

ICSE

Prodigy PHYSICS

Based on the latest CISCE Curriculum

SALIENT FEATURES

- Choupal Chat
- Hands-on Activities
- Experiential Learning Based Questions
- Image Based Questions
- Summing Up
- Multi-Disciplinary Based Questions
- Application Based Questions
- Quiz Zone

DIPAK KR SINGH
M.Sc, MBA, PGDE..

R.V. SINGH
M.Sc, B.Ed

6

5
YEAR ANNIVERSARY
SOUVENIR
PUBLISHERS PVT. LTD.
(Since 1971)

ICSE PRODIGY
PHYSICS-6

ANSWER KEY

Chapter-1 Matter

Quiz Zone (Page 12)

1. False. The particles (atoms or molecules) in solids are held together by strong intermolecular forces.
2. True
3. True
4. False. Gases can be compressed easily, but liquids are relatively incompressible. In gases the particles are much more widely spaced than in liquids.
5. False. The particles in gases (and liquids) have no fixed positions. They can move in any direction.

A. MCQs

1. b) Stretchable Layer
2. b) Solids
3. c) Gases
4. a) Solids
5. b) Only gases
6. d) Gases
7. a) Liquid

B. State True or False and correct the false statement giving reasons

1. False. Both dark clouds and white clouds are made of matter. Clouds are composed of tiny water droplets or ice crystals suspended in the air, and both water droplets and ice crystals are forms of matter.
2. False. Blue colour of the sky is caused by scattering of light by molecules of gases in air.
3. False. The shape of solids is fixed but not of liquids.
4. False. The smallest particle of water is a molecule, not an atom. A water molecule consists of two hydrogen atoms and one oxygen atom bonded together.
5. True
6. False. Particles of matter in a gas do not move in a circular fashion. Instead, they move randomly and in straight-line paths, colliding with each other and the walls of their container.
7. True

C. Fill in the blanks

1. maximum
2. gases
3. very closely
4. cohesive forces
5. oxygen
6. gases
7. volumes

D. Match the column

1. Solids (b) cannot be compressed
2. Gas changes to liquid (a) Volume becomes definite
3. Unit of mass (e) Kilogram
4. Fluidity (d) Liquids and gas
5. Can be made into wire (c) Solid metals

E. Find the odd option, giving reasons

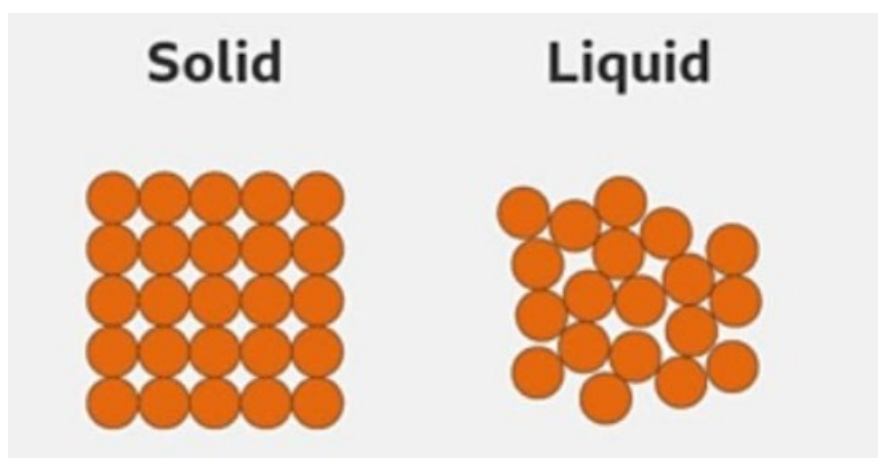
1. Stretchable layer - other options describe solids.
2. Does not need a container -other options pertain to fluids.
3. Viscous -other options pertain to gases.
4. Fixed shape -this describes solids, other options do not.

F. Short answer type questions

1. Matter is defined as anything that has mass and occupies space. It includes all substances that we can see, touch, and interact with, such as solids, liquids, and gases.
2. One criterion to differentiate between solids and liquids is their ability to maintain a fixed shape. Solids have a definite shape and retain it, while liquids take the shape of their container and do not have a fixed shape.
3. The states of matter are solid, liquid, and gas. These are the three most common phases of matter, each with distinct properties and characteristics.
4. Solids do not change shape like liquids because the intermolecular forces holding the particles in a solid are much stronger and more ordered than in liquids.

5. Intermolecular attraction refers to the forces of attraction between particles of substances. This maximum in solids.

6. Molecular models of solids and liquids.



7. We can prove that liquids have intermolecular spaces by doing a simple experiment. We take a known volume of water and add some sugar or salt to it. On dissolving the salt or sugar, we find that there is no change in volume of water. This proves that the salt/sugar molecules have entered the intermolecular spaces of water.

G. Long answer type questions

1. The solid state of matter differs from the gaseous state of matter in several fundamental ways:

a. Particle Arrangement:

- **Solids:** In solids, particles (atoms and molecules) are closely packed together in a regular and ordered structure. They have fixed positions and vibrate at their equilibrium positions. The intermolecular forces are strong, keeping the particles in place.
- **Gases:** In gases, particles are widely spaced and have high kinetic energy. They move freely and randomly throughout the available space. There is no fixed arrangement, and the intermolecular forces are weak.

b. Shape and Volume:

- **Solids:** Solids have a definite shape and a definite volume. They retain their shape under normal conditions.

- **Gases:** Gases have neither a definite shape nor a definite volume. They take the shape of the container they are in and fill the available volume.

c. **Compressibility:**

- **Solids:** Solids are generally incompressible because their particles are tightly packed and have limited space to move.
- **Gases:** Gases are highly compressible because their particles are far apart, allowing for compression under pressure.

d. **Density:**

- **Solids:** Solids are typically denser than gases because of the close packing of particles.
- **Gases:** Gases are much less dense than solids due to the greater separation of particles.

2. A grain of salt dissolves in water because it is hit by randomly moving water molecules. The smaller salt particles enter into the inter molecular spaces of water. The random movement of water molecules ensures that over a period of time a homogeneous mixture is formed.

3. The arrangement of particles in solids, liquids, and gases varies significantly :

- **Solids:** In a solid, the particles are closely packed together in a highly ordered and fixed structure.
- **Liquids:** In liquids, the particles are still relatively close together, but they are not as tightly packed as in solids. This allows the particles to move past one another.
- **Gases:** In gases the particles are very widely spaced and their arrangement is haphazard.

4. The difference in the ability of liquids and solids to take the shape of their containers is primarily due to the strength of intermolecular forces and the arrangement of particles in each state of matter.

- **Solids:** Solids have strong intermolecular forces that hold their particles in a fixed arrangement. This makes the position of the molecules fixed in their position.
- **Liquids:** Liquids have weaker intermolecular forces compared to solids. Here while the intermolecular force is able to keep the particles close, they are weak enough to allow movement of the molecules past each other. The

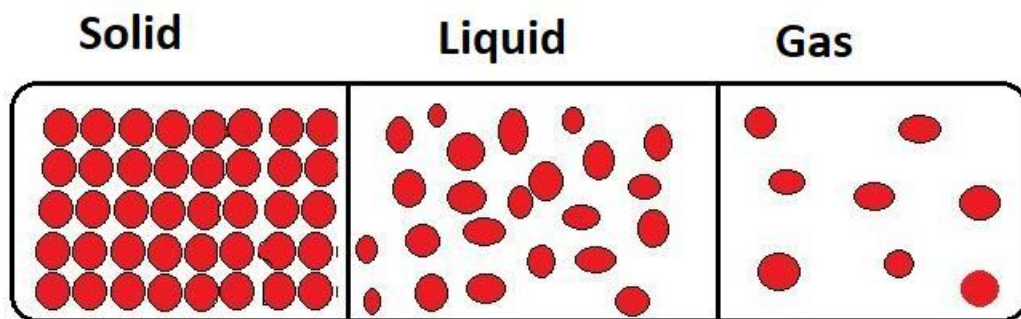
movement of molecules past each other allows liquids to take the shape of the container.

5. To find that molecules in liquids are in a constant state of motion we can do the following simple experiment: Put some dry Holi colour in a beaker of water and do not stir. In few minutes we observe that colour particles begin moving in the water on their own. Eventually the colour gets distributed evenly as water molecules keep hitting the colour particles. The experiment proves that particles of in liquids always keep moving in random directions.
6. To prove that molecules of water stick together we can perform the following experiment: Drop some water on the floor that is not inclined. Touch one end of the water and drag it to one side with the finger. We will see the whole body of water moves in the direction of the hand movement. The experiment proves that particles of liquids have attraction between them.
7. Several properties of solids depend on their particles being tightly packed. These properties include:
Particles are held close together by strong force of attraction. They are rigid and cannot be compressed. Solids expand very little on heating. They have definite shape and volume and can form many surfaces. The solids do not need a container for storage.

H. Application based questions

1. Household cooking gas (usually propane or butane) is stored under pressure in steel cylinders for several reasons:
 - Upon compressing the gases become liquid. and occupy less space. Hence a cylinder can store large amount of cooking gas.
 - That why it is called Liquified Petroleum Gas (LPG) and it is easy to transport over long distances.
2. The container that would require the largest amount of metal sheet in its construction is the container for the gas. This is because gases do not have a fixed shape or volume and tend to expand to fill the available space. As a result, the container for the gas needs to be capable of withstanding the pressure. More importantly the container for gas has to be covered from all sides, hence it will need more steel sheet.

3.



