



In the 19<sup>th</sup> century the average life span of human beings was just 35 years. But what is it today? Today it is over 60 years even in a developing country like ours.

We have achieved this through the progress in science.

Let us examine the various areas where science has scaled such wonderful heights.

- Health
- Industry
- Food production
- Space
- Habitat construction
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Won't you try to find out more such areas?

Have you ever thought about the role of physical science, especially chemistry in these areas?

What are the essentials in nature for the sustenance of the human race?

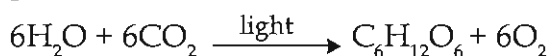
- Air
- Water
- Food
- Shelter
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Aren't they?

What is the part played by chemistry in each of these?

You have already learnt that the primary food producers in nature are the green plants. Photosynthesis is the process which enables plants to do this.

What is the chemical reaction that takes place here?



All living beings depend on plants for food. What did we do when the demand

for food grains increased as population increased? We increased food production by using chemical fertilizers and pesticides. Isn't it chemistry alone that is responsible for this achievement? What if we examine each such area? Aren't you now convinced of the unique role of chemistry in raising the standard of life, reducing manual labour and in health care?

### Field of medicine



Just imagine a situation where an anesthetic is not used during the extraction of teeth, suturing wounds and performing complicated surgery!

What are the purposes for which medicines are used including anesthesia?

- Prevention of disease
- Treatment
- Destruction of germs
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It is the chemical substances present in these medicines that are responsible for curing and resisting diseases. Which are the medicines familiar to you? What are the ingredients in them? See the common names of certain medicines and their chemical names listed in the table. Can you list the medicines familiar to you and the ingredients in them like this? Record them in your science diary.

Medicine (Common name)	Chemical name
Aspirin	2-Acetoxybenzoic acid
Paracetamol	4-Acetamidophenol

Table 16.1

Medicines can be classified into different groups based on their clinical action.

Try to understand some of the major groups and their uses from the table given below.

Group	Use
Analgesics	to relieve pain
Antipyretics	to lower body temperature
Antiseptics	to control germs without causing damage to body cells
Antacids	to reduce acidity
Antibiotics	to kill bacteria that cause diseases and also to control their growth.

Do you agree with a person having headache buying an analgesic on his own and using it? What if he does the same for other ailments too?

What are the unhealthy practices that prevail in our society regarding the use of medicines?

- Self treatment
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Is it the same when a person resorts to treatment by selecting medicines himself

and when a doctor prescribes the medicine after a correct diagnosis based on the patient's age, weight, immunity etc.?

Have you thought of the problems arising in the medical field due to faulty diagnosis, encouraging the excessive use of medicines and the interventions with a profit motive?

Discuss such unhealthy practices in the medical field with health workers, doctors, medical shop owners and medical representatives and prepare a report to present in the school.

### Clinical Test

There are several tests for the diagnosis of diseases. Though most of them involve



complex chemical reactions, some are simple chemical tests. The Glucose test is an example.

### Glucose Test

Prepare a 2% solution by dissolving glucose in water, i.e., 2 g glucose dissolved in 100 mL solution. Take a portion of this and add water to double the volume to get a 1% solution. A 0.5% solution can also be prepared like this. Keep these three solutions in three labelled test tubes separately. Take another set of three test tubes with 5 ml Benedict's solution in each. To these, add 10 drops each of the glucose solutions prepared in different concentrations. Heat each test tube. What do you observe?

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Find the quantity of glucose by comparing the colour in each with the colour chart given on the Benedict's solution bottle. Do the concentrations of the prepared solutions match with the colour chart?

Can we not use this method to detect the presence and estimate the quantity of glucose in a solution?

In this manner, this test can also be used for diagnosing diabetes by detecting glucose in urine.

### Plastics

Haven't you noticed the use of various plastic instruments in the medical field for diagnosis, administration of medicines and resolving the problems of damaged organs?

What are the other purposes in everyday life for which we use plastics? Prepare a table showing the main plastic items that you use and the reasons for using them.



Plastic items	Reason for use

Table 16.3

What are the items that are used for a long period of time? What is done with the others after use?

What are the environmental issues created by the careless disposal of plastic?

Discuss the merits and demerits of the use of plastics in our daily life, prepare an article and publish it in the class science magazine. The following notes can be used for this.

