AQA (GCSE Notes)

Chapter 6: Waves

Q1. Define the terms transverse wave and longitudinal wave with examples.

Q2. Describe how the particles move in a transverse wave compared to the direction of wave travel.

Q3. Describe how the particles move in a longitudinal wave compared to the direction of wave travel.

Q4. Give one example of a transverse wave and one example of a longitudinal wave.

Q5. Explain how sound travels through air as a longitudinal wave.

Q6. Describe the difference between compressions and rarefactions in a sound wave.

Q7. What does it mean when we say that waves transfer energy but not matter?

Q8. How can we show that water does not move with the wave in a ripple tank experiment?

Q9. What evidence shows that air particles do not move with sound waves?

Q10. Explain what amplitude of a wave represents and how it is measured.

Q11. Explain what wavelength of a wave is and how it can be measured from a diagram.

Q12. Define frequency and give its unit.

Q13. What does the period of a wave mean and how is it calculated from frequency?

Q14. Write the formula linking period and frequency and define all the terms.

Q15. If the frequency of a wave is doubled, what happens to its period? Explain.

Q16. State the wave equation and explain what each symbol means.

Q17. Describe how to calculate the speed of a wave using its frequency and wavelength.

Q18. A wave has a frequency of 5 Hz and a wavelength of 2 m. Calculate its speed.

Q19. Describe how the amplitude of a wave affects the energy it carries.

Q20. What would happen to the wave speed if the wavelength increases but frequency stays the same?

Q21. How would the wave speed change if a wave moves from air into water?

Q22. Describe a method to measure the speed of ripples using a ripple tank.

Q23. Describe how to use a strobe light and a ruler to measure wavelength in a ripple tank.

Q24. Explain how to measure the frequency of ripples using a timer and video recording.

Q25. Describe a method to measure the speed of sound in air using two microphones and a timer.

Q26. What are the risks involved in measuring ripple speed in a tank and how can they be reduced?

Q27. In a wave diagram, how can you identify one full wavelength?

Q28. How can you identify amplitude from a transverse wave diagram?

Q29. Explain how to calculate wave speed from a diagram if you know wavelength and frequency.

Q30. A wave has a period of 0.25 seconds. Calculate its frequency.

Q31. A sound wave travels at 330 m/s and has a frequency of 440 Hz. Find its wavelength.

Q32. Why do sound waves travel faster in water than in air?

Q33. How do changes in wavelength and frequency affect wave speed when a wave enters a new medium?

Q34. When a wave travels into a denser medium, what usually happens to its speed and wavelength?

Q35. If a wave's frequency remains the same but it moves to a new medium, what must change?

Q36. A wave with wavelength 3 m has a frequency of 10 Hz. What is its speed?

Q37. How can you show the difference between transverse and longitudinal waves using a slinky spring?

Q38. Describe what is meant by the wavefronts in ripple experiments.

Q39. How does increasing the frequency of a wave affect the number of waves observed per second?

Q40. Describe the motion of particles in water as a wave passes across the surface.

Q41. Explain why sound cannot travel through space.

Q42. What property of a sound wave changes when you increase the pitch?

Q43. What property of a sound wave changes when you increase the volume?

Q44. Why do waves slow down when entering a denser material, even though their frequency stays the same?

Q45. In an experiment with ripples, how can you ensure your measurement of wavelength is accurate?

Q46. How does the use of a strobe light help when measuring wavelength in a ripple tank?

Q47. Why is it better to use multiple wavelengths and divide by number of waves in ripple experiments?

Q48. Explain how frequency is measured when using two microphones and a sound source.

Q49. Describe what happens to wavelength and wave speed when a sound wave moves from air to a solid.

Q50. Why is understanding wave properties important in communication technology?

Q51. State the law of reflection and identify the two angles involved.

Q52. Describe how you would draw a ray diagram to show the reflection of light from a plane mirror.

Q53. Explain the difference between specular reflection and diffuse reflection with examples.

