Note to the teacher…

As we present this revised edition of the Science Textbook, we would like to express our deepest gratitude to the learners and the teaching community for their enthusiastic responses.

In science some concepts could be subject to change from time to time as new theories and principles are constantly being evolved.

We have tried to present facts and concepts of science (both concrete and abstract) in a visually appealing manner without detracting from the content.

Activity based learning is now accepted as the basis of science education. These activities should be regarded as a means for open-ended investigation rather than for verification of principles/content given in the textbook are has been designed to facilitate low cost activities and experiments using locally available materials. With a view to streamlining the activities, we have now segregated them into three groups:

- **I Do** - activities to be done by an individual learner.
- **We Do** - activities to be done by a group of learners. and
- **We Observe** - activities to be demonstrated by the teacher.

The third group of activities have a higher degree of difficulty or require careful handling as it may involve dealing with chemicals, electricity etc.,

The “More to know” snippets in the text represents some unusual and interesting facts or information in which the students need not be examined.

The evaluation section is nothing but another space for learning in a different manner. As the focus is on understanding, rote learning is to be discouraged thoroughly. Application of learnt ideas, problem solving skills and critical thinking is to be encouraged. There could be scope for more than one answer to a question, which should be acknowledged always.

To facilitate further reference, books and websites have been suggested at the end of each lesson. Suggestions and constructive criticism are most welcome. Valuable suggestions will be duly incorporated.

- Authors

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Why does the sun appear only during the daytime? Why do stars glow only at night? Why do plants grow towards the sunlight even when they are kept in a room?

All the activities we undertake to search for answers to questions like What? Why? and How? is known as science.

Many of the things that we use in a day from brushing our teeth in the morning till we sleep under the fan at night are the gifts of science.

**Physics** is the branch of science that deals with measurement, motion, sound, light, electricity, electronics etc.

**Chemistry** deals with the study of materials, their characteristics (metallic, non-metallic, taste, odour, acidic, basic etc.) and uses.

The study of the micro-organisms, plants and animals is called **Biology**.

The branch of Biology that deals with herbs, shrubs, climbers and trees is called **Botany** and the study of animals is known as **Zoology**.
We have learnt in history that early men were nomads, wandering and hunting for food. Several thousands of years later, they settled down in one place and learnt to cultivate food crops on their own.

**Food Plants**

We cultivate many crops like paddy, millet, ragi, maize, wheat, sugarcane, coconut and vegetables for food.

What are the vegetables that we buy when we visit a vegetable shop with our parents?

Those vegetables are a part of a plant, either a leaf or a stem or an unripe fruit.
Mani visited his grandma’s house during holidays. There, he bathed with his grandpa in the canal. He was affected with cold the next day. He thought that his grandpa would take him to the doctor. Instead, his grandma gave him herbal medicine for three days and to his surprise, he was cured of the cold completely.

In addition to vegetables, cereals, pulses, fruits, oils and spices are also obtained from plants. Food-based industries depend on plants. Plants are useful to us in many ways. They are used in the preparation of food items such as chips, pickle, food powder, jam etc.

**Medicinal plants:**

Plants are used not only as food, but also as medicines to cure many diseases. These medicines are obtained from plants.

The plants that have medicinal properties are known as **herbal plants**.

More to know

50,000 to 75,000 tons of mango pulp has been exported to foreign countries from Krishnagiri district of Tamilnadu every year. This gives considerable income to the farmers. It also increases the income of the nation.

<table>
<thead>
<tr>
<th>Activity 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>We list the food items obtained from the different parts of a plant.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food item</th>
<th>Ingredients required</th>
<th>Plant part used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sambar</td>
<td>thoor dhal, drumstick, chilli, curry leaf, turmeric powder</td>
<td>seed, unripe fruit, leaf, stem</td>
</tr>
<tr>
<td>Pepper rasam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brinjal fry</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Nowadays, plant-based medicines are preferred throughout the world. To find out the medicinal values of plants researches are done worldwide.

From ancient days, plants are being used to cure several diseases in our country.

The herbal plants grow naturally in forests, mountains and hills and some are found in the road sides.

Let us learn some of the medicinal values of herbal plants.

Our ancestors opined, “Food is medicine”. If we add sufficient plants with medicinal values with our food, we can live healthily without diseases.

**Uses of Herbal plants**

- **Pea egg plant (Thuthuvalai)**
  - Cures cold, cough

- **Neem (Vembhu)**
  - Germicides, regulates body temperature and destroys intestinal worms.

- **Carry me seed (Keezhanelli)**
  - Cures jaundice

What herbal medicine would his grandma have given to Mani? Find it out from your grandma or elders at home and write about it.

Know from your elders and write down the simple medicinal practices done at home to cure stomachache, headache and fever.
The World of Plants

Holy basil (Thulasi) cures cold, cough, fever

Country borage (Karpuravalli) increases sweating, cures cough and fever

Sweet flag (Vasambu) cures abdominal diseases

Turmeric (Manjal) used as germicide and cosmetic

Veldt grape (Pirandai) increases appetite, cures digestive problem

Ginger (Inji) cures digestive disorders

Pepper (Milagu) cures throat infection

Gooseberry (Nelli) cures mouth ulcer, regulates body temperature

Veldt grape (Pirandai) increases appetite, cures digestive problem

Ginger (Inji) cures digestive disorders

Pepper (Milagu) cures throat infection

Gooseberry (Nelli) cures mouth ulcer, regulates body temperature
Let us collect the herbs in and around in our area and organise a herbal exhibition in our class room. Let us discuss with our peer students the name of the herbs, their medicinal value and part of the plants used as medicines.

We grow plants not only for food and medicine, but also for ornamentation, as construction materials and for other purposes.

**Flowers and cosmetics**

We all love beautiful flowers such as rose, lily, jasmine, etc. Flowers play a key role in the preparation of cosmetics like bathing soap, talcum powder, deodorant and perfumes.

**SPICES**

Many a time we wonder at the pleasant odour from the food we cook. What is the reason for this? It is because of the spices that we add to it.

Spices are obtained from many parts of plants. By adding them to the food, the food gets good smell and colour.

Spices increase the amount of food eaten and the digestion rate. Many parts of plants such as leaves, stems and flowers are used as spices.

Some spices are also used as medicines. Dry ginger, mint and fenugreek are used as medicines for common cold, fever and stomach ache. Turmeric and clove are used as antibiotics and antiseptics.

**Activity 2**

Discuss with your parents or elders and fill up the following.

What are the ingredients needed to prepare dry ginger coffee?

______________

**Method of preparation**

______________

______________

______________

**Uses**

______________

______________

**Kerala is known as the Spice Garden of India**
Parts of the plants used as spices

<table>
<thead>
<tr>
<th>Seed</th>
<th>Underground stem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fenugreek (Vendayam)</td>
<td>Dry ginger (Sukku) / Ginger</td>
</tr>
<tr>
<td>Fennel (Sombu)</td>
<td>Turmeric (Manjal)</td>
</tr>
<tr>
<td>Mustard (kadugu)</td>
<td></td>
</tr>
</tbody>
</table>

Unripe fruit: Cardamom (Elachi), Pepper (Milagu)
Fruit: Cinnamon (pattai), Mint (pudina)
Bark: Clove (Krambu)
Leaves: Cinnamon (pattai)
Flower bud: Cardamom (Elachi)

Underground stem

Ginger and turmeric are the stems of the plant found under the ground. These stems do the function of food storage.
Fibre plants

The dress, the jute and the gunny bag we use are the products of fibre plants.

Our cotton dress is the gift from the cotton plant. Coir ropes are produced from the coconut fibre. Jute fibre is obtained from the plant Jute. It is used to make gunny bags. Apart from this, fibre plants are also used in making pillow, bed, mat and mattress. Fibres are also used to weave clothes, make nets and handicrafts.

There are many kinds of fibres. Fibres are classified based on the parts of the plants from which they are obtained.

Leaf fibres

Fibres are obtained from the leaves of Aloevera and Pineapple. These are called as leaf fibres.

Fibres are classified based on the parts of the plants from which they are obtained.

Long, thin, strong strand obtained from plants is known as fibre.

Stem fibres

Plantain fibre and Jute are obtained from the stem of their plants.

External fibres

Fibres obtained from the outer region of the seed are known as external fibres. 

eg. Cotton, Coconut, Silk cotton.

Activity 3

Write any ten products made by using fibres.

Plants in construction

Wood is used in building constructions and making furniture.

Let us know:

Nowadays Jute is cultivated not only for fibre, but also for some other purposes. It is used in the preparation of bio-plastics since it has 85% of cellulose. Bio-plastics are biodegradable.
The part of the tree that is used for various construction purposes is called wood. The dark inner region of the stem is called heartwood and the outer region is called as sapwood.

Sapwood helps to conduct water in plants. Heartwood gives strength and rigidity to the plant. It is stronger than sapwood. Mostly heartwood is not infected by fungus, termite, borers. It is hard and resistant to fungus due to the presence of gum, latex, resin and oil. It is more lustrous and is used for building purposes. Sapwood is infected by fungus and termites.

Many trees grow in and around our place. Knowing about their uses will be more useful for our life.

**GIFT OF NATURE - PLANTS**

Herbs, shrubs and trees are inevitable for our life. Plants fulfil the basic needs such as food, clothing and shelter. Forests are necessary for getting rainfall. Trees purify the air.

Do you understand how harmful it is to destroy trees? Let us not stop with just learning about it, but get involved in constructive activities like

---

**Activity 4**

List the things made of wood in your house and find out from which tree these are made.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the item</th>
<th>Name of the tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Teak:** Construction material, furniture

**Jack fruit:** Construction material, Fruits

**Eucalyptus tree:** Oil, paper

**Mango tree:** construction materials, fruits
1. Do you know that a small garden can be formed near the window of your kitchen? Fill the bucket with soil and sow seeds of medicinal plants, greens, coriander and tomato. Water them regularly. Thus, a small garden can be formed in your house. Now share your gardening experience in the classroom.

2. In countries like Japan, Russia and Cuba, vegetables are cultivated on the open terrace. Like this, you can also get benefited by forming garden on the open terrace of your school or house and cultivate pumpkin, snake gourd, tomato and bitter gourd.

Extended activities:

- creating gardens in the backyard and
- planting trees in the school campus.
Discuss in small groups and collect information and uses about herbs, shrubs, and trees found in your surroundings.

<table>
<thead>
<tr>
<th>Plants</th>
<th>Name</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Plant" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image2.png" alt="Plant" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image3.png" alt="Plant" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fact file**

1. Thickest African tree found in Zimbabwe is **Boabab tree**.
2. Orange trees yield fruits for about 400 years.
3. **Rafflesia** produces the largest flowers. The diameter of the flower is one metre.
4. **Red wood tree** doesn't easily catch fire
5. From a watermelon, 6,000,000 watermelon plants can be produced and from them watermelon weighing 180 tonne can be obtained.
I. Fill in the blanks:

- Fruit
- Leaf
- Seed
- Root
- Flower
- Vegetable
- Stem

Evaluation
II. Rearrange the letters and find out the name of the plant.
(Eg: Ricturme-Turmeric)

1. finlagerdy's - ____________________
2. reeogosbry - ____________________
3. mutayhcrsnhem - ____________________
4. irragonefut - ____________________
5. werflouns - ____________________

III. Names of some useful plants are hidden in the following checker. Find out at least ten plants and write their uses.

```
P   E   P   P   E   R   0   S   E   P   C   A   C   T   U   S
T   Q   M   U   L   B   E   R   R   Y   R   T   H   V   G   U
S   N   A   K   E   G   0   U   R   D   L   0   I   F   S   T
K   0   N   I   O   N   W   Z   N   0   K   M   P   I   N   E
E   U   C   A   L   Y   P   T   U   S   J   A   E   I   W   B
N   A   J   C   D   G   A   R   L   I   C   T   G   U   V   M
E   X   O   K   E   B   F   H   C   A   L   0   D   T   Q   L
E   N   P   B   R   I   N   J   A   L   P   M   A   N   G   0
M   B   K   L   M   N   0   B   A   N   A   N   A   Q   R   W
R   Z   M   A   Z   C   0   C   0   N   U   T   S   X   Y   R
```

IV. Choose the correct answer

1. Plants with medicinal value are called
   a) pulses       b) scented plants   c) medicinal plants   d) barks
2. Of the following, which is the seed part of the plant used as food?
   a) thoor dhal   b) veldt grape    c) banana             d) turmeric
3. Select the food-related industry from the following
   a) coir making  b) gardening       c) cotton cultivation d) pickle-making
4. Name the unripe fruit that we have to be consumed for blood purification.
   a) gooseberry   b) neem           c) veldt grape         d) carry me seed
5. Name the tree used in paper industry.
   a) Teak   b) Eucalyptus   c) Coconut tree   d) Sandalwood tree

V. Match the following:

<table>
<thead>
<tr>
<th>Trees</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eucalyptus</td>
<td>Parts of bullock cart</td>
</tr>
<tr>
<td>Silk cotton</td>
<td>Railway sleepers</td>
</tr>
<tr>
<td>Coconut</td>
<td>Tennis racket and Hockey stick</td>
</tr>
<tr>
<td>Mulberry</td>
<td>Thatching, construction</td>
</tr>
<tr>
<td>Pine</td>
<td>Match box</td>
</tr>
<tr>
<td>Babul bark tree</td>
<td>Oil, papers</td>
</tr>
</tbody>
</table>

VI. State whether the following sentences are true or false. Correct the statement.

1. Purple fruited pea egg plant is used as medicine for jaundice.
2. Ginger is the root of the plant.
3. Veldt grape is a medicinal plant.
4. Clove is the seed of the plant.
5. Silk-cotton tree is used to make matchbox.

VII. Fill in the blanks

1. Carry me seed (Keezhanelli) cures _____________ (Jaundice/Anaemia)
2. Pepper cures _____________ (Throat infection / Stomach ache)
3. __________are used in the preparation of cosmetics. (Flowers / Herbs)
4. __________used as gemicide and cosmetic. (Turmeric /Neem)
5. __________State is known as Garden of Spices of India. (Kerala / Tamilnadu)
6. Jute fibre is obtained from the ____________ of plant. (Stem / Leaf)
7. The soft, outer region of the stem is called as ____________ (Sap wood / Heart wood)
8. ____________ wood is used for building purposes. (Sap wood / Heart wood)
The World of Plants

9. Fibres obtained from the outer region of the cotton, coconut are known as _____________ (External fibres / Leaf fibres)

10. _____________ cures mouth ulcer (Gooseberry/ Holy Basil)

VIII. Answer the following

1. What is the reason for the scent / odour in bathing soap and perfume?
2. Write about the plants and parts of the plant from which coir ropes, and gunny bags are made.
3. Where do medicinal plants grow?
4. Name the plants that yield cooking oil.
5. Write down the benefits of adding spices in food.
6. Differentiate between heartwood and sapwood.

IX. Think and answer

1. How will you explain to a foreign tourist about any five medicinal plants of our country?
2. "Trees should not be cut off", but we cut and use trees for our various needs. What is the solution to this contradiction?
3. Only heartwood is used to make furniture. Is it correct? Give reason?

X. Project: Some places are very popular for their products, like Tanjore for Paddy, Madurai for Jasmine and Kumbakonam for Betel leaves. Refer the books and write such famous places known for their products.

FURTHER REFERENCE

Webliography:

http://en.wikipedia.org/wiki/food
http://www.moomilk.com/tour.htm
We know about the cartoon hero Popeye, don't we? In this story, Popeye, the sailor is lean and weak. But his opponent Brutus is stout and strong. Popeye is often beaten up by him.

Later on Popeye consumes spinach. It gives him immense strength and that's all, his opponent Brutus is defeated.

This cartoon story illustrates the importance of greens like spinach. It is true, that the food we consume must be nutritious.

Obese person may appear stronger. But, he may not be really healthy.

Chewing Gum which contains artificial sugar and colour does not provide any nutrient.

Food items like noodles, contaminated roadside food with artificial flavour and chemicals, tinned and fast food are harmful to our health. Therefore it is good to avoid these food items.

Let us learn about healthy food items and unhealthy food items.

Activity 1

List the food items that you consume in the following space provided.

Morning  __________________________________________________________

Afternoon________________________________________________________

Night  ___________________________________________________________
What are the various sources of food?

Food items obtained from plants and animals:

The root, stem, leaf, flower, vegetable, fruit and seed of the plants are used as food. Different food items like milk, egg and meat are obtained from animals.

Activity 2

List the food items obtained from plants and animals in the following table

<table>
<thead>
<tr>
<th>Food items obtained from plants</th>
<th>Food items obtained from animals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Nutrients

The constituents of the food which are essential for the body are called nutrients. Does a food contain more than one nutrient? Do you know any food without nutrients? Why do we need nutrients?

Types of Nutrient

- Carbohydrates - Provide energy
- Proteins - Help in growth
- Fats - Provide energy
- Vitamins - Help in physiological activities
- Minerals - Act as regulators in physiological activities
- Water - Transports food, regulates body temperature.

Activity 3

Take a cucumber. Cut it into small slices. Water oozes out while cutting it! Why?

All vegetables, fruits and food items contain water in different proportion.
Deficiency Diseases:

Diseases caused due to the deficiency of nutrients in food that we eat are called deficiency diseases.

Deficiency diseases and their symptoms

<table>
<thead>
<tr>
<th>Nutrient : Protein</th>
<th>Food source: Fish, meat, egg(albumin), milk, peas, cereals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deficiency disease(1) : Kwashiorkar (children from 1-5 age)</td>
<td></td>
</tr>
<tr>
<td>Symptoms: retarded growth, potbelly, swollen limbs.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nutrient : Protein</th>
<th>Food source: Fish, meat, egg(albumin), milk, peas, cereals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deficiency disease(2) : Marasmus</td>
<td></td>
</tr>
<tr>
<td>Symptoms: Thin limbs, weak appearance, enlarged head, loss of weight, retarded physical and mental growth.</td>
<td></td>
</tr>
</tbody>
</table>
## Vitamins

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Food source:</th>
<th>Deficiency disease</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>Fish liver oil, egg, milk, ghee, butter, carrot, corn, yellow fruits, greens</td>
<td>Night blindness</td>
<td>Defective vision, blindness in dim light</td>
</tr>
<tr>
<td>Vitamin B</td>
<td>Whole grains, pulses, unpolished rice, milk, fish, meat, peas, gram, raw vegetables</td>
<td>Beri-beri</td>
<td>Unhealthy nerve, muscle fatigue</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>Orange, lemon, gooseberry, green chillies, tomato.</td>
<td>Scurvy</td>
<td>Bleeding gums</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>Fish-liver oil, milk, egg. It is also synthesised by the skin with the help of sunlight.</td>
<td>Rickets</td>
<td>Weak and bow bones</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>Vegetable oils, green vegetables, whole wheat, Mango, Apple, Greens</td>
<td>Infertility</td>
<td>Sterility and reduction of immunity</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>Green vegetables, Tomato, Cabbage, Egg, Milk and milk products.</td>
<td>Haemorrhage (blood does not clot)</td>
<td>Loss of excessive blood even for a small wound</td>
</tr>
</tbody>
</table>

### Minerals

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Food source:</th>
<th>Deficiency of bones and teeth</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>Milk, Fish, Wheat, Green Gram</td>
<td>Disintegration of bones and teeth</td>
<td>Weak bones and teeth.</td>
</tr>
<tr>
<td>Iodine</td>
<td>Milk, Iodized Salt, Prawn, Crab</td>
<td>Goitre</td>
<td>Inflammation in neck</td>
</tr>
</tbody>
</table>
BIOLOGY

We can avoid diseases caused by deficiency by consuming nutritious food

Balanced Diet

A food that contains all the nutrients in the right proportion is a balanced diet. The following table shows the nutrients present in different food items.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Food category</th>
<th>Nutrients present</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cereals: Rice, Wheat, Ragi (Finger millet), Bajra (Pearl millet), Sorghum, Corn, Barley, Rye</td>
<td>Carbohydrate, protein, a small amount of lipid, vitamin B, folic acid, iron, fibre.</td>
</tr>
<tr>
<td>2.</td>
<td>Pulses: Red gram, Black gram, Green gram, Horse gram, Bengal gram, Chick pea, Pea, Soya beans, Country beans etc.,</td>
<td>High protein content, a small amount of lipid, vitamin B, folic acid, iron, fibre.</td>
</tr>
<tr>
<td>3.</td>
<td>Milk and meat products: Milk, Ghee, Curd, Yogurt, Skimmed milk, Chicken, Liver, Fish, Egg, Mutton.</td>
<td>Protein, lipid, vitamin B, calcium</td>
</tr>
<tr>
<td>5.</td>
<td>Ghee, Oils: Butter, Ghee, Vanaspathi, Cooking oils like Groundnut oil, Coconut oil, Gingely oil.</td>
<td>Lipid, Essential fatty acids</td>
</tr>
<tr>
<td>6.</td>
<td>Sugar, Jaggery</td>
<td>Carbohydrate, iron.</td>
</tr>
</tbody>
</table>
Nutrition: How do living organisms get energy from these food substances? Ingestion, digestion, absorption and assimilation are the various stages of nutrition. Organisms consume both solid and liquid food substances by various methods.

