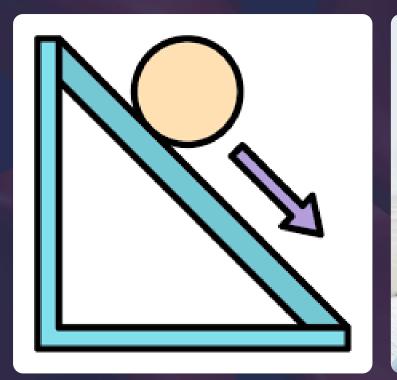
FSC- MIT-1

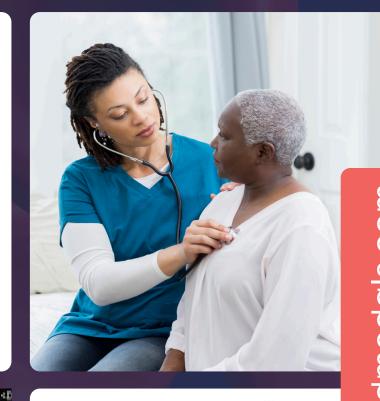
LEC#5 (24/10/2024)

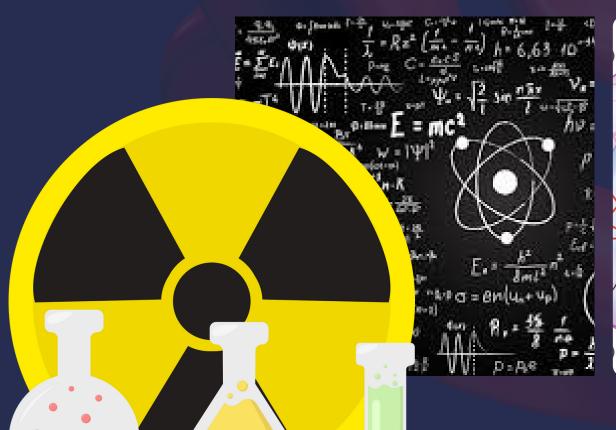
FIRST-YEAR PHYSICS FOR RADIOGRAPHERS

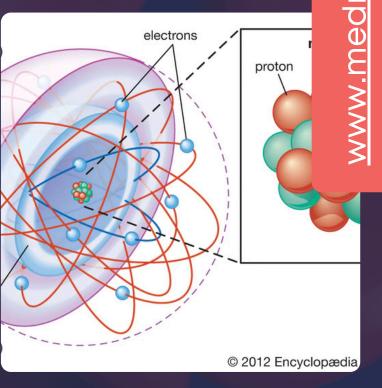
CHAPTER# 1, 2,3

GENERAL PHYSICS
ATOMIC STRUCTURE
ELECTRICITY



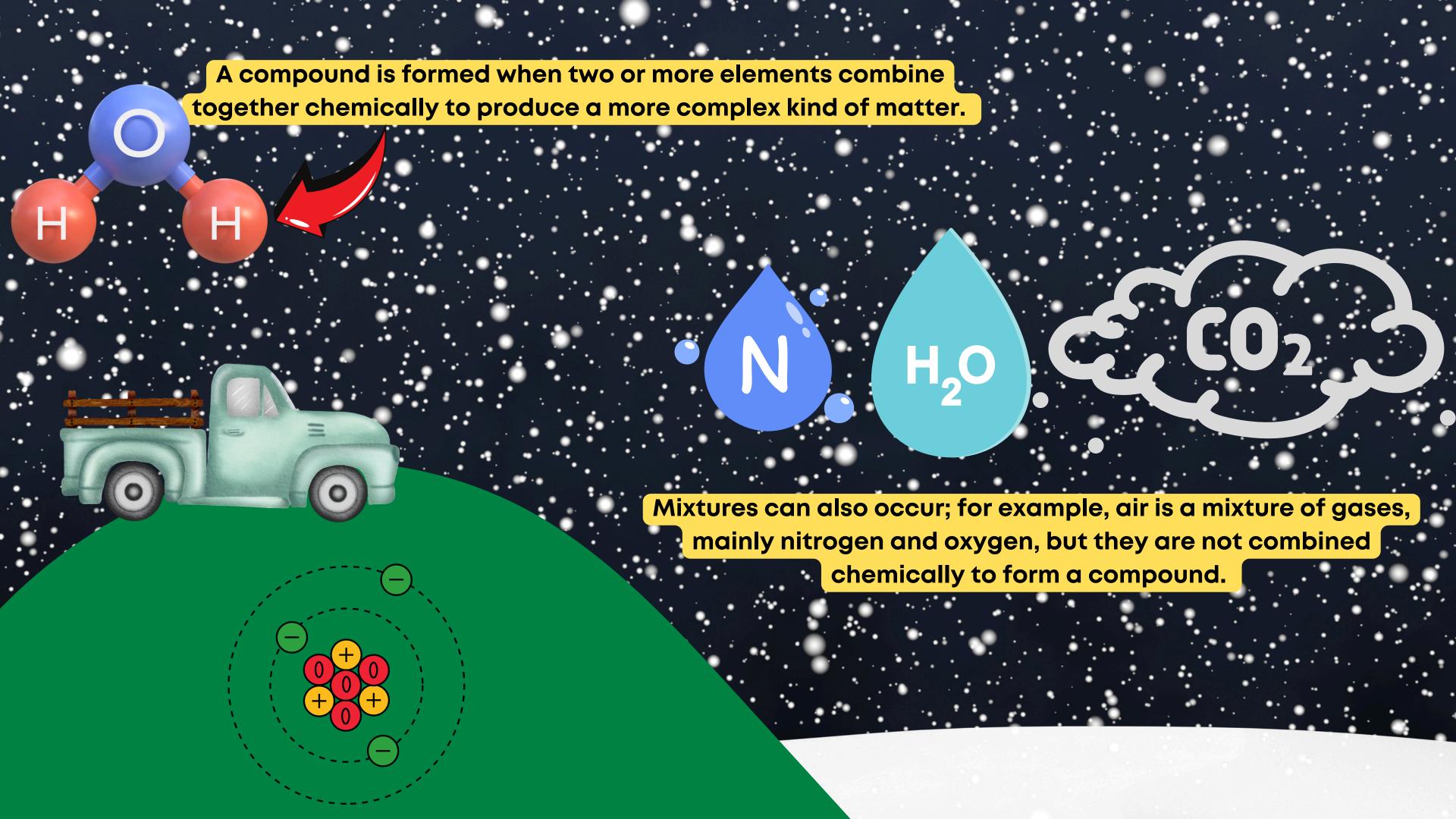


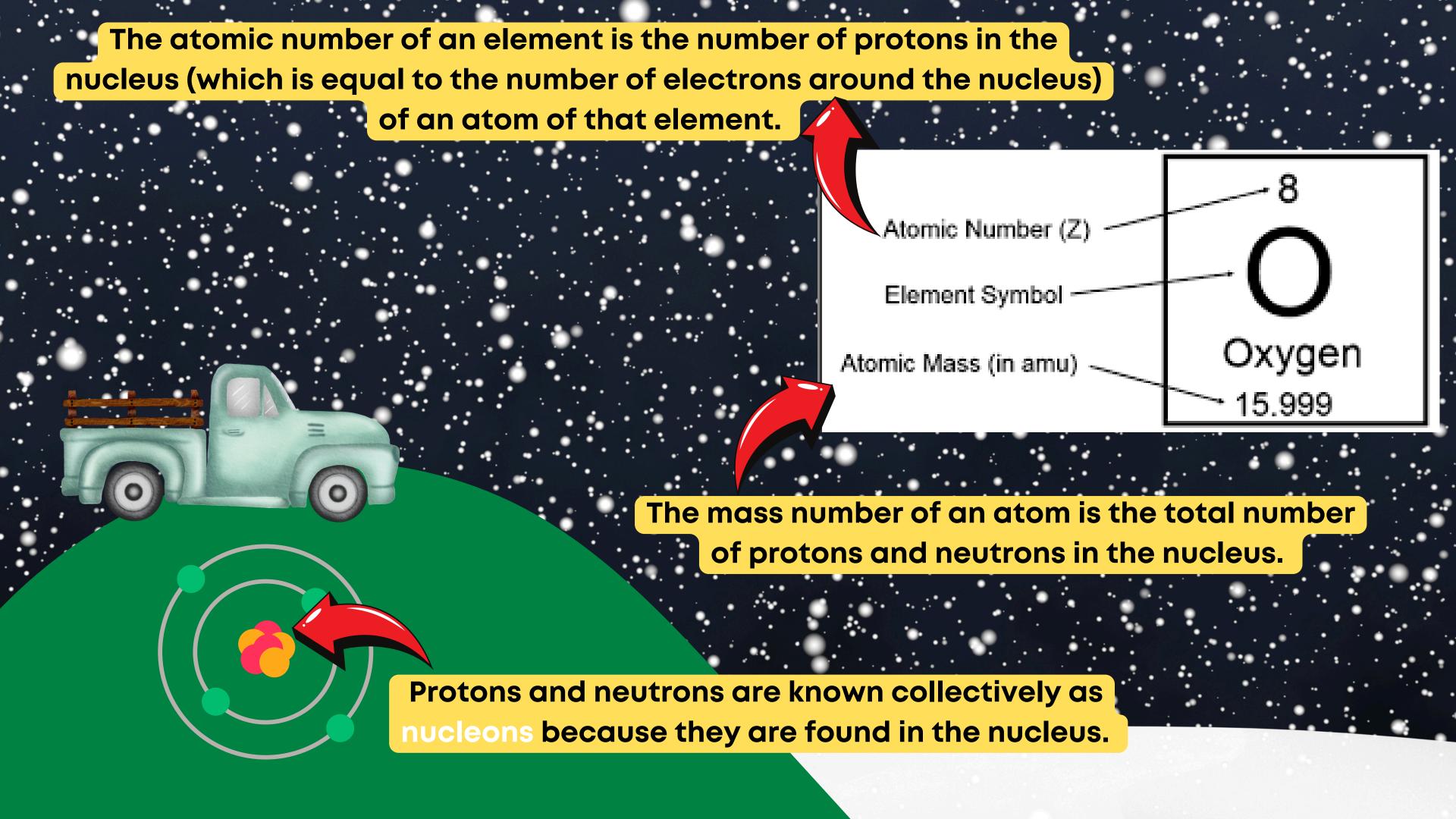


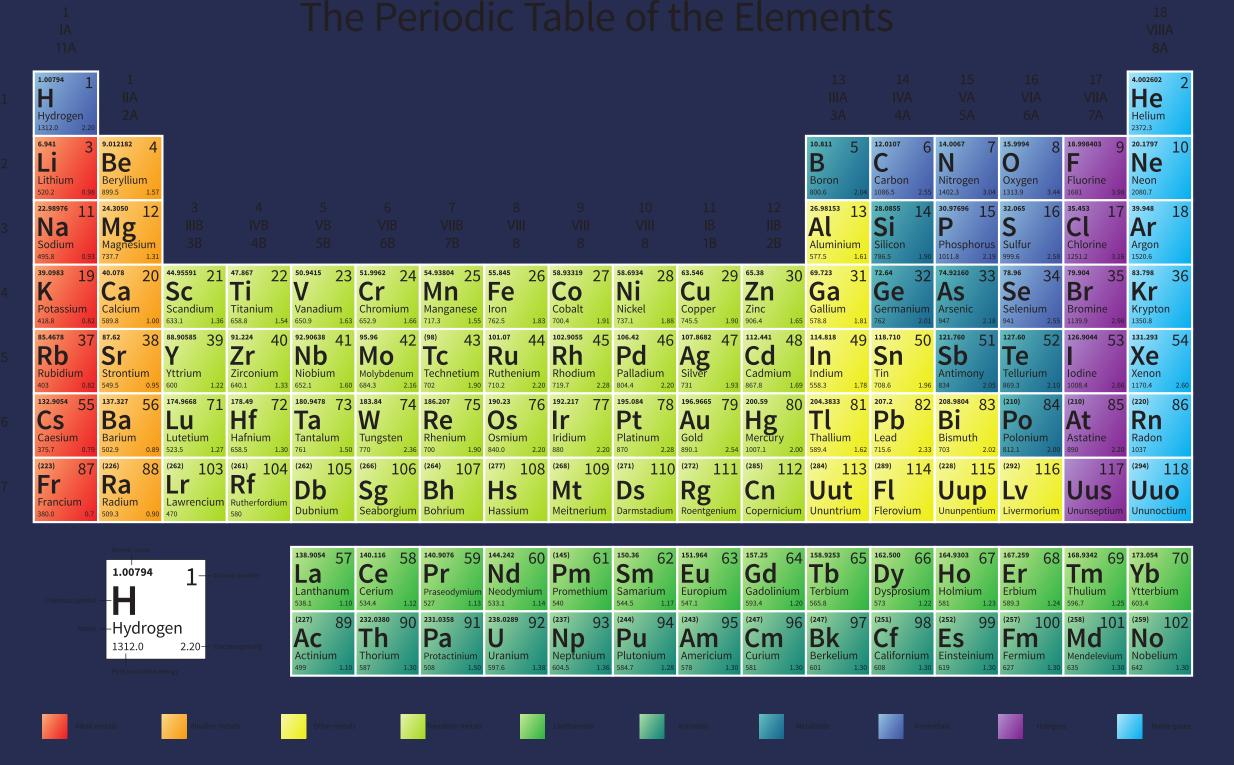


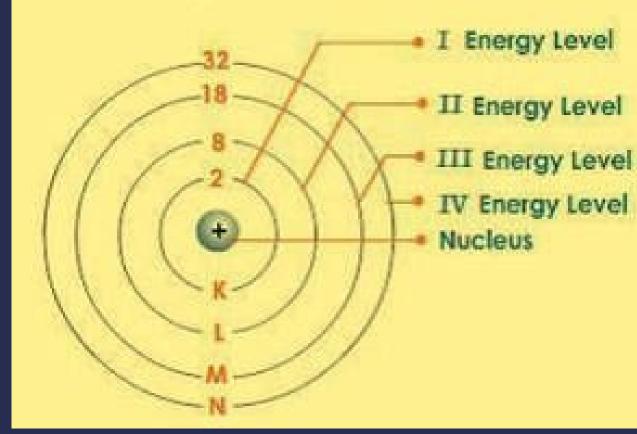
H/DR. AYESHA RAUF

Atoms are the smallest particles of an element that can exist without losing the chemical properties of the element. An element is a distinct kind of matter which cannot be decomposed into two or more simpler kinds of matter. **-**e Molecules are the smallest particles of a compound that can Iron exist without losing the chemical properties of the compound. A sample of an element is made up of 26 Fe extremely small entities called atoms. 55.85 Energy Level II Energy Level 10 III Energy Level IV Energy Level 11 12 6 **Nucleus** 13









The number of electrons in the outermost shell of an atom largely governs the chemical properties of the atom

Isotopes are nuclides which have the same number of protons but different nuclei.

17 p-17 n-18

Cl
Chlorine-35

17 p - 17 n - 20 Cl Chlorine-37



Energy is ability to do work.





There are several different forms of energy: mechanical, electrical, chemical, heat, light, X-ray, etc.

All forms of energy can be converted more or less easily into other forms



Thermal energy



Radiant energy



Light energy



Chemical energy



Nuclear energy



Electrical energy



Gravitation energy



Mechanical energy





Energy can be neither created nor destroyed.



MATTER CAN BE NEITHER CREATED NOR DESTROYED

matter is actually being destroyed and is being converted into energy.

