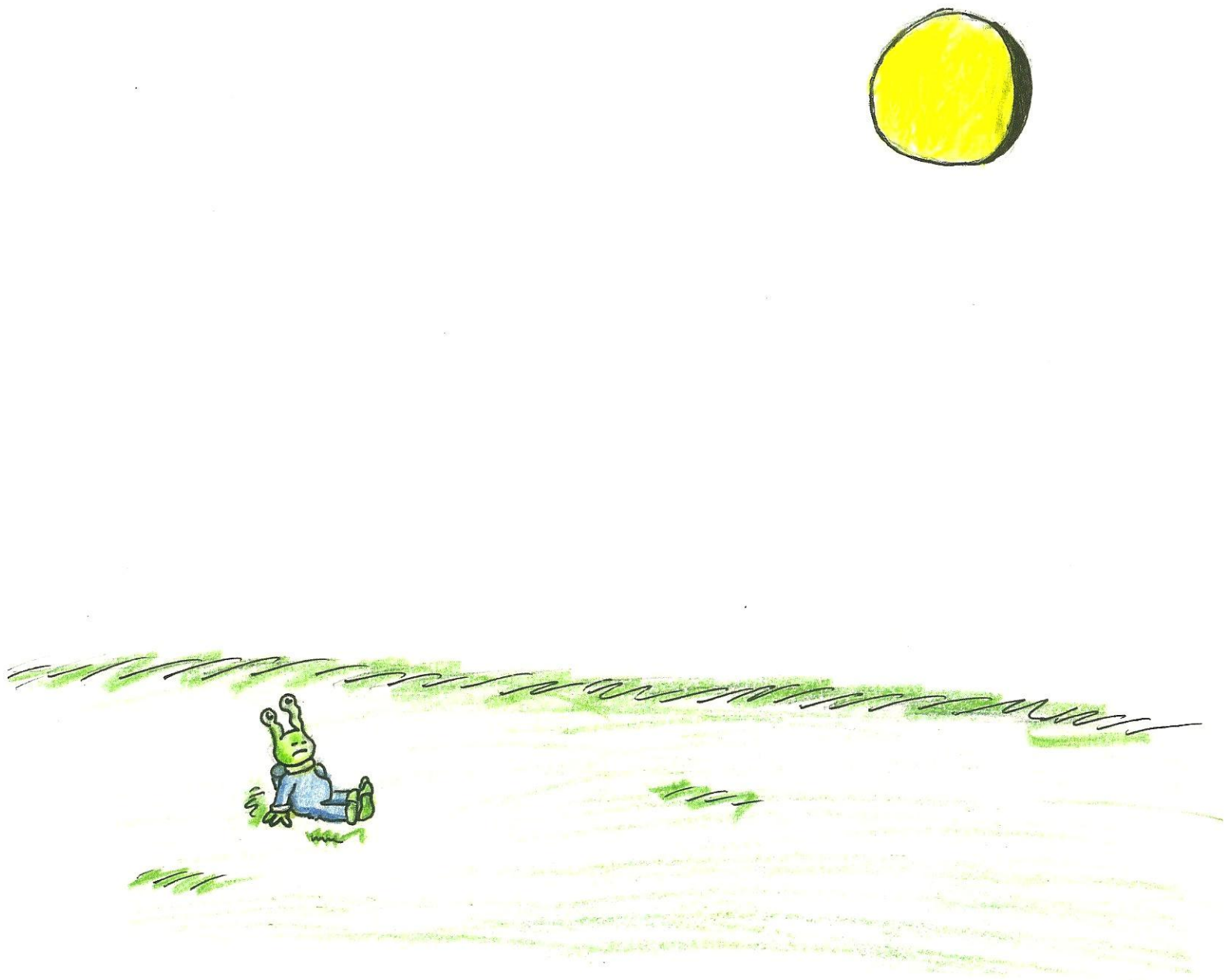


As he was returning to the spaceship that night, something caught Zoldar's eye. High in the sky among the stars, he could see a bright glowing ball.

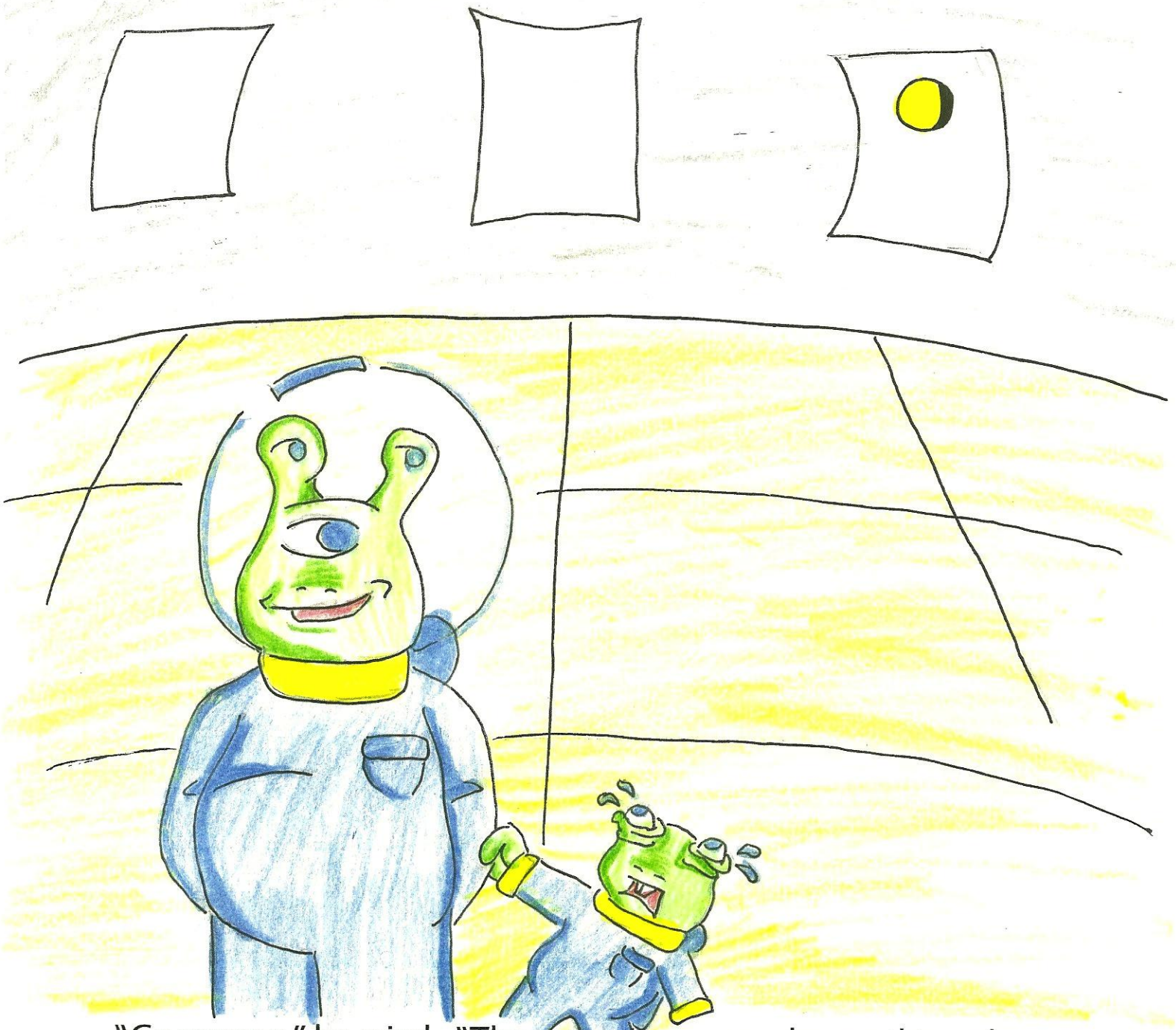


"What's that?" asked Zoldar.

"It's called the moon," his *Grumpapa* explained. "It's a large rock that orbits the Earth. Our planet has no moon."



