

LN-3 PHYSICAL QUANTITIES AND MEASUREMENT

DEFINE THE FOLLOWING:

- 1. Fundamental Quantity:** The physical quantity which does not depend on any other physical quantity for its measurement.
- 2. Unit:** A defined magnitude of a physical quantity which is used as a standard for measuring that quantity.
- 3. Length:** The distance between the two ends or extreme points of an object.
- 4. Time:** The gap or interval between two incidents or events.
- 5. Mean solar day:** The time taken by the earth to complete one rotation on its axis.
- 6. Clinical Thermometer:** A clinical thermometer is used to measure the temperature of the human body.

GIVE REASONS:

- 1. While taking measurement using rule, eyes should be vertically above the scale.**
While taking measurement using rule, eyes should be vertically above the scale, to avoid any parallax error.
- 2. Electronic balance is advantageous to use over a beam balance.**
Electronic balance is advantageous to use over a beam balance because it gives very quick and accurate measurement of mass.
- 3. Stopwatches are used in sports events.**
Stopwatches can be reset to zero again for taking a fresh count.
- 4. A clinical glass thermometer should be washed before and after each use.**
This is done to avoid any spreading of germs and for hygiene purpose.
- 5. In a clinical thermometer, there is a kink in the capillary tube just above the bulb.**
Clinical thermometer has a kink in the capillary tube so that the mercury does not fall back to the bulb while taking the measurement.

DISTINGUISH BETWEEN:

- 1. Fundamental quantity and physical quantity.**

Fundamental Quantity	Physical Quantity
These are the physical quantities which do not depend on any other physical quantity for their measurement.	These are the physical quantities which are directly dependent or derived from other physical quantities for their measurement.
They are of seven quantities – Length, mass, time, temperature, amount of substance, luminous intensity and electric current.	For example: Area, volume, Speed, Density etc.

2. Beam Balance and Physical Balance.

Beam Balance	Physical Balance
A beam balance is a commonly used instrument and is often seen at grocer's shop.	A physical balance is used in laboratories for measuring smaller masses with higher accuracy.

3. Clock and stopwatch.

Clock	Stopwatch
A clock is an instrument used to indicate and measure time.	A stopwatch is a device that can be started and stopped at will to measure the exact time duration of an event.

4. Kelvin scale and Celsius scale.

Kelvin Scale	Celsius Scale
This is a temperature scale having an absolute zero below which temperatures do not exist	Celsius, also called as centigrade, is a scale based on 0° for the freezing point and 100° for the boiling point of water.

ANSWER THE FOLLOWING QUESTIONS:

1. Define the term 'Unit'.

A defined magnitude of a physical quantity which is used as a standard for measuring that quantity is called a unit.

2. What is parallax error? How can we avoid it?

A parallax error is defined as the error in measurement arising due to the wrong positioning of the eye. While taking the reading, one should read with eyes vertically above the ruler, to avoid parallax error.

3. Name a few instruments used for measuring mass.

Beam balance, Physical balance.

4. Write the relationship between various units of mass.

Relation
$1\text{kg} = 1000\text{ g}$
$1\text{ g} = (1/1000)\text{ kg}$
$1\text{ g} = 1000\text{ mg}$
$1\text{mg} = (1/1000)\text{ g}$
$1\text{ quintal} = 100\text{kg}$
$1\text{ kg} = (1/100)\text{ quintal}$
$1\text{ ton} = 1000\text{ kg}$

5. Name a few instruments used for measuring time.

Clock, watch, digital clock, pendulum clock etc.

6. Name two thermometric scales with their temperature range.

Kelvin scale: 273 K (lower fixed point) to 373 K (upper fixed point)

Celsius scale: 0°C (lower fixed point) to 100°C (upper fixed point)

7. How are the Celsius and Fahrenheit scales related to each other?

$$F = (9/5C+32)$$

8. What is area? What is its SI unit?

Area is a derived physical quantity. The surface occupied by a plane figure is called the area of that figure. The SI unit of area is m².

LONG ANSWER QUESTIONS:

1. What are fundamental physical quantities? Tabulate all the fundamental quantities with their units.

Fundamental quantities are the physical quantities which do not depend on any other physical quantity for their measurement. There are seven fundamental quantities – length, mass, time, temperature, amount of substance, luminous intensity and electric current.

