‘IEC’ DIFFRACTION KIT - compact

Cat: HL1670-001 Diffraction Kit

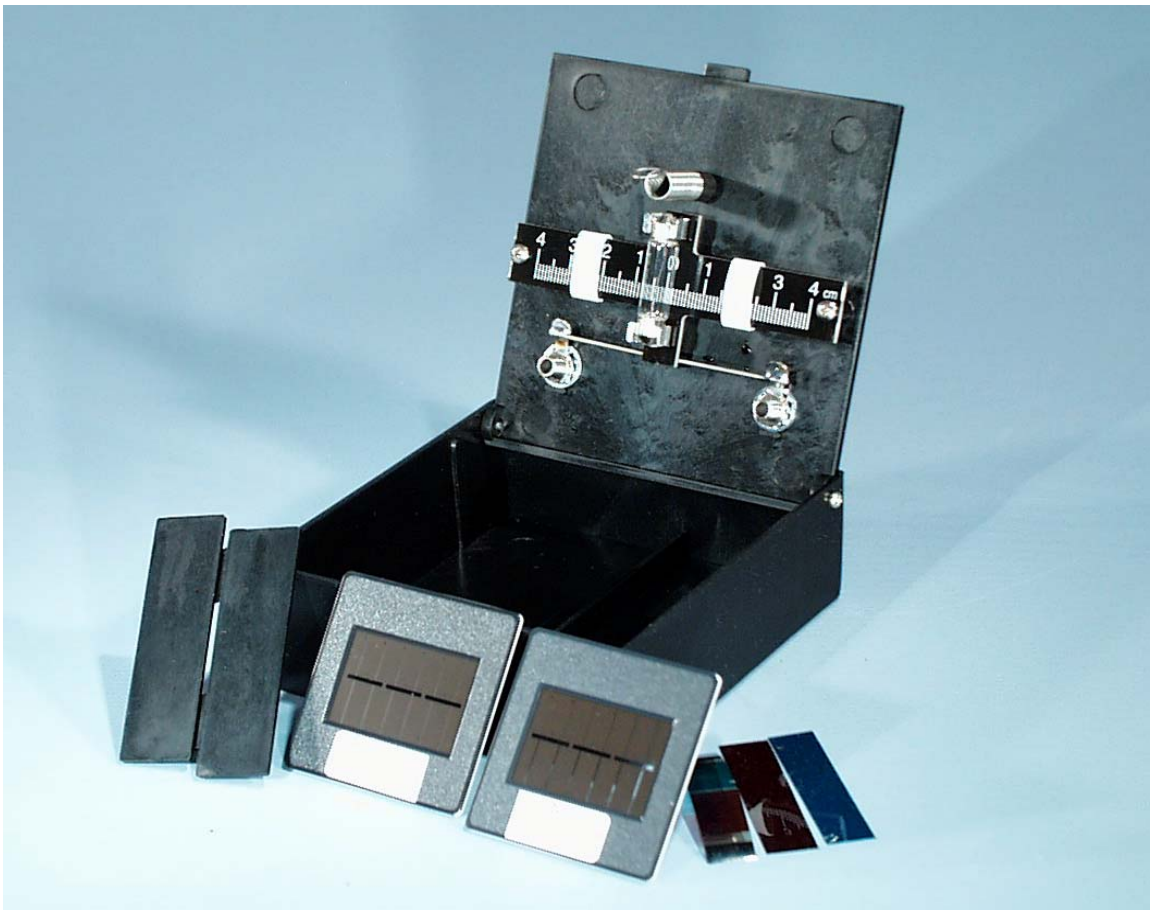
DESCRIPTION:

The ‘IEC’ **DIFFRACTION KIT** is a simple, compact and self contained instrument used for demonstrating the basic principles of the diffraction of light. The small plastic housing contains all the parts necessary for the experiments.

THE KIT CONTAINS:

- 1 pce. Housing and lid, complete with lamp, scale and terminals.
- 1 pce. Plastic slit device adjustable to provide a single slit of various widths.
- 1 pce. Red filter.
- 1 pce. Blue filter.
- 1 pce. Red/Blue colour filter with a clear band between.
- 1 pce. Photographic slide set of single slits of various widths.
- 1 pce. Photographic slide set of double slits of various widths.

HL1670-001 diffraction kit



Physical size: 105x114x38mm LxWxH **Weight: 0.12 kg**

INSTRUCTIONS FOR USE:

Open and raise the lid of the housing. Set it vertically or at a correct angle so that when you are standing about 2 metres away you are directly viewing the inside face of the lid.

Using a pair of leads with 4mm plugs fitted, connect the terminals on the lid to an AC. or DC. power source. Do not exceed 12 volts. The straight line single filament globe performs well at 6-8 volts and at this lower voltage it will last longer. If the filament is too bright it will make viewing tiresome.

Look closely at the line of the vertical filament. If it has any curvature, rotate the globe around in its holder until the filament appears as close to a straight line as possible when viewed from the front.

