

# Electromagnetic Spectrum

## Question Paper

Level	O Level
Subject	Physics
Exam Board	Cambridge International Examinations
Unit	Waves
Topic	Electromagnetic Spectrum
Booklet	Question Paper

**Time Allowed:** 31 minutes

**Score:** /26

**Percentage:** /100

**Grade Boundaries:**

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1 Microwaves are used to transmit television signals to and from a satellite.

Which statement about microwaves is correct?

- A They have a longer wavelength than radio waves.
- B They penetrate the atmosphere without significant loss of energy.
- C They travel much faster than radio waves in a vacuum.
- D They warm the satellite and stop it freezing.

2 Where are gamma-rays used?

- A in fluorescent tubes
- B in killing cancerous cells
- C in pre-natal scanning
- D in sunbeds

3 Which component of the electromagnetic spectrum is used for television transmission from satellites?

- A microwaves
- B radio waves
- C ultra-violet
- D X-rays

4 Which statement is correct?

- A Gamma rays have a longer wavelength than ultra-violet waves.
- B Infra-red waves have a lower frequency than radio waves.
- C Microwaves have a longer wavelength than visible light.
- D X-rays have a higher speed in air than visible light.

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- 5 Which application uses microwaves?
- A detecting small cracks in metals
  - B gaining a sun-tan
  - C lighting a fluorescent tube
  - D satellite television
- 6 Which wave property has the same value for all X-rays travelling in air?
- A amplitude
  - B frequency
  - C speed
  - D wavelength
- 7 The table lists the main components of the electromagnetic spectrum and their approximate frequency range.

	frequency/Hz
gamma rays	$10^{22}$ to $10^{19}$
X-rays	$10^{21}$ to $10^{18}$
ultra-violet	$10^{18}$ to $10^{15}$
visible light	$10^{15}$ to $10^{14}$
infra-red	$10^{14}$ to $10^{12}$
microwaves	$10^{12}$ to $10^9$
radiowaves	$10^9$ to $10^3$

Which range of frequencies can be used to detect cracks inside a block of metal?

- A  $10^3$  Hz to  $10^{12}$  Hz
- B  $10^{12}$  Hz to  $10^{15}$  Hz
- C  $10^{15}$  Hz to  $10^{18}$  Hz
- D  $10^{18}$  Hz to  $10^{22}$  Hz

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8 The speed of radio waves is  $c$ . A radio station transmits waves with a wavelength  $\lambda$ .

What is the frequency of the transmission?

- A**  $\frac{c}{\lambda}$                       **B**  $\frac{\lambda}{c}$                       **C**  $\frac{1}{\lambda}$                       **D**  $c\lambda$

9 Below are four statements about the uses of electromagnetic radiation.

Gamma rays are used in medical treatment.

Infra-red waves are used in sunbeds.

Microwaves are used in satellite television.

X-rays are used in intruder alarm

How many of these statements are correct?

- A** 1                      **B** 2                      **C** 3                      **D** 4

10 Which device uses ultra-violet radiation?

- A** electric grill  
**B** intruder alarm  
**C** television remote controller  
**D** sunbed

11 Red and violet are the colours at the ends of the visible spectrum.

How do the frequencies and the wavelengths of these colours compare?

	higher frequency	longer wavelength
<b>A</b>	red	red
<b>B</b>	red	violet
<b>C</b>	violet	red
<b>D</b>	violet	violet

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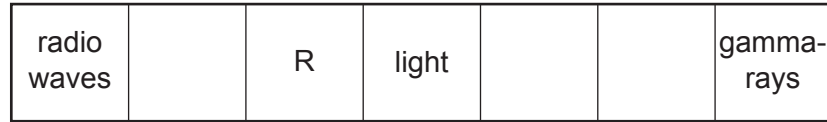
- 12 Which statement about red light and blue light is correct?
- A** Red light has a higher frequency than blue light.
  - B** Red light has a longer wavelength than blue light.
  - C** Red light has the same speed in glass as blue light.
  - D** Red light is refracted by a glass prism more than blue light.
- 13 Which application may use the part of the electromagnetic spectrum called microwaves?
- A** cooking vegetables
  - B** detecting small cracks in metals
  - C** gaining a sun-tan
  - D** lighting a fluorescent tube
- 14 How do the speed and the wavelength of red light in air compare with the speed and the wavelength of violet light in air?

	speed of red light	wavelength of red light
<b>A</b>	greater	greater
<b>B</b>	greater	less
<b>C</b>	same	greater
<b>D</b>	same	less

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- 15 The diagram shows the main sections of the electromagnetic spectrum in order of increasing frequency. Some of the sections are labelled.