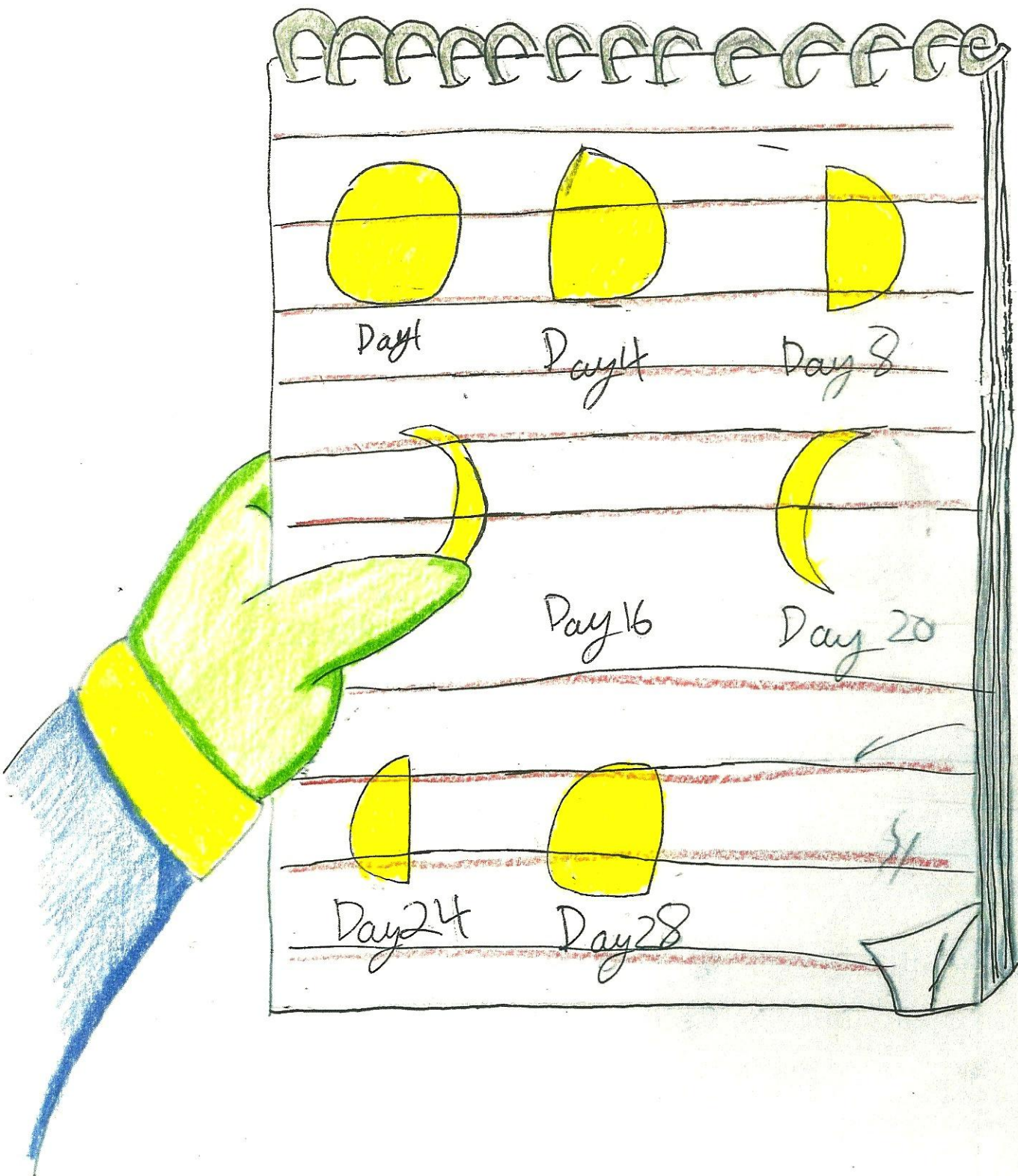
Zoldar was fascinated. The next night, he eagerly waited to see the moon again. To his surprise, it was gone. In its place, Zoldar saw a different, nearly circular shape.

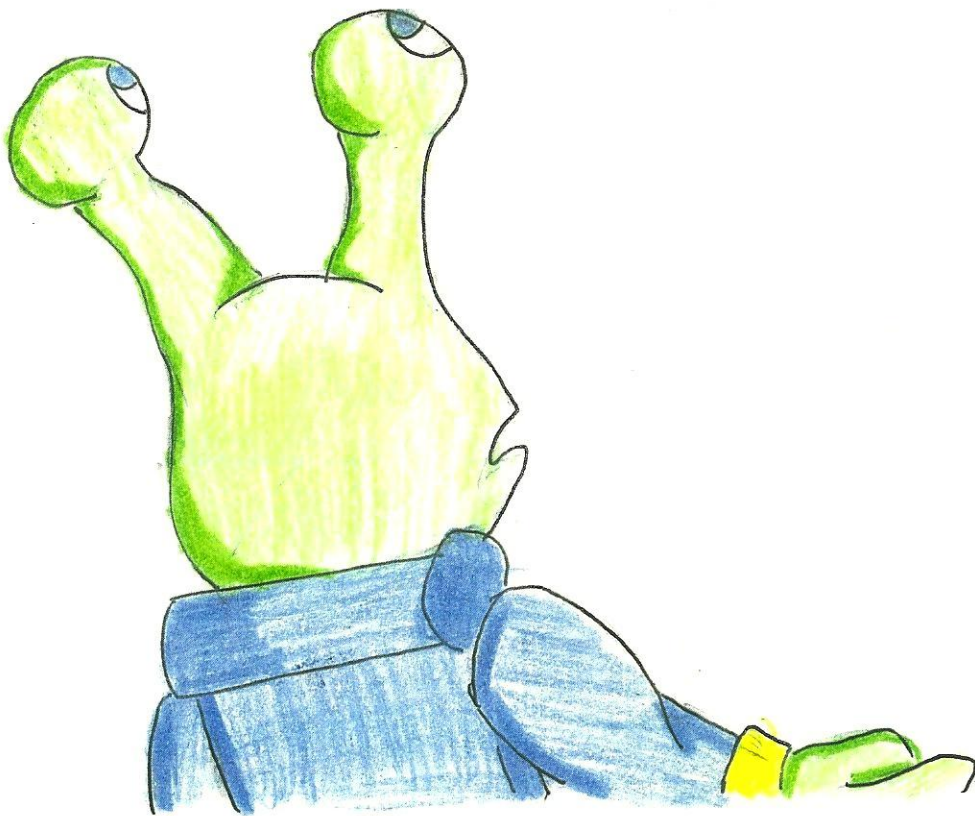
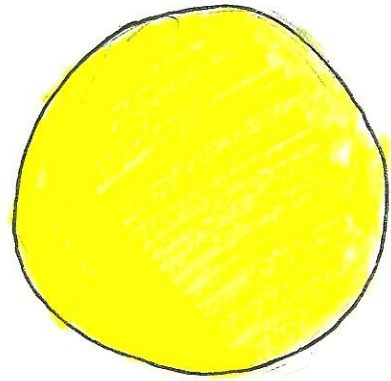


"Grumpapa," he cried. "The moon is gone and something else is in its place!"

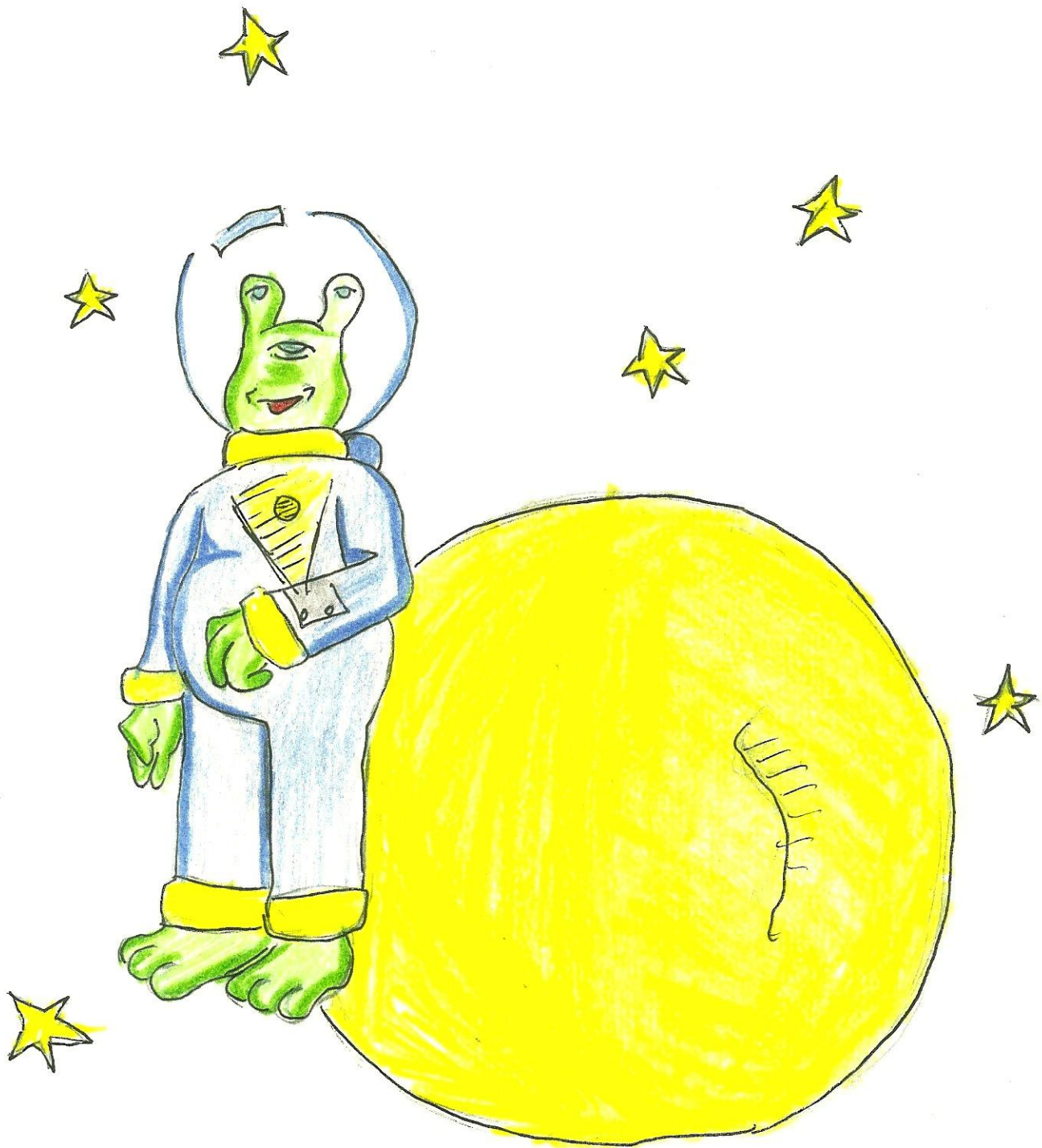
His *Grumpapa* gave Zoldar a wry smile and said, "Keep watching for it a few more nights. Maybe it will come back."

