7. Waves

7.4 Electromagnetic spectrum

Paper 1

Question Paper

1 An electromagnetic wave is travelling through a vacuum.

What could be the wavelength and period of the electromagnetic wave?

	wavelength	period
A	1.2×10^{-10} Tm	2.5 Ms
B	1.2 pm	2.5×10^{11} Gs
C	1.2×10^{2} pm	4.0×10^{-10} ns
D	1.2×10^{3} μm	4.0 ns

2 Which group of electromagnetic waves is arranged in order from shortest wavelength to longest wavelength?

A radio waves → visible light → gamma rays

B visible light → microwaves → infrared

C visible light → ultraviolet → X-rays

D X-rays → infrared → microwaves

3 An electromagnetic wave in free space has a frequency of 3.0×10^{16} Hz.

Which row gives the principal region of this wave and an example of an electromagnetic wave with a lower frequency?

	principal region	wave with lower frequency
A	infrared	visible light
B	infrared	X-rays
C	ultraviolet	visible light
D	ultraviolet	X-rays

4 Some sources of electromagnetic waves in free space are listed.

1 a radio wave transmitter

2 a source of X-rays

3 a 30 mm wavelength radar transmitter

4 a light-emitting diode that emits red light

Which list gives the sources in order of increasing wavelength, from left to right, of the waves emitted by the sources?

A $1 \rightarrow 3 \rightarrow 4 \rightarrow 2$

B $2 \rightarrow 4 \rightarrow 1 \rightarrow 3$

C $2 \rightarrow 4 \rightarrow 3 \rightarrow 1$

D $3 \rightarrow 1 \rightarrow 4 \rightarrow 2$

5 A beam of visible light is in a vacuum.

What could be the frequency of the light?

A 5.0×10^{5} Hz **B** 5.0×10^{8} Hz **C** 5.0×10^{11} Hz **D** 5.0×10^{14} Hz

6 Which statement about electromagnetic waves in a vacuum is correct?

A Infrared waves have shorter wavelengths than visible light waves.

B Microwaves have longer wavelengths than radio waves.

C Ultraviolet waves have higher frequencies than visible light waves.

D γ-rays have lower frequencies than X-rays.

7 A student is investigating two electromagnetic waves, X and Y, in a vacuum.

Wave X has a wavelength of 5.2×10^{-7} m. Wave Y has a frequency of 9.4 GHz.

Which principal regions of the electromagnetic spectrum contain waves X and Y?

	X	Y
A	radio wave	ultraviolet
B	ultraviolet	visible
C	visible	microwave
D	microwave	radio wave

8 Which statement about electromagnetic waves is correct?

A A wave of wavelength 5.0×10^{-6} m is invisible to the human eye.

B They can all travel at different speeds in free space.

C They cannot be polarised.

D They consist of vibrating atoms.

9 An electromagnetic wave in free space has a frequency of 2.5×10^{14} Hz.

Which region of the electromagnetic spectrum includes this frequency?

A infrared

B microwave

C ultraviolet

D X-ray

10 A telescope detects and analyses some electromagnetic radiation of wavelength 2 cm.

Which type of telescope is it?

A microwave telescope

B optical telescope

C radio telescope

D X-ray telescope

11 Two electromagnetic waves have wavelengths of 5.0×10^{-7} m and 5.0×10^{-2} m in a vacuum.

Which row identifies the regions of the electromagnetic spectrum to which the waves belong?

	wavelength 5.0×10^{-7} m	wavelength 5.0×10^{-2} m
A	ultraviolet	infrared
B	visible	microwave
C	ultraviolet	microwave
D	visible	infrared

12 Microwaves in a vacuum travel at speed X and have wavelength of order of magnitude Y.

What are the speed and a possible order of magnitude of wavelength of X-rays in a vacuum?

	speed	wavelength
A	X	$10^{-8}\,Y$
B	X	$10^{-4}\,Y$
C	$10^{4}\,X$	Y
D	$10^{8}\,X$	Y

13 Two lasers emit light in a vacuum. One laser emits red light and the other emits green light.

Which property of the light from the two lasers **must** be different?

A amplitude

B frequency

C intensity

D speed

14 Which list shows electromagnetic waves in order of decreasing frequency?

A gamma-rays → infrared → ultraviolet → radio waves

B gamma-rays → ultraviolet → infrared → radio waves

C radio waves → infrared → ultraviolet → gamma-rays

D radio waves → ultraviolet → infrared → gamma-rays

15 Which radiation could consist of waves of wavelength 0.5 nm?

A γ-rays

B ultraviolet

C visible light

D X-rays

16 Electromagnetic waves of frequency 30 THz are in a vacuum.

In which region of the electromagnetic spectrum are the waves?