### Plastic and the forest

*In several states, including Kerala, forest-based tourism is on the rise. Tourists have a tendency to throw plastic materials carelessly during such trips. This is a threat to the natural composition of the soil and wild animals. There have even been incidents of death of animals due to the consumption of plastic. But doesn't the use of plastic lead to bringing down deforestation also? Many things which we use such as chairs, tables and baskets are now made of plastic. What would have been the state of our forest wealth if these things were made of wood or plant parts? Think of the problems that might have been created by this.*



### Plastic and sports

*The use of plastic is on the increase in many fields. The use of plastic in the field of sports is very large. From the manufacture of sports goods to the construction of synthetic tracks, plastic is used.*



*CFRP (Carbon Fibre Reinforced Plastic) which is harder, lighter, durable and can withstand high temperature than steel, is used in the manufacture of aircrafts, nuclear reactors, sports equipment, space ships and so on.*

More details regarding these can be collected from books, newspapers and magazines.

Is the plastic used for the manufacture of poles for pole vault and the handle of a toothbrush of the same quality?

Plastics are polymers obtained by the polymerization of simple molecules.

Depending on the monomers used for their manufacture plastics differ in their properties.

Some plastics used in daily life and their monomers are given in Table 16.4.

Polymer	Monomer
P.V.C	Vinyl chloride
Polythene	Ethene
Bakelite	Phenol, Formaldehyde
Polystyrene	Styrene

Table 16.4

Heat a piece of PVC pipe and try to bend it. Does it bend? After cooling, heat it again and try to bend it. Can't you bend it again?

Plastics such as these that can be moulded any number of times by heating and cooling are called 'thermoplastics'.

★ When heated do these undergo a physical change or a chemical change?

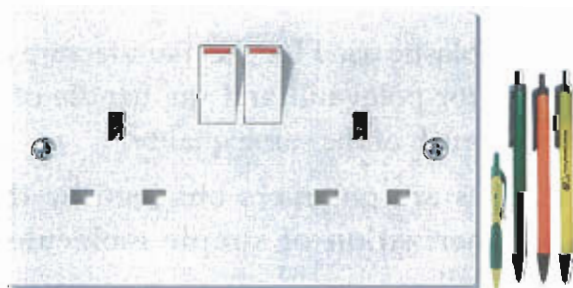
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★ What is the basis for your conclusion?

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★ Can plastics, used for the manufacture of switches and pens, be heated and bent like this? Just try it. What happened?

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The reason for your observation is that such plastics when heated undergo chemical changes. These are known as 'thermosetting plastics'.

Examples of each type of plastics are given below.

Thermoplastics: Polythene, PVC, Nylon, Polystyrene.

Thermosetting plastics: Bakelite, Urea-formaldehyde resin, Terylene.

### Plastic pollution control

Recycling is the process by which the plastic which is rendered useless is heated and subjected to certain processes to produce new materials.

Can't recycling bring down the extent of environmental pollution by plastics?

Is it the thermoplastic or the thermosetting plastic that can be easily recycled?

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The use of plastic can be avoided when it is not absolutely necessary. For example, we can refuse to accept things wrapped in plastic and plastic carry bags.

Don't plastics remain as such for a long time? If so, they should also be used for a long period. Instead of throwing plastic materials away, we can try to reuse them. How many of you change refills for your ballpoint pens? By using ink pens instead of ballpoint pens, and fibres, paper or cloth for making carry bags, the use of plastic can be reduced.

Think of the different ways in which the use of plastics can be reduced.

Make a note about this in the science diary.

If a person is determined, won't it be possible to carry out many of these?

What if the latest technologies of chemistry are also applied in addition to these?

### Biodegradable plastic

The thread that is used in the surgery of internal organs gets absorbed into the body. Similarly plastics that dissolve in the soil through biodegradation have been manufactured. Some plastics that are made from substances in nature and certain special types of artificial plastics come under this category.

#### Energy from plastic

*The main reason for pollution due to plastics is that the commonly used plastics do not undergo biodegradation. Isn't it necessary to find out some methods to process plastic waste that gets accumulated everyday? Think of one such method. If carry bags and bottles made of polythene, polypropene etc. are burnt at a high temperature in the presence of excess air, a lot of energy is also released along with  $\text{CO}_2$  and  $\text{H}_2\text{O}$ .*

*When hydrocarbon polymers are heated in the absence of air under high pressure and temperature, the polymer molecules decompose and the products formed can be used as fuel. The mechanism for generating electricity using these gaseous fuels are already existing.*

*The mechanism of collecting solid wastes containing plastics, sorting them out in the desired manner and processing them scientifically is now available in several countries, including ours.*

### Solid waste management

Due to the increase in population, industrialisation, consumer culture, the habit of using and disposing etc., the quantity of solid waste in our vicinity has increased alarmingly. Food waste, plastics, e-waste, bottles, carry bags etc. may be present in the solid waste. This is why the management of solid waste has become a serious issue.