Solid:

- In a solid, the particles (atoms or molecules) are closely packed together and arranged in a regular, repeating pattern.

Liquid:

- In a liquid, the particles are still close together, but they are not in a fixed, ordered arrangement like in a solid.

Gas:

- The particles in gas have large intermolecular space, which is more than liquids.

VALUES AND LIFE SKILLS

Attempt yourself

Image based questions

1. Water drops are formed because of cohesive forces between water molecules. They stick to glass panes because of adhesive force between glass and water molecules.
2. Liquids take the shape of the containers because the molecules can move past each other.
3. The property seen here is viscosity of liquids.
4. The property of rigidity shape and size.

Experiential learning questions

1. Atoms are called tiny particles because they are the smallest units of an element and they retain all the property of the element.
2. Neon is an example of an element that does not attach to other atoms unlike other element such as oxygen.
3. Atoms combine to make molecules; it means:
c) Molecules are bigger than atoms.
Atoms combine to form molecules, and molecules are typically larger in size than individual atoms. Molecules consist of two or more atoms chemically bonded together, so they have a greater number of particles and, consequently, a larger size compared to single atoms.

STEM Project

Attempt yourself

Play and Learn

Attempt yourself

Our Culture

Attempt yourself

Chapter-2 Physical Quantities and Measurement

Quiz Zone (Page 28)

1. True
2. False. Mass is not defined as the volume occupied by a body. Mass is a measure of the amount of matter in an object and is typically measured in units like kilograms or grams. It is distinct from volume, which measures the space occupied by an object. Mass and volume are related but separate physical properties.
3. False. Spring balance is used to measure weight of a body. To measure mass we use a beam balance.
4. True
5. True

A. MCQs

1. c) unit
2. c) 1/100 m
3. a) It is the space occupied by a body.
4. a) wrist watch and (d) stopwatch
5. b) A
6. a) After the bulb
7. c) Keeping the eye position at a perpendicular angle
8. a) Area
9. b) Units of time
10. b) 7.30 pm

B. State True or False and correct the false statement giving reasons

1. False. The distance between two fixed points is not called mass. The shortest distance between two points is called length.
2. False. The SI unit of length is not foot. The SI unit of length is the meter (m).
3. True
4. False. The mass of one pound is not almost equal to one kilogram. One kilogram is approximately equal to 2.20462 pounds.
5. False. A beam balance is typically used to measure mass, not volume.
6. True
7. False. The body temperature remains the same. Only the reading on celsius scale is less than that in Fahrenheit scale.
8. False. The unit of area is not written as m/2. The standard unit of area is square meters (m²).
9. True
10. False. Because this thermometer does not have a kink the temperature reading will fall and the reading will be wrong.

C. Fill in the blanks

1. digital
2. clinical thermometers
3. accurate
4. 100 degrees Celsius
5. time interval

6. consistent
7. standard year
8. geometric formulas
9. one second
10. 2.7 metric tons

D. Find the odd option, giving reasons

1. lb (pound) - The reason is that cm, m, and km are units of length, while lb is a unit of mass.
2. km - The reason is that year, leap year, and second are units of time or time-related concepts, while km is a unit of length.
3. clock- other options are related to mass.
4. second - The reason is that thermometer, °C (degrees Celsius), and K (Kelvin) are related to temperature measurement, while "second" is a unit of time.

E. Match the three columns

1. kilometer (a) 1000 m (ii. length)
2. Mass (c) kilogram (iii. 1000 gm)
3. Day (e) Hour (v. Seconds)
4. Area of a leaf (b) Graph paper (iv. Square cm)
5. Hot water (d) Thermometer (i. Centigrade)

F. Short answer type questions

1.
 - a) measured
 - b) length
 - c) hotness or coldness
 - d) square units
2.
 - a) To convert 5000 meters into kilometers, you divide by 1000, so it is 5 kilometers.
 - b) To convert one year to hours, you multiply by 365 (days in a year) and then by 24 (hours in a day), so it is 8,760 hours in a year.

- c) To avoid parallax error in reading a length, ensure that your line of sight is perpendicular to the measurement, and read the measurement at eye level.
- d) To measure the mass of a packet of paneer, you would use a beam balance. You place the paneer on one side of the balance and add known weights to the other side until the balance is level. The total weight on the other side corresponds to the mass of the paneer.
3. If a ruler is broken up to 3 cm, you can still take correct measurements by ensuring that you align the ruler with the starting point correctly. You measure up to the broken part and then reduce the known length (in this case, 3 cm) to get the total length.
4. A stopwatch is useful for accurately measuring short durations of time, such as elapsed seconds or minutes. It is commonly used in sports, scientific experiments, and various other applications where precise timing is required.
5. No, a clinical thermometer cannot be used to measure the temperature of boiling water. Clinical thermometers are typically designed to measure human body temperature, and their temperature range is limited to lower temperatures. Boiling water exceeds the upper limit of a clinical thermometer.
6. Multiple of meter: Kilometer (km)
Submultiple of meter: Centimeter (cm)
7. The mercury laboratory thermometer is longer than the mercury clinical thermometer to provide a broader temperature range and more accurate measurements. The longer column of mercury allows it to expand and contract over a wider range of temperatures, making it suitable for a variety of scientific applications.
8. The kink in a mercury clinical thermometer is placed to prevent the column of mercury from falling with a fall in the temperature. This allows the thermometer to be read after use without losing the measured temperature.
9. Hypothermia is a medical condition characterized by an abnormally low body temperature, typically below 95°F (35°C). It can occur when the body loses heat faster than it can produce heat, often due to prolonged exposure to cold temperatures.
10. Two precautions to take while using a sensitive balance are:

- a) Handle the balance gently and avoid sudden movements that could affect the measurement.
- b) Ensure that the balance is on a stable, level surface, and it is kept in a glass box to avoid effect of air current.

G. Long answer type questions

1. Standard units are crucial for measuring physical quantities because they provide a consistent and universally understood reference for making measurements. Here's how they are useful:

- a) **Universality:** Standard units are recognized and used worldwide, ensuring consistency.
- b) **Precision:** Standard units are precisely defined, allowing for accurate and reliable measurements.
- c) **Comparability:** Standard units allow for easy comparisons between measurements made by different individuals or in different locations.

2. Benefits of using the 24-hour clock system:

- a) **Clarity and Precision:** The 24-hour clock eliminates ambiguity between AM and PM and provides a clear and unambiguous representation of time.
- b) **International Standard:** The 24-hour clock is widely used and understood internationally, making it suitable for global communication and coordination.
- c) **Mathematical Simplicity:** It simplifies time calculations, especially when dealing with time intervals, duration, or scheduling.
- d) **Military and Aviation Use:** The 24-hour clock system is commonly used in military, aviation, and emergency services, ensuring consistent and precise timekeeping.

3. Advantages of a digital thermometer:

- a) **Accuracy:** Digital thermometers provide precise and accurate temperature readings, often to one decimal place. There is no chance of parallax error in taking the readings.
- b) **Easy Reading:** They display temperature values as numbers, making them easy to read and interpret, even for individuals with visual impairments.
- c) **Quick Results:** Digital thermometers typically provide temperature readings quickly, which is advantageous in clinical and home use.

4. To measure the area of a football ground, you can use the following steps:

a) Take a long rope and measure the length of the ground. Record the length of rope the rope by comparing it with measuring tape and find the length in meters. Take atleast five reading and use the mean value.

b) Do the same for the breadth of the ground and repeat the whole process as above.

c) Multiply the length and breadth. This is the area of the ground in sq m.d) Sum up the areas of all the shapes to obtain the total area of the football ground.

5. Steps in taking readings from a laboratory mercury thermometer:

Take a beaker with warm water. Keep it on a firm table.

Dip the laboratory thermometer bulb in the beaker. Hold the thermometer vertically and ensure that the bulb does not touch the walls of the beaker.

Take reading while the thermometer is still dipped in the water.

Lower yourself to the level of the mercury (to ensure there is no parallax error. Take multiple readings.

Thermometers measure the level of heat energy in a body,

6. Conversion of units:

a) 1500 kg to metric ton: $1500 \text{ kg} = 1.5 \text{ metric tons}$ (1 metric ton = 1000 kg).

b) 1500 kg to quintal: $1500 \text{ kg} = 15 \text{ quintals}$ (1 quintal = 100 kg).

c) 15 lb to kg: $15 \text{ lb} \approx 6.80389 \text{ kg}$ (1 lb \approx 0.453592 kg).

d) 10 mg to kg: $10 \text{ mg} = 0.00001 \text{ kg}$ (1 mg = 0.000001 kg).

7. Estimating the area of an irregular surface using grid paper:

a) Lay the grid paper over the irregular surface so that the lines of the grid align with the boundaries of the shape.

b) Count the number of complete squares that are fully covered by the shape.

c) For any partially covered squares, estimate the portion of the square that is covered and add it to the count.

d) Multiply the total number of squares by the area represented by each square (known from the grid paper) to estimate the area of the irregular surface.

8. Benefits of using internationally accepted units of measurement:

a) **Global Communication:** Internationally accepted units enable clear and consistent communication in various fields, promoting global collaboration.

b) **Standardization:** These units provide a standard reference for measurement, ensuring precision and accuracy in scientific research and engineering.

c) **Ease of Conversion:** Using the same units simplifies conversions between systems, making data exchange and analysis more efficient.

d) **Trade and Commerce:** Standard units facilitate international trade and commerce by providing a common basis for measuring quantities and ensuring fairness in transactions.

e) **Quality Assurance:** In manufacturing and quality control, using standardized units helps ensure that products meet international standards and specifications.

