contents

Brain Teasers

1. My bath has two taps and a plug hole. The cold tap on its own fills the bath in 12 minutes, the hot one in 8 minutes. The plug hole can drain the bath in 24 minutes with the taps off. How long will the bath take to fill if I leave both taps on with the plug left out?

2. Practical Peter was asked to cut a 99 foot rope into three smaller, equal length ropes. However, as usual, Peter couldn't find his measuring tape so he guessed! When he finally did find his tape, he discovered that:

a) the second piece of rope was twice as long as the first piece, minus 35 feet (i.e., 2 x first, - 35),

b) the third piece of rope was half the length of the first, plus 15 feet (i.e., 0.5 x first, + 15).

How long were each of the pieces of rope?

From brainbashers.com

Answers to last issue's Brain Teasers

1. *Yesterday I went for a long bicycle ride around the local lakes. As the ride was quite long, I rode in various stages. In the first stage I rode half of the overall distance. Stage two saw half of the remaining distance plus 35 metres covered. Stage three covered three-quarters of the remaining distance. Stage four completed half of the remaining distance plus 75 metres. Stage five completed the journey with a final burst of 150 metres. How far did I cycle in total?*

Ans: 7,340 metres. How do we get this? It's simplest to work forwards and then back again. Let the total distance be X. Then I cycled half the distance, X/2, in the first stage. So X/2 distance was left. I cycled half of this plus 35 m in the second stage, so that is (1/

2)(X/2)+35 or X/4+35 m. So the amount left was X/4-35 m. In stage 3, I cycled 3/4 of this distance, (3/4)(X/4-35), so (1/4) was left over: (1/4)(X/4-35). In stage 4, I cycled (1/2) this remaining distance plus 75 m, that is (1/2)(1/4)(X/4-35)+75=(1/8)(X/4-35)+75, so the other half minus 75 m was left over: (1/8)(X/4-35)-75, and I cycled it all in the fifth stage. Also, this amount of journey was 150 m.

So (1/8)(X/4-35)-75=150 m, or (1/8)(X/4-35)=(150+75)=225 m, or (X/4-35)=8X225=1800 m, or (X/4)=1835 m or X=1835X4=7340 m.

Counting backwards, in stage 1, I cycled 3,670 m, leaving 3,670 m, in stage 2, I cycled 1,870 m, leaving 1,800 m, in stage 3, I cycled 1,350 m, leaving 450 m, in stage 4, I cycled 300 m, leaving 150 m, and in stage 5, I cycled 150 m, leaving 0 m.

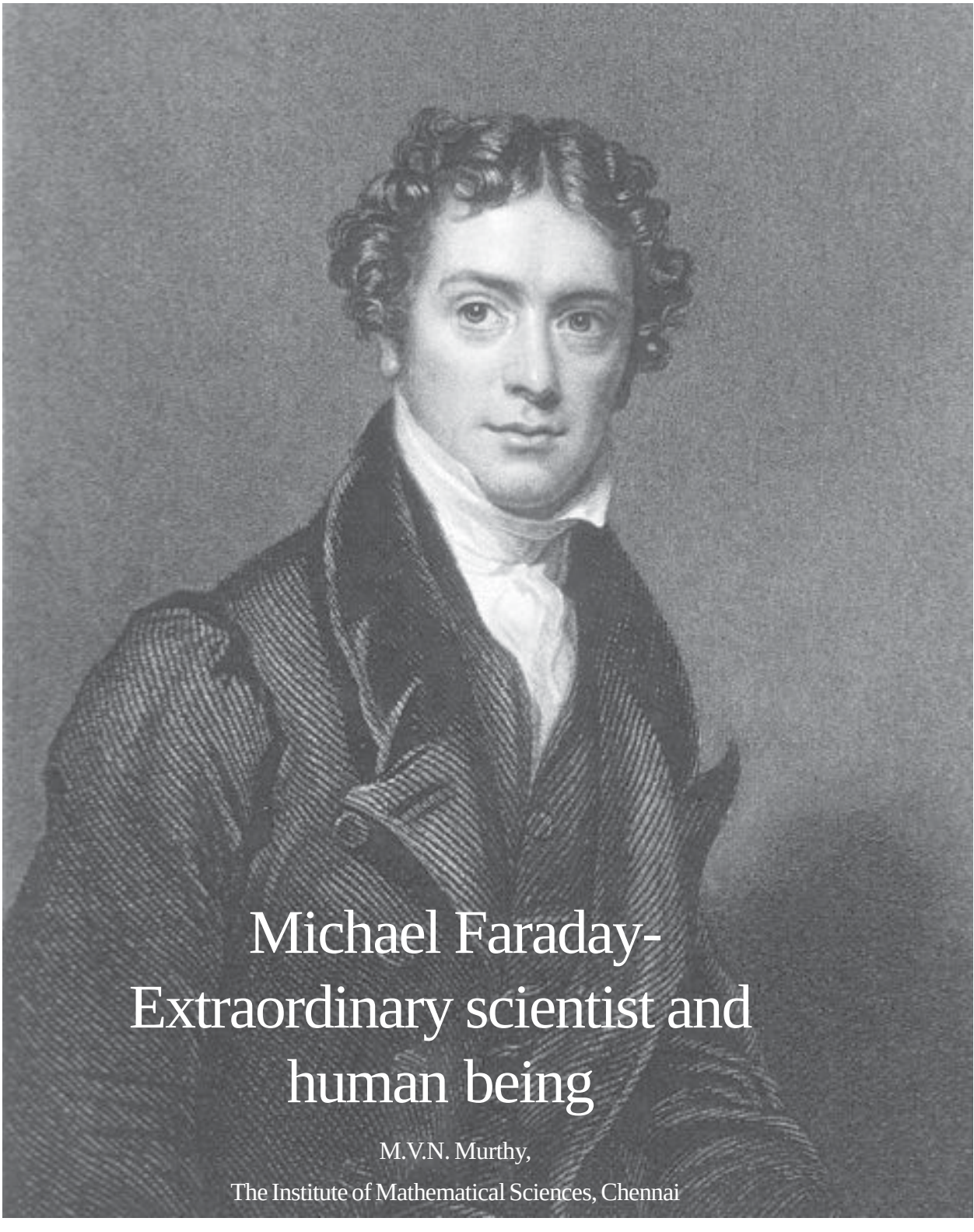
2. At the recent Sports Festival, the 100 metres heats were closely monitored. Each contestant had to run in two races so that the average place could be determined. Only one runner finished in the same place in both races. Abhay was never last. Charlie always beat Dilkush. Bharati had at least one first place. Abhay finished third in at least one of the races. Both Dilkush and Charlie had a second place. What were the results of the two races?

Ans: This is a logic puzzle. Let's start with the fact that Charlie always beat Dilkush. But Dilkush has a second place in one race. Let's call it Race 1. So Charlie had to be first in that race. Then Bharati was first in the other race, Race 2. And since both Charlie and Dilkush had a second place each, Charlie must have been second in Race 2. So now we have to find third and fourth place in each race. But Abhay was never last, and so he was third in both (and was the only runner to finish in the same place in both races). So Bharati came last in Race 1 and Dilkush came last in Race 2. So the results are

Race 1: Charlie, Dilkush, Abhay, Bharati.

Race 2: Bharati, Charlie, Abhay, Dilkush.

From http://www.brainbashers.com/



Michael Faraday- Extraordinary scientist and human being

M.V.N. Murthy,

The Institute of Mathematical Sciences, Chennai

There are few scientists who through the magnitude and extent of their discoveries have had definitive influence on the progress of science and technology. Michael Faraday is one them. He directly contributed to several fields of Science. His contribution to electricity and magnetism led to the formulation of electro-magnetic theory by **James Clerk Maxwell**. His experiments led to several discoveries in *Chemistry* including that of *Benzene*. He was also a proto-typical environmental scientist and refused to use his scientific skills in war efforts. He was not just a great scientist but an extra-ordinary human being. And he did all this with little formal education. It is therefore no wonder that **Albert Einstein** kept a picture of Faraday on his study wall, alongside pictures of **Isaac Newton** and **James Clerk Maxwell**.

Growing years

Faraday was born in a little village just north of London in the year 1791. His father was a blacksmith and he grew up under harsh conditions with limited means. Nevertheless it was a close knit family with strong faith in religion. The family followed a particularly open and liberal form of Protestantism, *Sandemanians*, which was a major influence in Faraday's life.

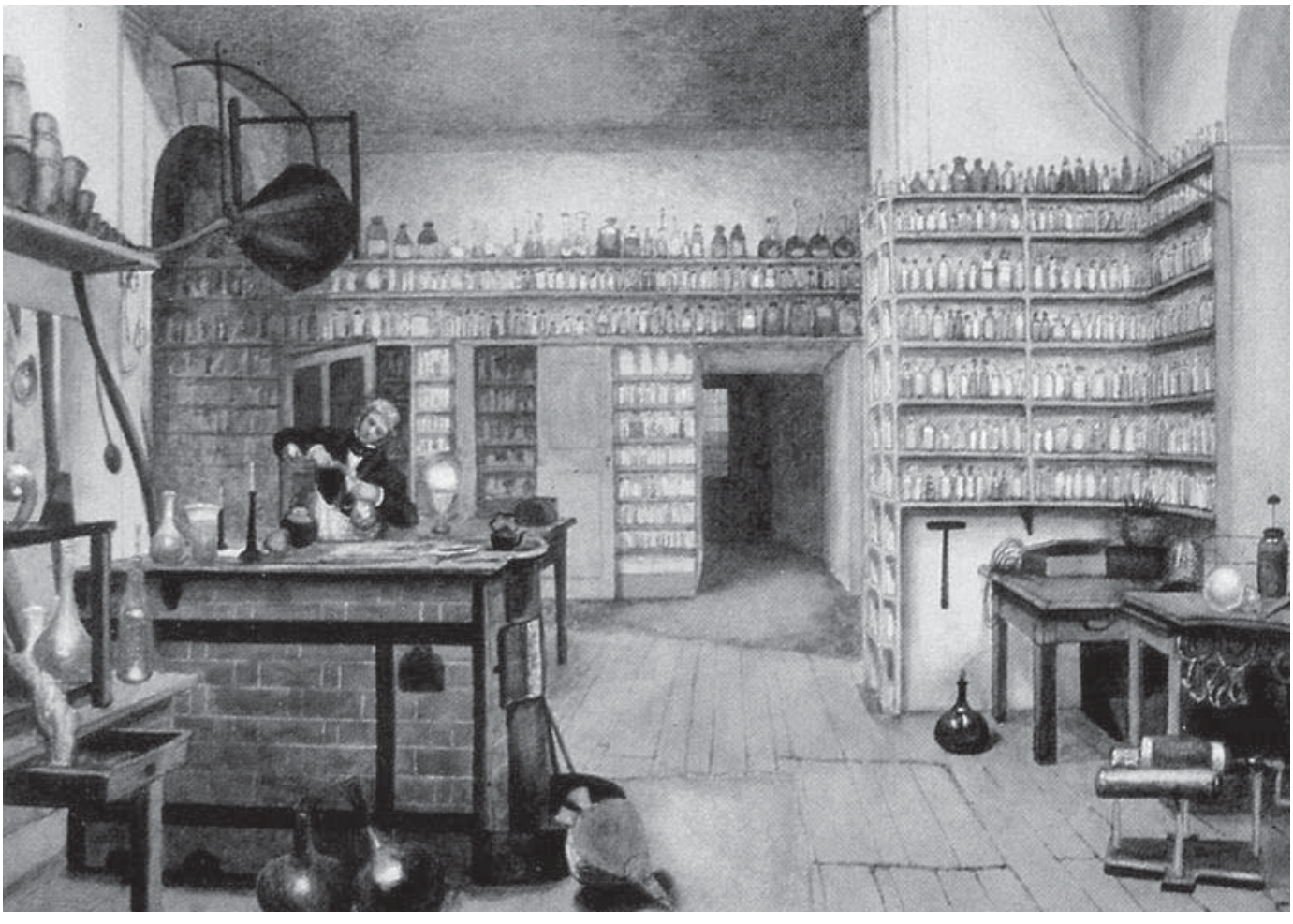
He attended school until he was thirteen years old when he had to leave to support his family by finding a job as an apprentice to a book binder. The job was routine, but Faraday found that he could now read books that interested him, especially, as he said "I loved to read the scientific books which were under my hands...". In between he also found time to attend lectures on different topics in the house of one **John Tatum**. The first important breakthrough in his career came when he attended lectures by the then well-known scientist **Humphry Davy** (known for Davy's lamp which was used by Coal miners as a warning device) of the *Royal Institution* in 1812. He made careful and extensive notes of Davy's lectures. The portrait shows Michael Faraday in his late thirties.

