#### Chapter 6 : Work and Energy

#### Can you tell? (National Book Foundation)

# Man is pushing the truck but truck is at rest, is he doing work? Explain.

Ans: No, the man is not doing any work on the truck.

Work is defined as the transfer of energy from one object to another through a force applied over a distance. In this case, the man is applying a force to the truck, but since the truck is not moving, there is no displacement or distance over which the force is being applied.

#### OR

In the given scenario, a man is pushing a truck, but the truck is at rest. This means that the displacement d of the truck is zero.

Since displacement d is zero, the work done W can be calculated as follows: WF-0-cos(0) = 0

Therefore, if the truck does not move, no matter how much force the nan applies, the displacement remains zero and consequently, the work done on the truck is zero.

#### **Science Tidbits**

#### (National Book Foundation)

Force is not always applied perfectly in the direction of motion. For example consider a toy car which is moving in horizontal direction and force F is applied making a certain angle " theta" with the horizontal. In such situations the force is resolved into its rectangular components.

# Do you know? Cantab

The work done is numerically equal to the area between the Force-displacement graph and the displacement axis. For a constant force, this area is represented by a rectangle.

# Real-World Example Cantab

#### Earth's orbit around the sun:

The gravitational force exerted to the Earth's circular path is no displacement is in the direction of force. Consequently, no work is done by the Sun's gravitational force on the Earth.

#### Do you know(National Book Foundation)

The light emitted by the bulb is converted into other forms of energy like kinetic energy of the surrounding molecules etc.

This means that a football will need a much larger amount of kinetic energy than a cricket ball to make it move at the same speed.

For your Information (National Book Foundation)

Perpetual motion is the motion of bodies that continues forever in an unperturbed system. A perpetual motion machine is without an external energy source. hypothetical machine that can do work infinitely

This kind of machine is impossible, as it would violate either the first or second law of thermodynamics, or both.

#### Do you know? (Cantab)

#### **Greenhouse Effect:**

Climate change is primarily caused by excessive greenhouse gases, such as CO<sub>2</sub> from burning fossil fuels and methane from agriculture. trapping heat in the Earth's atmosphere. While a natural greenhouse effect is essential for sustaining life.

#### Chapter 7 : Density and Temperature

## DO YOU KNOW? (National Book Foundation)

Osmium metal is the most dense material at room temperature and pressure. Its density is 50/g c \*m<sup>2</sup> It is harder than diamond.

#### CAN YOU TELL? National Book Foundation)

#### Why are liquids denser than gases?

Ans: Liquids are denser than gases because the molecules in a liquid are packed more closely together, resulting in a higher mass per unit volume. In a gas, the molecules are widely spaced and free to move, occupying more volume than in a liquid state This closer packing in liquids leads to a higher density compared to gases.

# CAN YOU TELL?

#### (National Book Foundation)

### Write the followings in increasing order of densities:

Hydrogen, milk, mercury, gold.

Ans: Here are the densities in increasing order: Hydrogen: 0.0899 g/cm<sup>3</sup> Milk: approximately 1.03 g/cm<sup>3</sup> (depending on fat content) Mercury: 13.546 g/cm<sup>3</sup> Gold: 19.3 g/cm<sup>3</sup> So, the order from lowest to highest density is:

Hydrogen Milk < Mercury Gold

#### CAN YOU KNOW? (Cantab)

The most dense material in the universe is the neutron star. Average density of a neutron star is 10 kgm.

FOR YOUR INFORMATION (National Book Foundation)

Particles in liquids move freely but stay at the bottom of the container due to a relatively strong attractive force, while in gases, particles spread. fill the container and move freely in it.

# POINT TO PONDER (National Book Foundation)

Because liquids and gases do not maintain a fixed shape, they both have the ability to flow. Thus, they are collectively referred to as fluids.

# FOR YOUR INFORMATION (National Book Foundation)

AURORAS: It is a solar phenomenon where colored lights appear in the sky as a result of charged particles from the Sun striking the upper atmosphere. It is called polar lights.

**NEBULAE:** It is a massive cloud of dust and gas that fills the space between stars. It is a Latin word, meaning "mist" fog etc. Nebulae are made up of dust, fundamental elements such as hydrogen and other ionized gases (i.e plasma). Hot stars inside of the nebula heats these elements which emit radiation of reds, blues and greens.

