# Simple machine

## Definitions

### Mechanical Advantage (MA):
It is the ratio of load to effort.

MA = Load/Effort

### Velocity Ratio (VR):
It is the ratio of distance moved by effort to the distance moved by load.

VR = Effort distance / Load distance

### Efficiency:
It is the ratio of work output to work input, expressed in percentage.

Efficiency = (Output work / Input work) x 100%

### Inclined Plane:
Inclined plane is a slanted surface over which a load can be pulled or pushed.
Example: hill road, ramp.

### Effort:
The force applied on a machine to do work.

### Load:
The object or weight that is to be moved by the machine.

## Give Reason

### 1. Velocity ratio has no unit.
Because it is the ratio of two similar quantities (distance/distance), their units cancel out.

### 2. Roads on hills are made winding.
Winding roads increase distance but reduce slope. This makes it easier and safer for vehicles to climb the hill with less effort.

### 3. Efficiency of simple machine is never 100%.
Because some energy is always lost in friction, heat, sound, etc.

Questions

a. The efficiency of a simple machine is 80%. What does it mean?
It means only 80% of the total work done on the machine is obtained as useful work, and 20% is waste in overcoming friction.

D. Derivation of relation between MA, VR and Efficiency:

The efficiency of a machine is defined by the relation:

Efficiency(n) = (Output work / Input work ) x 100%

Here, Output work = Load x  Load distance

Input work = Effort x  Effort distance

Therefore,

$n = \{ ( L \times LD) / ( E \times ED ) \} \times 100\%$

While rearranging,

$n = (L / E) / (ED/LD) \times 100\%$

$n = ( MA / VR ) \times 100\%$

F. Thread and Pitch of a Screw:

Thread: The spiral ridge around a screw is called Thread.

Pitch: The distance between two consecutive threads is called Pitch.

Relation: For a single thread screw, Pitch = distance moved forward in one rotation.

# Pressure

## Pressure

**Definition:**
Pressure is the force applied per unit area on a surface.

**Formula: Pressure = Force / Area**

**SI Unit:** Pascal (Pa)

## Factors affecting pressure

Pressure depends upon two factors. They are as follows:

1. The amount of force applied and
2. The area upon which the force is applied.

## Give Reasons

**a. Nose bleeding occurs when we move to higher altitudes.**
At higher altitudes, air pressure is very low compared to the pressure of blood inside the body. This difference in pressure causes tiny blood vessels in the nose to burst, leading to nose bleeding.

**e. The liquid pressure varies with the depth.**
Because the deeper we go, the greater the weight of liquid above that point. More liquid above means more force acting downward, so pressure increases with depth.

**g. The bottom of dam is made thicker.**
Water pressure increases with depth, so the bottom of a dam has to withstand very high pressure. To resist this, the bottom is made thicker and stronger.

# Classification of elements

**Atom:**
The smallest particle of an element which cannot be divided further by ordinary chemical means.

**Molecule:**
The smallest particle of a substance that can exist independently and shows all the properties of that substance.

**Electron:**
A negatively charged particle revolving around the nucleus of an atom.

**Proton:**
A positively charged particle present inside the nucleus of an atom.

**Neutron:**
A neutral particle (no charge) present in the nucleus of an atom.

**Atomic Number:**
The number of protons present in the nucleus of an atom.

**Atomic Weight (Mass Number):**
The total number of protons and neutrons present in the nucleus of an atom.

**Electronic Configuration:**
The arrangement of electrons in different shells (orbits) of an atom.

**Octet:**
A stable arrangement of 8 electrons in the outermost shell.

**Octet Rule:**
Atoms combine with other atoms by gaining, losing, or sharing electrons to complete 8 electrons in their outermost shell.

**Duplet:**
A stable arrangement of 2 electrons in the outermost shell (for small atoms like Hydrogen, Helium, Lithium).

**Duplet Rule:**
Atoms having only the first shell become stable by completing 2 electrons in it.

**Valence Electrons:**
Electrons present in the outermost shell of an atom.

### Variable Valency:
The property of some elements to show more than one valency. Example: Iron shows valency 2 and 3.

### Valency:
The combining capacity of an atom. It is equal to the number of electrons lost, gained, or shared to complete the octet or duplet.

### Mendeleev's Periodic Law:
"The physical and chemical properties of elements are the periodic functions of their atomic masses."

## Differences

| Atom | Molecule |
|---|---|
| It is the smallest particle of an element which can take part in chemical reaction. | It is the smallest of an element or compound that has independent existence. |
| Does not show all properties of a substance, only of an element. | Shows all the physical and chemical properties of a substance. |
| Example: H, O, Na | Example: $H_2$, $O_2$, $H_2O$, $CO_2$ |

| Atomic Number | Atomic Weight (Mass Number) |
|---|---|
| Number of protons present in the nucleus of an atom. | Total number of protons and neutrons in the nucleus of an atom. |
| Symbol: Z | Symbol: A |
| Each element has its own unique atomic number. | Atomic weight is not unique, it may be the same or nearly same for different elements. |

## Questions

### What is $2n^2$ rule? Explain with examples.
The $2n^2$ rule tells the maximum number of electrons that can be filled in a shell, where n = shell number.

## Merits of Mendeleev's Periodic Table:

It was the first systematic classification of elements in the from of table.

It helped in the systematic and easier study of the properties of several elements at a time.

It promoted discovery of new elements by leaving gaps.

## Demerits of Mendeleev's Periodic Table:

Hydrogen position was not clear.

Increasing order of atomic mass was not always correct (e.g., Argon and Potassium).

Could not explain isotopes.

Transition elements were not placed properly.

## Give Reasons

**An atom is electrically neutral. Why?**
Because the number of positively charged protons equals the number of negatively charged electrons in a neutral atom. Their charges cancel each other.

**The valency of sodium is one. Why?**
The outermost shell of sodium consists of 1 electrons. Since sodium easily loses that one electron to attain octet state, its valency is 1.