

Eureka!

The Queen of Sheba and
the Scientist of Syracuse



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The Queen of Sheba and the Scientist of Syracuse

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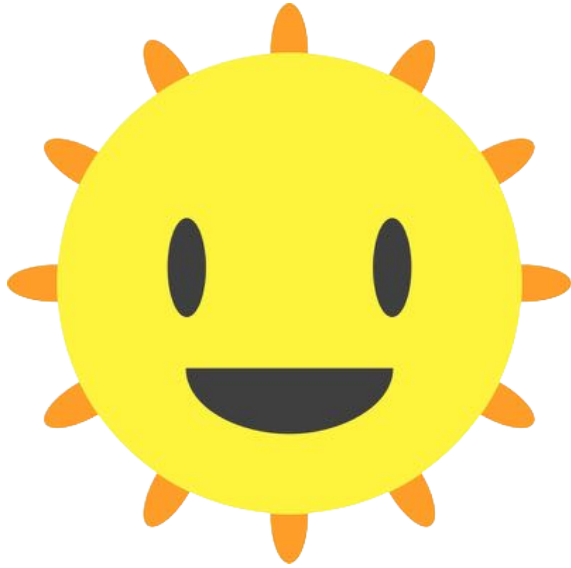
It was a lovely sunny morning in September. Ganesh Chaturthi meant it was a holiday from school. Tania and her friends were at Karishma's house celebrating the festival of the elephant headed God Ganesh.



There was an idol of Ganesh decorated with flowers and surrounded by lamps. Karishma's mother was distributing modaks. Modaks are dumplings made of rice flour stuffed with jaggery and grated coconut. They are supposed to be Ganesh's favourite food and was Tania's favourite part of the celebration. Karishma's mother also served puranpolis and some other Maharashtrian delicacies.



Replete with tasty wholesome food, Tania, Tanisha, Sonali, Rajiv and Nikhil decided to go outside and play to make the most of a rare sunny day in the midst of the Bombay monsoon.



Tanisha announced that her sister Trisha had taught her a new game called '*The Queen of Sheba*'. She said, "One of us has to be the queen of Sheba and ask everyone to get something from the surroundings and the person bringing the best sample wins." Tapping her wrist watch she added, "Of course there is a time limit. "



"Sounds like fun", said Nikhil. "Tanisha since the game was your idea you should be queen."

Tania, Sonali and Rajiv agreed. Tanisha was thrilled. She said "Let us do a trial round so I can explain better." Then in her most haughty voice, "The queen of Sheba wants a feather. The person bringing the longest feather wins. You have 1 and a half minutes. Your time starts now."

Tania, Sonali, Nikhil and Rajiv shot off in different directions in search of feathers. Nikhil was the first to return

with a feather closely followed by Sonali and then Tania. Rajiv arrived last just as the time was up but he was empty handed. Poor Rajiv had not found a single feather.



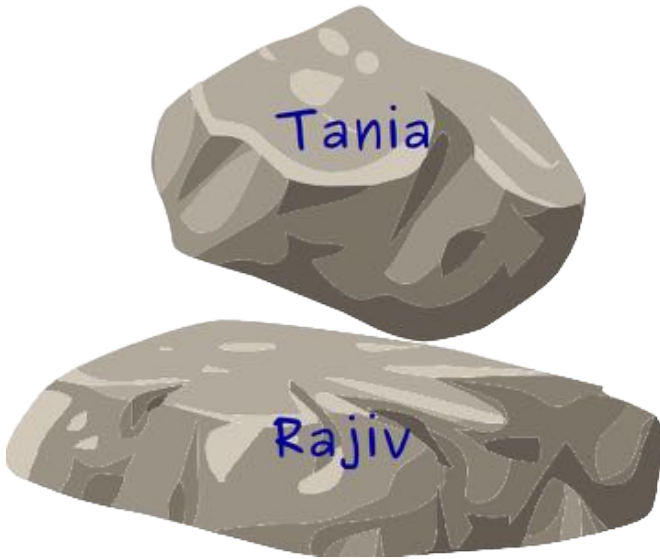
Nikhil, Sonali and Tania placed their feathers next to each other to compare their lengths. Sonali's was the longest so she won. With a clearer idea of the game they all waited eagerly for the next round. The next time Tanisha asked them to get individual blades of grass and the one getting the largest number of individual blades would win.



Nikhil, who managed to get 33 blades won this round. The game was quite enjoyable. Tanisha was inventive with her orders and fair in her judgements and made a great queen, until

It was round 5 and Tanisha had asked for a rock and said the person bringing the biggest rock would win. The rocks Sonali and Nikhil brought were clearly smaller than the other two. But Tanisha simply could not tell whether the rock Tania had brought was bigger or smaller than the one Rajiv had brought. They had very

different shapes and it was very difficult to compare.



Tania and Rajiv started fighting and Tanisha looked really harassed. Then Tanisha spotted Tania's papa sitting on a bench nearby reading a book. She said loudly so that she could be heard over the din, "Okay, stop! I see Tania's papa there. We should ask him. He may know how to decide which one is bigger." Every one agreed this was a good idea. They all approached Tania's papa. Tanisha explained their problem and

asked if he could help.

