

Projectiles

Every body gravitates to the
Centre of the Earth in an even
proportion to the squares of the
distances from the Centre.

All bodies projected from any
Earth are attracted to the Centre
equally, whatever Velocity a Body
may have in any direction, if
be thrown upwards with
some Velocity, it will lose so
much in the ascent.

Bodies falling through
the same medium, and
at the same time, will
fall together.

to their quantities of matter.
The height to which projected
bodies will rise is equal to the
Square of the Velocity of their
Projection.

A heavy body gravitates
to the Earth at the rate of 16
Feet in a second, at the
Equator only 16 Feet.

A Heavy body falls nearly
16 feet in a $\frac{1}{4}$ of a second. 4
feet in $\frac{1}{2}$ a second and 16 feet
in a second hence the spaces
passed over by bodies moving
by gravity are as the squares of
the times of their falling from
rest.

From rest and equal bases follows

Table

Times of falling	Spaces down	Velocities
1	1	1
2	3	4
3	5	9
4	7	16

This motion is uniformly
accelerated, Gravity therefore
communicates to a falling body
a motion of 32 feet per second.

V _____ Velocity
T _____ time in seconds
H _____ Height
M _____

The N. — V. h. — h. — 4
 V. — V. — V. — 2x32
 V. — $\frac{37}{11}$ — h. — 2x16
 h.

If a body be projected in a
 line not perpendicular to the
 Horizon, it must describe a
 Curve and this line must be
 a parabola. For it is composed
 of an uniform Motion of
 Gravitation, and an uniform
 motion of Projection.

A heavy body near the
 Surface of the Earth goes
 with a motion which is uniformly
 accelerated. If projected directly
 upwards

upwards with a certain velocity
 is retarded.

In any other direction it
 describes a parabola. In the
 Supposition of the Earth's mo-
 tion, all bodies thrown perpen-
 dicularly upwards describe a
 parabola.

If the line of the direction
 of any body projected from the
 Earth be not the angle formed
 by the vertical line, and line of
 the Plane it will describe the
 greatest parabola possible. For
 that place it will be projected
 into

in an Angle of 45° —

If two balls are thrown at different Elevations with the same velocity, the one will rise above 45° , as the other below 45° . The horizontal distances or Ranges where they both fall, will be the same; the Height a body will rise to, when thrown perpendicularly upwards is equal to half the greatest horizontal Distance that can be thrown to with the same velocity. The Ranges of two Projections being the

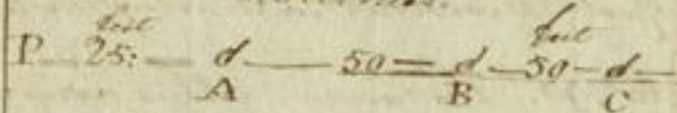
the same degrees of Elevation, but thrown with different Velocities, are as the squares of the Velocities.—

This Theory of Projection will not be found conformable to practice. A bullet shot in such a direction as according to this Theory of Projectiles it ought to describe a Parabola meeting the plane from whence it was shot at 1400 Feet Distance will only reach to 790. The reason of this variation is the Friction with the Air.

air, and the greater the viscosity
of the Body projected, and the
denser the air, the greater will
be the deviation.

The smaller, and the size of
the bullet the greater in pro-
portion will be the diminution
of the motion by the air.

An Experiment was made
to discover the Velocity with
which a bullet moves by
firing it Pendulums at
various Distances.



A Bullet fired from P
communicated

communicated to the Pendulum

A	in velocity of	1670 feet
To B		1587 do
To C		1525 do

The Pendulum B had 123
feet less Velocity than A. The
Pendulum C had 120 feet
less than B. Now as it was
found by computation that
 $\frac{1}{32}$ of a second was the time
in which the bullet was
moved from A to B and in
this time it lost a velocity of
123 feet in a second it would
lose a velocity of 393 feet. Given
by

Gravity takes from the body
a velocity of 92 foot 2 inches
per second, the resistance of
the Air was therefore found
to be 171 times the weight of
the Bullet which was found.

The Curve therefore
described by a bullet will
not be a parabola, but will
fall within a parabola,
and the latter part of the
Curve will be more bent
than the beginning of it.

Matter

Matter

Matter is preserved and carried
on by the Extension of Matter
communicated by its light
impenetrability and mediated
by its gravitation.

If one part of a pound of
wood be struck, the whole moves,
but if water be struck, a part
of it is only put in motion.

Communication of motion
may be produced without con-
stant contact, as shown of the
instance of that shown of its
production any other way.
Matter

Of Gravity.

Cohesion as well as gravity appears to be a force. Gravity is a Force which gives weight, Cohesion is a Force which gives solidity. Wood being a substance is not all put in Motion, for it does not Cohere. Wood is all moved by a Stroke through the medium of Cohesion.

Cohesion is a Force which resists other forces, the parts of a piece of wood do not separate when suspended and acted upon by the force of gravity, perhaps

may be thought not to resist Gravity in one respect, bodies being separated fall together by their gravitation, but bodies separated in their parts do not again Cohere, this is however only an apparent distinction, as we find bodies which certainly do cohere again when broken if they are brought by fire sufficiently near each other.

