


Mark scheme – The Electromagnetic Spectrum (F)

Question			Answer/Indicative content	Marks	Guidance
1	a		spoon A AND (More radiation emitted) at higher temperature / hotter objects (emit more radiation) / spoon A is hotter / AW / ORA✓	1(AO1.1)	ALLOW spoon A is heated (more) Examiner's Comments Many candidates correctly ticked Spoon A but did not explain their answer correctly. It was expected that they would state that objects at higher temperatures would emit more radiation.
	b		Any one from: Eye can only detect visible light / eye cannot detect IR ✓	1 (AO1.1)	ALLOW see for detect ALLOW spoon is not hot enough for a change in colour AW Examiner's Comments The common incorrect answer to this question was to refer to the spoons not melting rather than stating that infrared radiation cannot be detected by the eye.
			Total	2	
2			D ✓	1(AO1.1)	Examiner's Comments This question was not answered well. It was hoped that candidates would know that light is a type of electromagnetic wave and that all electromagnetic waves are transverse. This was a straightforward recall question from the specification.
			Total	1	
3			B ✓	1 (AO1.1)	Examiner's Comments There was evidence that a large number of candidates were unaware of the practical uses of electromagnetic waves. A common incorrect answer was C.
			Total	1	
4			A ✓	1(AO1.1)	Examiner's Comments This question required candidates to read the options carefully. Many candidates did not realise the direction was important.

			Total	1	
5			D ✓	1 (AO 2.2)	<p><u>Examiner's Comments</u> Candidates found this question difficult with only about a third of the candidates choosing the correct answer D. Candidates should know that electromagnetic waves are transverse and travel through space with the same velocity. The other three options were regularly chosen by the candidates.</p> <p>Candidates should practice answering this type of questions which often test basic knowledge and understanding. One way of answering these questions is to look at one of the column headings for example transmission and rule out with small crosses A and B, then look at the next column and rule out A and C, which then means the correct answer should be D. In this question the third column could be used to check that D would still work again by placing a cross next to A and B.</p>
			Total	1	
6			A ✓	1 (AO 2.2)	<p><u>Examiner's Comments</u> This was the most challenging question in Section A. The most common response was distractor D, where candidates multiplied the numbers together rather than dividing wave speed by wavelength.</p>  <p>AfL</p> <p>For these type of questions candidates should be encouraged to insert the numbers into the equation. When they do this they will see that the equation needs to be rearranged. Alternatively, candidates could rearrange the equation so that the unknown quantity is on the left-hand side of the equal sign.</p>
			Total	1	
7			D ✓	1 (AO 1.1)	<p><u>Examiner's Comments</u> This question was generally answered well. The common incorrect answer was B, where candidates thought that ultrasound was an electromagnetic wave.</p>
			Total	1	

8			C ✓	1 (AO1.1)	<p>Examiner's Comments</p> <p>This question was also based on the electromagnetic spectrum section of the specification. Candidates had a better understanding of the main groupings of the electromagnetic spectrum from long to short wavelengths and from low to high frequencies. An alternative way of answering this question is to apply the wave equation realising that the speed of electromagnetic waves in a vacuum is constant.</p>
			Total	1	
9	a	i	86 (%) ✓	1 (AO2.2)	ALLOW 85-87 %
		ii	<p>FIRST CHECK THE ANSWER ON ANSWER LINE</p> <p>If answer = 14 (%) award 2 marks</p> <p>100 – 86 ✓ = 14 (%) ✓</p>	2 (AO 2×2.2)	ALLOW ECF from (i)
	b		<p>Any one from:</p> <p>Similarity Both transverse waves ✓ Both electromagnetic waves ✓ Both travel at the same speed/speed of light (in a vacuum) ✓ Both can travel through space / vacuum ✓</p> <p>Any one from:</p> <p>Difference X-ray has higher frequency / shorter wavelength / ORA ✓ X-rays have higher energy / ORA ✓ X-rays are more penetrating / ORA ✓</p>	2 (AO2 × 1.1)	1 DO NOT ALLOW we can see visible light/we cannot see X-rays
			Total	5	
10		i	Radio / infra-red / microwave ✓	1 (AO 1.1)	
		ii	Ultra-violet / X-rays / gamma-rays ✓	1 (AO 1.1)	
		iii	<p>Any two from:</p> <p>Radiotherapy / killing cancer cells ✓</p> <p>Irradiating food / sterilisation of instruments ✓</p> <p>Tracer / medical imaging ✓</p> <p>Scanning metals / non-destructive testing (NDT) ✓</p>	4 (AO2.1)	<p>ALLOW tumours / treatment of cancer</p> <p>ALLOW killing bacteria / (harmful) microorganisms / sterilising food</p> <p>Examiner's Comments</p> <p>Candidates had a sounder understanding of the trend in frequency in the electromagnetic spectrum (part ii) than that</p>

				<p>for wavelength (part i). The most common misconception was by candidates who gave visible light as their response to both part i and part ii. Around half of the candidates knew that gamma-rays are used in the treatment of cancer but other uses, such as the irradiation of food or medical equipment, were known by far fewer.</p> <p>To gain credit, candidates need to ensure that their answers are specific. A number of candidates stated that gamma-rays were used in chemotherapy. Some candidates stated that gamma-rays were used in scans, often with an implication of unborn babies. It was hoped that candidates would understand the use of gamma radiation as a tracer and for sterilising instruments.</p>
			Total	4