Heads of a Course of Lectures 2nd
on Natural Philosophy —

— Friday 10th Oct 1783

Rivers

By L. Dimsdale

— Refraction —

Bodies Immersed Partially will not agar
Co-here — Oil and water — Water and a
Dry glass — Needle sworn on Water — flies
walk on the surface of water with care but
are immediately attached and made fast
to tread —

Gravitation

If a body is supported it presses upon its support, if the support be removed it descends towards the earth — Descent in this perpendicular to the surface — the same on all sides of the earth — This owing to the attraction of the earth. and that attraction is called gravitation — — extends to the greatest heights we can reach without any sensible diminution — — Attraction of mountains proved by the deflection of the pendulum in Peru, and on Schehallion —

— Bodies descend in the same time what- ever the differences in their figure &c. — — proved by the G. and Fl. Experiments — — resistance of the air accounts for some diff. in the descent of bodies — Lightest moving slowest —

— Weight of bodies greatest at the surface of the earth — Decreases inversely as the square of the distance — Demonstration — — Below the surface & from the center —

- In consequence of Irregularities
of bodies the Distance must be taken from
the center ——— Therefore all Distances
to which we have access by Experiment
the gravity will be the same as at the
surface —

Were the earth a sphere and of uniform
weight of bodies would be the same on all
parts — but as neither is true — Gravity is
Communed at the Equator — Experiment
Pendulums vibrate slower at the Equa-
tor at a distance from —

— Were the earth a sphere the Communter
of gravity arising from the centrifugal force
will be as the square of the cosine of the Lati-
tude — (Demonstration —

— Diminution of Gravity observed by Bou-
guer and Condamine on the Andes —

— Were the earth a hollow Shell and
Gravity to act $\frac{1}{D^2}$ then a particle of mat-
ter would remain any where in Shell at
at rest —

Descent of bodies by Gravity

In fluxional Lines

A body moved by gravity alone has
a motion uniformly accelerated

~~Spaces are as the Velocity~~

Spaces are as the Velocities

Spaces are as the times — Therefore
Spaces are as the squares of the Velocities
or times — Demonstrable from Propos
from Geometry — Triangle —

The velocity at any given instant
is such as if continued uniform would
enable the body to describe twice the
space from the beginning of the motion

Application —

To find the height of an object from the
time of a bodys falling from its top. —

To find the time and velocity of a body
falling below the surface —

+ A body falls in the first second of time
16.1 — Now this labour may be calculated
Spaces described in successive times are as the
numbers 1. 3. 5. 7. 9 &c — Odd numbers —

— A body projected upwards is uniformly retarded — Follows the same laws as a body uniformly accelerated — The Ascending and descending Velocity at any given point the same —

— Figure of the earth the consequence of its attraction —

— All the bodies on or connected with the earth are heavy — Air — Smoke — Exhalations — even light itself are subject to this universal property of matter —

— Attraction of the moon which is shewn to the earth by Her Power of Attraction & the earth — The Planets to the Sun, and the Satellites to their Primaries —

Descent of Bodies by Gravity

— An inclined Plane —— Hyp.

Projection uniformly accelerated — Ultimate velocity the same, as that would have been acquired ~~by~~ in falling thro' the perpendicular height — The Velocities are as the Times — The Velocities and Time are as the square roots of the Lengths of the Planes — Time of Descent on an inclined Plane is to the time of perfect Descent, as the Length of the Plane to its height — Times of different Planes of the same height are as their Lengths — The Velocities on inclined Planes of different Lengths are as the square roots of their heights

+ The time of Descent through any number of inclined Planes connected together is equal to that through one Plane joining their extremities — Descent through all the Chords of a circle and the Diameter in the same time — If from any point of the circumference of a circle a straight line be drawn at right angles to the inclined Plane — the extreme points of this line will form the common

my Letters of two bodies one moving along
the inclined Plane the other perpendicularly
in the same time
+ Let a spheer roll, and a plane descend
down an inclined Plane without friction, the spheer
descended in the same time from quiescence with the
as 5 to 7
— Body falling from the same height acquires the same
velocity whether it descends perp? or on any inclined Plane.