Gravity produces Motion or a change of Motion, and Cohesion does the same, Cohesion as well as gravity acts at a distance.

distances, every solid Body
will stretch in a certain
Degree of Force is applied to
it, without breaking, and if
this External Force is removed
it will resume its former
dimensions. This is Elasticity,
and it is not owing to the
Attraction of the shape of
the Particles of Bodies, but
to an absolute change of
distance between them.

If a Spring be forcibly
bent into a Curve, the
particles of the inside close
up

up on each other, and those
on the outside are drawn to a
greater distance asunder,
when the force is taken
away the Spring returns
to its former shape, and this
it does by means of the
repulsion of the inside, and
the attraction of the outside
particles of the matter of
which it is composed. Witness
evidently taken place between
two pieces of polished Glass
when pressed together, this
does not depend on their
weight

weights of the air, for the
same may be done with
pieces of metal and other
substances when brought
close together will also be
found to cohere.

The parts of fluids cohere
by Cohesion, and this force
also acts upon them at a
distance, thus we see a Drop
of water assume always a
Spherical form, this shows
that Cohesion always acts
at a distance, if it did
not the Drop would not be
spherical.

spherical, it would assume
that indeed but every shape
would be equally indifferent
to it.

The cohesion of fluids
to solids is also very evident
in this depends Capillary Attraction.

I. In every Capillary Tube,
the height to which water
will spontaneously ascend
is the Diameter of the Tube.

And it is found by
Experiment that the attraction
of the whole containing
of

a surface of a Capillary
Tube is not of course of the
waters suspension.

3^{dly} The next Cause A,
thus supports is the attraction
of the Periphery or rather
of the inner annular part
of the inside of the Tube, to
which the upper surface of
the Water is contiguous and
adheres. the gravity of the
Water being counteracted by
the attraction of the Periphery
with which its upper
surface is in contact, must
necessarily

necessarily rise partly from
the pressure of the Stagnant
Water, and partly by the
Attraction of the Periphery
immediately above it, &
which is contiguous to it.

4^{thly} The Periphery and
the Column suspended over
both in the same proportion
as the Diameter of the Tube.

D. Harris. This has

In some measure also of
Rise of Aspiration, also depends
on this Principle.

Glass does not attract
Water &
3

water at a greater distance
than the 10,000 part of an
an inch.

If the end of a Gold wire
be immersed in a basin of
Mercury, the mercury will
soon rise by a capillary attrac-
tion to the top of the wire
and the wire will then pass
into pieces.

This separation of the
Particles of Gold by the fluid
accounts for Chemical solution
upon Mechanical principles.

A Force of Repulsion too
exists

well as attraction is found to
subsist between different
bodies. Thus a needle swims
upon water, till it is wetted
This floats upon water, and
this affords repulsion between
of bodies affords us the reason
for the cohesion of particles
and having been proposed to
a force sufficient to overcome
it.

The particles of Matter
therefore attract at one
distance, and repel at another.

When a solid body passes
into a

into a fluid state it is pro-
-bable that the properties
are changed by the absorp-
-tion of latent heat, from
a greater degree to a less
degree of attraction, by the
attraction of their distances.

Fluids are compressible
as well as solids, and Mr.
Cavendish has found that
Water is so to a certain degree,
tho' the Torricellian experiment
seems to prove the contrary.

Air has its Elasticity to a
certain height: see New Jour
discovered at 159th below
height

might of Particles, Scales,
it would become solid.

The different Actions
therefore of the particles of
matter upon each other depend upon
their distances, and it is the
variation of these upon which
all the Phenomena of
attraction and repulsion
depend, thus water at a
certain distance is attracted
by the Earth in Vacuo, its
particles repel each other, in
water they attract to a certain
degree, in Ice still more, and
inf

in our power they refuse again,
Glasf at a certain distance
attracts Glasf. at another re-
pels it. At another it repels
Mercur, but the most striking
instance of these variations
is found in Sir Isaac Newtons
New Method or Optics, where
he mentions his discovery that
light was alternately attracted,
and repelled 12 or 13 times by
the Edge of a Knife, and that
some of these repulsions and
attractions took place at a
distance exceeding the 99th
part of

being performed quicker on the top
of a mountain than they are
according to the rule. This however
is an unfair conclusion, the weight
of matter in the mountain had
double of a material effect upon
the pendulum it was very different
again a suspension which was
less capable of being affected than
the surface of the sea, and till
the quantity of matter and the
mountain be discovered and an
allowance made for it no depend-
ence is to be made upon the result
that is related. Indeed we come
with propriety to affirm that a
pendulum

pendulum may even vibrate
quicker, on the top of a mountain
than at the bottom, as the super-
=ior rarity of the Air will make
them accomplish the top of the
Arc in a shorter time at so,
small distance from the Earth.
Pendulums of the same matter
and same length vibrate equally
which shows that all matter,
whatsomever Gravitates. —

Theory of Machines.

In many Machines we suppose
one power opposing another, the
work performed is found by
adding the Action produced by
the

the time of its production, and,
where the quantity is greatest the
Machine is best.

All simple Machines may be
reduced to the Screw. — Pulley —
inclined plane and Wedge — the
wheel and axle is composed of,
Screw of several arms, and the
Screw is a composition of the
Wheel and of the Wedge. —

The Pulley may be explained
on the Principle of the Lever con-
sidering the fulcrum as that part
of the pulley to which the support
is fixed. —

In Figure first B is that part
consequently E will balance F.
In 2