Orient BlackSwan

Inspired PHYSICS

For the CISCE curriculum

NEP Compliant inside

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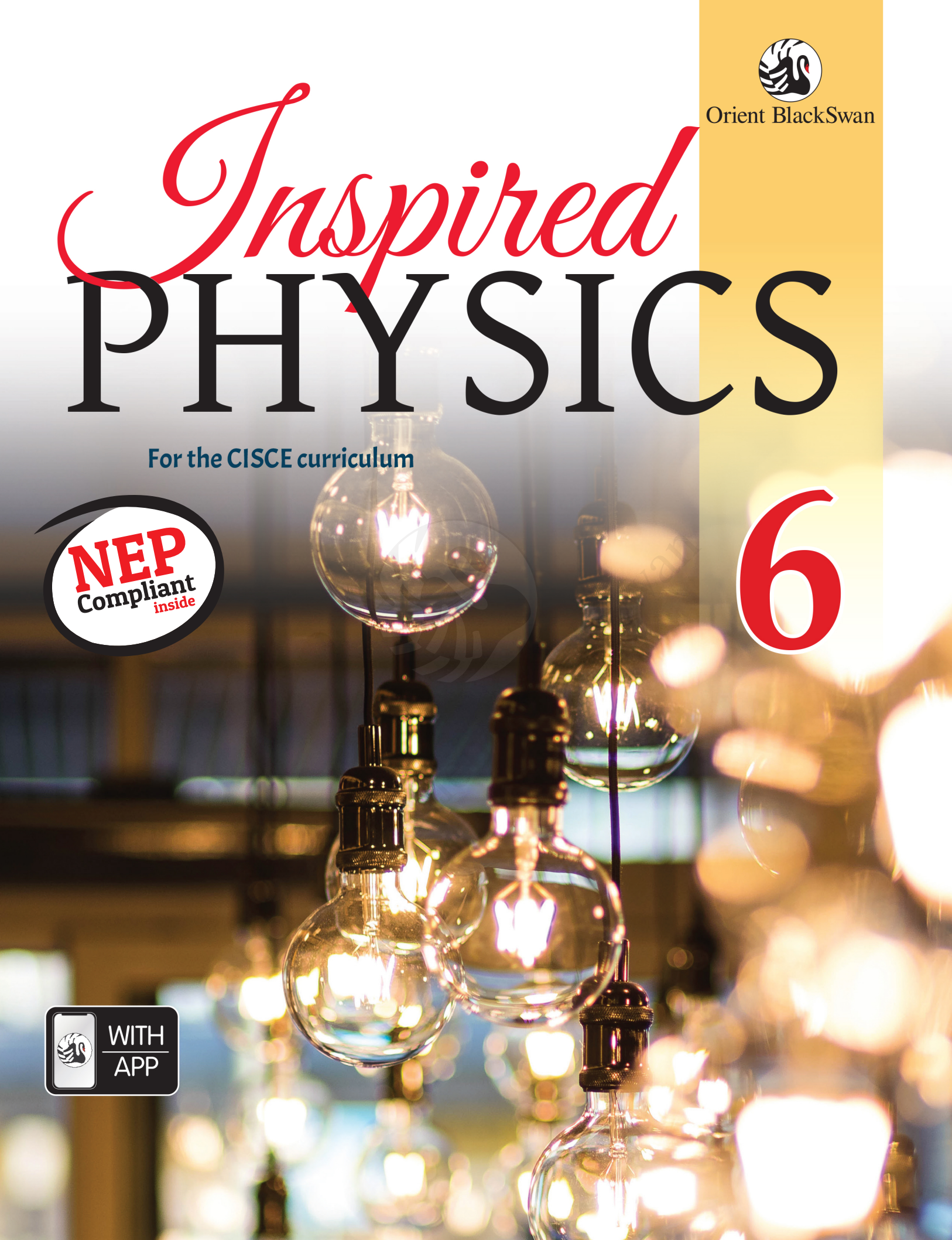

WITH APP

Inspired PHYSICS

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Orient BlackSwan

Inspired Physics

has been developed in accordance with the CISCE Upper Primary Science (Physics) curriculum. Its aims are:

- to enable students to relate their daily life experiences and science by following a practical, thematic approach
- to focus on the development of scientific temper through skill and process development
- to encourage knowledge construction through information collection, organisation and reflection

Students' book

- complete syllabus coverage
- carefully graded text
- appropriate, well-labelled illustrations and photographs
- appropriate activities and exercises

Let's learn

Learning outcomes
encourage students to take responsibility for their learning

Get going
helps focus and direct students' attention to the lesson

Activities
help students learn through practical exercises

Stop and check
provides checkpoints for teachers and students to evaluate progress

Spotlight
focuses on important topics in greater detail

Go further
provides additional, interesting, relevant information

SciTech
links scientific concepts with real-life occurrences and applications

Eco corner
presents issues that are an environmental concern

Let's revise

In a nutshell
is a comprehensive revision corner

Concept map
is a graphic presentation of concepts linked logically

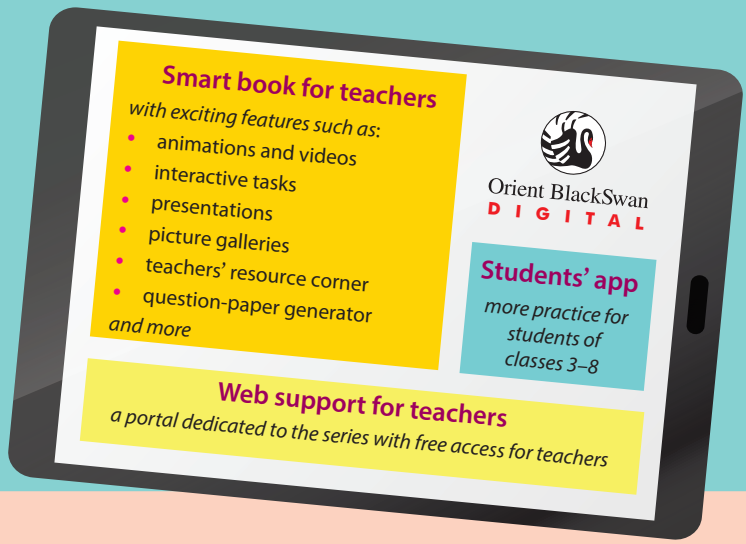
Summary
lists the main points of the lesson briefly

