

GCSE Combined Science: Trilogy

Worksheet: Types of electromagnetic waves

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Types of electromagnetic waves

NAME _____ **CLASS** _____ **DATE** _____

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

0 1 . 1 Which list shows the seven types of electromagnetic wave in order of **increasing** frequency?

Tick (✓) **one** box.

Radio, microwave, infrared, visible light, ultraviolet, X-ray, gamma ☐

Gamma, X-ray, ultraviolet, visible light, infrared, microwave, radio ☐

Radio, infrared, microwave, visible light, X-ray, ultraviolet, gamma ☐

Visible light, radio, microwave, infrared, ultraviolet, gamma, X-ray ☐

[1 mark]

0 1 . 2 State what all electromagnetic waves transfer from a source to an absorber.

.....

.....

.....

[1 mark]

0 1 . 3

Which type of electromagnetic wave has the longest wavelength?

.....

.....

.....

[1 mark]

0 2

Table 1 shows the groups of waves in the electromagnetic spectrum in order of wavelength. Some of the names are missing.

Table 1

Radio waves	A	Infrared	Visible light	B	X-rays	C
longest wavelength						shortest wavelength

0 2 . 1

Name the groups A, B and C.

.....

.....

.....

.....

.....

.....

[3 marks]

0 2 . 2

Which property is the same for all electromagnetic waves travelling through a vacuum?

Tick (✓) **one** box.

Amplitude

☐

Frequency

☐

Speed

☐

Wavelength

☐

[1 mark]

0 2 . 3

Electromagnetic waves are transverse waves.
What do electromagnetic waves transfer from a source to an absorber?

.....

.....

.....

.....

[1 mark]

0 3

Table 2 shows the approximate wavelength ranges of three unlabelled bands of the electromagnetic spectrum, A, B and C. Visible light has a wavelength range of about 4×10^{-7} m to 7×10^{-7} m.

Table 2

Band	Approximate wavelength range in m
A	1×10^{-8} to 4×10^{-7}
B	7×10^{-7} to 1×10^{-5}
C	1×10^{-12} to 1×10^{-10}

0 3 . 1

Use Table 2 and the wavelength of visible light to identify bands A and B.

.....

.....

.....

.....

[2 marks]

0 3 . 2

Explain how you used the data to decide which band was ultraviolet and which was infrared.

.....

.....

.....

.....

[2 marks]

0 3 . 3

Band C has much shorter wavelengths than bands A and B.
Suggest what band C could be.

.....

.....

[1 mark]

0 4

A radio station broadcasts using radio waves with a frequency of 97.5 MHz.
The speed of electromagnetic waves in air is 3.0×10^8 m/s.

0 4 . 1

Calculate the wavelength of the radio waves.

.....

.....

.....

.....

.....

Wavelength = m

[3 marks]

0 4 . 2

Give **two** examples of electromagnetic waves transferring energy from a source to an absorber.

.....

.....

.....

.....

[2 marks]

0 4 . 3

Human eyes can only detect a limited range of electromagnetic waves. Name this part of the electromagnetic spectrum.

.....

.....

.....

.....

[1 mark]

0 5

Astronomers observe a distant star that suddenly explodes. The explosion emits visible light, X-rays and gamma rays.

0 5 . 1

The visible light, X-rays and gamma rays from the explosion all reach a telescope on a satellite at the same time. Explain why.

.....

.....

.....

.....

[2 marks]

0 5 . 2

The explosion also produces a huge amount of sound.
Explain why the sound does not reach the telescope.

.....

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.....

.....

[2 marks]

0 5 . 3

Write these types of electromagnetic wave in order of increasing frequency.
gamma rays infrared microwaves visible light

.....

.....

[1 mark]

0 5 . 4

Gamma rays have a much higher frequency than visible light.
Compare the wavelength of gamma rays with the wavelength of visible light.

.....

.....

[1 mark]

0 6

X-rays travelling through a vacuum has a wavelength of 1.5×10^{-9} m.
Speed of electromagnetic waves in a vacuum = 3.0×10^8 m/s.

0 6 . 1

Calculate the frequency of the X-rays. Give your answer in standard form.