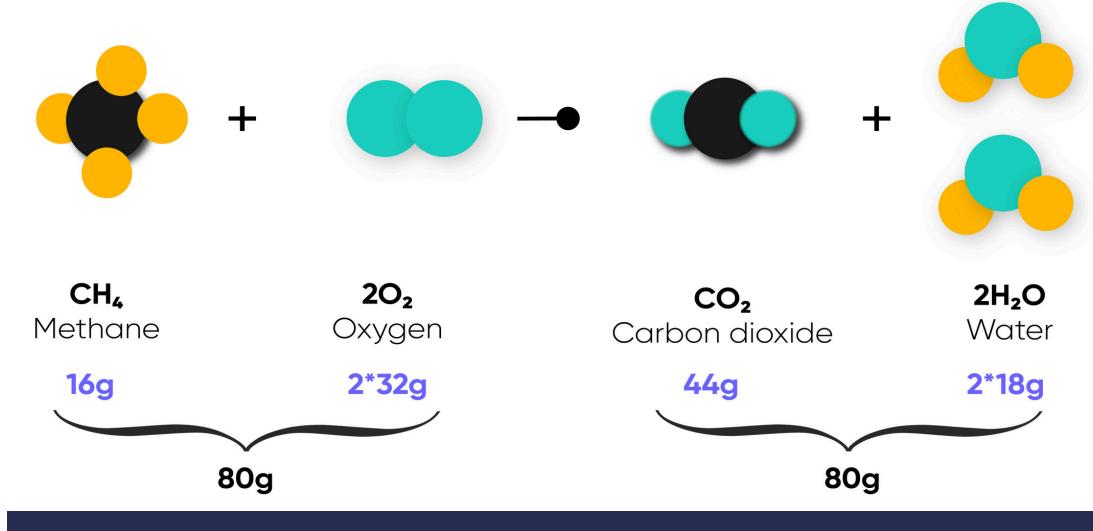
Energy transformations

chemical motion chemical radiant chemical motion

thermal

electrical

LAW OF CONSERVATION OF MASS





Physical Quantities:

Base Quantities

The quantities on the basis of which other quantities are expressed are called base quantities.

Derived Quantities

The quantities that tare expressed in terms of base quantities are called derived quantities.

Base quantity

Base Quantity	SI units
Length, I	metres, m
Mass, m	kilogram,
	kg
Time, t	second, s
Temperature, T	Kelvin, k
Electrical current, I	Ampere, A

Derived quantity

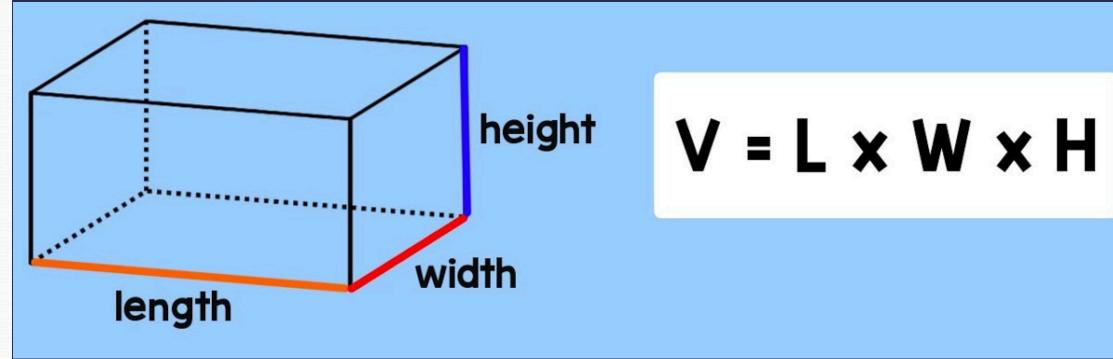
Derived Quantity	Units
Volume, V	m³
Density, ρ	kgm ⁻³
Velocity, v	ms ⁻¹
Force, F	N
Acceleration, a	ms ⁻²