Inspired by these lectures, he wrote to the President of the Royal Society, **Sir Joseph Banks**, asking if he could become get involved in scientific work at the Royal Society. Receiving no reply, he wrote to Humphry Davy sending copies of the notes he had taken. Davy arranged a meeting but advised Faraday to continue working as a book binder. Fortunately for Faraday an assistant of Davy had to be sacked and Faraday was hired for the position of an assistant to Davy at the Royal Institution. Now there was no looking back for young Faraday.

Within a year, in 1813, Davy set out on a scientific tour of Europe accompanied by his family and Faraday. The trip was not easy on Faraday since he had to perform the duties of assistant as well as a servant to the family. He was not particularly well treated during this tour as he was not considered a "gentleman" in a very class-conscious society. Nevertheless there were many positives since Faraday met the French scientist **Ampere** in Paris and the Italian scientist **Volta** in Milan in Italy. His scientific interests broadened during this tour.

Contributions to Chemistry

On his return to London, Faraday started his scientific work and published his first paper in 1816 on caustic lime. After his marriage to



Sarah Barnard in 1821, he made the Royal Institution his home as well as his laboratory. For the next ten years his major scientific contributions were made in the field of Chemistry. Two important contributions were *liquefaction of Chlorine* and isolating the chemical compound *Benzene* both of which made a huge impact. Because of his contributions he was elected a fellow of the Royal Society in 1824 in spite of the opposition from his mentor Humphry Davy whose class prejudice coloured his judgement. In fact Davy was the President of Royal Society at that time and had to be over-ruled by other Fellows. In spite of this, Faraday always held Davy in very high regard. Harriet Moore painted this picture of Michael Faraday in his lab. (Source Wikipedia)

Discovery of Electromagnetic Induction

During the ten years from 1830 onwards, Faraday made important discoveries in electricity and magnetism and by the end of this period was in a position to put all pieces together into a coherent theory. His most important discovery was "Electro-Magnetic Induction". We almost take this for granted now, even in schools such experiments are common. All motorised vehicles are fitted with battery charging equipment which is done through induction. However, during the time before Faraday, it was thought that electricity and magnetism were two different theories. Faraday showed that a moving magnet can induce

electric current in a closed loop of conducting wire. This lead to the development of the *Dynamo* using which mechanical energy could be converted into electrical energy. All power generating equipments use this idea every where.

He showed that electrical charges are distributed uniformly on the surface of a conductor when it is closed. In fact, if a person were to sit inside such a closed conducting shell, the person will not experience any electric field. This is known as the *Faraday cage* and has immense applications in practical life. For example the metallic body of a car, or air plane, acts as a Faraday cage so that even during heavy lightening the passengers sitting inside do not feel the otherwise deadly effect of lightning. Demos of Faraday cages are usually show-stoppers in Museums, as seen from the photo on the cover page of JM.

Yet another important discovery was that the magnetic field affects the *plane of polarised light*. This was important since this discovery showed that light could be considered as a form of electro-magnetic wave, thus unifying the description of light, electricity and magnetism. This important discovery led to the later formulation of electo-magnetic theory, by James Clerk Maxwell. Though Faraday was not a trained mathematician—his knowledge did not extend beyond trigonometry—his discoveries led to important developments in theoretical physics and mathematics. Indeed we have only cited a few of Faraday's important discoveries leaving out many other important ones.

Faraday and Children

Apart from his own scientific work, Faraday took a lot of interest in communicating the excitement of science to children and the public in general. He was an excellent teacher. He introduced a series called the Christmas lectures for children in 1826 at the Royal Institution. He continued this series till the end of his life. The last two lectures by him in this series were given in 1859 and 1860. In 1859 he gave Christmas lectures on various forces of matter. In 1860 he gave lectures on the chemical history of the candle. These two have been published and have become classics. The back inside cover of JM shows a typical Christmas lecture. The Christmas lectures started by Faraday continue to this day reaching many more children and public. It is the longest running such series anywhere in the world.

Environmentalist

Faraday was a proto-typical environmental scientist. He investigated industrial pollution near London, air pollution at the Royal Mint and commented on the pollution and foul smell in the river Thames.

The British government sought his advice on the production of chemical weapons for use in the Crimean War of 1853. Michael Faraday refused to oblige as he did not believe in using science for destructive purposes. His science was founded on strong ethics.

The last few years of his life saw Faraday's mental abilities decline. He died in the year 1867 aged 75. The Times of London noted in its obituary "Gladly would he learn, and gladly teach. The cause of science would meet with fewer enemies, its discoveries would command ready assent were all its votaries imbued with the humility of Michael Faraday".

Sunlight, Earth and Moon temperature

Kamal Lodaya,
The Institute of Mathematical Sciences, Chennai

Brinda's uncle Vivek was listening to an old recording of Western classical music by the Italian composer Antonio Vivaldi.

Vivek: Today is March 21st, so it is Spring. Do you know why the seasons occur?

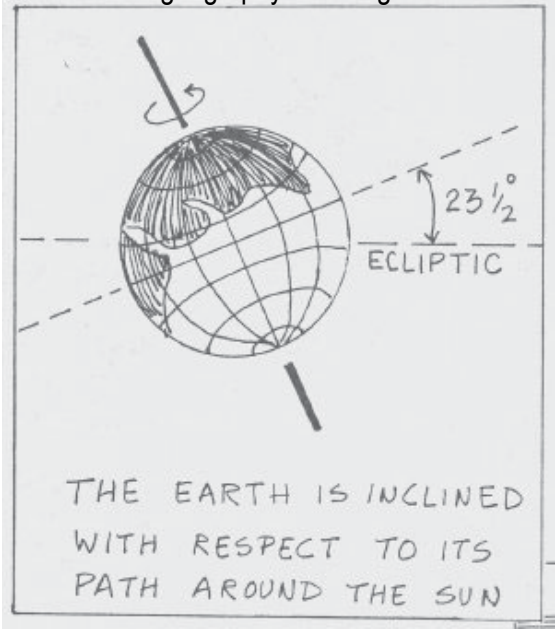
Brinda: Yes, I know, the Earth is inclined.

Vivek: You mean the axis of Earth's rotation is inclined. See, in this picture, the path of the Earth around the Sun defines a plane, which we call the Ecliptic. But the Earth rotates so that its axis —which is imaginary and there is no stick hanging out like in the picture—is inclined. The angle between the Ecliptic and our equator is 23 and a half degrees.

Brinda (*innocently*): Celsius or Fahrenheit?

Vivek: What do you mean ... (starts laughing as he sees Brinda smiling)? You want to have your joke, don't you?

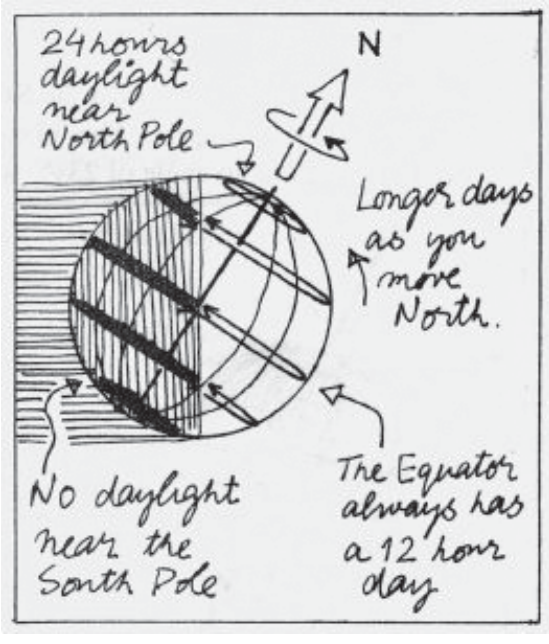
Brinda: Well, it is confusing, isn't it, having degrees of angles in geometry and degrees of latitude in geography and degrees of



temperature in physics on top of that!

Vivek: Not to mention my Kumbakonam degree coffee (now Brinda starts to laugh).

Vivek: Okay, now that we are serious again, do you see that because of the inclination,



there is more daylight in one of the hemispheres of the Earth? Summer is happening there because the axis is inclined towards the Sun. Our days are longer and we get more sunlight.

Brinda: This will mean that the Sun will rise earlier and set later in summer, but why is it *hotter*?