**Types of nutrition**

1. **Autotrophic nutrition**
   Mode of nutrition in which an organism prepares its own food is called autotrophic nutrition. E.g.: Green plants, Euglena. They prepare their own food by photosynthesis.

2. **Heterotrophic nutrition**
   The mode of nutrition in which an organism depends on other organisms for food as they cannot prepare their own food is called heterotrophic nutrition.

**Activity 4**

Let each student write the name of any one of the grains, pulses, fruits, vegetables, tubers and dry seeds. Then they shall be divided into small groups for discussion. Each group shall find:
- the nutrients present in these substances.
- whether the food substances written by the students in the small groups, make up a balanced diet?
- whether the same quantity and same type of food be suitable for all age group?
- whether it is possible to get a balanced diet at a minimum cost?

**Nutrition is the mode of intake of food**

Preparation of starch (sugar) by the plants with the help of sunlight, carbon-dioxide, water and chlorophyll is photosynthesis.
Types of Heterotrophic nutrition

Parasitic nutrition:

The mode of nutrition in which an organism depends on another living organism for its food and survival is called parasitic nutrition. The plant *Cuscuta* depends on other plants for food. It is an example for parasitic nutrition.

**Parasitic nutrition:**

The mode of nutrition in which an organism depends on another living organism for its food and survival is called parasitic nutrition. The plant *Cuscuta* depends on other plants for food. It is an example for parasitic nutrition.

**Endoparasites:**

Roundworm lives inside the intestine of animals and human beings and derives food from it. So it is an endoparasite.

**Saprophytic nutrition:**

In saprophytic nutrition, the organism decomposes the dead plant and animal substances and converts them into simple molecules and absorbs them through their body wall. E.g. Mushroom.

*Discuss with your teacher how do the non-green plants and animals get their food.*

3. Special type of nutrition

Plants like Nepenthes, Drosera, and Utricularia are green in colour and are autotrophic. They are found in nitrogen deficient soil. They trap insects and assimilate them to get nitrogen from them. So they are called insectivorous plants.

**Types of parasites:**

**Ectoparasites:**

Organisms like headlouse, leech, etc. are found attached to the outer surface of the body of other living organisms (host) and get nourishment from the host. These are called Ectoparasites.

**Animals based on nutrition:**

Animals that feed only on plants are called herbivores. E.g. goat, cattle. Animals that feed on other animals are called carnivores. E.g. tiger. Animals that feed on both plants and animals are called omnivores. E.g. crow.
Activity 5

Can you write the names of animals that you know under their mode of nutrition?

<table>
<thead>
<tr>
<th>Herbivore</th>
<th>Carnivore</th>
<th>Omnivore</th>
</tr>
</thead>
<tbody>
<tr>
<td>deer</td>
<td>lion</td>
<td>cockroach</td>
</tr>
</tbody>
</table>

Activity 6

We participate in a class discussion about the following ways to prevent heart diseases / attack.

1. To be happy.
2. To maintain the body weight according to the height of the individual.
3. To participate in games and practice proper exercises.
4. To avoid deep fried food items.
5. To avoid tobacco products in any form.
6. To eat fruits and vegetables more.

**Which is a good food?**

We have to maintain our organs in a good condition to lead a healthy life for a long time. It is based on the choice of food we consume.

It is important to keep our internal organs like heart, kidney, lungs, etc. healthy. Participating in games and exercises are important for this.

Junk foods and fried items should be avoided. Instead, food items containing protein and fibre, like peas, cabbage and greens should be added daily.

Eating steamed fish items and brinjal rich in ascorbic acid, prevent heart diseases.

We have to take equal quantities of vegetables along with our food like rice, wheat, bajra(kambu), maize, ragi etc. Fruits should also be included in our diet.
**Think for a few seconds**

You might have observed a variety of food items that are served in wedding feasts and parties.

- Are the people consuming all the food items or wasting them?
- Is wasting the food correct?
- What is the reason for wasting the food items?
- What are the remedial measures you would suggest to avoid wastage of food?

**Activity 7**

- I list the food items that I had been eating for the past 4 days.
- I learn about the food category present in the food items I had eaten.
- I learn about the balanced diet and make the following changes in my food habit.
  1. To avoid aerated drinks.
  2. To eat more vegetables and fruits.
  3. To eat variety of grains.

I compare my list with the ‘Balanced food chart’
Activity 8

Observe and Learn

- I learn about my Body Mass Index (BMI).
- I measure my height in metre by using the scale drawn by the teacher on the wall of my classroom. I also measure my body weight in Kg.
- I use the formula of BMI
  \[ \text{BMI} = \frac{\text{Weight in Kg}}{\text{Height}^2} \]
- By using the BMI formula, I have calculated my Body Mass Index. For example = \( \frac{35}{130^2} = 20.7 \)

<table>
<thead>
<tr>
<th>BMI value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 20</td>
<td>Underweight</td>
</tr>
<tr>
<td>20 - 24.9</td>
<td>Ideal weight</td>
</tr>
<tr>
<td>25 - 29.9</td>
<td>Overweight</td>
</tr>
<tr>
<td>above 30</td>
<td>Obesity</td>
</tr>
</tbody>
</table>

I compare the calculated BMI with the Table Value. I participate in a classroom discussion about the ‘Right Food Habits’ to maintain my ideal body weight. I have learnt about the need of maintenance of body weight (relevant) relative to my height.

“Health is Wealth”

**EVALUATION**

I. Fill in the blanks:

1. Disease caused due to protein deficiency is ____________ (Marasmus/Night blindness)
2. Deficiency of Vitamin C causes ____________ (Scurvy/Rickets)
3. ____________ is an omnivore. (Crow/Goat)
4. Milk is rich in ____________. (calcium/iron)
5. ____________ regulate the physiological activities. (Proteins/Minerals)
6. ____________ is used to strengthen the bone. (Calcium/Iron)
7. ____________ is saprophytic in nutrition. (Euglena/Mushroom)
8. Anaemia is caused due to the deficiency of ____________ (iron/protein)
9. ____________ is synthesized by the skin with the help of sunlight. (Vitamin B / Vitamin D)
Chapter - 2

10. Rickets is a ________ deficiency disease. (Vitamin A / Vitamin D)

II. Fill in the blanks:

<table>
<thead>
<tr>
<th>Types of nutrition</th>
<th>Heterotrophic nutrition</th>
<th>Parasitic nutrition</th>
<th>Endoparasite</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

III. Think and answer:

1. Observe the following picture.

Mahesh! You’ve become so fat like a bloated balloon because you drink softdrinks while watching TV. Come… let’s eat this mango and play.

No…no….. I’m not coming Suresh; I don’t like to play. I’ll get fever if I play.

a) Among the two, whose attitude is correct? Why?

b) Which of the following activities will lead us to have a healthy and long life?

- including more vegetables and fruits in the diet.
- waking up early in the morning.
- watching television till late night.
- eating more fast food.
- playing games like cricket, swimming and football.

10. Rickets is a ________ deficiency disease. (Vitamin A / Vitamin D)
2. Mala had inflamed and bleeding gums. Mala’s mother was frightened and took her to the doctor. What would the doctor have said as a reason for this disease? What kind of food the doctor would have prescribed to Mala?

3. Should we wash the fruits and vegetables before cutting them or after cutting them? Give reasons for your answer.

4. Few food items are placed on the table. Arthy wanted to select and eat the food which is rich in nutrients and healthy. You can help her, too.
IV. Answer the following questions:
1. What are nutrients?
2. Mention the different kinds of nutrients and their functions.
3. Why do a few plants feed on insects?
4. What kind of food should be taken to prevent night blindness?
5. What is a balanced diet?

Let us know
- We should avoid intake of artificially coloured sweets like kesari and cotton candy. The chemicals added in it are harmful to us.
- When you eat food, chew and taste it. Avoid eating food while watching TV or talking as you may eat more. This leads to obesity and causes many other diseases.
- Vegetables and greens should be taken raw or half-boiled. By doing this, we can avoid the loss of nutrients in them.
- Eating leftover food preserved in the refrigerator leads to health disorders.
- Consuming bottled drinks, packed chips, fried food items, etc. sold in shops is harmful to our health.

FURTHER REFERENCE

Webliography:
http://en.wikipedia.org/wiki/food
http://www.moomilk.com/tour.htm
http://www.diethealthclub.com
Kalpana Chawla was the first Indian born American woman who travelled to space in the space shuttle Columbia. This is an excerpt from the interview given by her in the year 1997 when she returned from space.

**Interviewer**: How did you feel when you flew in the spacecraft? What were the changes you felt in your body?

**Kalpana Chawla**: At first, I felt all parts of my body losing weight. When this transformation overpowered me, I could not feel any part of my body. As the spaceshuttle hurled at high speed, a kind of fear went down my spine. Before I could say, “Look at India” I was crossing it. The Gangetic Plains appeared to be a thin line, Africa looked like a desert and the river Nile appeared to be a thin vein on it. In about an hour and a half I revolved around the earth. I observed with wonder as the day and night changed very fast. I went round the whole world within one and a half hour. The moon, moving away from me, waned and waxed and then appeared and disappeared. I felt shocked and overjoyed at the same time. All these things happened in a very short span of time.

How do you feel when you read her statements? Isn’t it wonderful? The slow and natural changes that take place on earth seem to take place at a fast rate when we travel in space.

Shall we look at the changes that happen around us? That is, the seasonal changes, occurrence of day and night due to the rotation of the earth, curdling of milk, ripening of fruit, cooking of food, rusting of iron etc.

In this lesson, let us learn about the different types of changes that occur.
Chapter - 3

Look at the pictures given below and discuss in groups about the changes taking place.

Fill in the blanks with the given hints.
1. The _______ and _______ of the child have increased.
2. The _______ changes during day and night.
3. The _______ and the _______ change when a mango ripens.
(Hints: temperature, weight, taste, height, colour)

Hence changes in colour, temperature, place, shape and size of the substances are considered as changes.

**Slow and Fast Changes**

**Activity 1**

Discuss in small groups about the time duration for the changes to take place.

<table>
<thead>
<tr>
<th>Changes</th>
<th>Duration (few hours/ days/ weeks/months/ years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth of a child</td>
<td></td>
</tr>
<tr>
<td>Rusting of iron</td>
<td></td>
</tr>
<tr>
<td>Germination of a seed</td>
<td></td>
</tr>
<tr>
<td>Cooking of food</td>
<td></td>
</tr>
<tr>
<td>Curdling of milk</td>
<td></td>
</tr>
</tbody>
</table>

My Inference: All changes take place in __________________________
(the same/different) time duration.

Changes that take place in a few hours, days, months or years are called slow changes.
Burning a piece of paper, firing crackers, glowing of an electric bulb take place in a few seconds or minutes. don’t they?

**The changes that take place in a short duration of time are called fast changes.**

**Activity 2**

List some examples for fast change and slow change

- Fast change __________________  ______________  ________________
- Slow change __________________  ______________  ________________

**Activity 3**

Take a piece of paper and make a model of rocket as shown in the picture. Shall we unfold it after playing? Can you get back the same piece of paper? What do you infer?

____________________________

**Let us know**

Trees which got buried under the earth nearly 30 crore years ago had undergone many changes and turned into coal.

**Reversible and Irreversible Changes**
Activity 4

Take a balloon and inflate it by blowing air. After sometime release the air from it. Does the balloon get back its original shape?

What do you infer? _______________________________

Inflate the same balloon and tie it using a thread. Pierce it with a pin. Can you inflate the balloon again?

What do you infer? _______________________________

Can we get back the green vegetables from the cooked ones? The batter from Idly or dosa? Raw rice from cooked rice?

Is it possible to get back the original substances in the above changes? _______. (Yes/No)

In some changes, the substance can be brought back to its original state. Such changes are called reversible change.

The change in which the substance cannot be converted back into its original form is called irreversible change.

Let us know

You would have seen some hard metals like gold, silver, and iron being used to make ornaments and instruments. In this process, metals are heated, melted and cast into desired shapes. On cooling they become hard. This is also a reversible change.

I have seen workers laying road using a black substance (Tar). Is melting of tar a reversible change? or an irreversible change?
Changes Around Us

SCIENCE

Desirable and Undesirable Changes:

Are all changes that take place around us useful? Look at the pictures and write whether the changes are useful to us or not.

<table>
<thead>
<tr>
<th>Reversible change</th>
<th>Irreversible change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melting of ice</td>
<td>1. Curdling of milk</td>
</tr>
<tr>
<td></td>
<td>2. Melting of ice</td>
</tr>
<tr>
<td></td>
<td>3. Burning of wood</td>
</tr>
<tr>
<td></td>
<td>4. Batter into Idly</td>
</tr>
<tr>
<td></td>
<td>5. Evaporation of water</td>
</tr>
<tr>
<td></td>
<td>6. Greying of hair</td>
</tr>
</tbody>
</table>

Shall we classify the following changes? Reversible Irreversible
1. Curdling of milk
2. Melting of ice
3. Burning of wood
4. Batter into Idly
5. Evaporation of water
6. Greying of hair

Changes like raining, ripening of fruits, blooming of flowers, etc. are useful to us. Such useful changes are called desirable changes. Changes like spoiling of food, eruption of volcano, rusting of iron, breaking of glass are not liked by us, as they are harmful and not useful to us. Changes which are not useful to us are called undesirable changes.
Periodic and Non-Periodic Changes

Look at the calendar (monthly) and complete the tabular column;

<table>
<thead>
<tr>
<th>Month</th>
<th>New Moon (Date /Day)</th>
<th>Full Moon (Date /Day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How many days are there between a new moon day and a full moon day? Do the new moon and full moon occur at regular intervals? We understand that the new moon and full moon occur at regular intervals. Hence the changes that occur at regular intervals are called periodic changes.

More examples for Periodic Changes

Pendulum of a clock

Phases of Moon

Day and Night
Look at the pictures given below.
Can you predict when will these changes happen?
Will they take place at regular intervals?

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Periodic changes</th>
<th>Non-periodic changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Occur at regular intervals.</td>
<td>Do not occur at regular intervals.</td>
</tr>
<tr>
<td>2.</td>
<td>Can be predicted e.g. weather.</td>
<td>Cannot be predicted e.g. earthquake.</td>
</tr>
</tbody>
</table>

Exothermic and Endothermic Changes
Do the following activities and record your inference in the table.

Activity 5
1. Take a small amount of detergent powder in your palm and add water to it. How do you feel?
2. Take a small amount of quicklime in a beaker and add water to it. Touch the beaker. How do you feel?
3. Take a small amount of glucose in a beaker and add water to it. Now touch the beaker. How do you feel?

4. Take a small amount of water in a beaker. Add Ammonium Chloride salt and stir it. Touch the beaker. How do you feel?

<table>
<thead>
<tr>
<th>Experiment No.</th>
<th>My inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
</tbody>
</table>

From the above activities we find that in some cases heat is liberated while in others heat is absorbed. Changes in which heat is liberated are called exothermic changes. E.g. burning of a matchstick, dissolution of detergent or washing soda in water.

Changes in which heat is absorbed are called endothermic changes. E.g. Dissolution of glucose or ammonium chloride in water.

An invention from Nature

We can create new things by closely observing the Nature.

Invention of Velcro by George Mestral in the year 1948 is a right example for this.

George Mestral used to go for a walk with his pet dog daily. One day he found that some seeds were hooked on his clothes and on the fur of his dog. He observed these seeds under a microscope and found some hooklike structures on them. Based on this he tried to create a new thing.

This led him to the invention of Velcro. It has tiny hooks which can attach to the objects. Today Velcro is widely used in bags, footwear and clothes.
### Activity 1

Using a thermometer measure the temperature of your classroom from morning till evening and record in the tabular column. Know the changes in temperature.

<table>
<thead>
<tr>
<th>Day</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Morning</td>
</tr>
<tr>
<td>Monday</td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td></td>
</tr>
</tbody>
</table>

### Activity 2

1. Mention the months during which we have summer season in our state.

2. During which months do we have winter season?

3. During which months do we have rainy season?

4. Do we get the above seasons during the same months every year?

5. Under what type of change do you classify these seasonal changes?

### Activity 3

Select two students from each class of your school and record their age, height, and weight. See the changes in their height, weight with the increase in their age.

### Activity 4

Have you seen potmaking? The potter is making the pot by heating wet clay. When can you get back the wet clay from the pot? (before heating / after heating) Discuss in small groups and find the changes that take place in this process.
Evaluation

I. Fill in the blanks and question marks:

Changes

Based on speed

Based on time interval

Based on use

Based on heat

On the basis of reversibility

Reversible Change

Desirable change

e.g._______

e.g._______

e.g._______

e.g._______

e.g._______

e.g._______

e.g._______

e.g._______

II. Choose the correct answer

1. Release of the compressed spring is ________
   a) an irreversible change   b) a reversible change
   c) a non-periodic change   d) an undesirable change

2. Spoilage of food is___________
   a) a reversible change   b) a fast change
   c) an undesirable change   d) a periodic change

3. Dissolution of washing soda in water is___________
   a) an exothermic change   b) an irreversible change
   c) an undesirable change   d) an endothermic change

4. Which of the following changes is non-periodic?
   a) heartbeat   b) earthquake
   c) occurrence of day and night   d) oscillation of pendulum
III. Identify the changes in the following
   a) Tsunami  
   b) Swinging  
   c) Occurrence of New Moon and Full Moon  
   d) Melting of wax

IV. Answer the following
   1. Give five examples for desirable and undesirable changes.
   2. What type of change is an earthquake? Why?
   3. What is meant by slow change?
   4. What is an irreversible change? Give example.
   5. Differentiate the following
      a. Exothermic and Endothermic change
      b. Periodic and Non-periodic change

V. Reason out the following questions
   1. You have broken your favourite toy. Can you mend it? What type of change does this belong to?
   2. Meena and Nisha were about to have their lunch in their school. Nisha was not able to eat her lunch as her food was stale and spoiled. So Meena shared her food with Nisha. In the above situation, what kind of change is spoilage of food?
   3. Mention any five changes that take place in your kitchen. Identify the kind of changes each belong to
      e.g. Preparation of chapathi - Slow change, desirable change, irreversible change.
   4. The pencil and eraser that you use become smaller in size after a few days. Why? What are the different types of changes that occur?
   5. Based on the changes differentiate a paper boat made by folding and a paper boat by cutting.

FURTHER REFERENCE

Webliography:

www.simplescience.net
http://www.learnnext.com/class6/science/changes-around-us.htm
Measurement

On a holiday Ezhil went to market with his father. First they went to a grocer’s shop. Ezhil’s father asked for the following.

- Rice - 10 kg
- Bengal gram - 500 gm
- Groundnut oil - 2 litres
- Ghee - 200 millilitres

The shopkeeper used a balance for measuring rice and bengal gram. He measured oil and ghee with a measuring jar.

