1. Monochromatic light falls on 2 slits separated by 0.3 mm. The resulting interference pattern falls on a screen 0.3 m distant from the slits. The centre of the dark band next to the central maximum is found to be 2.25×10^{-4} m from the centre of the central maximum.

   (a) What is the wavelength of the monochromatic light?

   _____

   _____

   _____

   _____

   _____

   (b) What is the colour of this light? _____

   (c) What distance will there be between the central maximum and the third bright band to one side?

   _____

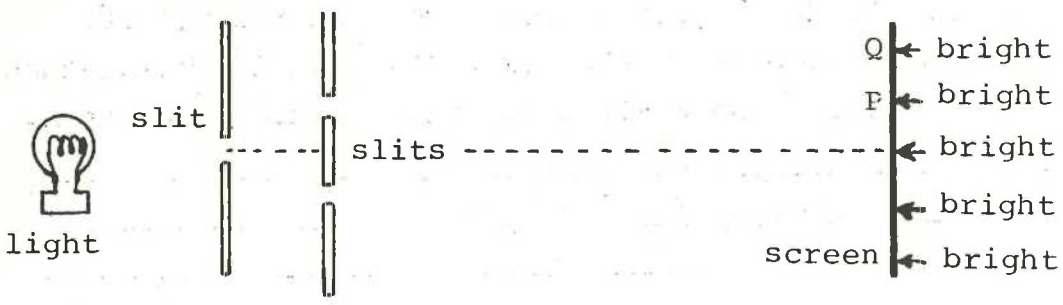
   _____

   _____

   _____

   _____

2. The next question refers to the diagram below.



   The incident light is a mixture of two wavelengths, one in the red end of the spectrum and one in the blue.

   There are two bright bands, adjacent to the central bright band, which are labelled P & Q. Which will be blue and which red?

   _____

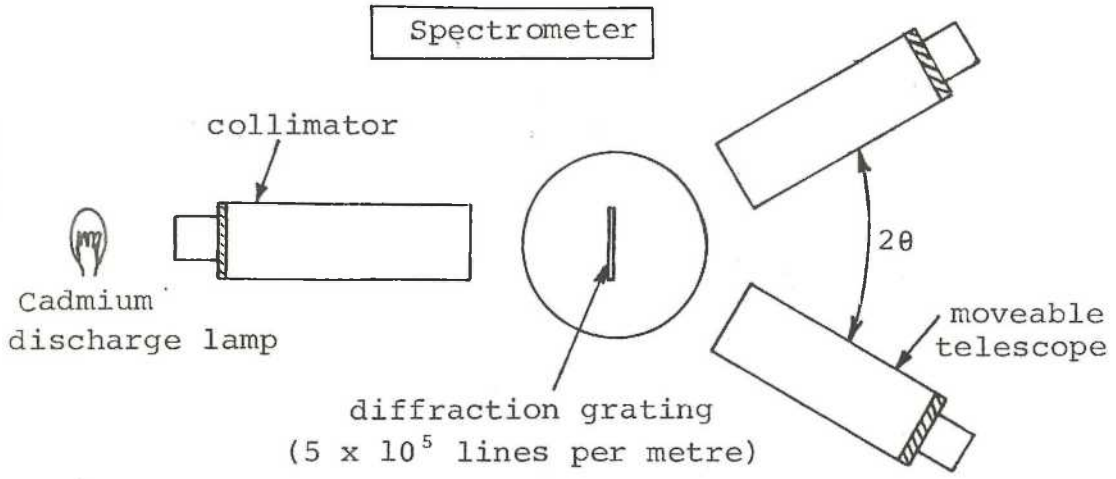
   _____

1. Light of wave length 580 nm is passed through a diffraction grating of 6000 lines per centimetre. What is the angle at which the first order maxima would be observed.

2. A laser beam emitting red light of 650 nm is shone upon a diffraction grating which has 2000 lines per cm scratched on it. The grating is positioned immediately in front of the centre of a screen and is 3 metres from the screen. If the screen is 3 metres wide, how many red spots will appear on the screen?

