

# Electromagnetic Waves 2 MS

## QUESTION 1

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	C or 0.18 mm		1
b)	0.6 (m)	allow 1 mark for correct substitution and/or transformation or 1 mark for changing frequency to Hz answer 600 gains 1 mark	2
c)	creates an alternating current  with the same frequency as the radio wave	accept 'ac' for alternating current accept alternating voltage accept signal for radio wave accept it gets hotter for 1 mark  provided no other marks scored	1  1
Total marks			5

## QUESTION 2

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	visible) light	accept visible	1
a)ii)	microwaves		1
b)	J		1
c)i)	B		1
c)ii)	shorter than		1
d)i)	To find out if using a mobile phone is harmful to health		
d)ii)	any two from: <ul style="list-style-type: none"> <li>• (X has a) low(er) SAR value</li> <li>• (maximum) energy absorbed (by the head) is less</li> <li>• (if mobiles are harmful) less likely to cause harm</li> </ul>	"it" refers to mobile phone accept has a low(er) rate  accept energy emitted (by phone) is less accept radiation for energy accept will not cause harm accept it is safer	2
Total marks			8

### QUESTION 3

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	any one from: gamma X-rays infra red microwaves radio	accept correct symbol  accept IR do not accept heat  do not accept TV	1
a)ii)	all the waves travel at the same speed		1
b)i)	(skin) cancer / melanoma	accept damage eyesight accept sunburn do not accept sun tan do not accept sunstroke	1
b)ii)	higher levels of UV greater risk to health / risk of skin cancer/ (more) protection needed / most likely to get burnt / damage skin	accept UV at its strongest / sun's rays are strongest ignore 'sun is at its hottest' ignore 'sun is at its highest' accept greater damage to / easier to damage cells / mutate cells  ignore just 'affect your health'  must be idea of greater adverse effect on health	1 1
Total marks			5

### QUESTION 4

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	infra red (rays) or radio (waves)	accept IR do not accept heat waves do not accept TV waves	1
a)ii)	radio (waves)	this answer only	1
b)	frequency		1
c)i)	need to know if it is harmful / makes you ill	answer should be in terms of establishing if harmful or not harmful ie trying to clear up any uncertainty do not accept answers that assume it is harmful eg Wi-Fi systems will make you ill	1

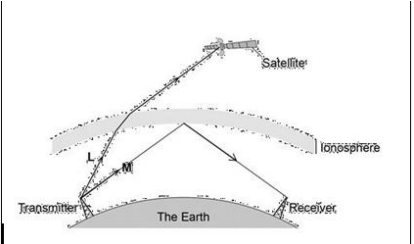
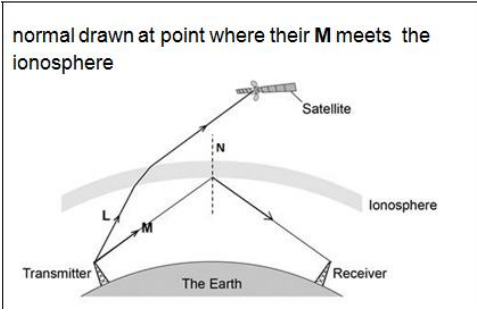
		accept idea that safety issue may worry people accept idea that (more) research may reassure people accept idea of finding out (the truth)	
c)ii)	an opinion		1
Total marks			5

### QUESTION 5

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	$10^{-15}$ metres to $10^4$ metres		1
b)i)	any one from: <ul style="list-style-type: none"> <li>• (TV / video / DVD) remote controls</li> <li>• (short range) data transmission</li> <li>• optical fibre (signals)</li> </ul>	mobile phones is insufficient  accept specific example, eg  linking computer peripherals do not accept Bluetooth	1
b)ii)	0.17	an answer 17 cm gains 3 marks an answer given to more than 2 significant figures that rounds to 0.17 gains 2 marks allow 1 mark for correct substitution, ie $3 \times 10^8 = 1.8 \times 10^9 \times \lambda$	3
Total marks			6

### QUESTION 6

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	microwave		1
a)ii)	refraction		1

<p>b)i)</p>	<p>wave M continues as a straight line to the ionosphere and shown reflected</p> <p>correctly reflected wave shown as a straight line</p> <p>reaching the top of the receiver</p> 	<p>Accept reflection at or within the ionosphere if more than 2 rays shown 1 mark maximum ignore arrows</p>	<p>1</p> <p>1</p>
<p>b)ii)</p>	<p>normal drawn at point where their M meets the ionosphere</p> 		<p>1</p>
<p>c)</p>	<p>any two from:</p> <ul style="list-style-type: none"> <li>• transverse</li> <li>• same speed (through air)</li> <li>• can be reflected</li> <li>• can be refracted</li> <li>• can be diffracted</li> <li>• can be absorbed</li> <li>• transfer energy</li> <li>• can travel through a vacuum</li> <li>• can be polarised</li> <li>• show interference</li> </ul>	<p>accept speed of light or <math>3 \times 10^8</math> m/s</p> <p>an answer travel at the same speed though a vacuum scores 2 marks</p> <p>travel in straight lines is insufficient</p>	<p>2</p>
<p>Total marks</p>			<p>7</p>