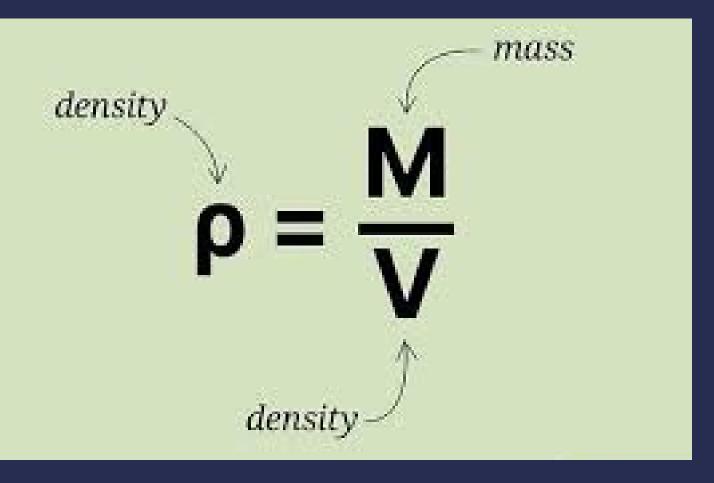
Base quantity

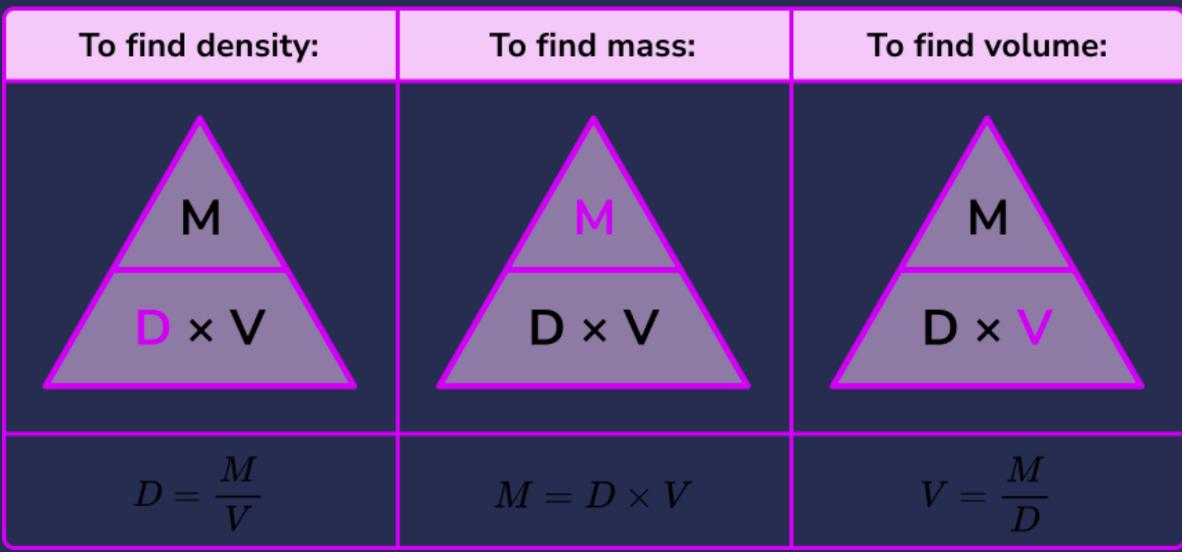
Base Quantity	SI units
Length, I	metres, m
Mass, m	kilogram,
	kg
Time, t	second, s
Temperature, T	Kelvin, k
Electrical current, I	Ampere, A

Derived quantity

Derived Quantity	Units
Volume, V	m³
Density, ρ	kgm ⁻³
Velocity, v	ms ⁻¹
Force, F	N
Acceleration, a	ms ⁻²





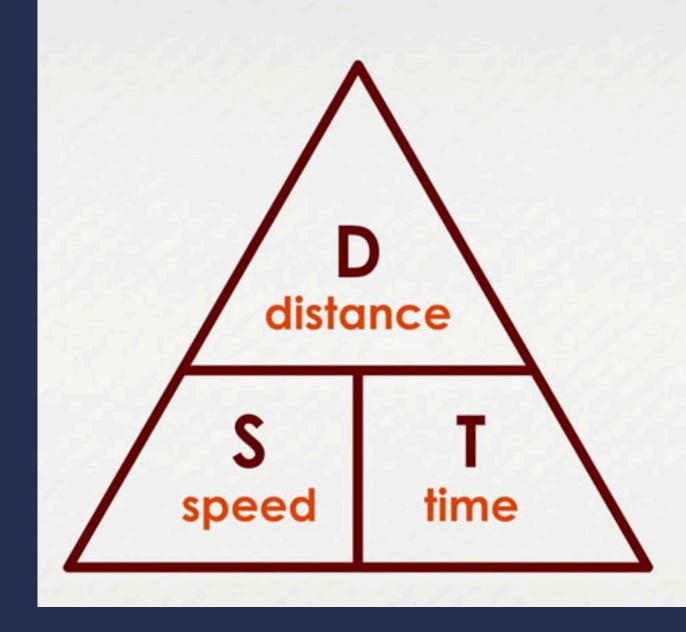


Base quantity

Base Quantity Length, I Mass, m kilogram, kg Time, t second, s Temperature, T Kelvin, k Electrical current, I Ampere, A

Derived quantity

Derived Quantity	Units
Volume, V	m³
Density, ρ	kgm ⁻³
Velocity, v	ms ⁻¹
Force, F	N
Acceleration, a	ms ⁻²



Average Speed (S)

Elapsed Time (T) total distance (D)
total elapsed time (T)

total distance (D)
speed (S)

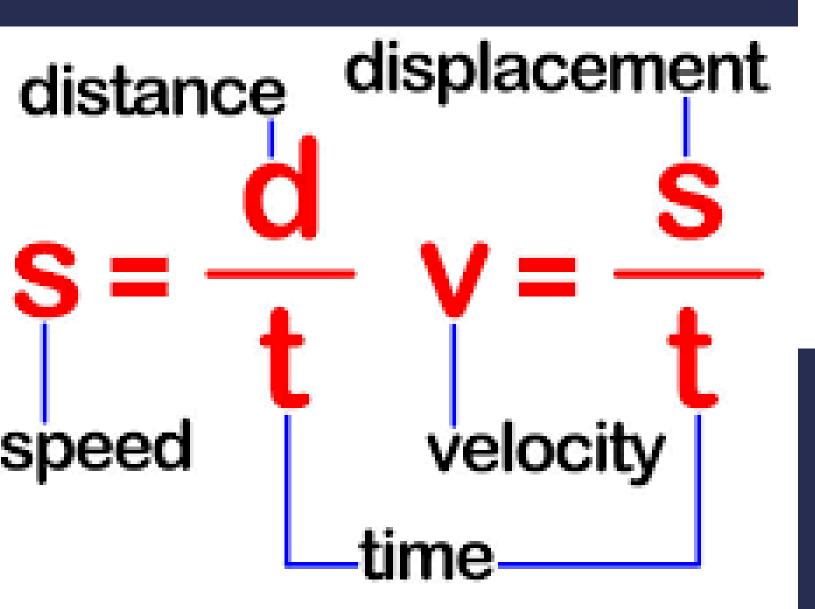
Distance(D) = speed(S) \cdot time(T)

