

The Electromagnetic Spectrum

Q1.(2018)

A ✓

Q2.(2019)

A ✓

Q3.a(2019)

Radio (waves) **AND** UV / ultraviolet ✓

1	1.1	BOTH needed in the correct order
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Q3.b(2019)

Any one from:

Sound is longitudinal / sound is not transverse / AW ✓

Sound cannot travel through a vacuum OR ✓

1	2.1	ALLOW It is not an electromagnetic wave/ radiation
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Q3.c(2019)

Gamma (rays) ✓

Q3.d(2019)

Decreases ✓

Q3.e(2019)

Damages cells/damages DNA / cause mutations/cause
cancer /ionises cells AW ✓

1	1.1	ALLOW damage to named tissue/organ ALLOW body tissue for cells
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Q4.a(2019)

FIRST CHECK THE ANSWER ON ANSWER LINE

If answer = 1.2 (ms) award 1 mark

$$t = 0.2 \times 6 = 1.2 \text{ (ms)} \checkmark$$

Q4.b(2019)

FIRST CHECK THE ANSWER ON ANSWER LINE

If answer = 90 000 (m) award 2 marks

$$d = (3 \times 10^8 \times) 0.0003 \checkmark$$

$$d = 90\,000 \text{ (m)} \checkmark$$

OR

$$d = (3 \times 10^8 \times 0.0006 =) 180\,000 (\div 2) \checkmark$$

$$d = (180\,000 \div 2) = 90\,000 \text{ (m)} \checkmark$$

Q4.c(2019)

energy lost (to the surroundings/air) / AW $\checkmark$

1

3.2b

ALLOW energy is dissipated / not all energy reflects / some energy is absorbed

Q4.d(2019)

FIRST CHECK THE ANSWER ON ANSWER LINE
If answer = 1.5 (m) award 4 marks

4

Recall and rearrange to give: $\lambda = v \div f \checkmark$

1.1

ALLOW correct formula in words

(Conversion $200(\text{MHz}) = 2 \times 10^8 \text{ (Hz)} \checkmark$

1.2

($\lambda =$) $3 \times 10^8 \div 2 \times 10^8 \checkmark$

2 x 2.1

ALLOW $\lambda = 3 \times 10^8 \div 2 \times 10^8$ for two marks

($\lambda =$) 1.5 (m) $\checkmark$

ALLOW 1.5×10^0 for correct calculation but incorrect conversion of MHz to Hz for 3 marks

Q5.(2020)

Transverse $\checkmark$
Speed $\checkmark$

2

Q6.a(2021)

Frequency or energy too high / too dangerous / gamma is ionising radiation / can cause cancer / AW $\checkmark$

1

1.2

ALLOW wavelength too small / can kill cells

Q6.b(2021)

Any **one** from:

1

1.1

IGNORE X-rays / gamma rays / radio waves

Microwaves $\checkmark$
Visible light $\checkmark$
Infra-red $\checkmark$
UV $\checkmark$

Q6.c(2021)

Any one from:	1	1.1	IGNORE any use which does not involve communications / just 'TV'
Radar ✓			
Satellite (TV) ✓			
Mobile phones ✓			
Remote controls ✓			
Optical fibres / optical wireless communications ✓			
Morse code ✓			
To see/to read CDs or DVDs ✓			
Bluetooth ✓			

Q7.a(2021)

As frequency increases, wavelength decreases / ORA ✓	2	2x3.1a	Possible pairs: f (MHz) λ(m)
Any two pairs of values of frequency and wavelength that shows this relationship ✓			562 0.533
			571 0.526
			578 0.519
			586 0.511
			594 0.505
			691 0.435

Q7.b(2021)

Three / 3 ✓

Q7.c(2021)

FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 299 970 000 (m / s) award 3 marks	3		ALLOW 300 000 000 or 3×10^8 (m / s) with workings shown ✓✓✓
594 MHz = 594 000 000 Hz ✓ (Speed =) 594 000 000 × 0.505 ✓		1.2 2.1	
(Speed =) 299 970 000 (m / s) ✓		2.1	ALLOW 2.9997×10^8 (m / s) ✓✓✓ ALLOW 299.97 (unit not changed) ✓✓

Q7.d(2021)

