Plane Mirrors

1. Magnitude of an object not altered

2. Mirror perp: to the horizon - object will be long seen in the mirror

3. Object appears as far behind the mirror as it is on this side

Distance is erect and similar to the object

4. If two plane mirrors are placed to each other in some image of one object will be seen - If the mirrors are inclined E.G. 30° there will in the two mirrors be 12 images viz. $\frac{360}{30} = 12$

— Concave Mirrors

Par. rays falling on a concave mirr. are reflected so as to meet in a point at the distance of half the radius of concavity —

Objects magnified by a concave mirror as by a convex lens — Magnifying power in proportion to the focal distance

If an object is farther from a mirror than its focus and the eye farther from the image a distorted inverted picture appears hanging in the air —

Concave mirror held to the sun's rays will burn

— Velocity of Sound

	Ft.	Inch.
Diameter	3	11 :
Focal Dist:	3	2.
Cast iron melted in		16"
Tin		3
Sixpence		7 ½
Half penny		20
Slate melted		3
Bone calcined		4
and Vitrified		33

In this experiment the heat was 400 times greater than common fire —

— In convex spec: the rays diverge — the object thereby diminished — always erect because the rays do not cross each other —

— Optical instrument.

— Diagonal machine —

— Opera Glass —

— Camera obscura

— The Reflecting Telescope

The image is formed in the focus of the object glass, & is this image, not the object which is seen — This image increases in proportion to the focal distance, and in the inverse proportion of the eyes distance from the image — The eye cannot view it more than a limited distant vision — hence the use of the eye-glass —

— Divide the one focal distance by the other gives the magnifying power —

The rays diverge from the image to the focus of the object glass must come parallel to the eye — This can be effected either by a convex or concave eye glass — In the first case the distance of the glass must be equal to the sum of their focal dist. In the latter to their difference — In the former the object is seen inverted the latter erect. —

— Field depends on the eye glass — the brightness on the object-glass —

— A concave eye-glass gives a less field —

Additional eye glasses do not increase the magnifying power of the telescope

Collective Telescope

New rule for finding the magnifying power of a telescope —

Divide the field of the eye glass by that of the telescope the quot is the magnifying power —

— Reflecting telescope —

The image is formed in the focus of the great mirror, which coincides with the focus of the less mirror — From this it is thrown down thro' the hole in the great mirror — and formed in the eye tube which consists of two glasses like a refracting telescope

— Magnifying power depends on the focal distances of the mirrors and the eye glass

Rule — Divide the F. L. of the Ocul: by the Lens, multiply this by the quot arising from the Division of the Lens by the second focal Dist: and the Prod: is the magnifying Power

Exp: —

12. F. L. of Ocul.
3 Lens
15. Second focal Dist. L. Sp.
1 Eye Glass

$\frac{12}{3} = 4$

$\frac{15}{60}$ Mag: Power

In a telescope we view the object but its picture proof of this better in reflecting and refracting telescopes —

Archimedes

Compound Engine to
raise a Ton by the Cranks

Two bodies on a horizontal
plane — Inclined plane

Perpetual motion 2 Lock

Changeable friction

Reading Desk —

Clock —

Great Engine of war —

Wedge —

Sappho

— air — bell — Receiver

vibration of strings —

— bells — pipes — Bottoms of metal &c.

Telechordon Stop —

— Horn — Trumpet

— Organ —

— Sounds produced in the room —

Air Gun —

Hermes

Colours —

— Two fluids make a solid

— Two cold fluids burst into flame —

Phosphorus —

— Air poured from one jar into another

— Bladder filled with Dephlogisticated air

— Arbor Martis —

— Paper in Dephlogisticated air

— Moses's face —

which directly shows that Magt
does not observe the same law as
gravity — Electric attraction
appears to follow the same law
& Electric repul —

8. A piece of iron hung to the
magnet becomes a Magnet
with reverse poles — Expt
a key hung to a bar, the
same pole of another bar joined
will suspend the key more
firmly — but the reverse pole
destroys the effect of the other —
Magism in this way only momentary

