

# Black Hole – The Ultimate Whirlpool

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This is a quarterly e-magazine published by Navi Mumbai Science Foundation, a society engaged in spreading science education among students of Navi Mumbai region for last one decade. The magazine will cover all the activities of the society as well as articles on educating science to the students and teachers.



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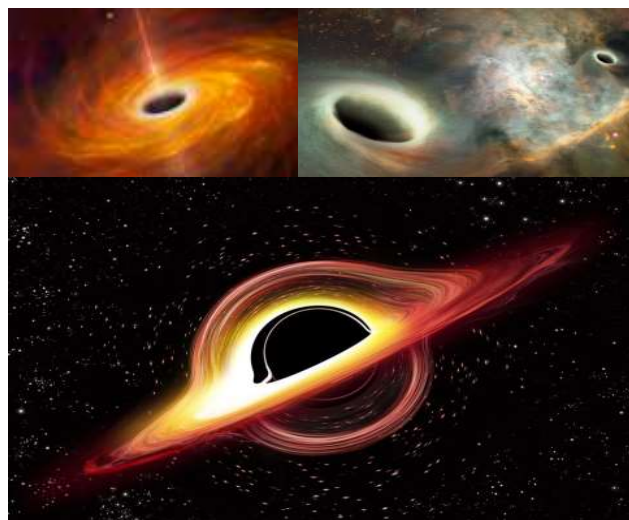


Image courtesy: [www.wikipedia.com](http://www.wikipedia.com), [www.physics.org](http://www.physics.org), [www.advocator.ca/science](http://www.advocator.ca/science)

## Foreword .....



Three kudos to the 'Team NMSF' for launching their e-magazine – EduREKA, the maiden issue of which is in front of me as I pen down the foreword for the second issue. I am hundred percent sure that this endeavor of Navi Mumbai Science Foundation will go a long way in bringing back students' interest in science, which during the last few years, has suffered to some extent because of the exam oriented and market driven approach towards education. The objective of promotion and popularization of Science among the students is not merely to encourage students to take up science as a career, but the larger objective is to nurture scientific temper in them which will help to inculcate rational and logical thinking in them. This will also help in eradicating superstitions still prevalent in many sections of our society. These superstitions push us back by many decades and hit at our pride which our scientists have earned by their hard work and perseverance. It is really ironical that on one hand Indian science is scaling new peaks through missions like ITER, Chandrayan and exploration of Mars etc. and on the other hand, we keep receiving the so called religious whatsapp messages with an appeal to forward them to at least 10 people and also with a warning of otherwise facing the dire consequences. I am sure that NMSF, through EduREKA can provide a yeomen service to the society by enlightening particularly the youth. This will be a real tribute to people like Dr. Narendra Dabholkar who gave away his life for the cause of enlightening India.

The present issue of EduREKA brings to its readers a lead story on Black Holes. Besides, it also talks about the NMSF initiative of Nobel Laureatism and an inspiring report on the students' initiative for water conservation in rural Maharashtra. I am particularly glad that this issue is starting features like Students' Corner and Teachers' Page. I am sure that the second issue of EduREKA will be very interesting, inspiring and informative to its readers. I once again greet and compliment Navi Mumbai Science Foundation for their efforts and wish all the readers a happy reading of the second issue of EduREKA!

**Swapnesh Kumar Malhotra**

Former Raja Ramanna Fellow &  
Secretary, Atomic Energy Education Society,  
Department of Atomic Energy.

# From Editor's Desk!!....

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With the immense efforts and lots of hard work, first issue of the EduREKA was inaugurated and distributed to different parts of the society including NMSF well-wishers like teachers, students, principals and scientists.

Inauguration of the issue took place during the currently ongoing activity of NMSF i.e. Homi Bhabha Balvaidnyanik Competition preparations. It was really a wonderful experience with parents and students to release of the issue.

Now the celebrations are over and it is now everybody's responsibility to carry the herculean task of smoothly running of the magazine further and also its distribution to the students and teachers. Our idea is to ensure the reach this magazine to each student and make them aware of the important milestones of scientific discoveries.

We also feel that there cannot be anything like an old issue as knowledge cannot not be old. So every issue should be preserved by students and whenever required can be used for reading.

Current issue is again going to be treat for the readers as it contains unique stories which may not have come before. Astronomers during this year unveiled the first photo of a black hole, one of the star-devouring monsters scattered throughout the Universe and obscured by impenetrable shields of gravity. The supermassive black hole now immortalised by a far-flung network of radio telescopes is 50 million light years away in a galaxy M87 and 40 billion times greater than our Sun. This is one of the greatest discoveries of mankind. I am sure that students will be enlightened by this exciting story.

