

The Electromagnetic Spectrum

Q1.(2018)

Which of these electromagnetic waves has the **smallest** wavelength?

- A Gamma-ray
- B Micro-wave
- C Radio wave
- D X-ray

Your answer

[1]

Q2.(2019)

Which statement describes what human eyes can detect?

- A Limited range of electromagnetic waves.
- B Limited range of sound waves.
- C Wide range of electromagnetic waves.
- D Wide range of sound waves.

Your answer

[1]

Q3.a(2019)

11 Electromagnetic waves are usually divided into seven different groups.

(a) This diagram of the electromagnetic spectrum is incomplete.

Complete the diagram by adding the missing parts of the electromagnetic spectrum.

	microwaves	infra-red	visible light		X-rays	gamma rays
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[1]

Q3.b(2019)

Sound is **not** part of the electromagnetic spectrum.

Explain why.

.....

..... [1]

Q3.c(2019)

All waves have a **frequency**.

(i) Which part of the electromagnetic spectrum has the **highest** frequency?

..... [1]

Q3.d(2019)

What happens to the wavelength of an electromagnetic wave as the frequency increases?

Tick (✓) **one** box.

Decreases

☐

Increases

☐

Stays the same

☐

[1]

Q3.e(2019)

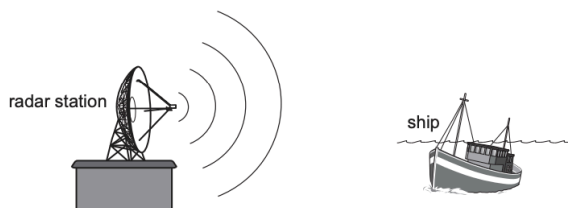
Describe how X-rays and gamma rays can damage humans.

.....

..... [1]

Q4.a(2019)

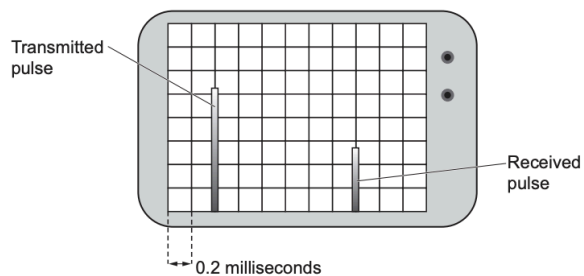
Radar stations can be used to find out where ships are.



At a radar station:

- a radar transmitter transmits pulses of microwaves
- the pulses are reflected by the ship
- a radar receiver detects the pulses.

(a) The diagram shows the radar signals on an oscilloscope screen:



(i) Calculate the time taken between the pulse being transmitted and received.

Time taken = ms [1]

Q4.b(2019)

A radar signal is sent from the radar station. The signal reflects off the ship and is detected 0.0006 s later.

The speed of the microwaves is 3.0×10^8 m/s.

Calculate the distance of the ship from the radar station.

Use the equation: distance travelled = speed $\times$ time

Distance = m [2]

Q4.c(2019)

The amplitude of the received pulse is lower than the transmitted pulse.

Suggest why.

.....
..... [1]

Q4.d(2019)

Radar stations use microwaves with a frequency of 200 MHz.

The speed of the waves is 3.0×10^8 m/s.

Calculate the wavelength of these waves.

Wavelength = m [4]

Q5.(2020)

Electromagnetic waves have similar properties.

Use these words to complete the sentences:

You can use each word once, more than once, or not at all.

Acceleration Frequency Longitudinal
Sound Speed Transverse Wavelength

Electromagnetic waves are waves.

Electromagnetic waves travel with the same in space.

[2]

Q6.a(2021)

Radio waves are electromagnetic waves and are used for communications.

(i) Suggest why gamma rays are **not** used for communications.

.....
..... [1]

Q6.b(2021)

Name **one** other electromagnetic wave that is used for communications.

..... [1]

Q6.c(2021)

State **one** use of this electromagnetic wave in communications.

..... [1]

Q7.a(2021)

A TV transmitter emits electromagnetic waves with different frequencies.

Table 15.1 gives information about the waves emitted.

Name of wave	Frequency (MHz)	Wavelength (m)	Energy (10^{-18} J)
BBC A	562	0.533	3.72
ARQ A	571	0.526	3.78
D3&4	578	0.519	3.83
BBC B	586	0.511	3.88
ARQ B	594	0.505	3.94
SDN	691	0.435	4.57

Table 15.1

Using data from **Table 15.1** describe the relationship between **frequency** and **wavelength**.