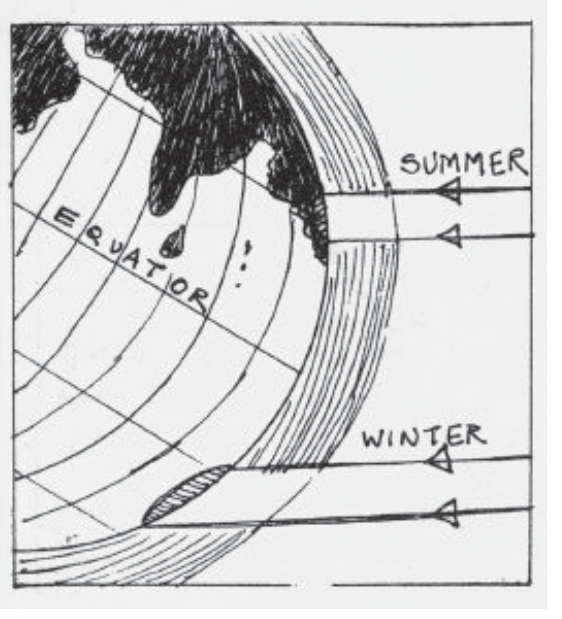
Vivek: The intensity of sunlight is higher because the Sun is high above in the sky.

Brinda: I don't understand ...

Vivek: Imagine that you are standing in space a little above the Earth holding a big cardboard one square meter in area.

Wherever the Earth is in its orbit, the amount of sunlight falling on the cardboard is nearly the same.

Vivek: When the Sun is overhead, in the picture that is on the Tropic of Cancer, that



much sunlight falls on around one square meter of the Earth's surface. But when the Sun is at an angle, say at the Tropic of Capricorn, the same amount of sunlight falls on a larger area of the Earth, because of the curvature. So if you are holding your cardboard there at the Tropic of Capricorn, it only gets about half the sunlight, so it is less hot. It is winter there.

Earth temperature

Brinda: Here is Shirish Uncle ... When did you get back from Bengaluru, Uncle?

Shirish: Just last night. I tell you, Bangalore and Madras might be at the same latitude, but Bangalore is a good 5 degrees colder.

Vivek (smiling): Degrees Celsius, you mean.

[Brinda is thinking, she does not notice.]

Brinda: Chennai is on the coast, but Bengaluru is higher. Uncle, why does it get colder as we go higher? After of all we are closer to the Sun as we go higher.

Shirish: That is a good question, young Brindavanam.

Vivek: "Closer" is a red herring. Compared to the Earth-Sun distance a thousand metres of height makes no difference.

Shirish: Correct. As we go higher the air is thinner.

Vivek: Remember when we went to Ladakh we had to rest for a day to get our bodies used to breathing in the thinner air?

Shirish: Exactly. Now sunlight heats up the Earth's surface and not its atmosphere. The lower atmosphere is almost transparent to sunlight. The Earth's hot surface re-radiates. The air is thinner and there is less atmosphere above acting as a greenhouse, so more of the re-radiation escapes into space. So the higher you go, the colder it is.

Brinda: Why is it hotter in a greenhouse? Is it because the sunlight is trapped and keeps circulating inside it?

Vivek: No, the glass roof of the greenhouse cannot prevent light from going out. It is the air warmed by the sunlight which is trapped inside. That's because part of the re-radiated light is in the infra-red region (lower wavelength than red light) and this light cannot pass through glass. So it gets trapped and heats the air inside.

Shirish: Okay, let us take that as an explanation. Now the atmosphere is pretty bad compared to glass, but molecules of water, carbon dioxide and other gases like methane and nitrous oxide do manage to trap the heat of the re-radiating Earth in a *greenhouse effect*. Air currents transport this heat to all over the Earth including the night side. So the daytime and nighttime temperature do not differ that much. Say at the equator it might be 30 degrees in the day and 20 degrees at night.

Vivek: What about the direct sunlight? Does it all reach the Earth?

Shirish: No, only about 23 per cent reaches the Earth directly. About 35 per cent is reflected back to space (mostly by clouds),

about 25 per cent is scattered to Earth from the blue sky and from the clouds, and about 17 per cent is absorbed by the nitrogen and oxygen in the upper atmosphere.

Vivek: So the atmosphere does a good job of insulating us from the heat of the Sun.

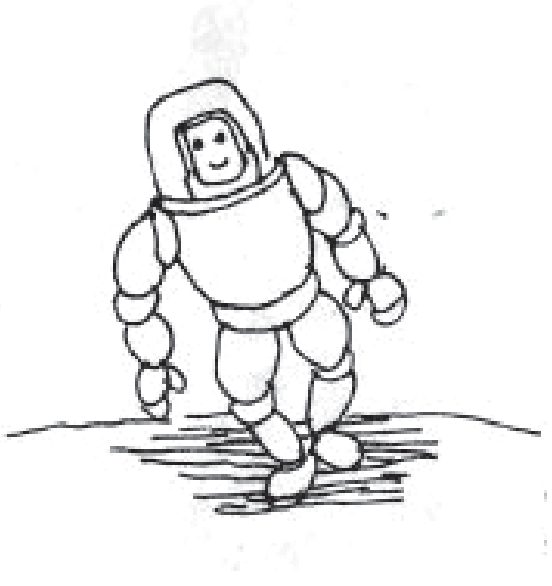
Moon temperature

Brinda: What do you mean? There is no atmosphere on the Moon. Is it hotter there?

Vivek: Yes, it is hundreds of degrees there.

Shirish: No, no, only around 120 degrees C, but that is more than anywhere on the Earth.

Brinda: But **Chandrayaan** found ice on the Moon. How can there be ice at 120 degrees C?

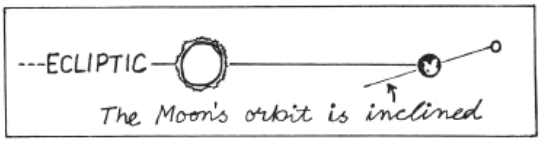


Shirish: That is another good question. Think about greenhouses again.

Brinda (*quickly*): The Moon has no atmosphere. So all the heat from the Moon will escape and it will be cold!

Shirish: Hold on. During the daytime it is 120 degrees C, as I said. Because one side of the Moon is locked facing the Earth, daytime on the Moon lasts for about 14 earthdays and then nighttime lasts for the next 14 earthdays. At night after the Sun has set, there is nothing to hold this heat, so it gets colder and colder and at "midnight" it is around -150 degrees C.

Vivek: But then does the ice on the Moon keep melting and freezing?



Shirish: Ah, no, but unlike the Earth whose axis is tilted by 23 degrees, the Moon tilts on its axis only by about 2 degrees. And its orbit around the Earth is inclined to the Earth's orbit around the Sun by about 5 degrees. So the variation is not enough for the Moon to have seasons.

Vivek: So?

Shirish: Because of this lack of tilt there are craters near the poles of the Moon inside which sunlight never reaches. The **Lunar Reconnaissance Orbiter** measured the coldest temperature there to be around -240 degrees C. This is colder than Pluto! It is inside some of these always dark craters that Chandrayaan detected water-ice. But that was sharp of you to remind me of the ice on the Moon, Brinda.

Brinda (*nonchalantly*): Good enough for an ice-cream treat?

Expanded from ***Signs of the zodiac***
by ***Deepak Khemani***

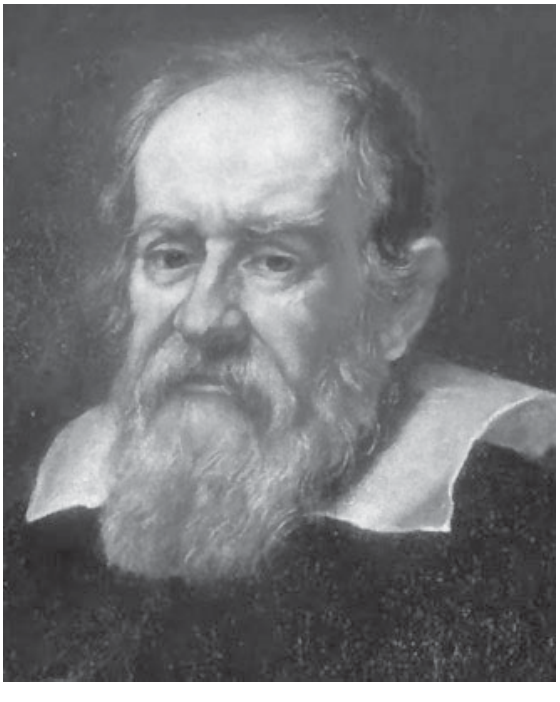
Newton's first law

V. Murugan

Any school student will give statements of Newton's first law of Motion. Usually the text books explain Newton's first law of motion by considering simple examples like the effect of sudden stopping of a moving bus on a standing passenger. One can give a number of simple experiments like coin on the cardboard on a tumbler. All these examples illustrate the concept of inertia of a material object. It is interesting to note that the first law of motion also provides an opportunity to discuss a number of other related issues.

Let us first state the first law.

Every object continues to be in a state of rest or in a state of uniform motion unless it is acted by an external agent.



More precisely,

Every object continues in its state of rest or in a state of constant speed along a straight line unless compelled to change that state by forces impressed upon it.

This law is also known as the **Law of inertia**.

A number of interesting questions can be raised. I will list some of the questions

1. How do you prove this law?
2. Have you ever seen this law operating in everyday life?
3. How will you devise an experiment to prove this law?
4. How did Newton arrive at this law?
5 Is it possible to verify this law in the lab? Did Newton do any experiment to find this law?
6. What kind of method of science used here to find out this law?
7. What is the history or the origin of the first law of motion?
8. Did Galileo discover the first law of motion?
9. Is there a situation where Newton's first law of motion does not work?
10. What are the basic assumptions behind Newton's laws of motion?

The list of questions has not been exhausted. Let me try to answer these questions in a coherent way.

Question 1.

This is a wrong question.

We ask for a proof only in **Mathematics**. It is a closed logical system. (Even in mathematics, sometimes, you cannot prove a result.) Proving a conclusion means that it is inevitable and final and there is no question of revising it. The sum of the three angles of a triangle in a plane is always 180 degrees. As long as we accept the basic axioms

of Euclidean geometry, this conclusion is final. There is no need to draw a triangle on a plane and verify this conclusion.

In S**cience**, we do not attempt to prove any result. No conclusion in Science is final in the sense that though we accept it now, it can be modified later. For instance, originally we thought that it is the Sun moves from east to west daily. Now we agree it is the Earth which moves from west to east.

In Science, we look for only evidences. This point requires more elaborate discussion; you can think about it. So, there is no question of proving Newton's first law or other laws.

Question 2.

A part of the first law agrees with our day-to-day experience and another part is beyond our day-to-day experience.