Every night, Zoldar waited for the moon to come back, but every night a slightly different shape appeared instead. Zoldar began to keep track of the shapes on a notepad. They looked like this:

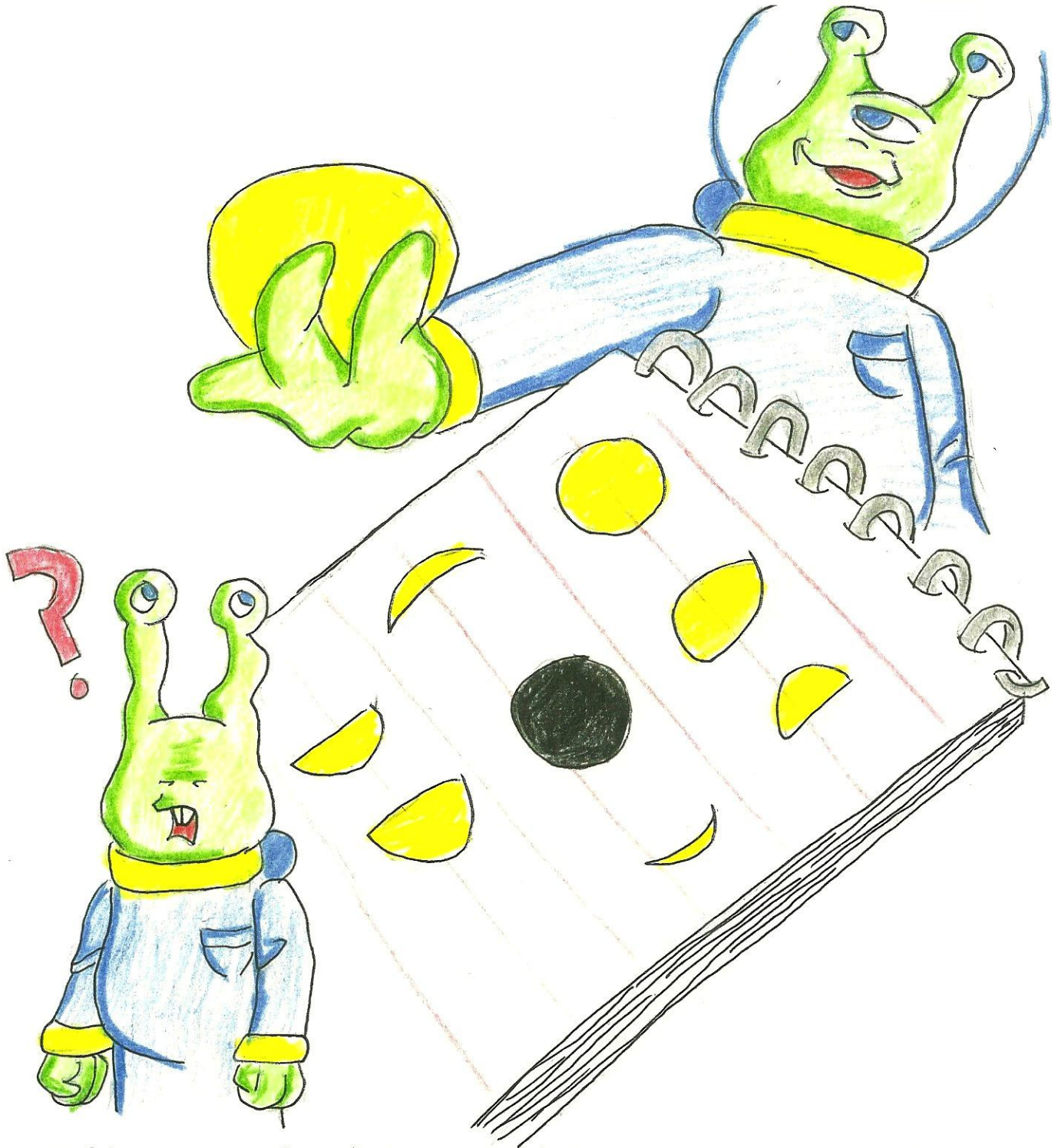




One month into their stay on Earth, Zoldar finally saw the moon again. But where had it been hiding for so long?



"The moon was never gone," said his *Grumpapa* when Zoldar told him the news. "All those different shapes you saw *were* the moon."

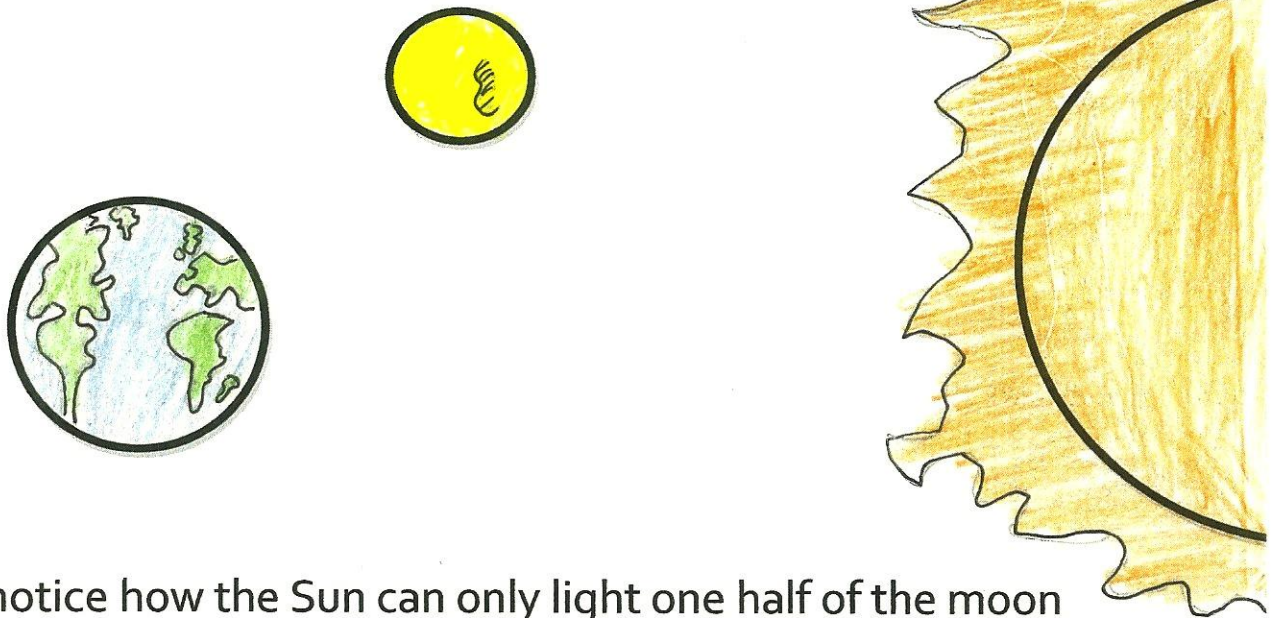


Zoldar was confused. How could the moon have changed shapes?

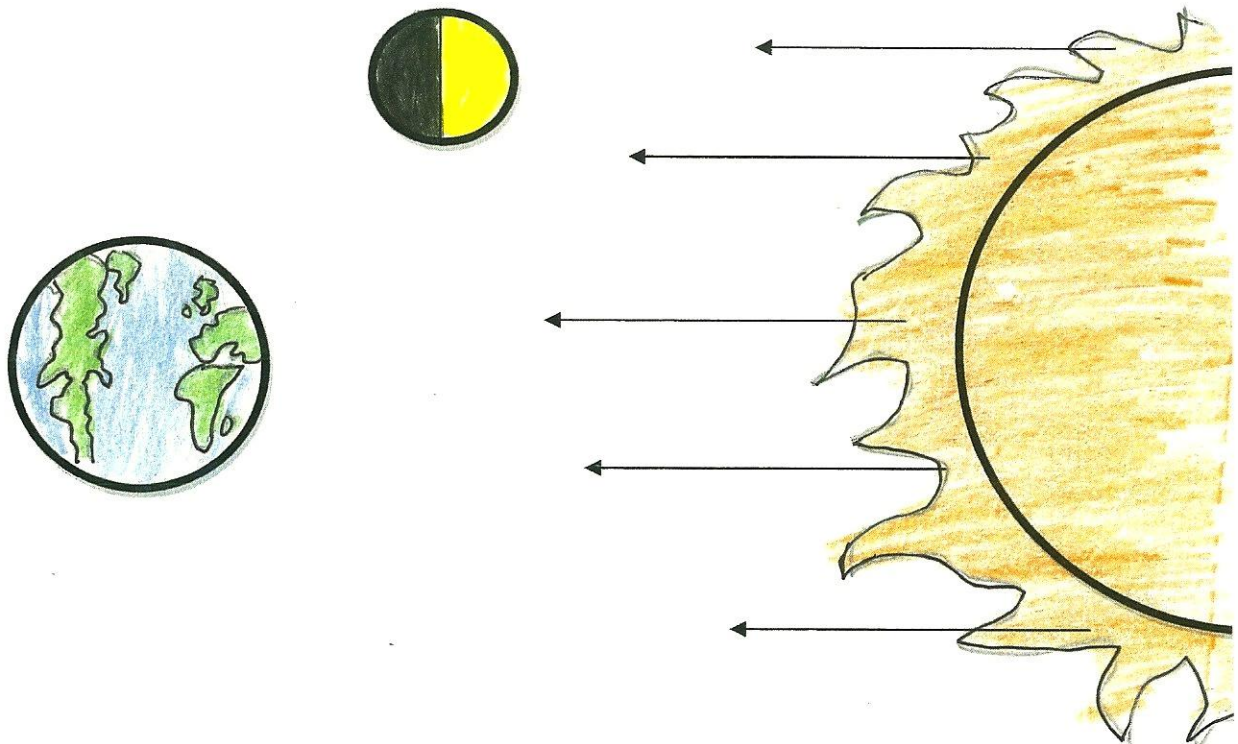
"The moon didn't change shapes," said his *Grumpapa*. "It's always round like a ball."