Keywords
lists important words and their definitions

Glossary
presents important words for quick revision at the end of the book

Teachers' resource pack

- lesson plans
- question bank with answers
- worksheets with answer key
- question papers with answer key
- answer key to the exercises in the students' book



Let's apply

Checkpoint
covers a variety of exercises (objective type, short answer and long answer)

Think and answer
encourages students to develop higher-order thinking skills necessary for the 21st century

Picture study
offers picture-based questions that encourage students to observe, identify and relate concepts to real life

Hands-on
offers a variety of projects that reinforce 21st century skills through experiments, model-making, discussion, role play, research work, report writing and so on

Subject integration
presents additional activities explicitly linking multiple subjects

Life skills and values
help children develop skills needed for everyday life and values needed to be well-adjusted members of society

Let's know more

Scientist in focus
describes the life and work of famous scientists to inspire students

Heritage corner
presents exciting and accurate information on India's scientific heritage

Internet links
provides sources for further study and research

Career watch
presents novel ideas for a career in science and technology

Let's work

- ***Worksheets*** a workbook corner with worksheets covering all lessons
- ***Test papers*** based on the ICSE pattern

CONTENTS

3 Force

Learning outcomes

By the end of this theme, you will be able to:

- define a force and explain its different effects
- describe the different types of forces
- explain how a force is measured
- define the force of friction and explain the factors that affect it
- describe the effects of friction
- describe static, sliding and rolling friction
- list the advantages and disadvantages of friction
- explain how friction can be increased or reduced

Get going

What do we do to make a shopping cart move or to make a *chapatti*? Do we need to apply some effort? Discuss this with your classmates.

a. pushing a pin into a board

b. hitting a ball with a bat

Fig. 3.1 Situations in which a force is applied

INTRODUCTION

We push or pull objects to make them move, to make them stop moving or to change their direction of motion. A push or pull on an object is a **force**.

Here are some examples of situations in which a force is applied (Fig. 3.1).

- We push a pin into a board or pull it to get it out.
- We can change the direction in which a cricket ball is moving by hitting it (giving it a push) with a bat.
- We can also change the shape of an object, such as *chapatti* dough, by squeezing it (applying a push to it) or stretching it (applying a pull to it).

EFFECTS OF FORCES

Forces can have the following effects.

- **A force can move a stationary object.** For example, when we kick a football at rest, the force we apply makes it move. When we pull a luggage trolley, it moves on its wheels.
- **A force can stop a moving object.** This occurs when the force acts opposite to the direction of motion of the object. For example, when we catch a ball, our hands apply a force on the ball to stop its movement.
- **A force can change the speed of a moving object.** If the force is applied in the same direction as the movement of the object, the object moves faster. If it is applied in the opposite direction, the object slows down. For example, pedalling harder makes a moving bicycle move faster. Pressing the **brakes** applies a force on the wheels in the opposite direction and slows down the bicycle.

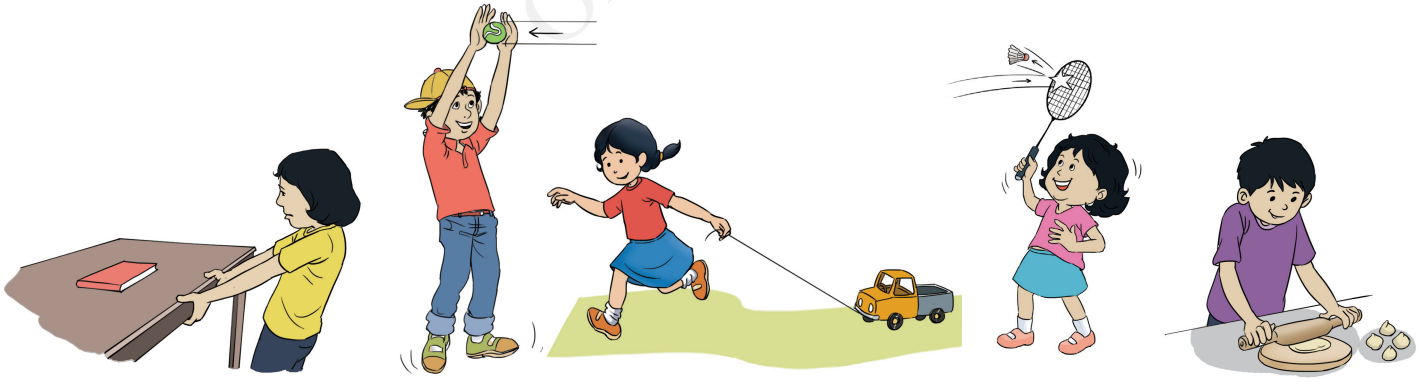
Spotlight

If an object is stationary, that is, standing still, it is said to be **at rest**. If it is moving, it is said to be **in motion**.

- **A force can change the direction of motion of a moving object.** This happens when the force is applied in a direction different from the direction of motion of the object. For example, the direction of motion of a tennis ball changes when it is hit with a racquet.
- **A force can change the size and shape of an object.** We squeeze and stretch a lump of clay to **mould** it into a new shape. We squeeze a sponge to **wring** it. We apply a force to elongate or compress a spring.