Q54. Why does a matte white wall appear bright even though it does not reflect rays specularly like a mirror?

Q55. Describe what happens to a ray of light when it meets a transparent material at an angle other than 90°.

Q56. What is meant by transmission of a wave at a boundary, and how is it shown on a ray diagram?

Q57. Give one everyday example where absorption of light is desirable and explain why.

Q58. Explain how the colour of an object relates to the absorption and reflection of different wavelengths of visible light.

Q59. Describe how total internal reflection occurs in an optical fibre and state the condition for it to happen.

Q60. Explain why diamonds sparkle by referring to their high refractive index and multiple internal reflections.

Q61. A light ray enters glass from air at 40° to the normal. Describe how to find its angle in the glass using a protractor and graphite outline.

Q62. Explain why a red laser beam is still visible when shone through smoke but a green laser is more strongly absorbed.

Q63. Explain what is meant by the term “angle of refraction” and how it differs from the angle of incidence.

Q64. Describe how to set up the required practical to measure the critical angle of glass using a semicircular block.

Q65. How can you tell whether a surface is good at reflecting ultrasound in a medical scanner?

Q66. State the normal range of human hearing and explain why very young children may hear slightly higher frequencies.

Q67. Describe how sound waves make the ear drum vibrate and how these vibrations are converted into electrical signals in the auditory nerve.

Q68. Explain why a tuning fork held against a metal rod can be heard on the far side even if the rod is long.

Q69. Describe why the ability of the middle ear bones to vibrate decreases at very high frequencies.

Q70. Explain how a pregnant mother’s scan uses ultrasound reflections to create an image of the fetus.

Q71. A pulse of ultrasound takes 0.00012 s to return from a kidney boundary and the speed of sound in tissue is 1540 m/s. Calculate the depth of the kidney.

Q72. Explain why ultrasound is preferred to X-rays for scanning soft tissues.

Q73. Describe two industrial uses of ultrasound that rely on partial reflection at material boundaries.

Q74. Explain why very high frequency sound is chosen for echo sounding in deep oceans.

Q75. Describe how a ship’s sonar can measure the depth of water beneath its keel.

Q76. A sonar pulse returns 1.6 s after emission. If the speed of sound in seawater is 1500 m/s, calculate the water depth.

Q77. State what P-waves are and describe their main properties, including direction of particle vibration.

Q78. State what S-waves are and explain why they do not travel through the Earth’s outer core.

Q79. Describe how seismologists use the arrival times of P-waves and S-waves to locate earthquake epicentres.

Q80. Explain how the absence of S-waves beyond a certain angle from an earthquake source led to the discovery of the liquid outer core.

Q81. Describe how differences in P-wave velocities helped scientists estimate the size of the Earth's core.

Q82. Explain why seismic waves bend as they travel through the mantle and core.

Q83. Describe how ground penetrating radar differs from seismic reflection when exploring subsurface features.

Q84. Explain what is meant by absorption of seismic energy and why it makes deeper reflections weaker.

Q85. Describe one safety precaution needed when performing the light reflection practical with a ray box.

Q86. Explain why using black paper around a glass block improves the visibility of light rays in a refraction experiment.

Q87. A ray of light strikes a boundary at 60° to the normal in air and enters a medium with refractive index 1.5. Calculate the angle of refraction.

Q88. Explain why sunglasses with polarising lenses reduce glare from reflecting surfaces like water.

Q89. Describe how a periscope uses plane mirrors to allow viewing over an obstacle.

Q90. Explain why a pencil appears bent when partly submerged in water.

Q91. State Snell's Law and describe how it is used to find the refractive index of a transparent material.

Q92. Explain how brushed metal surfaces reduce unwanted specular reflections in optical equipment.

Q93. Describe how a diffraction grating can separate white light into its component colours without absorption.

Q94. Explain why radar waves are suitable for detecting aircraft but visible light is not.

Q95. Describe how thermal imaging relies on absorption and emission of infrared waves rather than reflection.