They went to a flower shop and bought 5 cubits of garland. Then they went to a textile showroom and selected a shirt material and asked for 2 metres. The salesman measured 2 metres of the cloth with a metre scale and gave them.

Then, they went to a vegetable shop and asked for the following vegetables.

- Ladies’ finger - 1kg
- Green chillies - 100gm
- Onions - 2kg

The shopkeeper weighed the vegetables with the help of a balance.

After buying the vegetables they went to a fruit stall and asked for a dozen bananas. The shopkeeper counted and gave them 12 bananas. After getting them, they returned home.

Ezhil had a doubt and asked his father, “Whenever an item is bought why it is asked for in a different way?” His father said, “Go and prepare a list of the things that we bought and the instruments that were used to measure them. I will clear your doubts.” Ezhil got ready to prepare the list. Shall we also help him?
From the above activities, we have learnt that measuring instruments like metre scale, balance, clock, measuring jar, etc. are necessary for measuring different items.

**What is measurement?**

Now, shall we measure the length of our classroom cupboard using a metre scale? Have you measured the length? If it is 2 metres then 2 is the magnitude and metre is the unit of length. Metre is a known constant (accepted) quantity but the quantity 2 is to be determined. Here the length of the cupboard is two times length of 1 metre.

In the same way, can we measure the mass of your schoolbag using a balance? If it is 3 kilograms, here 3 is magnitude which has to be determined and kilogram is the unit of mass. Kilogram is a known constant quantity. That is, the mass of the bag is 3 times the mass of 1 kilogram.

Similarly, if it takes 20 minutes to reach your school from home, here 20 is the magnitude which has to be determined and minute is the unit of time. Minute is a known constant quantity. That is, the time to reach the school from home is 20 times the constant time unit 1 minute.

**Measurement** is a process of comparison of an unknown quantity with a standard (accepted) quantity of the same kind. The known constant quantity is called **Unit**. Here metre, kilogram and minute are units.
From the above activity we observe that though the same table is measured by different students, each student gets a different value. It is because the length of hand span differs from person to person. That is why there is a difference in the measurement of the length of garland in cubit by you and the shopkeeper.

Shall we individually measure the length of the same table by a metre scale? All of us get the same value. What do we infer from this?

Any measurement that gives the same value for all is called standard measurement. The units which are used in standard measurement are called standard units. Therefore, we infer that cubit, hand span, etc. are not standard units. Metre, kilogram and second are standard units. Now shall we learn about fundamental quantities?

**Fundamental quantities**

Length, Mass and Time are called fundamental quantities, because they cannot be expressed in terms of any other physical quantity. The units which are used to measure the fundamental quantities are called fundamental units.

**SI Units**

(System International Units)

In different parts of the world different systems of units for measuring length, mass and time were in use. A few systems of units are

1. **FPS system** (Foot, Pound, Second)
2. **CGS system** (Centimetre, Gram, Second)
3. **MKS system** (Metre, Kilogram, Second)

In order to overcome the difficulties of using different systems of units, an International system was adopted in
1960. This was accepted by scientists all over the world.

This system is called SI units. Shall we know the SI units of length, mass and time?

<table>
<thead>
<tr>
<th>Physical quantity</th>
<th>SI Unit</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>metre</td>
<td>m</td>
</tr>
<tr>
<td>Mass</td>
<td>kilogram</td>
<td>kg</td>
</tr>
<tr>
<td>Time</td>
<td>second</td>
<td>s</td>
</tr>
</tbody>
</table>

**Measurement of length**

Draw a straight line in your notebook. Plot two points A and B on the line.

Measure the distance between the two points using a scale. What you have measured now is length. The distance between two points is called length. The SI unit of length is metre. To measure length we use measuring tape, metre scale etc.

**Activity 4**

We shall measure the length of the following and write them with appropriate units.

- Length of your pencil
- Length of your thumb
- Length of your eraser
- Length of a leaf
- Length of your pen nib
- Length of the nail of your little finger

**Know yourself**

- Length of cloth required for stitching your shirt
- Distance between your home and school
- Distance of your neighbouring town from your home
- Distance between Chennai and New Delhi
Multiples and submultiples of length

In the above activity, larger distances such as the distance between two places are expressed in kilometre. This is called multiple of length. We express smaller lengths such as length of a pencil, pen nib etc. in centimetre and millimetre. These are called submultiples.

<table>
<thead>
<tr>
<th>Physical quantity</th>
<th>SI unit</th>
<th>Multiples</th>
<th>Submultiples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>metre</td>
<td>kilometre</td>
<td>millimetre, centimetre</td>
</tr>
</tbody>
</table>

Measurement of mass

**Activity 5**

Have you ever been to a market? How do the merchants measure rice, pulses, vegetables etc.? What instrument do they use to measure? In what units do they measure? Why do they not use the units millimetre and centimetre in measuring rice, pulses, vegetables etc.? Discuss with your friends and find out the answer.
From the above activity we have learnt that all quantities are not measured by the same unit. Different units are used for measuring different quantities.

**Activity 6**

Among the three, a handful of rice, a handful of sand and a handful of cotton, which one is the heaviest?

Sand is the heaviest because the amount of matter contained in sand is more than the amount of matter contained in rice and cotton.

**The mass of a body is the amount of matter contained in it.** The SI unit of mass is **kilogram**. We use beam balance, physical balance and electronic balance for measuring mass.

**Multiples and submultiples of mass**

We use units **quintal** and **metric tonne** to measure larger quantities of sugarcane bundles, cotton bales, etc. Similarly, we use units **gram** and **milligram** to measure smaller quantities of gold, silver, spices, etc. These are called multiples and submultiples of mass.

**Activity 7**

Carefully observe the wrapper of the following items and write down masses mentioned on it.

- Mass of toilet soap ________________
- Mass of a packet of tea ________________
- Mass of a biscuit packet ________________

**Know yourself**

The quantity of rice purchased per month at home ____________.
The quantity of vegetables used at home per day ____________.

<table>
<thead>
<tr>
<th>Physical quantity</th>
<th>SI unit</th>
<th>Multiples</th>
<th>Submultiples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>kilogram</td>
<td>quintal, metric tonne</td>
<td>gram, milligram</td>
</tr>
</tbody>
</table>
1 gram = 1000 milligrams
1 kilogram = 1000 grams
1 quintal = 100 kilograms
1 metric tonne = 1000 kilograms

Measurement of time

We perform many activities in our daily life and many events also take place but the duration of each event/activity differs from one another.

Activity 8

Look at the following activities. Discuss in small groups and tabulate the events/activities according to their duration.

1. Time taken for bathing
2. Duration of sleep
3. Working hours of your school
4. Time taken to blink your eyes
5. Time taken for ripening of fruits
6. Time taken for a plant to grow into a tree
7. Time taken for curdling of milk
8. Time taken to weave a saree
9. Time interval between a new moon and a full moon
10. Duration between sowing the paddy until harvesting
11. Duration between the first term and the second term examination
12. Time of fall of a coconut from the tree

| Events/activities occurring in seconds | Events/activities occurring in minutes | Events/activities occurring in hours | Events/activities occurring in days / months | Events/activities occurring in years |
From the above events / activities, we have learnt that we use different units for measuring time.

**Time is the interval between two events.** The SI unit of time is **second**.

For measuring time we use pendulum clock, wristwatch, wall clock, stop clock etc. In olden days people used sundial, sand clock, water clock etc. For measuring time accurately we use atomic clock.

**Multiples and submultiples of time**

Larger time intervals are expressed in **minute, hour, day, week, month, year** etc. These are called multiples of time. Any time interval less than 1 second is expressed in **millisecond, microsecond** etc. These are called submultiples of time.

<table>
<thead>
<tr>
<th>Physical quantity</th>
<th>SI unit</th>
<th>multiples</th>
<th>submultiples</th>
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<tbody>
<tr>
<td>Time</td>
<td>second</td>
<td>minute, hour, day, week, month, year</td>
<td>millisecond, microsecond</td>
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</table>

- 1 minute = 60 seconds
- 1 hour = 60 minutes
- 1 day = 24 hours
- 1 year = 365 1/4 days
- 1 second = 1000 milliseconds
- 1 second = 1000000 microseconds
Evaluation

I. Choose the correct answer.

1. SI unit of length is __________
   a) centimetre  b) millimetre  c) metre  d) kilometre

2. The symbol for SI unit of mass is __________
   a) g  b) kg  c) mg  d) cg

3. 1 metric tonne is equal to __________
   a) 1000 kilograms  b) 100 kilograms  c) 1 kilogram  d) 10 kilograms

4. SI unit of time is __________
   a) second  b) minute  c) week  d) day

5. 1 hour = ____________ seconds.
   a) 60  b) 3600  c) 24  d) 1000

II. Fill in the blanks.

1. One metre = ________ centimetre

2. One kilometre = ________ metre

3. One quintal = ________ kilogram

4. One minute = ________ second

III. Match the following with the correct units

1. Thickness of a five rupee coin - kilometre
2. Breadth of a classroom - centimetre
3. Distance between two places - millimetre
4. Height of your friend - metre

IV. Fill in the blanks with the correct answer.

1. The mass of gold is measured by the unit __________ (gram/metre)

2. Rice, sugar etc are measured by the unit __________ (milligram/kilogram)

3. Generally sugarcane is weighed by the unit __________ (tonne/gram)

4. The mass of the chemicals present in a tablet are expressed in the unit __________ (milligram/kilogram)

V. Arrange the following units in ascending order.

year, second, month, microsecond, hour, minute, week, millisecond.
VI.Find the answer

1) Ravi took 90 minutes to draw a picture. Kumar took 1 hour to draw the same picture. Who took more time to draw? How much more time did he take?

2) Thread and metre scale are provided to you, using them try to measure the length of the given curved line AB.

VII. Answer the following questions

1. Define measurement and unit.
2. What is the significance of standard units?
3. What are fundamental quantities? Why are they called so?
4. What are the SI units of length, mass, and time? Mention their symbols.
5. Expand the following
   (i) FPS   (ii) CGS   (iii) MKS   (iv) SI

   Project

1. Measure the length and breadth of your classroom and write them in foot, hand span, centimetre and metre.

2. Make a model of a sand clock using two ink bottles. With the model of the sand clock you have made,
   a) using a clock find the time taken for the sand to completely flow down.
   b) find your pulse rate with reference to your model.

Let us know

- The length of the largest sea animal, blue whale measures 30 metres approximately.
- Mass of the sun = $1.99 \times 10^{30}$ kilograms
- Mass of the earth = $5.98 \times 10^{24}$ kilograms
(mass of the sun is 3,20,000 times heavier than the earth)
Motion

We observe many objects in our daily life. Some of them move from one place to another and some of them remain stationary.

**Activity 1**

On your way to school, observe your surroundings and classify the objects under:

- **Objects in motion**
- **Objects at rest**

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From the above activity we have learnt that some objects move and some remain stationary.

Can we find out whether an object is at rest or in motion only by observing them directly?

**Activity 2**

Do the earth, air etc. move? If they move, how do we know it? We may get more information through a small group discussion.

From the above discussion, we can actually observe that some objects change their position with time. In some cases, though we can not see the objects change their position, we come to know their motion from the effects they make.

If an object does not change its position with respect to time, it is said to be stationary or at rest.

If the object changes its position with respect to time then it is said to be in motion. Hence motion is defined as the change of position of an object with respect to time.
Have you travelled in a bus? When you look out from a moving bus, do the trees, houses, lamp posts appear to be stationary or in motion? Share your experience in small groups.

Akiilan had two friends, Mugilan and Selvam. Akiilan invited his friends to his town for a circus show. The three friends went to the circus and enjoyed themselves. Akiilan returned home. His friends reached the bus terminus and got into a bus. The bus passed by Akiilan’s house. As Akiilan was in the sit-out, he waved to his friends.

The next day when Akiilan met his friends in school, he said, “When I was in the sit-out, I saw you in the moving bus”.

Mukilan and Selvam said, “Yes, we both saw you sitting and waving. From the moving bus both you and your house appeared to be moving backwards”.

What do we learn from this?

An object may appear to be stationary for one observer and appear to be moving for another. An object is at rest in relation to a certain set of objects and moving in relation to another set of objects. This implies that rest and motion are relative.

We have learnt about rest and motion. Now discuss in small groups and do this activity.
Activity 3

Are the following motions same or different type? Discuss in small groups and classify.

1. A sprinter running a 100 m race
2. A coconut falling from a tree
3. Marching of soldiers
4. The tip of hands of a clock
5. Movement of your hand when you write on a notebook
6. Revolution of the moon around the earth
7. The movement of a ball in a football match
8. Revolution of the earth around the sun
9. Children playing on a sliding board
10. Wagging tail of a dog
11. Children playing in a playground
12. Motion of flies and mosquitoes
13. Children playing in a swing
14. Flapping of elephant’s ears
15. Movement of people in a bazaar
16. Motion of people on a carnival day
17. Motion of a spinning top
18. Motion of opening and closing of a draw

From the above activity, we have come to know that there are different types of motion.

Types of motion

Linear motion

Did you observe the vehicle moving along a straight road and a coconut falling from a tree? What type of path did they take during their motion? Likewise, When an object moves along a straight line, it is said to be in
linear motion. Motion of a freely falling body and motion of a lift are examples for linear motion.

Circular motion

Take a stone, tie a thread to it and whirl it with your hand and observe the motion of the stone. The stone is moving along a circular path, isn’t it? In this motion we can see, in any point in the circular path the distance of the stone from the centre of the circle (hand) remains the same, doesn’t it?

Similarly, let us observe the motion of a child in the merry-go-round. Here also, the distance between the child and the centre of the merry-go-round remains the same at any point of the circular path.

From this, it is clear that if an object moves along a circular path, it is said to be in circular motion. Motion of the tip of hands of a clock and a point marked on the blade of the fan are some more examples for circular motion.

Rotational Motion

If a body revolves about an axis, it is said to be in rotational motion.

Eg. Spinning top
Motion of a fan
Motion of a merry-go-round
**Periodic motion**

If an object repeats the same type of motion at regular intervals of time it is said to be in periodic motion.

- Motion of a child in a swing.
- Motion of the pendulum in a wall clock.
- Motion of the string of veena while plucking.
- Motion of the moon revolving around the earth.
- Motion of the earth revolving around the sun.

**Random Motion**

When an object moves at different speeds and in different directions, it is said to be in random motion.

- Eg. A fish swimming in a tank.
- The movement of a football during a game.

**Multiple Motion**

Can a body perform more than one type of motion at a time? We ride a bicycle. What type of motion does the wheel perform? What type of forward motion does the cycle perform?

The motion of the wheels of a bicycle is rotational, whereas the motion of the bicycle is linear. The wheels of a bicycle perform rotational as well as linear motion simultaneously. Similarly, a rolling ball and a drilling machine perform more than one type of motion simultaneously.

Can you think of any other object performing more than one type of motion simultaneously? Explain.
Science Today

Robot

Issac Asimov invented robot. It is he who named the machine as robot (derived from Philippines language). Robot is a human machine. We programme (electronic signals) the robot to do the work we want it to do.

The machinery parts of robot follow and implement the commands already programmed. Robots are run by heavy batteries. Robot’s brain is nothing but an electronic chip. The movements of robot are controlled by electronic chip or computer. Nowadays well designed robots are used for complicated and minute clinical surgeries. Very soon we may have robots in our homes to do household work.

EVALUATION

I. Choose the correct answer.

1. Movement of a branch of a tree in air is an example for ________________
   a) Linear Motion     b) Circular Motion
   c) Periodic Motion   d) Rotational Motion

2. The motion of a rolling ball is ________________ motion
   a) Circular          b) Linear
   c) Rotational        d) Multiple

3. When a bicycle is in motion, the mouth which is used to fill the air will perform__________
   a) Random motion    b) Periodic motion
   c) Circular motion  d) All of these
II. Look at the pictures and answer the following.

1. From the given pictures, identify objects which are,
   In Motion 1.______________ 2.______________ 3.______________
   At Rest 1.______________ 2.______________ 3.______________

2. Classify the following pictures based on the kind of motion. Among them identify the pictures which work on more than one kind of motion.

III. Fill in the blanks.

   1. The movement of the needle in a sewing machine is _____________ (linear motion, random motion)
   2. The rotation of an object about an axis is _____________ (linear, rotational motion)
   3. Motion is defined as the change of _____________ of an object with respect to time. (position, mass)

IV. Give reasons for the following.

   1. Name the organ in your body which works in periodic motion.
   2. Is there any difference between a child who rides on a merry-go-round and a child who takes part in a 50m race?
3. Name the types of motion possessed by children playing in a playground. Give reasons.

4. What is the name of the instrument in the given picture? Specify its uses. What type of motion does it perform while in operation?

5. You are given a thread with a spherical bob attached to its one end. How many different kinds of motion could you demonstrate with this?

V. Answer the following.

1. When do you say that an object is in motion?
2. Distinguish between linear motion and circular motion.
3. What is rotational motion? Give example.
4. What is periodic motion? Give example.

**Do it yourself**

Spread a large sheet of white paper on the ground and keep a little sugar on it. Ants are likely to be attracted to the sugar and you will find many ants crawling on the sheet of paper soon. For any one ant, try and make a small mark with a pencil near its position when it has just crawled on to the sheet of paper. Keep marking its position often a few seconds as it moves along on the sheet of paper. After some time, shake the paper free of the sugar and the ants, and connect the different points you have marked with arrows to show the direction in which the ant was moving. Each point you have marked shows where the ant moved to, in intervals of a few seconds.

Motion seems to be some kind of a change in the position of an object with time, isn't it?

**FURTHER REFERENCE**

Webliography:


http://en.wikipedia.org/wiki/measurement

www.arvindguptatoys.com
MAGNETISM

You might have seen magnets. Have you ever enjoyed playing with them?

Because the magnets are attached to the pin-holder and the refrigerator.

Already we know that magnet attracts pins, iron pieces and iron particles in sand. Cranes are used to lift heavy iron loads. Powerful magnets are used in cranes.

Powerful electromagnets are used to operate electromagnetic trains, lifts and escalators.

Why do the pins stick to the pin holder placed on headmaster’s / headmistress’s table?

How magnets were discovered? It is an interesting story.

There was a region called Asia Minor, where there was a town called Magnesia. It was full of mountains, rocks and plateaus. The only occupation for the people was grazing the cattle. There was a shepherd named Magnes. In those days there was no school in the town. So he went along with others to graze the cattle.

Why does the door of the refrigerator get stuck automatically when it is very close to the refrigerator.
After leaving the cattle to graze in the plains, he used to sit and take rest on a big rock with his grazing stick. One day, as he was sitting on the rock he dozed off.

When he woke up, he found the iron-clad stick standing erect without any support. His nail-studded shoes were sticking to the rock. Magnes thought that the rock was God. The whole town looked at this scene with wonder.

The people witnessed that the rock attracted not only his stick but also their iron-clad sticks. People came to know that there were many rocks with attracting property in several regions of the world. Even before that the Chinese made compass for their navigators by using these rocks with attractive property. As it was discovered by Magnes, they called it Magnet and also Magnetite. Magnetite was the ore with attracting property found in that region.

Magnetites are natural magnets. They are called magnetic stones.

Natural magnets do not have a definite shape. When a magnet is freely suspended, it always comes to rest in north-south direction. That is why they are called leading stones or lode stones.
After learning the method of changing the piece of iron into magnet (magnetization) we have been making and using several kinds of magnet. Such man-made magnets are called artificial magnets. Here some of the shapes of artificial magnets that we use in our daily life.

What type of substances are attracted by magnets?

Shall we find out whether pen cap, plain pins, pencil, blade, nail, chalk piece, iron ball, plastic scale, wooden scale and coin are attracted by magnet or not? Shall we discuss in small groups and list them?

<table>
<thead>
<tr>
<th>Substances attracted by magnets</th>
<th>Substances not attracted by magnets</th>
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We understand that magnet attracts certain substances and do not attract some other substances.

Substances that are attracted by magnet are called magnetic substances.

Iron, cobalt, nickel are magnetic substances.

Substances that do not get attracted by magnet are called non-magnetic substances.