Wishing all the readers very happy reading.

**Editor....**

## Black Hole –The Ultimate Whirlpool

A king was celebrating his birthday. A poor farmer presented him three lemons as a birthday gift. Impressed with his affection the king gave him five lakh gold coins. The farmer was simply delighted. Next in the queue was a wealthy trader who offered king a very costly diamond locket. King gave trader those three lemons as a return gift! And to his further disappointment, pointed out that just now he has purchased these three lemons from the farmer for five lakh gold coins!!! This story shows that it is possible to represent money in the currencies that have strikingly different forms (like Gold coins, Diamond locket and yes—Lemons). It also shows us how exchange of these currencies can produce unexpected results (like the delight of farmer and disappointment of trader). It further provides us a valuable insight that if we are able to unbind our thinking (like the king did) then we can reveal the deeper truth that though currencies have different forms their essence is the same.

Interestingly, it is this kind of 'unbinding' of thinking that led Einstein to arrive at his famous equation  $E=mc^2$  and establish equivalence of mass and energy. Thus like the king of our story Einstein revealed the deeper truth that though 'mass' and 'energy' have altogether different forms they too are just currencies which can be exchanged like diamond locket and lemons.



Photograph 1: Black hole a) artist's view b) First image captured recently (Courtesy: Wikipedia)

Continuing with the lemons, let us put them in a container. If we increase number of lemons we can progressively visualize the states of matter with which we are most familiar with namely gas, liquid and solid. If we go on adding lemons, then their shapes will get gradually deformed. At some point of time they will lose their shapes altogether and finally (if container is rigid enough) will lose their identity to become a pulp. Something similar happens in case of the Black holes. Yes! Black holes are not really holes at all. In fact, it is quite the opposite! Black holes have the maximum matter packed into the smallest amount of space than any other objects in the universe. It is because they are so compact; they have an unusually strong gravity. Due to such a strong gravity black holes are able to trap everything -- even the light!

Before we see how this becomes possible and what the consequences are, it is important to note that scientific explanations and concepts are not final and change whenever fresh and new evidence becomes available [1-Tools of inquiry based science teaching-Prof. C. Natarajan –Proc. Teach. Conf. (2019) p. 30]. For example, we have changed our views about the basic element of which matter is made up of i.e. to say 'atom' several times. For us, initially, this basic element of matter was 'Water' [Thales of Miletus (~BCE 600) -a student of Pythagoras]. As per Leucippus (~BCE 500) all matter was composed of small indivisible particles called atoms (i.e. 'a'- not; 'tomos' –cuttable). According to him Universe consisted of two elements 'atom' and 'void'. His student Democritus thought that atoms have a range of sizes. Atoms that make up Iron have hooks while atoms that make up water are slippery. Interestingly, Aristotle (~BCE 300) he did not believe in the atomic theory and existence of the atom. According to him matter was continuous and as such there is no base unit of matter. He thought that all materials were made up of four elements namely Earth, Fire, Water, and Air. Galileo, however strongly opposed this view point and so did Newton.

Dalton (1800 AD) proposed that all matter was composed of atoms which are indivisible and indestructible. This concept of atom was revised once again when Rutherford showed that atoms have internal structure in the form of a positively charged dense nucleus surrounded by electrons and they in fact are divisible!