Q96. Explain how bats use ultrasonic echoes to avoid obstacles and hunt prey.

Q97. Describe one limitation of using ultrasound for detecting cracks in thick metal beams.

Q98. Explain why medical ultrasound gel is applied between the transducer and skin.

Q99. Describe how an oscillating crystal in a piezoelectric transducer both generates and detects ultrasound.

Q100. Explain why understanding reflection, absorption, and transmission of waves is essential for designing energy-efficient buildings.

Q101. What type of wave are electromagnetic waves and how do they transfer energy?

Q102. List the electromagnetic waves in order of increasing frequency.

Q103. Which electromagnetic waves have the longest and shortest wavelengths?

Q104. What do all electromagnetic waves have in common when travelling through a vacuum?

Q105. Explain why radio waves can be used for communication over long distances.

Q106. Why are gamma rays suitable for sterilising medical equipment?

Q107. What is the difference between the way visible light and X-rays interact with the human body?

Q108. Explain how electromagnetic waves can transfer energy from a campfire to your skin.

Q109. Describe how infrared waves are used in everyday heating applications.

Q110. Give an example of how ultraviolet waves are used and one risk they carry.

Q111. What is meant by the term ‘ionising radiation’?

Q112. Which electromagnetic waves are classified as ionising and why?

Q113. Why can X-rays be used to image bones inside the human body?

Q114. Describe how microwaves are used to cook food.

Q115. What is the danger of excessive exposure to ultraviolet radiation?

Q116. State one use of infrared radiation in medicine.

Q117. What is the difference between absorption and reflection of electromagnetic waves?

Q118. How do electromagnetic waves cause alternating currents in radio receivers?

Q119. Explain how oscillations in electrical circuits produce radio waves.

Q120. What happens when radio waves are absorbed by a conductor?

Q121. Explain how energy from the Sun reaches the Earth through space.

Q122. Why can't humans see ultraviolet or infrared light?

Q123. What determines the amount of energy carried by an electromagnetic wave?

Q124. What visible light colour has the highest frequency and what does this mean for its energy?

Q125. Why does light bend when it enters a different medium at an angle?

Q126. Describe how to draw a ray diagram showing refraction through a glass block.

Q127. What causes refraction in terms of wavefronts?

Q128. What is the effect of wavelength on the refraction of electromagnetic waves?

Q129. Describe how the velocity of light changes when moving from air to water.

Q130. How does the nature of a surface affect how much infrared radiation it emits?

Q131. What practical method could you use to compare the emission of infrared radiation from different surfaces?

Q132. Explain how surface colour and texture influence the absorption of infrared radiation.

Q133. Why are shiny surfaces used in thermal blankets?

Q134. What is radiation dose and how is it measured?

Q135. Which unit is used to measure radiation dose and what does it represent?

Q136. What health risks are associated with prolonged exposure to X-rays?

Q137. How can exposure to gamma rays affect living cells?

Q138. Why must workers using ionising radiation wear protective shielding?

Q139. Explain the risk of genetic mutation from high doses of ionising radiation.

Q140. How does the frequency of a wave affect the type of electromagnetic wave?

Q141. Why do ultraviolet rays cause more damage to skin than visible light?

Q142. Why is lead often used in X-ray rooms?

Q143. What changes in atoms or nuclei can produce electromagnetic waves?

Q144. Describe how gamma rays are generated during radioactive decay.

Q145. How do the properties of electromagnetic waves make them suitable for satellite communication?

Q146. Why is visible light used in fibre optic cables instead of microwaves?

Q147. What makes gamma rays useful for treating cancer?

Q148. Why must exposure time be limited when using ultraviolet lamps for disinfection?

Q149. How does wavelength affect the penetration ability of electromagnetic waves?

Q150. Describe how X-rays interact differently with soft tissue and bone.

Q151. Why are radio waves used for broadcasting television and radio signals?

Q152. Explain why microwaves are suitable for satellite communication.