Paper, plastic are called non-magnetic substances.

Does magnet have poles?

Of course, it is an interesting question. It is better to find it out by ourselves. To perform a simple experiment, it is sufficient to have iron filings and a magnet.

When some iron filings are spread on a sheet of paper and a bar magnet is placed over it, all the filings do not stick to the bar magnet uniformly, but we find more iron filings sticking to both ends of the magnet. Likewise,
more iron filings will stick to both ends of a horseshoe magnet.

The ends of a magnet have the strongest magnetic force. So most of the iron filings cling to the ends of the magnet. They are called poles of the magnet.

**Which is north pole? Which is south pole?**

The poles of a magnet are easily found by freely suspending the magnet as shown in the diagram.

A freely suspended magnet always comes to rest in north-south direction.

North seeking pole is called north pole. South seeking pole is called south pole.

The Magnetic compass has been designed by using this directive property of the magnet.

**A magnetic compass is a circular disc on which a small needle is pivoted at its centre. Different directions (North, South, East, and west) are marked on the compass. This needle can rotate freely and always point in the north-south direction.**

The magnetic needle always rests in north-south direction. By using this magnetic compass we can find out different directions.

**Shall we make our own magnet?**

There are several methods of making artificial magnets. Let us learn the simplest one.

Take a nail / a piece of Iron and place it on a table.

Now take a bar magnet and place one of its poles near one edge of the nail / piece of Iron and rub from one end to another end without changing the direction of the pole of the magnet.

Repeat the process for 30 to 40 times.
Shall we find out what happens when two magnets are brought closer? It is very easy to understand this.

Attraction? or repulsion?

When we bring two north poles of two bar magnets closer as shown in the figure they move away from each other. Similarly when the south poles of two bar magnets are brought closer they too move away from each other.

When a north pole of one magnet and a south pole of another magnet are brought closer, they pull towards each other.

Like poles repel each other.

Unlike poles attract each other.

Do magnets lose their properties? When?

Magnets lose their properties if they are heated or dropped from a height or hit with a hammer.

When heated

When dropped
Storage of magnets

Improper storage can also cause magnets to lose their properties. To keep them safe, bar magnets should be kept in pairs with their unlike poles on the same side. They must be separated by a piece of wood and two pieces of soft iron should be placed across their ends.

For a horse-shoe magnet a single piece of soft iron can be used as a magnetic keeper across the poles.

Let us know

Magnets lose their properties if we keep it near the cassettes, mobiles, televisions, compact disks and the computer. These materials may also get damaged.

Fact File
1. Electromagnets are used in giant wheels.
2. In 1600, English scientist William Gilbert proposed that earth behaves like a giant magnet.
Science today

Shall we learn about electromagnetic train?

Electromagnetic train is also called as suspension train. In France, it is called flying train. It does not require diesel or petrol.

The technology in which the property of magnetic attraction and repulsion used gave birth to super fast electromagnetic trains.

How does the electromagnetic train work?

Electromagnetic trains do not have wheels. Powerful electromagnets are attached to the bottom of the train as well as on the track. The north pole of the electromagnet on the track faces upwards and the north pole of the electromagnet on the train faces downwards. The north pole in the track repels the north pole on the train and levitates the train. The electric current that changes constantly allows a change in polarity of electromagnets. This change in polarity pushes and pulls the train.

Electromagnetic train runs faster than ordinary train. Another significance of electromagnetic train is that it does not make a noise. We can see electromagnetic train in Japan, China, France, Germany and America.

Write any 5 differences between a train and an electromagnetic train. (First difference is given)

1. Electromagnetic trains do not have wheels, whereas ordinary trains have.

2. ____________________________

3. ____________________________

4. ____________________________

5. ____________________________
Evaluation

I. Choose the correct answer

1. It is a natural magnet
   a) Bar magnet  b) Magnetite  
   c) Ring magnet  d) Horse-shoe magnet  

2. An object that is attracted by magnet.
   a) wooden piece  b) plain pins  
   c) eraser  d) a piece of paper  

3. The people who made mariner’s compass for the first time.
   a) Indians  b) Europeans  
   c) Chinese  d) Egyptians  

4. A freely suspended magnet always comes to rest in the _____________ direction
   a) North - east  b) South - west  
   c) East - west  d) North - south  

5. Magnets lose their properties when they are
   a) used  b) stored  
   c) hit with a hammer  d) cleaned  

6. Mariner’s compass is used to find the
   a) speed  b) displacement  
   c) direction  d) motion  

II. Circle the odd ones and give reasons.

1. Bar magnet, magnetite, ring magnet, horse- shoe magnet  
2. Iron nail, pins, rubber tube, needle  
3. Lift, escalator, electromagnetic train, electric bulb  
4. Attraction, repulsion, pointing direction, illumination  

III. Think and answer

1. You are provided with a bar magnet without labelling the poles of the magnet and iron filings. Using this.
   a) How will you identify the poles of the magnet?  
   b) Which part of the bar magnet attracts more iron filings? Why?  

2. You are provided with an iron needle. How will you magnetize it?
3. Two bar magnets are given in the figure A and B. By the property of attraction, identify the North pole and the South pole in the bar magnet (B).

![Diagram of bar magnets A and B with North and South poles indicated]

4. Take a glass of water with a few pins inside. How will you take out the pins without dipping your hands into water?

IV. Answer the following

1. What are artificial magnets? Draw some artificial magnets and name them and label the poles.
2. Explain the attraction and repulsion between magnetic poles.
3. Write the properties of magnets that you know.
4. When does a magnet lose its magnetic property?

V. Write down the names of substances.

Let us think over

With the help of your teacher find the direction in which the flagpole, principal's room, laboratory and playground are located in your school.

FURTHER REFERENCE

Webliography:

http://www.school-for-champions.com/science/magnetism.htm
http://en.wikipedia.org/wiki/magnetite
‘I can, I did’
Student’s Activity Record

Subject:

<table>
<thead>
<tr>
<th>Sl. No</th>
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SCIENCE
Standard Six
Term II
Note to the teacher…

As we present this revised edition of the Science Textbook, we would like to express our deepest gratitude to the learners and the teaching community for their enthusiastic responses.

In science some concepts could be subject to change from time to time as new theories and principles are constantly being evolved.

We have tried to present facts and concepts of science (both concrete and abstract) in a visually appealing manner without detracting from the content.

Activity based learning is now accepted as the basis of science education. These activities should be regarded as a means for open-ended investigation rather than for verification of principles/content given in the textbook are has been designed to facilitate low cost activities and experiments using locally available materials. With a view to streamlining the activities, we have now segregated them into three groups:

- **I Do** - activities to be done by an individual learner.
- **We Do** - activities to be done by a group of learners.
- **We Observe** - activities to be demonstrated by the teacher.

The third group of activities have a higher degree of difficulty or require careful handling as it may involve dealing with chemicals, electricity etc..

The “More to know” snippets in the text represents some unusual and interesting facts or information in which the students need not be examined.

The evaluation section is nothing but another space for learning in a different manner. As the focus is on understanding, rote learning is to be discouraged thoroughly. Application of learnt ideas, problem solving skills and critical thinking is to be encouraged. There could be scope for more than one answer to a question, which should be acknowledged always.

To facilitate further reference, books and websites have been suggested at the end of each lesson. Suggestions and constructive criticism are most welcome. Valuable suggestions will be duly incorporated.

- Authors

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What is a building made up of? What is our human body made up of?

Just as a building that is made up of many bricks, the human body is also made up of several small units called cells. The Cell is the basic structural and functional unit of all living organisms.

Can you see a cell with your naked eye? No, cells are very minute and cannot be seen with our naked eyes. They can be observed only through a scientific instrument called 'microscope'.

Do you know who saw the cell first? It was Robert Hooke, an optic seller. In those days, glass bottles were closed with lids made of cork. He cut thin sections of the cork and observed them through his hand-made lens and saw many small identical hexagonal chambers. Robert Hooke named these chambers 'cells' in 1665. In Latin, the word 'cellula' means "a small chamber". He became a famous scientist by showing the cell magic through his lens.

When we observe the cells of an onion peel and the bricks on the wall, we will find that they are similar in structure.

Not only human beings, but other organisms like plants and animals are also composed of cells.
Can we see the inner parts of a cell?

The same question arose in the minds of Robert Hooke and the biologist Robert Brown. Robert Brown was a school teacher and he was studying the structure of a cell. He invented an advanced microscope with a higher degree of magnification through which very small objects could be viewed with greater clarity. With the help of that microscope, he examined the cell and found that there is a different world within a cell.

The cell is like a small factory with nearly twelve to thirteen cell organelles, which are involved in various specified tasks.

Classification of Cells:

The cells of plants and animals are not similar. Bacteria and some algae are made up of a single cell. They lack membrane-bound organelles.

A cell that does not contain membrane-bound organelles and a well-defined nucleus is called a Prokaryotic cell i.e. a simple cell. e.g. Bacteria.

A cell that contains a well-defined nucleus, a nuclear membrane, and membrane-bound cell organelles is called a Eukaryotic cell, i.e. a complete cell. e.g. cells of plants and animals.

The plant and animal cells are not alike. They vary in their size and structure according to their functions, but both the cells are similar in their basic organisation.

Now, let us observe an animal cell.
Each cell is a small factory by itself. Let us learn the specific function of each component of an animal cell.

Shall we enter a busy cell factory and explore it?

I hear someone calling me........

**Plasma membrane:**

"Hi! The Animal Cell welcomes you. I am the plasma membrane, enveloping the cell. I give shape to the cell. I act as a guard. I control the entry and exit of materials. Come on my friends, come and introduce yourselves."

"Please come inside. The Protoplasm is waiting for you."

**Protoplasm:**

"I am a colloid, found inside the plasma membrane. I have two components of the cell namely the cytoplasm and the nucleus. My name is protoplasm."

J.E. Purkinjee coined the term protoplasm. 'Proto' means 'first' and 'plasma' means 'colloid'.

**Cytoplasm:**

"Hello! I am cytoplasm. I am located in between the plasma membrane and the nucleus. I am made up of carbohydrates and proteins. Organelles and lipid droplets are present in me.

**Nucleus:**

"I am the control centre of the cell, but I need not be present at the centre. I am known as the nucleus. I am spherical in shape. I have the nucleoplasm, the nucleolus and the chromatin reticulum. I am enclosed by the nuclear membrane. I carry the genetic characters from generation to generation."
Mitochondria-(singular-Mitochondrion)

"We are involved in cell respiration. We help in the oxidation of food materials that you eat and provide energy. We do not rest. We are also known as the Powerhouses of the cell."

Golgi bodies:

"Hi, come on! We are tubular structures, involved in the secretion of digestive enzymes and the formation of lysosomes. We separate proteins from the ingested food and give strength to the cells and the body. In plant cells, we are known as Dictyosomes."

Endoplasmic reticulum:

"Hello! I am the endoplasmic reticulum. I help in transportation of materials from one part of the cell to another."

Ribosomes:

"Please come. Take a look at us! We are granular structures. We are called the Protein factories of the cell. We help in protein synthesis."
Lysosomes:

"Are you interested in knowing about us? We are spherical yellow coloured bodies. We help in cell protection. We destroy the pathogens that enter the cell. We are called the Suicidal bags of the cell. In addition to this, we help in cell digestion."

Vacuoles:

"Wait! please don't avoid us. We are vacuoles. We are light blue in colour and appear like bubbles. We store cell sap. We maintain intracellular pressure. Oh! this work is very difficult."

Did you meet all the workers in the animal cell factory? Now, let us learn about the plant cell.

Plant cell:

Have you ever wondered about the different features of a plant cell? Let us examine a plant cell and see how it differs from an animal cell. We see that:

Structure of a plant cell

- Cell wall
- Chloroplast
- Plasma membrane
- Lysosome
- Vacuole
- Nucleus
- Ribosome
- Mitochondrion
- Endoplasmic reticulum
- Centrosome
The centrosome is absent in the plant cell.

Plants are more rigid than animals due to the presence of the cell wall.

They have plastids.

They have larger vacuoles.

**Cell wall:**

It is an outer layer, which gives shape to the cell. It is made up of cellulose. Its function is to protect the inner organelles and to give shape to the cell.

**Plastids:**

These organelles are found only in plant cells. They contain pigments. Based on the pigments, they are classified into three types.

<table>
<thead>
<tr>
<th>Type</th>
<th>Pigment</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloroplast</td>
<td>Chlorophyll - green pigment</td>
<td>gives green colour to the stem and leaves</td>
</tr>
<tr>
<td>Chromoplast</td>
<td>Carotene - orange pigment, Xanthophyll - yellow pigment</td>
<td>gives colour to flowers and fruits</td>
</tr>
<tr>
<td>Leucoplast</td>
<td>No pigments - colourless</td>
<td>found in roots and underground stems</td>
</tr>
</tbody>
</table>

**Activity 3**

*We divide ourselves as various components of the cell factory and enact their functions.*

Let us now list the differences between a plant cell and an animal cell.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Plant cell</th>
<th>Animal Cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Presence of cell wall</td>
<td>Absence of cell wall</td>
</tr>
<tr>
<td>2.</td>
<td>Presence of plastids</td>
<td>Absence of plastids</td>
</tr>
<tr>
<td>3.</td>
<td>Centrosome is absent</td>
<td>Centrosome is present</td>
</tr>
<tr>
<td>4.</td>
<td>Vacuoles are large in size</td>
<td>Vacuoles are small in size</td>
</tr>
</tbody>
</table>

All activities like eating, drinking, jumping, playing, breathing, thinking and even sleeping are due to the functioning of the cells. Each cell is a small factory. The brain has several million cells.

When the cells, the so called small factories get affected and injured, diseases are caused and we visit a doctor.

*E.g.* cancer, hereditary diseases, diabetes, etc.
### Activity 4

**Making a cell model**

We shall divide ourselves into groups and make the structure of a plant cell using easily available materials. We shall build the model of a cell and learn about cell organelles.

**Materials required:**

A thick cardboard from any old notebook, a white sheet of paper, paste, broomsticks, colour thread, sand, broken pieces of bangle, bindhi, groundnut shells, green gram, cowpeas, broken chickpeas, pepper, peas, mustard, cardamom, colour papers.

**Method we follow:**

- We take a thick cardboard and paste a white sheet of paper over it.
- We draw the outline of the plant cell (from the textbook) on the white sheet.
- We draw the nucleus at the centre of the plant cell.
- We make the organelles by pasting the materials as listed in the given table.

We label the parts one below the other, by sticking black threads.

**We have learnt**

The structure of a plant cell and the difference between a plant cell and an animal cell.

<table>
<thead>
<tr>
<th>Organelles</th>
<th>Materials we use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nucleolus</td>
<td>bindhi</td>
</tr>
<tr>
<td>Chromatin reticulum</td>
<td>colour thread</td>
</tr>
<tr>
<td>Nuclear membrane</td>
<td>bangle pieces</td>
</tr>
<tr>
<td>Cytoplasm</td>
<td>paste, sand</td>
</tr>
<tr>
<td>Endoplasmic reticulum</td>
<td>colour thread</td>
</tr>
<tr>
<td>Ribosome</td>
<td>mustard</td>
</tr>
<tr>
<td>Lysosome</td>
<td>broken chickpeas</td>
</tr>
<tr>
<td>Golgi bodies (dictyosomes)</td>
<td>bangle pieces, pepper</td>
</tr>
<tr>
<td>Mitochondria</td>
<td>groundnut shells</td>
</tr>
<tr>
<td>Plastids</td>
<td>green gram/peas/cardamom</td>
</tr>
<tr>
<td>Vacuoles</td>
<td>bits of paper</td>
</tr>
<tr>
<td>Plasma membrane</td>
<td>thread</td>
</tr>
<tr>
<td>Cell wall</td>
<td>broomstick</td>
</tr>
</tbody>
</table>

### Facts at a glance

1. There are about 6,50,00,000 cells in the human body.
2. Bones are made up of a special type of dry cells.
3. Anton Van Leeuwenhoek (1675) discovered that blood contains RBC (Red Blood Cells).
4. In animals, the nerve cell is the longest cell.
5. In animals, the bone cell is the toughest cell.
Having learnt the various components of the cell, shall we now learn their functions too?

**Cell organelles and their functions**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Cell components</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Plasma membrane</td>
<td>• It gives shape to the cell.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• It selects the substances required by the cell and transports them in and out.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• It controls the movements of substances in and out of the cell.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• It protects the cell.</td>
</tr>
<tr>
<td>2.</td>
<td>Cytoplasm</td>
<td>• It distributes the nutrients within the cell.</td>
</tr>
<tr>
<td>3.</td>
<td>Nucleus</td>
<td>• It controls all the activities of the cell.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• It carries the hereditary characters from one generation to another.</td>
</tr>
<tr>
<td>4.</td>
<td>Mitochondria</td>
<td>• They provide energy to the cell.</td>
</tr>
<tr>
<td>5.</td>
<td>Golgi bodies</td>
<td>• They secrete enzymes and hormones.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• They store protein.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• They help in the formation of Lysosome.</td>
</tr>
<tr>
<td>6.</td>
<td>Endoplasmic reticulum</td>
<td>• It helps in transportation within the cell.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• It helps in protein synthesis.</td>
</tr>
<tr>
<td>7.</td>
<td>Ribosomes</td>
<td>• They synthesize protein.</td>
</tr>
<tr>
<td>8.</td>
<td>Lysosome</td>
<td>• It destroys the germs that enter the cell.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• It helps in intracellular and extracellular digestion.</td>
</tr>
<tr>
<td>9.</td>
<td>Centrosome</td>
<td>• It helps in cell division.</td>
</tr>
<tr>
<td>10.</td>
<td>Vacuoles</td>
<td>• They control intracellular pressure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• They store cell sap.</td>
</tr>
<tr>
<td>11.</td>
<td>Plastids</td>
<td>• They help in photosynthesis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• They give colour to flowers and fruits.</td>
</tr>
<tr>
<td>12.</td>
<td>Cell wall</td>
<td>• It gives shape and protection to the plant cell.</td>
</tr>
</tbody>
</table>
EVALUATION

I. Choose the correct answer:

1. The structural and functional unit of the living organism is ________.
   a) nucleus       b) cell                c) mitochondria   d) ribosome

2. The instrument used to magnify things placed on a slide is ________.
   a) telescope       b) microscope   c) binocular        d) periscope

3. Select the prokaryotic cell from the given cells.

(a) (b) (c) (d)

4. The ________ is the powerhouse of the cell.
   a) mitochondria     b) ribosome       c) lysosome   d) nucleus

5. The organelle which is known as ‘suicidal bag’ is the ________.
   a) dictyosome       b) ribosome       c) centrosome   d) lysosome

6. The spherical organelle which controls the activities of the cell is ________.
   a) golgi bodies          b) ribosome       c) nucleus   d) lysosome

7. The organelle that involves in destroying the germs which enters the cell is ________.
   a) dictyosome       b) ribosome       c) centrosome   d) lysosome

8. The organelle which is found only in the animal cell is ________.
   a) mitochondria     b) centrosome   c) plasma membrane d) chloroplast

9. The cell of a /an ________ contains a large vacuole.
   a) onion peel       b) bacteria       c) nerve       d) muscle

10. The longest cell is the ________.
    a) bone cell       b) nerve cell  c) cell of a muscle   d) blood cell

II. Who am I?

1. I'm a tiny organelle. Cell respiration occurs in me. I'm also called the 'Powerhouse of the cell'. Who am I?
2. I help in Photosynthesis. I am found only in plants. Who am I?
3. I give shape and protection to plants. I'm made up of cellulose. I'm found only in plants. Who am I?
4. I help in cell division. I'm seen only in the animal cell. Who am I?
5. I'm a colloid, found in between the plasma membrane and the nucleus. I distribute the nutrients within the cell. Who am I?