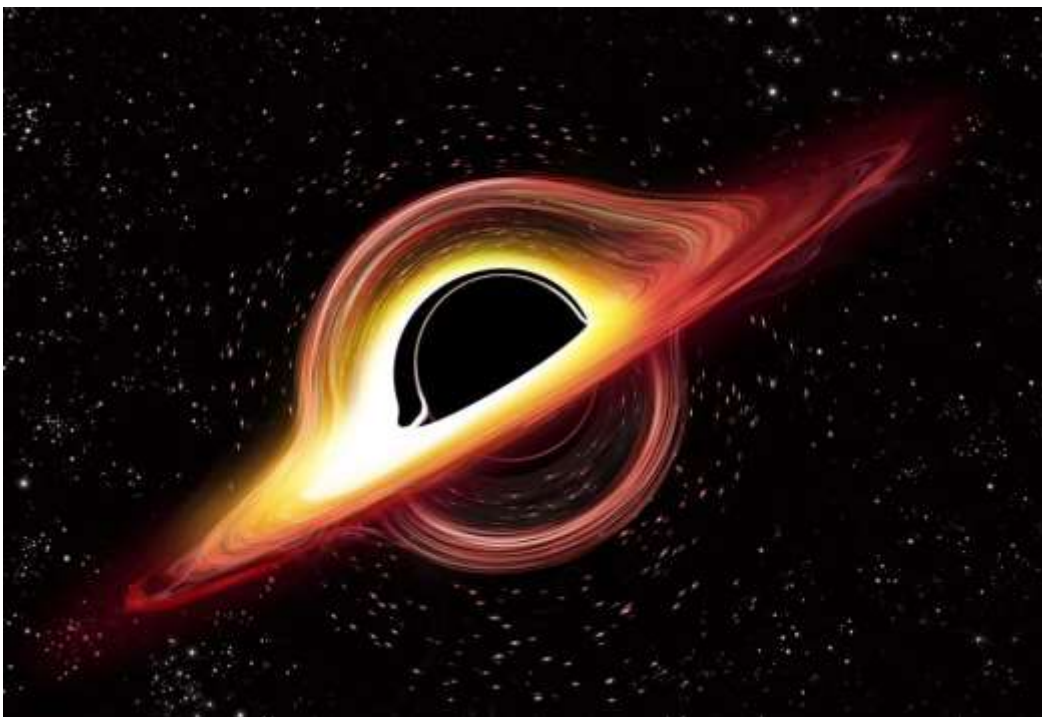
As a result of the nuclear forces that bind nucleus together and the forces acting between atoms, the atomic structure becomes stable against attraction due to gravity and does not collapse. Here it is interesting to note that atom itself is quite empty (if we consider nucleus to be of size of a grape then size of atom is that of a--- football field!). These factors in effect cause matter to occupy quite a large space. Therefore the states of matter that we come across everyday like solid, liquid and gas occupy space which is much larger than volume of all of their atoms taken together. So even solids are mostly an empty space! In addition to this, atomic structure also gives matter its ability to absorb, emit, reflect and transmit the light and thereby become visible in various colors.

On this backdrop, the facts that in black holes maximum amount of matter is packed in tiniest possible space and also that no light can escape them appear quite strange. This also indicates that behavior of matter when it is inside the black hole is strikingly different than the one when it is outside the black hole. So now let us see how black holes are able to do this.

We know that Stars [like our Sun], are made mostly of hydrogen and helium, which are packed so densely in a star that in the star's center the pressure becomes so high that it initiates nuclear fusion reactions. Nuclear reactions are different from chemical reactions. Chemical reactions involve transfer or sharing of electrons hence identity of participating elements does not change. In Nuclear reactions however, electrons are not roped in but nuclei of the elements themselves are involved. Hence unlike chemical reactions, nuclear reactions change the identity of participating elements and cause formation of altogether new elements. For example, in a nuclear fusion reaction, the nuclei of two atoms combine to create an atom of a new element. More specifically, at the center of the star, the pressure is so high that Hydrogen nuclei disregard the repulsion arising from their positive charge and fuse to become helium nuclei. This reaction is called 'thermonuclear fusion' and it produces enormous amount of energy [governed by the equation  $E=mc^2$ ]. The heat released in this reaction creates outward push which works against gravitational pull acting inwards and prevents star from collapse and makes it stable. But when star consumes its fuel, gravity takes over and

the core is compressed even further. With no more nuclear reactions fighting against gravity, the repulsive forces between electrons eventually create enough force which halts the progress of gravitational collapse and once again star becomes stable. Such stars are called 'white dwarfs'. White dwarf is typically as big as Earth. But its mass is as large as that of Sun. They are so called due to the white color of the first few that were discovered. We can make them out by their low luminosity.

For a star which is more massive (25 times Sun) this process continues till gravity defeats electronic repulsion and a 'neutron star' is formed. In neutron stars, the gravity compresses matter so tightly that protons and electrons combine to make neutrons. The radius of a typical Neutron star is  $\sim 10$  kilometers. And if star is still more massive (30 times Sun) then the collapse continues further till it overpowers the interactions between Neutrons and the matter of star is compacted to a point (mathematically known as 'singularity' i.e. singularity contains an extremely large mass in a vanishingly small space hence density and gravity become infinite. This stage in the evolution of a star is called Black hole.



Photograph 2. Black holes are perhaps the most mysterious objects in the universe.