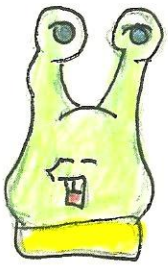
But Zoldar's drawings didn't all look like balls.

"Imagine the moon, the Earth, and the Sun out in space," said his *Grumpapa*. "It would look something like this."



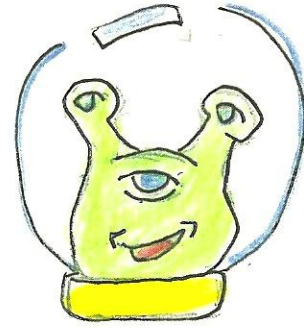
"Now, notice how the Sun can only light one half of the moon at a time. So when we add sunlight, it would look like this."



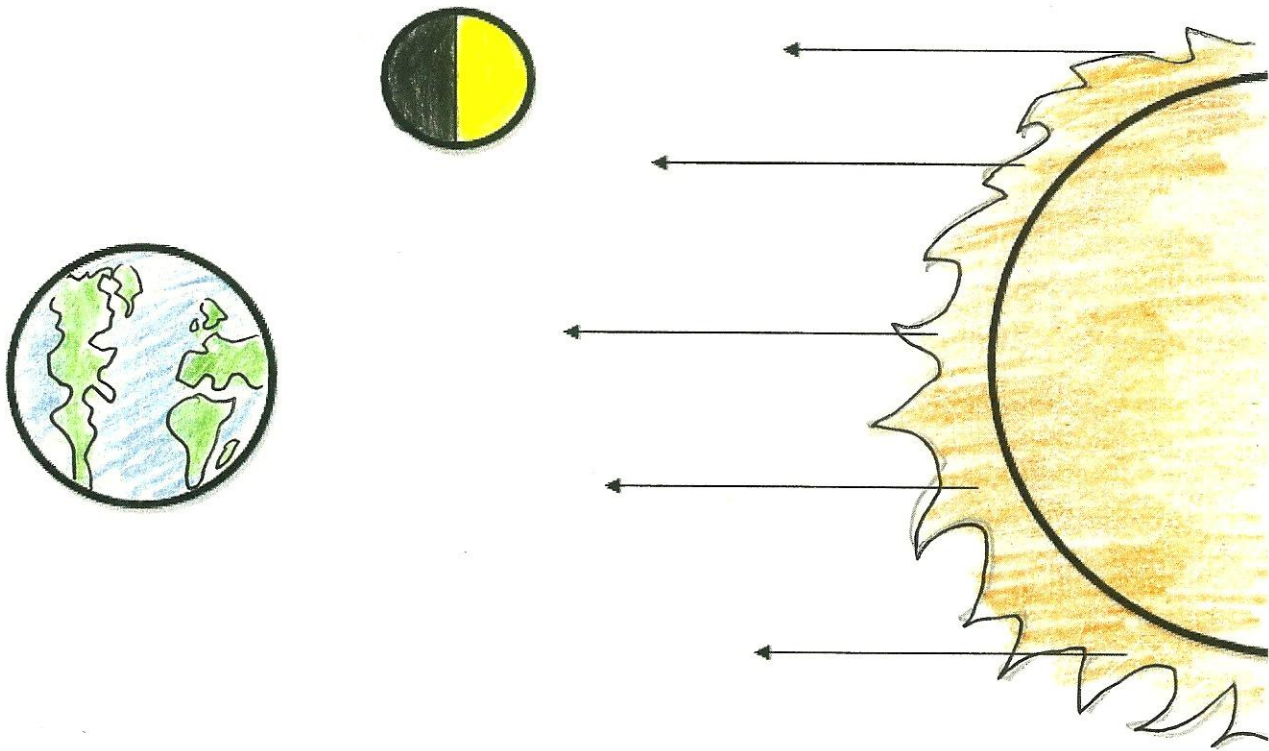


"But how does that make it change shapes?" asked Zoldar.

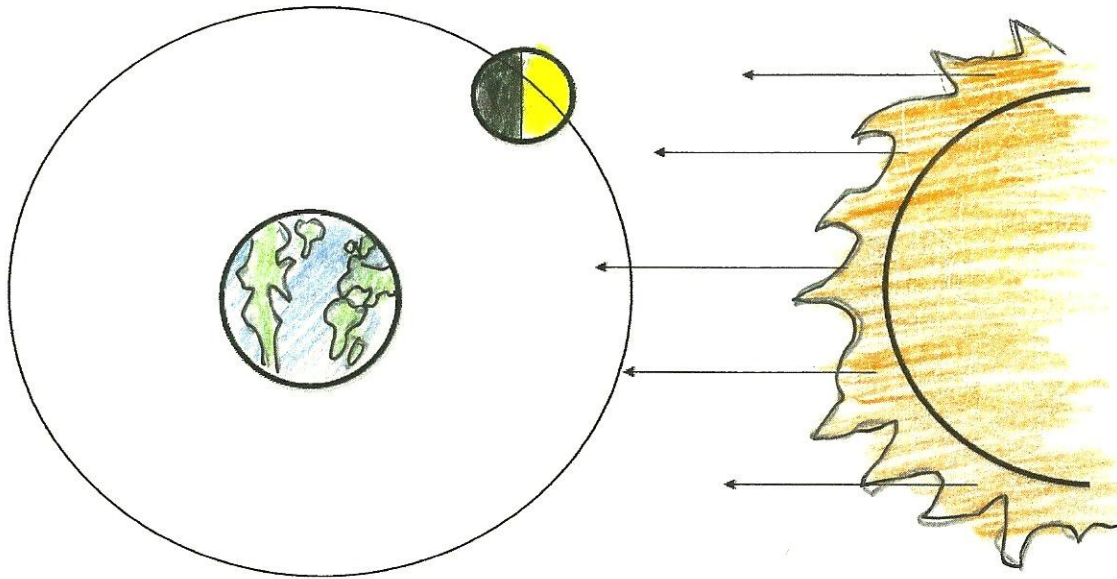
"We can only see the parts of the moon that are lit up by the Sun."



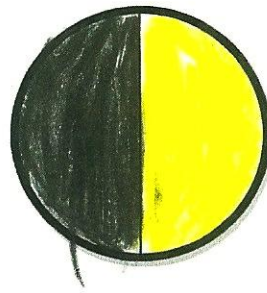
"Zoldar, if you were looking at the moon from the Earth what would it look like?"



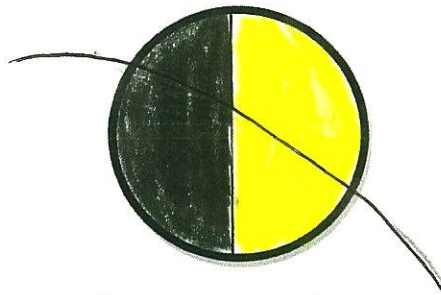
1. Draw a circle for the moon's orbit.



2. Shade in the half of the moon that sunlight does not reach.



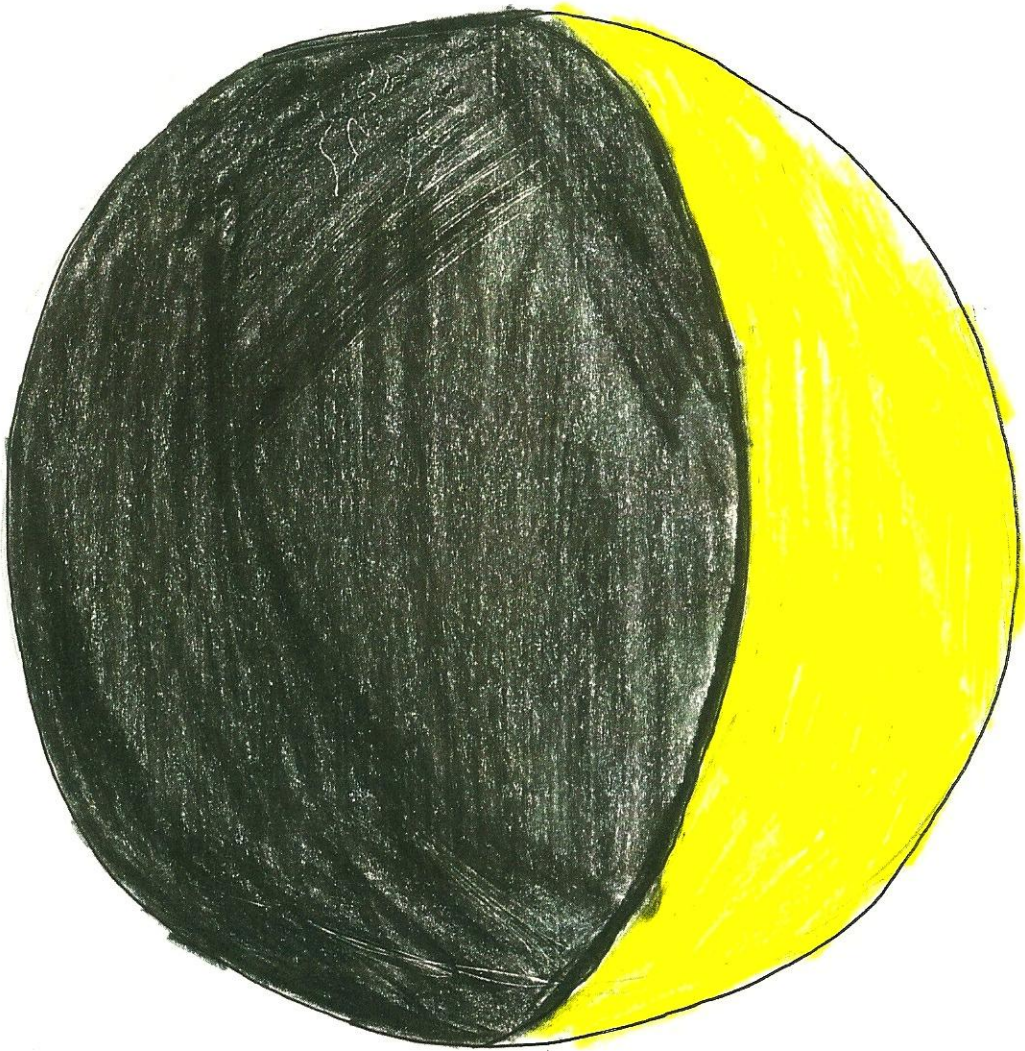
3. Find the half of the moon inside the orbit.