H. Application based questions

1. To measure the thickness of a thin copper wire using a ruler with centimeter marks, you can follow these steps:

a) Take a length of the copper wire and wind it closely and tightly on a bobbin.

Measure the width of the copper rotations on the bobbin with a scale.

b) Count the number of revolutions of the wire on the bobbin.

c) Divide the width of the wire on the bobbin with the number of revolutions of the wire. This gives you the thickness of one wire.

2. Goldsmiths keep their balance in a glass case for several reasons:

a) **Protection:** The glass case provides physical protection to the balance, preventing it from being accidentally bumped, touched, or tampered with. This is essential to maintain the precision and accuracy of the balance.

b) **Dust and Contaminant Control:** The glass case helps keep dust, debris, and other contaminants away from the sensitive components of the balance. Even small particles can affect the accuracy of weight measurements.

c) **Preventing Air Currents:** Air currents in the environment can cause slight fluctuations in the balance, affecting its measurements. The glass case helps to minimize the impact of air currents.

d) **Security:** Valuable metals and gemstones are often used in goldsmithing, and a glass case adds an extra layer of security to protect both the balance and the precious materials.

e) **Display:** The glass case allows customers or onlookers to view the balance without direct contact, providing a display of the goldsmith's precision tools and showcasing their commitment to accuracy and quality.

3. We cannot use the laboratory thermometer for clinical purpose because

a) It is very long and inconvenient to use.

b) It does not have a kink, hence as we take out the thermometer from the mouth for taking the reading, the temperature will change.

VALUES AND LIFE SKILLS

Attempt yourself

Play and Learn

Attempt yourself

Image based questions

- 1) When standard units are used there would be no such confusion.
- 2) 18.1 cm
- 3) The time difference in reaching the finishing line between two sprinters can be measured by using a stopwatch.

Experiential learning questions

1. The prime theme of the passage is:
 - b) Scientific process is systematic.
2. The importance of experimentation in the scientific process is highlighted in the passage. Experimentation is a crucial step within the scientific method, as

it serves to test and validate the hypothesis. The passage explains that through experimentation, scientists determine whether the hypothesis is supported (in which case a conclusion can be drawn) or not supported. If the results do not support the hypothesis, scientists have the option to revise or change the hypothesis and repeat the scientific steps.

Multi-disciplinary questions

1. Importance of Clinical Thermometers:

Humans being warm blooded animals they maintain a constant body temperature.

The clinical thermometer is designed to measure any deviation in our body temperature.

A deviation in our body temperature usually indicates a disease which the doctor has to diagnose.

2.

- **Mass:** Mass is a fundamental property of matter and represents the amount of substance in an object. It is typically measured in units like kilograms (kg) or grams (g). Mass is an intrinsic property and remains the same regardless of an object's location in the universe. In other words, an object's mass is constant.
- **Weight:** Weight is the force exerted on an object due to gravity. It is measured in units like newtons (N) or pounds (lb). The weight of an object varies with the strength of the gravitational field it is in. Hence the packet of biscuit would measure 16.6 g, because the gravitational force on the Moon is 1/6 th of Earth's gravitational force. However, the mass of the pack of biscuit will remain the same.

STEM Project

Attempt yourself

Our Culture

Attempt yourself

Chapter-3 Force

Quiz Zone (Page 45)

1. True
2. False. Force can change the shape and motion of a body, but it does not change its mass. Mass is a measure of the amount of matter in an object and remains constant unless you add or remove matter from the object.
3. False. The force of friction opposes motion, rather than supporting it. Friction is a force that acts in the opposite direction of the relative motion between two surfaces in contact, making it more difficult for objects to move or maintain motion.
4. False. Polished surfaces produce less friction, not more. The rougher a surface is, the more friction it typically generates because there are more irregularities and contact points that resist motion. Polishing a surface makes it smoother, reducing the friction between two surfaces in contact.
5. True

A. MCQs

1. c) Push or pull must be applied in the opposite direction.
2. b) Mass of the body
3. c) A contact force
4. b) Gravitational force
5. c) Ball falling from a height
6. b) It can reduce the mass of a body
7. b) South to North

B. State True or False and correct the false statement giving reasons

1. False. Force does have a proper direction. It has both magnitude and direction. The direction of a force is crucial in understanding its effects.
2. True.

3. False. There are benefits from friction. Friction provides traction, helps in walking, prevents objects from slipping, and is essential in various everyday activities. It can also be harnessed for useful purposes like in braking systems or the grip of tires on the road.
4. True
5. False. Moving heavier bodies is not necessarily easy because friction is less. In fact, heavier bodies often have more friction to overcome due to increased contact between surfaces. Moving heavy objects usually requires more force to overcome this increased friction.
6. False. Wet surfaces typically have much less friction than dry surfaces. Water on surfaces can reduce the effectiveness of friction, making them more slippery. This is why wet surfaces are often considered hazardous for walking and driving.
7. True

C. Fill in the blanks

1. zero
2. magnitude, direction
3. a non-contact
4. the direction of motion
5. opposing
6. friction
7. less

D. Match the column

1. Push and pull (c) Contact force
2. Gravitational force (a) Non-contact force
3. Rolling friction (d) Ball bearing
4. Wear and tear (e) Disadvantage of friction
5. An advantage of friction (b) Ability to walk and run

E. Short answer type questions

- 1.

(a) On a moving body:

A force can change the speed or direction of the moving body.

It can accelerate the body if applied in the direction of motion.

It can decelerate or stop the body if applied in the opposite direction of motion.

It can also cause the body to change its path or trajectory.

(b) On a body at rest:

A force can move a body when applied on a body at rest.

If the force is not sufficient to overcome the body's inertia, it will remain at rest.

(c) On a soft object:

A force can deform or compress a soft object.

It can change the shape of the object, depending on the amount of force applied.

2. One example of how force can change the direction of motion is when you hit the cricket ball with a bat.

3. Here are the forces and their types in the given examples:

(a) A ball falling from a height:

Force: Gravitational force

Type: Contact force (as gravity acts through direct contact with the Earth)

(b) A donkey moves a cart:

Force: Muscular force (exerted by the donkey)

Type: Non-contact force

(c) A ball stops rolling:

Force: Force of friction (between the ball and the surface it's rolling on)

Type: Contact force (as it occurs through physical contact between the ball and the surface).

4. Friction is considered a contact force because it arises from the physical interaction or contact between two surfaces in contact with each other. It is the force that opposes the relative motion or tendency of motion between these surfaces.

5. A surface will have low friction when it is smooth and has minimal roughness or irregularities. Providing lubrication on the surfaces reduces friction.

6. When you stop pedaling your bike and it slows down or comes to a stop, this is mainly because:

- **Friction:** The primary force that opposes the motion of your bike when you stop pedaling is friction. As long as the wheels are in contact with the ground, rolling friction between the tires and the road surface slows down the bike. This friction gradually reduces the bike's speed and eventually brings it to a stop.
- **Slope and Elevation:** Going uphill, gravity works against your forward motion, and going downhill, it can help maintain or increase your speed.

7. It can be difficult to walk on a tiled floor for a few reasons, primarily related lack of friction:

- **Smooth Surface:** Tiled floors are often smoother and have less texture compared to other types of flooring, such as carpet or wood. The smooth surface reduces the friction between the soles of your shoes and the floor. When your shoes have less traction, it can be challenging to push off or maintain stability.

F. Long answer type questions

1. When two forces act on a body, their combined effect depends on their magnitudes, directions, and the properties of the body. Here are the possible outcomes for both scenarios:

(a) When two forces act in opposite directions:

- If the two forces are of equal magnitude and opposite direction, they can cancel each other out, resulting in a net force of zero. The body remains at rest or continues to move at a constant velocity if it was already in motion.
- If the two forces are not equal, the net force is in the direction of the larger force. The body will accelerate in the direction of the larger force.

(b) When two forces act in the same direction:

- The forces add together, increasing the net force acting on the body. As a result, the body accelerates in the direction of the combined force.
2. Contact forces are forces that arise due to physical contact between objects. These forces occur when two objects are in direct contact with each other. Examples of contact forces include:
- **Friction:** When two surfaces are in contact, such as a book resting on a
 - **Air Resistance:** When an object moves through the air, the force of air resistance opposes its motion.
3. Walking on wet floors requires caution because of the following reasons:
- **Reduced Friction:** Wet surfaces have reduced friction, making it easier to slip and lose balance.
 - **Increased Risk of Falls:** The combination of reduced friction and the potential for a loss of traction can lead to accidents and falls, causing injuries.
 - **Longer Stopping Distance:** Wet floors increase the distance required to come to a complete stop, making it challenging to halt suddenly in case of an obstacle.
4. There are three main types of friction:
- **Static Friction:** Static friction is the force that opposes the initiation of motion when an object is at rest. It prevents an object from moving until an external force overcomes it.
 - **Sliding Friction:** Sliding friction occurs when two surfaces are in relative motion. It opposes the sliding motion of one surface over another.
 - **Rolling Friction:** Rolling friction is encountered when an object, like a wheel or ball, rolls on a surface. It is generally lower than sliding friction and enables smoother motion.
5. Several factors can affect the level of friction, including:
- **Nature of Surfaces:** The type of materials and their roughness or smoothness affect friction.
 - **Normal Force:** The force pressing the surfaces together plays a role in determining friction.
 - **Lubrication:** The presence of lubricants like oil or grease can reduce friction.
6. Advantages of friction include:

- **Traction:** Friction provides traction, allowing vehicles to grip the road, and enables us to walk without slipping.
- **Control:** Friction allows us to control the speed of vehicles using brakes and provides the ability to grasp and manipulate objects. That is why while we can write on paper, we cannot write on a glass surface because there is almost zero friction.