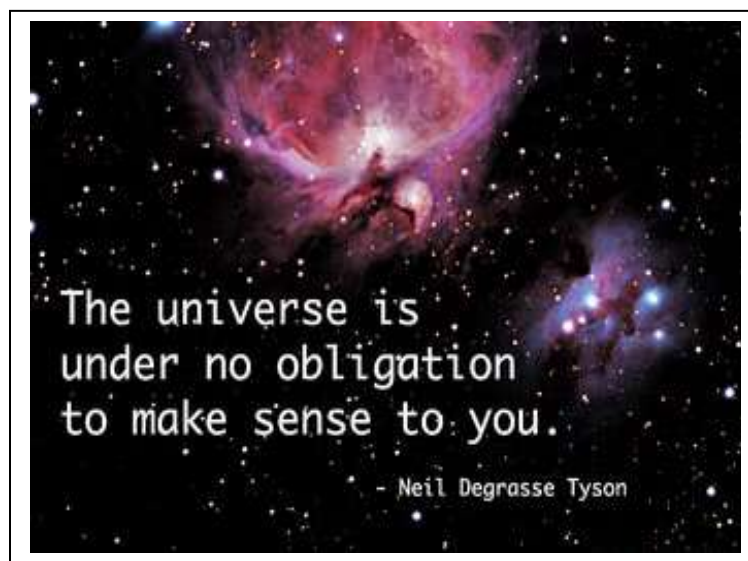
As per Newton, gravitational pull between two objects is more when their masses are large and also when their separation distance is small. Thus closer and closer we get to the object its gravity will become stronger and stronger.

We have seen that a neutron star is more compact than a regular star having same mass. Hence we can get comparatively much closer to it and therefore will experience a far stronger gravity. Black hole is much more compact than neutron star as it has a much smaller radius (it is point source!). Therefore in case of black hole, an object can reach right up to that separation distance where gravity is extremely strong. In fact so strong that for an object to escape it should have velocity more than that of light! This situation is quite like a whirlpool. If we get too close to its center then we cannot escape from it.

It may be noted that all the black holes have a finite lifetime due to the emission of Hawking radiation. However, for most known astrophysical black holes, the time it would take to disappear through Hawking radiation is far longer than the current age of the universe. For example, a black hole with the mass of the Sun would take  $2 \times 10^{67}$  years to evaporate (i.e.  $\sim 2$  followed by 67 zeroes!). However, since the age of the universe is only  $13.8 \times 10^9$  years (thus it will take more than  $10^{67}$  times the current age of the universe for that black hole to evaporate i.e.  $\sim 1$  followed by 67 zeroes!). Thus practically black holes may be considered to have infinite life.

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## **Nurturing Talent for Nobel Laureatism**

### **“Need Statement: Why this essay competition”**

Navi Mumbai Science Foundation (NMSF) and Reliance Foundation School (RFS) have ventured upon the idea of organizing this event 2 years and a good number of schools have given positive response to it. This competition is an initiative to contribute towards the holistic development of the nation and endeavours to prepare it to face the challenges posed by a technologically advancing global environment without losing sight of its societal commitments. Also, this competition aims to develop "scientific temperament" in the student community in particular.

Needless to remind that India has become a parched territory/country as far as the count of homegrown Nobel Laureates in science is concerned. The last Indian Nobel Laureate in science stream was seen on the world stage in the year 1930. What happened thereafter?

A time has therefore come to review the scenario in retrospect, then introspect and come out with a feasible solution without getting involved in a blame game of any sort. While doing so, one can keep in mind that India too had a rich past in scientific achievements in the fields like Mathematics, Astronomy, Medicine and Metallurgy which covered India with glory for more than two millennia before the 12<sup>th</sup> century AD.

The present day mind boggling technological progress (which we see all around) is the result of contributions from various branches of engineering and technology. They are attracting the best talent everywhere in the world, especially so in India, the underlying reason being “Lucrative Pay Packages” right from day one of the service career. The younger generation, which gets easily attracted by a rich “Material Life Style” naturally opts for it. All good students are therefore drifting towards lucrative branches (particularly the software side) where they merely operate, most often, a few software systems without even knowing how they were developed.

It is thus being forgotten that it is the R & D effort in basic sciences which provides the real platform for sound technological growth. It is this issue which needs to be addressed to attract some good students to science streams where more satisfaction prevails in the long run. It is time to remind the youth of India what Swami Vivekanand used to say often **“Arise, awake, and stop not till .....”** And one of the ways to do it is to bring the younger generation closer to the lives of the present day “Nobel Laureates” through a humble effort of this sort. May be, it will pay off better dividends than expected in future.

First year the competition was held on July 28, 2017 (written test) and September 9, 2017 (oral + presentation followed by an interview) for all the three streams i. e., Physics, Chemistry and Biology (Physiology or Medicine). Following are results based on the overall performance of students.