A infrared

B microwave

C ultraviolet

D visible light

17 What are the names of the electromagnetic waves that have wavelengths in a vacuum of 100 pm and of 100 μm?

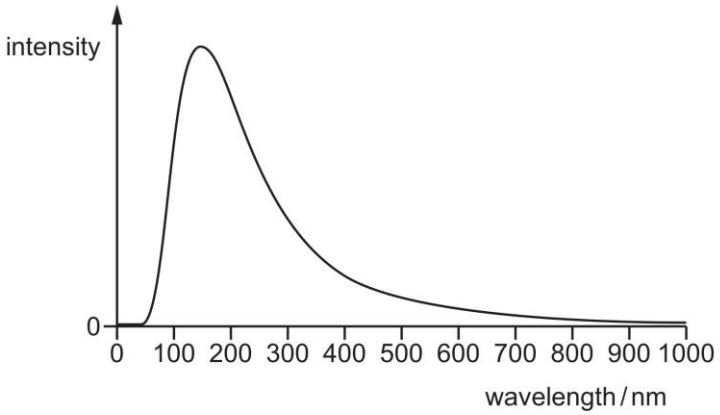
	wavelength 100 pm	wavelength 100 μm
A	γ-rays	infrared
B	γ-rays	red light
C	X-rays	infrared
D	X-rays	red light

18 The table shows the wavelengths of five electromagnetic waves.

Which row correctly identifies the principal radiation for each of these wavelengths?

	10^{-14} m	10^{-10} m	10^{-6} m	10^{-2} m	10^{2} m
A	gamma-ray	X-ray	infrared	microwave	radio wave
B	radio wave	microwave	infrared	X-ray	gamma-ray
C	radio wave	microwave	ultraviolet	infrared	X-ray
D	X-ray	infrared	ultraviolet	microwave	radio wave

19 The graph shows how the intensity of electromagnetic radiation emitted from a distant star varies with wavelength.



In which region of the electromagnetic spectrum is the radiation of greatest intensity?

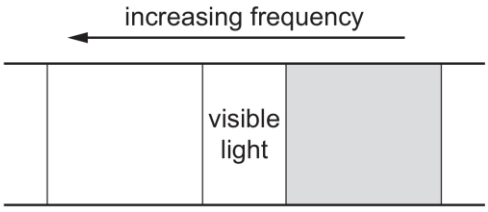
A infrared

B visible light

C ultraviolet

D X-ray

20 Part of the electromagnetic spectrum is shown.



What is the name of the shaded region and what is the order of magnitude of a wavelength of a wave from this region?

	name	wavelength / m
A	infrared	10^{-5}
B	infrared	10^{-8}
C	ultraviolet	10^{-5}
D	ultraviolet	10^{-8}

21 The electromagnetic spectrum consists of waves with different wavelengths.

Which row correctly identifies regions of the electromagnetic spectrum?

	10^{-10} m	10^{-8} m	10^{-5} m	10^{-2} m
A	microwaves	X-rays	ultraviolet	infrared
B	infrared	microwaves	X-rays	ultraviolet
C	microwaves	infrared	ultraviolet	X-rays
D	X-rays	ultraviolet	infrared	microwaves

22 An electromagnetic wave has a wavelength of 138 pm in a vacuum.

To which region of the electromagnetic spectrum does this wave belong?

A radio wave

B microwave

C visible light

D X-ray

23 Which region of the electromagnetic spectrum includes waves with a frequency of 10^7 MHz?

A infra-red waves

B radio waves

C ultraviolet waves

D X-rays

24 What can be deduced from a table of wavelengths of the waves in the electromagnetic spectrum?

A Green light has a shorter wavelength than X-rays.

B Red light has a shorter wavelength than green light.

C The wavelength range for radio waves is less than that for infra-red waves.

D The wavelength range for X-rays is less than that for radio waves.

25 Which region of the electromagnetic spectrum has waves of wavelength 1000 times smaller than the wavelength of visible light?

A infra-red

B microwaves

C ultraviolet

D X-rays

26 A surveyor's device emits a pulse of light. The light is reflected from a wall 150 m away.

What is the time taken for the pulse to travel from the device to the wall and then back to the device?

A 0.05 ns **B** 0.10 ns **C** 0.50 μs **D** 1.0 μs