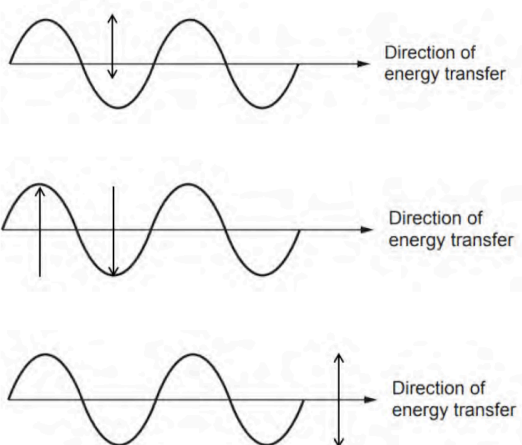
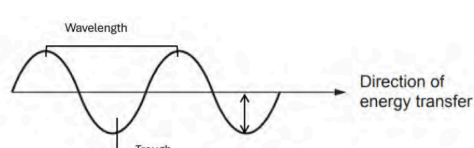
FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.4 award 3 marks	3		
(efficiency =) useful E output ÷ input E ✓ (efficiency =) 100 ÷ 250 ✓ (efficiency =) 0.4 ✓		1.2 2.1 2.1	ALLOW 40% ✓✓✓ ALLOW 0.4% or 0.4 with units or 40 ✓✓

Q8.(2022)

A ✓

Q9.a(2023)

Gamma rays ✓	1	2.2	ALLOW gamma / symbol γ
Q9.b(2023) Gamma rays ✓	1	1.1	ALLOW gamma / symbol γ
Q9.c(2023) 10^2 ✓	1	2.2	ALLOW any indication of the correct answer selected e.g., ticking or underlining but circling takes precedence DO NOT ALLOW more than one answer circled
Q9.d(2023) First check the answer on answer line If answer = 1 000 000 (Hz) award 2 marks (Frequency =) 10^6 (Hz) ✓ (Frequency =) 1 000 000 (Hz) ✓	2	1.2 2.2	ALLOW answer on graph ALLOW 1×10^6 (Hz) for 1 mark ALLOW ECF from standard form to non-standard form e.g., 10^7 to 10 000 000 (Hz) for 1 mark
Q9.e(2023) They are transverse waves ✓	1	1.1	ALLOW any indication of the fourth box selected e.g., X or circling but ticking takes precedence DO NOT ALLOW more than one box ticked
Q9.f(2023) First check the answer on answer line If answer = 0.7 (h) award 3 marks (Time =) $\frac{\text{energy transferred}}{\text{power}}$ ✓ (Time =) $\frac{0.56}{0.8}$ ✓ (Time =) 0.7 (h) ✓	3	1.2 2 × 2.1	ALLOW POT error e.g., 7 / 70 / 0.07 on answer line = 2 marks ALLOW symbols (t =) $\frac{W}{P}$ or $\frac{E}{P}$ ALLOW for 1 mark the numbers in an unarranged equation e.g.: $0.56 = 0.8 \times t$
Q10.(2024)			

<p>Either: Oscillations/vibrations are at 90°/right angles/perpendicular (to the direction of energy transfer /wave motion) ✓</p> <p>Or: Diagram showing vibration at 90° to the arrow for direction of energy transfer ✓</p>	<p>1</p>	<p>1.1</p>	<p>ALLOW (oscillations/vibrations) right angle/perpendicular/90 degrees to direction of energy transfer/wave motion ALLOW vibrations are vertical <u>and</u> energy transfer wave motion horizontal ALLOW <u>vibration</u> goes up and down</p> <p>ALLOW answers on diagram or in description</p> <p>Examples of acceptable answers:</p>  <p>Example of a not acceptable answer (vibration must clearly go above and below centre line):</p>  <p>CON if arrow contradicts written answer</p>
<p>Q11.(2024)</p> <p>First check the answer on the answer line If answer = 300 000 000 (m / s) award 3 marks</p> <p>unit conversion: $7\,500\text{ kHz} = 7\,500\,000\text{ (Hz)}$</p> <p>(wave speed =) $7\,500\,000 \times 40$ ✓</p> <p>(wave speed =) $300\,000\,000\text{ (m / s)}$ ✓</p>	<p>3</p>	<p>1.2 2 × 2.1</p>	<p>ACCEPT $7\,500 \times 10^n \times 40$ for 1 mark</p> <p>ACCEPT $3 \times 10^8\text{ (m / s)}$ ACCEPT $3 \times 10^n\text{ (m / s)}$ incorrect/no unit conversion for 2 marks</p>
<p>Q12.a(2024)</p> <p>As frequency (range) increases, wavelength (range) decreases / ORA ✓</p>	<p>1</p>	<p>3.1a</p>	<p>ALLOW inversely proportional ALLOW higher frequency lower wavelength / ORA</p>

Q12.b(2024)

HF ✓

Q12.c(2024)

May cause heating (to skin/water molecules) / burns (to skin) ✓	1	3.2a	ALLOW makes thermal energy
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Q12.d(2024)

High frequency radio waves are <u>less</u> dangerous than microwaves.	1	3.2a	
And Frequency is lower / (transfer) less energy / ORA ✓			DO NOT ALLOW references to radioactivity