

# Eureka Science Test 2007-08

**Eligibility:** Age group of 11-15 or 8<sup>th</sup> to 10<sup>th</sup> standard in India, Resident of Maharashtra, or having Marathi mother tongue but staying out of Maharashtra

**Medium of Answer sheet:** Marathi or English

Answer sheets should use **ruled sheets of paper**, should be hand-written and sent to the address

1. Either personally
2. By post
3. Through school

**Students are allowed to read books, refer to the information on internet(not copy/paste), consult teachers and parents, scientists, farmers, doctors and engineers in the community. It is necessary to perform some experiments to solve some questions and it is necessary to think also. Test is designed to nurture student's interest in science. Parents or teachers should not dictate any full/part of the answers to the participants as it defeats the purpose.**

**Date of Receipt:** 28<sup>th</sup> February, 2008

**Address for submission:**

Eureka Science Test  
Lok Vidnyan Sanghatana (LVS)  
129 B/2 Erandavane  
Near Nal Stop, Law College Road  
Pune-411004

## **General Guidance for students, their teachers, parents and guardians:**

The Eureka Science Test (Eureka Science Exercise) is named after the famous words "Eureka!" uttered by Archimedes when he discovered the principle that "the buoyant force of an object immersed in water (a fluid) is equal to the weight of the water displaced by the object."

Though he lived 23 centuries ago, Archimedes (287-212 B.C.) is even today considered as one of the greatest mathematicians, physicists and inventors of all time. He was struggling to solve a problem about whether a gold crown had been mixed with some other metal. He is said to have discovered the solution while he was taking a bath in a tub of water as was the custom in his native country of Greece.

He got so excited that he had discovered a solution to the problem that he is said to have got out of the bath-tub naked and ran out shouting, "Heureka! Heureka!" ("I have found it!" in Greek)

We have designed the science exercises so that students may feel the thrill of discovery that Archimedes may have felt, as they search sincerely and hard for the answers to these questions.

Students! Please remember the process of how you search and how you learn as you search and write a journal about your observations, experiments and conclusions is more important in science than finding the so-called "correct" answer. Do not copy the answers from books, your friends, or ask your parents or teachers to write the answers for you.

Teachers and Parents! **Do not dictate the answers to the students.** This is not only an "open book" but also an "open world" exercise. The important thing is how the students go about finding the answer in their own way. You can help them by finding a suitable book or reference material and work with them to set up an experiment, if necessary.

If you as teachers and parents are interested in helping students to get the thrill of discovering answers for themselves, join the Eureka team in LVS.

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### **E-1: Energy**

We have listed some ways to overcome the energy problem in India. Arrange them in order of merit against each of the following criteria: a) cost effectiveness, b) safety, c) pollution and d) sustainability.

- Use of fossil fuels like kerosene, petrol, LPG, CNG.
  - Use of coal from mines to generate electricity
  - Use of charcoal
  - Solar energy
  - Gobar gas
  - Hydro-electricity
  - Atomic or Nuclear energy
  - Wind energy
  - Tidal wave energy
  - Hydrogen
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### **E-2: Life**

The mango tree blossoms and later bears fruit in the form of mangoes. Guava and pomegranate trees also bear flowers and we see fruits on those trees also after fertilisation. But the ground-nut (pea-nut) plant is different from the above three plants. The groundnut plant bears fruits underground, but the flowers bloom above the ground. Why? How does this happen?

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### **E-3: Calculation**

Two tall trees are located along the opposite banks of a river. One of the trees is 60 feet tall while the other is 40 feet. The distance between the two trees is 50 feet. One bird is sitting on the top of each tree. Both the birds notice a fish on the surface of the water in the river. Both the birds fly and catch the fish at the same instant.

On the basis of this observation, can you tell the distance of the 60-ft tree from the fish in the river?

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### **E-4: Machines**

A foot-operated sewing machine has one big wheel which makes revolutions continuously but the tailor is moving his feet up and down. The needle also moves up and down in a straight line. This means linear motion of the feet gets converted into circular one and back to the linear motion. Observe how it happens in a sewing machine and give one example each of

- (a) Circular motion getting transformed into linear motion
  - (b) Linear motion getting transformed into circular motion
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### **E-5: Calculation**

The total number of handshakes that occurred during a meeting was 66 (sixty-six). If each person shook hands with another person only once how many persons took part in the meeting?

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### **E-6: Life**

Some flowers/ twigs are kept in water. What will be the effect if we add sugar, jaggery or salt to the water? Keep a journal and write in detail your experiment, observations and conclusions?

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### **E-7: Life and Machines**

The tallest trees can carry water right up to their topmost tips. Human beings use pumps to supply water to overhead tanks. What are the differences between these two ways of taking water from a lower to a higher level?

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### **E-8: Physics in your Life**

What is the pressure on your feet when you stand barefoot? Will the pressure on your feet be the same or different if you wear school shoes, high heels or flat chappals? What is the pressure on your feet if you stand on your toes? From this discussion, can you give advice on the best type of shoes that students should wear?

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### **E-9: Life**

What happens when an egg rots? Why does a rotten egg give off a foul smell? Suggest a simple method to distinguish between a rotten egg and a fresh egg. Explain your choice of method with reasons.

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### **E-10: Clock**

When it is 12 o'clock, the hour and minute hands overlap. How many times do the hands overlap between two overlaps at 12 O'clock? Observe this phenomenon as it happens on the face of a clock and keep a record. Prove the result using mathematics.

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### **E-11: Do it Yourself**

Cut out a paper strip from a newspaper, about 8 inches in length and one inch in breadth. Take care that it has no matter printed on it. Draw a line across its breadth with a lead pencil at one inch from one of its sides. Spot a dot of black sketch pen ink at the centre of the line.