III. Pick the odd one out:
1. nucleus, nucleolus, chromatin reticulum, plasma membrane
2. Robert Hooke, Anton Van Leeuwenhoek, Schleiden and Schwann, Newton
3. lysosome, centrosome, ribosome, chromosome
4. cell wall, chloroplast, large vacuole, centrosome

IV. Match:

<table>
<thead>
<tr>
<th>Cell Organelles</th>
<th>Other names</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitochondria</td>
<td>“Suicidal bag”</td>
<td>protein synthesis</td>
</tr>
<tr>
<td>Ribosome</td>
<td>“Powerhouse of the cell”</td>
<td>transfer of hereditary characters</td>
</tr>
<tr>
<td>Lysosome</td>
<td>“Control centre of the cell”</td>
<td>production of energy</td>
</tr>
<tr>
<td>Nucleus</td>
<td>“Protein factory of the cell”</td>
<td>cell destruction</td>
</tr>
</tbody>
</table>

V. Draw and label:
1. Nucleus (nuclear membrane, chromatin reticulum, nuclear sap, nucleolus)
2. Mitochondria (outer membrane, cristae, inner membrane)

VI. Draw the following diagram of the animal cell and label the parts:
VII. Answer the following questions based on the given diagram:

1. Name this organelle.
2. How is this organelle known in a plant cell?
3. What is the function of this organelle?

VIII. Explore and answer:

1. The leaves appear green due to the presence of a green pigment called chlorophyll. A ripened mango appears yellow. Give reason.
2. Nucleus is known as the ‘control centre of the cell’. Give reason.

IX. Fill in the empty bubbles:

FURTHER REFERENCE

Webliography:

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www.teacher vision.fen.com
www.diffen .com
www.wiki.answers.com
Ibrahim loves science and participates in all science competitions. Last week, he won the first prize at the Science Talent Search Competition. Ibrahim found the competition interesting and challenging. Each participant was provided with (i) an empty bucket (ii) a bucket full of water (iii) a bag of sand (iv) gravel (v) a sieve.

The contestants were asked to fill the empty bucket with the given water, sand and gravel. They should use up the entire material. The participant who filled the bucket without the water overflowing was declared the winner.

Some of them first poured water into the empty bucket and then added the gravel. Immediately the water overflowed.

Some put the sand in the bucket first and then poured the water on it. The bucket became full and the gravel could not be added.

Are you eager to know what Ibrahim did?

First, he put the gravel in the empty bucket. Then he put the sand gently over it and poured the water slowly over it. The bucket became full but did not overflow. He used his knowledge of science to fill the bucket with the materials given.

Then, Ibrahim was asked to separate the mixture. How did he do that? First he drained out the water slowly from the bucket. Then he spread the wet sand and gravel mixture on a newspaper and dried it. Next he poured the mixture of gravel and sand in the sieve. The sand fell through and the gravel remained on the mesh. Thus he separated all the three components.

Discuss and give reasons why the others lost to Ibrahim

In the above competition, Ibrahim used methods of separation like decantation and filtration.

We drink water after it is boiled and filtered. We know that before cooking, rice is rinsed in water. While preparing tea, we separate tea leaves by filtration. We purify rava and wheat flour by sieving. We clean rice and pulses by winnowing.

What do we understand from this?

We need to use various methods of separation:
- to remove unwanted substances
- to remove substances which are harmful to our body
- to obtain the substances which are useful to us in a pure state.
Let us learn about the different methods of separation we adopt in our daily life.

**Methods used to separate mixture of solids:**

Solid mixtures can be separated using methods like hand picking, winnowing, sieving and magnetic separation.

**Hand picking**

How do we separate vegetables at home? We separate them into their kinds like tomatoes, chillies etc. by using our hands. Separation is easy as they differ in size, colour and shape.

The method of separating the substances based on size, colour and shape using hands is called hand picking.

1. Which method does the woman in the picture follow to separate the substances?

2. Mention some substances that can be separated by this method.

Lighter particles present in a mixture can be separated by winnowing.

**Winnowing**

Farmers allow the mixture of grain and husk to fall from a height. Grains, being heavier fall down and form a heap. Husk, being lighter is carried away by wind and forms a separate heap.

The method of separating lighter particles from heavier particles with the help of wind is called winnowing.
Sieving:
We can separate the impurities like bran, husk, stone, worms, stalk and tiny insects from flour by sieving. It allows the fine particles to pass through the pores, while the coarser particles remain in the sieve.

Magnetic separation:
Insert a magnet into a heap of sand and take it out. If iron particles are present in the heap of sand, we can see them clinging to the ends of the magnet.

Magnetic separation is used to separate mixtures containing components, which are attracted by a magnet.

Can we separate iron substances from water, using a magnet?

Components of a mixture can be separated by the method of sieving only when they differ in their size.

At construction sites, you would have seen the separation process of pebbles and stones from sand. It is done by sieving using a sieve.

Activity 1

I need: Beaker, water, bell pins and a magnet

I take a beaker and fill half of it with water.

I drop some pins into it.

I hold a magnet over the surface of water or by the side of the beaker.

My inference:

______________________________
______________________________
______________________________
______________________________
Shall we complete the table?

<table>
<thead>
<tr>
<th>Mixture</th>
<th>Method of separation</th>
<th>Physical state of the components (Solid, Liquid, Gas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddy and chaff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ragi and pulses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand and stones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rava and iron particles</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Methods of separation of insoluble solids from liquids

Can we separate a mixture of sand and water by using methods like hand picking, sieving, winnowing or by magnetic separation? No, we cannot separate them. Why? It is because water is in liquid state and the methods used to separate solid mixtures cannot be used here. The method of separation depends on the nature of the substances to be separated.

Hence, we can separate insoluble solids from liquids by using the method of sedimentation, decantation and filtration.

Sedimentation

The mixture of insoluble solids and liquid is taken in a beaker and the solid substances are allowed to settle down as sediments. This is known as sedimentation. The clear liquid above the sediment is called supernatant liquid.

* e.g. a mixture of sand and water

Decantation

Transferring the clear liquid (supernatant liquid) into another container using a glass rod is called decantation.

Filtration

Observe the liquid obtained by decantation and see whether it contains suspended impurities. Try to filter the impurities using a clean cotton cloth. As there are tiny pores in the cloth (like the pores in a sieve), the clear water passes through the pores and the suspended impurities like sand...
remain on the cloth. In the laboratory, we use a filter paper instead of a cloth to purify water. There are tiny pores in the filter paper also.

Let us filter the mixture in the laboratory using a filter paper.

Take a filter paper and fold it like a cone. Fix it inside a glass funnel. Fix the funnel on a stand and place a beaker below it. Pour the impure liquid containing suspended impurities into the funnel. The liquid drains through pores of the filter paper. The clear liquid that is collected in the beaker is known as filtrate. The dust particles that remain on the filter paper is called "residue".

Methods of separation of solid substances dissolved in liquids

Evaporation and condensation processes are used to separate solid substances dissolved in liquids.

Activity 2 We Observe

Take a small amount of salt solution in a beaker and place it over a wire gauze on a tripod stand. Heat the solution well. After complete evaporation of water, see what is left in the beaker.

Our observation and inference:

______________________________
______________________________

Evaporation

We have separated salt from water by evaporation method.

Evaporation is a process in which a liquid changes into vapour on heating. Evaporation method is used to separate dissolved solids from liquids.

Do you know?

One litre of sea water contains about 3.5 grams of salt. Sea water not only contains common salt but also more than 50 other mineral salts. These salts are industrially important.
Condensation

Take a mixture of sand and salt in a beaker. Add water to this mixture and stir. The salt gets dissolved. How can we separate the components from this mixture?

Filter this solution using a filter paper. The sand can be separated from the salt solution by filtration.

I should get both salt and water back. What shall I do for this?

Set up the apparatus as shown in the picture. Take the salt solution in a conical flask and heat it strongly. The water vapours pass through the delivery tube and get collected in a test tube. The test tube is placed inside a pack of ice cubes. The water vapours get cooled and condense into water. The salt remains as residue in the conical flask, once all the water gets evaporated. When the vapours of a substance get cooled, they condense into liquid. This process is known as condensation.

Need for applying more than one method of separation

The various substances that we use in our daily life, reach our hands only after undergoing different methods of separation and purification.

For example, in the preparation of sugar from sugarcane juice, the methods of separation like filtration, evaporation and crystallization are used. More than one method of separation are used to extract metals like iron, gold, aluminium and copper in pure state, from their ores.

Shall we complete the table?

<table>
<thead>
<tr>
<th>Mixture</th>
<th>Method of separation</th>
<th>Physical state of the components (Solid, Liquid, Gas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>sand and water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rava and water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>salt and water</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Do you know?

Evaporation and Condensation are the basic processes involved in the water cycle. Formation of rain involves these two reverse processes.
We are going to separate iron filings, salt and chalk powder from the given mixture.

We need: bar magnet, beaker, water, filter paper, funnel, tripod stand, glass rod, watch glass, matchbox, wire gauze, bunsen burner.

**Activity 3**

<table>
<thead>
<tr>
<th>We Do</th>
</tr>
</thead>
<tbody>
<tr>
<td>We are going to separate iron filings, salt and chalk powder from the</td>
</tr>
<tr>
<td>given mixture.</td>
</tr>
</tbody>
</table>

1. **We take the mixture in a watch glass and stir it using a bar magnet.**

<table>
<thead>
<tr>
<th>Our observation</th>
<th>Substance separated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. **We take the remaining portion of the mixture containing salt and chalk powder in a beaker. Then we add water and stir it well using a glass rod. We allow the liquid to remain undisturbed.**

<table>
<thead>
<tr>
<th>Our observation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

3. **We fold the filter paper into a cone and keep it inside a funnel.**
4. **We keep the funnel on a tripod stand and place a beaker below it.**
5. **We transfer the liquid mixture slowly into the funnel using a glass rod.**

<table>
<thead>
<tr>
<th>Our observation</th>
<th>Substance separated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. **We take the beaker containing salt water and place it over a wire gauze on a tripod stand. We heat the solution strongly using a bunsen burner.**

<table>
<thead>
<tr>
<th>Our observation</th>
<th>Substance separated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I. Choose the correct answer:

1. A suitable method to separate lighter impurities from a mixture is _____.
   a) winnowing  
   b) hand picking  
   c) evaporation  
   d) magnetic separation

2. In a mixture, solids of different sizes can be separated by _____.
   a) magnetic separation  
   b) winnowing  
   c) sieving  
   d) evaporation

3. The method used to separate seeds from fruit juice is _____.
   a) filtration  
   b) sieving  
   c) crystallization  
   d) winnowing

4. Separation of common salt from the sea water is done by _____.
   a) sieving  
   b) evaporation  
   c) magnetic separation  
   d) winnowing

5. The method used to separate substances that differ in colour, size and shape from a solid mixture is _____.
   a) magnetic separation  
   b) decantation  
   c) hand picking  
   d) sieving

II. Encircle the odd one and give reason:

1. hand picking, evaporation, winnowing, sieving
2. filtration, sedimentation, decantation, condensation

Our inference:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Separated substance</th>
<th>Method used for separation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Facts at a glance:

1. Crude oil is a mixture from which nearly eighty six substances like petrol, kerosene and naphtha are obtained.
2. Air is a mixture of gases.
3. evaporation, magnetic separation, condensation, crystallization
4. filter paper, sieve, funnel, glass rod

III. Replace the underlined in the following statements with suitable methods of separation:

a) We can segregate different kinds of vegetables by winnowing.

b) Lighter particles present in a mixture can be separated by magnetic separation.

c) The method of converting liquid into vapour by heating is known as condensation.

d) Sieving method is used to remove a magnetic substance from a mixture.

IV. Draw and label the apparatus used in the laboratory for the process of filtration.

V. Explore and answer:

1. Amudha’s family gets water from the nearby pond which is turbid in nature. Suggest certain methods to purify and convert this water into safe drinking water.

2. We do not apply the same method of separation to separate a mixture of chalk powder and water, a mixture of green peas and groundnuts, and iron objects from garbage. Why?

3. Why is separation of substances necessary in our daily life?

4. You are given a sample of salt solution. You are asked to separate the salt from it. Filtration method cannot be applied here. Why? Mention the correct method of separation.

5. Differentiate the following:
   a. filtrate and residue
   b. winnowing and sieving

6. While preparing lemonade, how will you remove the seeds of the fruit from the juice? We add ice cubes to get chilled juice. When will you add sugar to the juice, before or after adding ice cubes? Why? When can you dissolve more amount of sugar?

7. A mixture contains saw dust and some iron nails. Which method will the carpenter use to collect the iron nails from the saw dust?

8. During winter season, we see dew drops on grass and plants. Can you give reason for this?
9. Can we separate tiny white stones from 100kg of rice by the method of hand picking? Give reason for your answer.

VI. Fill in the empty boxes and bubbles with suitable answers:

VII. Find the terms that denote different methods of separation hidden in this word puzzle:
VIII. Observe the pictures given and arrange them in proper order based on the activities they indicate. Encircle the methods of separation found in them.

1. ____________________ 2. ____________________
3. ____________________ 4. ____________________
5. ____________________ 6. ____________________
7. ____________________ 8. ____________________

Projects:
1. List the various methods of separation used in our day-to-day life. Describe each process and mention the places they are used in. Explain their significance.
2. Discuss in groups on how salt is obtained from sea water. Collect relevant pictures and stick them in your scrapbook. Find out the places of salt pans in Tamil Nadu.

FURTHER REFERENCE
Webliography:
http://en.wikipedia.org/wiki/separation_process
A students' Science Conference was held on the terrace of a multi-storeyed building. Many high school students took part in this conference. They used different modes of transport to reach the venue.

- One student flew by a mini helicopter and landed on the terrace.
- A few students travelled by a motor boat to reach the destination as the building was located close to a river.
- A few students rode a bicycle to reach the spot.
- Some took a bus to reach the place.

Some students used the lift to reach the terrace, while others climbed the stairs.

In each case, a different type of energy has been used. Before we discuss various types of energy, let us learn what energy is.
We need energy to perform both mental and physical activities like thinking, reading, analysing, running, walking, cycling, climbing, playing and jumping. How do we perform these activities? Don't we need energy to do these activities? Where does this energy come from? We obtain energy from the food we eat. When we are tired and hungry, we lack energy to do our work.

The bus, the boat and the helicopter get the energy to run from fuel. Have you seen ants and bees working busily? They need energy to do work and they get that energy from the food they eat.

**Energy in day-to-day activities**

**Activity 1**

**We Observe**

*Take a pinch of baking soda in a small bottle and add a few drops of lime juice or vinegar to it. Close the bottle lightly with a cork. What do you see? What happens to the cork after sometime?*

*We see bubbles form inside the bottle and the cork is soon ejected from the mouth of the bottle. Why does this happen? It is because of the formation of bubbles, which indicate that a gas has evolved. The gas pushes the cork out.*
**Activity 2**

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Activity</th>
<th>Required energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To dry clothes</td>
<td>heat energy from the sun.</td>
</tr>
<tr>
<td>2</td>
<td>To run a bus</td>
<td>energy from diesel or petrol.</td>
</tr>
<tr>
<td>3</td>
<td></td>
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<tr>
<td>4</td>
<td></td>
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</tbody>
</table>

**I have inferred**

Based on the above activity, we can define **energy** as the capacity or ability to do work. The unit of energy is joule.

There are many different types of energy. Some of them are:

- Mechanical energy, chemical energy, light energy, sound energy, electrical energy, heat energy, wind energy. Let us learn more...

1. **Mechanical energy**:

   Mechanical energy is the energy possessed by an object due to its movement or position. There are two types of mechanical energy.
   i) Potential energy
   ii) Kinetic energy.

   i) Potential energy: Water stored in a dam, a rock on top of a mountain and water stored in a tank possess potential energy due to its position.

   ii) Kinetic energy: A flowing river, a moving bus, a galloping horse or a freely falling stone possess mechanical energy due to their motion.

   Similarly, things like a compressed spring or a stretched rubberband have potential energy due to its configuration.

   Hence, the energy possessed by an object by virtue of its position or configuration is called potential energy.
The energy possessed by a body by virtue of its motion is called kinetic energy.

Potential energy and kinetic energy are interconvertible. This property is used to generate electricity in hydro-electric power stations.

When water is stored in a dam, the stored water contains potential energy. When this water is allowed to flow down, it changes into kinetic energy. This kinetic energy of water is used to rotate the turbines and generate electricity.

We also observe that the mechanical energy of the rotation of turbines is converted into electrical energy in a generator.

**Uses:**

i) Mechanical energy can bring a moving body to rest or can make a body at rest to move.

ii) Using wind energy, we can generate electricity through windmills.

### 2. Chemical energy

Energy that is stored in the bonds of chemical compounds is called chemical energy. Chemical energy is released during a chemical reaction, often in the form of heat and light. A type of energy is released, when wood, charcoal, petrol etc., are burnt. This is because of a chemical reaction that takes place when they burn.

The food we eat undergoes chemical reaction and releases energy to enable us to work.

"Heat is a form of energy" - James Joule. The unit of energy (joule) is named after him.

In Mettur and Bhavani-sagar, electricity is generated using hydroelectric power.
Chapter - 3

Uses:

1. The chemical energy stored in the food of plants and animals is used for their growth and function.

2. A battery or an electric cell converts chemical energy into electrical energy.

3. While using fuels, chemical energy is converted into heat energy and light energy.

3. Electrical energy

Do you know how a fan rotates or an electric bulb glows, when we switch them on? In an electric bulb, electrical energy is converted into light energy and in an electric fan, electrical energy is converted into mechanical energy. In a windmill, the wind energy (kinetic energy) is converted into electrical energy.

Uses:

1. In industries, electrical energy is used to operate machines and is also used in telecommunication.

2. In cities, electrical energy is used to run electric trains.

4. Heat energy

Can you guess what the primary source of heat energy is? It is the Sun.

What fuel do you use for cooking in your houses? Do you use wood, kerosene or LPG for cooking? What energy is released when you burn wood, kerosene or LPG?

The chemical energy stored in wood, kerosene and LPG is converted into heat energy. Rub your hands together and feel your palm. They feel warm because friction causes heat. Due to friction and chemical reaction, heat energy is produced. Discuss with your friends and find out the various other sources of heat energy.

Activity 3  We Observe

Hold a magnesium ribbon with tongs and burn it. Observe the energy changes that occur in it.
Types of Energy

Uses:
1. We get rain due to evaporation of water from water bodies. It is because of the heat energy from the sun.
2. In a thermal power station, of electricity is generated from the heat energy obtained by burning coal.
3. In an electric stove, electric iron etc., electrical energy is converted into heat energy.

5. Solar energy

The energy obtained from the sun is called solar energy. What are the types of energy obtained directly from the sun? Can you list them?

Uses:
1. Solar energy is directly used in solar heater, solar cooker etc.,
2. Solar cells are used in artificial satellites, watches, calculators and is used to operate solar vehicles.

Can we convert one type of energy

**Activity 4**

*We Do*

Let us know how energy is obtained directly from the sun.

**We need:**

*Magnifying lens and bits of paper.*

1. Using the magnifying lens, focus the sunlight on the bits of paper.
2. Observe what happens to the bits of paper, after sometime.

**We observed and inferred**

____________________________________________________

____________________________________________________

*Do you know?*

In 212 BC, the Greek scientist, Archimedes used magnifying glasses to burn Roman warships with solar energy.

*Share what you have observed in this activity with your friends.*
into another?

Look at the pictures given below. What do we understand from them?

We know that most forms of energy are obtained from the sun.

1. In Tamilnadu, at Neyveli and Ennore, thermal power stations, coal is burnt to generate electricity. Here the chemical energy of coal is first converted into heat energy and then into electrical energy.

2. The loudspeaker converts electrical energy into sound energy.

3. When water stored at a height flows down, its potential energy is converted into kinetic energy, which rotates the turbine of a generator and generates electrical energy.

4. When wood, charcoal, petrol, diesel and other fuels are burnt, chemical energy is converted into heat energy.

5. During photosynthesis, plants convert light energy from the sun into chemical energy and store it.

6. In electric doorbells and horns of automobiles, electrical energy is converted into sound energy.

7. In a torch light, the chemical energy of the cell is first converted into electrical energy and then into light energy.