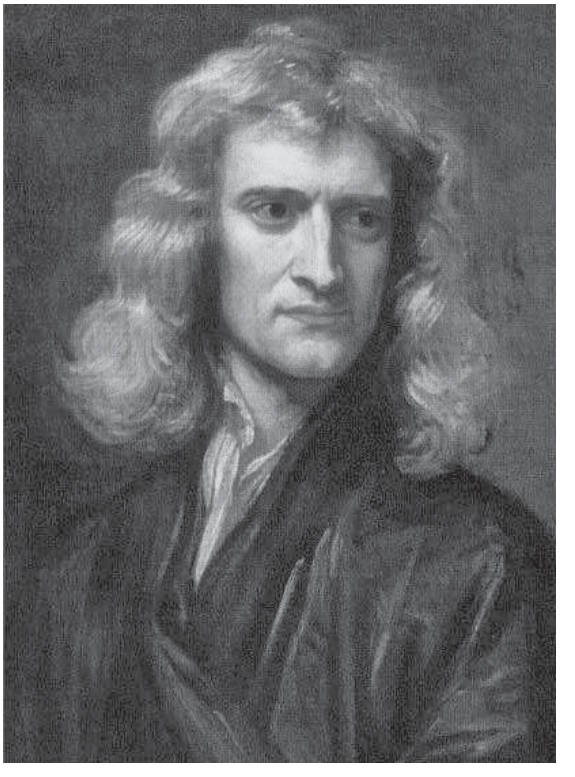
There are two kinds of state of motion are mentioned in this law. They are (i) State of rest (ii) State of constant speed along a straight line.

State of rest

There is nothing profound about this state. It is such a state in our experience that there is no need to give any example. A chair or a book on table or a car on the road. To produce a change of this state for the chair is to move it. Obviously someone has to push it i.e., an *external agency* is required to move it from the rest. Any object at rest, which is left alone, will not start moving on its own. An external agency is a must or compulsory to compel the object to change the state of rest of an object. So, this part of Newton's law is merely a restatement of what is obvious in day-to-day experience.

S**tate of constant speed along a straight line**

No one has ever on this earth observed an object moving on its own continuing to move at



constant speed along a straight line without the aid of external agency. A ball rolling on a floor, if left alone, slows down and comes to rest. In fact, all our experiences, generally, negates this law. No amount of common sense observation will help us to arrive at this part of Newton's first law of motion.

It requires a special method, namely the **method of Science,** to arrive at this part of the law. This is the reason why it took nearly two thousand years to develop this law.

Incidentally, we come across repeatedly the following statement: "*Science is nothing but common sense*". This is a myth.

Question3.

Let us consider a method of devising a particular method of verifying this particular law. First, we have to find an object which is moving

with constant velocity along a straight line. Second, we have to ensure that there is no external agency acting on it. How do we ensure this condition? We have to remove nearby objects from our object, i.e., we have to isolate our object from other objects. This is a hopeless task, since it will amount to literally taking out the entire Universe!

We arrived at this method by literally analyzing each word in the statement of the first law. This is a philosopher's method of analyzing a problem.

This is not the method employed by the scientific community to analyze a problem.

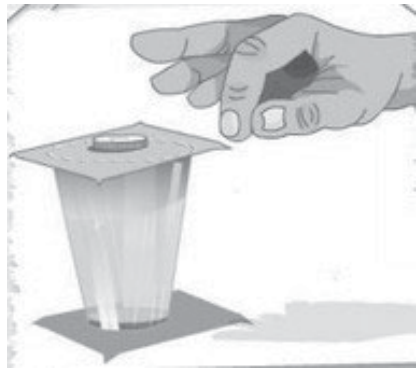
Questions 4,5,&6.

Detailed answers to these questions are beyond the scope of this article. Let me give a brief outline here. The scientists do not look for completely irrefutable and absolute kind of evidences for basic laws like Newton's laws of motion. These laws have been applied to a wide variety of problems. The results obtained agree well with the experimental observations. One simple example is the success in explaining Kepler's laws of motion. Discovery of Neptune is a dramatic story and very impressive in illustrating the success of Newtonian mechanics. The story of such successes is really enormous. Of course, it is a general theory based on Newton's laws of motion that work very well. This is enough for the scientists to believe that the Newton laws of motion are correct.

Questions 7& 8.

Galileo almost got the first law motion. Still, he was far away from the exact formulation of the first law. Newton arrived at the first law using Galileo's investigations.

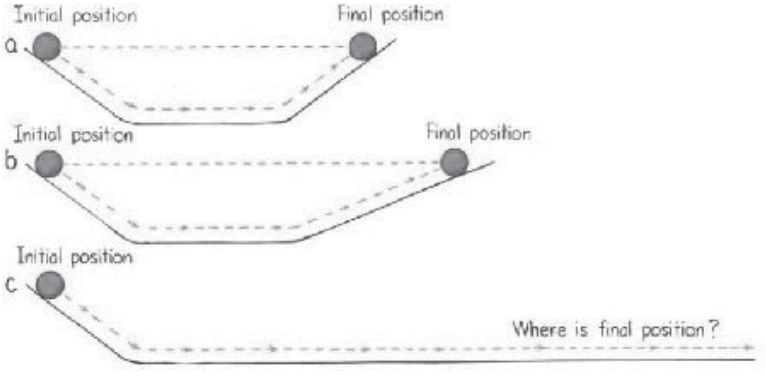
Galileo is well known for his support of the **heliocentric model**. In the process of his defence of Copernican theory, he realized that the old Aristotelian ideas of mechanical motion have to be replaced by a new theory of motion. He devised



a number of new techniques. Einstein, in fact, termed him as the *father of modern Scienc*e.

He constructed frictionless inclined planes and studied the properties of motion of the balls on such inclined planes. We see the extraordinary genius of Galileo in the choice and the design of these experiments. It is indeed a great creative act on the part of Galileo. Galileo correctly guessed that the motion of a ball is due to superposition of vertical motion and the horizontal motion. Again he guessed gravitational attraction always tries to pull the ball in the vertical direction and the only force in the horizontal direction is friction. Gravitation cannot be controlled, but friction can be reduced enormously.

Look at the figure taken from **Conceptual Physics** by *Paul Hewitt*. Galileo observed that if we reduce the friction between the rolling ball and the surface of the inclined plane, a ball that starts rolling from a particular height in the left inclined plane moves up the right inclined plane and reaches the same height on the other side. This is shown in fig (a). Now change the inclination of the plane in the right by lowering the angle of inclination. In this case also the ball reaches the same height. See fig (b). Compared to the case (a) the ball has to travel longer distances in the case (b). Extending this idea further, lower the angle of the inclination of the right plane, the ball



has to travel a larger the distance to reach the same height. In the limiting case, when the angle of the inclination is made zero, the right plane becomes horizontal and the ball is likely to travel indefinitely along a straight line in the absence of the frictional force. Note the final conclusion is an *inference*.

Note the interesting features of gathering knowledge in Science. Science is not simply a mechanical collection of information or data. It is a very creative act. One has to make an intelligent and educated guess. We have to do controlled experiments using specially constructed apparatus. Such a situation is not readily available in day-to-day life. In fact, the events in day-to-day life are very complex. It goes to the credit of Galileo to demonstrate these ideas successfully. We can make many more comments on this aspect. However, let us go to the next set of questions.

Question 9.

Answer to this question is beyond the scope of this article.

Question 10.

There are situations where Newton's first law of motion does not work. For instance for an observer in a lab, where the lab itself is in an accelerated motion, this law will not work. Do you think that this is a contrived situation? Wait. The simplest example is Earth itself! After all, it is on Earth that Newton and Galileo lived and discovered this law. Does this mean that Galileo and Newton erred? They did not err. This law works only approximately for the observers on Earth. In fact, the first law as well as the whole of **classical mechanics** does not work in the atomic world. However, the deviations from this law are very small and we know how to take care of it. This is yet another amazing character of Science.

This is the strength of science. There was a time when it was thought that these laws work for all observers. Now, we know its boundaries beyond which these laws fail to work.

Many more questions can be asked which are not directly about the Science. For instance,

. Did the social conditions of England play a role in the discovery of the first law of motion?

. Had Newton been born three or four centuries earlier, would he have still discovered his laws of motion?

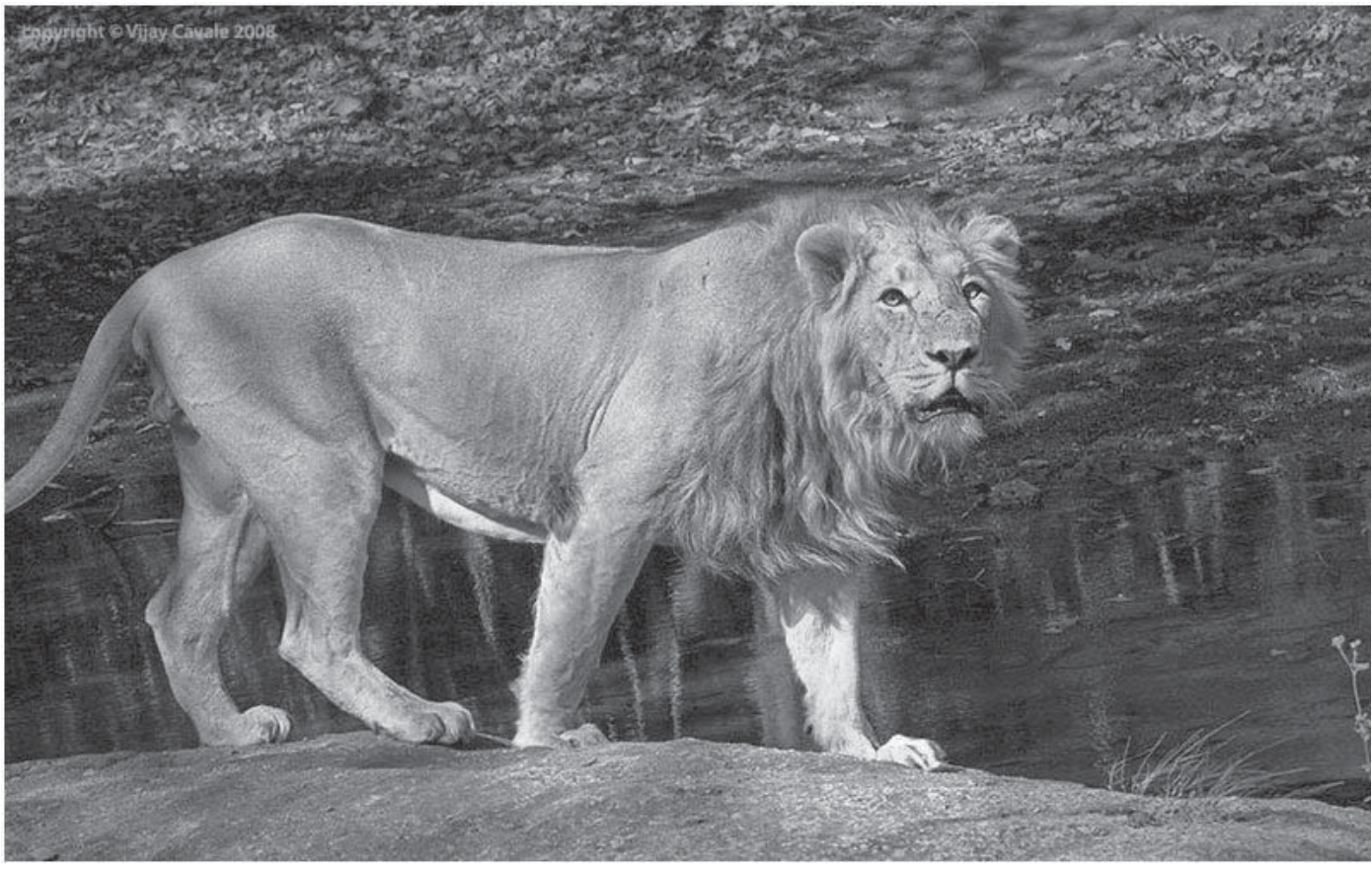
. Had Newton been born and lived in India, would he have still discovered his laws of motion?