9. A body interposed does
not diminish Magnism —
& penetrates the hardest bodies
in a moment — differing from

other manufactures —

10. Magnet attracts equally in Vacuo as in the air either rarefied or condensed — therefore the air is not concerned in this attr. — Attracts equally in the dark as in sun-shine, therefore light has no connection with it — Attraction not affected by Electricity, therefore the two fluids do not act on each other

11 Magnetism not diminished by communication. — In this respect it differs from every thing else — A spark from the conductor lessens the quantity of electricity — If you put some grand reservoir

15. Needle exactly balanced on its center of gravity, will when touched respectively north pole — This is called the Dip — and varies nearly in :: Lat. Dip at present about 74° — South lat. the S. pole dips —

16. Dip has not varied so much — A sphere of hard wood will show that the Var. has not exceeded 9°

17. Different methods of making magnets —
— 1 by one straight bar
— 2 by two straight bars
— 3 by Horse shoe Magnet
— 4 by position
— 5 by heating and cooling

Magnets made —

— 4 By a stroke of a hammer

— 5 By Mr Canton's Method —

— 6 A small needle should be
laid between two magnets

18. Most forms of a magnetical
needle should not be pointed
— nor made of two slat wires
as in the box compasses —

19. Method of preserving Magn
— of increasing the strength —
of a magnet — weight hung —

20. Magnets have different
degrees of strength at different
times of the day —

Hence a different Variation
from 8 or 9 in the morning to a-
bout 2 afternoon when
mean motion 13' in time. Jointe

21. Mariner's Compass —

— Phenomena —

22. 1 Spindles of the glass magn.
they acquire this by position
— If the position stands perpendicular it is no matter
whether it is high or low —

— 2. A shock of Electricity sent
through a small needle gives
it polarity — Heating it in
common fire will produce
the same effect —

3. Under pearl of a natural
magnet as it lay in the
mine is the north pole
— hence Nat. Magn. owes
their virtue from position

23. If not the Earth a large Mag:
— with one pole about the
— head of Baffins bay, the oth
— on the opposite point +
— Dip in various lat: equable
— to this — Par, at Equator —

24. A natural Magnet has
sometimes two North and
— two South poles, when this
is the case two are always
much stronger than the other
two. The weak poles become
in time still weaker, until
they disappear altogether —
— May not the same have
been the situation of the
earth

Descent of bodies by Gravity
motion accelerated —
— 1 : 3 : 5 : 7 : 9 : 11
1 2 3 4 5 7
— spaces as the squares of the
times —— —— ——
— near the surface of the earth
bodies descend 16.1 in a sec.
Expt.
1 Descent 4 × 4 × 16.1 = 257.6
2 — — 3 × 3 × 16.1 = 144.9
— depth of a well ——
to find the height to which
a bullet rises perpendicularly
— Rule ½ seconds square and mult
by 16.1 each ——

Cone

Only 5 Sections in a Cone

3 Hyperbola Parabola

Ellipsis

Properties of the Parab.

Projectile moves in a Parabola — Proof —

Rules

1. Powder
2. Elevation
3. Distance
4. Time of flight

Centres of Magnitude — Motion

Gravity

Definition —

— Supported the body at rest

\+ when the centres of motion

\+ and gravity do not agree

the body rests only

when the C. G. is perpen-

dicularly below C. Mo: —

Plane dividing the body

so that portions matter × div

for the planes

— Practical method of finding

the centre of G — hang up

the body by two different

points — point of intersection

is the centre of Gravity —

Different figures

1\. Regular bodies C. G. and C Mo. the same

2\. Triangle — two lines from two angles of a triangle to the middle of the opposite sides — therefore the distance is $\frac{2}{3}$ of the line bisecting the side

3\. Trapezium — Find the center of gravity of the four triangles which join, intersect in the center of G.y —

4\. Cone and Pyramid $\frac{3}{4}$ of the axis from the vertex

5\. Arch of a circle $\frac{1}{2}$ arch : sine $\frac{1}{2}$ arch :: radius : dist from center —

6. Parabola $\frac{3}{5}$ from the Vertex

7. Sector of a circle Arch : chord :: $\frac{2}{3}$ Radius to the distance from the cent

8. Segment of a Sphere

r = radius
x = height Segment

Then $\frac{8r - 3x}{12r - 4x} x$ Distance from the vertex

9. Paraboloid $\frac{2}{3}$ from the Vertex

Systems of bodies

1 Two spheres

2. Three spheres

3. Any number of bodies

4. Motion of a System the same as that of the center of Gravity

5.