Based on its effects, *a force can be defined as a push or pull that changes or tends to change the state of rest or of uniform motion of an object, or its shape.*

A force does not change the mass of an object.



a. moving a stationary object | b. stopping an object in motion | c. changing the speed of motion | d. changing the direction of motion | e. changing size or shape

Fig. 3.2 Effects of forces

TYPES OF FORCES

Forces can be classified into two types—**contact forces** and **non-contact forces**.

Contact Forces

Forces which act between objects that are in contact with each other are called contact forces. Two examples are **muscular force** and **frictional force**.

Muscular force

Muscular force is the force that is applied on an object by the muscles of the body (Fig. 3.3). For example, we lift a bag or push a chair using muscular force.

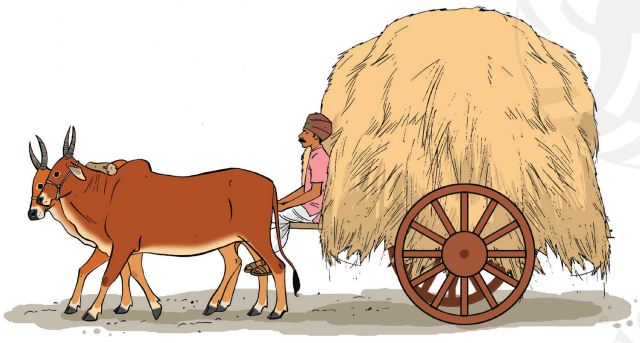


Fig. 3.3 Bullocks use muscular force to pull a cart.

Frictional force

Frictional force is the force that acts between the surfaces of objects in contact and opposes the movement of one surface against the other.

Frictional force acts on objects whose surfaces are in contact with each other. If an object moves over another one, friction acts in the direction opposite to the direction of motion. We will learn more about this force later in the lesson.

Non-contact Forces

Forces which act between objects that are not in contact with each other are called non-contact forces. Examples are **gravitational force**, **magnetic force** and **electrostatic force**.

Gravitational force

Gravitational force is the force of attraction that acts between any two objects in the universe that have mass. All objects exert this force on each other.

The Earth's gravitational force is called **gravity**. It acts on all objects on the Earth's surface and attracts (pulls) them towards the centre of the planet. It thus makes objects fall downwards to the ground. This is why water flows downwards from a height (Fig. 3.4) and a ball thrown into the air falls back to the ground.

Fig. 3.4 Water flowing downwards in a waterfall

You have learnt that weight depends on gravity. The weight of an object on Earth is the force with which it is attracted by the Earth. Therefore, weight can vary, unlike

mass. The weight of an object is different on planets that have stronger or weaker gravitational forces than the Earth.

Go further...

The gravitational force of the Earth is six times greater than that of the Moon. Therefore, an object will weigh six times more on the Earth than on the Moon.

Magnetic force

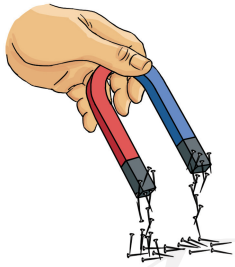


Fig. 3.5 A magnet attracts iron nails.

A **magnet** is a piece of metal, usually iron, that attracts other metals such as iron and nickel (Fig. 3.5).

Magnetic force is the force of attraction or repulsion that acts between two magnets or between a magnet and another material.

A magnet has two **poles**—a north pole and a south pole. Opposite or unlike poles (south–north) attract each other, bringing the magnets closer. Similar or like poles (south–south and north–north) **repel** (push away) each other, making the magnets move away from each other (Fig. 3.6).

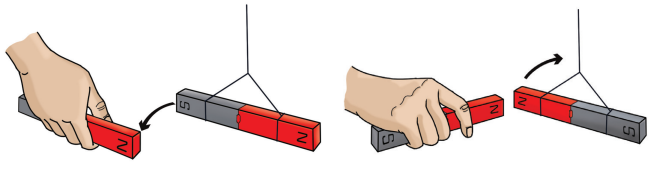


Fig. 3.6 Like poles attract and unlike poles repel each other.

Electrostatic force

If you touch the screen of an old-style TV or computer that has just been switched off, you may hear a crackling sound and get a small shock. This is because such objects are **electrically charged**.

There are two types of **electric charges**—positive charges and negative charges. Most objects are **electrically neutral** (with equal positive and negative charges that balance each other), but they can become charged under certain conditions. Objects with opposite charges attract each other and those with similar charges repel each other.

The force that electrically charged objects exert on each other is called electrostatic force.

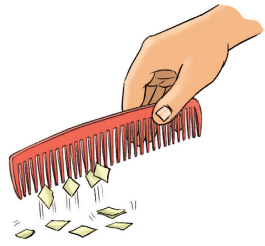


Fig. 3.7 A charged comb attracts pieces of paper.

When we rub a plastic comb against our dry hair, the comb becomes charged. If we hold it near tiny pieces of paper, the pieces stick to the comb because of the electrostatic force of **attraction** (Fig. 3.7).

MEASUREMENT OF FORCE

Some important facts about forces are as follows.

- A force is expressed in terms of its **magnitude** (strength) and its **direction**.

- When two forces act on an object in the same direction, the **resultant force** that acts on the object is equal to the sum of the forces.
- When two forces act on an object in opposite directions, the resultant force is equal to the difference of the forces.

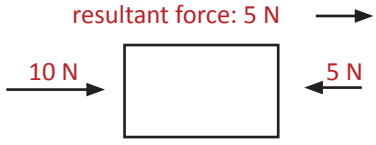


Fig. 3.8 The resultant force is the difference of the forces.

- If two equal forces act on an object but in opposite directions, the resultant force is zero.

