INTERNATIONAL SYSTEM OF UNITS (abbreviated SI from French: Le Système international d'unités)

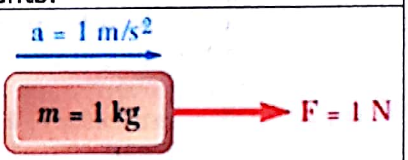
Multiplication Factor	Prefix†	Symbol
$1\ 000\ 000\ 000\ 000 = 10^{12}$	tera	T
$1\ 000\ 000\ 000 = 10^{9}$	giga	G
$1\ 000\ 000 = 10^{6}$	mega	M
$1\ 000 = 10^{3}$	kilo	k
$100 = 10^{2}$	hecto‡	h
$10 = 10^{1}$	deka‡	da
$0.1 = 10^{-1}$	deci‡	d
$0.01 = 10^{-2}$	centi‡	c
$0.001 = 10^{-3}$	milli	m
$0.000\ 001 = 10^{-6}$	micro	μ
$0.000\ 000\ 001 = 10^{-9}$	nano	n
$0.000\ 000\ 000\ 001 = 10^{-12}$	pico	p
$0.000\ 000\ 000\ 000\ 001 = 10^{-15}$	femto	f
$0.000\ 000\ 000\ 000\ 000\ 001 = 10^{-18}$	atto	a

†The first syllable of every prefix is accented so that the prefix will retain its identity. Thus, the preferred pronunciation of kilometer places the accent on the first syllable, not the second.
‡The use of these prefixes should be avoided, except for the measurement of areas and volumes and for the nontechnical use of centimeter, as for body and clothing measurements.

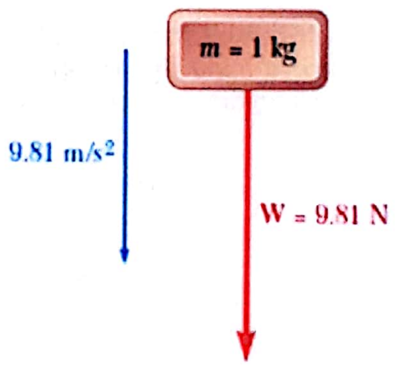
PRINCIPAL SI UNITS USED IN MECHANICS

Quantity	Unit	Symbol	Formula
Acceleration	Meter per second squared	. . .	m/s^2
Angle	Radian	rad	†
Angular acceleration	Radian per second squared	. . .	rad/s^2
Angular velocity	Radian per second	. . .	rad/s
Area	Square meter	. . .	m^2
Density	Kilogram per cubic meter	. . .	kg/m^3
Energy	Joule	J	N · m
Force	Newton	N	$kg \cdot m/s^2$
Frequency	Hertz	Hz	s^{-1}
Impulse	Newton-second	. . .	kg · m/s
Length	Meter	m	‡
Mass	Kilogram	kg	‡
Moment of a force	Newton-meter	. . .	N · m
Power	Watt	W	J/s
Pressure	Pascal	Pa	N/m^2
Stress	Pascal	Pa	N/m^2
Time	Second	s	‡
Velocity	Meter per second	. . .	m/s
Volume			
Solids	Cubic meter	. . .	m^3
Liquids	Liter	L	$10^{-3} m^3$
Work	Joule	J	N · m

†Supplementary unit (1 revolution = 2π rad = 360°).
‡Base unit.



The unit of force is a derived unit. It is called the newton (N) and is
defined as the force which gives an acceleration of **1m/s²** to a mass of **1kg**



The weight of a body, or the force of gravity exerted on that body, should, like any other force, be expressed in newtons.
W=mg=(1 kg)(9.81 m/s)
=9.81 N