— Bodies thrown into the air revolve round their center of gravity — Hich
+ the heaviest out of a body moves before the other
+ Motion of a System the same as that of its center of gravity —
+ Center of G. of the Earth and Moon forms the annual orb —
— Why bodies stand and fall — Pendulums —
— Two weights & equilibrio on any machine. If moved the center of gravity will always be in the same horizontal line —
— Animals — walking standing — sitting — rising — dance —

Experiments

1. Inclined board
2. Pendulum — sequence
3. Double cone —
4. Tumbler —
5. Equilibrium

Pendulums

1. Two :: 1 : 4 —
2. Ballet machine
3. Escapement. —
4. Centre of pendulum pins applied to Astronomy Clocks and applied it to Clock work —
5. Cycloid how formed — useless in Clock work
6 — Great and small Orbs

Perpendicular descent of bodies &c

— Conic Sections 5 Sections

— Described on a plane —

— Properties of the Parabola —

× Time of the ascent = Descent

— Point and Shot velocities equal —

1 Greatest random

2 Equal above and below

3. Gr. R: = Double height: Alt.

4. Time at 45 = $\sqrt{\frac{1}{4}}$ gr. R: in feet time in seconds

5. Time as the Sine of the angle of Elevation —

6. Place the Zenith dist on an inclined plane —

Penetration of Iron Balls

The penetration a measure of the velocity — The larger balls penetrate farther than less — Penetrations nearly as the squares of the velocities —

18 pound shot with a vel. of 1200 feet in a second will penetrate a block of sound seasoned oak 34 inch — But may be made to penetrate three times that quantity — Batteries Common will put a bullet 100 or 12 feet into a bank of earth at 200 feet Distance — A piece of more 200 feet Distance — A piece of more 200 or 6 feet — This determines the thickness of breast works

from its place by the force of the powder — In a manner the action is confined to a small part of the shell —

The part of the shell of a projectile to the large end — that the large may keep in the wake of shell — by this the shell does not turn so equally

+ If the large keeps constantly in the wake it must be extinguished when the vel. is greater than 1200 feet in a second; also the spring of the air, may blow out the contents of the large —

[illegible]ctions —

6.

+ Resistance to a 24 lb.
is 20 times its weight
14 ~~lb~~ less than 3 miles

Fowling pieces — small calibre
— perhaps a small calibre
the best — in this the shot will
pass in a longer stream from the
muzzle of the barrel + two bullets
do not move equally fast. —
perhaps the same with shot — perhaps
the balls would be better — the longer
the shot so much the better. —

Penetration of the Ball

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Perpendicular descent of
bodies &c

Conic Sections 5 Sections

Described on a plane —

Properties of the Parabola

× Time of the ascent = Descent

First and last velocities

equal —

1 Greatest random

2 Equal above and below

3. gr. R. = Double height H.t

4. Time at 45 = $\sqrt{\frac{1}{4}}$ gr. R.
in feet time in seconds

5. Ran as the Sines of the compt
of Elevation —

6. Have the Greatest Dist
on an inclined plane —

— Initial Velocities — —
— Resistence of the air — —
real resistance drawn with
difficulty — Different density
different elasticities. — —
— Proportional resistance known
+ as the square of the velocity
— and square of the diameter
— or as the surface — —
+ But when above 1200 feet —
in a second — triple the
above proportion — —
2 — Resistence of a 24 Lib ball
with 16 pounds of powder
= 20 times the weight — —
1 To find the resistence from
bullets at the pendulum
placed at different distances
Difference of the velocity