Papa nodded and said "Over 2000 years ago the king of Syracuse had a similar problem. The king had given a goldsmith a block of pure gold to make a crown for him. The goldsmith though talented was also known to be dishonest. He presented the king with a beautifully crafted crown. "

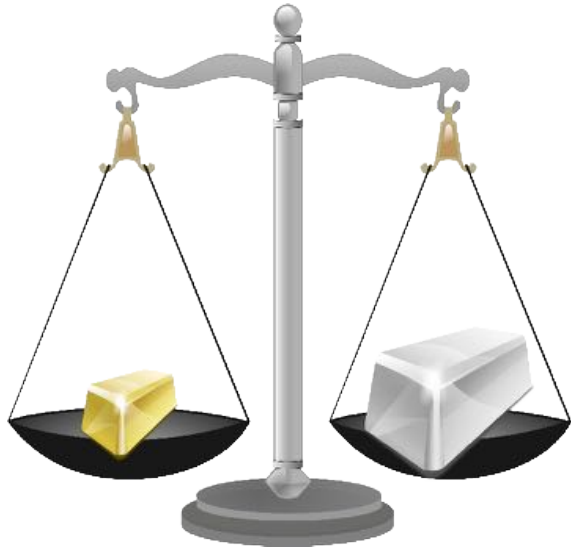


"But the king suspected that the goldsmith had substituted some of the pure gold with silver and kept the gold for himself. The king wanted to know if he had been duped. Desperate to know the truth, the king approached the scientist Archimedes. Archimedes promised to do

his best."



"Archimedes knew that if a gold and silver bar are of the same weight the silver one is bigger because silver is lighter. So if silver was mixed in then the crown would be bigger than a block of pure gold of the same weight as the crown."



"So the problem was to figure out if the crown was bigger than a block of gold of the same weight or not. It was so hard to tell because of the funny shape of the crown . So the problem was essentially the same as the one you have."

"So then what did Archimedes do papa?" asked Tania. "Did he figure it out?"

"Patience, Tania. I am coming to that. Archimedes was still thinking about the problem when he went for a bath. The

water level in the bath tub went up when Archimedes stepped in. That triggered an idea and Archimedes got so excited that he ran out of the bathroom, forgetting even his clothes, shouting **eureka! eureka!**"



"What is eureka?" interrupted Rajiv puzzled.

"Eureka is the Greek word for 'I got it!'", said papa.

"So he did figure it out then. But how? I don't understand." said Tania.

"Okay let me explain with an example. Suppose you have a glass with a little water in it. You mark the water level."



"Now say you put a lemon in that glass. Then what happens?"



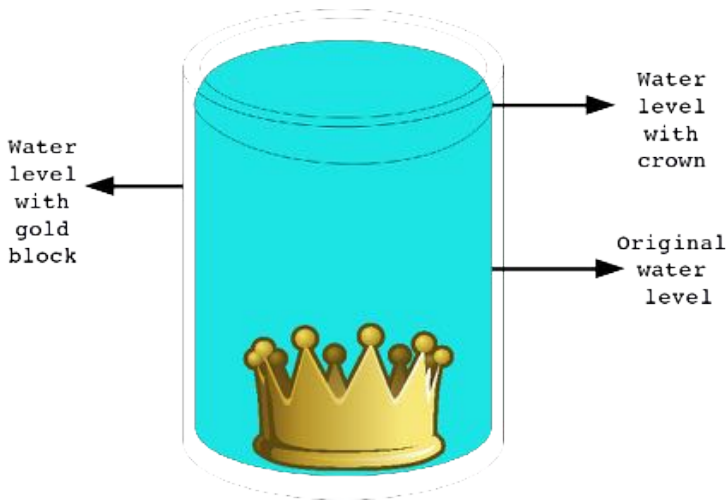
"The water level goes up, just like in the story of the thirsty crow" said Tania.

Papa prompted "The bigger the lemon..."

"The higher the water level rises" finished Nikhil.

"So now you can imagine what Archimedes

did. He took a glass container and filled it with some water and marked the water level. Then he put the block of pure gold of the same weight as the crown in and marked the new water level. Next he replaced the block with the crown. The water level rose higher than it had for the gold block. That meant that the crown was bigger than the gold block. So it was not made of pure gold."



Then papa turned to Tanisha and said, "So now do you know how to solve your problem queen of Sheba?"

"Yes!" exclaimed Tanisha. "Look Rajiv, your brother is washing his new motorbike there. We can ask him to lend us the bucket."



The kids filled the bucket with some water and marked the water level. Then they put Tania's rock in and marked the new level. Next they replaced Tania's rock with Rajiv's rock. This time the water level rose higher than it did for Tania's rock. That meant Rajiv's rock was bigger making him the winner.

That evening, at dinner, Tania looked very thoughtful. She asked, "Papa we could not have used that idea to compare

the size of two objects if one of them floated right, like a piece of wood I mean?

"I am really impressed you thought of that. It is good to know the limitations of any scientific method. But it is also important to see if you can come up with a simple work-around. Can you think of a way to work around that problem Tania?"

Tania thought for a moment and said "You could push the wooden piece in so it is submerged in the water". She sounded very sceptical that the solution could be that simple.

To her surprise papa said "That is correct Tania, but you need to push it just a little below the surface so your finger does not get submerged too pushing the water further up."



"The real problem would be to compare the size of 2 things if one of them was spongy like a sponge or a pillow. Then the sponge would soak up the water and the water level would not rise much. In that case you would have to look for a different solution."

Papa added "Tania I think this was a great way to celebrate Ganesh Chaturthi."

"What do you mean?" asked Tania puzzled.

"Well Ganesh doesn't only eat modaks you know. He is also a patron of arts and sciences and the God of intellect and wisdom." said Papa grinning.

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"Although he is known by many attributes, Ganesha's elephant head makes him easy to identify. Ganesha is

widely revered as the remover of obstacles, the patron of arts and sciences and the deva of intellect and wisdom." This information was obtained from <http://en.wikipedia.org/wiki/Ganesha>