The SI unit of force is the **newton** (N).

The unit **kilogram-force** (kgf) is used to express the force exerted by the Earth and is therefore used to express weight. Thus, the weight of an object of mass 5 kg is 5 kgf. One kilogram-force is approximately equal to 10 N. One kilogram-force is the force with which the Earth attracts an object of mass 1 kg towards its centre.

A **spring balance** is a device used to measure weight. As weight is a force, the device can also be used to measure applied forces.

Spotlight

A spring balance works on the principle that the length of a spring increases uniformly as the weight pulling on it increases.

A spring balance consists of a spring with a scale. A pointer and hook are attached at one end. When an object is attached to the hook, the spring lengthens. The reading on the scale is equal to the weight of the object.

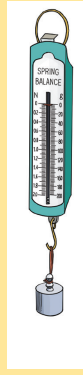


Fig. 3.9 Spring balance

Stop and check

Say if the statements are true or false.

1. When we fold paper, we apply a force to it.
2. A force can change the state of rest of a body.
3. Gravitational force acts on a ball only when it is on the ground.
4. The symbol for the SI unit of force is N.

FORCE OF FRICTION

A ball made to roll on the ground slows down and then comes to a stop. This is because frictional force or **friction** acts against the movement of the ball when it is in contact with the ground.

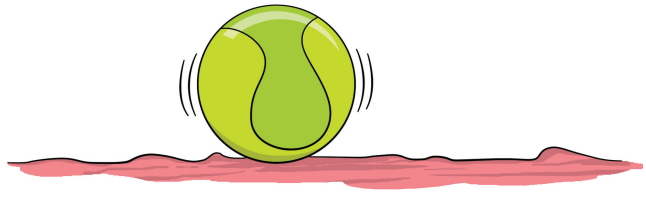


Fig. 3.10 Friction opposes the movement of an object on a surface.

Factors affecting Friction

Two important factors that affect friction are the nature of the surfaces in contact and the weight of the object moving on the surface.

The nature of the surfaces in contact

Any surface, even a smooth one, has tiny irregularities in the form of grooves and ridges (Fig. 3.11). We can see these using a powerful magnifying glass or a microscope. When one surface moves over another, the irregularities get stuck against each other and slow down the movement. Therefore, a rough surface offers greater friction than a smooth surface. Some substances offer more friction in general than others (for example, rubber more than steel).

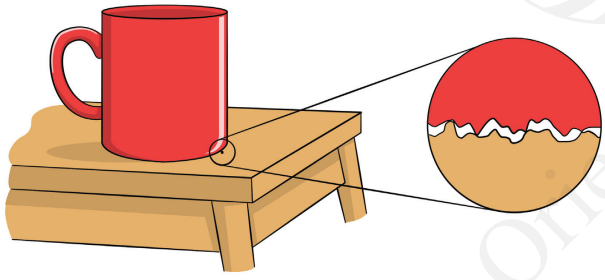


Fig. 3.11 Irregularities on surfaces get caught in each other and generate friction.

Activity 3.1

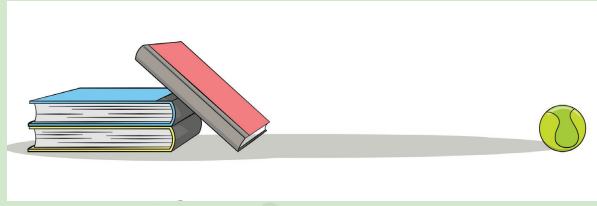
Aim: To show that friction depends on the nature of the surfaces in contact

Materials required: books, tennis ball, chalk, ruler, carpet or mat

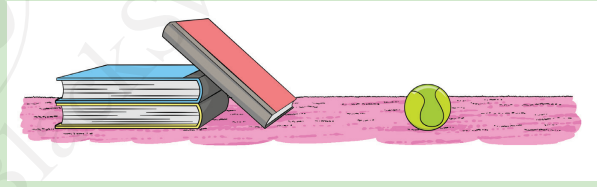
Method

1. Lean a book against one or two other books to create a slope on the floor.
2. Release the tennis ball from the top of the slope. Mark how far it rolls and measure the distance.
3. Repeat the experiment on a rougher surface such as a carpet or table and measure the distance.

Observations and conclusions: The tennis ball moves farther on the floor than on the carpet. The carpet is rougher and offers greater friction, therefore slowing down the ball much faster than the floor. So, smooth surfaces offer less friction than rough surfaces.



a. The ball rolls farther.



b. The ball stops sooner.

Fig.3.12 Rougher surfaces offer more friction than smoother surfaces.

The weight of the object moving on the surface

The greater is the weight of the object on a surface, the more tightly the irregularities on the surfaces in contact are interlocked (Fig. 3.13). Therefore, a heavier object will experience greater friction than a lighter object when both are moved on the same surface.

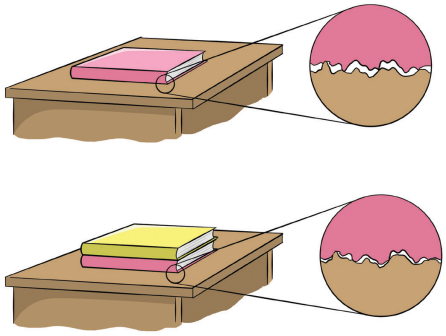


Fig. 3.13 The interlocking of irregularities is tighter for heavier objects.

Go further...

A brick will experience the same friction on its side as it does when placed upright on one end. This is because friction is independent of the area of contact with the surface when the weight remains unchanged.

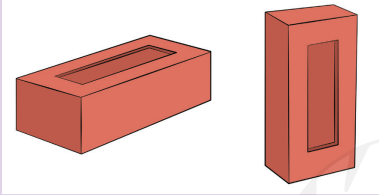


Fig. 3.14 Friction is independent of area of contact.