Answers to all these are for you to think about!

Hypothesis is a best-guess answer to a problem at hand.

Observation is the act of seeing an object or event and noting the relevant characteristics in the event. Observation is an extension of our senses.

Inferences are conclusions based on observations. Inferences go beyond what we can directly sense.



Endangered Animals of India

D. Indumathi,
The Institute of Mathematical Sciences, Chennai

The International Union for the Conservation of Nature (IUCN) is the world's main authority on the conservation status of species. A series of ***The IUCN Red List of Threatened Specie***s is the world's most comprehensive inventory of the global conservation status of biological species. Regional Red Lists are also produced by countries or organizations.

The IUCN Red List defines precise criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. The aim is to convey the urgency of conservation issues to the public and policy makers, as well as help the international community to try to reduce species extinction by

(1) providing scientifically based information on the status of species and subspecies at a global level,

(2) drawing attention to the magnitude and importance of threatened biodiversity,

(3) influencing national and international policy and decision-making, and

(4) providing information to guide actions to conserve biological diversity.

This work was first begun in 1964.

Throughout 2014 we are celebrating the significant contribution of The IUCN Red List of Threatened Species in guiding conservation action and policy decisions over the past 50 years. The IUCN Red list is an invaluable conservation resource, a health check for our planet - a Barometer of Life.

Many species groups including mammals, amphibians, birds, reef building corals and conifers have been comprehensively assessed. However, there is much more to be done to enable better conservation and policy decisions. The first step is to know which are the endangered species in our country. Next, we can ask how we can help protect and conserve their habitat. Only then can we expect to successfully achieve their preservation.

Asiatic Lion-Panthera Leopersica (Meyer)

The Asiatic lion is also known as babbarsher in Hindi and as simham/singham in many south Indian languages. The only place in the wild where this species is found is in the Gir Forest in Kathiawar of Gujarat, India. The Asiatic lion is one of the five major big cats found in India, the others being the Bengal tiger, the Indian leopard, the snow leopard and the leopard.

They prey mainly on cattle, deer, pig and other herbivores by making a short, high-speed charge up to 80 km per hour.

The Asiatic lions once ranged from the Mediterranean to the northeastern parts of the Indian subcontinent, but excessive hunting, habitat destruction, decline in natural prey and human interference have reduced their number. This forest is the last refuge of the Asiatic lion in the world, other than those protected in various zoos.

Black Buck — Antilope Cervicapra (Linnaeus)

The blackbuck (Antilope cervicapra) is an antelope species native to the Indian Subcontinent that has been classified as endangered by IUCN since 2003, as the blackbuck range has decreased sharply during the 20th century. Males and females have distinctive coloration. Male blackbucks are dark brown, black, and white and have long, twisted horns, while females are fawn-coloured with no horns. Blackbucks originally ranged over large tracts of India except in the northeast. Today,

the blackbuck population is confined to areas in Maharashtra, Orissa, Punjab, Rajasthan, Haryana, Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka, with a few small pockets in central India. The main threats to the species are poaching, predation, habitat destruction, overgrazing, diseases, in-breeding and sanctuary visitors.

Hoolock Gibbon (Hylobates hoolock)

Hoolock Gibbon is the only ape to be found in India. It is the most accomplished acrobat of all the apes. It lives in dense forests of north - eastern India. It is found in Bangladesh and in some parts of Burma and China. Its range extends into seven states covering Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura.

Nilgiri Langur (Presbytisi Johni)

The Nilgiri langur (Trachypithecus johni) is found in the Nilgiri Hills of the Western Ghats in South India. Its range also includes Kodagu in Karnataka, Kodayar Hills in Tamil Nadu and many other hilly areas in Kerala and Tamil Nadu. This primate has glossy black fur on its body and golden brown fur on its head. It is similar in size and long tailed like the gray langurs. Females have a white patch of fur on the inner thigh. It lives in troops of five to 16 monkeys. The animal is often seen encroaching into agricultural lands. Its diet consists of fruits, shoots and leaves. The species is endangered due to deforestation and poaching for its fur and flesh; the latter is believed to have

aphrodisiac properties.

Wild Ass (Equus Hemionus Khur)

The Indian wild ass's range once extended from western India, southern Pakistan (i.e., provinces of Sindh and Baluchistan), Afghanistan, and south-eastern Iran. Today, its last refuge lies in the Indian Wild Ass Sanctuary, Little Rann of Kutch, and its surrounding areas of the Great Rann of Kutch in the Gujarat province of India. The animal, however, is also

seen in the districts of Surendranagar, Banaskantha, Mehsana, and other Kutch districts. Saline deserts (rann), arid grasslands and shrub lands are its preferred environments.

Lion Tailed Macaque -Macaca Silenus (Linnaeus)

The lion-tailed macaque (Macaca silenus) is endemic to the Western Ghats of South India. The hair of the lion-tailed macaque is black. Its outstanding characteristic is the silver-white mane which surrounds the head from the cheeks down to its chin. The hairless face is black in color. With a head-body length of 42 to 61cm and a weight of 2 to 10 kg, it ranks among the smaller macaques. The tail is medium in length, and has a black tuft at the end, similar to a lion's tail. The male's tail-tuft is more developed than that of the female. It primarily eat indigenous fruits, leaves, buds, insects and small vertebrates in virgin forest.

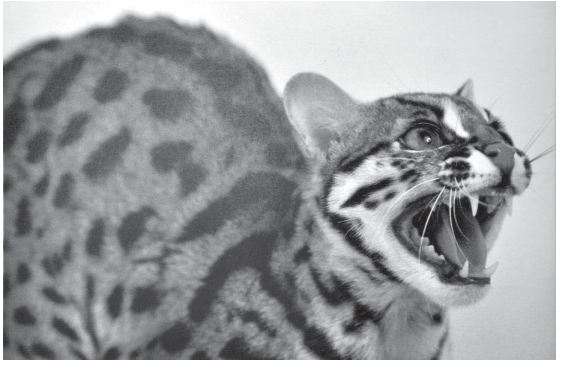
The Nilgiri Tahr (Nilgiritragus Hylocrius)

The Nilgiri tahr, Nilgiritragus hylocrius, known locally as the Nilgiri ibex or simply ibex, is an ungulate that is endemic to the Nilgiri Hills and the southern portion of the Western Ghats in the states of Tamil Nadu and Kerala in southern India. It is the state animal of Tamil Nadu. The Nilgiri tahrs are stocky goats with short, coarse fur and a bristly mane. Males are larger than the females, and have a darker color when mature. Both sexes have curved horns, which are larger in the males. Adult males develop a light grey area on their backs and are thus called "saddlebacks".

The Leopard Cat (Prionailurus Bengalensis)

The leopard cat is a small, wild cat of South and East Asia. Since 2002 its status has been listed as being of Least Concern by IUCN as it is widely distributed but it is threatened by habitat loss and hunting in parts of its range. The leopard cat's name is derived from the leopard-like spots prevalent in all subspecies, but its relation to the leopard is distant. They are found in agriculturally used areas but prefer forested habitats. They live in tropical evergreen rainforests and plantations at sea level, in subtropical, deciduous and coniferous forests in the foothills of the Himalayas. Leopard cats are solitary, except during breeding season.

*Adapted from the presentation entitled "**Endangered Animals in India**", by the Division of Education Services, (Visitor Services), NMNH, Ministry of Environment and Forests, New Delhi.*



Do You Know?

1. What is fire and how does it burn?

2. Do our actions affect our genes, and if yes, how?

3. How many trees should we plant so we can combat climate change?

4. Why are planets round? Why not other shapes?

5. I saw an advertisement for heat sensitive paint. Is this true ? How does it work ?

6. From how far can flies smell food?

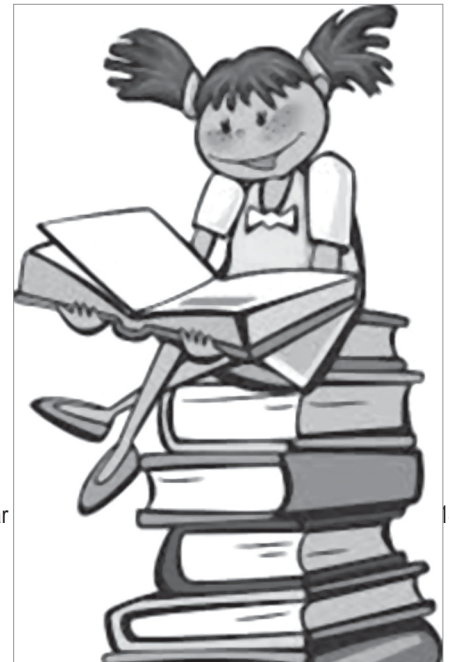
Answers to last issue's Do You Know?

1. Since the earth rotates, can we not design a lift that transports people up, and waits until the destination comes, then brings them down?

Ans: That's not a bad idea, but see what will happen when you try some thing like that. You, the Earth and the atmosphere are constantly moving very fast as the Earth rotates. How fast is the Earth moving due its rotation? Well, it's moving at about 1,670 km an hour which means that if you did sort of hover at rest above the spinning Earth, the wind speed you feel would be 1,670 km an hour. There is another problem: how would you stop at all after jumping up? But we will take it up later.