.....

.....

.....

.....

.....

Frequency = Hz

[3 marks]

0 7

Infrared radiation travelling through a vacuum has a wavelength of 6.0×10^{-6} m.

Speed of electromagnetic waves in a vacuum = 3.0×10^8 m/s.

0 7 . 1

Calculate the frequency of the infrared radiation. Give your answer in standard form.

.....

.....

.....

.....

.....

Frequency = Hz

[3 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Types of electromagnetic waves · 31 marks

Question 1 (3 marks)

01.1 [1 mark]

Correct: Radio, microwave, infrared, visible light, ultraviolet, X-ray, gamma

01.2 [1 mark]

Answer: Energy

- energy (1)
-

01.3 [1 mark]

Answer: Radio waves

- radio waves (1)
-
-

Question 2 (5 marks)

02.1 [3 marks]

Answer: A microwaves, B ultraviolet, C gamma rays

- A: microwaves (1)
 - B: ultraviolet (1)
 - C: gamma rays (1)
-

02.2 [1 mark]

Correct: Speed

02.3 [1 mark]

Answer: Energy

- energy (1)
-

Question 3 (5 marks)

03.1 [2 marks]

Answer: A ultraviolet, B infrared

- A: ultraviolet (1)
 - B: infrared (1)
-

03.2 [2 marks]

Answer: A's wavelengths are shorter than visible light's, matching ultraviolet; B's are longer, matching infrared.

- band A has shorter wavelengths than visible light, and ultraviolet has a shorter wavelength than visible light (1)
 - band B has longer wavelengths than visible light, and infrared has a longer wavelength than visible light (1)
-

03.3 [1 mark]

Answer: X-rays (or gamma rays).

- X-rays (or gamma rays) (1)
-

Question 4 (6 marks)

04.1 [3 marks]

Answer: 3.1 m (3.08 m)

- $97.5 \text{ MHz} = 9.75 \times 10^7 \text{ Hz}$ (1)
- $\lambda = 3.0 \times 10^8 \div 9.75 \times 10^7$ (1)
- 3.1 (m) (1)

Notes: 3.08×10^6 (m) (from not converting MHz to Hz) scores 1 mark.

04.2 [2 marks]

Answer: Any two, e.g. the Sun warming your skin; a microwave oven heating food.

- infrared / visible light from the Sun warming the Earth or a person's skin (1)
- microwaves from a microwave oven heating food (1)
- radio waves from a transmitter being absorbed by an aerial (1)
- infrared from an electric heater warming a room (1)
- light from a lamp being absorbed by a solar cell / the eye (1)

Any 2 of the points above.

04.3 [1 mark]

Answer: Visible light

- visible light (1)
-

Question 5 (6 marks)

05.1 [2 marks]

Answer: All electromagnetic waves travel at the same speed through a vacuum.

- all electromagnetic waves travel at the same speed (1)
- in a vacuum / through space (1)

05.2 [2 marks]

Answer: Sound needs particles to travel through, and space is a vacuum.

- sound needs a medium / particles to travel through (1)
- space is (almost) a vacuum (1)

05.3 [1 mark]

Answer: microwaves, infrared, visible light, gamma rays

- microwaves, infrared, visible light, gamma rays (1)

05.4 [1 mark]

Answer: Gamma rays have a much shorter wavelength.

- gamma rays have a (much) shorter wavelength (1)
-

Question 6 (3 marks)

06.1 [3 marks]

Answer: 2.0×10^{17} Hz

- frequency = wave speed $\div$ wavelength (1)
- $3.0 \times 10^8 \div 1.5 \times 10^{-9}$ (1)
- 2.0×10^{17} (Hz) (1)

Notes: Allow the answer written as an ordinary number.

Question 7 (3 marks)

07.1 [3 marks]

Answer: 5.0×10^{13} Hz

- frequency = wave speed $\div$ wavelength (1)
- $3.0 \times 10^8 \div 6.0 \times 10^{-6}$ (1)
- 5.0×10^{13} (Hz) (1)

Notes: Allow the answer written as an ordinary number.