EFFECTS OF FRICTION

Friction has the following effects.

Friction Opposes Motion

A ball rolling along the ground comes to a stop after some time. This is because friction with the ground opposes the ball's movement. Therefore, friction opposes the movement of an object.

Friction Produces Heat

Rub your palm against each other fast. Do they feel hot? A pebble rubbed on the floor several times feels hot. This is because friction produces heat.

Fig. 3.15 Friction helps us to light a match.

Friction between the head of a match and the rough side of a matchbox produces heat. This causes the chemicals on the matchstick to catch fire (Fig. 3.15). In ancient times, people would rub dry sticks or strike flints[1] together to produce a spark and light a fire.

Friction Causes Wear and Tear

Fig. 3.16 Friction wears out footwear.

Friction with the ground wears out the soles of our shoes and slippers (Fig. 3.16) and the tyres of vehicles. In machines, parts that move against each other are worn out by friction too. This is why footwear, tyres and machine parts need to be replaced from time to time.

TYPES OF FRICTION

There are three types of friction—**static friction**, **sliding friction** and **rolling friction**.

Static friction *The frictional force that acts between two objects that are in contact and at rest is called static friction.*

[1]flint a kind of hard grey rock

When we apply a force to slide a book on a table, the book does not slide if the force applied is less than the friction. But if we increase the applied force, at a certain maximum force, the book will be at rest but just about to slide. The maximum frictional force that opposes this movement is static friction.

Sliding friction *The force of friction that acts between two objects in contact when one object slides over the surface of the other is called sliding friction.* Sliding friction is equal to the force needed to keep the object moving. Sliding friction is less than static friction.

Rolling friction *The force of friction that opposes the motion of an object that rolls over the surface of another is called rolling friction.* Rolling friction is less than sliding friction. This is why wheels and rollers are used to move heavy objects such as furniture and luggage from place to place (Fig. 3.17). For an object, static friction is greater than sliding friction, and sliding friction is greater than rolling friction.

Fig. 3.17 Suitcase with wheels

static friction > sliding friction > rolling friction

Activity 3.2

Aim: To show that static friction is greater than both sliding friction and rolling friction

Materials required: block of wood, spring balance, string, four cylindrical pencils

Method

1. Fasten the block to the hook of the spring balance. Place the block on a table surface.
2. Pull the spring balance gently to exert a force on the block. The reading on the spring balance gives the frictional force. Increase the pull on the spring balance until the block just starts to slide. The reading F_1 is a measure of the static friction on the block.
3. Pull the spring balance until the block slides smoothly. The reading F_2 is a measure of the sliding friction on the block.
4. Place four pencils under the block so that it rolls on the table. Pull the spring balance to make the block roll smoothly. The reading F_3 is a measure of the rolling friction of the block.

Observations and conclusions: You will find that $F_1 > F_2$ and $F_2 > F_3$. We can also say $F_1 > F_2 > F_3$. Therefore, static friction is greater than both sliding friction and rolling friction.

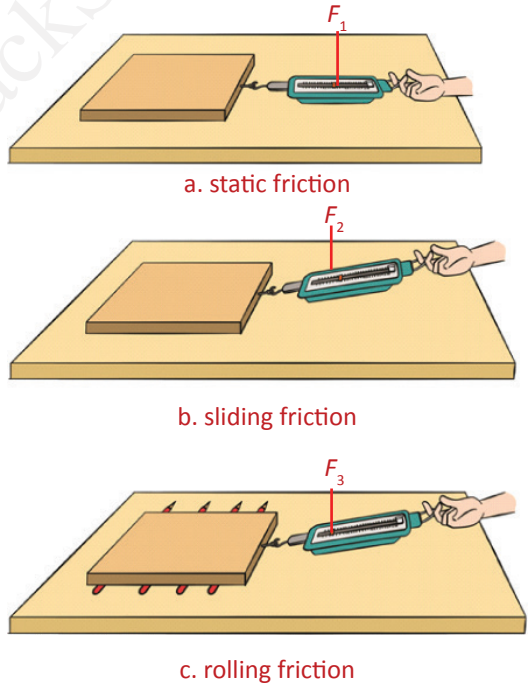


Fig. 3.18 Comparing static, sliding and rolling friction

ADVANTAGES OF FRICTION

Friction plays an important role in our daily life in the following ways.

- Friction helps us to walk and run on the ground. Without friction, we would slip and fall all the time!
- Friction between our fingertips and objects helps us to hold them. It keeps objects in place on shelves and tables so that they do not slide off.
- Friction between the tip of the pencil and the surface of paper helps us to write (Fig. 3.19).
- Friction helps nails and screws to remain fixed firmly in walls.

Fig. 3.19 Friction helps us to write on paper.

- Friction helps us to light a match by striking it against the rough side of a matchbox.
- Vehicles move on roads because of friction between tyres and the surface of the road.
- Moving vehicles slow down and stop when the brakes are applied to the wheels. This is because of friction between the brake pads and the wheels (Fig. 3.20).

Fig. 3.20 Brake pad touching a bicycle wheel

METHODS OF INCREASING FRICTION

Friction can be increased by increasing the roughness of a surface. This is done in the following ways (Fig. 3.21).

- **Treads** on tyres and the soles of footwear are made of rubber to increase friction and provide grip to vehicles and people. Treads and soles have patterns cut into them to allow water to be pushed out from under them in wet conditions to prevent slipping.
- Sportspeople and athletes wear shoes with spikes on their soles. The spikes help them grip the ground firmly as they run.
- Sand and gravel are strewn on slippery paths in rainy or snowy weather to increase friction.

a. treads on a tyre b. sports shoes with spikes

Fig. 3.21 Methods of increasing friction

DISADVANTAGES OF FRICTION

Friction is a disadvantage in many situations.