So what can you do against such a wind? That would be impossible to deal with unless you had an aerodynamic object like an aircraft with engines to hold yourself against the wind and that's exactly what an aircraft is. Concorde for instance could fly the equator at about 1,670 km an hour and could stay still essentially. It would hover above the Earth. The Earth would be spinning around underneath it and it would then land somewhere else. If there were no atmosphere, it does not solve the problem because we then do not have aerodynamic lift to hold the plane up.

So, we have to go into orbit and going to orbit, the speeds there are even bigger, roughly 35,000 km an hour and that requires a lot of fuel and a spacecraft. Thus, get out of the wind and up into orbit and the fuel you would have to consume to get there would far exceed the fuel used by a plane which uses



the wind currents to their advantage.

Another point is that as Newton worked out, objects keep moving at the same velocity unless a force is applied. So, stopping from speed is just as tricky as starting to get to speed in the first place. Thus even in an airless world, lift style travel across the Earth using its spin would still use up energy and would not be that different to other modes of transport.

2. Do plants die of old age?

Ans: Well, think about this. How old do you think the oldest plant is on Earth? Thousands of years, right? Think of **giant sequoia** and **redwood** trees. So, would it surprise you then that actually, the oldest plant on Earth is at least 43,000 years old! It may actually be 135,000 years old. It is a **Lomatia** and it was found in south western Tasmania in the 1930s and the person **King** who found it sent it off to the Botanical Society and they called it **King's Lomatia** in his honour. It has subsequently been examined in more detail.

This plant clearly cannot reproduce because it's got three copies of its genetic material in its cells which means that it's genetically incapable of producing any seeds. So, the plant can only grow by effectively cloning itself. In other words, a bit of the plant digs into the ground and puts down some roots and makes another side spinoff plant. So, the tissue is slowly growing and growing from the same stock that has been there for all that time.

How do they know how old it is? These plants are growing now in just one tiny part of

Tasmania in south western Tasmania in Australia. They have found remnants in the fossil record (going back at least 35,000 if not135,000 years) of plant tissue resembling very precisely this existing plant. They have carbon dated it to those ages. So, it looks so similar that they are happy to conclude that it must be the same plant and therefore, it must have been growing there for at least 135,000 years,

possibly longer. And there are some pine trees which are of the order of 4,500 years old. So, there's certainly a lot of old stuff in the plant world.

The trick here is that it has got to be able to replicate its DNA, but without introducing errors along the way.

When plants are that old, they have been replicating their genetic material for that long. But then a plant has a much lower metabolic rate than us. That being the case, when you copy your DNA and you grow your cells very, very rapidly, they are less likely to get damaged if they don't have this highly damaging environment that a fast metabolism like ours tends to breed. This is probably why

the trees are able to be more resilient and live for these extended periods of time.

3. How strong are gorillas?

Ans: An adult gorilla is about 6 times stronger if you are talking about upper body strength than an adult human. If you think about it, that makes sense because although gorillas mainly walk on the ground now, much more recently than us, they were swinging in the trees and they needed strong arms. Even now, they walk sometimes on all fours. So, their arms are much more used to support

themselves than ours are and that's probably one of the reasons that they're so strong. They are actually remarkably gentle in the wild so although they could do a lot of damage, they don't tend to.

People can get close to gorillas and they are very mild. They are curious about us. The most intelligent animals which are the primates, the dolphins and whales and also birds like crows are all very curious, very interested in us and very intelligent.

4. How old is the Milky Way?

Ans: The way we start looking at how old our galaxy is, is by looking at the contents of it, so we look at the age of the stars that it contains. We do know the age of the Sun and the Earth. It's about 4.5 billion years old. If we look at the stars in our Milky Way, we find that some of them are actually about 13 billion years old. We can say they really date back to the very, very early beginning of the Universe.

Then we can wonder whether what we see are younger stars. It is possible that there is even an older generation of stars which have already died out, but to settle this, we can look at the abundance of heavier elements within our galaxy. These are only formed in supernova explosions, that is, by the death of stars or through so-called cosmic ray interactions. This gives us an idea of how old our galaxy must be, some thing like carbon dating. Some estimates put it at about 13.2 billion years old.

Still it is pretty old, when you think that the Universe as a whole is only about 13.7 billions years old. Does that mean that pretty much all the galaxies came fully formed very quickly after the **Big Bang** when the Universe was formed? The answer is yes — quick in the timescale of the whole Universe, but they did build up from the Big Bang. Initially, they were just small perturbations, that is, the local areas in the Universe that were denser then others started to form **stars**. The stars were gravitationally bound together into **globular clusters**. We believe that there was a hierarchy building up into the galaxies that we recognise as spirals and elliptical galaxies.

5. Does time stop for photons travelling

at the speed of light?

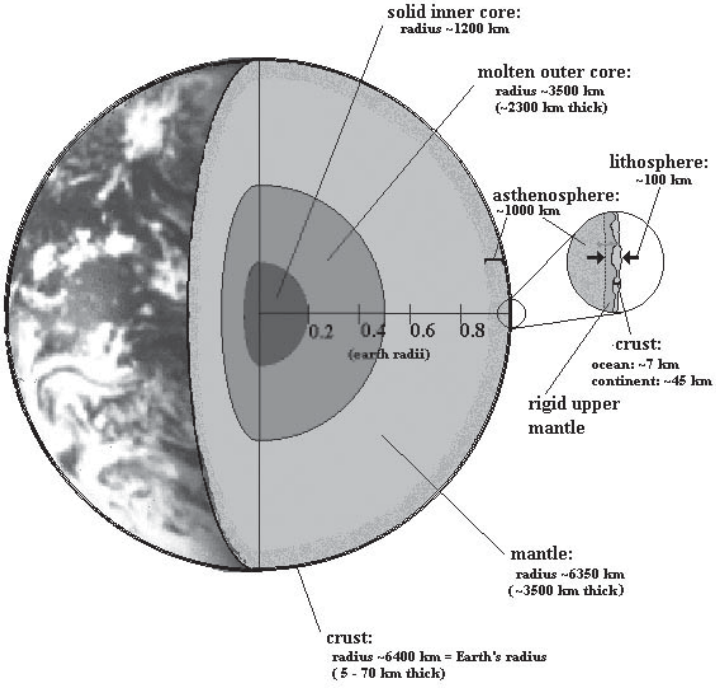
Ans: Yes, that is right, though it seems a very strange thing indeed.

If a particle is approaching the speed of light and had a clock on it, we as observers of that particle going extremely fast would see that time slows down and approaches this sort of eventual stopping. This is what Einstein formulated as the theory of special relativity. It takes the speed of light (usually called c) as a constant and that is regardless of what speed you are going at. So, even if you are travelling at 99% of the speed of light, you are still measuring c as c. In that sense, it is difficult to answer what kind of time the photon is experiencing. But we are just saying that if you were a particle, perhaps travelling at 99% at the speed of light, in your own frame of reference, then time is moving normally. You have a much faster ticking clock compared to the observer that sees that time has nearly slowed down.

Actually, you have probably heard of this, but we have experimentally confirmed such '*time dilation*' here on Earth. There was an experiment back in the 1970s that put atomic clocks on commercial aircraft and had them fly around the Earth, both in the eastward direction and the westward direction, and we were able to compare, once they got back on Earth with some naval observatory clocks. There was an actual difference because they were moving faster than the Earth's rotation at some point.

You have probably heard of this too, the great pyramids also distort time because they are very massive and so, they bend space-time. So, time travels at a different rate. Any time you go near something very massive, time changes. If you go to Egypt, sit next to a pyramid, time is distorted for you, actually. To extend this even further, if you go to a black hole and start falling into a black hole, your observer (outside) is seeing that time has nearly stopped for you as you fall towards it because you have warped that time so much.

Lots of interesting things going on, isn't it? Thinking about travelling at the speed of light or sitting near some thing very massive can get your mind going.



6. How do we know the Earth's core is solid?

Ans: It was discovered that the inner core of the earth was solid while the outer core was liquid because *shear waves* had passed through the inner core and they cannot pass through a liquid. Since the inner core is solid and the outer core is liquid, how did the shear waves pass through the outer liquid core in order to get to the detectors?

Mainly, there are two different kinds of waves. One is a *pressure or P-wave*. It is like a sound wave whereby the movement, the wobble, is in the same direction as the wave is travelling. Another is the *shear or S-wave*, which is like a wave on a string; it is at a right angle to the way the wave is travelling. In a liquid, you cannot get any shear waves except on the surface. So, in the bulk of a liquid, in the body of a liquid, all the waves must be pressure waves. This is so for a fluid of any kind, in gases as well. But at the surface of a liquid, you can get shear waves and you can get shear waves created when a pressure wave hits a surface.

Thus, basically, the way they found out that the centre of the earth is solid is this:

* When waves created by earthquakes on the surface go down, they hit the liquid outer core. The S-waves are stopped and the P-waves are severely slowed down and refracted or bent.

* Then when they go deeper still, the P-waves start to speed up, because they are now going from a liquid outer core into the solid inner core: when a P-wave strikes the boundary of molten and solid cores, S-waves will then propagate in the solid medium. And when the S-waves hit the boundary again they in turn create P-waves.

This will come out through the liquid outer core and bounce off to an earthquake station on the wrong side of the planet where it should not have been seen. The only way you can explain those waves getting to the earthquake station is if the centre of the Earth is solid and there is a shear wave going through it.

Sources: Univesity of Cambridge, The Naked Scientists, Scientific American.

Science News

Headlines

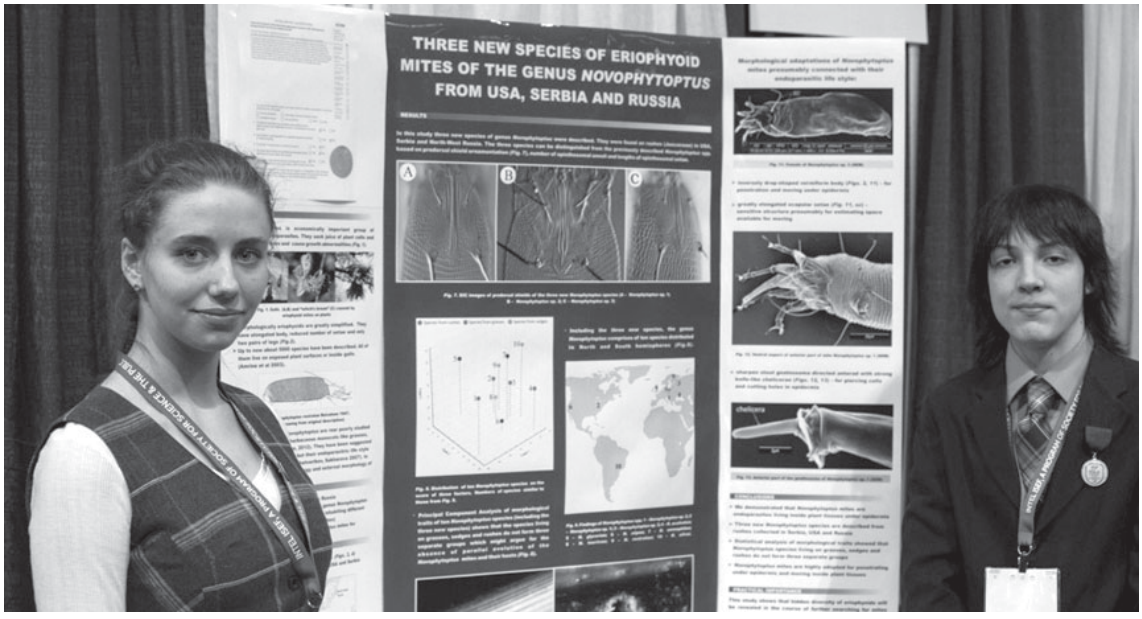
- **Teens discover new species of mites**
- **How we confuse poor birds**
- **A strong, waterproof building material from plant leaves**
- **Welcome the new element, ununseptium!**
- **A striped shirt is a good idea against flies**

Read more about them below

. *Teens discover new species of mites*

Imagine the excitment of finding three new animal species. This is what two Russian teens have achieved, as they searched through vegetation, looking for mites.

