

Introduction

It is true that science develops an attitude of logical thinking and inculcates the spirit of inquiry. Scientific attitude or scientific temper is characterized by traits like healthy skepticism, freedom from prejudice, objectivity, open mindedness, rationality, curiosity, and positive approach to failure. Normally, a person having scientific attitude uses the method of science in decision making process in the course of life, whether it is knowingly or unknowingly. Scientific attitude is not the prerogative of only the scientists or the students and teachers of science. It is a way of life. The entire population can be put into three categories - one category may include the well educated people having good accomplishments in science, the second category may include the well educated people having no background in science and the third category includes the uneducated or less educated people. But a common feature of most of the people from these groups is that they act scientifically and if I may be permitted to say so, they have a scientist in them. I would say here that you also have a scientist in you. Don't you believe? Let us see how is it possible?

Who is a Scientist?

Before we justify that there is a scientist in every one of us, let us try to understand who can be called a Scientist? Can a doctor be called scientist? Think for a while.

A scientist is a person who...

- **is curious about the world:** Curiosity is one of the important trait of a scientist. For example, Galileo Galilei's curiosity about the heavenly bodies made him the first person to use a telescope to study the moon, the sun, the planets and the stars.
- **is logical and systematic:** You might be knowing that Gregor Mendel discovered the principles of heredity when others had failed. This was because of his logical experiments, systematic work and accurate record keeping of the observations.
- **is open-minded and free of bias :** An open-minded person is one who is ready to accept criticism and modify plans or discard hypotheses, if necessary. Johannes Kepler was one such person who was hired to develop evidence that planets moved along perfect circles.
- **is intellectually honest:** Isaac Newton gave laws of motion on the basis of the previous work of Galileo and others and very honestly he gave them credit for their previous work. In this context, Newton said, *"If I could see little further than others, the reason was that I was sitting on the shoulders of giants like Galilio and Kepler"*
- **works hard and is persistent:** If one takes the example of the discovery of radium, one should not be surprised to know how hard Marie Curie had to work to extract a grain of radium after processing hundreds of tons of residual waste of Pitch bland. Because of her hard work and persistent efforts she became the first person ever to be awarded the Nobel Prize twice.
- **does not jump to conclusions :** Scientists do not take decision at once. They perform on experiment several times and then come to a conclusion. For example, John Dalton's

atomic theory was backed by several experimental evidences. He is not the first to propose that the atom is the smallest particle of matter, but he is the first to use experimental evidence to support his theory.

- **is a creative and critical thinker:** Creativity and critical thinking are two very important characteristics of a scientist which help him in deriving theory or concrete conclusions. For example, Albert Einstein was able to derive his theory of relativity because of his creative thinking. In fact he was able to think beyond what was given and known at that time. He saw links and connections where others did not. He looked at things from different perspectives.
- **is rational who believes that everything that happens has a reason.** For example, while taking bath in a water tub, Archimedes felt lighter. Keeping it in mind that everything that happens has a reason, he could explain the principle of floating.
- **is willing to suspend judgement** until he is sure of his results. For example, Edison believed that nothing is final in science, and patience and perseverance pay in arriving at the result. Thomas Edison tested over 3000 filaments before he came up with his version of a practical light bulb.
- **tries new approaches** to arrive at solutions. For example, Rayleigh had explained the blue colour of the sky adequately by using the theory of scattering. But why the ocean is blue, could not be explained by the theory of scattering. For this Raman tried a new approach and explained it on the basis of molecular scattering.

In brief we can say that a scientist has considerable knowledge of science, applies scientific principles/concepts and uses method of science for solving different problems.

Where do we stand?

Now the question is where do we stand? Do we also have some traits of a scientist? Lets us see.