Energy is needed to apply a force large enough to overcome friction. For example, vehicles need energy to overcome friction on roads and move.

Friction causes wear and tear. This reduces the life of footwear, tyres, machines and so on.

Friction produces heat, which can cause damage in machines.

Eco corner

Machines work using energy. If the friction between machine parts is high, energy is wasted in overcoming friction. Energy is also wasted when heat is produced due to friction. Therefore, machines should be maintained well and lubricated to reduce friction and therefore conserve energy.

METHODS OF REDUCING FRICTION

Friction between surfaces can be reduced in the following ways.

Polishing Polishing surfaces makes them smooth and reduces friction.

Using lubricants *A **lubricant** is a substance that is applied between surfaces in contact to reduce friction.* It fills the tiny grooves on surfaces, making the surfaces smoother.

Oil and grease are liquid lubricants used in vehicle engines, bicycle chains and so on. Solid lubricants are used in the form of powders. An example is the powder used on carrom boards.

Using ball bearings Ball bearings reduce friction by making surfaces roll over each other instead of slide. They consist of small balls of steel placed between steel rings (Fig. 3.22). These reduce friction as the rings rotate.

Fig. 3.22 Ball bearings

SciTech

Cold welding

When two extremely smooth pieces of similar metals are brought in contact in vacuum, they will stick to each other, forming what is called a 'cold weld'. This is due to inter-molecular forces of attraction. This can be a significant problem in spacecraft.

Streamlining Liquids and gases offer friction too. The movement of aeroplanes in air and boats in water is slowed down by friction. *The friction that occurs when objects pass through liquids and gases is called **drag**.*

Streamlining involves giving objects a special **streamlined** shape to reduce drag. A streamlined shape is rounded in the front and narrows at the back, like a teardrop. Aeroplanes and ships are

streamlined. Birds and aquatic animals such as fish have streamlined shapes that help them to move easily through air and water, respectively (Fig. 3.24).

a. shark

b. aeroplane

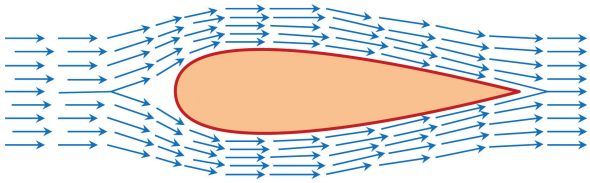


Fig. 3.24 Streamlined shapes

Career watch

Automotive designer

An automotive designer develops the outer body and the inner design of road vehicles such that they work well and look appealing to customers. The job needs creativity and a technical understanding of how vehicles can be made in the best way possible. To become an automotive designer, you will need a degree in automotive design or engineering.

CHECKPOINT

A. Choose the correct option.

1. Force cannot change the _____ of an object.
   a) shape b) mass
   c) state of rest d) direction of motion
2. Which one of these is a contact force?
   a) gravitational force
   b) muscular force
   c) electrostatic force
   d) magnetic force
3. Gravity _____.
   a) causes all movement on the Earth
   b) is the Earth's force of attraction
   c) does not vary from place to place
   d) is a force that both attracts and repels
4. The resultant force of two forces of 2 N and 3.5 N acting in opposite directions is _____.
   a) 0 b) 1.5 N
   c) 5.5 N d) 1 N
5. The maximum frictional force on an object just before it begins to move is _____.
   a) sliding friction b) rolling friction
   c) moving friction d) static friction
6. The streamlined shape of birds and airplanes is _____.
   a) like a sphere
   b) like a cylinder
   c) narrow in front and rounded at the back
   d) rounded in front and narrow at the back

B. Fill in the blanks.

1. The like poles of two magnets _____ each other and the unlike poles _____ each other.
2. Charged objects exert a force on each other called the _____ force.
3. When a toy car rolls down a plank, the force that opposes its movement is _____ friction.
4. The _____ of tyres help to increase their friction with the road.

5. Grease is a kind of liquid _____ that helps machine parts slide smoothly over each other.

C. Say if the statements are true or false.

1. Force can affect the movement and the shape of an object.
2. Gravitational force can both attract and repel objects.
3. Friction always acts in a direction opposite to the direction of movement of the object.
4. Automobile brakes would work very well if there was no friction.
5. Using ball bearings increases friction.
6. Only solid surfaces offer friction.

D. Give reasons.

1. Kicking a football that is in motion makes it move in another direction.
2. A pencil that rolls off the edge of a table does not go flying upwards into the air.
3. When a plastic comb is rubbed against dry hair and then held near pieces of paper, the pieces get stuck to the comb.
4. Two forces of 10 N each, applied on a block in opposite directions, do not make it move.
5. Many suitcases and bags used for travel have wheels attached to them.
6. The brakes of vehicles need to be regularly checked and replaced.