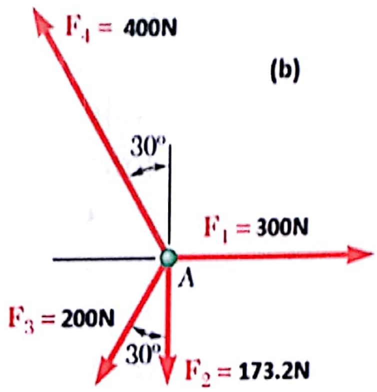
Pruthviraj U, NITK Surathkal

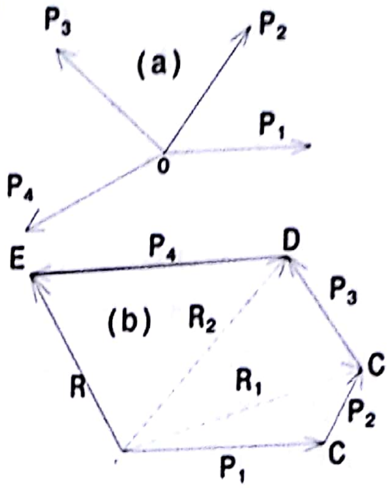
WHAT IS MECHANICS? Mechanics can be defined as that science which describes and predicts the conditions of rest or motion of bodies under the action of forces. It is divided into **THREE** parts: **MECHANICS OF RIGID BODIES, MECHANICS OF DEFORMABLE BODIES,** and **MECHANICS OF FLUIDS.** The mechanics of rigid bodies is subdivided into statics and dynamics, the former dealing with bodies at rest, the latter with bodies in motion. In this part of the study of mechanics, bodies are assumed to be perfectly rigid. Actual structures and machines, however, are never absolutely rigid and deform under the loads to which they are subjected. But these deformations are usually small and do not appreciably affect the conditions of equilibrium or motion of the structure under consideration.

EQUILIBRIUM OF A PARTICLE: When the resultant of all the forces acting on a particle is zero, the particle is in equilibrium.

*(By **particle** we mean a very small amount of matter which may be assumed to occupy a single point in space)*

$\Sigma F_x = 0$
$\Sigma F_y = 0$
$R = \Sigma F = 0$





POLYGON LAW OF FORCES may be stated as: If a number of concurrent force acting simultaneously on a body, are represented in magnitude and in direction by the sides of a polygon, taken in order, then the resultant is represented in magnitude and in direction by the closing side of the polygon, taken in opposite order

NEWTON's THREE FUNDAMENTAL LAWS. Formulated by Sir Isaac Newton in the latter part of the seventeenth century, these laws can be stated as follows:

FIRST LAW: If the resultant force acting on a particle is zero, the particle will remain at rest (if originally at rest) or will move with constant speed in a straight line (if originally in motion)

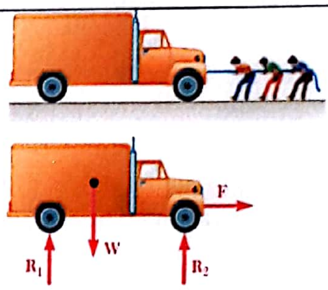
SECOND LAW: If the resultant force acting on a particle is not zero, the particle will have an acceleration proportional to the magnitude of the resultant and in the direction of this resultant force. This law can be stated as **F = ma**, where **'F', 'm'** , and **'a'** represent, respectively, the resultant force acting on the particle, the mass of the particle, and the acceleration of the particle, expressed in a consistent system of units.

THIRD LAW: The forces of action and reaction between bodies in contact have the same magnitude, same line of action, and opposite sense.

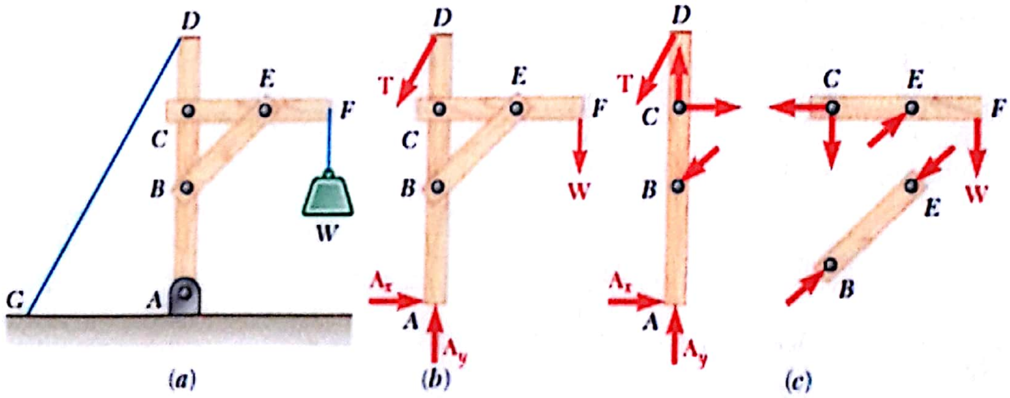
EXTERNAL AND INTERNAL FORCES: Forces acting on rigid bodies can be separated into two groups:

The **external forces** represent the action of other bodies on the rigid body under consideration. They are entirely responsible for the external behavior of the rigid body. They will either cause it to move or ensure that it remains at rest.

The **internal forces** are the forces which hold together the particles forming the rigid body. If the rigid body is structurally composed of several parts, the forces holding the component parts together are also defined as internal forces



External forces acting on the truck



The external forces, which are shown in the diagram, include the weight **W**, the two components $\mathbf{A}_x$ and $\mathbf{A}_y$ of the reaction at *A*, and the force **T** exerted by the cable at *D*.

The internal forces holding the various parts of the crane together do not appear in the diagram. If, however, the crane is dismembered and if a free-body diagram is drawn for each of its component parts, the forces holding the three beams together will also be represented, since these forces are external forces from the point of view of each component part

Pruthviraj U. NITK Surathkal