What exactly are the sources of these solid wastes? If the organic and non-organic materials in solid wastes are separated before they are disposed of on the roadside or the urban limits, won't it help in their processing, thereby controlling pollution?

Who can easily separate these at the source itself?

If each of us thinks and acts in this manner, the problem can be solved to a great extent.

What about organising a class seminar to discuss these problems and their remedies?

### Pesticides

The contribution of chemistry to the field of agriculture has already been discussed. What is the relevance of the use of pesticides in agriculture?

What are the ways in which pests affect food grain production and its storage?

- the attack of pests on seeds
- eating up plants
- eating up food grains
- spreading diseases in plants

Such types of pest attacks are to be resisted.

Do you know the pesticides that were used in the past?

- Tobacco extract
- Garlic extract

Living beings like frogs, snakes etc. that prey on pests play a significant role in pest control.



### Frogs have disappeared

*In Kerala, paddy fields and ponds were the habitat of frogs. With the levelling of paddy fields and ponds, their habitat reduced considerably. Frogs and fish have a great role in the control of mosquitoes. Excessive use of pesticides has also contributed to their annihilation. Many species among them now face the threat of extinction.*



- destruction of eco-friendly pests
- water pollution
- extinction of small living organisms
- diseases
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Refer the facts given about chemical pesticides in Table 16.5.

Should strong pesticides be used when mild pesticides are sufficient?

Are the merits, demerits and strengths of each pesticide taken into consideration before its use?

What about examining these aspects?

What are the points to be considered?

- Pesticides that are used
- Conditions under which they are used
- Quantity used
- Side effects

Analyse the findings of your study. Haven't the pesticides we used to make giant leaps in the field of agriculture turned harmful at times?

The increasing demand for food grains made large scale agriculture essential. As a result of this the use of natural pesticides alone for pest control became insufficient. Thus chemical pesticides were used instead of natural pesticides. This, though useful, also produced harmful effects.

What are the advantages of the use of pesticides?

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And their disadvantages?

Name	Main ingredient	Pests against which mainly used	Period of time upto which its effects last
Endosulfan	Organochloride	Tea mosquito, worms of cabbage	upto 6 years
Malathion	Organophosphate	Mosquito, small insects	upto 3 months

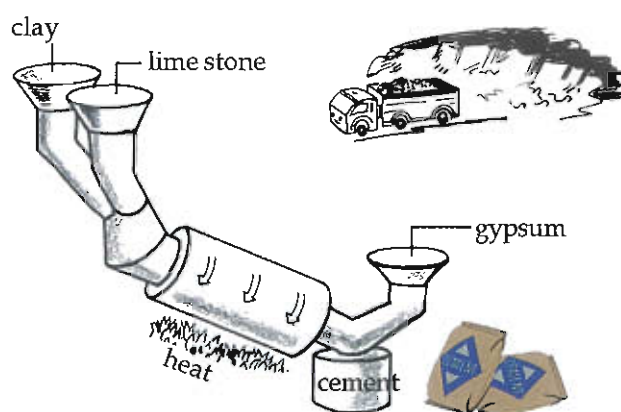
Table 16.5



Isn't the unjudicious use of pesticides the reason for this?

## Cement

Cement is one of the main materials used for house construction. To manufacture cement, lime stone and clay are heated at a high temperature ( $1500^{\circ}\text{C}$ ) in a rotary kiln. The raw materials react to produce cement clinker. This is powdered after mixing with 2% gypsum (calcium sulphate) and used as cement. Setting is the process in which the cement mixed with water hardens and solidifies. This is a complex exothermic chemical reaction. The gypsum is added to control the setting time of cement.



## The chemical substance called glass

In daily life, glass is used for a variety of purposes.

The glass used for making window panes, bulbs and tumblers is soda glass. For its

manufacture the following chemicals are used as raw materials.

Sand (silica  $\text{SiO}_2$ )

Lime stone (calcium carbonate  $\text{CaCO}_3$ )

Soda ash (sodium carbonate  $\text{Na}_2\text{CO}_3$ )

These raw materials are melted at about  $1500^{\circ}\text{C}$  and poured into moulds of the required shape or blown to make different types of glassware.

By suitably changing the raw materials the properties of glass can be altered.

Different types of glasses and the raw materials used for their production are given in Table 16.6.

