**Using diffraction from a CD as a means to determine wavelength**

**Introduction**

In this experiment learners will be estimating the relative wavelengths of colours in visible light by observing the diffraction pattern from the tracks on a CD or DVD and by taking simple measurements of distances with magnitudes in the order of cm and m.

They are expected to be familiar with the formula *λ* = *d* sin*θ* relating the wavelength to the angle of diffraction. (This investigation is only concerned with the first diffraction pattern so the n of the standard formula is 1.)

*d* is the separation of the tracks producing the diffraction pattern.

*θ* is the angle of the diffracted path of the light.

**Aims and skills covered**

* To observe and use a diffraction pattern to estimate the ratio of wavelengths
* To consider uncertainty
* To consider the effect of qualitative changes

**Links to Specification**

**Physics A**

* 4.4.3(c)(d) interference, coherence and path difference, constructive and destructive interference in terms of path and phase difference
* 5.5.2(g)(h) determining the wavelength of light using transmission diffraction grating

**Physics B**

* 4.1a(v) diffraction by grating
* 4.1c(iii) path differences for diffraction grating, for constructive interference

*nλ* = *d* sin*θ*

**Practical Skills**

* 1.2.1(b) safely and correctly use a range of practical equipment and materials
* 1.2.1(c) follow written instructions
* 1.2.1(d) make and record measurements
* 1.2.1(f) present information in a scientific way
* 1.2.2(a) use appropriate analogue apparatus to record a range of measurements
* 1.2.2(j) use laser or light source to investigate characteristics of light, including interference and diffraction

**CPAC**

* (1) Follows written procedures
* (3) Safely uses a range of practical equipment and materials
* (4) Makes and records observations

**Mathematical skills**

* M0.1 recognise and make use of appropriate units in calculations
* M0.2 recognise and use expressions in decimal and standard form
* M0.6 use calculators to handle sin *x*, cos *x* and tan *x*
* M1.1 use an appropriate number of significant figures
* M1.4 make order of magnitude calculations
* M2.1 understand and use inequality symbols
* M2.2 change the subject of an equation
* M2.3 substitute numerical values into algebraic equations
* M4.5 use sin, cos and tan in physical problems
* M4.6 use of small angle approximation

**Equipment**

* lamp
* CD or DVD
* metre rule

The lamp should provide a point source such as from a filament lamp. Fluorescent lamps and compact fluorescent lamps do not give a suitable result.

Either mains lamps with a clear filament bulb, such as a desk lamp, or 12V lamps with a 12V power supply, will give suitable results.

**Health and safety**

* Do not look directly at the lamp for long periods.
* The lamp may get hot.

Before carrying out any experiment or demonstration based on this guidance, it is the responsibility of teachers to ensure that they have undertaken a risk assessment in accordance with their employer’s requirements, making use of up-to-date information and taking account of their own particular circumstances. Any local rules or restrictions issued by the employer must always be followed.

**Notes**

* These practical activities are not controlled assessments, should not be carried out in exam conditions and can be adapted by the centre. Students can work in small groups during the activities which should take place as part of the normal teaching sequence. They are intended to be formative with students acquiring and practising skills throughout the course.
* To achieve a pass in the Practical Endorsement the student is required to demonstrate competence in all the skills, apparatus and techniques listed in section 1.2 of the specification and assessed against the Ofqual Common Practical Assessment Criteria (CPAC) at the end of the course.
* The skills, apparatus and techniques can be demonstrated during **any** practical work undertaken during the A Level course whether an OCR practical activity or not.
* In Physics A the diffraction grating occurs in the A level specification and not the AS, although many teachers will cover this alongside the double slit experiment. Learners can complete this practical activity by using the formula given prior to covering the theory in the second year of A level, or the practical activity may be carried out at that later time.

**Recording**

* Learners should not need to re-draft their work but rather keep all their notes as a continuing record of Practical Activity.
* Learners should have evidence of their readings

Additionally to support learners in the written examination:

* Learners should have obtained ratios which are similar to accepted values.
* Learners should have commented on the uncertainty of readings.
* The separation of tracks on the CD or DVD could be calculated.