Q153. How do microwaves cook food efficiently?

Q154. Why is infrared radiation useful for cooking and heating?

Q155. How do infrared cameras work to detect people or animals?

Q156. Why is visible light used in fibre optic communications?

Q157. Explain why ultraviolet light is used in energy-efficient lamps.

Q158. Why can ultraviolet light cause skin tanning?

Q159. How are X-rays used to produce images of bones?

Q160. Why are gamma rays useful in medical treatment such as cancer therapy?

Q161. What are the advantages of using electromagnetic waves in communication?

Q162. Why are long-wavelength radio waves good for transmitting signals over long distances?

Q163. How do satellites use microwaves to send signals to Earth?

Q164. Why is it important to limit exposure to X-rays during medical imaging?

Q165. What makes infrared radiation safer than ultraviolet radiation for heating?

Q166. Explain how ultraviolet radiation is used to disinfect water.

Q167. Why must gamma radiation be precisely targeted during cancer treatment?

Q168. How does the wavelength of visible light affect its transmission in optical fibres?

Q169. Describe how microwave ovens heat food from the inside out.

Q170. How does the frequency of infrared radiation relate to the heat it transfers?

Q171. What is a convex lens and how does it change light rays?

Q172. What is meant by the focal length of a convex lens?

Q173. Describe how a convex lens forms a real image using a ray diagram.

Q174. When does a convex lens produce a virtual image?

Q175. What is a concave lens and how does it affect light rays?

Q176. Why does a concave lens always form a virtual image?

Q177. How can ray diagrams help compare convex and concave lenses?

Q178. Describe how to draw a ray diagram for a convex lens showing a real image.

Q179. Describe how to draw a ray diagram for a concave lens.

Q180. What happens to the size of the image when an object is moved closer to a convex lens?

Q181. What are the three key rays used to draw a ray diagram for a convex lens?

Q182. What is meant by a virtual image?

Q183. What is meant by a real image?

Q184. Describe a method for investigating the magnification produced by a convex lens.

Q185. What equipment is needed to investigate magnification using a convex lens?

Q186. How is magnification calculated in a lens experiment?

Q187. What unit is used for magnification and why?

Q188. If the object height is 3 cm and the image height is 6 cm, what is the magnification?

Q189. What does a magnification value greater than 1 mean?

Q190. What does a magnification value less than 1 mean?

Q191. How does the position of the object affect the magnification in a convex lens?

Q192. How does the shape of the lens affect the focal length?

Q193. What are the uses of convex lenses in everyday life?

Q194. What are the uses of concave lenses in real-world applications?

Q195. Why are ray diagrams important in understanding how lenses work?

Q196. Explain how a magnifying glass works using a convex lens.

Q197. Why does a concave lens make objects appear smaller?

Q198. Describe how to measure focal length of a convex lens in a practical.

Q199. What precautions should be taken when using a lamp to illuminate objects in a lens experiment?

Q200. Why must image and object height be measured in the same units when calculating magnification?

Q201. What does each colour in the visible spectrum represent in terms of wavelength and frequency?

Q202. Explain how the wavelength of visible light affects its colour.

Q203. Describe what happens when white light hits a red apple.

Q204. Why does a black object appear black under white light?

Q205. Why does a white object appear white under white light?

Q206. How does the surface texture of an object affect the type of reflection that occurs?

Q207. What is the difference between specular and diffuse reflection in terms of how light behaves?

Q208. How does a red filter affect white light passing through it?

Q209. What colour does a blue object appear under red light and why?

Q210. Why do green leaves appear black when viewed through a red filter?

Q211. Explain how colour filters are used in stage lighting to create effects.

Q212. Describe what happens when red light shines on a white shirt.

Q213. What determines the apparent colour of an opaque object?

Q214. How do transparent materials affect the transmission of light?

Q215. What is the difference between a translucent and a transparent object?

Q216. How does a blue filter affect the appearance of a green object?