3. A diffraction grating has 8000 lines per centimetre and is used to determine the wavelength of light. It is observed that there is a bright line 6° either side of the central (straight through) position. What is the wavelength and frequency of the light being observed.

1. This question refers to the diagram below.



A student studies the emission spectrum of Cadmium using a spectrometer and diffraction grating as shown. For each spectral line she measures the angle 2θ. Find 2θ for the lines listed below and write your answers in the appropriate column in the table.

Colour	Wavelength ($\times 10^{-7}$ m)	2θ
Orange	6.438	
Green	5.155	
Green	5.086	
Blue	4.800	
Blue	4.678	
Blue	4.412	

2. Monochromatic light falls on a diffraction grating which has 6×10^5 lines per metre. The angle between the two first order maxima is measured to be 60°. What is the wavelength of the light?

_____

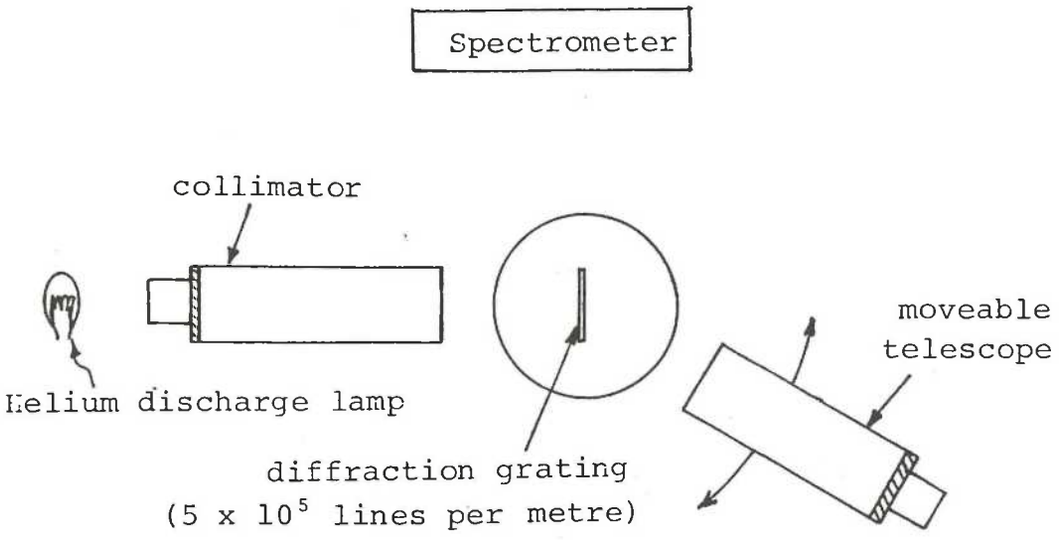
_____

_____

_____

_____

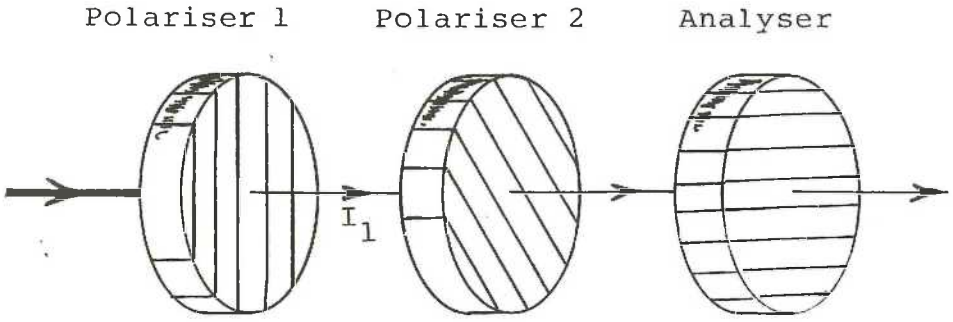
1. This question refers to the diagram below.



A student uses a spectrometer to find the wavelength of the prominent lines in the emission spectrum of helium. He measures the angle (2θ) between the two first order maxima for each spectral line. His results are tabulated below. Calculate the wavelength of each line. Write your answer in the appropriate column in the table below.

