— Bodies luminous, opake
— Particles — Strait lines
— Reflection — Light does
not touch the surface —
particles small, surface
irregular — Angles of I & R
— Mediums — air, water, Glass
\+ Refraction — surface of two
mediums — Stick! bent —
bottom of a pool — the
magnifier — Sines varying
— Sine I & R: I, & R, in a
given ratio
E.G. Air to Glass 3 : 2
Air to Water 4 : 3
— Mediums of unequal dens.
Any incidence to the
[illegible] point —

Different forms of Glass
— Plane no effect — Incident &
emergent rays parallel
— Sphere rays meet at ½ Rad
— Double convex at the
centre of convexity —
— Single conv^x. 2 Radius
— Double concave virtual
focus centre of Concavity
— plano Concave 2 Radius
— Meniscus —
— Multiplying Glass —
+ Magnitude of ——
+ Effect of a convex lens
+ Concave ——
+ ~~The~~ Magnifying power in-
versely as the Radius ——

+ Image in a plane mirr
the size of the object — within
— In a concave it is mag^d:
— In a convex diminished
+ Two specula parallel —
Divide 360 by the angle
of inclination gives the
number of images $\frac{360}{30} = 12$

— Inverted image in a focus of a convex lens or concave mirror —
— The Image is to the object as the distances from the lens —
— Ball and socket —
— This Image will increase and decrease with the optic angle
— 'Tis the image not the object which the mind contemplates —
— Camera obscura —
+ Portable ditto

Eye

— Globular forms near an inch in diam.
+ 3 Coats — a bag
1 Sclerotica — not elastic — cornea
2. Choroid — uvea — Iris — Pupil —
3 Retina — attached to the choroid by one point

3 Humours

1 Christallin divides the eye into two unequal parts — ligamentum Ciliare

1 Aqueous humour, very transparent — never freezes. Let out is supplied again

2. Vitreous, has apparently a yellowish tinge, yet

very transparent

+ Manner of vision like the ball and socket —

+ Magnitude of the smallest visible $\frac{1}{5000}$ part of an inch —

+ Short sight — concaves

+ Long sight convexes

+ Spectacles — how magnifying power at first —

— Green Glass —

— Small Lenses — same power

— How tried —

— Two Lenses should make an angle —

+ Axes of both eyes directed to the same object —

+ Squinting —

+ Causes — cure —

= Single Microscope

— Magnifying power —

— as the Lenses of distinct vision to the focal length

— how the object must be small and placed in one focus —

+ Reflecting Telescope —

— History — amendt —

— Two Lenses of equal focal distances no magnifying power

— Image of the object Glass inverted into focus which is the focus of the eye glass —

– Object seen inverted –

– Magnifying power –
as the Focal length of the object lens : eye Glass

– Two intermediate glasses
of equal focal distances with
the eye Glass –

– Refractor with a concave
eye Glass —— erect –

– Compound Microscope –

– Two eye Glasses ——

– Solar Microscope ——

+ Reflecting Telescope –

Two concave Mirrors and
eye Glasses – Newtonian

– Gregorian –

– Herschell's Telescope

– Diagonal Print machine

– Magic Lantern &c

~~On Visions~~

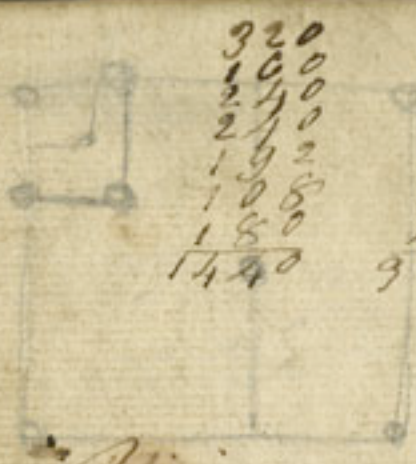
× New method of calculating
the magnifying power of
every telescope

Vision

1. Why is not the object double
2. Distinct vision at different distances
3. Contraction of the pupil
4. Use of two eyes
5. Object appears brighter but not larger to two eyes than to one — $\frac{1}{12}$ part
6. Objects inverted on the retina
7. Known objects appear nearer and smaller when magnified by the Teles:
8. Light of the moon $\frac{1}{300,000}$ Bouguer
9. Horizontal moon
10. When one turns round objs in the contrary direction and move after the eye is at rest
11. An object in motion will appear at rest provided the space it moves thro' in one second does not exceed the $\frac{1}{14,000}$ part of the distance
12. Touch educated vision —
13. Best way of viewing a piece of perspective is with one eye, or even thro' a tube —
14. Cats pupil long verte
    Ox's horizontal —
15.