Table 1: Winners of the essay competition-2017

No	Name of Student	Name of the School	Stream	Position
1.	Harsh Pahade	St. Mary's ICSE School, Koparkhairane	Physics	1
2.	Mythili Mishra	Podar International School, Nerul (ICSE)	Physics	2
3.	Abhigyan Lahiri	Delhi Public School, Nerul	Physics	3
4.	Aaryan Nagraj	Euro School, Airoli	Chemistry	1
5.	Dhruv Garg	Delhi Public School, Nerul	Chemistry	2
6.	Dhatri Mehta	Reliance Foundation School, Koparkhairane	Chemistry	3
7.	Zinneerah Khan	Podar International School, Nerul (CBSE)	Biology	1
8.	Shreya Singh	D. A. V. International School, Kharghar	Biology	2
9.	Neeyati Fitkariwala	Delhi Public School, Nerul	Biology	3

**Overall topper School for Sir C.V. Raman Award: Podar International School (CBSE), Nerul.**

During last year the exam was conducted on Friday, 27<sup>th</sup> July, 2018 (written test) and Saturday, 24<sup>th</sup> November, 2018 (oral + presentation followed by an interview) for all the three streams i. e., Physics, Chemistry and Biology (Physiology or Medicine).

Table 2: Winners of the essay competition-2018

No	Name of Student	Name of the School	Stream	Position
1	Ashutosh Kashyap	Bal Bharti public school, Kharghar	Physics	1
2	Dheeraj Anna	DAV International School, Kharghar	Physics	2
3	Alphonz George	Don Bosco Senior Secondary School, Nerul	Physics	3
4	Srijita Singh	DAV International School, Kharghar	Chemistry	1
5	Sukriti Choudhari	St. Mary's ICSE School, Koparkhairane	Chemistry	2
6	Aditya Jindal	Reliance Foundation School, Koparkhairane	Chemistry	3
7	Abigail Thomas	New Horizon Scholar's School, Airoli	Biology	1
8	Paridhi Maheshwari	Reliance Foundation School, Koparkhairane	Biology	2
9	Dawoo Maheshwari	St. Mary's ICSE School, Koparkhairane	Biology	3

**Overall topper School for Sir C. V. Raman Award: Bal Bharti public school, Kharghar.**



Photograph: Students writing essay and interview in front of judges at Reliance School.

Dr DAR Babu

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## Sir C. V. Raman Award Winning Essay 2018

### Nobel Prize for Physics: Gravitational wave experiment

Ever wondered what's the most powerful wave in the universe? The most powerful wave in the universe so far had energy equal to 3 solar masses when converted using  $E=mc^2$ ! And the speed of light squared is already a large exchange factor.

But why didn't we see such a strong beam of light? Sorry, the wave wasn't light or any other electromagnetic wave. It was a gravitational wave. If you don't know what one is, the idea is simple; just like light is disturbance in the electromagnetic field, a gravitational wave is a ripple in the space time.

But these ripples were so small that it took a century to find even the biggest one. The ones who measured this wave, Kip Thorne, Rainer Weiss and Barry Barish got the Nobel Prize for physics in 2017.

You must have understood by now that finding a ripple in the weakest Force isn't easy. But don't think that you can make it even with professional help. Only 2 such detectors are made and are together called LIGO or Laser Interferometry Gravitational wave Observatory. The concept of these detectors is simple. Einstein said, "Gravity is the distortion of space-time". So a gravitational wave will change the length of everything. So the light speed constancy can be used to detect any change in length which would show the presence of gravitational wave – Voila!

I wish life would have been that easy. But it isn't, because the devil is always in the details. For starters, the light beam would have to be long enough for the distortion to be visible. But even the 4 km long arms of the two LIGOs, mentioned wave which was detected changed the length of the column by a mere thousandth of the width of a proton! Two: The light used has to have really stable wavelength for accurate results. So, most of the materials in LIGO are actually used for stabilizing the lasers.

To add to this point, the mirrors sending the light back for interference have to be so smoothest ever created and have to be fixed in plane so that uniform reflection takes

place. Also the mirrors have to be equally reflecting so that the light beam is equally bright when they come back together.

Three: No air allowed. Air molecules scatter the light tampering the result.

As the cherry on the top of the cake of impossibilities, there have to be at least two detectors as far apart as possible to remove the chance of false positives. After all these you can only pray.

After years, no decades of planning, developing and failures, our three scientists struck the gold: A lot of noise rapidly rose up to a crescendo and disappeared. They have discovered, rather detected the collision of 2 multi-solar-mass black holes, which created a wave that was the most powerful one in the universe and yet moved spaces through one part in  $10^{21}$ .