Colour	Angle (2θ)	Wavelength
Red	41.37^{o}	
Red	39.01^{o}	
Orange	34.17	
Blue-green	29.04	
Blue	28.49	
Blue	27.28	
Blue	25.84	

The next 2 questions refer to the diagram below.



1. Light of intensity I_1 is transmitted by polariser 1. Polariser 2 is at 60^1 to polariser 1 and 30^o to the analyser.

   What intensity (in terms of I_1), will be transmitted by polariser 2?

2. What intensity (in terms of I_1), will be transmitted by the analyser?

1. The wavelength of the pair of dominant yellow lines (which are very close together) in the emission spectrum of sodium is about 5.9×10^{-7} m. When this wavelength is measured in the emission spectrum of galaxies A, B, C, D and E, the results are as shown in the table below.

   (a) Fill in the blank spaces in the table below to indicate whether

   (i) the measurements indicate a red or a blue shift

   (ii) the galaxy in receding or approaching.

Galaxy	Wavelength of sodium lines as measured on Earth (m)	Red Shift or Blue Shift	Galaxy receding or Approaching
A	7×10^{-7}		
B	3×10^{-7}		
C	8×10^{-7}		
D	4×10^{-7}		
E	5.9×10^{-7}		

   (b) Which of the galaxies is

   i) receding at the greatest velocity?

   _____

   ii) approaching at the greatest velocity?

   _____

2. A car is driven towards an observer standing beside the road. The driver of the car continually sounds the car horn.

   As the car passes the observer at high speed, explain what happens to the pitch of the car horn as perceived by the:

   (a) observer _____

   (b) driver _____

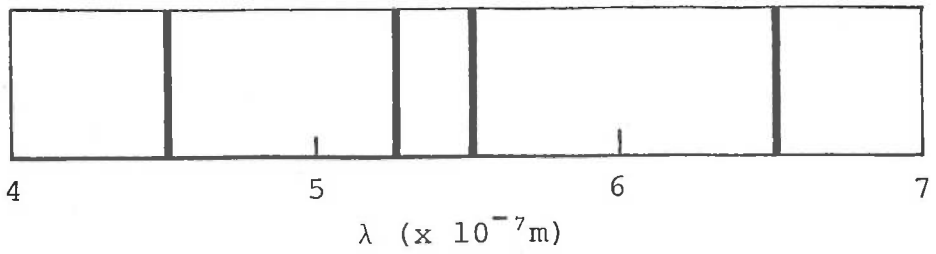
   (c) A second car overtakes the car which has its horn sounding. What happens to the pitch of the car horn as perceived by the driver of the overtaking car.

   _____

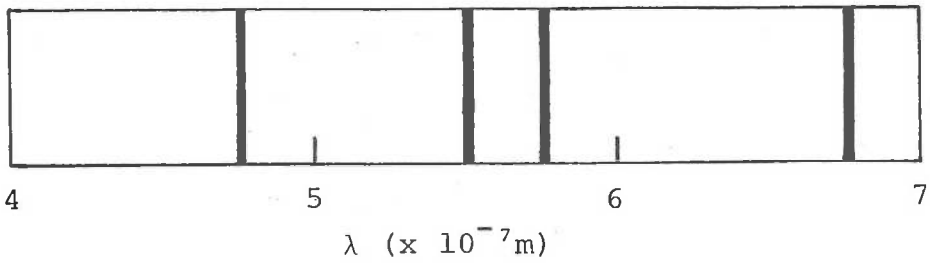
   (d) What name is given to this effect?

   _____

1. The emission spectrum of a certain element is shown below:



Emission lines are found in light coming from a distant galaxy as shown below:



Is the relative movement of the galaxy towards or away from the earth? Explain your answer.

2. A space ship, approaching earth at a velocity of 3×10^7 ms^{-1}, emits a beam of yellow light of frequency 5×10^{14} hz.

(a) What frequency will be detected by an observer on earth?

(b) What is the wavelength of the detected beam?

(c) What colour is this?