4. Imagine looking at that moon from the Earth.

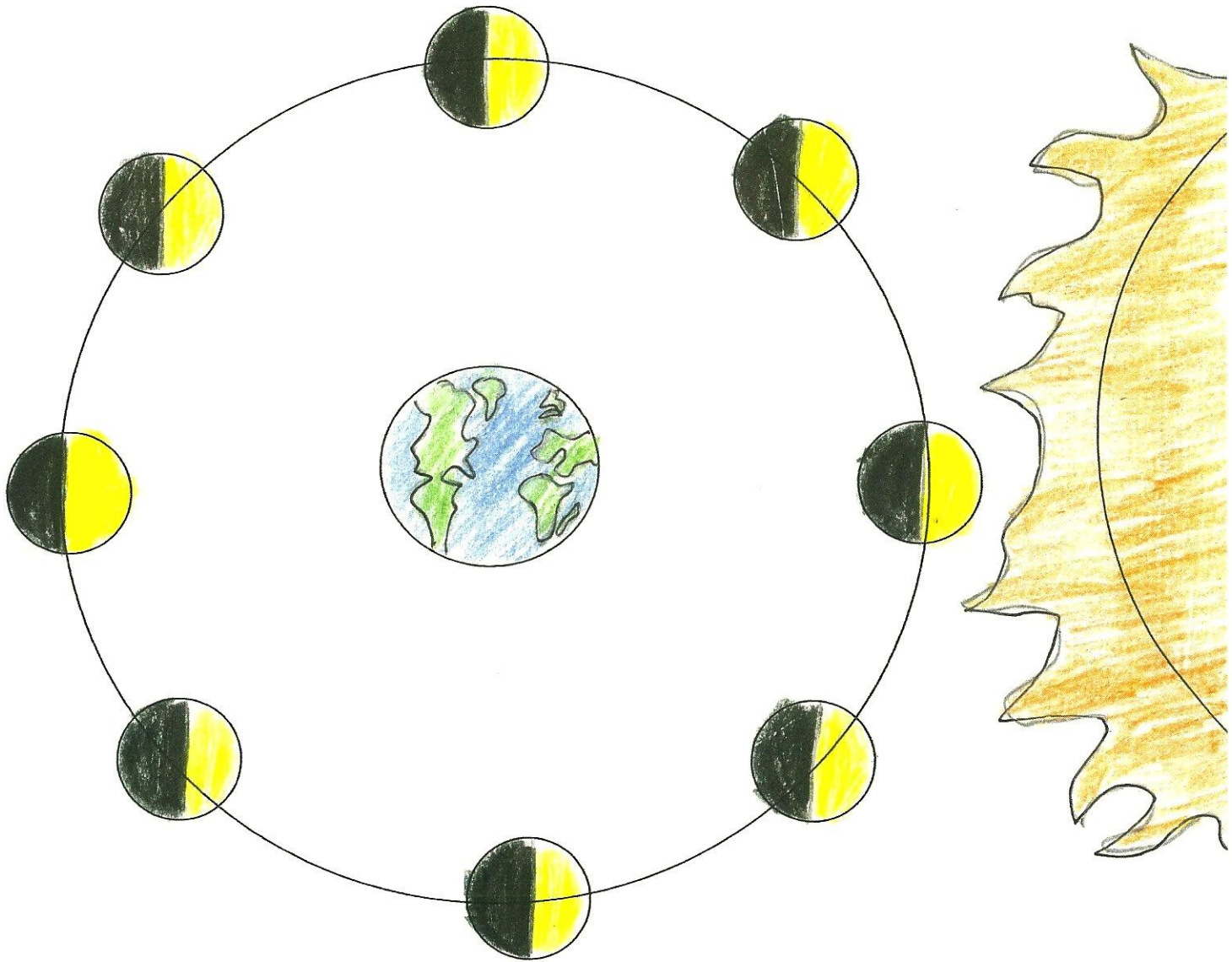


"Like this!" answered Zoldar.



"Correct," said his *Grumpapa*.

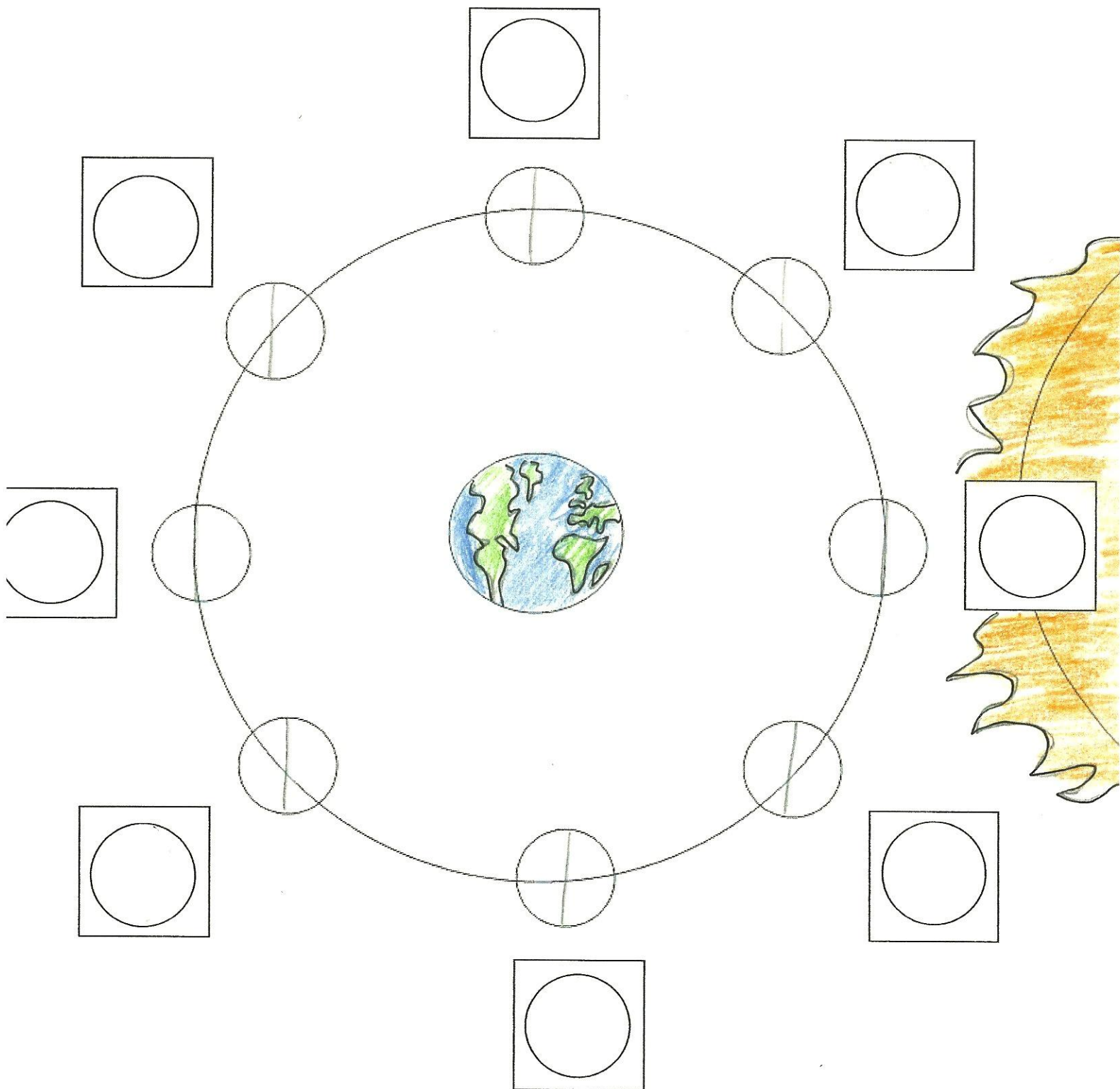
“Now remember that the moon moves around the Earth,” said his *Grumpapa*. “It takes the moon one month to move around the Earth. So let’s draw positions for the moon as it moves.”