Base quantity

Derived quantity

Base Quantity	SI units
Length, I	metres, m
Mass, m	kilogram,
	kg
Time, t	second, s
Temperature, T	Kelvin, k
Electrical current, I	Ampere, A

Derived Quantity	Units
Volume, V	m³
Density, ρ	kgm ⁻³
Velocity, v	ms ⁻¹
Force, F	N
Acceleration, a	ms ⁻²



VELOCITY FORMULA



Velocity

$$v = d/t$$

$$t = d / v$$

$$d = v \cdot t$$

SPEED VS.VELOCITY

Speed is simply how fast you are travelling



This car is travelling at a speed of 20 m/s

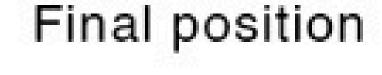
Velocity is Speed in a given direction



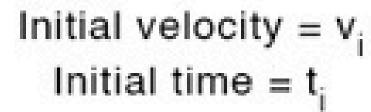
This car is travelling at a velocity of 20 m/s east

Acceleration Equation

Intial position







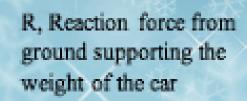


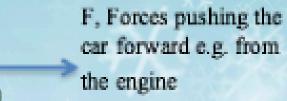
Final velocity = v_f Final time = t_f

Acceleration (a) =
$$\frac{\text{Change in velocity }(\Delta v)}{\text{Change in time }(\Delta t)}$$

$$a = \frac{\Delta V}{\Delta t} = \frac{V_f - V_i}{t_f - t_i}$$

Force produces or tends to produce movement in a body.





IF THE BODY CONTAINS MORE MATTER, I.E. IT HAS A LARGER MASS, THE VELOCITY SO PRODUCED WILL BE LESS.



motion of the car e.g. air resistance

Fr, Forces opposing the



THE UNIT OF FORCE, CALLED THE NEWTON, IS THAT FORCE WHICH, WHEN APPLIED TO A BODY HAVING A MASS OF ONE KILOGRAM, GIVES IT AN ACCELERATION OF ONE METRE PER SECOND PER SECOND. THE NEWTON IS CALLED A DERIVED UNIT BECAUSE IT IS DERIVED BY DEFINITION FROM THE BASIC UNITS.

Scalar and vector quantities. MASS HAS NO IDEA OF DIRECTION ASSOCIATED R, Reaction force from WITH IT, AND IS CALLED A SCALAR QUANTITY ground supporting the weight of the car F, Forces pushing the A SCALAR QUANTITY HAS MAGNITUDE car forward e.g. from Fr, Forces opposing the (SIZE) ONLY. motion of the car e.g. air the engine resistance W, Weight = mg

DOWNWARDS, ETC., AND HAS DIRECTION; IT IS CALLED A VECTOR QUANTITY.

A VECTOR QUANTITY HAS DIRECTION AS WELL AS MAGNITUDE.

A scalar quantity has magnitude (size) only.

R, Reaction force from ground supporting the weight of the car

A VECTOR QUANTITY HAS DIRECTION AS WELL AS MAGNITUDE.

Fr, Forces opposing the motion of the car e.g. air resistance



W, Weight = mg

SCALAR

A scalar quantity has magnitude only.









mass



time

VECTOR

A vector has both magnitude and direction.



velocity



weight



	Mass		
1.	The quantity of matter		
	contained in an object is		
	known as its mass.		
2.	The mass of an object is		
measured in kg.			
3.	The mass of an object is		
measured by a beam balance.			

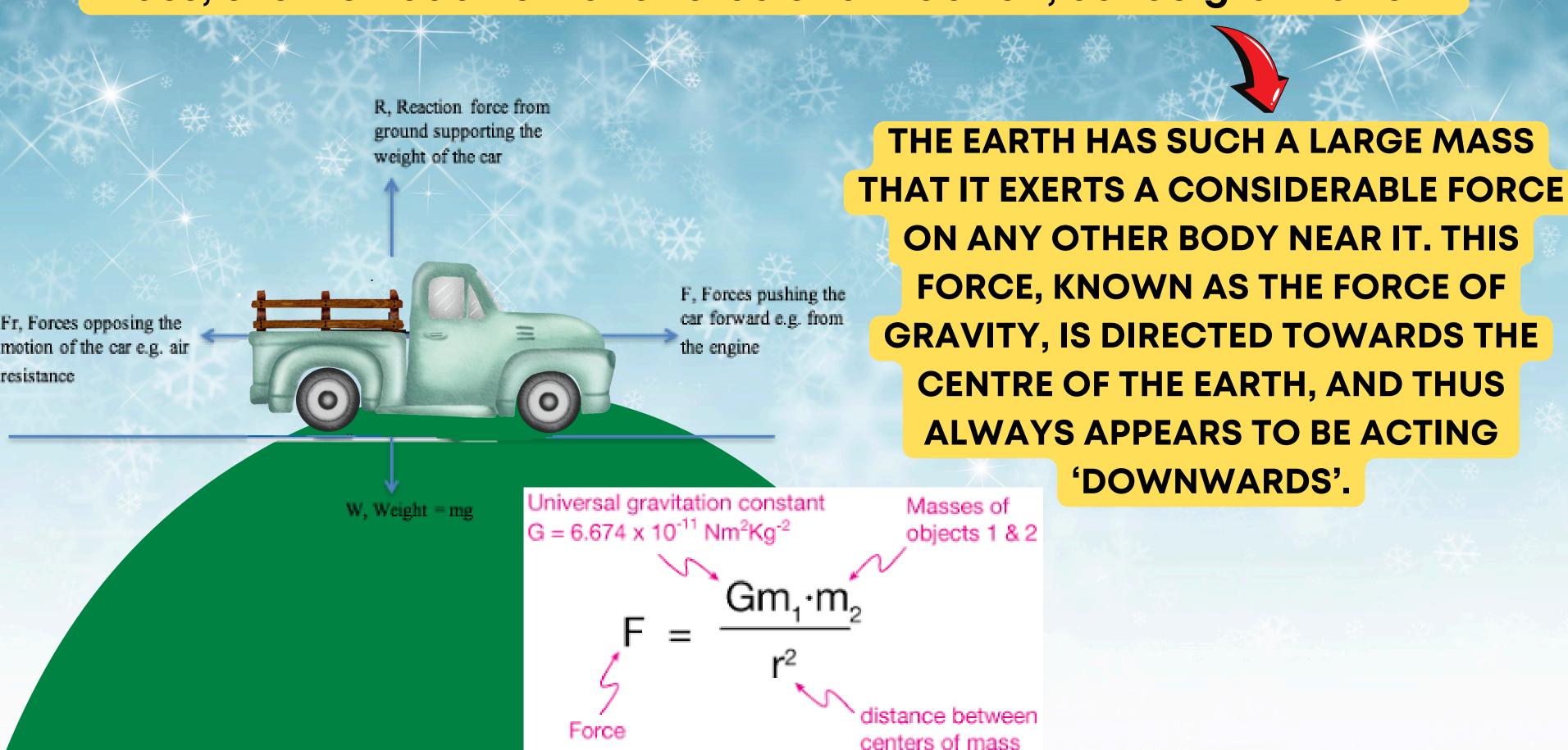
4. The mass of an object remains constant at all places.