— Lemma —

— Pendulum —

— Vibration — Oscillation — Point of Suspension
— Time of pendulums motion gravity —
— Descent from greatest Elongation to the lowest
performed in the same time that a body would
take to fall through ~~twice~~ Length of the pendulum
or Diam. of the circle of which the pendulum is
the radius —
— Pendulums of the same length vibrate in the
same time, whatever be the proportion of their
weights —
— Were the vibrations performed in Big Chords,
great and small would be performed — in the same
time
— Velocity at the lowest point is as the chord of the
arc through which it descends —
— Motions in small arches differ very little from
the motions performed in Chords — nearly equal
— Times of Vibration in small arches nearly equal
— Times of Oscillation in the subduplicate proportion of their ~~Lengths~~ 4ths or
Lengths — Examples —
— Real pendulum Centre of Oscillation at ⅔ from the point
of suspension — centre of gravity, In a ball suspended
suspended by a thread the centre of arc is very near
the centre of the ball — The Difference in a common
Royal pendulum
— ~~If~~ If Equate Vibrates Slower — long clock to lose
would gain 139".8 = 2' 19".8 in 24 hours — and
must be short .1262 Inch to bring it to time —

— A pendulum moving in a cycloid performs all its vibrations quick and in exact
— Principle properties of the cycloid — The above
property of the cycloid suppose all the motion
of the pendulum collected in one point which
is impossible in practice. In a cycloid the centre
of oscillation is continually changing — How
do we get in practice —
A pendulum the last Standard hitherto dis-
covered for weights and measures ——
— Principal use of the pendulum is its of-
fice to clock work —
— Compound pendulum — two balls on one
rod, the upper tends to accelerate the motion
of the ~~the~~ lower and the lower to retard the
of the upper —

Projectiles

A body projected in any direction except that of the perpendicular describes a curve — By the projectile force it would move uniformly in a straight line, describing spaces proportioned to the times — By Gravity it is drawn downwards and falls thro' spaces which are as the squares of the times, but a curve which has its abscissa as the square of the corresponding ordinates is a parabola — Every projectile therefore describes a parabola

— Impetus is the perpendicular height thro' which a body must fall to acquire the initial velocity of the projectile —

— The Amplitude or horizontal range is double the impetus — Elev. 45° —

— Horizontal R. at 45°. the greatest —

— Ranges at equal distances above and below 45 are equal — Hence any object at distance less than the greatest range may be hit by two elevations —

— Problems in Gunnery —

— Resistance of the air —

— Central Forces —

Rectilinear motion — Curvilineal

— Centripetal — Centrifugal forces —

Table — Sling —

— Projectile force along the Tangent — uniform

— Centripetal force continual pressure towards

a point — Center of forces —

= Description of a Circle — Ellipse &c by

the projectile and Centripetal forces —

— Propositions —

1 Centripetal forces are ÷ quantities of matter in the revolving bodies

2. Centripetal force in a circle would generate the same velocity as that of a body falling thro' half the radius —

3. Centripetal Forces ÷ Distances directly

4. ——— ÷ squares of the Periodic times reciprocally ——

5. — Sweep equall areas in equal time

6 Periodic times squared are as the Distan- cubes — this discovered by Kepler to obtain in the planetary system —

7. If the centripetal force be different at different distances from the center, then the projectile may describe an ellipsis or any other conic section — In this case

8. velocities in every points of the orbit will be to each other inversely as perpendiculars to the tangents at these points —

9. In an Elliptical orbit the ~~centrifugal~~ centripetal force is inversely proportional to the square of the distance —

These propositions demonstrated from directly and illustrated by Experiments on the whirling machine — circular pendulum &c —

Collision

— Of inelastic bodies — Balls of putty or clay

— Of Elastic bodies — ivory balls

— Direct and oblique impact

Propositions

+ — vide Helshams two general propositions which include all the Phenomena — also Hamiltons 4th Lecture — Parkinson on impact

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Doctrine of infinitesimals

— Prime and ultimate ratios — Exhaustion

— Fluxions — nature and application of each