So, what is the problem? The problem is that for the past 87 such success stories none of the scientists were Indians. So, what's stopping India from getting a Nobel Prize in physics, or Chemistry or Plain science? The problem is that the child, who wants to go into pure science, has a peculiar property: an insatiable appetite for knowledge. But this puts him at a crossroads: Either he goes through intense session of rote-learning which gives him good marks, but kills his curiosity, hence giving him no reason to go into science; or, he goes out to try to keep his curiosity satisfied, but without good marks, Institutes like IISc would close their doors killing his dream.

So what should we do? The word limit isn't very adequate, so I will close my essay with an analogy to the answer of the above question:-

Don't assess an artist's skills using a point by number kit. She may add a personal flair here and there so much but by restricting her so much, you'll have but a slender view of her abilities. Give her a blank canvas and you will be surprised"

**Ashutosh Kashyap,**

Bal Bharti public school, Kharghar

## **PAANI FOUNDATION: SUCCESS STORY WITH CHILDRENS PARTICIPATION**

Paani Foundation was set up by Amir Khan and his team with the aim of making Maharashtra drought-free using the power of communication. The team of Satyamev Jayate researched the issue of water and found that man, not nature is largely responsible for this crisis of drought. While decentralised watershed management has proved to be the scientific solution to this problem, the greater problem to address has been that of social fracture. At Paani Foundation it is believed in the power of unity, and all are convinced that only a people's movement can eradicate drought. Through a holistic, experiential training programme, we equip villagers with both technical know-how as well as leadership skills to tackle the issue of drought in their villages. For this purpose they have created simple training films, an Android App as well as training manuals to spread the knowledge across the state. Every year, to incentivise this programme, a competition called the Satyamev Jayate Water Cup has been organized from last four years, in which villages compete to win prizes for the best watershed management work. A typical example of watershed is shown in the photograph.



Photograph 1: Typical example of watershed full of water after rain.

In these past four years, this competition has become a movement and has created water revolution. It is believed that if we are to succeed in the battle against drought, creating a love for nature among children and providing them with opportunities to nurture nature is critical. This is why they have created a school

workshop **Nisargachi Dhamaal Shala (निसर्गाची धमाल शाळा!)** which, through games and activities, sensitises students about the environment and water, and empowers them to take action. Using music, films and experiments, it devised one-hour long sessions that bring to life the inseparable bond between humans and nature.



Photograph 2. Children participate in the game and learn the concept of nature

It is emphasized that the students visit the nature, play with the trees, and plant new trees. As a part of this programme, each student from Chincholi Pimpri Dist Jalgaon planted one tree and adopted them. Each tree has been named by the name of students and the students are taking care of the tree as long as they are in the school.



Photograph 3. Students participate in the work after school



As a part of this competition, hundreds of villages have taken part and work on water conservation has taken place in entire Maharashtra. All the villagers stopped their personal work, donated money, students collected their savings and donated money for this noble cause.



Photograph 4: Each student adopted a tree and his name is given to the tree.

In drought-prone Maharashtra people spend hours of their lifetime fetching water. In order to change this, thousands participated in the Satyamev Jayate WaterCup and undertook watershed treatments. With the arrival of monsoons watershed structures have now begun to harvest rainwater and their lives have begun to change.

Dr S.T. Mehetre

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**Source:** The article has been prepared with the inputs from Paani foundation webpage and other different videos available on social media with the intention to spread the information to students community.



# Teachers Page...

## BE AN OBSERVER

Today I want to talk to you about a simple experiment. You will require a candle, a match stick and a glass. What you need to do is light the candle and cover the burning candle with the glass and note your observations.

Did, I hear you say "oxygen is required for burning"? Is this an observation or a conclusion?

An important distinction that needs to be made is what exactly is an observation and what is a conclusion. The candle stops burning after some time is an observation. On the other hand, oxygen is required for burning is a conclusion.

How can you be sure that it was oxygen that was helping the candle burn and not some other gas? You will have to do a couple of more experiments before you can conclude that it was indeed oxygen that supports burning.

The objective of this article is not how we prove that oxygen is required for burning but to show how many more aspects of science can be explored with this experiment if we were to learn to observe and ask questions and not just jump to conclusions.