7. Disadvantages of friction include:

- **Wear and Tear:** Friction can cause wear and tear on moving parts of machines and objects.
- **Loss of Energy:** Friction results in the conversion of kinetic energy into thermal energy, leading to energy loss.
- **Resistance:** Friction resists motion, making it difficult to move objects.

To reduce friction, strategies include using lubrication (e.g., oil), employing smooth surfaces or materials, and using ball bearings or rollers to decrease direct contact between surfaces.

G. Application based questions

1. Lubricants, such as oil or grease, are used in engines to reduce friction between moving parts. Here's how lubricants work to prevent excessive heating in engines:

Engines have many moving components, such as pistons, crankshafts, and bearings. When these parts move, they generate friction and heat. If the friction and heat are not controlled, it can lead to wear and damage of engine components.

Lubricants are introduced between these moving parts. They form a thin layer or film that separates the surfaces in contact. This layer reduces direct metal-to-metal contact, minimizing friction. The lubricant also absorbs and dissipates heat that is generated during movement.

2. Pencils write on paper but not on glass because of the difference in surface properties and the writing mechanism:

Pencil "lead" is actually made of a solid material called graphite. Graphite is a type of carbon that has a layered structure. When you write with a pencil, the layers of graphite are deposited onto the writing surface.

On paper, the surface is rough and textured, providing friction and allowing the layers of graphite to stick and leave marks. The pencil lead leaves a trail of graphite on the paper, creating visible writing or drawing.

In contrast, glass surfaces are smooth and do not provide the necessary texture or friction for the layers of graphite to adhere and leave marks.

3. The markings on our palms, fingers, and soles of the feet, such as fingerprints and palm prints, serve several purposes in our day-to-day lives:

- **Biometric Identification:** Fingerprints, palm prints, and footprints are unique to each individual. They are widely used for biometric identification, such as in fingerprint scanners and security systems, to confirm a person's identity.
- **Grip and Traction:** The ridges and patterns on our fingertips and the soles of our feet provide better grip and traction. This is especially important for activities like grasping objects, walking, and maintaining balance.

VALUES AND LIFE SKILLS

Attempt yourself

Play and Learn

The girl in figure -B, is likely to fall because she is wearing roller skates instead of normal shoes. We know that rolling friction is much less than static friction. Hence the grip of her feet on the ground may not be enough to hold her body in upright position after the throw.

Experiential learning questions

Attempt yourself

Multi-disciplinary question

The process of chewing and swallowing food involves several forces and frictional interactions in the alimentary canal. Less explore how these forces come into play:

1. Chewing (Mastication):

Muscular Force: Chewing is initiated by the muscles in the jaw and tongue. Muscular forces are applied to break down the food into smaller pieces. The tongue and jaw work together to manipulate and grind the food.

Friction: The teeth play a crucial role in mastication. As they come into contact with the food, friction between the teeth and the food helps break it into smaller particles. The irregular surfaces of the teeth assist in grinding and mashing the food.

2. Swallowing

Mastication converts the food into semi-solid mass. This greatly reduces friction. Now the tongue pushes the food to the back of the mouth and forms it into a bolus (a soft, moist mass). Muscular contractions in the throat and esophagus help propel the bolus downward.

STEM Project

1. Find two points where there is a need to reduce friction in your bike:

- **Chain and Gears:** Friction between the bike's chain and gears can result in energy loss and decreased efficiency. To reduce friction, keep the chain well-lubricated and ensure the gears are properly aligned and maintained.
- **Wheel Bearings:** Friction in the wheel bearings can slow down the bike. Proper maintenance, including cleaning and lubrication, can reduce friction and ensure smooth wheel rotation.

2. Locate two points where there is a need for adequate friction in your bike:

- **Brakes:** Adequate friction in the braking system is crucial for safety. Brakes need sufficient friction to grip the wheel rims or discs when you apply them, allowing you to slow down or stop. Ensure brake pads are in good condition and provide enough friction for effective stopping.
- **Tire and Road Contact:** Adequate friction between the tires and the road is essential for stability and control. Tires should have sufficient tread and proper air pressure to maximize contact with the road and ensure grip, especially in wet or slippery conditions.

3. How should we maintain the bike in the above context (Brakes, handle grip, tire, wheel bearing):

- **Brakes:** Regularly inspect brake pads for wear and tear. Replace them if they are worn down. Ensure the brake cables are properly tensioned. Clean the braking surfaces on the rims or discs to remove debris that could reduce friction. Lubricate pivot points if necessary.

- **Handle Grip:** Handlebar grips should provide a comfortable and secure grip. Replace worn or damaged grips. Check that they are secure and do not rotate on the handlebars.
- **Tire:** Maintain the tires by checking air pressure regularly. Underinflated or overinflated tires can affect grip and rolling resistance. Inspect tires for cuts, punctures, or worn tread, and replace as needed. Keep them clean and free of debris that could reduce traction.
- **Wheel Bearing:** Keep the wheel bearings clean and lubricated. Clean and regrease the bearings periodically to reduce friction and ensure smooth wheel rotation. Check for play or wobbling in the wheels, which may indicate bearing issues.

Image based questions

- 1) This is because sliding friction is much more than rolling friction.
- 2) Static friction is more than sliding friction. Rolling friction is the least.

Our Culture

Answer yourself

Chapter-4 Energy and Simple machines

A. MCQs

1. b) Simple machines do not need energy to do work.
2. c) Inclined plane
3. c) Hundred percent
4. c) around which the beam of a lever moves
5. a) The load arm should be shorter than the effort arm
6. d) Both (a) and (c)
7. b) More effort is needed to move an object along the ramp
8. b) always less than 1
9. a) a screwdriver
10. c) inclined plane wrapped around a cylinder

B. State True or False and correct the false statement giving reasons.

1. False. When you are waiting for your school bus, you are not doing any work in the scientific sense. Work, in physics, is the product of force and displacement in the direction of the force.

2. False. In a pulley force can be applied only in one direction that is towards the ground.
3. False. Our arm is an example of class 3 lever.
4. True
5. True
6. False. The common pair of scissors is an example of class 1 lever.
7. True
8. False. Rolling a barrel on a ramp is typically easier than pushing it, as it reduces friction and requires less effort. Friction is less than sliding friction.
9. False. Screws are typically used to join or secure materials together, not to split them.
10. True.

C. Find the odd option giving reasons:

To find the odd option in each set, we can look at the characteristics or functions of the items in each group.

1. Sewing needle, nail, incisors, beam balance.

- The odd option is "beam balance" because it is not a pointed or sharp object. Others are examples of wedge.

2. Arm, tongs, fishing rod, MA more than 1.

- The odd option is MA more than 1. All other options have mechanical advantage of less than 1.

3. Door knob, car steering wheel, screw driver, pulley.

- The odd option is pulley. All others are examples of wheel and axle.

4. Wheelbarrow, nutcracker, bottle opener, MA less than 1.

- The odd option is MA less than 1. All other options have mechanical advantage of more than 1.

So, the odd options and their reasons are as follows:

D. Match the column

1. Wedge - (e) Axe, pin, chisel
2. Class 3 lever - (d) Sugar tongs, our fore arm, fishing rod
3. Class 2 lever - (a) Bottle opener, wheel barrow, nut cracker
4. Class 1 lever - (c) See-saw, scissors, tin opener

5. Inclined plane - (b) Ramp, winding road of a hill, screw

E. Fill in the blanks

1. a wedge
2. a wheel and axle
3. wedge
4. pointed
5. longer than the load arm
6. 1
7. closer to
8. a wedge
9. a wedge
10. a lever and a pulley.

F. Short answer type questions

1. Definition of Simple Machine and Application: A simple machine is a mechanical device that helps make work easier by multiplying or changing the direction of force. An application of a simple machine is a lever, which can be used to lift heavy objects with less effort.

2. Reason for Not Making Inclined Planes Steep: Inclined planes are not made steep because a steep incline would require a greater effort to lift an object, reducing the advantage of using an inclined plane. The purpose of an inclined plane is to reduce the effort needed, and a shallower angle achieves this more effectively.

3. How Machines Help Us Without Producing Energy: Machines help us by allowing us to apply a smaller input force to overcome a larger output force, which may involve changing the direction of the force or increasing the distance over which it is applied. While machines don't produce energy, they help us use the available energy more efficiently.

4. Fulcrum in a Lever: The fulcrum in a lever is the fixed point or pivot around which the lever rotates. It is the point where the lever is supported or balanced.

5. Mechanical Advantage: Mechanical Advantage (MA) is calculated as the load force divided by the effort force. In this case, $MA = \text{Load Force} / \text{Effort Force} = 100 \text{ kgf} / 20 \text{ kgf} = 5$. Therefore, the mechanical advantage is 5.

6. Law of the Lever: The law of the lever states that in a balanced lever, the product of the force applied (effort) and the distance from the fulcrum to the point of force application is equal to the product of the force exerted by the load and the distance from the fulcrum to the load. It is expressed as $\text{Effort Force} \times \text{Effort Arm} = \text{Load Force} \times \text{Load Arm}$.

7. Manipulating a Beam Balance: A beam balance can be manipulated by making the arms of the balance unequal. Hence less force (or weight) is needed on the long arm side to balance larger weight on the short arm side.