- 1) **It is true that all of us have considerable knowledge of science.** For example, if we take up the health related issues, we find that most of us have some knowledge about diseases, their prevention, and some medicines. At the same time we know what kind of food should be taken and which food items have good nutrients. We have knowledge of measurement of various quantities like time, length, volume, speed, temperature, etc. and their units. We know about energy like heat, light, and electricity and its forms and their uses. We have fair idea about the environmental issues and related problems, importance of oxygen for breathing and burning, and importance of carbon dioxide for fire extinguishing and food production by plants, etc. It shows that all of us have considerable knowledge of the facts and figures of science.
- 2) **Secondly, it is also a fact that we apply scientific principles in our daily life even without knowing them.** For example, while cooking we put the flame to low after one whistle by a pressure cooker or once boiling temperature is reached. Similarly, you would have noticed that people make guess whether a bucket kept under water tap is filled or not just on the basis of the changing sound without actually looking at the bucket. Here they unknowingly apply the principle of vibration of air column. While choosing which type of clothes to use in which season and why, we apply principle of science. Another very common observation is that normally we bend our body on one side while carrying bucket full of water in a hand. Similarly, we lean forward while climbing a mountain or bend the bicycle while taking a turn on a curved road. In all such happenings we apply one or the other principle of science even without knowing the basic concepts or principles.

3) **The third important thing is that we use method of science in our daily life for solving different problems.** In order to understand how we use method of science in our day to day activities, let us take an example.

One day you arrive home late at night, walk up to the door, unlock it, reach out to the switch just inside the front door and switch it on. You encounter a problem that the light is not switched on. Can you think for a while, as a normal human being what do you do in this situation?

In fact in this situation you use the method of science for solving your problem. Before coming to this problem, let us first understand what is the method of science?

Method of Science

The method of science consists of following steps in a systematic way. First you encounter a problem and ask a question, then review the background of the situation, based on the background you draw a hypothesis and then test the hypothesis by performing an experiment. Based on the experimental observations you analyse the result and find whether the hypothesis is true or not. If the hypothesis is true, you take decision accordingly and if the hypothesis is false, you construct another hypothesis and this process continues until you come to the final conclusion. All these steps of the method of science are shown in the flow chart (Fig. 27.1). This method is used by all of us knowingly or unknowingly for solving the day to day problems.

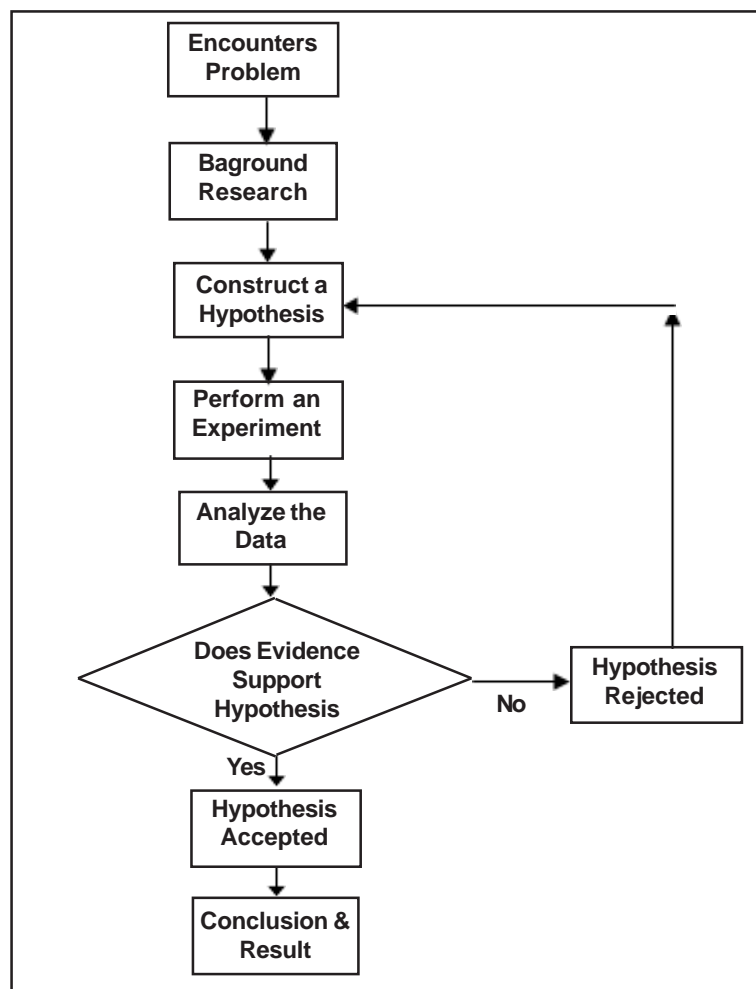


Fig. 27.1: Steps of the Scientific Method

Now, let us take your problem again to understand how you use method of science for solving the problem.