Q217. Why does a red object appear dark or black under green light?

Q218. How can coloured filters be used in photography?

Q219. What causes a red shirt to look red in sunlight?

Q220. Explain why some objects look different colours under different lighting conditions.

Q221. Why does a mirror show clear reflections while a piece of paper does not?

Q222. How does diffuse reflection help us see most everyday objects?

Q223. What happens to light that is not reflected by an opaque object?

Q224. Why do we see shadows when objects block light?

Q225. How can you use coloured filters to identify the primary colours present in white light?

Q226. What happens to the amount of infrared radiation emitted as the temperature of a body increases?

Q227. Why does a hotter object emit more radiation in a given time than a cooler one?

Q228. What is meant by a perfect black body in terms of radiation absorption?

Q229. Why is a perfect black body also the best possible emitter of radiation?

Q230. How does the surface temperature of an object affect the intensity of the infrared radiation it emits?

Q231. Why do dark, matt surfaces emit and absorb radiation better than shiny, white surfaces?

Q232. How is infrared radiation transferred from the Sun to Earth?

Q233. What happens when an object absorbs more radiation than it emits?

Q234. What happens to the temperature of an object that emits more radiation than it absorbs?

Q235. What is meant by a body being in thermal equilibrium with its surroundings?

Q236. Why does a hot cup of tea cool down when left on a table?

Q237. How can you investigate which surface is the best emitter of infrared radiation?

Q238. Describe a simple experiment to compare radiation emission from different surfaces.

Q239. Why does a car parked in the sun feel hotter inside than outside?

Q240. Why do pavements feel hot during summer afternoons?

Q241. What factors affect the temperature of the Earth's surface?

Q242. Why does the Earth's temperature remain fairly stable over time?

Q243. How does the Earth's atmosphere affect the balance between incoming and outgoing radiation?

Q244. What role do clouds play in the Earth's radiation balance?

Q245. Why does the temperature drop quickly at night in a desert?

Q246. How does radiation from the Sun contribute to the Earth's weather systems?

Q247. How does reflection of solar radiation affect the temperature of the Earth?

Q248. What happens to incoming solar radiation that is not absorbed by the Earth's surface?

Q249. How do greenhouse gases affect the Earth's radiation balance?

Q250. Why does the Moon have greater temperature extremes than Earth?

Q251. How can satellite data be used to study Earth's radiation balance?

Q252. What effect does surface colour have on the absorption of solar radiation?

Q253. Why do white buildings stay cooler in hot climates?

Q254. What is the relationship between the wavelength of radiation emitted and the temperature of the object?

Q255. How does increasing temperature affect the peak wavelength of radiation emitted by a body?

Q256. How does the radiation curve for a hot object differ from that of a cooler object?

Q257. Why are radiators in homes often painted white?

Q258. What materials are best for thermal insulation and why?

Q259. How do thermal imaging cameras detect heat from objects?

Q260. What is the link between the energy of emitted radiation and its frequency?

Q261. Why do astronauts wear reflective suits in space?

Q262. Why does a hot object eventually stop getting hotter when left in a cooler room?

Q263. What role does radiation play in keeping a greenhouse warm?

Q264. How does the balance of radiation affect the Earth's climate?

Q265. What is meant by net radiation gain or loss?

Q266. Why is it important to understand radiation in designing buildings?

Q267. How does a vacuum flask reduce energy loss by radiation?

Q268. Why do metallic surfaces reduce heat loss better than non-metallic ones?

Q269. How does wearing light-coloured clothing help in hot weather?

Q270. Why does a hot air balloon rise in terms of infrared radiation and heat transfer?

Q271. What does it mean if an object is a poor emitter of radiation?

Q272. What kind of radiation is mainly responsible for heating the Earth?

Q273. What everyday examples show the balance between absorption and emission of radiation?

Q274. What effect does angle of sunlight have on radiation absorption?

Q275. Why does standing in the shade feel cooler on a sunny day?