8. Directions of Effort and Load in a Class 2 Lever: In a class 2 lever, the effort force is applied down ward and load force is applied upwards. The effort arm is longer than the load arm. The fulcrum is at the end.

9. Mechanical Advantage of a Fixed Pulley: A fixed pulley has a mechanical advantage of 1. It changes the direction of the force but does not provide a force multiplication advantage.

10. Two examples of wheel and axle are:

- a. A doorknob, where the knob (wheel) rotates around the spindle (axle).
- b. A car's steering wheel, which allows you to turn the wheel (the wheel part) around the shaft (the axle) to control the direction of the car.

G. Long answer type questions

1. Two benefits of simple machines are:

a. **Mechanical Advantage:** Simple machines allow you to multiply the force you apply to accomplish tasks. For example, a lever can be used to lift a heavy object with less effort.

b. **Efficiency:** Simple machines make tasks easier and more convenient by reducing the amount of force or work required. For instance, a pulley can make it easier to lift a heavy load.

2. Three Kinds of Levers with Examples:

a. **First-Class Lever:** In a first-class lever, the fulcrum is located between the effort and the load. Example: A seesaw, where the pivot point (fulcrum) is between two people applying effort to move up and down.

b. **Second-Class Lever:** In a second-class lever, the load is between the fulcrum and the effort. Example: A wheelbarrow, where the wheel acts as the fulcrum, the load is the material being carried, and the effort is applied by lifting the handles.

c. **Third-Class Lever:** In a third-class lever, the effort is applied between the fulcrum and the load. Example: Your forearm when you flex your elbow to lift a load, with the elbow joint acting as the fulcrum, the hand holding the object being the load, and the bicep muscle providing the effort.

3. **Work is Done:**

Work is done when a force is applied to an object, and the object is displaced in the direction of the applied force. For example, lifting a book off the floor does work because you apply a force to move it vertically against gravity.

4. **Mechanical Advantage:**

Mechanical advantage is the ratio of the output force to the input force in a machine. It quantifies how much a machine amplifies the input force. For example, if you use a lever to lift a heavy object with less effort, the mechanical advantage of the lever is the ratio of the force required to lift the load to the force you apply to the lever. In other words the ratio - input arm length to output arm length is the same as the ratio of the output force to input force, and this is the mechanical advantage.

5. **Inclined Plane and Its Application in a Screw:**

An inclined plane is a flat surface that is tilted at an angle. It allows you to exert less force over a longer distance to lift an object. An application of an inclined plane is in a screw. A screw is essentially an inclined plane wrapped around a central axis. Turning the screw allows you to raise or lower a load with less effort, as seen in various applications such as in fastening screws and bolts.

6. **Functioning of Our Arm as a Lever:**

The human arm can be considered a third-class lever. The elbow joint acts as the fulcrum, the load is the object you are lifting or holding, and the bicep

muscle applies the effort to move the forearm. By contracting the bicep, you create a force that allows you to lift and manipulate objects.

7. Class 2 Lever with Mechanical Advantage:

A class 2 lever has the load between the fulcrum and the effort. An example is a wheelbarrow. When you push down on the handles (effort) to lift the load in the wheelbarrow, the load (e.g., a stack of bricks) is raised with less effort than it would take without the lever. This results in a mechanical advantage, making it easier to lift the load.

8. Functioning of a Screwdriver:

A screwdriver is a simple machine that uses the principle of a wheel and axle. The handle having a larger radius uses less force and the metal end having smaller radius can handle larger load. Hence by turning the handle a large turning force is created on the screw.

9. Class 3 Lever with Examples:

In a class 3 lever, the effort is applied between the fulcrum and the load. Examples include tweezers (fulcrum at one end, effort applied in the middle, and the load at the other end), a fishing rod (fulcrum is the hand, effort applied near the grip, and the load is the fishing line and bait), and a broom (fulcrum is where you hold it, effort applied by your hand, and the load is at the other end of the bristles).

10. Mechanical Advantage of the Lever:

Mechanical advantage is calculated as the ratio of the load force to the effort force. In this case, with a load of 600 kgf and an effort force that is 1/3rd of the load force, the mechanical advantage would be:

Mechanical Advantage = Load Force / Effort Force

Mechanical Advantage = 600 kgf / 1/3 of 600 = 200.

The lever provided a mechanical advantage of 3, meaning you were able to lift the load with one-third of the force that is 200 kgf.

H. Application based questions

1. Simple Machines for Shifting to the First Floor:

When shifting from the ground floor to the first floor, you may use several simple machines:

- **Inclined Plane:** If you are using a ramp or stairs to move heavy items like furniture or boxes, you are using an inclined plane.
- **Pulley:** In some cases, you might use a pulley system to hoist or lower heavy items, such as lifting furniture or boxes using a rope and pulley

2. Unequal Arms of a Weighing Balance:

If the arms of a weighing balance are not equal, it means that the balance is not calibrated correctly. If the grocer puts the goods on the longer arm and weight on the shorter arm you will end up getting less goods.

3. Benefits of a Pulley System in a Village:

Even if a pulley fixed over a well doesn't provide a mechanical advantage, it can still offer several benefits to villagers:

- **Ease of Lifting:** While the pulley may not provide mechanical advantage, it makes it easier to lift a bucket of water from the well compared to manually pulling it up this is because the effort is applied towards the ground in the direction of the gravitational pull of the Earth.
- **Safety:** Using a pulley reduces the risk of accidents and injuries associated with manually pulling up heavy buckets of water from the well.

4. Daily Use Equipment with Simple Machines:

Three pieces of equipment in daily use that contain simple machines are:

- **Bicycle:** Bicycles use a combination of wheels and axles, gears, and levers to make pedaling easier and more efficient.
- **Scissors:** Scissors are an example of a class 1 lever, making it easier to cut materials with less effort.
- **Door Knob:** A door knob is an example of a wheel and axle, making it easier to open and close doors by applying a turning motion.

VALUES AND LIFE SKILLS

Attempt yourself

Image based questions

1) Inclined plane. The barrel can be rolled over the inclined plane.

- 2) It can lead to faulty measuring of weight.
- 3) It is a class 2, lever. The longer effort arm gives a mechanical advantage.

Experiential learning questions

1. The statement that is not correct for a class 2 lever is:
 - b) The effort and the load move in opposite direction.
2. Class 2 and Class 3 levers can be differentiated based on the relative positions of the fulcrum, effort, and load, as well as the direction in which the effort and load move:

In a Class 2 Lever:

- The fulcrum is at one end.
- The load is in the middle.
- The effort is at the opposite end and effort arm is longer.
- The effort and load move in the same direction.

In a Class 3 Lever:

- The fulcrum is at one end.
- The effort is in the middle and the effort arm is smaller.
- The load is at the opposite end.
- The effort and load move in opposite directions.

Multi-disciplinary question

Incisor teeth, which are located at the front of the mouth, are indeed a perfect example of a wedge.

1. Cutting and Shearing: Incisor teeth have a wedge-like shape with a sharp, chisel-like edge. This shape allows them to effectively cut and shear food into smaller, more manageable pieces. For example:

- When eating fruits like apples, incisors can slice through the skin and flesh.
- When consuming vegetables like carrots or lettuce, incisors help break them into bite-sized portions.

Play and Learn

1. Archimedes' famous statement, "Give me a place to stand and with a lever I will move the whole world," is a testament to his understanding of the principles of levers and the concept of mechanical advantage. This statement

highlights the remarkable idea that by using the right leverage, even a single individual can achieve incredible feats.

2. Even when there is a mechanical disadvantage, we use class 3 levers in various applications because they offer advantages in terms of control and speed. When using a class 3 lever, the effort arm is shorter than the load arm, which results in a mechanical disadvantage in terms of force multiplication. However, these levers allow for a greater range of motion and speed, making them suitable for tasks that require quick and precise movements.

An example is the use of a class 3 lever in sports, such as cricket. When a batter swings a bat (a class 3 lever), the mechanical advantage might not be in favor of force, but it allows for a rapid motion that's essential for hitting a fast-moving ball.

Our Culture

Ancient civilizations, including those in Egypt (pyramids) and India (ancient temples), were indeed able to move and transport massive stone blocks to construct their impressive monuments. They utilized a combination of simple machines and innovative techniques to achieve this remarkable feat. Some of the simple machines that could have been employed in the construction of these ancient monuments include:

- **Rollers:** Wooden logs or cylindrical objects were placed under the stone blocks, allowing them to roll rather than be dragged. This reduced the friction between the stones and the ground, making it easier to move them. Rollers were especially effective for short distances.
- **Ramps:** In the case of constructing tall structures like pyramids or multi-level temples, inclined planes or ramps were used. Stones were transported up these ramps, which were constructed gradually as the monument rose in height. The construction of ramps was a complex and labor-intensive process but allowed for the transport of stones to upper levels.

Chapter-5 Light

Quiz Zone page – 76

1. False. Light always travels in a straight line, (not almost always).
2. False. A shadow is formed because of absence of light, hence the colour of shadow is always black. The colour of light rays do not affect the colour of the shadow.
3. True
4. False. Making the pinhole in a pinhole camera larger does not make the image sharper. In fact, a smaller pinhole produces a sharper image. Larger pinhole will make the image blurred as it will act as multiple pinholes.
5. True

A. MCQs

1. c) The Moon
2. b) Transparent material
3. b) Light from the Sun does not bend
4. b) Light travels in a straight line
5. c) The size and position of the tree's shadow can change
6. d) It is of the same size as the object
7. c) Because light travels in a straight line

B. State True or False and correct the false statements giving reasons.

1. False. We see the Moon, but it is not a luminous source of light. The Moon reflects sunlight, and that reflected light is what makes it visible in the night sky.
2. True
3. False. We see various things because our eyes can detect light. Our eyes receive light from external sources, allowing us to perceive and interpret the objects and surroundings.