From the above examples, we have learnt that one type of energy can be converted into another type of energy. When one type of energy is used, an equal amount of another type of energy is released. Therefore in any conversion of energy, the total amount of energy will not change.

Hence, we say that energy can neither be created nor be destroyed, but can be transformed from one form into another. This is called the Law of Conservation of Energy.
Moreover in any conversion of energy the total amount of energy will not be changed.

Discuss in small groups how diesel and petrol can be consumed economically. Present a report.

A man carried a heavy load on his head to his house located on top of a hill slope. He left the load by the side of his house and took rest for sometime. When he came back, he noticed that the load had rolled down to the bottom of the hill.

1. From where did the man get the energy to lift the load?
2. What energy did the load possess when it was placed on the mountain?
3. From where was the energy obtained for the load to roll down the slope?
4. What energy did the load possess while rolling?
5. What energy did the load possess on reaching the ground?
6. Write down the energy changes that occurred in the above activity, in sequential order.

We shall form small groups and discuss the various uses of solar energy in our daily life to list them hereunder.

My list

1. To get salt from sea water
2. For rain
3. ____________________
4. ____________________
5. ____________________
6. ____________________

Discuss in small groups how diesel and petrol can be consumed economically. Present a report.

For example, let us see how energy conversion takes place, when an electric motor pumps water.

To operate the electric motor, electrical energy is used. This electrical energy is converted into kinetic energy, sound energy and heat energy.

Electrical energy $\rightarrow$ Kinetic energy + Sound energy + Heat energy

(To operate the electric motor) (to lift water) (released when electric motor works)

We do.

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To operate the electric motor, electrical energy is used. This electrical energy is converted into kinetic energy, sound energy and heat energy.

Electrical energy $\rightarrow$ Kinetic energy + Sound energy + Heat energy

(To operate the electric motor) (to lift water) (released when electric motor works)

We do.
We answer

Shall we discuss and answer the above questions related to this event?

Our answers

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

6. ______________________________

We have learnt

__________________________________________________________________________

__________________________________________________________________________

Evaluation

I. Choose the correct answer:

1. Energy required to dry clothes quickly is ______.
   a) solar energy  
   b) sound energy
   c) kinetic energy  
   d) potential energy

2. "Heat is a form of energy". This was discovered by ________.
   a) Volta  
   b) James Joule
   c) Thomas Alva Edison  
   d) Galileo

3. Which of the following requires electrical energy?
   a) windmill  
   b) industry
   c) bicycle  
   d) parachute

4. The ________ energy cannot be used to run vehicles.
   a) solar  
   b) chemical
   c) electrical  
   d) sound
5. When charcoal is burnt, chemical energy is converted into______energy.
   a) heat                  b) sound
   c) mechanical           d) solar

II. Tick the correct answer:

1. Energy obtained by wind energy in wind farms
   (Chemical energy / Electrical energy)
2. Energy possessed by a rustling leaf
   (Kinetic energy / Chemical energy)
3. Energy possessed by a person landing from a parachute
   (Kinetic energy of wind / Chemical energy in food)
4. Energy produced by rubbing the two palms of your hands
   (Heat energy / Electrical energy)

III. Match the following:

1. Electric bell : Electrical energy
   Solar cooker : ______________
2. The sailing of yacht : ______________
   Air filled in a balloon : potential energy
3. For the growth of living things : Chemical energy in food
   To run vehicles : Chemical energy in__________

IV. Say true or false:

1. Energy is the capacity or the ability to do work.
2. Potential energy and kinetic energy are types of mechanical energy.
3. Electrical energy is released during chemical reaction.
4. Heat energy can be produced by friction.
5. One type of energy cannot be converted into another type of energy.

V. What type of energy do the following possess?

1. sun               2. charcoal       3. water in a lake
4. solar cell        5. waterfalls     6. compressed spring
7. fuel              8. moving cloud   9. firewood
VI. Find out the energy conversion that takes place in the following:

1. Torchlight  _________  →  _________
2. Radio  _________  →  _________
3. Iron (box)  _________  →  _________
4. Generator  _________  →  _________

VII. Explore and answer:

1. We know that we need energy to ride a bicycle, to play cricket or to do any kind of work. How do we define the energy used in these activities and what is the unit of measurement?

2. The coconut in the picture possesses three types of energy. Can you find out what they are?
   
   1. 
   2. 
   3. 

3. What type of energy is stored in each of the objects shown in the pictures given below? In which way is this energy useful to us?

   Diesel can (1)    Gas cylinder (2)    Plant (3)

   1. 
   2. 
   3. 

4. We know that the water stored in Mettur dam and Bhavanisagar dam is used to generate electricity. List the conversion of energy that occurs in the hydroelectric power stations.
5. Observe the pictures given below and write down the energy possessed by the stone at each level.

VIII. Answer the following:

1. Differentiate potential energy from kinetic energy.

2. Explain the Law of Conservation of Energy with an example.

IX. Project work

Write down the names of the gadgets used in your house, the changes in energy that happens and their uses in the tabular column given below.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the gadget</th>
<th>Change in energy</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Electric bulb</td>
<td>Electric energy into light energy</td>
<td>to get light</td>
</tr>
<tr>
<td>2.</td>
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<td>5.</td>
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</tbody>
</table>

FURTHER REFERENCE

Webliography:
http://www.tutorvista.com
http://www.arvindguptatoys.com
http://www.wikipedia.org
### ‘I can, I did’

**Student's Activity Record**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Date</th>
<th>Lesson No.</th>
<th>Topic of the Lesson</th>
<th>Activities</th>
<th>Remarks</th>
</tr>
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SCIENCE
Standard Six
Term III
Note to the teacher…

As we present this reprint of the Science Textbook, we would like to express our deepest gratitude to the learners and the teaching community for their enthusiastic responses.

In science some concepts could be subject to change from time to time as new theories and principles are constantly being evolved.

We have tried to present facts and concepts of science (both concrete and abstract) in a visually appealing manner without detracting from the content.

Activity based learning is now accepted as the basis of science education. These activities should be regarded as a means for open-ended investigation rather than for verification of principles/content given in the textbook are has been designed to facilitate low cost activities and experiments using locally available materials. With a view to streamlining the activities, we have now segregated them into three groups:

- **I Do** - activities to be done by an individual learner.
- **We Do** - activities to be done by a group of learners. and
- **We Observe** - activities to be demonstrated by the teacher.

The third group of activities have a higher degree of difficulty or require careful handling as it may involve dealing with chemicals, electricity etc.,

The “More to know” snippets in the text represents some unusual and interesting facts or information in which the students need not be examined.

The evaluation section is nothing but another space for learning in a different manner. As the focus is on understanding, rote learning is to be discouraged thoroughly. Application of learnt ideas, problem solving skills and critical thinking is to be encouraged. There could be scope for more than one answer to a question, which should be acknowledged always.

To facilitate further reference, books and websites have been suggested at the end of each lesson. Suggestions and constructive criticism are most welcome. Valuable suggestions will be duly incorporated.

- Authors

scientextbook@gmail.com
Do you know which book was sold in large number and paved way for the maximum criticism? It was the book titled ‘Origin of Species’ published in the year 1859. It was written by a scientist Charles Darwin. Why did it raise criticism?

Darwin sailed to several important islands of the world in the ship H.M.S.Beagle, for more than 10 years and gathered information. He said that living organisms on the earth have evolved gradually from one form to another over a million years. He was the first person to explain why ape and man, cat and tiger share common characters.

Mushrooms grow in our garden when it rains. Why? Frogs croak when water stagnates. Dragonflies fly before it rains. Fire flies glow during night time. Are you not curious to know about the various features of living organisms on the earth? Darwin too was interested.

When he was young, he collected one hundred and seventeen types of beetles. We too grow peacock feather in our book. Can we rear a golden beetle? There are many such forms on this earth.

When did life originate on this earth? How was the first formed organism? How did organisms procure food? How did they grow? How do we resemble our parents? How can the body be healthy? How can food be produced? Biology, a branch of science that answers these questions.

Biology is the science that deals with the study of living organisms.

Botany and Zoology are the branches of Biology.
Organisms differ in their character, habit, size, structure, nutrition and habitat. This is known as Bio-diversity. Organisms exist in different forms such as micro-organisms, plants, animals, worms, insects and birds. Shall we learn about micro-organisms?

1.1 Micro-organisms

**ACTIVITY 1.1 WE OBSERVE**

**Aim:**
To observe micro-organisms.

**Things we need:**
Compound Microscope, water, buttermilk, slide.

**Procedure:**
- Let us add 5 drops of water to a drop of buttermilk.
- Place a drop of this mixture on the slide.
- Observe it under a compound microscope.
- Draw the diagram we have observed.

Organisms that can be seen only under a microscope are called micro-organisms. They can be either unicellular or multicellular. They occur in air, water, land, food and even in other living organisms. The study of micro-organisms is called Microbiology.

Bacterium, virus, fungus, alga, protozoan etc. are micro-organisms. Bacterium and protozoan are unicellular micro-organisms. Most of the fungi and algae are multicellular micro-organisms.

### 1.1.1 Virus

We know many people suffering from diseases like swine flu, bird flu, chikungunya, jaundice, polio, chicken pox, rabies and AIDS.

**How are these diseases caused?**

These are caused by viruses. We cannot see virus with our naked eyes. It can be seen only through an electron microscope. Viruses cause many diseases in plants and animals. They infect us if we are not aware of them. The branch of science that deals with viruses is called Virology.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Name of the Virus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Cold</td>
<td>Rhino Virus</td>
</tr>
<tr>
<td>Polio</td>
<td>Polio Virus</td>
</tr>
<tr>
<td>Chicken pox</td>
<td>Herpes Virus</td>
</tr>
<tr>
<td>Tobacco Mosaic Disease</td>
<td>Tobacco Mosaic Virus (TMV)</td>
</tr>
<tr>
<td>AIDS</td>
<td>HIV</td>
</tr>
<tr>
<td>Rabies</td>
<td>Rabdo Virus</td>
</tr>
</tbody>
</table>
Electron microscope was invented by Ernst Ruska and Max Knoll in 1931.

Some viruses are also useful. They are used in genetic researches.

Eg: Bacteriophage.

1.1.2. Bacteria

How are we affected with diphtheria (a type of throat infection) and pyorrhea (dental disorder)?

How does milk get converted into curd?

How does garbage become manure?

These are caused by bacteria, a micro-organism, which was discovered by Anton Van Leeuwenhoek in 1675.

The branch of science that deals with bacteria is called Bacteriology.

Beneficial activities of bacteria:
  ▶ curdling of milk
  ▶ decomposition of organic wastes into manure.
  ▶ fermentation of idly and dosai flour
  ▶ act as bio-fertilizer increasing the yield.

Robert Gallo

In 1984, Robert Gallo discovered HIV which causes AIDS.

Diseases caused by bacteria

Plants – citrus canker, blight disease of tomato

Animals – anthrax, tuberculosis

Man – pneumonia, tetanus, tuberculosis

ACTIVITY 1.2 WE OBSERVE

Aim: To identify the micro-organisms.

Things we need:

Compound Microscope, waste water, slide, ink filler.

Procedure:

▶ Let us place a drop of waste water on the slide by using an ink filler.
▶ Observe it under a compound microscope and draw the diagram.

Note: During activity, avoid contact with the waste water.

It is surprising to know that there are organisms made up of single cell. All activities like ingestion, digestion, respiration, excretion and
reproduction are carried out by the same cell.

Unicellular plants and animals belong to the kingdom Protista.

Example: Chlamydomonas, Amoeba, Euglena, Plasmodium.

Unicellular animalcule – Amoeba

1.1.3 Fungi

Most of the fungi are multicellular organisms. Penicillin is extracted from the fungus Penicillium notatum. It was discovered by Sir Alexander Fleming in 1928. Certain fungi cause diseases like dandruff formation on our scalp.

Mushroom

We see small umbrella-like structures growing on the bark of trees, soil and wood during rainy season. These are called mushrooms.

ACTIVITY 1.3     WE OBSERVE

Aim: To identify fungi.

Things we need : Compound Microscope, bread affected with fungi, slide, forceps.

Procedure:

- Let us place a small piece of bread affected with fungi on the slide using forceps.
- Observe it under a compound microscope and draw the diagram.

1.1.4. Algae

Algae are unicellular and multicellular organisms. They have chlorophyll pigment which helps them to prepare their own food by the process of photosynthesis.

e.g. Chlamydomonas, Volvox, Spirogyra.

Chlamydomonas

Chlamydomonas is a motile, unicellular plant. It is an alga.

- Micro-organisms are the most diversified organisms on earth.
- A dot can be filled with 70,000 amoebae.
- 17,000 types of micro-organisms live in a human body.
Have you seen flowering plants? What does the flower change into? Have you tasted fruits? Discuss in small groups what is inside the fruit?

**ACTIVITY 1.4 WE DO**

**Aim:** To identify monocot and dicot plants.

**Things we need:**
- soaked chick pea, ground nut, maize and paddy.

**Procedure:**
- Let us remove the seed coat of soaked chick pea, ground nut, maize and paddy. Try to separate the cotyledons.

**We learn:**
- Plants that have seeds which can be separated into two cotyledons are called dicot plants.
- Plants that have seeds which cannot be separated into two cotyledons are called monocot plants.

Can’t we say a plant is a dicot or monocot without seeing the seed? Can it be identified only after separating the cotyledons?

**1.2. Plants**

Where do you find seeds of mango, guava and bean? Most of the plants that we see in our day-to-day life are closed seeded plants.

In some plants, the seeds are exposed without any covering. These are naked seeded plants. These plants are found in snow-covered mountains and cool places.

Eg. Cycas, Pine.
ACTIVITY 1.5
I DO

Aim:
To classify plants based on the root system.

Things I need: Plants with roots, grass and water.

Procedure:
- I take plants with roots and some grass.
- I wash the roots with water.
- After observing the roots, I group the plants into A and B.
- I observe the venation on the leaves.

I infer:

<table>
<thead>
<tr>
<th>Part</th>
<th>Dicot (A)</th>
<th>Monocot (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Group A plants have tap root system and reticulate venation.
- Group B plants have fibrous root system and parallel venation.

You understand the correlation between the root system and the venation in each group.
Plant Kingdom

Cryptogams (non-flowering plants)
- Thallophyta
- Bryophyta
- Pteridophyta
  - Algae
    - e.g. chlamydomonas
  - Fungi
    - e.g. mushroom
  - Pteridophyta
  - Gymnosperms (naked seeded plants)
    - e.g. cycas
  - Phanerogams (flowering plants)
    - Angiosperms (closed seeded plants)
      - Dicot plants
        - e.g. mango tree
      - Monocot plants
        - e.g. coconut tree
1.3 Animals

Based on the presence and absence of backbone, animals are classified as vertebrates and invertebrates.

First, let us learn about some of the invertebrates.

**Worms:**

Worms like *tapeworm, hookworm* and *roundworm* live in the small intestine of man. These cause indigestion, stomach ache, dysentery, stomatitis in man. Intake of well cooked food and boiled water is good for our health.

**Earthworm:**

It has segmented body. It feeds on organic matter in the soil and is called the friend of farmers. Preparation of vermicompost is carried out extensively using this organism.

**Insects:**

Insects like mosquito, housefly, honeybee are found everywhere. They have compound eyes. They are both beneficial and harmful to us.

**Molluscs:** These are softbodied organisms. They have muscular foot which helps in slow movement. They possess shell. Eg: *Snail*.

**Echinoderms:**

Some of these are exclusively marine. Eg: *starfish, sea cucumber*. Their skin is covered with calcareous spines. Using these spines they attack their enemies. They can regenerate the broken or lost parts.
Now let us see about vertebrate animals.

**Fish**: These are aquatic. The body is covered with scales. Respiration takes place through the **gills**.

**Frogs**: These are amphibians which can live both on land and in water. The body is covered with moist skin. Respiration occurs through lungs, skin and gills. These are oviparous (egg laying).

**Snakes**: These belong to the class **reptilia**. They respire through lungs. Heart is three chambered. These are oviparous.

- Crocodile is the only living organism that cannot protrude its tongue.
- Anaconda, the world’s biggest snake is **viviparous**. (gives birth to young ones)
Birds:

Generally birds are the most attractive creatures in nature because of their appearance and sweet voice. They are economically beneficial to us in many ways. They have four chambered heart. They are oviparous. Their body is covered with feathers. Respiration occurs through lungs.

Among the birds, ostrich lays the largest egg. It is almost the size of a coconut.

Mammals:

Their heart is four chambered. They feed their young ones with the help of milk producing glands. They have hairs, sweat glands and oil glands all over their body.

Monkey, elephant, bat, cat, rat, blue whale and man are examples of mammals.

More to know

- Blue whale is the largest living organism. Its weight is equal to the weight of 22 elephants. Its heart is of a size of a small car.
- Dog was the first animal sent to space. Its name was Laika. It was sent by Soviet Russia.
- In cows, sweat glands are found on the surface of nose.
- Man is the only living animal who can sleep with his back touching the floor.
- The trunk of an elephant is the modified form of nose and upper lip. Tusks are the incisors of the elephant.

There are a variety of plants and animals on earth. They range from microscopic unicellular organisms to the largest blue whale. It is our prime duty to preserve them from their extinction.

Humming Bird is the only bird that can fly forwards, backwards and sideways.
EVALUATION

I. Fill in the blanks by choosing the correct option

1. __________ discovered bacteria.
   (Anton Van Leeuvenhoek / Alexander Flemming)
2. __________ is a motile plant.
   (Amoeba / Chlamydomonas)
3. __________ is the friend of farmers.
   (locust / earthworm)
4. __________ disease is caused by virus.
   (Polio / Cholera)
5. Chicken pox is caused by __________
   (virus / fungi)

II. Choose the correct answer

1. Unicellular plant
   a) Euglena   b) Amoeba   c) Chlamydomonas

2. To which class does man belong?
   a) aves   b) mammals   c) reptiles

3. Which is a vertebrate?
   a) jelly fish   b) starfish   c) eel

4. Which is a monocot plant?
   a) mango   b) jack fruit   c) paddy

5. Which is the characteristic feature of a dicot plant?
   a) tap root   b) parallel venation   c) fibrous root

III. Pick the odd one out based on their scientific character and circle it

1. Elephant, bat, cat, earthworm.
   (based on backbone)

2. Crocodile, tortoise, frog, fish.
   (based on habitat)

   (based on usage)

4. Amoeba, Euglena, Plasmodium, scorpion
   (based on cellular organisation)
IV. Find out who am I and circle me

1. I appear after the rains. I have no chlorophyll so I appear white. I am multicellular. Who am I? (mushroom/alga)

2. Stagnant sewage water welcomes me. Human body is my vehicle. Their blood is my food. I am simple in my appearance but pierce like a needle. Disease is my partner. Who am I? (mosquito/housefly)

3. I live in water as well as on land, but I am not a tortoise. I hop, but not a rabbit. My skin is moist. I am not a crocodile. Who am I? (frog/snake)

4. I am green in colour. I am found in moist areas. Who am I? (alga/chameleon)

5. I am long but not a rope. I creep but I am not a worm. I have no ear and legs, but I moult. Who am I? (snake/eel)

V. FA (a): Choose any one project and submit the same

1. List out the different plants and animals that you see from morning to evening next Sunday.

2. Write about your pet animal in five lines.

3. Collect information about rearing of honeybee and silkworm and write down (direct observation/newspaper/news/books/library). Write down what you have learnt?

4. Collect different kinds of seeds that you get. Write their names. Sow it in a small container and water it. Observe how many seeds have germinated in a week.

5. Draw a picture of your favourite bird and colour it. Write a small poem about it.

6. Make one handicraft by using the feathers of birds and display it in the classroom.
VI. Answer the following

1. Mention a few advantages and disadvantages of micro-organisms.

2. Why do we call the earthworm the ‘friend of farmers’?

3. Write any two adaptations of frog that enable them to live both on land and in water.

4. Write a short note on fungi.

5. How will you identify a monocot and dicot plant?

VII. Think and answer

1. Reports from media say that the sparrow, eagle, butterfly etc., once found in abundance are now seen scarcely. Is this statement true? Reason out. Can we save from extinction? Summarize your ideas to conserve them.