—————→ increasing frequency

The section R has a frequency just below that of light.

Which application uses the section R?

- A** killing cancerous cells
  - B** satellite television
  - C** sterilisation
  - D** television remote controller
- 16 A hospital needs to sterilise medical equipment.
- Which electromagnetic waves could be used?
- A** infra-red
  - B** microwaves
  - C** radiowaves
  - D** ultraviolet
- 17 Which pair of emissions travels with the same speed in air?
- A** alpha-particles and gamma-rays
  - B** gamma-rays and infra-red waves
  - C** infra-red waves and sound waves
  - D** sound waves and alpha-particles

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18 When white light is dispersed by a prism, compared with blue light, the **red** light is

- A slowed down less and refracted less.
- B slowed down less and refracted more.
- C slowed down more and refracted less.
- D slowed down more and refracted more.

19 Which colour, red or blue, has the higher frequency and which has the longer wavelength?

	higher frequency	longer wavelength
<b>A</b>	blue	blue
<b>B</b>	blue	red
<b>C</b>	red	blue
<b>D</b>	red	red

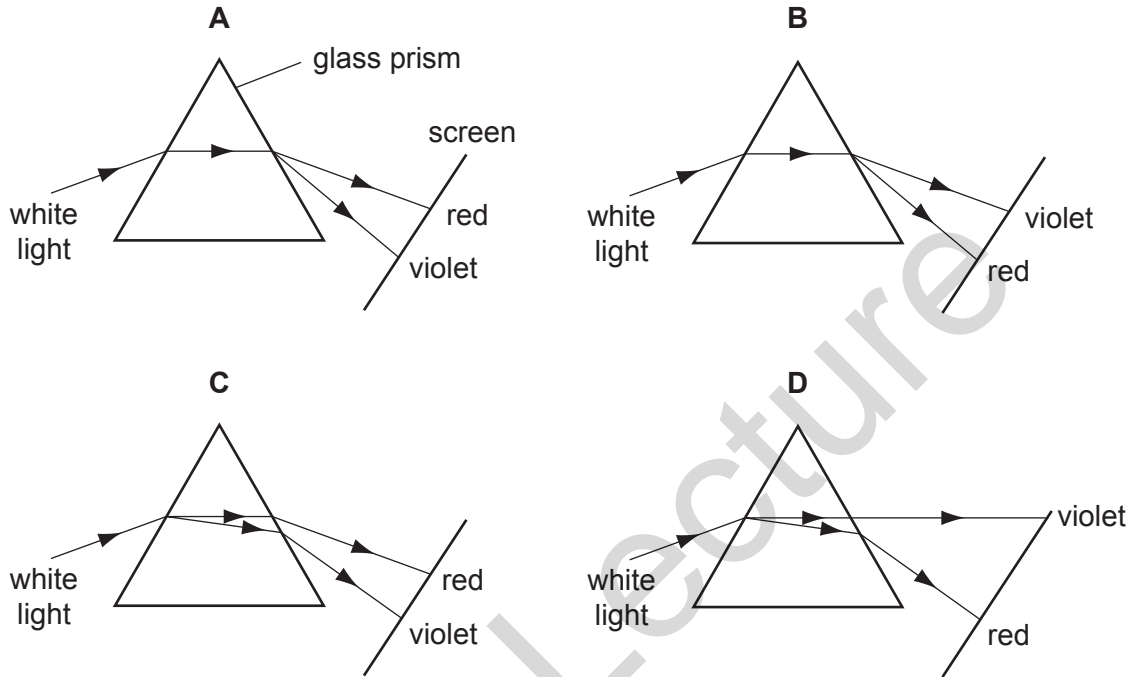
20 Which type of wave is used to send telephone signals to and from a satellite?

- A infra-red waves
- B light waves
- C microwaves
- D sound waves

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21 Which diagram correctly shows the dispersion of white light by a glass prism?