From a distance of about two metres, view the filament through:

- The adjustable-single slit device, keeping the slit parallel to the filament.
- Single slits on the prepared slide.
- Double slits on the other prepared slide.

Viewing the light through a single narrow slit:

Hold the various slits close to the eye and notice the bands of bright and dark either side of the light source. In the case of the adjustable slit, adjust the width of the adjustable slit and observe the behaviour of the bands. Use the photographic slits and note the difference in the number and positions of the bands when viewed through different slit widths.

Viewing the light through colour filters:

The red, blue or combination colour filter may now be supported in front of the filament by pressing back the tab of the spring clip above the lamp and slipping the filter between the coils of the spring. The filter material will be held close to the lamp as the spring tab is released.

When using the two colour filter, adjust the position of the filter in the spring holder so that the red, clear and blue portions are in front of the filament at the one time.

View the light source again through the single and double slits with coloured filters in place and notice the effect that colour has on the spread of the diffraction patterns. Different wavelengths spread different amounts. The combination colour filter is to permit a comparison between the diffraction patterns of the red, white and blue light simultaneously.

Quantitative experiments:

For quantitative experiments, use the two white markers that slide sideways over the scale and set them symmetrically either side of the filament (Note that the filament may not be central in its glass globe). Use the white markers as position indicators for the spread of the first dark bands (the ones closest to the filament) in a single slit pattern, or for a known nodal line on each side of the central one for double slit patterns.

With the photographic slit up to your eye, cover the unused slits with both thumbs whilst looking through the chosen slit.

Your eye should be positioned relative to the slit so that you are seeing the scale and the white markers through the long clear (1cm.long) 'windows' on the slides and at the same time be seeing the diffraction pattern. In this way the inside edge of the white markers can be set to fit exactly in the centre dark part of the nodes on each side.

NOTE 1): It is usually more convenient to leave the width markers set at say 2cm. apart and to fit the spread of the diffraction pattern to suit that spacing by moving yourself to and from the filament. A distance further away from the filament spreads the pattern and a position closer to the filament compresses the pattern.

NOTE 2): When using the single slit, the distance between the centres of the middle pair of dark bands is measured by the two adjustable white markers that are positioned one on each side of the centre of the scale. Half of this width of the central maximum pattern is the distance from the filament to either of the white markers.

NOTE 3): When using the double slits, the central pair of dark bands are too close together to use. Therefore, another pair of dark bands must be chosen for measurement by the white markers. The number of the chosen node must be noted for use in the formula.

Observations to record:

- Which nodal line you are observing.
- What is the separation of the nodal lines as indicated by the inside edge of the white sliding markers beside the filament.
- The distance of the viewing slit from the filament.

The above observations will then permit you to determine the widths of the single slits and the distance between the centres of the double slits (their separation or pitch).

SINGLE SLIT:

- The width of slit (if you know wavelength).
- Wavelength (if you know slit width).

Formula: $\frac{x}{L} = \frac{\text{wavelength}}{w}$

- x = half the width of the central maximum pattern.
- L = distance, slit to filament.
- w = width of the slit.

DOUBLE SLIT:

- The slit separation (if you know wavelength).
- Wavelength (if you know slit separation)

Formula: $\sin \Theta_n = x_n / L = \frac{(n-1/2) \times \text{wavelength}}{d}$

- Θ = angle from perpendicular.
- x = distance of nodal dark band sideways from filament.
- n = number of nodal points from filament.
- d = slit separation.
- L = distance, slit to filament.

ANOTHER METHOD OF MEASURING SLIT DIMENSIONS:

Project the slide on a wall and measure the length of the 1cm. 'window'. Scale that measurement back to the slit widths.

METHOD: Rule two vertical pencil lines on a white wall exactly 20cm. apart (you can use 30 or 40 cm. apart). Place the slide in a projector and adjust the projector's distance from the wall until the projection of one of the 1 cm.long 'windows' fits exactly the distance of the 20 cm (or 30 or 40cm). This is best done in room light, not in a blacked out room. Then, using a mm. ruler, measure and record ***either:***

- The distance between the centres of the double-slits
- The widths of single slits

Dividing by the enlargement factor of 20 (or 30 or 40) will give the actual dimensions of the slits on the photographic slides. For greater accuracy, magnifications of up to 50x are possible if the optics of the projector are good. It is usual for 'colour aberration' to occur.

SLIT WIDTHS AS ORIGINALLY DESIGNED ON THE ARTWORK:

These dimensions are taken from the original artwork used to photographically create them. The actual exact widths might be slightly different from these figures depending on the photographic processes and computer resolutions used to create them:

Single slit widths:

upper row 'A' to 'F' 0.025 0.050 0.075 0.100 0.125 0.150 mm wide

lower row: 'G' to 'L' 0.175 0.200 0.225 0.250 0.275 0.300 mm wide

Double slit widths:… All slits are 0.025mm wide.

Centre distances (pitch) between slits:

upper row: 0.175 0.150 0.125 0.100 0.075 0.050 mm wide

lower row: 0.325 0.300 0.275 0.250 0.225 0.200 mm wide

Designed and manufactured in Australia