Introduce the marked paper strip in some water in a jar, such that the paper dips in the water but the mark remains above the water level. Observe that water starts rising along the paper strip. Allow the water to rise by about 4 inches. Take the paper strip out of the water.

Do you see any colour separated on the strip? Try the experiment with some more paper strips and sketch pen colours. Submit at least three different such paper strips, along with your answer sheet. Call these paper strips as "chromatograms"

Why do we get chromatograms, i.e., separation of colours? What principle is there behind the process of separation?

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**E-12: Food**

We watch and listen to advertisements on TV and radio, with the message, “If you do not have time to eat your lunch or dinner or you are feeling weak due to any reason, take so-and-so health drink”.

Read carefully the label on the contents of the package. Find out and list what are the contents of the food you eat at home – poli-bhaji, roti-sabzi, dal-chawal, fruits, milk, etc, in terms of proteins, carbohydrates, vitamins.

Imagine you are going to have only a health drink as your daily food. Calculate how much health drink powder you would need for the day. How much will it cost?

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**E-13: Life**

Why do ants move in a single file or line on the ground or on a wall? What happens if you break the file or line and rub the ground or wall with your fingers at the point where you break the file or line? Discuss why?

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**E-14: Work**

Farm workers are cutting the harvest crop in two fields. One of the two fields A is double the area compared to the other B. When half of the larger field A was completed, workers divided themselves into two equal groups. One group continued in field A and completed cutting by the evening.

The second group started cutting in field B. But they did not complete it by the evening. On the second day, only one farmer completed the remaining work in field B. From these observations, find out how many workers were there in the group.

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**E-15: The world**

Increasing industrialisation is giving rise to new problems in our world. Global warming is one such phenomenon causing concern. Prepare a detailed note of 500 words on the subject.

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**E-16: Facts and claims**

You may be watching advertisements on TV, listening to them on radio, or reading them in newspapers and magazines. Some of these make some un-scientific statements or claims. Give two such examples, explaining the un-scientific part involved in the advertisements.

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**E-17: Work**

In our society many household jobs have been classified as “boy’s work” and others as “girl’s work”. List five such tasks in each of the two categories. Do you think girls cannot do “boy’s work” and that boys cannot do so-called “girl’s work”? Do you think there is any biological basis to this practice or there are some other reasons? Explain in brief in 500 words.

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### **E-18: Food**

Keep a record of what and how much you have eaten for one week. Determine the calories, carbohydrates, fats and proteins in your diet, referring to suitable charts. Comment on whether your diet is balanced.

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### **E-19: Observation**

Cockroaches that do not die when immersed in plain water die when immersed in soap water. Why does this happen?

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### **E-20: Waste**

Organic waste which is generated after trimming and cutting of trees, bushes, etc., from gardens as well as leaves that fall, is commonly burnt. Why do we say that this way of waste disposal is not proper? How should we dispose off this organic waste in a scientific manner?

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### **E-21: Magic**

A magician claimed that he can convert water into milk and milk into water. When he showed this magic he took three transparent glasses and kept them on the table. All three glasses contained a liquid looking like water and the magician claimed that it was water.

Then he poured the liquid from the first glass into the second one. The liquid in the second glass started looking white like milk. Immediately he poured liquid from the third glass into the liquid looking like milk in the second glass. Then the milk in the second glass started boiling and again started looking like water.

(Our guess is that the three liquids were  $\text{CaCl}_2$ ,  $\text{Na}_2\text{CO}_3$  and dilute  $\text{HCl}$ .) Verify with an experiment and explain the chemical reactions.

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### **E-22: Calculation**

Two cylindrical flat-bottom pots have the same diameter but different heights. The first having 12 cm height weighs 2 kgs when filled with coffee. The second pot having 9.5 cm height weighs 1 kg when filled with coffee. Find out how much coffee each pot contains. Find mass of coffee in each pot.

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### **E-23: Observation**

While swimming underwater a clearer view is seen with swimming goggles on the eyes compared to naked eyes. Explain why? (Hint: refractive index of water and the material of the lens in the human eye is very close)

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### **E-24: Tumbling Jill**

An interesting toy can be made as follows:

You need: About 6mm diameter steel ball (ball bearing), aluminium foil (This can be obtained from a cigarette pack) a round pencil.

You do: Take a piece of about 3x3 cm of aluminium foil. Wrap it around a pencil. Press one end of the cylinder and close it when it is still on the pencil. Remove the cylinder. Put a steel ball inside the cylinder and carefully close the other end.

Your Tumbling Jill is ready!

Put this toy on your palm to move to and fro. The toy will make tumbling dance on your palm. You can also put your toy on an inclined plane. The toy will delight you by tumbling movements.

Try and explain the scientific principles behind tumbling action.

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### **E-25: Health**

Cigarette / bidi is one form in which tobacco is consumed. What are the other forms in which tobacco is consumed? Describe the health hazards of each of these tobacco preparations. There is no ban on tobacco but gutka has been banned. Why?

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### **E-26: Health**

Imagine a wound in the foot caused by a spade during gardening. How would you stop bleeding from this wound? When would you require to go to the doctor to stop the bleeding? Why? Describe the steps involved in dressing and bandaging this wound along with the scientific reasons behind each of these steps. When would you change this dressing. Why?

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### **E-27: Health**

Note down the content of a saline bottle used in hospitals from the label of the bottle. What is the scientific principle of giving saline infusion through a vein directly into the blood?

Based on this principle, in which conditions should saline be given to a patient? Some people think that “saline gives strength”. Is this notion scientific? How much does a saline bottle cost? How much do doctors charge for giving one bottle of saline?

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