

Electromagnetic Waves Uses and Dangers 2 MS

QUESTION 1

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	refraction	accept refracted reflection, diffraction and dispersion are incorrect	1
a)ii)	to check rise in temperature (of other thermometers) was due to the (different wavelengths of) light	accept as a control / comparison to measure room temperature is insufficient	1
a)iii)	any two from three: different colours produce different heating effects / (rises in) temperatures red light produces the greatest heating effect / (rise in) temperature or violet produces the least heating effect / (rise in) temperature all colours produce a greater heating effect than outside the spectrum	an answer the longer the wavelength the greater the (rise in) temperature or the lower the frequency the greater the (rise in) temperature gains both marks	2
b)	move a thermometer into the infrared region / just beyond the red light the temperature increases beyond 24(°C)	allow use an infrared camera / infrared sensor accept temperature higher than for the red light	2
c)	0.0000094	$v = f \lambda$ accept 9.375 10-6 or 9.38 10-6 accept 0.000009375 or 0.00000938 allow 1 mark for correct	2

		substitution ie $3 \times 10^8 = 3.2 \times 10^{13} \lambda$	
d)	at night the surroundings are cooler or at night there is a greater temperature difference between people and surroundings (so surroundings) emit less infrared (than in daytime) or gives larger difference in infrared emitted (between people and surroundings)	accept at night the air is colder there is no heat from the Sun is insufficient accept camera detects a greater contrast	1 1
Total marks			10

QUESTION 2

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	gamma	accept correct symbol	1
a)ii)	any one from: • (ultraviolet has a) higher frequency • (ultraviolet has a) greater energy • (ultraviolet has a) shorter wavelength	ultraviolet cannot be seen is insufficient ignore ultraviolet causes cancer etc	1
b)	$1.2 \times 10^7 / 12000000$ hertz / Hz / kHz / MHz	allow 1 mark for correct substitution, ie $3 \times 10^8 = f \times 25$ do not accept hz or HZ answers 12 000 kHz or 12 MHz gain 3 marks for full credit the numerical answer and unit must be consistent	2 1
Total marks			5

QUESTION 3

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i	a signal that has only two states / only discrete states	accept can only be on or off accept made up of 1 and 0 only	1

		accept high and low accept diagram with all amplitudes equal	
a)ii)	400 000 000 or correct equivalent	allow 1 mark for correct transformation and substitution (of 75) answer 4 000 000 gains 1 mark only	2
b)i)	emit / uses / transmit / receive microwaves some microwave / energy absorbed by /enters the body raises temperature of (body) cells / tissue/ water	any mention of alpha, beta, gamma waves scores 0 marks accept radiation for microwaves throughout ignore radio waves ecf for their given electromagnetic wave do not accept goes through the body accept reference to water molecules vibrating faster accept it could cause mutation / harm / kill cells do not accept answers in terms of ionisation ignore references to cancer	1 1 1
b)ii)	any two from: • research (may be) biased or may have been misled in the past • some research suggests a link • long-term effect not proven / studied • residents may not have seen the research	accept not independent or may be lying accept not studied for long enough	2
Total marks			8

QUESTION 4

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	soil		1
a)ii)	type of surface is a categoric (variable)	accept surface is not a continuous (variable) do not accept data is discrete	1
a)iii)	skier exposed to high(er) level reflected UV or less UV absorbed by the atmosphere golfer out when Sun's intensity is highest or larger area of skin / body exposed	mark is for a feasible reason linked to either the skier or golfer accept radiation for UV accept snow is a good reflector of UV do not accept snow reflects UV accept snow is a poor absorber of UV do not accept snow absorbs UV accept when Sun is stronger / hotter accept golfer is outside for longer	1
a)iv)	any one from: <input type="checkbox"/> (skin) cancer <input type="checkbox"/> premature skin ageing	accept kills / damages cells accept a correct description do not accept suntan accept burn (it)	1
b)i)	level of UV transmitted is very low for all wavelengths shown / up to 400 nm	accept energy / rays for UV accept answers in terms of absorbed / blocked only scores if first mark scores accept an answer in terms of cannot support 95 % claim as measurements cannot be taken from the graph or an attempted calculation	1 1
b)ii)	glass transmitted most / a lot of UV	accept energy / rays for UV do not accept light for UV	1

	or glass absorbed little UV	do not accept all UV accept results (almost) same as no absorbing material accept blocks / stops for absorbed do not accept no UV	
c)i)	Publicity and education		1
c)ii)	implication of financial gain	accept to promote the product sunglasses cost a lot of money is insufficient	1
Total marks			9

QUESTION 5

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	cooking or satellite communication	do not accept microwave (oven) accept radar accept (microwave) telescopes accept Wi-Fi do not accept radio	1
b)i)	compare (the health of) mobile phone users with non-mobile phone users	must be an implied comparison between users and non-users any idea of doing an experiment negates the mark	1
b)ii)	increase the sample size	accept use more people accept have a large sample size repeat the research / test is neutral	1
b)iii)	ethical		1
c)i)	so the phones can be compared(fairly)	a fair test is insufficient accept different tests (may) give different results do not accept to make the results reliable, unless qualified eg all variables are controlled do not accept bias unless qualified	1
c)ii)	yes all are below the legal limit / 2 (W/kg) or no and any one from: <input checked="" type="checkbox"/> even absorbing a small	accept microwaves for energy accept emits energy absorbed by head / other parts of body	1

	amount of energy may be harmful ☒ no proof that small amounts of energy are not harmful	accept because the SAR value is not 0 (W/kg)	
d)	any one from: ☒ to get an independent opinion ☒ company scientists may be biased	accept company scientists may manipulate results	1
Total marks			7

QUESTION 6

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	microwave		1
b)i)	infra red		1
b)ii)	2 or 3 reflections shown	lines are straight and most angles look correct by eye four or more reflections gains 1 mark only ray must touch side of the fibre to qualify as a reflection ray must reach end of the fibre	2
Total marks			4

QUESTION 7

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	high		1
b)i)	reduce		1
b)ii)	increases (it) less / no vitamin D produced	points may score written in either answer space do not accept less sunlight / UV	1 1
Total marks			4