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WAVES AND RADIATION

Study Guide

1.1 Waves

At the end of the section you should be able to :

- ❑ 1 State that a wave transfers energy.
- ❑ 2 State the difference between a transverse and longitudinal wave and give examples of each.
- ❑ 3 Use the following terms correctly in context: frequency, wavelength, speed, amplitude.
- ❑ 4 Carry out calculations involving the relationship between speed, wavelength and frequency for waves.
- ❑ 5 Carry out calculations involving the relationship between distance, time and speed in waves.

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1.2 Sound

At the end of the section you should be able to :

- ❑ 1 State that sound can pass through solids, liquids and gases.
- ❑ 2 State that sound cannot pass through a vacuum.
- ❑ 3 Give an example which shows that the speed of sound in air is less than the speed of light in air.
- ❑ 4 Describe a method for measuring the speed of sound in air using the relationship between distance, time and speed.
- ❑ 5 State that the speed of sound changes as it moves from one material to another.
- ❑ 6 Carry out calculations involving the speed of sound.
- ❑ 7 State that the higher the pitch of a sound the larger the frequency.
- ❑ 8 State that the louder the volume of a sound the greater the amplitude.
- ❑ 9 Identify from oscilloscope traces the signal which would produce:
  (a) the louder sound
  (b) the higher frequency.
- ❑ 10 State that if two sounds are one octave apart, the frequency of one is double the other.
- ❑ 11 State that the frequency produced by a vibrating string can be increased by shortening the length of the string and increasing the tightness of the string.
- ❑ 12 State that the frequency produced by a vibrating air column can be increased by shortening the length of the air column.
- ❑ 13 State that the normal range of human hearing is from 20 hertz to 20,000 hertz.

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- ❑ 14 State that high frequency sounds beyond the range of human hearing are called ultrasounds.
- ❑ 15 Give one example of a use of ultrasound in medicine.
- ❑ 16 Give one example of a non-medical use of ultrasound.
- ❑ 17 State that sound levels are measured in decibels.
- ❑ 18 Give two examples of noise pollution.
- ❑ 19 State that excessive noise can damage hearing.
- ❑ 20 State that hearing can be protected by ear protectors.
- ❑ 21 State that some ear protectors rely upon noise cancellation.
- ❑ 22 State that the output signal from an amplifier has the same frequency but a bigger amplitude than the input signal.
- ❑ 23 State the function of each of the three major components needed to amplify speech (microphone, amplifier, loudspeaker).
- ❑ 24 Explain why your recorded voice sounds different to you.

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1.3 Electromagnetic Spectrum

At the end of the section you should be able to :

- ❑ 1 State in order of frequency, the members of the electromagnetic spectrum: TV and radio, microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays.
- ❑ 2 All waves of the electromagnetic spectrum travel 300 000 000 metres per second (the speed of light).
- ❑ 3 State that light can be reflected.
- ❑ 4 State that all visible objects give out, or reflect, light to the eye.
- ❑ 5 Use correctly in context the terms: angle of incidence, angle of reflection and normal when a ray of light is reflected from a plane mirror.
- ❑ 6 Describe one practical use of optical fibres.
- ❑ 7 State what is meant by the refraction of light.
- ❑ 8 Draw diagrams to show the change in direction as light passes from air to glass and glass to air.
- ❑ 9 Describe the shapes of converging and diverging lenses.
- ❑ 10 Describe the effect of a converging and a diverging lens on parallel rays of light.
- ❑ 11 Describe, in words or using a diagram, the eye defects called long and short sight.
- ❑ 12 State that a converging lens can correct long sight and a diverging lens can correct short sight.
- ❑ 13 State that a laser is a concentrated source of light of only one colour.
- ❑ 14 Describe how a laser is used in one practical application.

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- ❑ 15 State that all other forms of radiation in the spectrum are invisible to the naked eye.
- ❑ 16 State that infrared radiation is called heat radiation.
- ❑ 17 Describe one use of infrared radiation in medicine.
- ❑ 18 Describe one non-medical use of infrared radiation.
- ❑ 19 Describe one use of ultraviolet radiation in medicine.
- ❑ 20 States that some chemicals glow ie fluoresce when they absorb ultraviolet radiation.
- ❑ 21 Describe how ultraviolet radiation can be used in identifying security markings.
- ❑ 22 State that photographic film may be used to detect X-rays.
- ❑ 23 Describe one use of X-rays in medicine.
- ❑ 24 Describe one use of X-rays in industry.
- ❑ 25 State that X-rays are dangerous since they can damage living cells.
- ❑ 26 State that gamma radiation can kill living cells or change the nature of living cells.
- ❑ 27 State that gamma radiation can pass through most materials.
- ❑ 28 Describe how gamma radiation can be used as a tracer in both medicine and industry.
- ❑ 29 State that the strength of a source of gamma radiation decreases with time.
- ❑ 30 Describe the hazards associated with the radiations of the spectrum
- ❑ 31 Describe the safety precautions which need to be taken when dealing with the radiations of the spectrum.

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1.4 Nuclear Radiation

At the end of the section you should be able to :

- ❑ 1 Describe a simple model of the atom which includes protons, neutrons and electrons.
- ❑ 2 State that there is radiation present in our surroundings known as background radiaition.
- ❑ 3 Identify natural sources of background radiation.
- ❑ 4 Identify artificial sources of background radiation.
- ❑ 5 State that radiation can kill living cells or change the nature of living cells.
- ❑ 6 Describe medical uses of radiation based on the fact that radiation can destroy cells.
- ❑ 7 Describe uses of radiation based on the fact that radiation is easy to detect.
- ❑ 8 State that electricity can be generated from nuclear fuel.
- ❑ 9 State the advantages and disadvantages of using nuclear power for the generation of electricity.

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