4. False. Shadows are created by the shape of the opaque body and also the shape of the light source. On a cloudy day whole of the sky acts as a huge light source. Hence the shadow spreads out and becomes a dim overlapping patch of penumbra, so that it seems to be completely absent.

5. True

6. False. During a solar eclipse, it is the Moon that comes between the Earth and the Sun, causing the Sun to be temporarily blocked. The Moon is the object that obscures the Sun during a solar eclipse.

7. True

C. Fill in the blanks

1. When a beam of light meets an obstacle it does not **bend**.
2. Medium that allows light to pass partially is called **translucent**.
3. When the source of light is larger than the object, the size of umbra is **smaller**.
4. The darkest portion of a shadow is called the **umbra**.
5. An image shows color, but a shadow **is typically devoid of color**.
6. In a pinhole camera, when the object comes near, the image becomes **larger**.
7. In case of a Solar eclipse, the heavenly body that is in the middle is **the Moon**.

D. Match the column

1. The Sun - (c) Natural luminous source
2. Umbra - (d) Complete darkness in a shadow
3. Penumbra - (b) Partial darkness in a shadow
4. Light - (e) Makes things visible
5. Moonshine - (a) Reflected by the sunlight

E. Short answer type questions

1. Two artificial sources of light are electric bulbs and fluorescent lamps. Two natural sources of light are the Sun and fireflies.
2. Light doesn't travel through a curved pipe because light travels in straight lines, and a curved pipe obstructs the straight-line path of light.

3. An example of bioluminescence is the firefly, which emits light through a chemical reaction within its body.
4. An opaque body is one that does not allow light to pass through it. It completely blocks or absorbs light, creating a shadow behind it.
5. A shadow is formed when an object blocks the path of light, preventing the light from reaching the area behind the object. This occurs because light travels in straight lines, and when it encounters an opaque object, it cannot pass through.
6. The image is formed in a pinhole camera on the opposite side of the pinhole, on the interior surface of the camera's wall or screen.
7. The pinhole in a pinhole camera serves to control the entry of light. It allows only a limited amount of light from a specific point on the object to pass through, which helps create a focused and inverted image of the object on the opposite side of the camera.

F. Long answer type questions

1. We are able to see an object through a process involving light. When light from a source (e.g., the Sun or a lamp) strikes an object, some of the light is reflected off the object's surface. This reflected light then enters our eyes. Image of the object is formed inside the eye (on the retina).
2. Rectilinear propagation of light refers to the ability of light to travel in straight lines through a uniform medium. Light will continue to travel in straight paths unless it encounters an obstacle. An example is the casting of shadows. When an object blocks the path of light, it forms a shadow because light rays cannot penetrate the object.
3. The size of the object in a pinhole camera can be calculated using a simple formula. If you know the distance between the object and the pinhole, as well as the distance between the pinhole and the image formed on the screen, you can use the following formula:

$$\text{Size of Object} = \frac{\text{Size of Image}}{\text{Distance from Image}} \times \text{Distance from Object}$$

This formula allows you to determine the size of the object based on the size of the image formed on the screen and the distances involved.

4. The shadow of a tree moves throughout the day because of the changing position of the Sun in the sky. The Earth rotates on its axis, causing the Sun to appear at different positions in the sky at different times. As the Sun's position changes, the direction of light also changes. This results in the shadow of the tree moving with the changing direction of light. In the morning, the shadow is cast in one direction, and as the Sun moves across the sky, the shadow shifts in the opposite direction

5. We are able to see non-luminous objects because they reflect light. When light from a source (e.g., the Sun, a lamp, or a torch) falls on non-luminous objects, it strikes their surfaces. These surfaces then reflect the light in various directions. Some of the reflected light enters our eyes, and this is what allows us to see the objects.

6. a) There are two holes close by: If there are two holes close to each other, it can create interference patterns in the image, resulting in a less distinct and blurred image. The two holes that are close behave as one large hole.

b) Distance between the screen and the hole is increased: Increasing the distance between the screen and the hole in a pinhole camera will create a larger image.

7.

- A shadow is formed when light is blocked by an object, resulting in an area of darkness on a surface, while an image is a reproduction of the object formed by the interaction of light with a surface or optical device.
- Shadows are typically devoid of color and are either partially or completely dark, while an image may contain colors and represent the object accurately.
- Shadows are formed by the absence of light, while images are created by meeting of two or more rays. Images can be real or virtual.

G. Application based questions

1. To increase the size of the image of a tree on the screen of a pinhole camera, we can do the following:

- By increasing the distance between the pinhole and the screen, the image will appear larger.

- The image size can be increased by reducing the distance between the object (tree) and the screen.
2. A pinhole camera can be used to safely observe a solar eclipse by following these steps:
- Create a pinhole camera with a small hole and a screen.
 - During a solar eclipse, stand with your back to the Sun.
 - Hold the pinhole camera with the pinhole facing the Sun.
 - We can see the Sun's image on the screen inside the box. As the Moon passes in front of the Sun, it will gradually block out a portion of the Sun's image, showing the progression of the eclipse.

H. Find the odd option giving reasons

1. New Moon -Lunar eclipse happens when it is full Moon night. All other options are about full Moon.
2. Full Moon Day. -Solar eclipse happens on New Moon Day. All other options are about solar eclipse.
3. Same colour as object. Other options are about shadow.
4. Same size image. All other options describe image formed in a pinhole camera correctly.

VALUES AND LIFE SKILLS

Answer yourself. Focus on scientific knowledge.

Play and Learn

1. Marking the shadow length and synchronizing it with a clock is a simple way to create a sundial. We can use this sundial to tell time accurately in the future:
 - Note the exact time on a clock when each mark is made.
 - This works as a sundial and the length of the shadow is used to estimate the time during the day.
2. We can use a pinhole camera to observe a distant object without anyone knowing about it because a pinhole camera works by allowing light from the object to pass through a small hole and project an inverted image onto a surface inside the camera. Here's how you can do it discreetly:

Image based questions

1. A solar eclipse. It occurs when the Moon passes between Earth and the Sun.
2. The Earth glows very brightly as seen from the Moon. This is because the Earth reflects more light coming from the Sun. This happens because the oceans reflect more light.
3. The size of the bird is very small compared to the source of light that is the Sun. Also the distance of flying birds is quite far from the Earth's surface. Thus umbra is absent in the image. The whole image is formed by penumbra.

Experiential learning questions

1. The incorrect statement is:
c) Sound and light can travel in opaque solids.
2. Light gives us the sense of sight through the following process:

We are unable to see anything when there is darkness or no light. In such conditions our sense of sight is unable to function.

When light falls on an object, the reflected light from the object reaches our eyes thus making it visible to us.

A part from these we are able to see luminous objects because that emit their own light.

STEM Project

Attempt yourself

Chapter-6 Magnetism

Quiz Zone (Page 89)

1. True
2. False. Magnetic and ferromagnetic substance are the same. Three metals Iron, Cobalt and nickel have the ability to be permanently magnetised. This property is called ferromagnetism.
3. True
4. False. If a bar magnet cracks in the middle, the cracked pieces will not get repulsed. Each piece will become its own separate magnet with both a North and a South pole, and they will attract each other.

5. False. The north pole of a freely suspended magnet points to the south magnetic pole of the Earth.

A. MCQs

1. d) Gold

2. d) Middle

3. d) South-North direction

4. a) Magnets can exercise their attractive property through glass.

5. b) Induction method

6. a) Repel

7. b) Directive property

8. a) It is demagnetised

9. b) The magnets are not lifted high up after rubbing the iron bar.

10. b) the south pole

B. State True or False and correct the false statements giving reasons.

1. False. Every magnet must have north and south poles

2. False. A horseshoe magnet does not need to be stored in pairs. It can be simply stored with a magnetic keeper.

3. True

4. True

5. False. The north pole of a magnetic compass points to the geographic north pole, (or magnetic south pole).

6. True

7. False. A broken magnet will have its north and south pole. Hence on suspension it will show north-south direction.

8. False. Magnetic keepers are not pieces of rubber. They are typically made of soft iron or other magnetic materials to help maintain and strengthen the magnetism of permanent magnets.

9. False. Hammering a magnet does not improve its magnetic properties. In fact, it can weaken the magnet or even demagnetize it.

10. True

C. Fill in the blanks

1. cobalt and nickel
2. Lodestone
3. magnetic needle
4. north-north and south-south.
5. Two
6. north and south poles
7. opposite
8. Magnet
9. various electrical switches
10. pairs or with magnetic keepers

D. Match the column

1. Magnetic material - (c) Nickel
2. Electromagnet - (d) Temporary magnet
3. Poles of a magnet - (a) Maximum magnetism
4. Storing of magnets - (e) Magnetic keepers
5. Demagnetization - (b) Heating

E. Short answer type questions

1. The poles in a magnet are located at its two ends, referred to as the North pole and the South pole.
2. Two items at home that may have magnets are refrigerator magnets and magnetic cabinet latches.
3. The pencil sharpener is attracted by a magnet because its cutting edge is made of steel. The plastic body is not attracted by a magnet.
4. The area of influence of a magnet is called its "magnetic field."
5. The directive property of a magnet refers to its ability to align itself along the north-south direction. It allows a compass needle to point in a specific direction.
6. Three uses of magnets are:
 - Magnetic locks for doors and cabinets.
 - MRI machines in the field of medicine.