Fundamental Quantity	SI unit	Symbol of unit
Length	Metre	M
Mass	Kilogram	Kg
Time	Second	s
Temperature	Kelvin	K
Electric current	Ampere	A
Amount of substance	Mole	mol
Luminous Intensity	Candela	cd

2. Define length. What are the steps followed when length of the object is measured using a ruler?

The length of an object is defined as the distance between its two ends or extreme points.

Some steps are given below that should be followed to take correct reading using a ruler.

- As there are different types of rulers available with different graduations such as millimeter, centimeter, inches markings, one should make sure to choose the ruler with correct markings as per the requirement.
- Place the ruler parallel along the edge of the object whose length is to be measured.

- Keep the zero mark of the ruler on one of the end points of the object. In case the ends of the ruler are broken or rough, you can take some other point as the initial reading. But, in such a case, do not forget to subtract it from the final reading of the ruler.
- Mark the final reading of the ruler where the other end point of the object coincides with the ruler. The difference of the two readings gives the length of the object.

3. Define mass. How does a beam balance measure mass?

The mass of an object is defined as the amount of matter contained in it. In a beam balance, the unknown mass is determined by comparing it with standard or defined masses.

It works on the simple principle that when masses on both the pans are equal, the arms will be balanced.

In the balanced position, the standard mass on one pan equals the pan of the object. When both the pans are empty, the beam rests in the horizontal position.

4. What is an electronic balance? What are the precautions to be taken while using it?

An electronic balance is a device which works on electric current and gives very quick and accurate measurement of mass. The results in this device are displayed digitally.

As electronic balances are very sensitive, one must follow these precautions while using them.

- The balance should be kept on a horizontal, stable and dust free surface.
- Make sure that the range setting of the balance conforms to the mass being measured.
- Wet or hot objects should not be put on the pan.
- Before measurement, ensure that the pan is free from the remains of any substances.

5. Write a short note on stopwatches.

A stopwatch is a device that can be started and stopped at will to measure the exact time duration of an event. In a typical stopwatch, pressing a button starts the clock or counting of time. On pressing the button the second time, the counting of time stops. It can be reset to zero again for taking a fresh count.

6. Write a short note on clinical thermometer. How is it different from a laboratory thermometer?

A clinical thermometer is used to measure the temperature of the human body. The range of the clinical thermometer is 35°C to 42°C .

The construction of the clinical thermometer is the same as that of a laboratory thermometer with exception that there is a kink in the capillary tube just above the bulb. This is done to ensure that the mercury level does not drop down quickly. Also, the laboratory thermometer has a wide range for temperature measurement.

7. What are the steps that should be followed for converting 24-hour clock time to 12-hour clock time?

- The 00 hours and 12 hours in 24 hour clock mean 12 o' clock at noon in 12-hour clock.
- If the number of hours in 24- hour clock is less than 12, there is no change and the same time is written with a.m. For example, 10:30 hours will be written as 10:30 a.m.
- However, if the number of hours (hh) in 24 hour clock is greater than 12, then to convert into 12- hour clock, subtract 12 from hh and add p.m. after it. For example, 22:40 hours will be written as 10:40 p.m.

8. Explain why digital thermometers are replacing clinical glass thermometers nowadays.

Digital thermometers do not contain any liquid. They measure the temperature using an electrical component called thermistor. These thermometers are highly accurate and deliver quick results. They can be carried easily. The temperature displayed can be read more conveniently than a glass thermometer.

LESSON-4 FORCE

I. DEFINE THE FOLLOWING:

1. Force

Force is a push or pull which can bring about change in the position, motion, shape, speed and direction of the body.

2. Friction

The force that opposes the motion between two surfaces in contact while moving against each other is called friction.

3. Static friction

The frictional force that comes into play when an object is at rest is called static friction.

4. Sliding friction

The frictional force that acts on a body when it is sliding over another body is called sliding friction.

5. Rolling friction

When a body rolls over a surface, the frictional force that comes into play is called rolling friction.

II. ANSWER THE FOLLOWING QUESTIONS:

1. What is force?

A force can either be in the form of a push or pull. Every movement is a result of some force. Force acting on a body has both magnitude and direction.

2. Give two examples where force can change the speed of an object.

- Hitting a ball with a bat.
- Pedaling the bicycle

3. Give two examples where force can change the state of motion of a body.

- Hitting a golf ball
- Applying brakes on a car.

4. Give two instances where force can change the direction of motion.

In the playground, we kick a football to make it move and goalkeeper applies force to stop the moving ball.

5. When you roll down a ball it comes to rest after some time. Why?

The ball comes to rest on its own because of the frictional force acting on it in the direction opposite to the direction of motion on the floor.