E. Define the terms.

1. Muscular force
2. Non-contact force
3. Magnetic force
4. Frictional force
5. Static friction
6. Drag

F. Short-answer questions

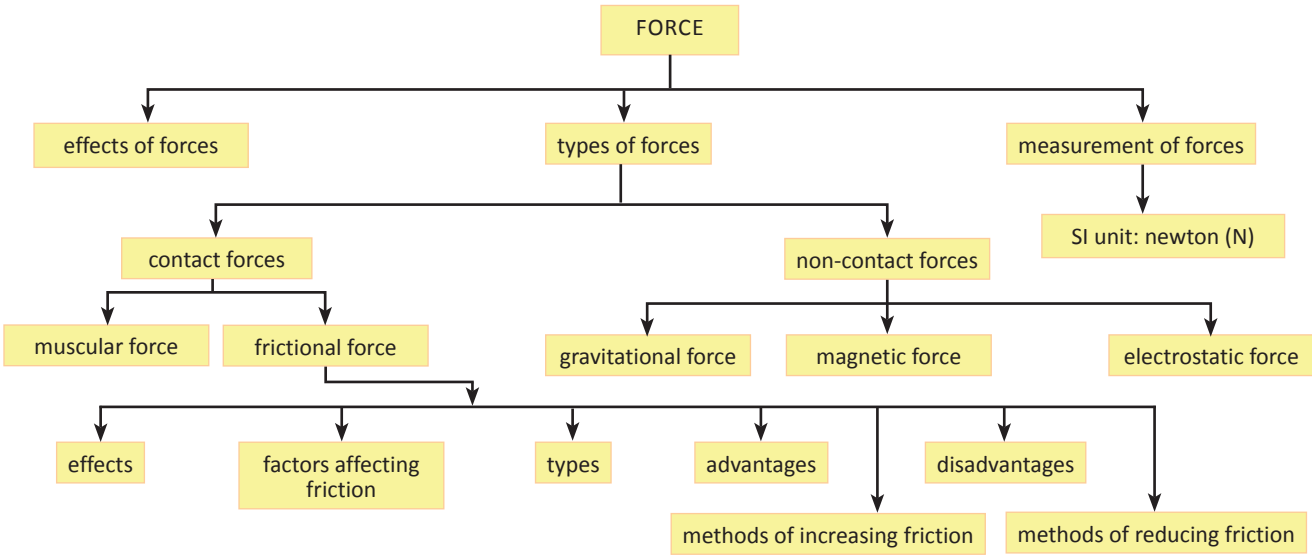
1. Give two examples each of contact and non-contact forces.
2. What happens when two positively charged objects are brought near each other?
3. Name the SI unit of force. Which unit is used to express weight?
4. What will the resultant force be in each of the following cases?
   i. Two forces act in the same direction.
   ii. Two forces act in opposite directions.
   iii. Two equal forces act in opposite directions.
5. Why does a heavy object experience greater friction than a lighter object?
6. How does friction help us to light a match?
7. Give two ways in which friction is a disadvantage.
8. What is streamlining? Give two examples of streamlined shapes that we see in nature.

G. Long-answer questions

1. Give an example to demonstrate each of the following.
   i. Force slows down a moving object.
   ii. Force changes the direction of a moving object.
   iii. Force can increase the length of an object.
2. What are the two main types of forces? Differentiate between them.
3. What is gravity? How does it affect the weight of an object?
4. List the effects of friction and explain one of them.
5. List the factors that affect the frictional force on an object.
6. Explain the difference between static friction and sliding friction. Which is greater for an object of the same mass?
7. Describe five ways in which friction is an advantage.
8. Give three examples where friction between surfaces is increased.
9. Describe three methods used to reduce friction between surfaces.

In a nutshell

CONCEPT MAP



SUMMARY

- A force is a push or pull on an object.
- A force can move a stationary object, stop a moving object, change its speed and direction and also change the size and shape of an object. It does not change the mass of an object.
- Contact forces such as muscular force and frictional force act between objects that are in contact.
- Non-contact forces such as the gravitational force, magnetic force and electrostatic force act between objects that are not in contact with each other.
- The SI unit of force is the newton (N). Weight is expressed in terms of kilograms-force (kgf).
- Frictional force is a contact force that opposes the movement of one surface against another.
- Friction depends on the nature of the surfaces in contact and the weight of the object on a surface. It does not depend on the area of contact.
- A rough surface offers greater friction than a smooth surface. A heavier object also experiences greater friction than a lighter object on the same surface.
- Friction has three important effects—it opposes the motion of an object, it produces heat, and it causes wear and tear of the surfaces in contact.
- There are three types of friction.
  1. Static friction acts between two stationary objects in contact and at rest.
  2. Sliding friction acts between two objects in contact and sliding over one another.
  3. Rolling friction opposes the movement of an object that rolls over the surface of another.
- Friction plays an important role in life. We would not be able to walk, stand and so on without friction.
- Friction can be increased by increasing the roughness of surfaces in contact. For example, tyres have treads to increase friction.
- Friction is also a disadvantage because it requires energy to overcome, it causes wear and tear, and it causes the production of heat that can damage machines.
- Friction can be decreased by polishing surfaces in contact, applying lubricants to them, using ball bearings and streamlining the shape of the object.

KEYWORDS

brake a device used to slow down or stop a moving vehicle by pressing against the wheels

charge an electrical property of matter

drag the friction that occurs when objects pass through liquids and gases

force a push or pull that changes or tends to change the state of rest or of uniform motion of an object or its shape

gravity the gravitational force exerted by the Earth

mould give a shape

resultant force (or resultant) a force that is equal to the combined effect of two or more forces

streamlining giving objects a streamlined shape that is rounded in the front and narrower at the back

wring squeeze and twist to remove water from something

Think and Answer

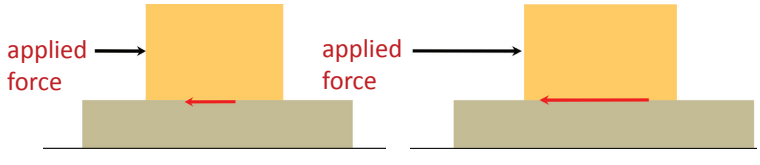
1. 'A force can sometimes have no visible effect.' Is this statement true? Explain your answer with examples.
2. Which would make a better lubricant for an engine—water or oil? Explain your answer. (*Hint:* Remember that friction produces heat.)
3. Why do many machines such as car engines need a cooling arrangement to work properly?

