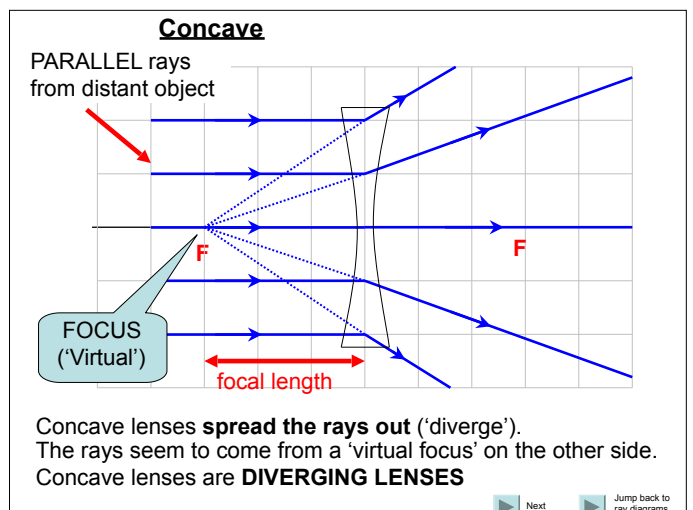
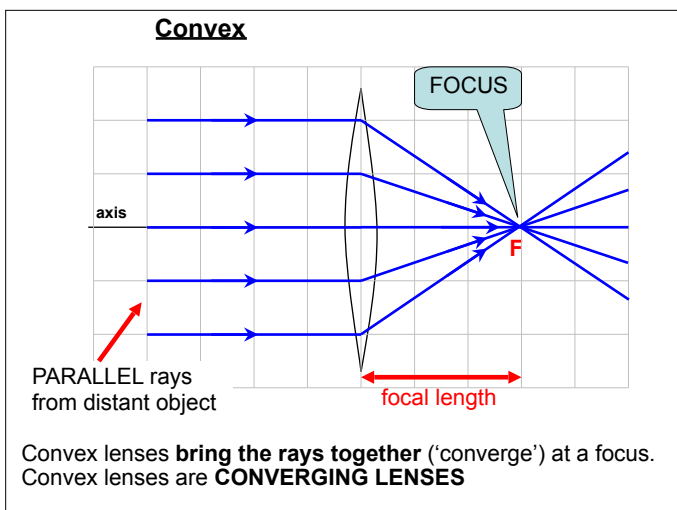
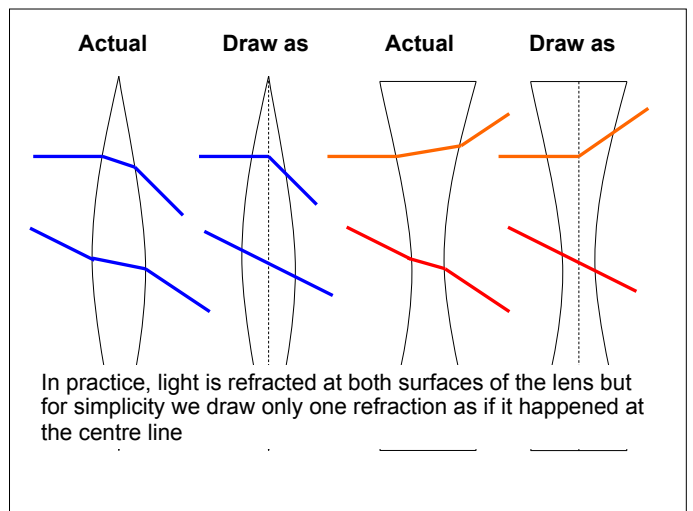
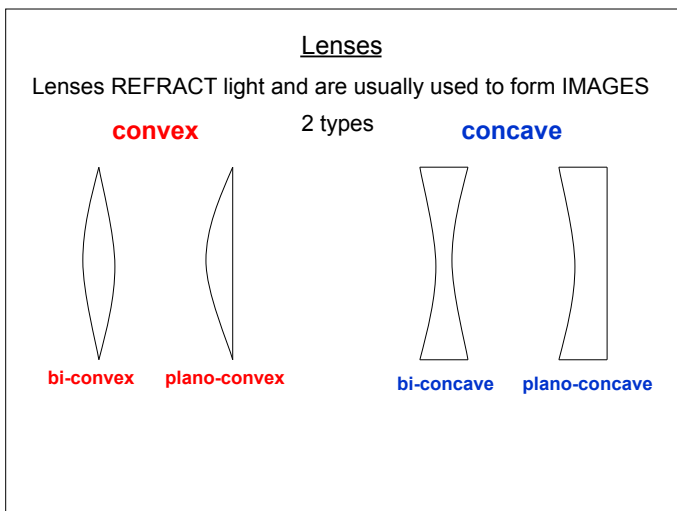


13 - Convex and Concave lenses

- Level 4 - Show how lenses bend light using ray diagrams.
- Level 5 - Explain how a camera lens works
- Level 6 - Relate the shape of a lens to the type of glasses needed for long and shortsightedness.



Ray diagrams

Light is reflected off ALL POINTS of a non-luminous object in LOTS OF DIFFERENT DIRECTIONS

To work out what sort of image a lens will produce, we select **2 rays only** from the top point of the object:

- one parallel to the axis
- one to the centre of the lens

RAY DIAGRAMS: RULES

Image – diagram gives position and size

focal length

2 x focal length

1. A ray parallel to the axis is refracted through the focus
2. A ray to the centre of the lens passes through undeflected
3. A ray through the focus is refracted parallel to the axis

RAY DIAGRAMS: IMAGES

If image LARGER than object: **MAGNIFIED** If image SMALLER than object: **DIMINISHED**

MAGNIFICATION = IMAGE HEIGHT / OBJECT HEIGHT

If image SAME WAY UP as object: **UPRIGHT** If image UPSIDE DOWN: **INVERTED**

If rays pass through object: **REAL**
If rays only seem to come from object (see diverging lens): **VIRTUAL**

This is: **MAGNIFIED INVERTED REAL**
Mag = 1.25

IMAGE TYPES

Image DIMINISHED INVERTED REAL	Image MAGNIFIED UPRIGHT VIRTUAL
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REAL images can be **PROJECTED ON A SCREEN**
VIRTUAL images cannot be projected

1. Draw the following on graph paper

2cm large square

2. Draw an object **outside 2F** at the position shown and at the size shown
3. Apply the ray diagram rules and draw in the image
4. Classify the image by filling in the table below. Repeat for other positions

Object pos.	Image pos.	mag/dim	upright/inverted	real/virtual	Uses
outside 2F					
at 2F					
between F & 2F					
at F					
inside F					

6. CONCAVE (DIVERGING) LENS

Used in spectacles:

Short sight 'Myopia'

Eye lens too **strong**:
spectacle lens **diverges** light to bring back into focus

Long sight 'Hyperopia'

Eye lens too **weak**:
spectacle lens **converges** light to bring back into focus