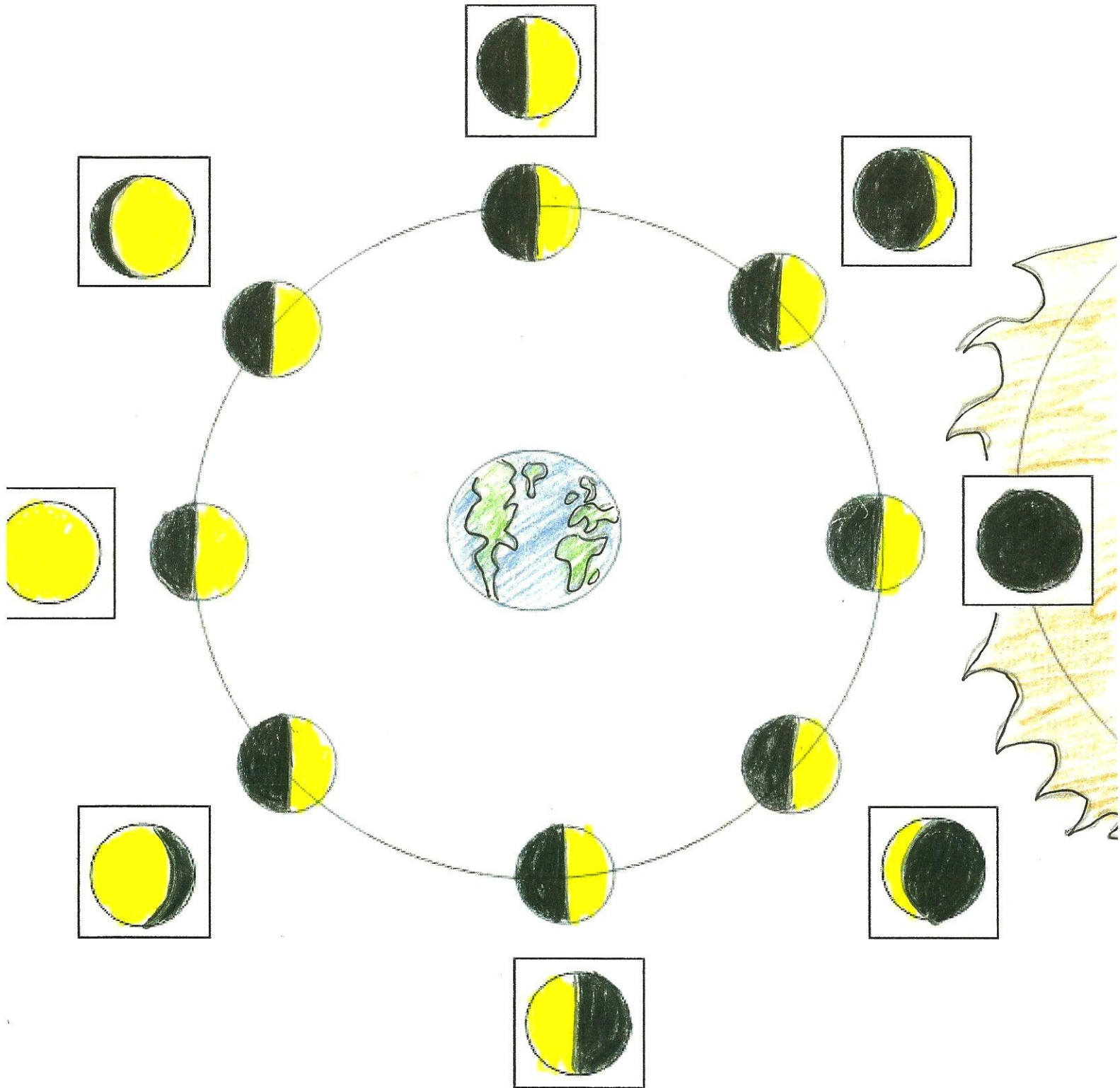
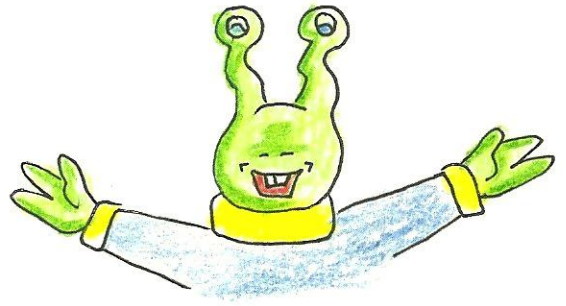
“Each moon here is about four days apart,” he said.

“Now, let’s try to imagine what the moon would look like from Earth at each of these positions.”

Remember the four steps and try it on your own:



"It should look like this."

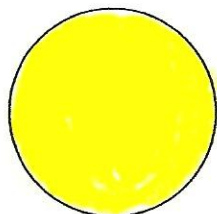


"Each of these shapes are called phases of the moon," said Zoldar's *Grumpapa*. "Would you like to know the name for each phase?"

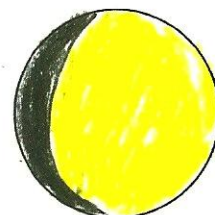
"Boy, would I!" said Zoldar.

His *Grumpapa* began naming each phase.

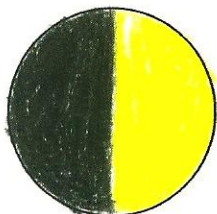
Full:



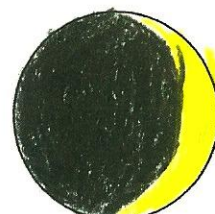
Waxing Gibbus:



First Quarter:



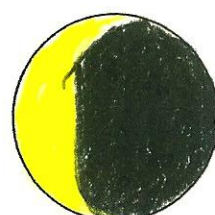
Waxing Crescent:



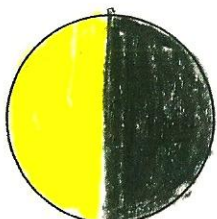
New:



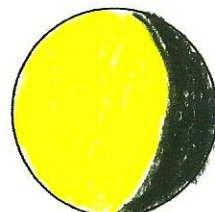
Waning Crescent:

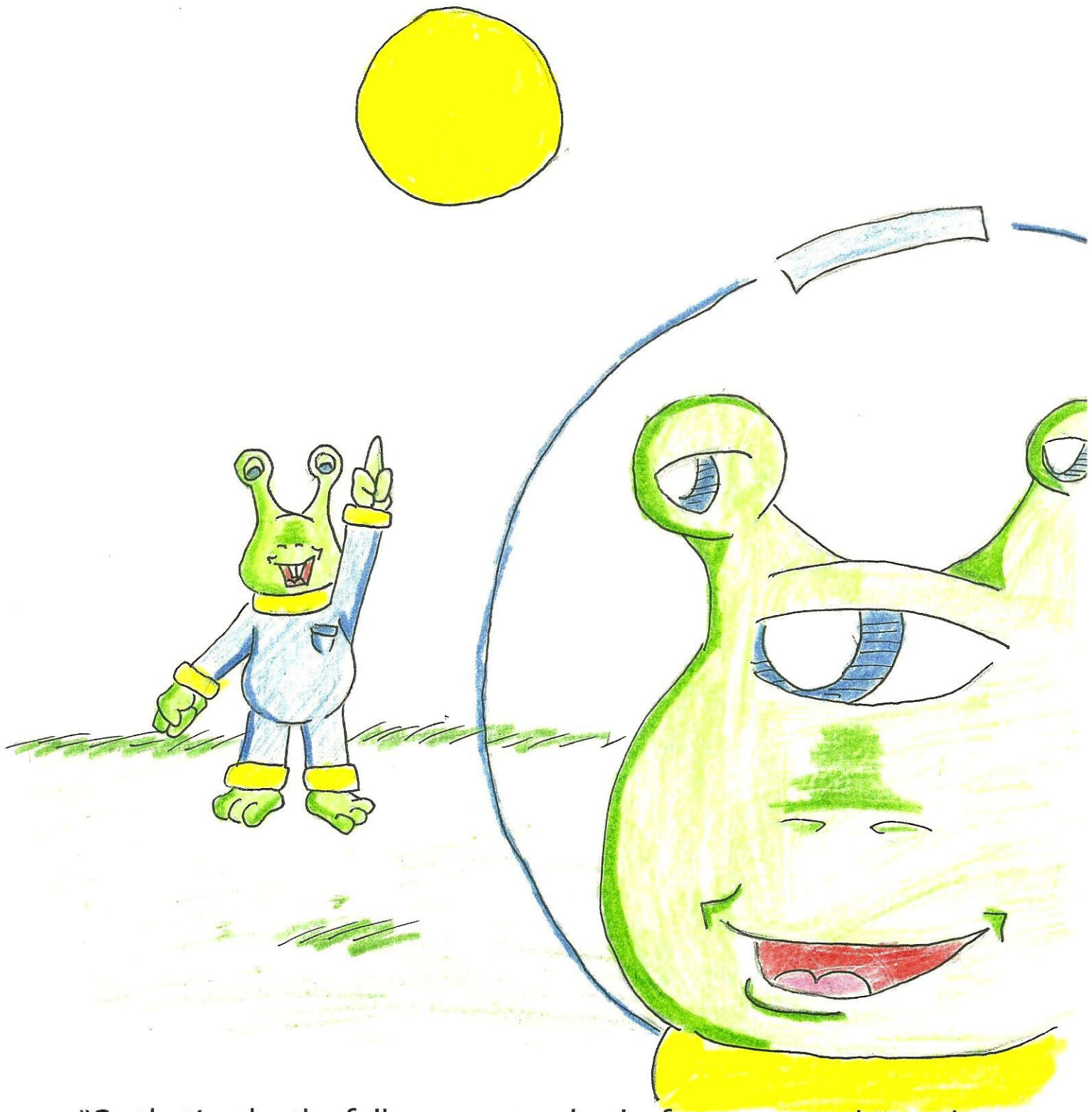


Third Quarter:



Waning Gibbus:

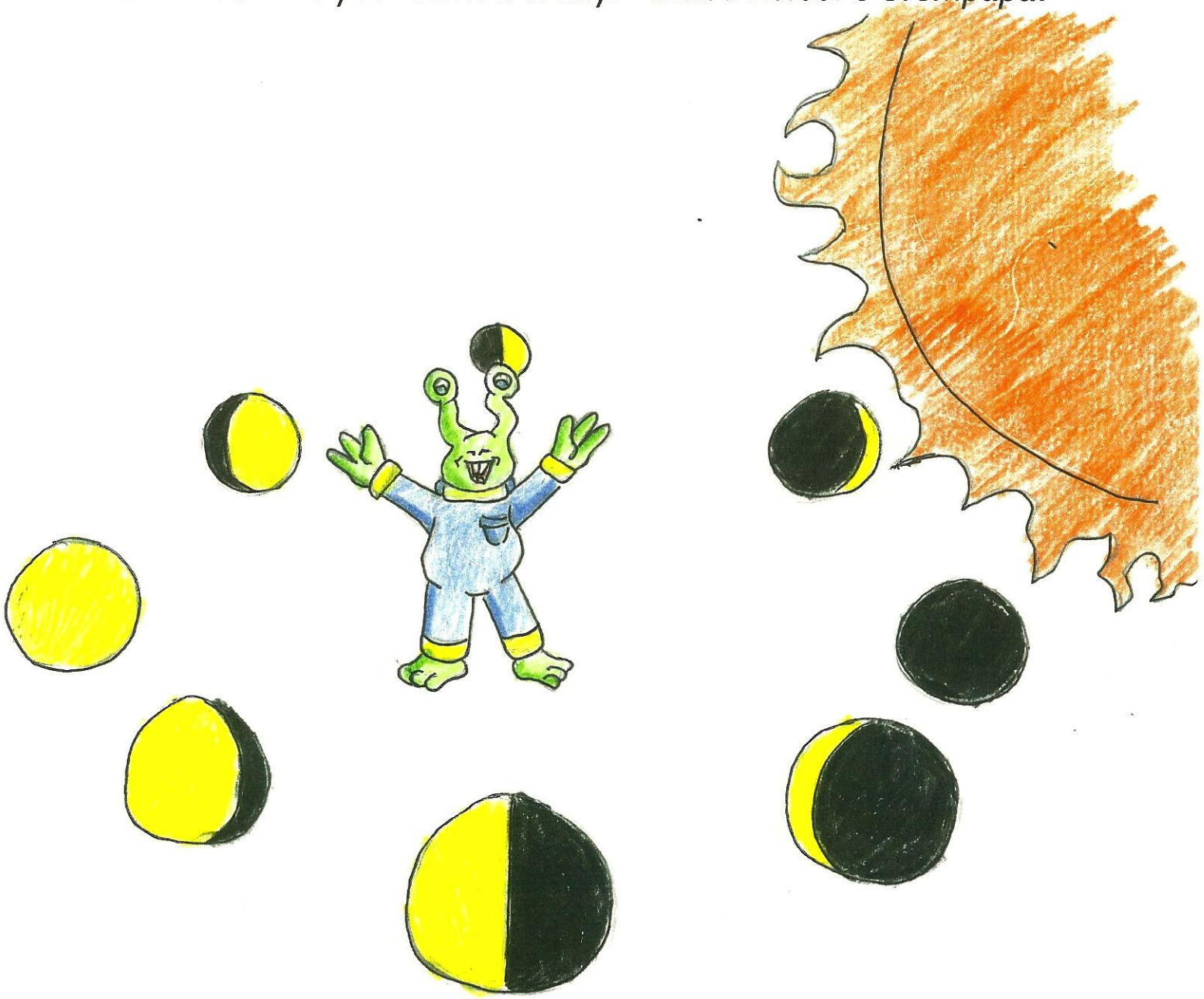




"So that's why the full moon came back after one month!" said Zoldar.

"Right again, my son," answered his *Grumpapa*.

“So what have you learned today?” asked Zoldar’s *Grumpapa*.



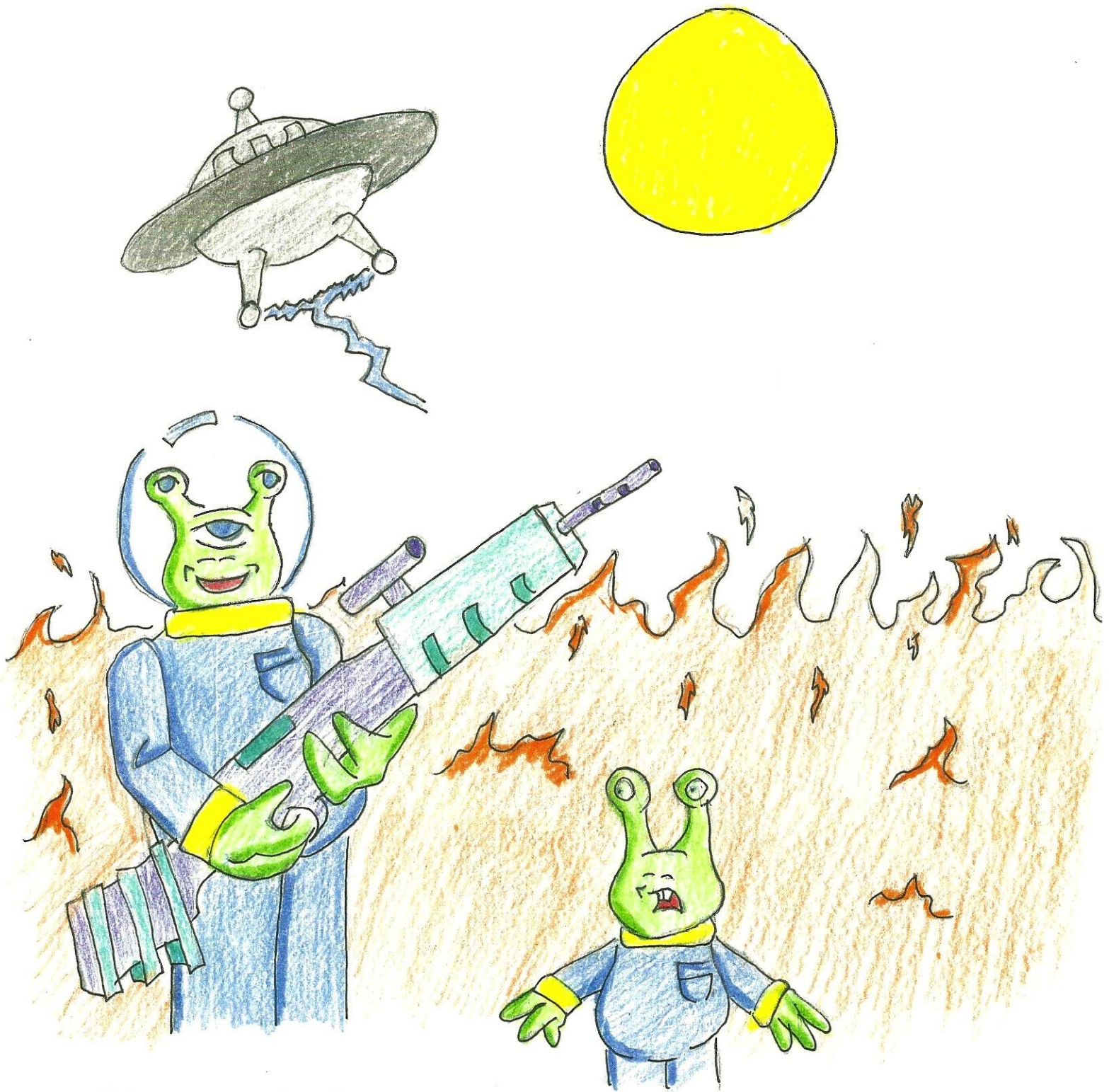
“The moon does not change shape. It only looks that way because of the way sunlight hits it. Each shape is called a phase of the moon, and those phases repeat every month,” said Zoldar.

"Very good, Zoldar," said his *Grumpapa*.

"But *Grumpapa*," said Zoldar. "Why do you know so much about Earth's moon?"



"To prepare," answered his *Grumpapa*.