Burning Specula –

1. Heat in the direct ratio of the square of the Diam. and inverse ratio of the focal length
2. Air was taken heated – wood in ashes burnt
3. Rays very little heated at a small distance from the focus –
4. Mirror remains cold –



Vision

No

Description of the Eye

Globular form —

Coats and humours —

3 Coats — a bag

Selerotic. — Choroid.

— Retina

Sclc. covers the whole eye except the fore part which is transparent, it is called the cornea from its resemblance to horn

Chor. coat within the other, the fore part is

called the Uvea or Iris

in middle the Pupil —

3 - Retina a thin membran

— 3 Humours

Chrystalline humour

is placed a little behind

the Pupil — like a lens

flatter before than behind

— Ciliary ligament

— Divides the Eye into two

unequal parts — In the

foremost part is the Aq.

humour from its resem-

blance to water — In the

hindmost is the Vit. H.

from the ~~resemblance~~ supposed resemblance to

melted glass

3 St

3 P S

2 French

— Nature of Vision —

— Like the Camera — Obs.

— Distinct vision when the rays ~~fall~~ meet on the Ret.

The picture is then distinct

— How do we know that Dist. picture produces distinct vision? — By the Camera Ob.

The same causes produce an indistinct picture in both. —

Picture inverted on the Retina — Why do objects appear erect? Position of the picture has no share in the apparent situation

but from our own position up and down — Objects appear erect tho' viewed with the head down, or oblique —

Erect through an inverting glass. —

Short sight remedied by concave glasses, they make the rays diverge —

Long sight cured by convex glasses —

— Eye adapts itself to distinct distances

— Object appears single tho' seen by two eyes —

— Contraction of the pupil —

— Use of two eyes — 1/13 P.

Squinting — Causes

1 Muscles not acting in unison

2. Most sensible part of the retina to one side the axis

3. Habit —

4. Object in one eye — limits of distinct perception unequal. — Can this be the case in a whole family? — It may, as figure colour &c.

— Cure

1 Shut the good eye

2. Direct the axes to a point

3 When the eyes are very unequal it is in vain to attempt a cure —

Observations —

1 Objects seen at different distances —

2. Contraction of the pupil —

3. Use of two eyes —

4. Candle and spring —

5. Two tubes, shillings —

6. An object to be seen must subtend an angle of 1' at least, the picture on the retina $\frac{1}{3000}$ Inch

7. An Object appears at rest if the space it runs over in a second of time be to its distance as 1 to 11000 — Watch-hand. Planet

8. An object appears brighter but no larger to both eyes than one

9. Bright objects appear larger than dark ones—

10. When a man turns round objects appear to turn in the opposite direction, and move after the eye is at rest.

11. A torch whirled round with a certain velocity seems a circle — Thus two from the same cause.

12. Known objects appear near and unknown, only magnified by the Telescope

13. Best way of viewing a piece of perspective painting

14. Light of the moon
$\frac{1}{300,000}$ of the sun
Deception in estimating
light — room, window —

15. Horizontal moon. —
we judge more accurately
of distances when there
are objects interposed —
walk in fields — Stone
on the road — Moon seen
over a hedge — by a tree —
— According to Metaphy
it is thus we estimate the
length of time —

but the quality as well
as the quantity of the
objects must be taken into
account. — When we lye awake
racked with pain or brooding
over the melancholy re-
membrances of a departed fr
how slowly do the hours drag
on; on the other hand
while we are engaged in
conversation with a few agree
able friends, how nimbly
do they glide along. — —
Number of objects that
pass in review before the
mind the same — our
estimate different —

16. Globe and cube —

17. To draw two rows of trees
that from a given point
shall appear parallel —

×18 Why do objects appear
erect — Explain & account
the apparent inversion
of an object has no
connection with the
position of the picture
— object appears erect
when viewed with the
head in a horizontal
or inverted position

up and down relative
to our own position
Objects appear inverted
through an inverting
telescope —
Perhaps children see obj
at first inverted

× Obey the humour —
of children terrib-
-ble contrivance —
Drum of the ear [illegible]
[illegible] —

Theodolit	16	
Elect:	7	
Sextant	10	10
Mechanics	5	
Hydrostatic Ps	1	10
Hydrostatics	2	2
Mass	2	2
Globes	5	
Microscope	1	1
Astronomical J	1	1
	51	6
Telescope	10	10
	61	16

A 1780