.....
..... [2]

Q7.b(2021)

How many significant figures are used in each value in **Table 15.1**?

..... [1]

Q7.c(2021)

Calculate the speed of the wave **ARQ B**.

Use the equation: wave speed = frequency $\times$ wavelength

Speed = m/s [3]

Q7.d(2021)

A TV transmitter has a useful output energy transfer of 100 kJ in 1 second.

The input energy is 250 kJ in 1 second.

Calculate the efficiency of the TV transmitter.

Efficiency = [3]

Q8.(2022)

Which type of wave is light?

- A Electromagnetic
- B Longitudinal
- C Sound
- D Water

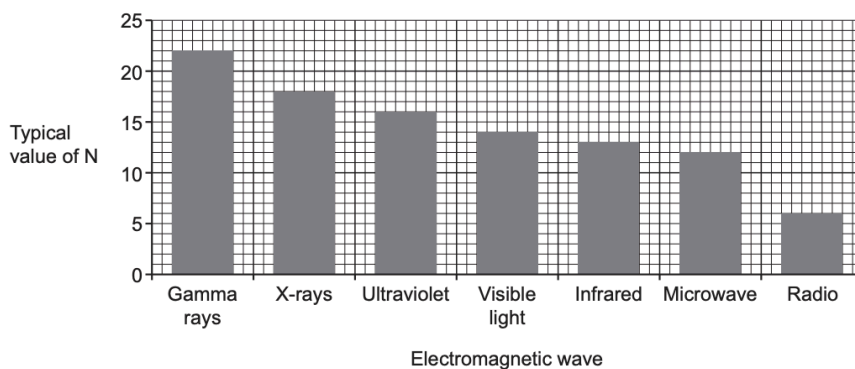
Your answer

[1]

Q9.a(2023)

The frequency of electromagnetic waves can be written as 1×10^N Hz.
N is an integer (a whole number).

The graph shows the typical values of N for different electromagnetic waves.



(a) Which electromagnetic wave has the **highest** frequency?

..... [1]

Q9.b(2023)

Which electromagnetic wave is the **most** dangerous?

..... [1]

Q9.c(2023)

Ultraviolet waves have a greater frequency than visible waves.

How many times greater?

Put a (ring) around the correct answer.

10^2

10^3

10^{13}

10^{14}

10^{16}

[1]

Q9.d(2023)

What is the frequency of a typical radio wave on the graph?

Write your answer as an ordinary number without standard form.

Frequency = Hz [2]

Q9.e(2023)

Which sentence is true about electromagnetic waves?

Tick (✓) **one** box.

Infrared waves do not have any harmful effects on human body tissue.

☐

Only microwaves transfer energy.

☐

Our eyes can detect all electromagnetic waves.

☐

They are transverse waves.

☐

[1]

Q9.f(2023)

A 0.8kW microwave oven is used to cook food.

The microwave oven transfers 0.56kWh when it is used to cook food.

Calculate the time the microwave oven is used for.

Use the equation: energy transferred = power $\times$ time

Time = h [3]

Q10.(2024)

This question is about electromagnetic waves.

Electromagnetic waves are transverse waves.

Describe what a transverse wave is.

You can label the diagram of a transverse wave to help explain your answer.



.....
..... [1]

Q11.(2024)

A radio wave has a frequency of 7 500 kHz and a wavelength of 40 m.

Calculate the speed of this radio wave.

Use the equation: wave speed = frequency $\times$ wavelength

Give your answer in metres per second.

Speed =m/s [3]

Q12.a(2024)

The table shows some different radio waves.

Type of radio wave	Frequency range (Hz)	Wavelength range (m)
HF	3 000 000–30 000 000	10–100
VHF	30 000 000–300 000 000	1–10
UHF	300 000 000–3 000 000 000	0.1–1
SHF	3 000 000 000–30 000 000 000	0.01–0.1

What is the relationship between frequency range and wavelength?

Use the table.

.....
..... [1]

Q12.b(2024)

Which type of radio wave has a frequency of 15 MHz **and** a wavelength of 20 m?

Tick (✓) **one** box.

HF	☐
VHF	☐
UHF	☐
SHF	☐

[1]

Q12.c(2024)

High frequency radio waves are similar to microwaves.

Suggest how high frequency radio waves can harm the human body.

.....

..... [1]

Q12.d(2024)

Complete the sentence about high frequency radio waves.

Put a ring around the correct option.

High frequency radio waves are **more** / **less** dangerous than microwaves.

Suggest a reason for your answer.

Reason

..... [1]