Electromagnetic Spectra Past Paper Answers IGCSE Edexcel

1.

Question Number	Answer	Notes	Marks
a	**C** – radio; this has the longest wavelength A—this has the shortest wavelength B—this has a shorter wavelength than radio D—this has a shorter wavelength than radio		1
b	any two from: MP1. (same) speed; MP2. (all) transverse (waves); MP3. (can all) travel through vacuum; MP4. (all) transfer energy;	allow 3×10^8 m/s	2

	Answer	Notes	Marks
c	for **three** named parts of the spectrum 1 use and 1 harmful effect max. **gamma use;** • radiotherapy • sterilising medical equipment / food • (radioactive) tracers **gamma harmful effect;** • causes cancer / cell mutation **x-ray use;** • observing internal structure of the body/eq **x-ray harmful effect;** • causes cancer / cell mutation **ultraviolet use;** • fluorescent lamps • treating skin disorders • killing bacteria **ultraviolet harmful effect;** • damage to skin (cells) • blindness **visible use;** • optical fibres • photography **visible harmful effect;** • eye damage (at high intensity) **infrared use;** • short range communication e.g. remote controls • heaters • night vision equipment **infrared harmful effect;** • burns skin/tissue **microwave use;** • cooking • satellite communications **microwave harmful effect;** • internal heating of body tissue **radio use;** • communications;	 allow treating cancer damage is not sufficient kills cells damage is not sufficient allow tanning, security allow sunburn, skin cancer allow cataracts ignore sunburn ignore 'damage' allow internal burns	6

Total for question 6 = 9 marks

2.

nber	Answer	Notes	F
	any six from:	ignore references to devices references to advantages unqualified 'damage' as it is in the stem of the question allow tissue for cells throughout	
	MP1. excessive exposure is caused by high intensity or high amplitude or long period of exposure;		
	MP2. radio waves (probably) don't cause harm to human bodies;		
	MP3. microwaves can cause (internal) heating of body (cells);		
	MP4. IR can cause surface burns to skin;	not 'sunburn'	
	MP5. visible can cause vision impairment;	allow blindness, damage to fovea/retina	
	MP6. UV can cause <u>skin</u> cancer;	allow sunburn ionise cells / DNA damages eyes/cornea, blindness causes cataracts cause skin aging	
	MP7. x-rays can {mutate/kill} cells inside the body;	allow ionise cells / DNA causes radiation poisoning causes cancer	
	MP8. gamma can {mutate/kill} cells inside the body;	allow ionise cells / DNA causes radiation poisoning causes cancer if no specific parts of the EM spectrum are referred to, a max. of 1 mark can be awarded for any/all of the acceptable forms of damage	

Total for Question 8 = 6 r

3.

Question number		Answer	Notes	Marks
a		ultraviolet;	UV	1
b		gamma;	accept γ	1
c		frequency decreases; because c= f.λ OR speed is constant;	accept eqn in words all travel at same speed	2
d		infrared;	IR	1

e	i	any three from:-
		  MP1. time taken (is noted);
		  MP2. for the beam /microwaves to get
		      to plane and return;
		
		  MP3. distance calculated from speed =
		      distance/time;
		  MP4. distance is halved;
			for signal to get to
			plane and back
			accept 'bounce back'
			any form of the eqn
			
			allow time halved
				3

	ii	any suitable and sensible suggestion;
		e.g.
		• planes move very fast
		• planes travel a long distance in a
		  short time
		• planes can arrive from any direction
		• updates distance/position of plane
		  frequently
				1

4.

Question number		Answer	Notes	Marks
(a)	(i)	any two from:- MP1. travels at speed of 3 x 10^8 m/s; MP2. travels in a vacuum; MP3. transverse wave; MP4. transfer energy / information; MP5. can be reflected/refracted/diffracted;	travel at the same speed /speed of light	2
	(ii)	B gamma rays;		1
(b)	(i)	step- up;		1
	(ii)	$$\frac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \frac{\text{primary turns}}{\text{secondary turns}}$$ $$\frac{V_p}{V_s} = \frac{n_p}{n_s}$$	allow equation in any rearrangement	1
	(iii)	substitution; rearrangement; evaluation; e.g. $\frac{230}{2000} = \frac{110}{n_s}$ $n_s = \frac{110 \times 2000}{230}$ $n_s = 960$	sub and rearrangement in either order 956.52, 957	3
	(iv)	to protect user from high voltage/eq;	allow plastic is an insulator to prevent (electric) shock Total 9 marks	1

5.