Life Skills and Values

1. Have you seen the sign in the figure? It is often placed on the floor in public areas such as schools, offices, airports and other buildings. Smooth floors made of tiles or marble tend to become very slippery when wet. These signs are placed to indicate that the floor has been cleaned and may be slippery to walk on, so we must be careful. We can avoid slipping by wearing proper footwear which have soles with treads.
2. Neeraj was teaching his little sister Radha how to ride a bicycle. He told her to always check whether the brakes of the bicycle were working properly before starting to ride. Why do you think this is important? What values do we learn from Neeraj?

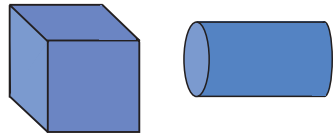
Picture Study

1. Any frictional force has a magnitude and direction, like any other force. In each picture, a force is applied to the block, but the block does not move.
   i. What is the magnitude of the frictional force in each case?
   ii. The block begins to move when the applied force is 8 N. What is the static friction on the block?



a. applied force = 2 N b. applied force = 7 N

2. The objects A and B in the picture have the same mass. Which one would you have to push harder to make it move and why?



Hands-on

1. **Activity**

   Aim: To observe the difference in friction offered by writing paper, butter paper and sandpaper

   Materials required: block of wood, spring balance, sheets of writing paper, butter paper and sandpaper

   Method

   1. Fasten the block of wood to the spring balance. Place the setup on a table.
   2. Place a sheet of writing paper under the block of wood. Use small weights at its corners to hold it in place.
   3. Now, pull the spring balance until the block just starts to slide on the paper. The reading on the spring balance gives you the static friction offered by the writing paper.
   4. Repeat the experiment with the butter paper and sandpaper. Compare the readings of friction.

   Note down your observations and conclusions.
2. In sports such as racing and swimming, speed is important. Find out about how athletes use different methods of streamlining to increase their speed.

Subject Integration

(Technology in daily life, Geography)

1. You have learnt that the like poles of magnets repel each other. This principle is used in maglev trains. These trains can travel at very high speeds because there is no friction with rails, unlike in regular trains. Find out about how maglev trains work. Make a presentation in class.
2. Gravity is different not just on different planets but even at different places on the Earth. This is because the Earth is not a perfect sphere but is flattened at the poles. It is also affected by the rotation of the Earth. Find out whether gravity is more at the equator or near the poles.

Scientist in Focus

Leonardo da Vinci

Leonardo da Vinci (1452–1519) was a famous Italian artist and scientist. He was one of the first people to study friction in a systematic manner. He observed the working of different machines and realised the importance of friction. He found that smoother surfaces offer less friction. He also described the difference between sliding friction and rolling friction.

Internet Links

https://www.bbc.com/bitesize/articles/zxqrdxs
https://www.dkfindout.com/us/science/forces-and-motion/friction/

Inspired PHYSICS

For the CISCE curriculum
CLASS 6

Orient BlackSwan

The National Education Policy (NEP) 2020 emphasises certain crucial parameters based on content and pedagogy. The Inspired Physics series provides a rich range of exercises and activities for each of the parameters. Here is a quick reference guide to some of the examples in this book.

The Inspired Physics series is mapped perfectly to the National Education Policy 2020.

21st Century Skills

A broad set of skills, knowledge, work habits and character traits that are important for success in the 21st century

Experiential/ Constructivist Approach

Learners construct their knowledge, based on what they already know, through experience or by doing and reflection

Integrated Approach

An approach to teaching and learning that works by connecting knowledge and skills across the curriculum, by bringing real life examples to the classroom

The NEP parameters	Features	Page nos.
The 4Cs		
Critical Thinking	Think and Answer	76
Creativity	Hands-on (1)	63
Collaboration	Hands-on (2 and 3)	35
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Social and Emotional Learning	Life Skills and Values (2)	13
	Life Skills and Values (2)	35
	Life Skills and Values (2)	91
Multiple Intelligences	Hands-on (2)	35
	Activity 5.2	67
	Subject Integration	77

The NEP parameters	Features	Page nos.
Experiential/Constructivist Approach	Hands-on (1)	14
	Activities	41, 43
	Activities	67, 68

The NEP parameters	Features	Page nos.
Subject Integration	Subject Integration (Chemistry)	14
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Values	Life Skills and Values (1)	13
	Life Skills and Values (1)	49
	Life Skills and Values (2)	91

Sustainable Development Goals

A framework of 17 global goals designed to be a blueprint to achieve a better and more sustainable future for all

The NEP parameters	Features	Page nos.
Life Skills	Activity 2.5	31
	Life Skills and Values (1)	63
	Life Skills and Values (1)	91

The NEP parameters	Features	Page nos.
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	Eco Corner	65

The NEP parameters	Features	Page nos.
Know more about India	Go Further	17
	Heritage Corner	77
	Text	78

India Knowledge

A strong focus on ancient knowledge from India, traditional values, modern developments and future aspirations

Digital Integration

The use of digital tools to enhance and support the teaching–learning process

ICT/Digital resources

Orient BlackSwan Smart App - Interactive Tasks and Games for Practice and Revision

Teacher's Smart Book - Flipbook, Animations, Videos, Presentations, Picture Galleries, Interactive Tasks, Embedded Questions, Lesson Plans, Students' Book Answer Key, Worksheets with Answer Key, Question Paper Generator

Teacher Empowerment

Teachers' Resource Pack - Lesson Plans, Students' Book Answer Key, Question Bank with Answer Key, Worksheets with Answer Key, Test Papers

Teachers' Portal - Chapter e-Book, Presentations, Picture Galleries, Animations, Videos, Students' Book Answer Key, Worksheets with Answer Key, Interactive Tasks, Lesson Plans, Question Bank with Answer Key

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3-6-752 Himayatnagar, Hyderabad 500 029, Telangana, INDIA
customercare@orientblackswan.com | www.orientblackswan.com