Electromagnetic Spectrum

Question Paper

Course	CIE IGCSE Physics
Section	3. Waves
Topic	Electromagnetic Spectrum
Difficulty	Hard

Time Allowed 50

Score /41

Percentage /100

Question 1a

Fig.9.1 represents the seven main regions of the electromagnetic spectrum.

radio waves	microwaves	infra-red radiation	visible light	ultraviolet		gamma rays

Fig. 9.1

(i) In Fig.9.1, one region is not named.

State the name of the radiation in this region.

[1]

(ii) State which region has waves with the longest wavelength.

[1]

[2 marks]

Question 1b

Tick the box for the wave with the lowest speed in air.

- ☐ ultraviolet
- ☐ ultrasound
- ☐ visible light

[1 mark]

Question 1c

A group of students want to determine the speed of sound in air.

Describe a method they can use. State the measurements they need to make.

[4 marks]

Question 2a

Circle two of the following that apply to an ultrasound wave travelling in air.

frequency 3.5 Hz	frequency 350 Hz	frequency 35 000 Hz	longitudinal
transverse	speed 1.5 m/s	speed 1.5×10^3 m/s	speed 1.5×10^6 m/s

[2 marks]

Question 2b

Calculate the wavelength of X-rays with frequency 1.3×10^{17} Hz in a vacuum.

wavelength = ...

[3 marks]

Question 2c

A dentist takes an X-ray photograph of a patient's teeth. Explain why it is safe for the patient to be close to the source of X-rays, but the dentist must stand away from the source.

[2 marks]

Question 2d

State, with a reason, why microwave ovens are designed only to work with the door closed.

[2 marks]

Question 3a

Extended tier only

Gamma rays are the highest energy waves in the electromagnetic spectrum.

State the maximum speed of gamma rays in a vacuum.

[1 mark]

Question 3b

Calculate the frequency of a gamma ray with a wavelength of 6.5×10^{-13} m.

frequency = ...

[2 marks]

Question 3c

Compare and contrast gamma rays and radio waves. You should consider both their properties and their applications.

[6 marks]

Question 3d

Gamma rays are dangerous to work with because they transfer large amounts of energy.

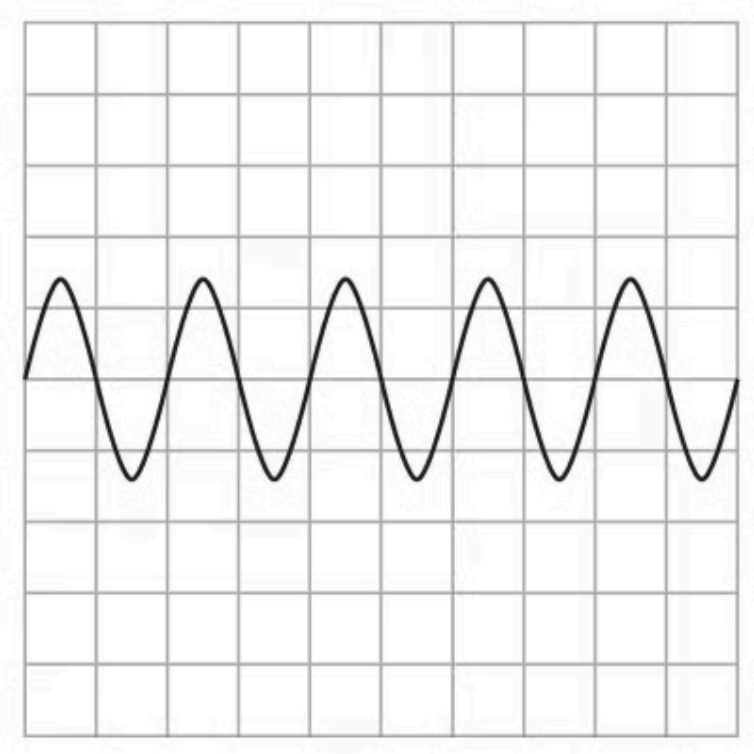
People who work with gamma radiation need to take precautions to keep themselves safe.

Suggest **two** ways that workers can keep themselves safe when working with gamma rays.

[2 marks]

Question 4a

Fig. 1.1 shows a radio wave. Each 1 cm square is equal to 2 m.



(i) State the wavelength of the radio wave in Fig 1.1.

[1]

(ii) Sketch on Fig. 1.1 a wave that has a greater amplitude and lower frequency.

[2]

[3 marks]

Question 4b

Extended tier only

A radio wave with a frequency of 20 GHz travels through the vacuum of space.

Calculate the wavelength of this radio wave.

wavelength = ...

[3 marks]

Question 4c

Extended tier only

State why sound waves and radio waves have different frequencies at the same wavelength.

[2 marks]

Question 5a

Table 1.1 shows a list of the electromagnetic spectrum.

gamma						radio

Table 1.1

(i) Complete Table 1.1 by filling in the missing EM waves.

[3]

(ii) Suggest what the arrow is indicating.

[1]

[4 marks]

Question 5b

Fig. 1.1 shows an X-ray of a broken bone.

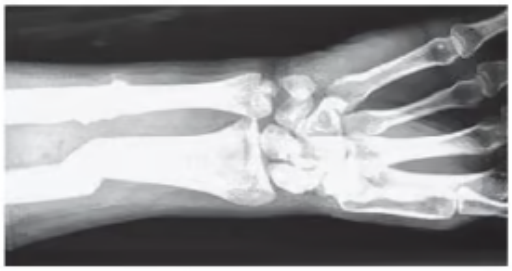


Fig. 1.1

Describe the interaction between the x-rays and

(i) soft tissue.

[1]

(ii) bone.

[1]

[2 marks]