- Strong electromagnets are used in cranes for lifting heavy loads at dockyards.
7. Artificial magnets are preferred over natural magnets because they can be designed and customized for specific applications. They can also be made stronger and are more consistent in their magnetic properties.
 8. We know that the Earth has a magnetic property because of the behavior of a magnetic compass. A compass needle aligns itself with the Earth's magnetic field, with one end pointing to the magnetic North pole.
 9. The magnetic property of an electromagnet can be increased by increasing the number of turns in the coil of wire, increasing the current flowing through the coil.
 10. When a magnet is brought near a freely suspended magnet, the two magnets will either attract or repel each other, depending on whether like poles are brought close (resulting in repulsion) or opposite poles are brought close (resulting in attraction).

F. Long answer type questions

1. When we dip a bar magnet into a mixture of sand and iron filings, the iron filings cling to the poles only because they are attracted to the magnet's magnetic field. In the mixture only iron is magnetic material. Sand is not a magnetic substance hence it is not attracted to the magnet. This process can be used to separate sand from iron pieces.

2.

Magnetic Materials	Non-Magnetic Materials
1. Magnetic materials are materials that can be attracted by a magnet or can be influenced by a magnetic field	1. Non-magnetic materials are materials that are not attracted by magnets and are not influenced by magnetic fields.
2. Common examples of magnetic materials include iron, nickel, and cobalt.	2. Common examples of non-magnetic materials include wood, plastic, glass, and most non-metallic substances.
3. Magnetic materials can be permanently or temporarily magnetized.	3. Non-magnetic materials do not exhibit magnetic behavior and do not become magnets themselves.

3. Three properties of magnets and their usefulness:

a) **Attracting and Repelling:** Magnets can attract objects made of magnetic materials and repel objects with the same magnetic pole. This property is useful in various applications, from door locks to generators.

b) **Magnetic Field:** Magnets have a magnetic field that allows them to influence other magnetic objects without direct contact. This property is vital in devices like compasses, which use the Earth's magnetic field to determine direction.

c) **Alignment:** Magnets have a directive property, which means they tend to align themselves along the north-south direction. This property is used in compasses for navigation.

4. To find the north pole of an unmarked magnet, we can use a freely suspended magnetic needle or a compass. The end of the magnetic needle that points to the north direction is the north pole of the magnet.

5. Magnetism is a contact force because it can directly influence objects in contact with the magnet, such as attracting iron nails. It is also a non-contact force because magnets can exert their influence without physical contact, such as aligning a compass needle through their magnetic fields.

6. The maximum magnetic power of a magnet resides in its poles because the magnetic field lines are most concentrated at the poles. We can prove this by observing that iron filings adhere most strongly to the poles of a magnet, indicating the highest magnetic attraction at those points.

7. Magnets should be stored carefully to prevent them from losing their magnetism. They should be kept away from strong heat, shock, and exposure to other strong magnets. Storing magnets with magnetic keepers can help maintain their magnetic strength and prevent demagnetization.

8. To make an artificial magnet from a bar of iron, we can follow these steps:
Take a bar of iron.

Place the iron bar flat on the table. Take a bar magnet and select one of its end to be used in rubbing.

Place the magnet at the left hand end vertically with the north pole touching the iron bar.

Move the north pole of the magnet along the steel bar till the right hand side end .

Lift the magnet high above and bring it down at the left hand end to repeat the process. Repeat the process 20-30 times.

The same process can be done for the other side of the iron bar by the same pole of the magnet.

The iron bar now becomes a magnet.

9. You can ascertain that a piece of iron is a magnet by bringing it near a freely suspended magnetic needle or compass.

a) If it is a magnet it will repel the magnetic needle from one end.

b) If it is just a piece of iron its both the ends will get attracted to the magnetic needle (or suspended magnet).

Thus repulsion is a sure test of magnetism.

10. A magnet can lose its magnetism due to various factors, including:

a. A very effective way of demagnetising a magnet is to place it in a coil of insulated wire (solenoid) through which alternating current is passed. The current can be obtained from a 12 V, transformer. As the current is on, the magnet is withdrawn from the coil to a distance of few meters in east-west direction.

b. If a magnet is heated to redness and allowing it to cool by keeping it in east-west direction. However this method can destroy the steel of the magnet.

c. Any rough treatment such as hammering the magnet while it is in east-west direction destroys its magnetic properties.

G. Application based questions

1. No, the weight of a bar of iron does not increase after it is magnetized.

Magnetization is a result of the alignment of the magnetic particles within the iron. While this alignment changes the magnetic properties of the iron, it does not affect the mass of the iron. The weight of an object is determined by the gravitational force acting on it, and that remains constant. Magnetization does not add any extra mass to the iron.

2. When using a magnetic switch, you do not necessarily need to use a permanent magnet. Magnetic switches work by using the magnetic field to control the flow of electric current. You can use both permanent magnets and electromagnets in magnetic switches. The choice depends on the specific application and requirements.

- **Permanent magnet:** Permanent magnets are always magnetized and do not require an external power source to maintain their magnetism. They are useful when you need a simple and reliable switch for a specific purpose.
 - **Electromagnet:** Electromagnets can be turned on and off by controlling the current through them. This provides more flexibility and control over the switch. Electromagnetic switches are commonly used in various applications where the magnetic field needs to be adjusted or switched on and off.
3. Artificial magnets are preferred for most practical uses for several reasons:
- **Control:** Artificial magnets can be manufactured with precise specifications, allowing for better control over their magnetic properties. This is important in applications where the strength and direction of the magnetic field need to be tailored to specific requirements.
 - **Consistency:** Natural magnets, such as lodestones, can vary in strength and quality, making them less reliable for certain applications. Artificial magnets offer consistent and predictable magnetic properties.
 - **Customization:** Artificial magnets can be designed to suit specific needs, whether it's for making stronger magnets, electromagnets, or magnets with unique shapes.
 - **Durability:** Artificial magnets can be made with materials that are more resistant to demagnetization and environmental factors, ensuring their long-term usability.
 - **Versatility:** Artificial magnets can be used in a wide range of applications, from electric motors and generators to magnetic locks and medical devices.

VALUES AND LIFE SKILLS

1. A construction worker can separate scraps of iron from a large amount of debris and give it for recycling using magnetic separation. The worker can use a strong permanent magnet or an electromagnet to separate iron scraps from other materials. When the magnet is brought near the debris, the iron scraps will be attracted to it due to their magnetic properties, making it easy to separate them from non-magnetic debris.
2. Attempt yourself

Play and Learn

Attempt yourself . We can check a piece of iron's magnetism by repulsion method. There must be ways to check character of a person. Suggest one in your answer.

Image based questions

1. They represent the same pole.
2. They represent the opposite poles.
3. North(1) --and --south (2).
4. North (1) South (2)

Experiential learning questions

1. According to the passage:
 - c) Earth has its own magnetic field.
2. The two common types of permanent magnets mentioned in the passage are:
 - Bar magnets
 - Horseshoe magnets

Multi-disciplinary questions

1. Migratory birds possess remarkable navigational abilities that allow them to undertake long journeys, often spanning thousands of miles, during their annual migrations. One of the key elements contributing to their navigation skills is their ability to detect the Earth's magnetic field, effectively serving as a built-in compass. Here's an exploration and explanation of how this works:
 - **Magnetoreception:** Birds, as well as other animals like sea turtles and some insects, have a phenomenon known as magnetoreception, which is the ability to perceive and respond to the Earth's magnetic field. This is believed to be an innate skill in many bird species.
 - **Magnetite Crystals:** It is hypothesized that birds have tiny magnetic particles of magnetite in their beaks or brains, which act like a natural compass. These magnetite crystals are believed to respond to the Earth's magnetic field, helping birds determine their orientation relative to the North and South poles.
2. Magnetic separation is a common technique used in various industries, including metal extraction, to separate magnetic materials from non-magnetic materials. The theory behind this application is based on the fact that magnetic substances get attracted to magnets while non-magnetic substances do not get attracted to magnets.

STEM Project

1. Making a Compass from a Thin Nail

Materials Needed:

- A thin nail
- A strong permanent magnet
- A small piece of cork or foam
- A shallow dish of water
- A ruler
- A small piece of paper
- A marker or pencil
- A compass for reference

Procedure:

Prepare the Nail:

- Take the thin nail and rub it with the strong permanent magnet. Rub it in one direction repeatedly for several minutes. This will magnetize the nail.

Prepare the Cork or Foam:

- Cut a small piece of cork or foam and attach it to the head of the nail to make it buoyant. You can use a small drop of glue or tape for this purpose.

Place the Compass Needle:

- Fill a shallow dish with water and float the cork/foam-attached nail on the water. Ensure that the nail is free to move and doesn't touch the sides of the dish.

Reference Point:

- Use a compass to find the North direction in your location. Mark this direction on a small piece of paper.

Testing:

- Observe how the nail with the cork/foam aligns itself in the water. It should point in the North-South direction, with the head of the nail (where you attached the cork/foam) pointing towards North.

Explanation:

The project demonstrates the basic principle of how a compass works. When you rub the nail with a strong permanent magnet, you align the magnetic domains in the nail, effectively turning it into a temporary magnet with a North and South pole. When placed in water, the nail is free to rotate and align itself with the Earth's magnetic field, where the North pole of the nail points to the North pole of the Earth, and the South pole points to the South pole of the Earth.