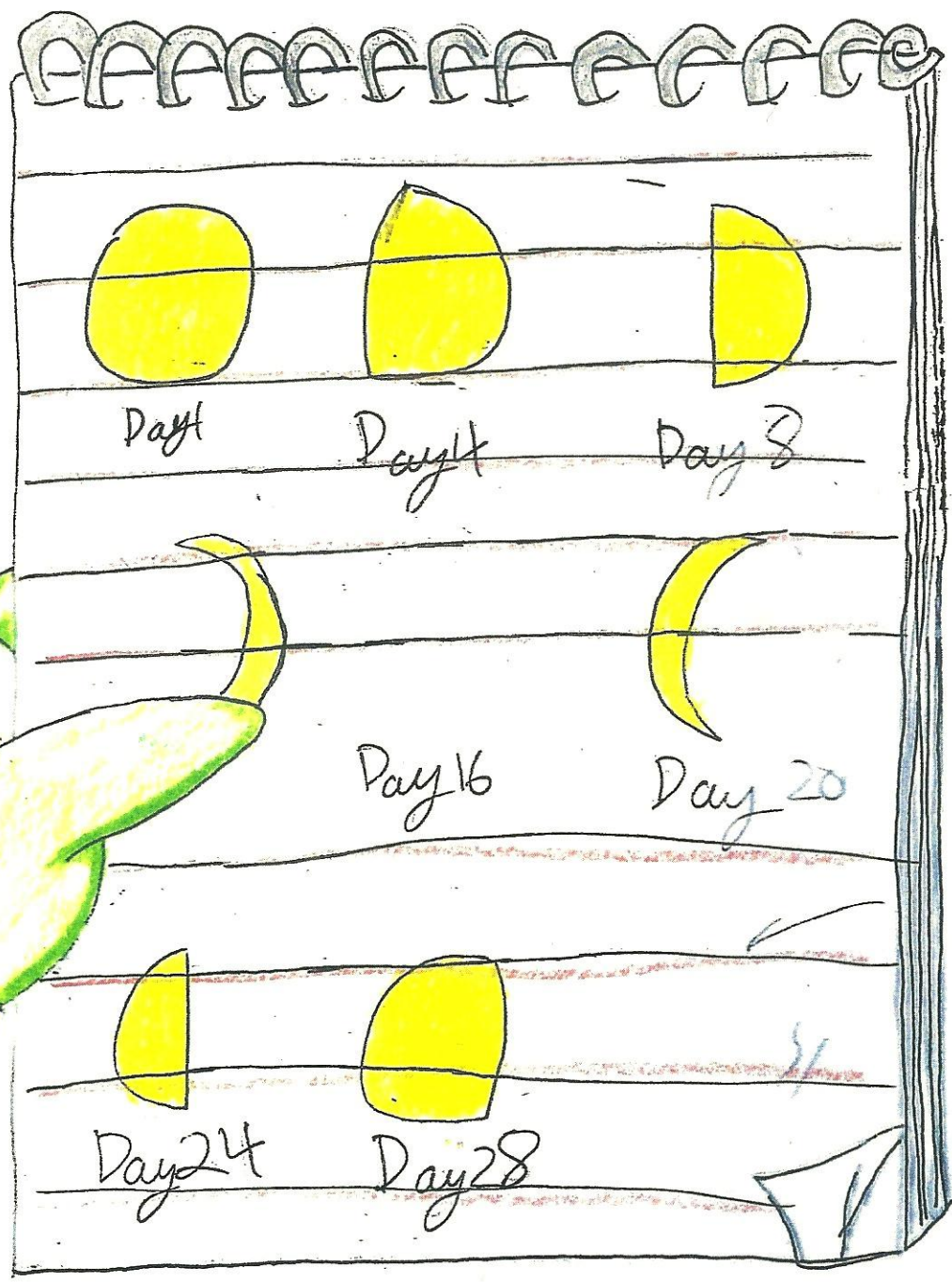


"To prepare for the invasion!"

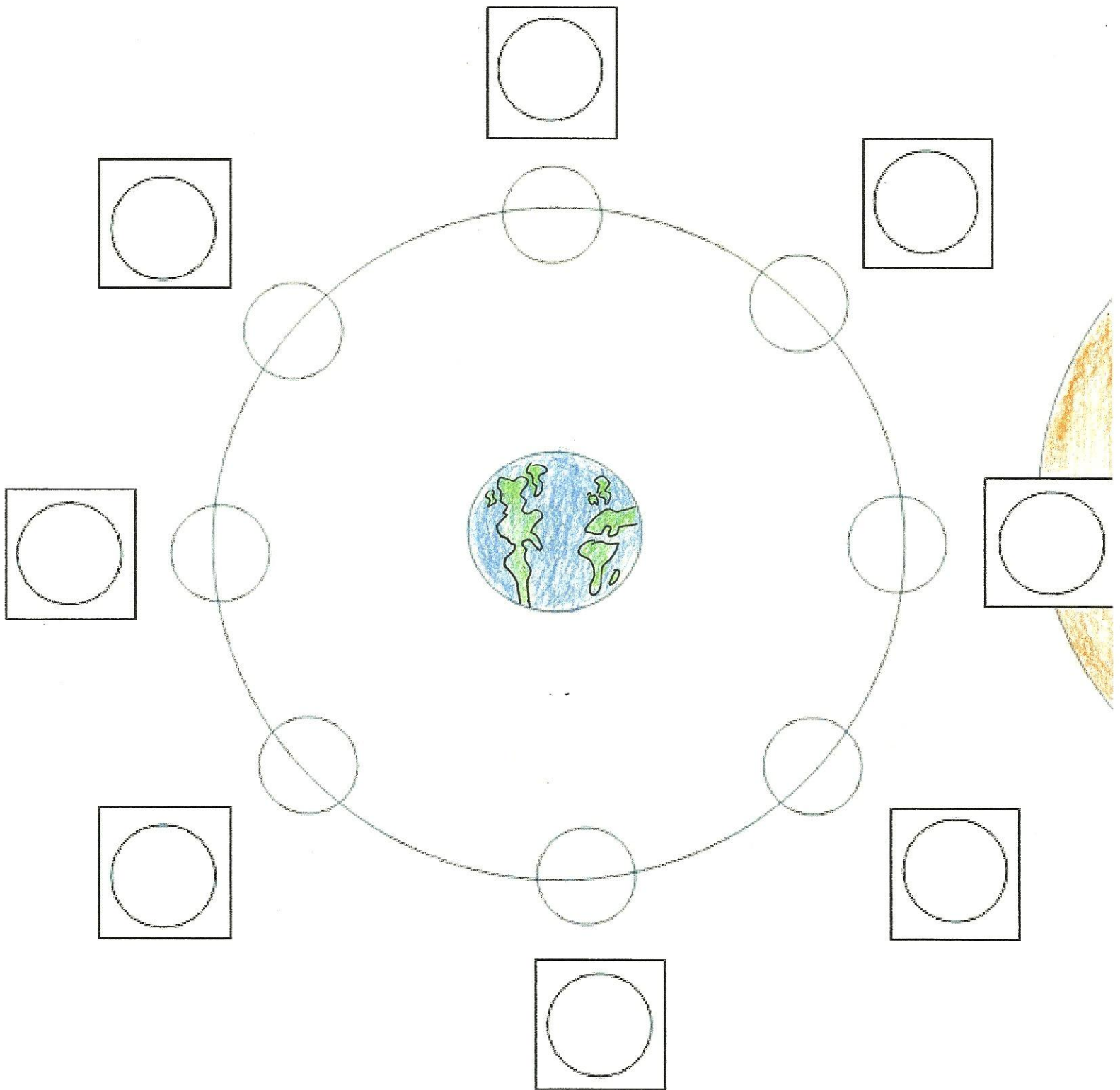
The End

Activities

Fill in the names of each phase on Zoldar's notebook.



Draw in each phases of the moon as seen from Earth.
Remember the four steps.



Zoldar's Word Search

Words can appear backwards, forwards, up, down, or diagonally in either direction.

A	R	W	S	A	R	D	N	E	E	T	O	Z	G	X	E	P	N	I	A	E	N	W	T	P
L	O	A	E	E	C	W	W	C	S	T	O	A	C	S	U	T	R	H	G	M	N	R	I	E
L	E	S	X	E	T	A	R	A	S	L	E	H	R	U	H	W	G	O	N	E	O	R	N	S
F	E	L	O	O	I	E	S	H	Q	M	L	T	U	N	F	T	T	N	I	E	A	L	U	E
N	O	P	N	N	S	G	U	M	O	W	I	U	T	W	H	U	R	B	I	N	R	B	A	G
I	M	U	S	E	O	R	N	O	N	C	O	A	F	D	L	S	T	A	T	X	B	G	N	N
N	A	L	N	T	I	W	N	G	O	N	E	N	T	A	G	A	U	S	E	I	A	N	A	A
I	T	T	R	D	T	L	P	S	A	N	N	G	R	N	G	S	G	S	G	Z	U	W	D	F
N	Q	N	N	E	T	P	T	M	P	S	U	I	R	N	A	M	R	R	I	A	U	U	S	A
H	A	T	S	P	N	O	G	I	N	H	O	A	N	U	L	O	M	U	M	E	H	A	U	R
A	S	N	E	I	N	O	N	R	T	T	U	I	L	V	M	N	E	T	Q	T	W	S	N	W
T	E	R	D	Q	R	E	E	U	E	A	R	H	E	M	A	P	L	P	I	B	H	L	S	S
N	U	S	I	A	G	T	T	O	M	N	R	R	N	U	E	S	A	T	E	T	A	S	I	N
N	D	R	U	W	N	L	S	T	A	E	E	R	O	W	S	X	I	P	T	E	U	N	U	V
A	F	U	E	N	I	B	V	I	P	S	C	A	E	A	S	O	U	O	A	T	T	S	D	R
N	W	Z	O	H	H	T	B	O	A	A	N	B	U	W	W	Q	U	R	N	Q	N	S	I	W
U	N	U	D	H	G	R	E	H	S	N	A	R	N	E	P	O	E	R	T	T	R	R	B	A
G	T	O	P	W	S	N	P	U	P	W	W	V	N	I	N	A	M	I	A	W	H	P	O	S
A	A	W	O	H	E	N	I	S	W	T	M	G	T	V	E	I	O	A	A	D	S	W	W	H
B	E	R	R	R	B	N	W	N	A	U	E	O	O	R	H	N	B	A	G	O	L	U	S	L
N	L	H	M	A	B	P	L	O	A	P	S	E	E	P	S	A	U	S	S	R	O	O	N	R
S	B	A	N	S	O	I	E	U	D	W	W	T	N	H	B	Q	U	T	T	N	B	O	Z	B
N	D	G	N	M	R	T	T	X	N	A	A	N	N	L	I	S	U	E	S	S	I	W	P	S
E	I	X	S	G	U	N	N	G	W	U	H	T	Q	I	M	A	O	G	A	T	O	L	T	W
Z	A	H	N	L	F	U	R	O	Q	W	D	S	X	R	A	O	H	N	T	M	M	E	S	N

Zoldar	Orbit	Grumpapa	Moon
Earth	Sun	Gibbus	Waxing
Crescent	Waning	Quater	Shadow
Full	New	Phase	Invasion