Question number		Answer	Notes	Marks
(a)	(i)	C (ultra violet);		1
	(ii)	A (longitudinal);		1
	(iii)	C (internal structure of objects);		1
(b)	(i)	any sensible use further detail e.g. sterilising medical equipment; gamma kills bacteria; OR treating cancer/mutates cancer **cells**; radiotherapy/**focused** gamma rays; OR detecting cancer; PET scanner/(radioactive) tracers/gamma camera;	ignore CT scan, CAT scan, MRI scan allow kills cancer/cells allow scintillation counter	2
	(ii)	any 2 of: MP1. any one sensible comment about risk for either; 　　e.g. 　　increased risk of cancer/mutation of cells 　　damage to neighbouring/good/healthy cells MP2. a further detail of the risk; 　　e.g. 　　radiation is ionising 　　gamma has high/highest energy MP3. statement about the relative risk/exposure of doctor or patient; 　　e.g. 　　patient is only exposed for a short period of time 　　doctor has continual (low level) exposure		2
	(iii)	any one sensible method; e.g. (use for a) limited time idea of working at a distance/in another room	ignore protective clothing, lead shielding, lead apron etc.	1

6.

Question number			Answer	Notes
(a)	(i)		B radio waves	
	(ii)		C Microwaves and radio waves travel at the same speed in a vacuum.	
	(iii)		any one sensible property; e.g. travels (very) fast travel at speed of light can be coded can travel in vacuum	Allow can penetrate the ionosphere, can carry more information (than radio) higher frequency /shorter wavelength (th radio) minimal diffraction
(b)			Quantities substituted in the correct equation; Rearrangement; Calculation; Conversion from hours/days to s at any point (implicit if correct ans in km); e.g. $3.1 = \dfrac{2 \times \pi \times r}{(24 \times 3600)}$ $r = \dfrac{3.1 \times 24 \times 3600}{2\pi}$ r = 42 600 km	No credit for quoting the equation as $v =$ $2\pi r/T$ is given on page 2. sub and rearrange in either order allow 3600 or 86 400 seen Allow 42630, 42628 Allow 42622 (from π = 3.142)

7.

Question number		Answer	Notes
a	i	Any two from – Radio; Microwaves; Infrared; Visible;	
	ii	Microwaves; Infrared;	
b		D Increasing wavelength	
c	i	(wave) speed = frequency x wavelength	Accept equivalent Accept recognised symbols
	ii	Substitution into correct equation; Evaluation; Unit; Eg. (wave) speed = 200 000 x 1500 300 000 000 m/s	mark unit and calc independently Power Of Ten error = -1 e.g. not converting kHz to Hz Accept • bald answer • answer in SF • alternative speed units with corresponding evaluation e.g. 300 000 km/s 1.08×10^{12} km/hour

8.

Question number		Answer	Notes
(a)			longest wavelength	→	shortest wavelength
infrared	visible (light)	ultraviolet		All three must be correct for the mark Allow IR for infrared Allow visible (without light) Allow UV for ultraviolet
(b)		Any two of: Radio (waves); Microwave(s); x-rays; Gamma (rays);	Allow T-rays γ - rays or γ
(c)	(i)	Any two of 1. killing bacteria e.g. in water purification OR in hand driers in toilets OR sterilisation of equipment; 2. medical uses e.g. setting dental fillings OR detection of bacteria OR treatment of (named) skin diseases; 3. security markings e.g. for checking banknotes; 4. fluorescent lamp e.g. tanning machines, black-light, detecting blood /other body fluids; 5. data reading e.g. blu-ray devices	Must be specific, ignore vague answers such as 'used in a hospital', 'for CSI' Allow other sensible suggestions for each MP

Question number	Answer	Notes	Marks
(ii)	Any two of 1. cell damage e.g. (skin) cancer, cell mutation; 2. Sunburn/skin aging; 3. eye damage e.g. cataracts, blindness;	Must be specific, do not allow vague answers such as 'causes burns' 'danger to skin' 'burns skin'	2
		Total	**7**

9.

Question number		Answer	Notes	Marks
(a)		A - microwave(s) B - X–rays	REJECT 'micro' REJECT 'X' ACCEPT capital or lower case X, with or without hyphen	2
(b)	(i)	C		1
	(ii)	D		1