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| OCR Physics A  Module 4B : Waves | Module RAG sheet |

Use this sheet to track and review your learning and revision.

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| **4.4** | **Waves** | RAG1 | RAG2 | RAG3 |
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| **4.4.1** | **Wave motion** |  |  |  |
| (a) | progressive waves; longitudinal and transverse waves |  |  |  |
| (b)(i) | displacement, amplitude, wavelength, period, phase difference, frequency and speed of a wave |  |  |  |
| (b)(ii) | techniques and procedures used to use an oscilloscope to determine frequency |  |  |  |
| (c) | the equation *f = 1 / T* |  |  |  |
| (d) | the wave equation *v = f λ* |  |  |  |
| (e) | graphical representations of transverse and longitudinal waves |  |  |  |
| (f)(i) | reflection, refraction, polarisation and diffraction of all waves  Learners will be expected to know that diffraction effects become significant when the wavelength is comparable to the gap width. |  |  |  |
| (f)(ii) | techniques and procedures used to demonstrate wave effects using a ripple tank |  |  |  |
| (f)(III) | techniques and procedures used to observe polarising effects using microwaves and light |  |  |  |
| (g) | intensity of a progressive wave; *I = P / A*; intensity ∝ (amplitude)2. |  |  |  |
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| **4.4.2** | **Electromagnetic waves** |  |  |  |
| (a) | electromagnetic spectrum; properties of electromagnetic waves |  |  |  |
| (b) | orders of magnitude of wavelengths of the principal radiations from radio waves to gamma rays |  |  |  |
| (c) | plane polarised waves; polarisation of electromagnetic waves  Learners will be expected to know about polarising filters for light and metal grilles for microwaves in demonstrating polarisation. |  |  |  |
| (d)(i) | refraction of light; refracti7ve index; *n = c / v*;  *n* sin θ= constant at a boundary where θis the angle to the normal |  |  |  |
| (d)(ii) | techniques and procedures used to investigate refraction and total internal reflection of light using ray boxes, including transparent rectangular and semi-circular blocks |  |  |  |
| (e) | critical angle; sin *C =* 1/*n* ; total internal reflection for light |  |  |  |
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| **4.4.3** | **Superposition** |  |  |  |
| (a)(i) | the principle of superposition of waves |  |  |  |
| (a)(ii) | techniques and procedures used for superposition experiments using sound, light and microwaves |  |  |  |
| (b) | graphical methods to illustrate the principle of superposition |  |  |  |
| (c) | interference, coherence, path difference and phase difference |  |  |  |
| (d) | constructive interference and destructive interference in terms of path difference and phase difference |  |  |  |
| (e) | two-source interference with sound and microwaves |  |  |  |
| (f) | Young double-slit experiment using visible light  Learners should understand that this experiment gave a classical confirmation of the wave-nature of light – suggested internet research on the ideas of Newton and Huygens about the nature of light. |  |  |  |
| (g)(i) | *λ = ax/D* for all waves where *a ›› D* |  |  |  |
| (g)(ii) | techniques and procedures used to determine the wavelength of light using (1) a double-sl⁸8it, and (2) a diffraction grating.  *d sinθ = nλ and diffraction gratings will only be assessed at A level* |  |  |  |
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| **4.4.4** | **Stationary waves** |  |  |  |
| (a) | stationary **(standing)** waves using microwaves, stretched strings and air columns |  |  |  |
| (b) | graphical representations of a stationary wave |  |  |  |
| (c) | similarities and the differences between stationary and progressive waves |  |  |  |
| (d) | nodes and antinodes |  |  |  |
| (e)(i) | stationary wave patterns for a stretched string and air columns in closed and open tubes |  |  |  |
| (e)(ii) | techniques and procedures used to determine the speed of sound in air by formation of stationary waves in a resonance tube |  |  |  |
| (f) | the idea that the separation between adjacent nodes (or antinodes) is equal to λ/2, where λ is the wavelength of the progressive wave |  |  |  |
| (g) | fundamental mode of vibration (1st harmonic); harmonics.  tensile and compressive deformation; extension and compression |  |  |  |