- 5. There is no place where the mass of an object is zero.
- 6. It is a scalar quantity.

Weight

- 1. It is the force with which an object is attracted towards the centre of the earth.
- 2. The weight of an object is measured in newton or kg. wt.
- 3. The weight of an object is measured by a spring balance.
- 4. The weight of an object is different at different places on the surface of the earth.
- The weight of an object is zero at the centre of the earth.
- It is a vector quantity.

The concept of weight depends on the fact that all bodies, whatever their mass, exert on each other a force of attraction, called gravitation.



The unit of work, called the joule, is the work done when the point of application of a force of one newton moves through a distance of one metre in the direction of the force.

WORK (W)=FORCE (F)*DISTANCE (D)

SI UNIT:

1 JOULE (J) = 1 NEWTON METER (N·M)



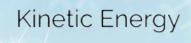
IN THE DIRECTION OF THE FORCE' IS NECESSARY BECAUSE SOMETIMES THE BODY DOES NOT MOVE IN THE DIRECTION OF THE FORCE;

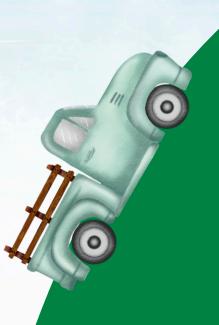
mechanical energy; because it is energy of position, it is also called potential energy.





here the potential energy has been converted into energy of movement, called kinetic energy.







Kinetic Energy

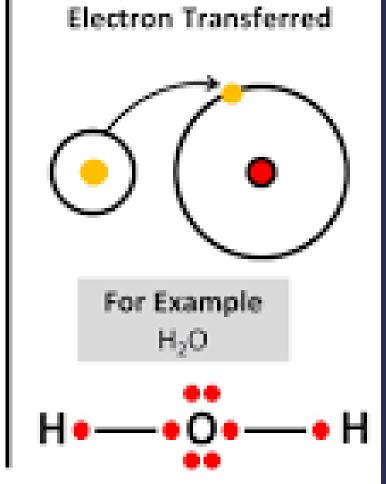
Kinetic Energy	Potential Energy
Kinetic energy is a form of energy possessed by	Potential energy is the stored form of energy
an object due to its motion.	due to its position.
It can be transferred from one body to another.	It cannot be transferred from one body to
This transfer process happens during the time	another body since the body possessing it is in
of collision between two objects in motion.	a rest position.
It is a relative form of energy.	It is a non-relative form of energy.
The factors affecting kinetic energy are Speed	The affecting factors are height/distance and
or velocity, and mass.	mass.
The formula for kinetic energy is	The formula for Potential energy is
$K.E = \frac{1}{2} mv^2$	P.E. = mgh
The external environment impacts the amount	The external environment does not affect the
of kinetic energy the object will gain.	amount of potential energy the object will
	possess.
Kinetic energy example- Flowing water.	Potential energy example – Water present at
	the top of a hill.

Ionic compounds	Covalent compounds
1. Ionic compounds are formed by the	Covalent compounds are formed by the
complete transfer of electrons.	sharing of electrons between two atoms.
2. Thou oviet in colid state	They exist in all three states - solid, liquid,
They exist in solid-state	gases
3. They have high melting and boiling point.	They have low melting and boiling point.
4. They are soluble in water	They are generally insoluble in water.
5. Ionic compounds are good conductors of	They are insulators i.e they do not conduct
electricity in the molten state as well as in	electricity in the molten state as well as in
aqueous solutions.	aqueous solutions.