1. First you switch on the light, but find that still it is dark. This is the first step of the method of science i.e. **Observation**
2. This is now the origin of the **problem**
3. Now you **Question** yourself: *Is power supply there?*
4. Immediately you make **Hypothesis**: *Is it a case of no power supply.*
5. Now, you perform some **Experiment** based on the idea that in case of a power cut the lights in the neighbourhood should also remain off. So you observe the situation regarding the neighborhood lights (this is an indirect evidence as you are not responsible in any way about the switching on/off of the lights in the neighbourhood).
6. Based on the evidence you make an **Analysis**:
 - a) If any other house has lights on then your prediction or hypothesis fails.
 - b) If all houses are dark then your prediction or hypothesis is true.
7. Based on the analysis you draw **Conclusion**. If there is no power cut then your **hypothesis is rejected** and if there is power cut then your hypothesis stands accepted.

If power supply is there, still lamp does not glow, what will you do next?

Obviously, you will try another switch in the house, with a revised hypothesis/prediction. This is a **new experiment** under a revised hypothesis. You may switch on another bulb or tube light, or you may check to ensure that the bulb is not fused, you may check the connections, and so on.... In every case you will make a revised hypothesis, test it, analyze the data and take decision. But in the entire process you are following the method of science.

However, like any scientific experiment, there is possibility of error also. For example, in this case if there are inverters or generators in some of the neighboring houses, then your prediction may not be as discussed above.

In this way, you will notice that in almost all such cases we follow the method of science in our daily life. This we can call a common man's approach of solving the day to day problems. Let us compare the two approaches of solving the problems.

S.No.	The Scientific Approach	The Common man's Approach
1.	Identification of a problem (specific question) Hypothesis formulation	Ordinary questions Guess ("This fruit is eatable")
2.	Methodology (Experimentation) Data and Information Collection (Systematic way)	Methodology (trial and error) Data and Information Collection (not so systematic)
3.	Analyzing data	General kind of Analysis
4.	Conclusion (generally meant for the masses)	Conclusion (normally meant for the Individual)

Now, we can say that all of us have considerable knowledge of science, we apply scientific principles/concepts in our day to day life even without knowing and we use method of science in our daily life for solving different problems. If it is so why can't we say that there is a scientist in each one of us?

In fact, there is no doubt that we have a scientist in ourselves, but the need is to nurture the scientist and keep it alive by inculcating scientific attitude and following method of science in daily life.

In order to keep the scientist alive in ourselves, we should

- be a keen observer,
- be curious about the world around us by asking whys and hows about the events and happenings,
- think rationally and shun blind faith & superstitions,
- be logical and systematic in our daily activities,
- be open-minded and free of biases,
- be ready to accept positive criticism,
- be intellectually honest,
- not jump to conclusions without having firm evidence,
- be creative and a critical thinker, and
- try new approaches to arrive at solutions, and pursue our goal persistently

Conclusion

Now after knowing about the characteristic traits of a scientist, you should be able to tell whether the statements like 'The sun rises in the east in the morning', and 'The sun is not going to rise in the east in the morning tomorrow,' are scientific or not and why? Think whether the predictions or explanations of Stock Markets provided by Finance Reporters through television, newspaper or radio are scientific or not.

Conclusively, it can be said that the science is not just a subject to be studied, but it is a way of life. For a progressive and meaningful life, we should not only have a minimum knowledge of science, but we should develop a scientific attitude and follow method of science for solving the problems. Curiosity to know the reason behind any event and asking questions will certainly help in inculcating scientific attitude. I would like to conclude by saying that think scientifically, act scientifically and live scientifically to keep the scientist in you alive.