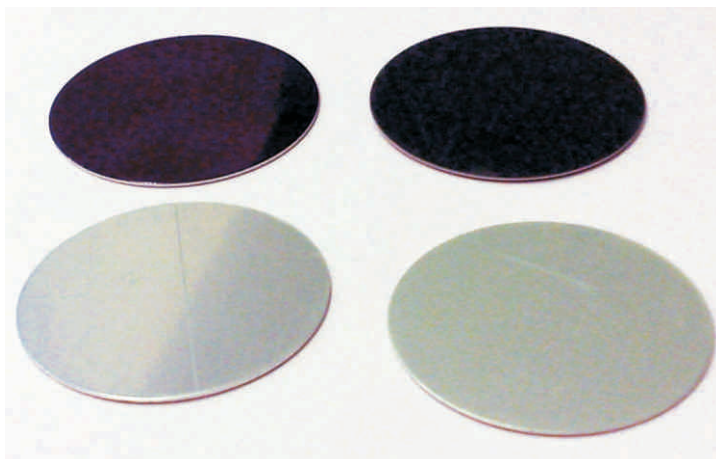


RADIATION ABSORPTION KIT

The kit contains four aluminium discs, each having a different durable finish: Matt black, mirror black, matt silver and mirror silver. Bonded to the reverse of each disc is a Liquid Crystal thermometer measuring 30°C to 65°C in 5°C increments. The Liquid Crystal device on the disc is easy to read and shows how absorption of heat radiation depends on surface colour and texture. The disc reacts very quickly to a heat source such as infrared or a bright light, giving fast results, so more experiments can be completed in each lesson. The discs can be used to investigate rates of cooling, the effects of filters and reflectors, inverse square law and equilibrium between absorption and emission. The discs are supplied as a set of 4 with a holder in a storage box.



READING THE TEMPERATURES

The indicated temperature is read when the segment is GREEN. When heating the disc the segments appear brown, then green, then blue, before returning to black. If STOP appears the heat source should be removed immediately.

HOW THE LIQUID CRYSTALS WORK

When cooler than the indicated temperature, the crystals in the film are solid and do not show any colour. Above the indicated temperature they melt and also show no colour, however behind the film is a black backing sheet and so the film appears black. Between these temperatures the crystals are in a Liquid Crystal state called a mesophase or Liquid Crystal phase. At these temperatures the crystals line up, or polarise, creating optical effects as a result of Bragg diffraction taking place within the Liquid Crystal layer. When these are placed on the black background, different colours of the visible spectrum can be seen at different temperatures.



EXPERIMENTS

The distances used are based on a 300W Radiant Heat Source

COMPARING THE EFFECT OF SURFACE FINISH ON ABSORPTION

Place the twin disc holder 200mm from the Radiant Heat Source. Time the temperature rise to 65°C for each of the four discs. Plot the temperature rise against time for each disc.

OBSERVATIONS.

The different surface texture and colour of the discs has a clear effect on the absorption of radiant heat. The rate of temperature increase is not uniform. As the disc temperature rises, the disc itself starts to radiate heat.

COOLING

The rate of cooling also depends on the surface texture and colour. The rate of cooling is not uniform. The rate depends on the temperature difference between the disc and its surroundings.

EQUILIBRIUM

There are a number of distances from the radiant source that will result in equilibrium. The disc will reach a temperature at which it is emitting as much heat as it is absorbing. The equilibrium temperature varies with distances from the source and the surface properties of the disc.

WARNING

The discs will be damaged by repeated exposure to temperatures over 100 °C. Providing that the discs are removed from the heat source as soon as STOP appears, the discs will last for many years. The alloy discs heat more slowly as the temperature rises because they lose more heat by radiation. The 30°C safety margin is therefore much greater than you might think intuitively and it is unlikely that the Liquid Crystal discs will be damaged.

NRDS-4 (SET OF 4 ALUMINIUM DISCS WITH LC DISCS BONDED)

Rest the discs carefully in the curved slots in the holder. Always hold the discs by the edge. Keep fingers off the absorbing surfaces. Clamp the holder in a retort stand clamp. Keep hands and face away from the radiant heat source as far as possible. Finger grease can affect the readings. Make sure that the discs are clean. DO NOT USE SOLVENT CLEANERS. A soft damp cloth is ideal. If the discs get very dirty, use a little soap and rinse off. The anodised coatings are very tough and not affected by solvents, but the liquid crystal films will be damaged by contact with solvent based cleaners.