So what other observations could we have made while doing this experiment? At the very least I can list the following observations that can be easily made:

- The shape and color of the flame (both the candle and the matchstick that was used to light the candle).
- Does the flame go off in puff or does it slowly become smaller and smaller and die out?
- The change in the physical appearance of the candle. It becomes shorter, the wick is burnt and is black in colour and the top of the candle is convex in shape.
- The temperature of the glass which is placed over the candle.

- The small puff of smoke that is produced as the candle goes off and the direction in which this puff of smoke moves.
- The small black spot that is formed at the top of the glass and the forming of small droplets of water in the inner surface.
- The physical appearance of the matchstick and the matchbox.
- How one lights a matchstick and how one puts it off.

These observations lead to the following questions:

- Why do we have a flame in the first place? Does everything that burns produce a flame? Why is the flame not triangular or round but tear drop shaped? Why does it seem to travel upwards? Why does the flame have different colours? Do the colours signify anything? Will the colour change if we burn something else?
- Why does the candle stop burning?
- What exactly is burning – the wax or the wick? What is the role of the wick? Can we have a candle without a wick?
- How does the heat of the candle reach the glass?
- What is the puff of smoke and the black spot that is formed in the glass?
- Where did the water come from? Could it have come from the wax? What is wax made of?
- Can you light a match by striking it against any rough surface?
- Why does blowing the matchstick put off the matchstick?

The process of science starts with making observations. These observations lead to questions and the quest to find the answers to these questions leads to new discoveries. If you have found the answers to the above questions, I suggest you repeat the experiment with two candles – one big and the other small? You will find that while the bigger candle goes off the smaller one continues to burn? But if there is no oxygen then how is the smaller candle burning?

Happy exploring.

**Tejas Shah**

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# Students Corner...

## COMPETITIVE EXAMINATIONS - A GIFT FOR MAN

विद्वत्त्वं च नृपत्वं च नैवतुल्यं कदाचन !

स्वदेशे पूज्यते राजा विद्वान्सर्वत्र पूज्यते !!

**अर्थार्थ:** एक विद्वान और राजा की कभी कोई तुलना नहीं की जा सकती क्योंकि राजा तो केवल अपने राज्य में सम्मान पाता है वही एक विद्वान हर जगह सम्मान पाता है।

Hence knowledge is very important. Knowledge is the root for achieving anything and everything in life. This knowledge is present everywhere around us. It is only how we perceive and grasp it. Competitive exams are one of the main elements which help us understand our surroundings and help us differentiate between different elements.

They open our mind about different things and our reasoning multiplies at an unbelievable rate. I, at a personal level feel that these competitive exams play a major role in development of a child's brain. The competition which is created due these exams keeps the children busy and makes them more and more competitive. To compete with each other and stay in this competition, the child not only prepares himself for the exam but also for real competition prevailing in the world. To stay in this competition and survive, one needs to know the necessary changes he/she has to adopt as per the Principle of Natural Selection. The scholarships given are medium to appreciate and encourage those hardworking souls who are always looked down. It is the best for giving moral and financial support to the ones who need it the most. These competitive exams are not biased; they are a perfect example of healthy competition. The entrance examinations for government jobs and other jobs at multinational companies are just an advanced level of these exams. Moreover a merit obtained in a particular exam adds one bonus point to us during the interview of these entrance exams. I personally feel that these exams and competitions help students know where

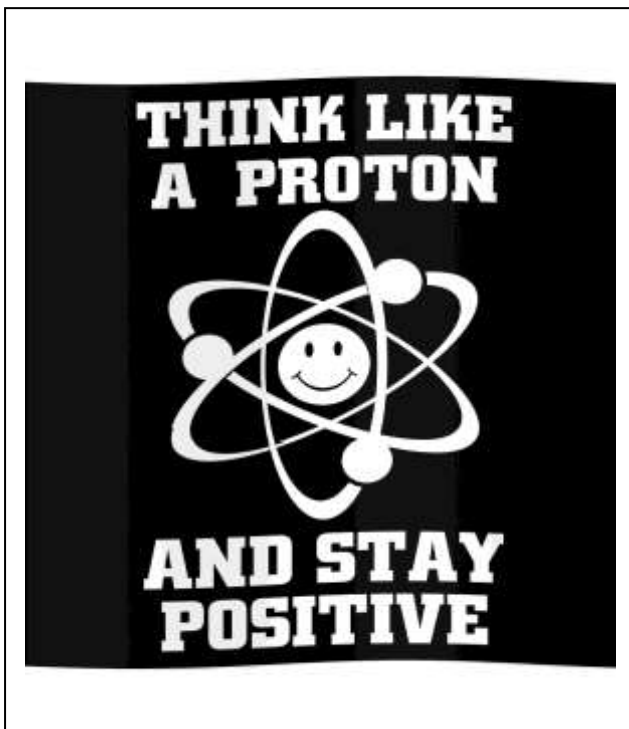
their likes for a particular subject lie. The main aim of these exams is to give experience of how life works and how we have to manage it all by ourselves to sustain a happy and content life. I feel that every child should participate in maximum no. of exams. Even if he/she is not able to achieve anything now, the knowledge obtain, gained is useful somewhere or the other in future. This can be understood well with the help of the following Sanskrit shloka:

न चोरहार्यं न राजहार्यं न भृतृभाज्यं न च भारकारि!