22 Which does **not** normally use infra-red radiation?

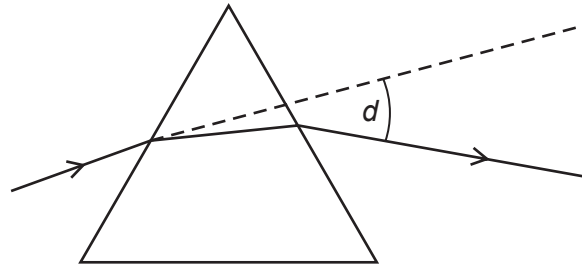
- A electric grill
- B intruder alarm
- C television remote controller
- D sunbed



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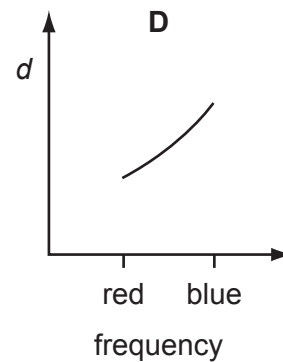
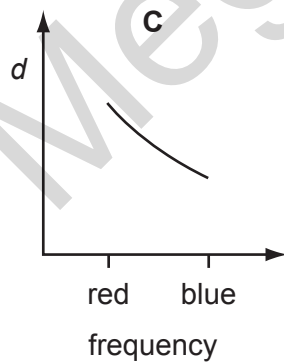
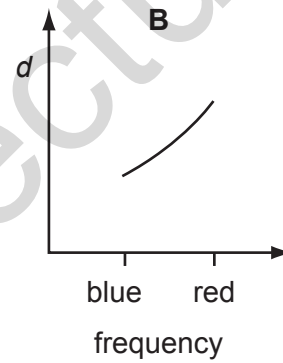
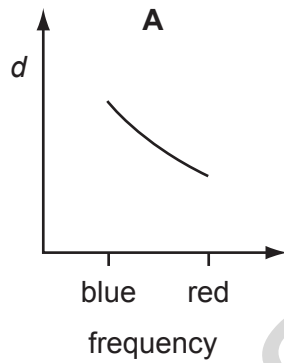
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23 Light rays are deviated by a prism.



The deviation angle  $d$  is measured for light rays of different frequency, including blue light and red light.

Which graph is correct?



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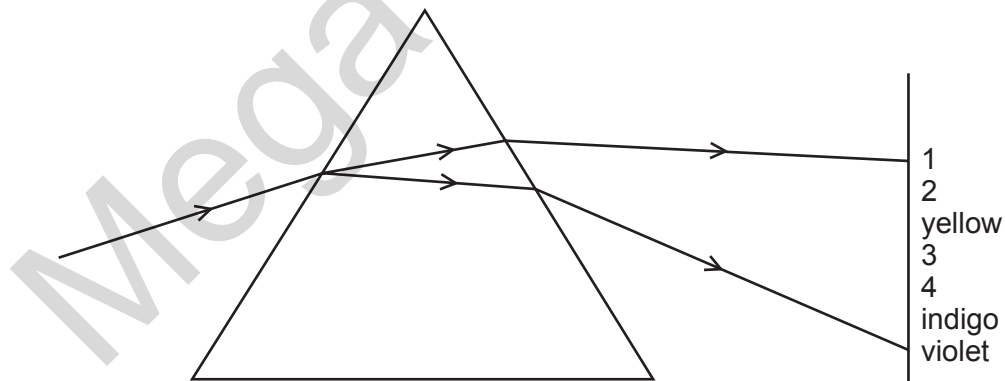
24 Which wave is part of the electromagnetic spectrum?

	$\frac{\text{speed}}{\text{m/s}}$	type
<b>A</b>	330	longitudi
<b>B</b>	330	transverse
<b>C</b>	$3 \times 10^8$	longitudinal
<b>D</b>	$3 \times 10^8$	transverse

25 Which statement is true for all electromagnetic waves?

- A** They are longitudinal.
- B** They can be seen.
- C** They have the same frequency in air.
- D** They travel at the same speed in a vacuum.

26 The diagram shows the spectrum produced when white light is dispersed by a glass prism.



What are the numbered visible colours?

	1	2	3	4
<b>A</b>	infra-red	red	green	ultra-violet
<b>B</b>	red	green	orange	blue
<b>C</b>	red	orange	green	blue
<b>D</b>	red	orange	green	ultra-violet