6. Recognize the property of the surfaces which affects the force of friction.

Friction depends on the nature of surfaces in contact with each other. In case of rough surfaces in contact will be rigid, thus friction will be more.

7. Why do tyres wear out after some years of usage?

Tyres wear out because of the friction between the road and the surface of the tyres.

8. List two situations where the force of friction is a necessity.

- It is because of the friction between our feet and floor that we can walk properly.

- Without it, we would slip on the floor. Vehicles are able to drive on the road because of the friction between the road and the tyres.

III. Long Answer Questions:

1. Explain the effects of force with suitable examples.

Effects of force:

- A force can change the state of motion of a body. A body remains in a state of rest or in a motion until or unless it is acted upon by some external force. In the play ground, we kick a football to make it move and the goalkeeper applies force to stop the moving ball.
- A force can change the speed of an object. A push or pull is usually used either to increase or decrease the speed of a moving object. For example, while riding a bicycle, we keep pedaling to increase the speed of the bicycle and when we apply brakes, we reduce the speed of motion.
- A force can change the shape and size of an object. For example, kneading dough, modeling clay, etc.

2. How is a force represented?

Force acting on a body is usually denoted by the letter F. All forces have a magnitude and a direction in which it is applied. Magnitude is the strength of the force. The force is represented by an arrow, which gives the direction in which it is acting.

3. What is friction? Why do any two bodies in contact with each other exert a force of friction? Explain using diagrams.

- Friction is a certain type of force that comes into play whenever a body moves over a surface.
- Friction is a force exerted between the two surfaces in contact. The force of friction acts in a direction opposite to the direction of motion.
- Two bodies in contact exert a force of friction because all the surfaces have irregularities at microscopic level, even if they appear to be smooth. When one surfaces slides over the other, these irregularities form an interlock, which makes it difficult to move.

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4. What is the cause of friction? Explain using a diagram.

The cause of friction is the irregularities at the microscopic level present in all the surfaces, even if they appear to be smooth. These irregularities can be seen if we look at the magnified image of the surface. When one surface slides over the other, these irregularities form an interlock, which makes it difficult to move.

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5. Write the various properties of friction in detail. Explain them in relation to an activity.

The properties of friction are mentioned below:

- Friction is a force that always acts whenever any two surfaces come in contact and one surface moves or slides over the other.
- The force of friction always opposes the motion. It slows down the motion of the object or stops it.
- Different solids experience different amounts of friction on a surface. For example, an ice cube will experience less friction than a cubical rubber object on a glass table.
- Solids, liquids and gases all exert the force of friction on an object moving over or through it.
- The force of friction generates heat.
- Friction can also lead to wear and tear of the objects.

Activity

Aim: To study the effect of roughness on friction.

Materials Required: Two ordinary balls, crumbled aluminum foil sheet, two ramps, a wooden table.

Procedure:

1. Place two ramps side by side on a wooden table.
2. Now, at the foot of one of the ramps place a sheet of crumbled foil paper.
3. Roll down the balls from each of the ramps.
4. Measure the distance travelled by each ball. Note down the observations.

Conclusion: The ball travels a longer distance on the wooden table than on the foil paper as the rough surface offers more friction and hampers the motion of the ball.

6. Discuss different types of friction in detail.

Static friction: The frictional force that comes into play when an object is at rest is called static friction. Static friction is a self-adjusting force. As the input force increases, the value of static friction also increases.

Sliding friction: The frictional force that acts on a body when it is sliding over another body is called sliding friction. The magnitude of sliding friction is always lower than that of the limiting friction.

Rolling friction: When a body rolls over a surface, the frictional force that comes into play is called rolling friction. The value of rolling friction is the least in comparison to all the other types of friction. It is easier to roll a body than to slide it.

7. Force of friction is a necessary evil'. Explain the statement giving suitable examples.

- Friction between our feet and the ground enables us to stand, walk and run.
- We can write because of friction.
- Vehicles move on the road because of friction. Friction between the surface of the road and tyres allows the vehicles to move without slipping.

8. State a few disadvantages of frictional force.

- Friction always opposes the motion. A moving bicycle will come to a halt eventually if we stop pedaling.
- Friction causes wear and tear of objects or parts of a machine. As the soles of shoes or the tyres of vehicles wear off because of friction, we have to buy new ones.
- Friction produces heat and sound in machine parts of machinery. It causes wastage of energy. So, more power is needed to drive those machineries.