L2 **WAVES** CHEAT SHEET

STUDY TIME

EXAM STRUCTURE

- The waves exam will be broken into three topics:
    - **Mirrors and lenses:** Ray diagrams, object/image distance/height, focal lengths.
    - **Refraction:** Refractive indices, critical angles, total internal reflection.
    - **Diffraction:** Wave properties and path difference.
- You can expect to see three types of questions: calculations, diagrams and written answers.
- This 'cheat sheet' consists of tips and tricks aimed to equip you with the right strategies so you can come out on top!

MIRRORS AND LENSES

Mirrors:

- Convex = diverge
- Concave = converge

Lenses:

- Convex = converge
- Concave = diverge

- *Is it enlarge or diminished*? You can usually tell, otherwise you can use your equations. If the magnification (m) is larger than 1 it is enlarged, if it's smaller than 1 it is diminished.
- *Real or not rea*l? A real image has the light rays actually reaching it. Virtual images occur when you're drawing your ray diagrams and you have to do the dotted lines extending off rays in order to make them meet and make an image.
- *Upright or inverted*? Draw it. The bottom/tail of the arrow will touch your base line that runs through the centre of the lens/mirror.
- ***The best way to go wrong is to not know which mirror does what and which lens does what. You want your exam script to be filled with drawings and diagrams. Remember that there is spear diagrams at the end and you can always ask for extra paper.***

REFRACTION:

- Incident ray = critical ray when refracted ray = 90 degrees.
- When the incident ray is larger than the critical ray, we have *total internal reflection* and the refracted ray = incident ray.

- Conditions for TIR: Incident ray>critical ray. Second medium is optically less dense than first.
- Critical angles and TIR are super connected so you want to remember both of them if either is mentioned as they may be asking you to make this jump without explicitly saying so.
- Snell's Law is by far the most important equation you have for this paper.
- n1sin(theta)1 = n2sin(theta)2
- Also remember if you get a question about waves entering a shallower area of water, the direction of the waves is what refracts towards the normal, not the wavefronts, they are simply 90 degrees to the normal.

DIFFRACTION

- This is also a good place to think about wave relationships, including this equation v=f(lamda). If you walk into your exam and absolutely forget everything about waves, physics, and planet Earth, hold one fact near and dear, frequency is constant.
- In diffraction, velocity of a wave can change which will affect wavelength, but never frequency!
- Path difference is to do with wavelength, and nodes are quantities of half wavelengths whereas antinodes are whole wavelengths.
- Make sure for these questions you rewrite down everything you've been told.
- It is most beneficial to draw a diagram representing what's going on.
- ***In fact***, draw diagrams as much as possible. Release your inner artists and draw everything. This is the paper where word-answers can be best achieved through an explanation of a diagram about 70% of the time which is much higher than a lot of other papers! If you have a picture of what is happening, then all the words and number there to confuse you can't!

HOW TO PREPARE FOR THE EXAM

- The best way to prepare for this exam is to practice! We recommend spending time on each individual topic, and then noticing when you need to spend more time on some topics than others. Reflecting on your study and progress is so, so important!
- NCEA has heaps of practice papers available from past years. Attempt these far away from the answers, and then only at the end, find the working for what you didn't get full marks for, and search for similar questions to practise these skills.
- Also check out the StudyTime Walkthrough Guide and Checklist to really check and consolidate your knowledge and feel 100% prepared!