2. Which of these is the spectroscopic designation for a lithium atom?

A $1s^2\ 2s^2$
B $2s^1\ 1s^2$
C $1s^2\ 2s^1$
D $2s^2\ 1s^1$

3. Which element has atoms with the spectroscopic designation [Ar] $4s^1$

A hydrogen
B lithium
C chlorine
D potassium

4. How many electrons are there in the 2p sub-shell of the oxygen atom?

5. Which number would complete this spectroscopic notation for a nitrogen atom?

$1s^2\ 2s^2\ 2p^?$

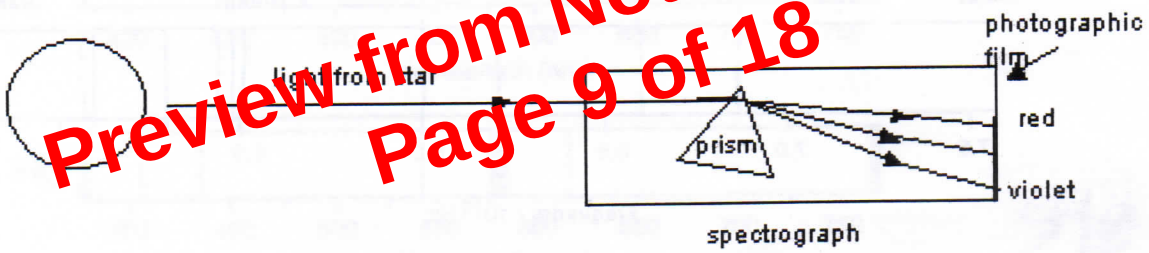
6. Carbon has two unpaired electrons. How many unpaired electrons would boron have?

SPECTROSCOPY

The light emitted by stars contains all the frequencies between the ultraviolet and infra red parts of the spectrum. Our own star, the Sun, is fairly cool with a surface temperature of about 6000K and emits mainly visible light (400nm to 700nm). Some stars are cooler than ours and emit mainly infra red radiation whereas some are very hot with surface temperatures in excess of 40,000K. Very hot stars emit mainly ultraviolet radiation (approximately 200nm to 400nm).

Any atoms in the outer regions of a star will absorb some of the light emitted from the surface of the star and so the light which reaches us will have certain frequencies missing – frequencies which have been absorb by the atoms. Different atoms absorb different frequencies of light.

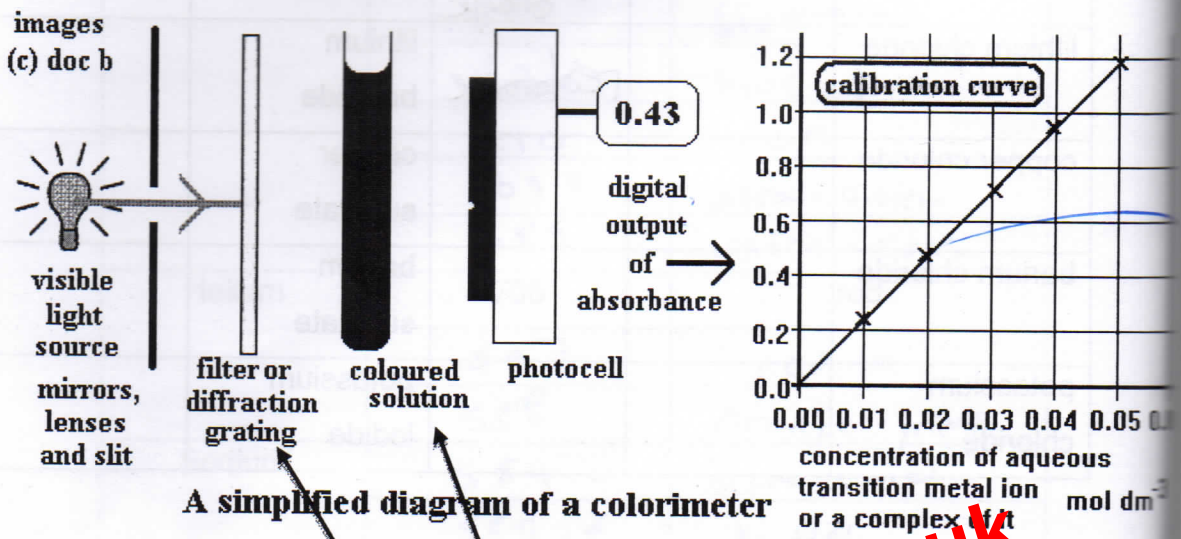
When the light from the star is analysed in a spectrometer black absorption bands appear on a bright background of light emitted from the star. The black bands correspond to the frequencies which are missing – the ones which are absorbed.



COLORIMETER

A colorimeter is an instrument that can be used to determine the concentration of a species by determining the amount of light energy absorbed, or transmitted.

A schematic diagram of what is in a colorimeter is shown below.



A simplified diagram of a colorimeter

Firstly we determine which frequency of light is absorbed most by the coloured sample, e.g. potassium permanganate crystals are purple as they absorb green light and transmit the red and blue light which together make the sample appear purple. In this case a green filter would be used.

The higher the concentration of the coloured sample the lower the % of light which would be transmitted through the sample. By determining the amount of light transmitted by solutions of known concentration we can construct a calibration graph by plotting transmittance against concentration. A sample of unknown concentration