2. Among insects, mosquitoes are the leading vectors of disease causing organisms.
   a) What are the diseases that spread by mosquito bite?
   b) In what ways can mosquitoes be destroyed?

3. Tap root system and fibrous root system are seen in plants. What type of root systems are seen in big trees? Give reasons.

4. Scientific development has led man to discover new things every day. Inspite of this, man is affected by microscopic organisms. Find out and discuss the causes and its preventive measures.

Camel | Polar bear

FURTHER REFERENCE

Webliography:
http://www.en.wikipedia.org/wiki/microorganism
http://www.aravindguptatoys.com
http://www.rhs.org.uk
Our Environment

Air, light, land, soil, water bodies, plants and animals around us constitute our environment. Living organisms are not only interdependent on each other but also on the non-living components of the environment. Therefore, a small change in the environment causes a great impact on the living organisms.

Environment is polluted, due to industrial development, over population, modern life style and urbanization, which leads to undesirable and harmful effects.

2.1. Garbage

A lot of waste is accumulated owing to our busy life style. Things like plastic bags, papers, water bottles, aluminium foils, chocolate wrappers, peels of fruits and vegetables are thrown away after use. Unwanted substances formed during a process or substances which cannot be reused are called wastes or effluents.

Garbage are generated in places like houses, classrooms, industries and public places like streets, market and sea shore.

2.2. Types of garbage

Solid wastes which pollute environment are of two types, namely

- Bio degradable waste
- Non bio degradable waste

Bio-degradable waste

In nature, some wastes are gradually degraded by bacteria, fungi (micro-organisms) and earthworm. These are bio degradable waste. Leaves, agricultural wastes, animal wastes, vegetables, fruits and their peel, seed, nut are examples of bio degradable waste.

**ACTIVITY 2.1**

<table>
<thead>
<tr>
<th>I DO</th>
</tr>
</thead>
</table>
| I collect waste papers and make them into small bits.  
I soak them in water for some time in a container.  
I smash them with my hand.  
Likewise I collect polythene wastes and do as above.  
I observe if any change occurs. |

**I Observe**

__________________________
__________________________

From this activity we observe that paper is converted into pulp, whereas the polythene waste is not.
Non-biodegradable waste

Waste substances that are not degraded by micro-organisms are non-biodegradable wastes. Eg: plastics, industrial effluents, metals.

1. Landfilling

Landfilling is a method in which wastes are dumped into naturally occurring or man-made pits and covered with soil. Garbage buried inside landfills remain here for a long time as they decompose very slowly and become manure. These places can be converted into parks, gardens, etc.

2. Incineration

The burning of solid waste in incinerator is called Incineration.

Human anatomical wastes and biomedical wastes (discarded medicines, toxic drugs, blood, pus) are disposed by means of incineration. During incineration, the enormous heat kills all contagious disease-causing germs.
3. Composting

The process of degradation of organic wastes into manure by the action of microorganisms is called composting. The manure thus obtained becomes natural fertilizer for the plants as well as increases the soil fertility.

4. Reducing the usage

The best way to manage wastes is not to produce them. This can be done by using durable goods that last longer instead of things that are used once
and thrown away. Use of fountain pen in place of ballpoint pen is a good example of reduce.

5. Reusing

Reusing means using a thing again and again, rather than using and throwing it after a single use. Instead of using plastic bags for shopping, using cloth bags is the best example for reusing.

6. Recycling

The process by which waste materials are used to make new products is called recycling. Using old clothes to make paper and melting some plastics to make floor mats, plastic boards and hose pipes are example of recycling.

From this pyramid, we infer that reducing the utilisation of material is the best method of garbage disposal.

2.4. Benefits of garbage disposal

- Pollution of air, water and land is reduced.
- Natural resources such as trees and metals are protected.
- Clean and hygienic surrounding is made.
- Unnecessary expenses are avoided.

ACTIVITY 2.2 WE DO

- Let us collect waste papers and make them into small bits.
- Take a wide vessel containing water and put the bits of paper in it. Add some fenugreek and soak it for a day.
- Grind the soaked paper and make it into dough.
- With the help of this dough we can make some useful things like tumbler, plate, etc.
THINK........!

- What happens if garbage is not removed frequently?
- How does it affect us?
- Can we convert these wastes into non-hazardous substances?
- What should we do for that?

DO YOU KNOW?

Garbage collectors sort out wastes from dustbins for recycling and reusing. They help us to lead a healthy life by disposing the garbage.

2.5. Vermicomposting

Vermicomposting is a type of composting where the organic wastes are degraded by using earthworms. The manure obtained by this process is called vermicompost.

Vermicompost pit in school campus

Make a pit of 30 cm or take a wooden box. Place a thin net on the base of the pit or wooden box. Fill it with sand for about 1-2 cms.

Spread some plant wastes (like dry leaf, flower) and biodegradable wastes on it.

Sprinkle some water. Add some earthworms to these substances and cover it with old cloth or dried coconut leaf.

We can find that vermicompost is formed after four weeks.

Create a garden in your school and use this vermicompost as manure for plants and conserve soil fertility.
**FACT FILE**

- Indraprastha Park in New Delhi is built on a landfill site.
- In 1862 Plastic was introduced for the first time in International Trade fair at London.
- In a vehicle only 30% of fuel is used for driving, 70% of fuel is released as Carbon monoxide which is a poisonous gas.
- In a day an earthworm consumes food equal to its weight.
- June 5th is the World Environmental Day.
- When plastic is burnt, the harmful gas called dioxin is released.

**EVALUATION**

I. Choose the correct answer

1. ___________ decomposes degradable substances in the soil.
   - a) micro-organism
   - b) earthworm
   - c) bird
   - d) both 'a' and 'b'

2. An example for non-biodegradable product is ____________
   - a) paper
   - b) cloth
   - c) polythene bag
   - d) fodder

3. Waste that can be converted into manure is ____________
   - a) glass
   - b) plastic
   - c) metal
   - d) household waste

4. Bio-medical wastes can be removed by ____________
   - a) landfill
   - b) composting
   - c) incineration
   - d) recycling

5. Organism used in vermicomposting is ____________
   - a) leech
   - b) roundworm
   - c) earthworm
   - d) tapeworm
II. Match the following

1. Household waste  - a) fertilizers, pesticides
2. Industrial waste - b) medicines, syringes
3. Agricultural waste - c) smoke
4. Medicinal waste  - d) peel of vegetables and fruits
5. Automobile waste - e) chemicals

III. Circle the odd one and give reason

1. Peel of fruit, plastic, leaves, vegetables.
2. Glass, animal waste, metal, plastic.
3. Incineration, composting, landfill, evaporation.

IV. Fill in the blanks

1. Used to make floor mattresses, hose pipes, tiles, plastic boards.
2. If dustbins shown below are placed in your school campus. List out the names of wastes that you would collect in each of the bins.

![Image of dustbins]

- Biodegradable garbage
  1. ________________________
  2. ________________________
  3. ________________________

- Non-biodegradable garbage
  1. ________________________
  2. ________________________
  3. ________________________

V. Shall we answer from environmental aspect?

1. Viji and Suji are students of standard VI. Viji brings her lunch packed in a plaintain leaf but Suji brings her lunch packed in an aluminium foil. Whose activity is right? Write down the reason.

2. A fountain pen is better than a ballpoint pen. Why?

3. Madhan and Sudhan went to the beach. They took some fruits, groundnuts and biscuits with them. After eating Madhan threw the biscuit wrapper, peel of fruit and groundnut on the beach. But Sudhan threw them in a dustbin which was kept there. Whose activity is appreciable? Why?
PROJECT

Collect waste materials from the kitchen for a week’s and segregate them into degradable and non-degradable substances. After segregating these substances, place them into two different pits and cover them with soil. Make a note of the changes that occur after 30 days and fill the following table. Discuss and present in small groups.

Pit 1. Vegetables, peel of fruits, egg shell, food remains, tea dust, dry leaves and paper.

Pit 2. Polythene bag, glass pieces, Aluminium foils, nail and broken toys.

<table>
<thead>
<tr>
<th>Pit</th>
<th>After 30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Our findings:

FURTHER REFERENCE

Webliography:

http://www.indiaonestop.com/export-hazardwaste.htm
http://www.learner.org/exhibits/garbage/hazardous.html
Do you know Tamizharasi?

What does Tamizharasi do from the time she wakes up till she goes to school? As we all get up in the morning and brush our teeth with toothpaste, she too brushes her teeth.

She washes her dirty clothes using detergents. She takes a bath using a toilet soap. She washes her hair with shampoo.

She also uses a notebook, pencil, pen and eraser to do her homework as we do.

She stands before a mirror to comb her hair, dresses herself, takes water in a plastic water bottle and wears her spectacles and rubber shoes and goes to school by a bicycle. These are the daily activities of Tamizharasi.

Tamizharasi’s parents are constructing a house. So they have bought cement, bricks, gravels, and iron rods. She carefully crossed all these materials and reached the tar road.

Most of the things that she uses are chemical substances.

The ink used in our pen and chalk piece used by our teachers are also chemical substances.

Based on the chemical properties of naturally available raw materials, we produce many things which are very useful in our daily life.

Chemistry plays a major role in manufacturing useful things that we need.

3.1. Cement and its uses

We all would have played making sand houses with our friends. We enjoy ourselves by heaping sand in the form of a mound and on its top build a castle with steps. In real life, can we build a house so easily with sand alone?

Tamizharasi’s house and the school she goes to are stone buildings. List out the materials that are needed to construct these buildings.

___________________________
___________________________
___________________________

Cement is an important chemical substance used in the construction of buildings.
In 1824 Joseph Aspidin, a mason in England synthesised cement. As this cement resembled the limestone found in Portland, he named the cement as Portland cement.

Cement is a mixture of limestone, clay and gypsum in definite proportion. This mixture is heated, cooled and powdered to get the chemical substance called cement. This greyish powdery cement is packed in airtight bags and sold.

What happens when a little water is added to cement?

**ACTIVITY 3.1  WE DO**

**Aim:** To know about the nature of cement.

**Materials we require:** paper cups, a small amount of cement, water, a stick or glass rod.

**Procedure:**

- Let us take a small amount of cement in the paper cup and add required amount of water and stir it well with the help of the glass rod/stick.
- After a few hours let us observe the change that has occurred.

**Our observation:**

________________________________________________________________________
________________________________________________________________________

We understand from the above activity that when water is added to cement, it sets to a hard substance within a few hours. This is known as setting of cement.

**Uses of cement**

Cement is used in different forms like mortar, concrete and reinforced cement concrete.

**Mortar**

Mortar is obtained in the form of thick paste by mixing cement, sand and water. This paste is used in flooring, constructing and plastering the walls of the houses.

**Concrete**

Concrete is a mixture of cement, sand, gravel and water. It is used in the construction of buildings, bridges, dams or reservoirs.
Reinforced cement concrete (RCC)

When concrete is filled in and around a steel wire netting or skeleton of iron rods and allowed to set we get reinforced cement concrete. This RCC is very strong and durable. This type of concrete is used in the construction of dams, bridges, pillars and roofs of the buildings. It is also used in making pipes, constructing water tanks, and laying sewage and drainage canals.

3.2. Plastics

We are familiar with the term plastics. Only glass bottles and iron pipes were in use for a very long period. Do we find them in large numbers at present? No, today we use mostly things made of plastics. Tamizharasi’s water bottle is also not an exception.

Nowadays plastics are very much used in making pipes, toys, utensils, stationeries, medical instruments etc. Plastic water bottles are commonly used everywhere. Plastic is also a type of chemical substance.

3.3. Types and uses of plastics

Tamizharasi’s father bought a plastic hosepipe for construction purpose. But he could not join it with the water tap as the size of the plastic pipe was smaller in diameter than the water tap. What should be done to join the plastic pipe with the water tap?

What happens when we pour boiling water into a plastic (PET - Polyethylene terephthalate) bottle?

In the above incidents, plastic pipe and plastic bottle melt and become soft on heating. On cooling, they become hard. These types of plastics are known as ‘Thermo Plastics’. Polythene bags, PET bottles, PVC(Polyvinyl chloride) pipes, buckets, mugs, combs, toys etc. are made of thermo plastics.

Do the plastic handles of cookwares melt on heating? Can we expand them like PVC pipes by heating? No, we cannot. It is because they are thermo setting plastics.
An object made of thermo setting plastics cannot be softened or melted by heating. Example: Bakelite and melamine.

Bakelite is a non-conductor of heat and electricity. It is used to make electrical insulators, switches and handles of cookwares. Melamine is a non-inflammable substance. Moreover, it can withstand very high temperature. Therefore, it is used to make floor tiles, cookwares, fireproof clothes etc.

3.4. Plastics and environment

We know that plastics are widely used in our day-to-day life. At the same time they are also a great threat to our planet Earth. The disposed plastics bring about the following effects,

- Plastics do not get degraded.
- They do not allow rainwater to seep through the soil.
- They affect the growth of the plants.
- Water gets stagnant in these disposed plastic pieces. It becomes the breeding place for mosquitoes, which in turn spread contagious diseases.
- They arrest the flow of water.
- When food contaminated with plastic material is consumed, it leads to the death of living organisms.
- When Plastics/Polythene bags are burnt, they emit toxic gases. These gases mix in air and cause respiratory problems.

As plastics pollute land, air and water, we must avoid the usage of plastics. Instead of plastics we can use things made of cloth, jute, coir and areca-plate which are bio-degradable.

3.5. Glass and its uses

When we hear the word glass, it immediately reminds us of plane mirrors and spectacles. Glasses are also used in window panes, automobiles, decorative lamps etc., There is a plane mirror in Tamilazhrasi’s house also. She is wearing spectacles.

Some glasses allow the light to pass through them like Tamizharasi’s spectacles. But the plane mirror does not allow light to pass through it. A chemical substance coated at the
back of the mirror reflects the light thereby we could see the image.

**What is glass made of?**

Glass is made of chemical substances like silica (sand), calcium carbonate (limestone) and sodium carbonate. The above mixture is melted into a viscous liquid by heating it to a very high temperature. This liquid is poured into a suitable mould and cooled to get glass objects of desired shape. When molten glass is cooled rapidly it becomes brittle. When the molten glass is cooled very slowly, it will not allow light to pass through. Therefore glass should not be cooled either very slowly or rapidly. It should be cooled gradually. This method of cooling is called **annealing**.

Glass finds a wide range of application in the manufacture of window panes, automobile windows, electric bulbs, medical instruments, laboratory apparatus like standard flasks, test tubes, beakers, measuring jars etc.

### 3.6. Soap — preparation and uses

Every morning Tamizharasi uses toilet soap for bathing; Detergents for washing her clothes. We also use different types of soaps in our daily life to keep ourselves and our clothes clean.

Different types of soaps like washing soap, toilet soap, baby soap, liquid soap, medicinal soap etc. are in use.

All the above mentioned soaps are not prepared from the same raw materials. The ratio of raw materials also differ. The raw materials used for the preparation of the soap are mentioned on the wrapper of the soap.

We should wash our hands before eating. Because of various reasons the germs that stick to our hands, which mix with the food particles. While eating can cause diseases. In order to prevent from infection, we should wash our hands with soap is essential.

How is soap prepared? Can we prepare soap at home? Yes, we can prepare soap at home provided sodium hydroxide is available.

**ACTIVITY 3.2 WE OBSERVE**

**Aim:** To prepare soap

**Materials we require:**
- water - 35 ml
- sodium hydroxide - 10 g
- coconut oil - 60 g
- glass rod
- beaker
Procedure:
Take 35 ml of water in a beaker and dissolve 10g of sodiumhydroxide pellets in it. Allow the liquid to cool. Add 60g of coconut oil to this solution little by little. Stir it gently with the glass rod till it becomes a paste. Pour this paste into an empty match box and dry it to get the soap.

3.7. Fibres

We come to know from history, that ancient man wore the leaves of plants and skin of animals as clothing. But in our present civilized and modern scientific world we have developed fashionable and attractive dresses using different types of fibres. Are all of them alike?

Which kind of clothes do you wear during the following seasons?

1. Monsoon / rainy season:

2. Winter season :

3. summer season :

During hot summer season we like to wear cotton clothes. During winter season we wear woollen clothes to protect ourselves from severe cold. During rainy season, we use umbrellas and rain coats made of polyester. The clothes which we wear are of different kinds. Let us know how we get all these.

ACTIVITY 3.3 I DO

Aim: To separate the fibres from the cloth.

Materials I require: a piece of cotton cloth.

Procedure:
- I take a piece of cotton cloth.
- I slowly remove the threads from the edge of the cloth.
- I press one end of the thread on the table and scratch it gently with the nail till the fibres are separated.
- I will stick the samples as below.

Cloth

Thread

Fibre

My observation:

In the above activity, the thin strands we get while separating thread are fibres. Fibres are drawn together and twisted to get thread. Clothes are woven using the thread.
3.7.1. Types of fibres and their uses

Fibres are classified into two types based on their source.
- natural fibres
- synthetic fibres

Natural fibres

Fibres which are obtained from plants and animals are known as natural fibres. Jute is obtained from the stem of the jute plant. It is used to make bags, curtains, carpets, etc.

Cotton is obtained from cotton plant. Cotton fibres are twisted to get threads which are used to make cotton cloth. Cotton fibre consists a chemical substance called “cellulose”.

The fibres on the coconut shell are removed and processed to get coir. Coir is used to make ropes, carpets and other household articles. We get silk from the silkworms and wool from the fur of sheep.

Synthetic fibres

The fibres which are synthesized from chemical substances using scientific technology are called synthetic fibres. Polyester, nylon, rayon are some of the examples of synthetic fibres. These fibres are not only used in making clothes but also used in making fishing nets, ropes and parachutes. They are also used widely in various industries.

Can you differentiate the clothes which are made out of natural fibres and made out of synthetic fibres?

**ACTIVITY 3.4**

**Aim:** To differentiate various types of clothing materials.

**Materials we require:** Cloth bits of cotton, wool, silk, polyester and a magnifying glass.

**Procedure:**

- We identify the type (natural/synthetic) of fibre used for making each cloth. We record our findings in the following table.
- We touch and feel each cloth bits of cotton, wool, silk and polyester cloth, a magnifying glass to know the nature (soft /rough).

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Material</th>
<th>Type of the fibre (Natural / synthetic)</th>
<th>Nature (soft /rough)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cotton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Wool</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Silk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Polyester</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Each group should share their observations with peer groups.

Chemical substances are not only used to prepare the things that we have seen in this lesson but also used in the preparation, preservation, enriching taste and colouring of every substance that we use.

Thus in our daily life chemical substances are used in food, clothing, shelter, transportation, medicine, entertainment and in industries. Since they have become part of our life, it is the duty of each and every one of us to use them carefully and wisely so as to preserve our environment.

**Science club debate topic**

“Invention of plastics by man is a crime”

Students can be divided into two groups and they can have a debate on this topic.

Importance should be given for scientific information and effects of science. A science teacher or a student can be the judge.

---

**FACT FILE**

- The first Government approved Indian cement factory was started in the year 1914 at Porbandar in Gujarat by India Cement Ltd.,

- Broken glass pieces found during the archeological survey at Mesopotamia confirms that Mesopotamians were the first to use glass in the third century.

- Nowadays a new kind of plastics namely Bio-plastics are manufactured. This kind of plastics is Bio-degradable in nature.
EVALUATION

I. Choose the correct answer

1. Identify the one which is not a natural fibre.
   (a) silk          (b) wool       (c) polyester    (d) jute

2. Which kind of clothes do you prefer in summer?
   (a) nylon       (b) wool      (c) silk              (d) cotton

3. The clothes which are made from the fur of the animals
   (a) woollen   (b) cotton    (c) silk              (d) nylon

4. Which of the following is widely used in the manufacture of medical instruments?
   (a) polyester (b) plastics  (c) glass          (d) cotton

5. The important chemical substance used in the preparation of soap is
   _______________________
   (a) sodiumhydroxide    (b) sodium amalgam
   (c) sodiumsilicate        (d) sodiumbicarbonate

II. Fill in the blanks

1. The basic raw materials used in the manufacture of cement are
   ______________________ , ______________________ and ______________________

2. The expansion of P.V.C.is ______________________

3. ______________________ is used to make fireproof clothes.