Mites are tiny. Most can be seen only with the aid of a microscope. As **arachnids**, they belong to the group of animals that includes spiders, scorpions and ticks. Like ticks, their closest relatives, many mites are parasites. That means that they get their nutrition by



taking advantage of their plant or animal hosts.

This is especially true for a group of mites called *eriophyoid mites*. Because mites in this group live inside plants—and outside of view—they have not been well studied. So says **Timofei Petrushenko**, 16. He is a Class 10 student at the Academic Gymnasium of Saint-Petersburg State University in Saint Petersburg, Russia.

Though poorly known, eriophyoid mites could be very important. They spread from plant to plant by riding the winds. They can cause abnormal growths on the plants they infect. These mites also can ferry viruses from one plant to another. That could cause big problems for crop species hosting the mites.

He and classmate **Valentina Ruazantceva**, also 16, collected samples of grass-like plants called rushes. These were growing near their homes in northwestern Russia. They also asked a Russian scientist for samples of similar plants from other parts of the world. Then, Timofei and Valentina looked at the samples closely.

In particular, the teens pored over parts of the plants that were discoloured. With tiny needles, they probed the plants in those areas, removing samples from inside them. They also searched discoloured stems for tiny holes. Holes could signal where mites had bored through to get inside the plants.

During their research, Timofei and Valentina found three new species of mites. One came from the plants the teens collected near their homes. The other two came from plant samples collected in the United States and Serbia.

Like previously known species of eriophyoid mites, each of the three new ones has only two pairs of legs. (Many mites, especially those that live on the outside of

animals or plants, have eight legs.) Distinctive patterns of ridges and grooves on the new mites' bodies are unlike those found on other species. That is a how they realised they had found species new to science.

The teens plan to submit a scientific paper describing their findings to a journal where scientists describe details of newfound animal species. If the paper is accepted by the journal—and the mites confirmed to be novel species—these teens may get to choose the scientific names for each one. That is what they are most excited about, apparently.

. How we confuse poor birds

Research has shown that robins get disoriented when surrounded by the electromagnetic noise given off by some ordinary electronic devices.

Birds know where to go when it is time to migrate. They get some of that superb sense of direction from their ability to detect the Earth's magnetic field. That magnetic sense acts a bit like a compass used by human hikers. But the energy coming from some electronic devices can perturb a bird's internal compass. And that might confuse a bird's sense of direction, according to a new study.

Most electronic devices send out waves of energy called electromagnetic radiation. The levels are too low to harm people. Any given device only sends out a small amount. But some types of this radiation could pose a problem to birds.

Even when held captive in a lab, birds know when it is time to migrate. They fidget in their cages. They try to face in the direction they would fly away, if outdoors. But the birds cannot always line up correctly, as some German scientists have reported in the journal Nature.

They observed that caged robins did not face toward their migratory directions. For several years they could not figure out why. Then a researcher suggested that they set up a shield. Called a Faraday cage, it consisted of grounded aluminum screens that blocked incoming electromagnetic radiation. When protected by the screening, birds in the lab at last faced in the direction they should migrate.

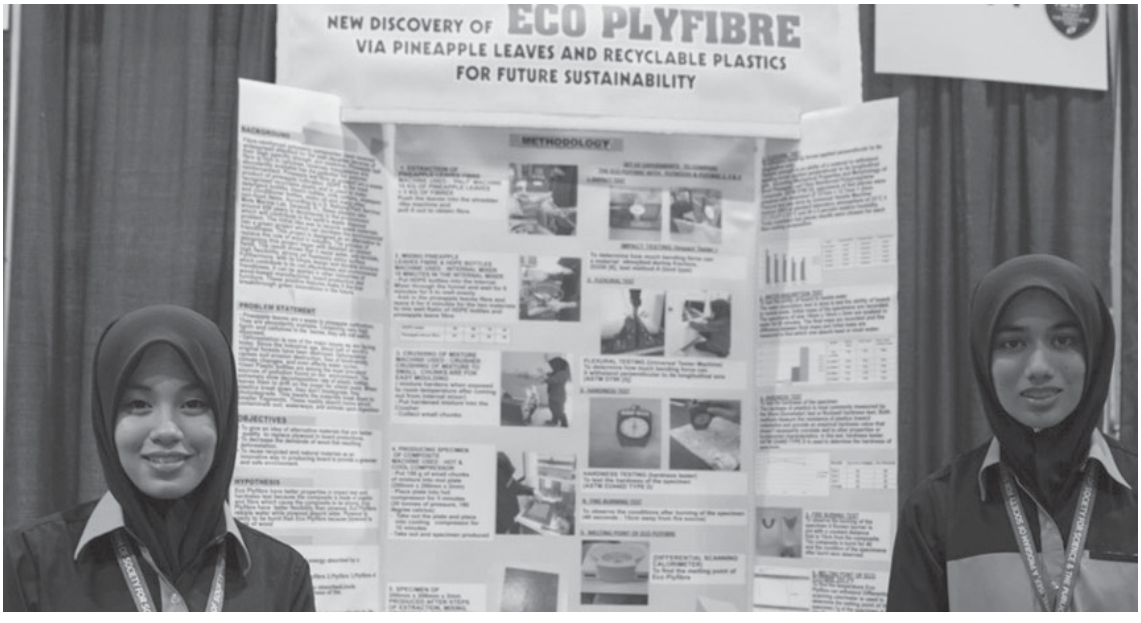
Over the next few years, they kept testing the idea that electromagnetic noise upsets a robin's sense of direction. They tried various ways to challenge it. Yet their data always showed the same thing. The birds only faced the correct direction when the shield blocked out the electromagnetic radiation.

Not all types of everyday radiation confused the birds' sense of direction. Cell phones and power lines are often blamed for confusing birds. But the researchers reported that they had no effect in their tests.

. A strong, waterproof building material

A new material made from plant leaves could replace plywood for many uses. The material is strong, waterproof, cheap and easy to make. Two girls in their teens have invented it using a blend of pineapple waste and recycled plastics.

Those raw ingredients are abundant in Malaysia, where the two girls live. The largest



part of the new material is a type of plastic called high-density polyethylene. It is used to make many things, including milk jugs and shampoo bottles. Known as HDPE, this plastic is often recycled or thrown away. **Nurul Roslan** and **Hanis Zaini**, both 17, Class 11 students at Mara Junior Science College Terendak in Melaka, Malaysia, have found a good use for it. When treated like trash, the plastic does not degrade quickly, it can take about 450 years to break down.

The other ingredient in the new material is fibre from pineapple leaves. These leaves are tough because they contain a strong material called **lignin**. It does not decompose quickly. Farmers often burn the leaves to dispose of them. That causes air pollution. If farmers don't burn the leaves, they send them to a landfill. There they join the discarded plastic.

Nurul and Hanis wanted to find a use for these normally discarded items. That is when they came up with the idea to create a new building material. They tried many recipes. First, they melted the HDPE at 180° Celsius and stirred it for 6 minutes. Then they added pineapple leaf fibres and stirred the mix for another 4 minutes. After that lumpy mush hardened and cooled, they ground it into a powder. Finally, they melted that powder and moulded the material into its final shape.

Nurul and Hanis tested their material by moulding it into large square tiles 1 millimeter thick. According to their tests, the best mix is made from 90 percent HDPE and 10 percent pineapple leaf fibre. The tiles they created are waterproof and termite-resistant. Those are big gains in tropical countries like India and Malaysia. The material is twice as flexible as plywood but twice as strong, they say. Their new material is also durable, has a shiny surface and can be dyed any colour. They expect that it could be used to make anything from shelving to plastic furniture.

Best of all, they claim, their material is eco-friendly. Using waste plastic and pineapple leaves could help reduce air pollution (by keeping those items out of incinerators) and extend the lives of landfills. What is more, replacing wood-based building materials with the new material could also help reduce the need to cut down local forests.

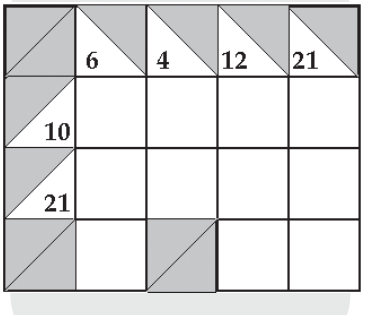
activity page

Kakuro

Kakuro or **Kakkuro** is a kind of logic puzzle that is often referred to as a mathematical transliteration of the crossword. Here we play a smaller version of the traditional game.

How to play

The totals for each row and column are given in the squares at the top and left. For example, the numbers in the first row must add up to 4. The constraint is that numbers can be from 1 to 9 and cannot repeat. This means that we can write 4 as 4=1+3 or 4=2+2, but the latter is not allowed. Hence the second column must contain 1 and 3. Use the properties of the numbers given to see what possible combinations are allowed. While the numbers in the rows must add up to the number on the left, the numbers in the columns must add up to the number at the top. The answer is unique and is got by elimination of possibilities across rows and columns.



Do write in your answers to the JM address given in the magazine and we'll print the ones with the right answer. Don't forget to write in your name and address.

Sudoku

Rules

. Use the numbers from 1 to 6.

. Every row must have all the numbers from 1 to 6

. Every column must have all the numbers from 1 to 6

. Every sub-rectangle must have all the numbers from 1 to 6

. The central shaded square (in the medium puzzle) must have the numbers 1 to 4

(A sub-rectangle is the 2 x 3 rectangle; the 6 x 6 square is broken up into 6 such sub-rectangles.)