By modifying the manufacturing process, glasses with different properties can be made and used for various purposes.

## Fibre glass

Fibre glass is manufactured by passing molten glass through fine metal holes so as to change it into thin fibres. These glass fibres are laminated using polyester resins and used for various purposes. Fibre glass laminates which are stronger than steel can be made.

## Safety glass

Safety glass is made by placing plastic sheets between two or three glass plates and heating under low pressure. Its peculiarity is that it does not scatter into pieces when broken. Hence it is used for making wind glasses of vehicles and aeroplanes.

## Coloured glass

In addition to colourless glass you might have noticed different varieties of coloured glasses.



Glass	Raw materials	Use
Soda glass	-	-
Hard glass	Silica, Potassium carbonate, Calcium carbonate	Lab equipment, Factory/ kitchen utensils
Flint glass	Silica, Potassium carbonate, Lead oxide, Sodium carbonate	Lenses and prisms
Borosilicate glass	Silica, Boric oxide, Sodium carbonate, Calcium carbonate, Aluminium oxide	Lab equipment, Factory equipment

Table 16.6

In most of the coloured glasses compounds of transition metals are used for giving colour.

See some compounds and the colour they give to glass.

Compound	Colour
Iron oxide	Red
Copper oxide	Green
Cobalt oxide	Blue

Table 16.7

All branches of science including chemistry have helped in reducing human labour and increasing facilities for man.

Haven't this leap of science inflicted some wounds to nature while providing man a lot of facilities?

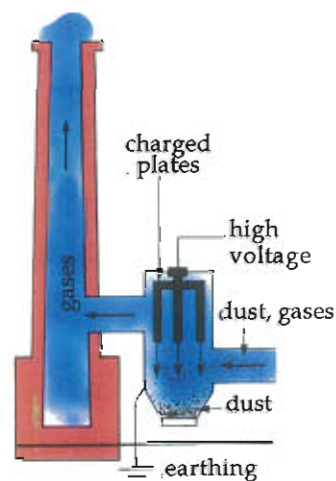
Is it science or the indiscriminate way of handling science that is the reason for such problems? Just think.

Is it not necessary to find the real problems behind these? And their solutions?

Won't the neutralising of acids and alkalies expelled from industries, by adding the required quantity of chemicals, reduce pollution?

There are many methods provided by science to reduce the bad effects of chemicals and prevent pollution. Examine some of these.

*The smoke and gases expelled from industries become the main reason for atmospheric pollution. Smoke is a colloid. The minute particles in smoke have electric charge. Hence when smoke is passed between electrodes with opposite charges, the charged particles lose their charge and get deposited. There are Cottrell precipitators that control smoke pollution from factories based on this principle.*



We have seen that the development of science brings in many ecological problems also. And there is the panacea for these from science itself. Manufacturing goods without causing environmental problems and ensuring the protection of the living beings has become more relevant these days. A new branch of science has emerged for this. It is called green chemistry.

Green chemistry tries to create a new generation of ecofriendly products by converting harmful chemicals into harmless and useful materials during the production process.

The message of green chemistry is that chemistry is not a problem but a solution.



### Follow up Activities

- Solid waste contains organic as well as non-organic substances.
  - What are the methods for managing these?
  - What are the benefits of such waste management?
- 'Stop the manufacture and use of plastic that destroys nature'.  
How will you react to this statement? Substantiate.
- Pesticides have to be used for pest control in many fields.
  - What are the advantages and disadvantages of using pesticides?
  - What are the pest control methods that can be used without harming the environment?
- Green chemistry is the science stream that gives prominence to the production of environment friendly products. Prepare an article about these types of products referring IT etc.
- Match column A by selecting suitable choices from columns B and C.

A	B	C
Paracetamol	Glucose	Handle of iron box
Benedict's solution	Sand	Pesticide
Bakelite	Antipyretics	Manufacture of spectacles
Malathion	Gypsum	Clinical test
Optical glass	Organophosphate	Setting
Cement	Thermosetting plastic	To lower body temperature

6. There are different branches in chemistry related to the study of different substances that are handled in everyday life. For example, the branch that deals with the study of plastics is polymer chemistry. The names of certain substances are given in the box. Find the branch related to these and complete the table.

*Nylon, Antacid, Fertilizers, PVC, Antipyretics, Terylene, Thermocol, Cement, Dyes, Pesticides, Glass.*

<b>Agricultural Chemistry</b>	<b>Polymer Chemistry</b>	<b>Pharmaceutical Chemistry</b>	<b>Industrial Chemistry</b>