4. The process of slow and steady cooling of glass is called ______________________

5. The fibre obtained from the stem of the plant is ______________________

6. The chemical substance present in the cotton fibre is ______________________

III. Match the following

1. Glass - a. gypsum
2. Switch - b. silica
3. Tiles - c. synthetic fibre
4. Cement - d. bakelite
5. Nylon - e. melamine
IV. Think and answer

1. Why do we spray water (i.e. curing) on the building that is being constructed? What will happen to the building if water is not sprayed?

2. We use mortar for flooring and plastering the walls. But we use _______________ to construct dams and bridges. Find out the differences between the two?

3. Name the part of the cookwares labelled as ‘X’ in the given diagram. Name the material used to make it. Why is it used? What type of material is it?

4. You know that switches and waterbottles are made of plastics. Under what category do you classify them based on the kinds of plastics?

5. During winter season how will you feel when you wear two or three clothes one over the other instead of wearing a woollen sweater? Why?

6. Explain in your own words whether the chemical substances that we use in our daily life are useful and do not pollute the environment.

7. Plastics are ‘a great threat to the life of the planet Earth’. How?

8. Classify the following:
   jute, rayon, nylon, silk, cotton, polyester, wool - Give reason.

9. Molten glass should not be cooled rapidly or very slowly during its preparation. Why? Instead of that what should be done?

V. Project

1. Visit a nearby construction site. Collect the following information and prepare an assignment.
   i) List of materials used for construction
   iii) The type of cement mixtures used in flooring and construction of roofs.
2. Observe your school campus and its surroundings for a week, collect the following information and present them in your class.

i) What are the plastic materials accumulated in your class, school and its surroundings?

ii) How do they get accumulated?

iii) What are the steps that you will take to make your school a ‘plasticfree zone’?

FURTHER REFERENCE

Webliography:

http://www.fabrics.net/cotten.asp
Light

Have you heard about Galileo Galilei? He was a great Italian scientist. He was a physicist, mathematician, astronomer, and philosopher who played a major role in the Scientific Revolution. Earlier, it was believed that the earth was stationary and it was in the centre of the solar system. But the polish scientist Nicholaus Copernicus suggested that “The earth is not stationary. It spins on its own axis and revolves around the Sun”. This theory appealed to Galileo and he proved this concept by his experiments.

In 1609, Galileo invented the telescope, through which he saw the stars, planets and the moon. According to Galileo, the Sun is a star. All stars are like the Sun.

We were able to know more about the solar system only by using the telescope invented by Galileo. To commemorate the 400th anniversary of this invention, the year 2009 was declared the “International Year of Astronomy”.

Now we will learn about light. Have you ever wondered how visually challenged people move about? Let us understand this by doing an activity along with our friends.

**ACTIVITY 4.1**

- The whole class must be divided into groups of two students each.
- One student is blindfolded using a handkerchief. For his safety another student is made to accompany him.
- The student is asked to walk around the classroom carefully without bumping against any object.
- At the same time he/she is asked to touch and feel the shape, size and nature of different objects in the classroom.
The students must be asked to go out of the classroom and to listen to various sounds carefully and visualise them.

Similarly other students must be asked to do the same.

The students must be given a chance to discuss and share their experiences in small groups.

4.1 Sources of light

In our daily life we see many objects. How do we see them? Have you ever thought of it? We need light to see objects. The objects that emit light are called as sources of light.

Sources of light are of two types natural and artificial. The sun is the primary and the natural source of light. Some of the man-made objects also produce light. These are called artificial sources of light.

During the day, we are able to see with the help of sunlight and during the night, we can see with the help of light from the electric bulb, torch light, candle etc. Bodies that emit light on their own are called luminous bodies.

Do things like table, chair, book, blackboard in our classroom emit light? No, then how do we see them? We are able to see objects like chair, table etc. when the light from luminous bodies like the sun, torchlight etc reaches our eyes after bouncing back ie reflected from them. Objects like table, chair etc. do not emit light on their own. Objects like these that do not emit light on their own are called non-luminous bodies.

<table>
<thead>
<tr>
<th>Natural sources of Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
</tr>
<tr>
<td>Fire flies</td>
</tr>
<tr>
<td>Jelly fish</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Artificial sources of Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil lamp</td>
</tr>
<tr>
<td>Decorative lamp</td>
</tr>
<tr>
<td>Chimney lamp</td>
</tr>
</tbody>
</table>
Therefore we understand that to see an object we need the following

- a source of light
- object to be seen
- observer.

**Do you know?**

- **Though the moon looks bright, it is not a luminous body. It shines by getting light from the sun.**
- **The sunlight takes 8 minute and 20 second to reach the earth.**
- **We should not see the sun directly with naked eyes. It may affect our eyesight.**

### 4.2. Propagation of light

**How does light travel?**

**ACTIVITY 4.2**

Let us take a thick paper (chart paper), roll it into a cylinder, observe the candlelight/objects in the classroom through this cylinder by keeping it straight. Now bend the paper cylinder slightly and observe the same. (Instead of a paper cylinder, a plastic/rubber pipe can be used.)

Could you see the objects when the paper cylinder was straight? Or when it was bent? Write down your observations.
From the above activity, the candlelight/object was seen when the cylinder was straight. When the cylinder was bent the same candlelight/object could not be seen. This is because light travels in a straight line. This property is called rectilinear propagation of light.

**ACTIVITY 4.3**

**Aim:** To know the path of light.

**Materials we require:** Torchlight, stand, two used dusters

**Procedure:**
- We shall fix the torchlight on the stand in such a way that the light falls on the wall of our classroom.
- We shall ensure that the distance between the torch and the wall is at least six to ten feet.
- We shall take two used dusters.
- We shall tap them in such a way that the chalk powder falls in the space between the wall and the torch.
- We shall observe the path of light when the light passes through the chalk powder.
- We shall discuss our observations in small groups and try to find out the reasons.

**Inference**


This activity confirms that light travels only in a straight line.

### 4.2.1. Pinhole camera

**Shall we make a pinhole camera?**

- Let us take two cardboard boxes (a small one and a big one) such that one slides into the other.
- Cut open on one side of the bigger box.
- On the opposite face of the larger box, make a small hole in the middle. (the hole should be very small to get a clear image)
- Then a square has to be cut off on one side of the small box.
- An oil paper is pasted inside. (Tracing paper can also be used.)
- Make a hole on the other side of the small box such that the pasted trace paper can be seen.
- Slide the smaller box inside the larger one with the hole, in such a way that the side of the tracing paper is inside.
Let us play and enjoy:

Mount a convex lens on a stand and focus it to a distant object (tree, building, electric pole.) A white screen is placed on the other side of the convex lens and its position is adjusted to get a clear, inverted image of the distant object on it. Don’t you think that this image formed is similar to the image formed on the pinhole camera?

From this we understand that the hole of a pinhole camera acts like a convex lens.

Let us make sure that there is no hindrance between the two boxes.

This set up has to be placed in the sunlight and should be covered with a black cloth so that light will enter only through the pinhole.

The pinhole of the big box should be focused towards the distant object (tree or candle) and the tracing paper is observed.

1. Is anything seen on the tracing paper?
2. Is there any difference between the object and its image formed on the tracing paper? (Image is the same copy of the object)
3. Shall we trace out the image formed on the tracing paper and compare it with the object?
4. Do you observe any change in the size of the image, when the distance between the pinhole and the tracing paper is increased or decreased?

Let us try and understand how the pinhole camera works.

Observation and conclusion:

The light that comes from the object passes through the pinhole and forms an inverted image on the tracing paper. When the distance between the pinhole and the tracing paper is increased, the size of the image also increases. When the distance is decreased, the size of the image decreases. If the size of the pinhole is increased, the clarity of the...
image decreases and the image becomes blurred.

Why the image formed in a pinhole camera is inverted?

The reason is light travels in a straight line. The light rays from the top of the object travel through the centre of the pinhole in a straight line and go downwards. Similarly the light rays from the bottom of the object travel through the centre of the pin hole in a straight line and go upwards. Therefore, we get an inverted image on the screen.

4.3. Transparent, Translucent and Opaque objects

Place a glass tumbler/beaker before you and view the objects in your classroom through it. You see all the objects clearly. Don’t you? It is because glass is a transparent object.

The objects which allow light to pass through them are called transparent objects.

Spectacles, clear water, pure air are some more examples of transparent objects.

Take water in a glass tumbler and add a few drops of milk. Now see the objects in your classroom, through the tumbler. The objects are not seen clearly. They appear blurred because water mixed with milk allows only some amount of light to pass through it.

The objects which allow the light to pass through them partially are called translucent objects.

Air with dust particles, mist, ground glass, a sheet of paper smeared with oil are some more examples of translucent objects.

Look at the objects in your classroom through your note book. Can you see them? No, you cannot because note book is an opaque object.

Thus the objects which do not allow light to pass through them are called opaque objects.

Wooden door, plastic chair, brick are some more examples of opaque objects.
### ACTIVITY 4.4

**Aim:** To differentiate various objects based on their transmission of light.

**Materials we require:**

A glass plate, black cloth, white muslin cloth, clear water, muddy water, water with a few drops of milk, plastic scale, oiled paper, stone, handkerchief, blotting paper, ball, a piece of rubber, book, leaves, metal scale etc.

**Procedure:**

- We are going to see the objects in the classroom through the collected material.
- We are going to find out through which material we could see the objects very clearly and could not see clearly and could not see at all.
- We are going to see the objects in the classroom through each collected material and record our observations in the table given below.

**Our observations:**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Material</th>
<th>Could see through it clearly/ could not see clearly/ could not see at all</th>
<th>Nature of the materials used (Transparent/ Translucent/ Opaque)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>book</td>
<td>Could not see at all</td>
<td>Opaque object</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3.</td>
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<tr>
<td>4.</td>
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<tr>
<td>5.</td>
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</tr>
</tbody>
</table>

### 4.4. Shadows

**Answer this riddle!**

A friend who is always with us and follows us wherever we go. Who is he? To know the answer for this riddle, let us play the following game with our friends.

Keep your fingers in front of an intense source of light. Adjust your fingers to get shapes of different animals as shown in the picture. Ask your friends to identify the different animals from the different shapes. Did they identify?
Now you would have got the answer for the above riddle. The answer is - shadow.

Note: Better results can be obtained by using Overhead Projector (OHP)

How shadows are formed?

**ACTIVITY 4.5**

**Aim:** To find out the objects that cast shadow.

**Materials we require:**

Things we used in Activity 4 and a torchlight etc.

**Procedure:**

- We shall hold these objects one by one in the path of sunlight entering through the window of our classroom / torchlight and see whether we get the shadows of the objects.
- Let us see whether all the objects cast shadow.
- Let us tabulate which objects cast shadows and which did not.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Object Name</th>
<th>Casts shadow Yes / No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td></td>
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<tr>
<td>2.</td>
<td></td>
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<tr>
<td>3.</td>
<td></td>
<td></td>
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<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
We shall write from the table one by one which objects cast shadow.

What did we learn from the above activity? We learnt that when certain objects are placed in front of sunlight or torch light a shadow is formed behind the object. Since the object placed in the path of light do not allow light to pass through it, there is no possibility of light rays to go behind the object. Hence that region is dark. This is because light travels in a straight line. Objects that cast shadow are opaque objects.

From this we know that all objects do not cast shadow, only opaque objects cast shadow. We also understand that we need a source of light, an opaque object and a screen (wall, floor, building etc. act as a screen) to cast shadow.

ACTIVITY 4.6

Aim: To study the size, colour and shape of the shadow.

Materials we require:

a torch, ball, book, pen, rectangular card board, stick, pencil, eraser, different types of colourful flowers, a white screen. (a piece of cardboard covered with white paper) etc.
Procedure:

- Let us turn on the torch and place the object (whose shadow we want to study) in front of it.
- Hold the screen on the other side of the object to get the shadow. Ask your friend to trace out the outline of the shadow on the screen.
- Repeat the above steps for different objects and note the colour, shape and size of the shadow and compare the same with the original objects.

Observation:

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

Properties of shadow:

- Shadow is always formed on the opposite side of the light source.
- It only shows the shape or outline of the object and not the details.
- A shadow cast by an intense beam of light is dark.
- A shadow is always black regardless of the colour of the object and the light source.
- The size of a shadow varies depending on the distance between the object and the source of light, and the distance between the object and the screen. (As the distance between the object and the source of light increases the size of the shadow decreases and as the distance between the object and the screen increases the size of the shadow increases)
- Source of light, an opaque object and the shadow will always lie in a straight line.

4.5. Reflection of light and plane mirror

When a tennis ball is thrown against a wall, it bounces back. Similarly when a beam of light falls on a smooth shining surface, it bounces back into the same medium (solid, liquid or gas). This phenomenon is called reflection.

Plane mirrors:

Have you seen your face in a mirror? What you see on the mirror is your own reflection. This is called image. Shall we learn, how we are able to see our own image on the mirror?

Light rays from the light source which fall on our face are reflected.
More to know

When one side of the transparent glass is coated with a chemical substance, it becomes a plane mirror (opaque). All the highly polished opaque objects show the property of reflection.

These reflected rays are reflected back again when they fall on a mirror. When these reflected rays from the mirror reach our eyes we are able to see the image of our face (object) in the mirror. Isn’t the surface of the mirror plane and smooth? This is called plane mirror.

**ACTIVITY 4.7**

*Aim:* To study different types of reflecting surfaces and formation of images on them.

*Materials we require:* Materials we use daily.

*Procedure:*

We study the reflected image of our face on various surfaces chosen by us and observe the nature of the surfaces and the same will be tabulated as follows:

<table>
<thead>
<tr>
<th>Sl.no.</th>
<th>Name of the surface</th>
<th>Image obtained (clear/not clear)</th>
<th>Nature of surface (smooth and polished/ rough)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>plane mirror</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>marble floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>still water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>a new stainless steel plate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>a plate with scratches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>table top</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What do we learn from this?

We have learnt that polished plane surfaces like new stainless steel plate, glass, marble floor, still water, produce clear images. Other surfaces do not produce clear images.

Look at the pictures given here. When a beam of light falls on a plane surface, the surface changes the direction of the light rays. We have learnt that the direction of light is changed when it is reflected.

**ACTIVITY 4.8**

Fix a comb on one side of a thermocol and a mirror on the other side as shown in the picture. Spread a thick coloured paper in between the comb and the mirror. Keep this set up in sunlight or pass light from a torch through the comb. What do you observe? Is it not the same as given in picture?

From this we learn how light is reflected by mirror.
**Do you know?**

Shadow is cast since light travels in straight line. Solar and lunar eclipses occur because of this property of light. When the sun, the earth and the moon come in a straight line eclipses are formed.

**Lunar Eclipse: (Eclipse of the moon)**

When the earth comes between the sun and the moon, lunar eclipse occurs. This happens on a full moon day.

- The Sun - source of light
- The Earth - opaque object
- The Moon-screen

When the shadow of earth falls on the moon, the moon is hidden. This is called lunar eclipse.

**Solar Eclipse: (Eclipse of the sun)**

When the moon comes between the sun and the earth, solar eclipse occurs. This happens on a new moon day.

- The Sun - source of light
- The Moon - opaque object
- The Earth-screen

When the shadow of the moon falls on the earth, the sun is hidden. This is called solar eclipse.

---

**Group discussion:**

Can we organize a science awareness play to the common people in order to eradicate the superstitious beliefs about solar eclipse and lunar eclipse?

(You have learnt about solar eclipse and lunar eclipse in Geography also.)
I. Choose the correct answer

1. The name of the instrument invented by Galileo
   a. microscope   b. telescope   c. mirror

2. Which is an artificial source of light?
   a. Sun   b. fire fly   c. torch light

3. An example for Non-luminous body.
   a. Sun   b. candle   c. moon

4. Human body is ________________.
   a. translucent   b. opaque   c. transparent

5. The colour of the shadow of any coloured opaque object is
   a. white   b. the same colour   c. black

6. Reflected image can be clearly seen on a _______.
   a. polished surface   b. rough surface   c. shadow

II. Match the following

1. Artificial light source - a. moon
2. Non-luminous body - b. turbid water
3. Reflecting surface - c. spectacles
4. Translucent object - d. tree
5. Transparent object - e. disc
6. Opaque object - f. burning lamp

III. Circle the odd one out and give reason

1. oil lamp, blackboard, electric bulb,
2. oiled paper, rough surfaced window pane, wooden door
3. formation of shadow, formation of eclipse, appearance of face on the mirror
IV. Fill in the blanks

1. Look at the picture and write down the nature of the given objects.

Object:  A) __________  B) __________  C) __________

2. Which property of light is shown by the diagram given below?

3. Mention the nature of each object A, B, C given in the picture

   A  __________
   B  __________
   C  __________
4. The Objects which are seen clearly through the glass tumbler from outside are __________, __________.

Classify the materials in the picture according to their property.

<table>
<thead>
<tr>
<th>Sl.no.</th>
<th>Object</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
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<td>3</td>
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</tbody>
</table>

V. What do you understand from the given pictures? Explain

Picture 1

Picture 2

VI. Answer the following in one or two words

1. Objects that emit their own light.
2. Objects that do not emit their own light.
3. Objects that allow light to pass through.
4. Objects that allow light to pass through partially.
5. Objects that do not allow light to pass through.
6. Things that cast shadow.
7. Things required to see the objects.

VII. Differentiate the following

1. Shadow, image.
2. Natural source of light, artificial source of light.
3. Transparent object, opaque object.
4. Luminous body, non-luminous body.

VIII. Think and answer

1. Hold various colours of ball, flowers, cubic block, square block and coin in front of the source of light and observe clearly the shadow of these objects on the floor.
   a. Will the shape and colour of the shadow be similar to the objects or not?
   b. Which of the objects have similar shadows?

2. A boy is standing in front of the pin hole camera, which is below the source of light in the picture. Look at the picture and answer the following questions.
At which point does the light ray from the boy’s head fall on the screen of pinhole camera?

At which point does the light ray from the centre of the boy fall on the screen of pinhole camera?

At which point does the light beam from the foot of the boy fall on the screen of pinhole camera?

Will the image of the boy formed on the screen be erect or inverted?

3. Observe the picture and Identify the errors.
Project

1. Reflect sunlight on a wall using stainless steel plate, metal scale and stainless steel lunch box.

2. Stand for a few minutes in the sunlight with a mirror. Look at your image on the mirror and your shadow cast on the ground. List out the similarities and differences between the two.

3. Shall we do this activity along with our friends on a holiday? Draw a large circle on the play ground at any place and one can stand in the centre of the circle. The shape of the shadow can be traced on the ground, in the morning, at noon and in the evening with the help of his friends. The length of the shadow, the direction of the Sun and the direction of the shadow can be noted each time and tabulated.

<table>
<thead>
<tr>
<th>Time</th>
<th>Length of the shadow</th>
<th>Direction of Sun</th>
<th>Direction of shadow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning</td>
<td></td>
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<tr>
<td>Noon</td>
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<tr>
<td>Evening</td>
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</tr>
</tbody>
</table>
Three questions to know more about the study of light.

1. A person is eating in front of a plane mirror. Why does the image appear as if he is eating with his left hand?

2. In a car or a bus, why do the objects seen on the mirror at the driver’s side appear small and very close?

3. In some textile showrooms, the four walls of the trial room are fitted with mirrors. We see many images of us when we enter in. How?

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Webliography:
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http://www.howstuffworks.com/light2.htm
http://uhaweb.hartford.edu/nasa/basic/light-6.htm
### ‘I can, I did’

**Student’s Activity Record**

Subject:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Date</th>
<th>Lesson No.</th>
<th>Topic of the Lesson</th>
<th>Activities</th>
<th>Remarks</th>
</tr>
</thead>
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