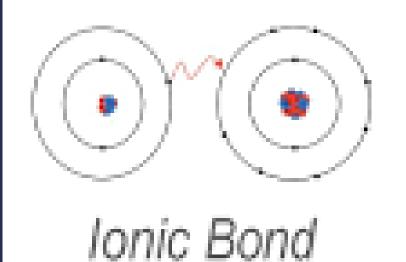
COVALENT BONDS OR IONIC BOND

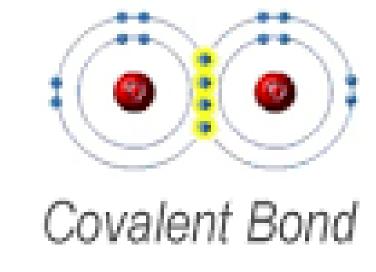
For Example Cl₂

CI — CI



lonic vs. Covalent Bonding





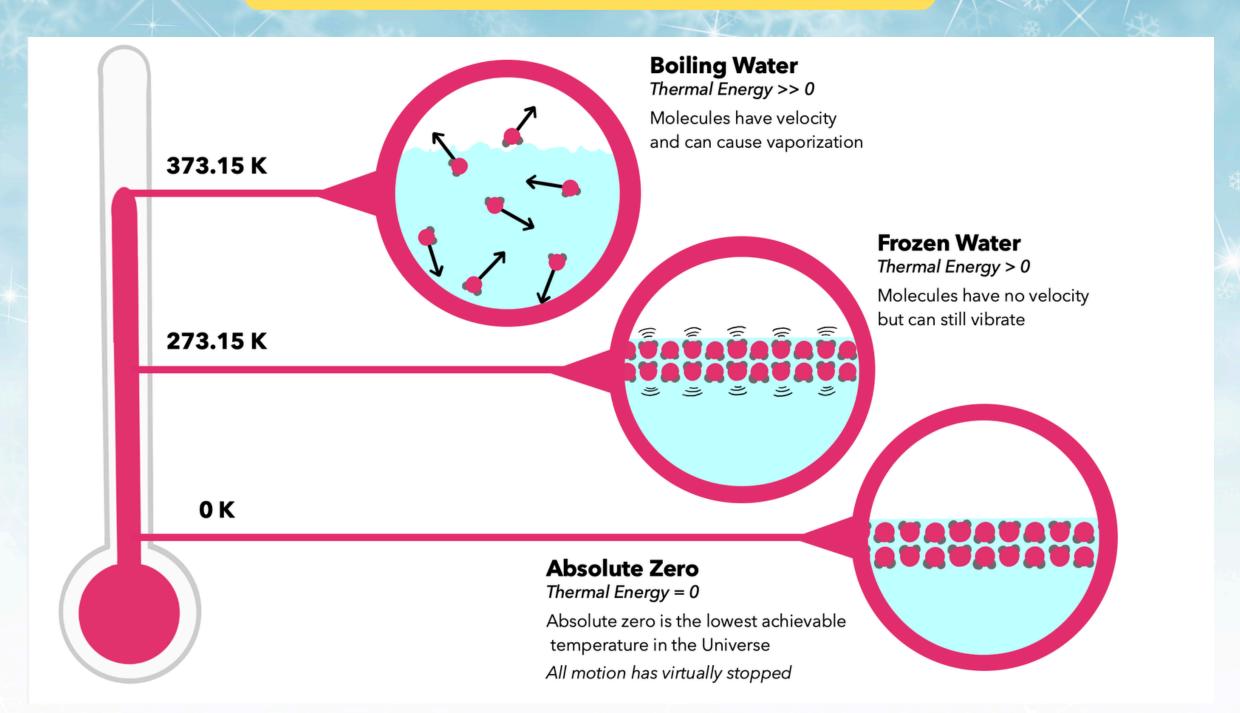
In solids, this movement is regular and is called vibration (rather like the vibration of a guitar string). In liquids and gases it is haphazard, and is normally called random movement.



IF THE ATOMS OR MOLECULES ARE IN VIGOROUS MOVEMENT, AND THEREFORE HAVE A HIGH ENERGY, THE BODY IS SAID TO HAVE A HIGH TEMPERATURE. IF THE ATOMS OR MOLECULES HAVE ONLY /OW ENERGY, THE BODY HAS A LOW TEMPERATURE.

IF A SOLID IS HEATED, AT A CERTAIN TEMPERATURE (KNOWN AS THE MELTING POINT) IT MELTS AND CHANGES INTO A LIQUID. IF THE LIQUID IS THEN HEATED, AT A HIGHER TEMPERATURE (KNOWN AS THE BOILING POINT) IT BOILS AND CHANGES INTO A VAPOUR. BOTH TYPES OF CHANGE ARE VERY FAMILIAR IN THE TRANSITIONS FROM ICE TO WATER AND FROM WATER TO STEAM.

If matter is cooled to lower and lower temperatures, the kinetic energy of the atoms or molecules becomes less and less. One can in fact imagine a stage at which all movement ceases. This temperature, which has never been quite attained in practice, is called the absolute zero of temperature. Its value is about -273° Celsius (0° K).



a flow of energy from one body to the other. This particular form of energy s called heat, and the way in which it is thus transferred through solid matter is called conduction. Being a kind of kinetic energy, it would be natural to measure the quantity of heat in joules

a special unit of heat was derived, called the calorie (cal)

The calorie is the amount of heat which will raise the temperature of one gram of water by one degree Celsius.

```
Joule is a unit of work.

Using the relation,

work = force × displacement

= mass × acceleration × displacement

= mass × velocity
time
```