व्यये कृते वर्धति एव नित्यं विद्याधनं सर्वधनप्रधानम्!!

**अर्थार्थ:** न चोर चुरा सकता है, न राजा छीन सकता है, न इस का भाइयों के बीच बंटवारा होता है, और नहीं सम्भालना कोई भार है. इसलिए खर्च करने से बढ़नेवाला विद्यारूपी धन, सभी धनों से श्रेष्ठ है।

To make this come true, we have to take necessary hard decisions in life. It will help build ourselves into good citizens of the world. We, all students should strive to compete with each other in a healthy manner. We should always be hungry to grasp and gain maximum knowledge. We should always remember that, 'The purpose of competitive exams should not be to fill one with knowledge, But these exams should make you hungry for knowledge.'



**Master Vansh Vijay Aggarwal**

10<sup>th</sup> Standard

Fr. Agnel Multipurpose School, Vashi

# Picture gallery.....



**Photograph1.** Release of first issue of EduREKA at Fr. Agnel High school, Vashi on 2<sup>nd</sup> June 2019.



**Photograph 2.** Science Exhibition at Reliance Foundation School, Vashi on 29<sup>th</sup> July 2019.



**Photograph 3.** Homi Bhabha Balvaidnyanik Competition guidance session under progress at Fr. Agnel Multipurpose School, Vashi

**DON'T MISS IT.....**  
**COMING UP IN NEXT ISSUE No 3**  
(October to December 2019)

1. India's Exciting Space Journey: Chandrayan 2
2. Navi Mumbai Science Foundation's "World Nuclear Energy Day"
3. Student's corner
4. Teacher's Page
5. Parent's views



**Do you have a interesting educational story???**  
**Share with Us!!!!**

# NMSF Events Calendar 2019

January							February							March						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5						1	2						1	2
6	7	8	9	10	11	12	3	4	5	6	7	8	9	3	4	5	6	7	8	9
13	14	15	16	17	18	19	10	11	12	13	14	15	16	10	11	12	13	14	15	16
20	21	22	23	24	25	26	17	18	19	20	21	22	23	17	18	19	20	21	22	23
27	28	29	30	31			24	25	26	27	28			24	25	26	27	28	29	30
														31						

**Science Utsav**

**Fun with Science from 15 Feb to 15 March**

**Pre-RMO**

April							May							June						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6				1	2	3	4							1
7	8	9	10	11	12	13	5	6	7	8	9	10	11	2	3	4	5	6	7	8
14	15	16	17	18	19	20	12	13	14	15	16	17	18	9	10	11	12	13	14	15
21	22	23	24	25	26	27	19	20	21	22	23	24	25	16	17	18	19	20	21	22
28	29	30					26	27	28	29	30	31		23	24	25	26	27	28	29
														30						

**HBBVC Classes April to September (except May) every Sunday**

July							August							September						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6					1	2	3	1	2	3	4	5	6	7
7	8	9	10	11	12	13	4	5	6	7	8	9	10	8	9	10	11	12	13	14
14	15	16	17	18	19	20	11	12	13	14	15	16	17	15	16	17	18	19	20	21
21	22	23	24	25	26	27	18	19	20	21	22	23	24	22	23	24	25	26	27	28
28	29	30	31				25	26	27	28	29	30	31	29	30					

**RMO Guidance and Science Club every Sunday**

**Nobel Laureatism**

October							November							December						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5						1	2	1	2	3	4	5	6	7
6	7	8	9	10	11	12	3	4	5	6	7	8	9	8	9	10	11	12	13	14
13	14	15	16	17	18	19	10	11	12	13	14	15	16	15	16	17	18	19	20	21
20	21	22	23	24	25	26	17	18	19	20	21	22	23	22	23	24	25	26	27	28
27	28	29	30	31			24	25	26	27	28	29	30	29	30	31				

**Children Science Congress**

**HBBVC practicals full day**

**World Nuclear Energy Day**