2. Using Magnets to Keep Office Floors Free of Pins and Paper Clips

Materials Needed:

- Strong magnets
- Broom
- Metal container or box
- Small metal objects like paper clips and pins

Procedure:**Attach Magnets to Cleaning Tools:**

- Attach strong magnets to the bristles or bottom of your broom.

Clean the Office:

- Sweep the office as you normally would. The magnets attached to your cleaning tools will pick up small metal objects like paper clips and pins from the floor.

Collect Metal Objects:

- After cleaning, remove the magnets from your cleaning tools. You'll find that they have collected a significant number of objects which has iron in it.

Dispose of Collected Items:

- Empty the collected metal objects into a metal container or box designated for these items. This helps keep them organized and prevents them from scattering on the office floor.

Explanation:

This project demonstrates a practical application of magnets in maintaining a tidy workspace. The strong magnets attached to the cleaning tools attract and

pick up small metal objects like paper clips and pins from the office floor, preventing them from becoming a hazard or clutter. This not only keeps the office clean but also ensures that small metal items are safely collected for reuse or recycling.

Our Culture

- Sushruta, also known as Sushruta the Physician, was an ancient Indian physician and is considered one of the most important figures in the history of medicine. He lived during the time period you mentioned, from around 800 BC to 700 BC. Sushruta is often referred to as the "Father of Surgery" for his significant contributions to the field of surgery.

Test Paper–1 (Chap 1-3)

A. MCQs

1. b) Both liquids and solids have mass, weight and volume.
2. d) Air between the balloon and the bottle has nowhere to go.
3. c) 0.05 cm
4. b) Gravitational force

B. Fill in the blanks

1. cohesive force
2. one second
3. sliding friction

C. Answer the following in one word or one sentence:

1. They take the shape of the container.
2. Adhesion.
3. -173.15 degrees Celsius.
4. Yes

D. Give reasons for the following?

1. Digital thermometers are preferred because they provide several advantages, including:

- **Accuracy:** Digital thermometers are generally more accurate in measuring temperature compared to traditional mercury thermometers.
- **Ease of reading:** The temperature is displayed in a digital format, making it easier to read and interpret.
- **Faster results:** Digital thermometers provide faster temperature readings, which is especially useful for medical purposes.
- **Safety:** They do not contain mercury, making them safer for both users and the environment.

2. Dolphins benefit from a streamlined body shape in several ways:

- **Reduced drag:** The streamlined body shape allows dolphins to move efficiently through the water with minimal resistance, reducing energy expenditure.
- **Increased speed:** The streamlined body enables dolphins to swim at high speeds, which is important for catching prey and evading predators.

3. Sprinkling sand on rails at hill stations is done for traction and safety reasons:

- **Traction:** Sand increases the friction between the train's wheels and the rails, improving traction. This helps the train maintain its grip on the tracks, especially when navigating steep gradients or curves in hilly terrain.
- **Preventing slipping:** Hill stations often experience cold and damp conditions, which can make the rails slippery due to frost or moisture. The sand helps prevent slipping and ensures that the train can start and stop safely.
- **Safety:** Adding sand to the rails is a safety measure to reduce the risk of accidents, ensuring that trains can operate reliably and passengers can travel safely in hilly regions.

E. Answer the following questions in short:

1. "Intermolecular attraction" refers to the attractive forces between molecules in a substance.
2. To take correct measurements with a ruler that is broken up to 2.5 cm, you should estimate the measurement to the nearest half-centimeter and then subtract half of 2.5 cm to get a more accurate measurement.

3. Force can change the direction of motion by causing an object to deviate from its current path. For example, when you push a ball to the left, it changes its direction of motion from straight ahead to the left due to the applied force.

4. Lubricants keep a running engine cool by reducing friction between moving parts. When friction is reduced, less heat is generated, and the engine operates at a lower temperature, preventing overheating. Additionally, some lubricants also have heat-absorbing properties, further aiding in cooling the engine.

F. Answer the following in detail:

1. Changes in the Property of Water as it Converts to Steam:

When water converts to steam, it undergoes several significant changes in its properties:

a. **Phase Change:** Water changes from a liquid phase to a gaseous phase. This phase change occurs at the boiling point of water, which is 100 degrees Celsius (at standard atmospheric pressure).

b. **Expansion:** As water is heated and converted to steam, it undergoes a tremendous increase in volume.

2. Estimating the Area of an Irregular Surface Using Grid Paper:

To estimate the area of an irregular surface using grid paper, follow these steps:

a. Place the object over the grid paper.

b. Count the number of complete grid squares that are fully or partially covered by the irregular shape.

c. Multiply the number of counted grid squares by the area each square represents.

d. Add up all the areas of the squares to find the estimated total area of the irregular surface.

3. Contact Forces:

Contact forces are forces that act between objects in physical contact with each other. They result from the direct interaction between the surfaces of objects. Examples of contact forces include:

a. **Frictional Force:** This force opposes the relative motion or tendency of motion between two objects in contact. For example, when you slide a book on a table, the frictional force opposes the motion.

b. **Air Resistance:** When an object moves through the air, it experiences air resistance, which is a contact force opposing its motion.

4. Differentiating Between Static Friction and Sliding Friction:

Static friction and sliding friction are two types of frictional forces with distinct characteristics:

a. **Static Friction:** Static friction is the frictional force that opposes the initiation of motion between two objects at rest. It prevents an object from moving when a force is applied but doesn't exceed the applied force until the limiting static friction is reached. It's typically higher than sliding friction.

b. **Sliding Friction:** Sliding friction, is the frictional force that opposes the motion of objects sliding past each other. It acts once the object is in motion. Sliding friction is lower than static friction.

Test Paper–2 (Chap 4-6)

A. MCQs

1. a) Wheelbarrow – First order Lever
b) Pair of tongs – First order lever
c) See-saw – First order lever
d) Paper cutter – Second order lever
e) Pair of scissors – First order lever
2. b) The customer will get less goods than the weight
3. d) It gives a good outline of the opaque object.
4. (a) The North of a magnetic needle is attracted to the Earth's magnetic South which is the geographic North

B. Fill in the blanks

1. wedge
2. larger
3. the moon
4. poles

C. Answer the following in one word or one sentences:

1. Third-class lever

2. Yes
3. Soft iron

D. Give reasons for the following?

1. **Reason:** During though energy is consumed by the body there is no movement hence work-done is zero.
2. **Reason:** When the hole is bigger it acts as many small holes. This there is overlap of many images. This makes the resulting image blurred.
3. The arms of the balance are equal in length to ensure that when a known weight (standard weight) is placed on one side of the balance, it will balance with an unknown weight (the object being weighed) on the other side. Equal arms help maintain equilibrium, allowing for accurate measurement of the object's weight.
4. **Reason:** A solar eclipse can be partial because the moon does not always align perfectly with the Sun and Earth. When the moon partially obscures the sun from the perspective of an observer on Earth, it results in a partial solar eclipse.

E. Answer the following questions in short:

1. In a class 2 lever, the effort is applied in the direction opposite to that of the load, meaning the effort force is applied downwards and the load is lifted upwards.
2. The lever provides a mechanical advantage of 3. It means that with 1/3rd of the force, you can lift a load that is 3 times heavier.
3. Two differences between Umbra and Penumbra in the context of shadows during an eclipse:
 - a. Umbra is the darkest part of the shadow and completely blocks the light source, while Penumbra is the lighter, partially shaded area surrounding the umbra.
 - b. Umbra is the central part of the shadow while Penumbra is the outer part.
4. A magnet can attract only a magnetic substance, such as iron, nickel, and cobalt. Non-magnetic materials lack any magnetic property hence they are not attracted or repulsed by magnets.

F. Answer the following in detail:

1. Function of a Screwdriver:

A screwdriver is a simple hand tool designed for turning or driving screws into or out of various materials. Its primary functions include:

It works on the wheel and axle combination. It acts as a form of rotary lever.

When we turn the large wheel that is the handle with a small force the smaller rod turns with a large force. Thus with the help of a screw driver we can open or tighten screws.

2. Increasing the Size of the Image in a Pinhole Camera:

To increase the size of the image of a tree on the screen of a pinhole camera, you can do the following:

a. **Move the Screen Closer:** If you have control over the position of the screen inside the pinhole camera, you can move away from the pinhole. This will make the image on the screen appear larger.

b. **Increase the Distance to the Tree:** If you can physically move the pinhole camera closer to the tree, the image on the screen will become larger. This is because the farther the object is from the pinhole, the larger its image will be on the screen.

3. Proving that a Piece of Iron is a Magnet:

To prove that a piece of iron is a magnet, you can do the following:

Hang a magnet of known polarity freely. Bring the piece of iron near it.

a) If it is a magnet it will repel the magnetic needle from one end.

b) If it is just a piece of iron its both the ends will get attracted to the magnetic needle (or suspended magnet).

Thus repulsion is a sure test of magnetism.

4. Uses of Electromagnets:

Electromagnets are temporary magnets created by passing an electric current through a coil of wire. They have a wide range of applications, including:

- a. **Industrial Machinery:** Electromagnets are used in various industrial applications, such as in cranes, conveyor systems, and magnetic separators for separating ferrous materials.
- b. **Electrical Switches and Relays:** Electromagnets are key components in electrical switches and relays, allowing for the control of electrical circuits.

- c. **Magnetic Resonance Imaging (MRI):** In the field of medicine, powerful electromagnets are used in MRI machines to create detailed images of the human body for diagnosis and medical research.