# CAN YOU TELL? (National Book Foundation)

# Why does the temperature of a substance not change at its melting point and at its boiling point even after giving it heat?

Ans: The temperature of a substance remains the same at its melting and boiling points during heating because the heat energy provided is used to overcome the intermolecular forces, not to increase the average kinetic energy of the molecules. At these points, the added heat, known as latent heat, increases the distance between molecules to change the state of the substance (solid to liquid at the melting point and liquid to gas at the boiling point). Therefore, the temperature, which is proportional to the average kinetic energy of the molecules, does not change.

# DO YOU KNOW?

#### (Cantab)

The crocus flower is a natural thermometer. It opens when the temperature is precisely 23°C and closes when the temperature drops.

# DO YOU KNOW? (Cantab)

A clinical thermometer is used to measure the temperature of the human body. It has a narrow range from 35°C to 42°C. It has a constriction that prevents the mercury from returning. Thus, its reading does not change until it rests.

# DO YOU KNOW?

#### (Cantab)

#### **Temperature Strip:**

A strip thermometer works based on the thermochromic properties of liquid crystals. which change color in response to temperature changes. When the temperature varies the structure of the liquid crystals alters, causing the strip to change color. This color change is used to indicate the temperature, with different corresponding to different temperatures.

#### Chapter 8: Magnetism

#### For your Information (National Book Foundation)

"A domain is the group of atoms in a material which have n-poles pointing in the same direction".

#### Information (National Book Foundation)

Magnetic field (B) of a wire carrying a current (1) can be found by placing iron filling around the wire. We get the magnetic field of current carrying wire as the concentric circles have centers in the wire. The direction of such a field can be found by using the right hand rule. Hold the current carrying wire in your right hand, the fingers will curve in the direction of the magnetic field.

#### Science Tidbits (National Book Foundation)

"The relative strength of a magnetic field is the degree of closeness of the field lines".

#### Science Tidbits (National Book Foundation)

Materials used for magnetic shielding are called shields. These materials are used for protecting sensitive circuits from unwanted parasitic magnetic fields including power inverters, magnetic immunity, magnetic sensors and EMI.

#### Do you know? (Cantab)

If you cut a bar magnet in half, each half becomes a whole magnet.

#### Magnetic Dip (Cantab)

A compass contains a small magnetic needle mounted on a pivot that allows it to swing. The needle aligns with Earth's magnetic field, so as well as pointing north, it tuts downward in the northern hemisphere and upward in the southern hemisphere. The angle of tilt, called magnetic dip or magnetic inclination, varies from 0° at the equator to 90° at the poles. Studying magnetic dip allowed scientists to work out the shape of Earth's magnetic field.

#### For your Information (National Book Foundation)

"A material that becomes a magnet when it is placed in a magnetic field is called an induced magnet".

#### For your Information (National Book Foundation)

Electric motors used in hand-held hair dryers, electric razors, hair trimmers and many more such devices, work with the help of magnetic force. An electric motor generates a magnetic field with electric current through the coil. The magnetic force then causes the movement or spinning that runs the motor.

# SCIENCE TIDBITS (NBF)

Aurora (the dancing lights in the sky) at the northern and southern poles of Earth forms due to the magnetic field pattern of Earth.

## SCIENCE TIDBITS (NBF)

# In ancient times people use to send messages through pigeons. How they locate their destination to deliver the messages?

Iron crystals are found in the beaks of pigeons. These crystals give the bird a nose for north. Pigeons can sense Earth's magnetic field. With the help of this magnetic navigation pigeons locate their destinations. Similarly some other migrating birds have crypto chrome - 4 molecules in their eyes, which are sensitive to the magnetism.

#### Chapter 9: Nature Of Science And Physics

#### FOR YOUR INFORMATION

#### (NBF)

Physics is the branch of science that describes matter, energy, space, time and their mutual connections and interactions throughout the universe.

#### FOR YOUR INFORMATION (NBF)

Relationship between Classical Mechanics, Quantum Mechanics. Relativistic Mechanics and Quantum Field Theory can be easily cleared by the diagram below.