Use the numbers already filled in as hints to complete the grid. Each Sudoku puzzle has a unique solution.

Send in your answers to us at the JM address given elsewhere in the magazine. Don't forget to write in your full name and address.

EASY

1					
			2		
		4			
		3		6	1
	5		6		3
					4

MEDIUM

6			1		
				3	
4	6				
					2
					5
1		5			

Crossword

Here is a math puzzle for you from http://www.educationworld.com.

Across

1. 150, 161, ___, 183, 194, 205,...

4. 1824 divided by 12 =

6. 4 hours = ___ minutes

7. Bill started work at 8:00 a.m. He worked for 6 1/2 hours before he took a break. What time did he take his break? (Answer: _:__ p.m.)

8. Round 866 to the nearest 10.

10. (12 - 7) X 63 =

12. 7,000 + 600 + 50 + 4 =

14. 60 X 25 =

15. (129 X 2) X 2 =

17. Angela went to bed at 8:30 p.m. She slept for 8 hours and 45 minutes. What time did she wake up? (Answer: _:__ a.m.)

19. 554 divided by 2 =

21. 11 X 11 =

22. The train was scheduled to leave at 6:10 p.m. It left 1 hour and 30 minutes late. What time did it leave? (Answer: _:__ p.m.)

23. 22 Across - 7 Across =

Down

1. (5 X 15) + 37 =

2. School starts at 7:50 a.m. The school day is 6 hours and 30 minutes

long. What time does school finish? (Answer: _:__ p.m.)

3. 47 X 43 =

4. 1 rupee + 7 five paise coins + 3 one paise coins = Rs _.__

5. 4 1/2 minutes = ___ seconds

9. 7,000 + ___ + 70 + 7 = 7,777

10. If Stan watches TV on Saturday from 8:00 a.m. to 11:45 a.m., he watches TV for a total of _ hours and __ minutes.

11. 43 feet = ___ inches

13. 600, 607, 614, ___, 628, ...

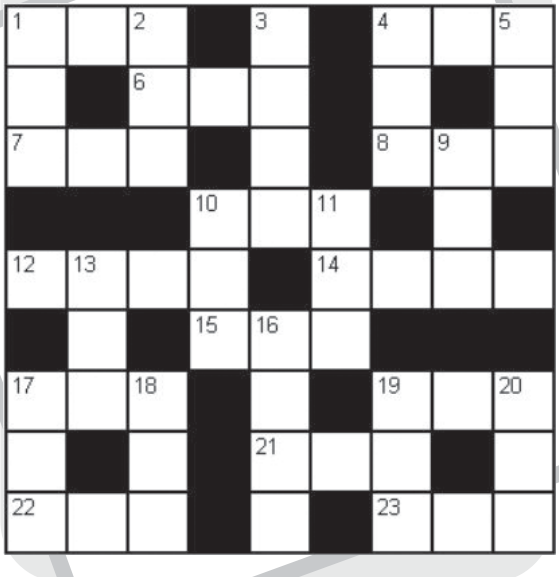
16. The marathon started at 8:30 a.m. The first runner crossed the finish line 3 hours and 40 minutes later. At what time did the first runner finish? (Answer: __:__ p.m.)

17. (1 Across + 10 Across) + 100 =

18. 9 hours = ___ minutes

19. The ball game started at 7:30 p.m. It was over at 9:45 p.m. How long did the game last? (Answer: _ hours and __ minutes)

20. 30 days = ___ hours



Solutions to March-April 2014 issue's Activities

CrossWord

Across

3. MELTING 5. FREEZING 6. SOLIDIFICATION 7. VAPORIZATION

Down

1. CONDENSATION 2. BOILING 4. EVAPORATION

Jumble

1. TEMPEST 2. STRATUM 3. ASTRIDE 4. EXTRACT 5. LAMINAR

Visitor: not of this Earth?

Ans: Extra-terrestrial

Sudoku

Sudoku

EASY

3	6	4	5	1	2
5	1	2	4	6	3
1	4	6	3	2	5
2	3	5	6	4	1
6	2	3	1	5	4
4	5	1	2	3	6

MEDIUM

2	3	1	5	4	6
6	4	5	2	1	3
1	5	4	3	6	2
3	6	2	1	5	4
4	1	3	6	2	5
5	2	6	4	3	1

Kokuro

	14	15
4	3	1
17	9	8
8	2	6

Jantar Mantar,

Children's Science Observatory,
245 (Old No:130/3), Avvai Shanmugam Salai,
Gopalapuram, Chennai 600 086.
e.mail: jmantar@gmail.com
Website: http://hsb.iitm.ac.in/~jm
Phone: 044-28113630

Rain tree: Albizia saman

Called **Siris** or **Shirish** in many parts of northern India and Bengal, *chakkarakkay maram* in Malayalam, and the **mazhai maram** or **thoongu moonji maram** in Tamil, this tree is very common in the tropics. **Saman** is its native name in Brazil but it grows in Mexico, Peru, South and South East Asia including India as well as the Pacific Islands such as Hawaii. It is cultivated throughout the tropics as a shade tree, although it has shallow roots and easily falls down in the rain or storm.

Saman is a wide-canopied tree with a large symmetrical crown. It usually reaches a height of 25 m and a diameter of 40 cm. It has evergreen soft foliage which is dotted all over with pink and white flowers from March to May (see cover photo). In June the pods come out although a few flowers can be seen all the year around. The flowers are like silken bunches with one central and a surrounding crown of florets, up to 20 in number. The stamens are half pink and half white and prominently stick out of the flowers. Sometimes the flowers are cream-gold.

The leaves are long and feathery while the bark is dark grey and tough. Each pinna contains four to eight pairs which bear three to seven pairs of leaflets. They are oval-shaped without a stalk and become bigger towards the tip. During the day, they spread out horizontally, not allowing sunlight to pass, which is why they make good shade trees. However, at night or during the rainy season, the pairs of the leaflets fold together, the leaf stalks bow down and each pinna rotates so that the leaves all lie sideways. This sleeping habit has given it the name thoongu moonji maram (sleepy-face tree) in Tamil.

In India people strongly believe that the name **Rain Tree** was given because the trees possess an interesting habit of occasionally spraying the ground beneath with moisture. However, later, botanists discovered that the spraying was caused because of the innumerable small insects called *cicadas* feeding on the leaves that discharge this shower.

The fruit of the rain tree is a fleshy pod. The seeds are contained in the brown sugary pulp of the pod. People use the leaves as fodder. The timber of the tree is soft and light and that is another reason why it easily falls over in stormy weather. However, after being watered for only 3-4 years, the tree grows to a height of 3 m or more, and then spreads out over great areas and great heights; hence they are still popular as avenue trees although neem and tamarind trees have more dense wood and are much more sturdy.

The photo shows the leaves of the tree and a flower being pollinated by a bee (image courtesy *Wikimedia Commons*).

. Welcome the new element, ununseptium!

Scientists have confirmed element 117. This superheavy element was produced for the second time —and by a different team of researchers than four years ago—thus proving that ununseptium is real. Both times, scientists reported making only a small amount. Just a few atoms. And they lasted for less than a second before breaking apart. But that was enough.

The new announcement means that chemists will likely soon be adding number 117 to their periodic table of the elements. The new entrant's name? Unofficially, scientists are calling it ununseptium. Not terribly clever, it is based on the Latin for one-one-seven. But that name is only temporary. Those who first created 117 will get a chance to rename it before long.

Uranium is the heaviest naturally occurring element on Earth (at least in substantial quantities). It is number 92 on the periodic table. But for decades, scientists have been bombarding big elements with smaller ones. Their goal has been to briefly fuse them. That creates a superheavy element: in different classifications, that is an element bigger than uranium or one more massive than rutherfordium (number 104).

For now, number 117 is the most massive element confirmed to exist. In 2006, researchers reported creating one slightly bigger: ununoctium, or number 118. But such superheavy elements must be created more than once, by different teams. Until that happens, the scientific community will not formally accept that their existence is real. Ununoctium is still awaiting such a confirmation through a second set of tests.

The creation of element 117 began with another element, berkelium (number 97). For more than a year, researchers worked to make some 13 milligrams of almost pure berkelium. They shipped the radioactive element to another team, where it was bombarded with a high-energy beam of calcium ions. A small number of the smash-ups resulted in fusion reactions. A few atoms of element 117 emerged from those reactions.

The researchers did not actually "see" the new element. They deduced its creation by studying its radioactive decay. That is when an atom sheds subatomic particles (here alpha particles). All radioactive elements, including number 117, decay. It means they break into smaller atoms or spit out subatomic particles. In the new tests, scientists quantified each successive decay of the original element and its breakdown products—known as daughters. That let them confirm that the short-lived parent must have been element 117.

In all, 72 scientists and engineers from 16 different research groups took part in this project. They reported their achievement in the journal *Physics Review Letter*s.

. A striped shirt is a good idea

Zebras, the large african animals with black and white stripes, are some of the most fascinating creatures on Earth. Scientists have long wondered what benefit zebras might get from their fancy black and white coats. Those lovely stripes may be most useful as protection

from biting flies, a study now reported in *Nature Communications* concludes.

Biologists studied zebras and other closely related African animals. They tested five popular ideas about how the stripes might function. No evidence emerged to support most of these notions. Some scientists had proposed those stripes help zebras hide from predators, such as lions, or confuse them. Still others suggested that those stripes might offer some cooling or help the animals in forming social groups. None of those ideas hold up. Instead, the stripes appear to help the animals avoid the bite of bloodthirsty flies. This finding supports some studies had found signs that flies prefer solids to stripes when hunting for a landing place.

To test all of the theories, scientists used geographic information. They looked at where in Africa the 20 different types of animals belonging to the genus **Equus** lived. Some of these equines have stripes, including zebras and asses with striped legs. Others are stripe-free. These include other asses and wild horses.

The team found no connection between stripes and whether the animals lived in woodsy areas. This suggests that stripes do not camouflage zebras in those places.

In other studies, researchers found that lions ate plenty of zebras. The new observations suggest that stripes do not confuse the predators. The experts also looked for—and found no evidence that stripes cool the zebras or help them recognize each another when forming social groups.

Striped animals often live in places where the environment is just right most of the year for biting flies to flourish. In those areas, horseflies, tsetse flies and other biting flies spread fatal diseases to zebras and horses. That connection now suggests stripes may help zebras reduce the number of bites, and the infections they can spread.

There are still many questions to be answered in this regard, but this seems a good explanation.

Sources: Society for Science and the Public, Nature, Science,Nature Communications