

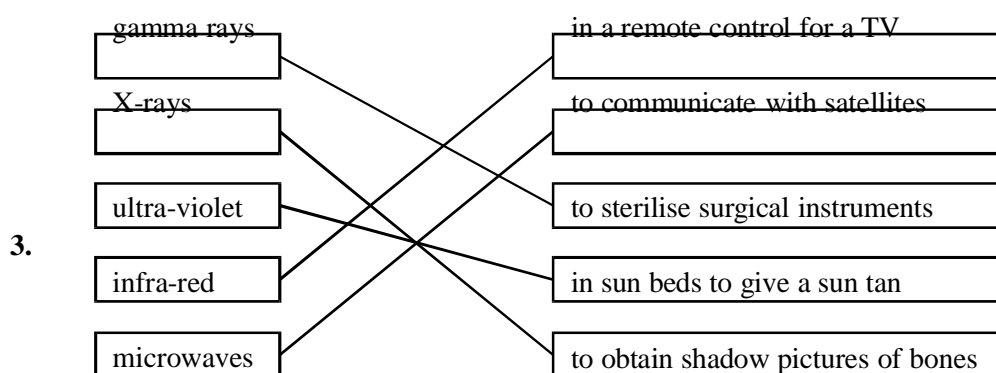
ELECTROMAGNETIC WAVES

1. (a) wavelength increases;
frequency decreases; 2
- (b) Any two from:
1. gamma ray;
2. X-ray;
3. ultraviolet;
4. microwaves; 2
- (c) correct use for named wave;
one mark each correct detail;; 3
- eg microwaves - used to cook food;
- reference to absorption of microwaves;
- causing heating;

[7]

2. (a) infra-red; 1
- (b) heating/cooking/remote control/any appropriate use;
[Answer to this part must be a correct use of the answer given in part (a)] 1

[2]



All four correct - 3 marks
three/two correct - 2 marks
one correct - 1 mark

[3]

4. (a) Any two from:
1. all transverse waves;
2. all travel at the speed of light;
3. can all travel in a vacuum; 2
- (b) (i) red; 1
- (ii) violet/blue; 1
- (c) (i) sun tan/security marking of equipment; 1
- (ii) kill cancerous cells/sterilising medical equipment/
treating cancer; 1

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let - skin cancer;
gamma - radiation/burns/cancer/destroys cells;

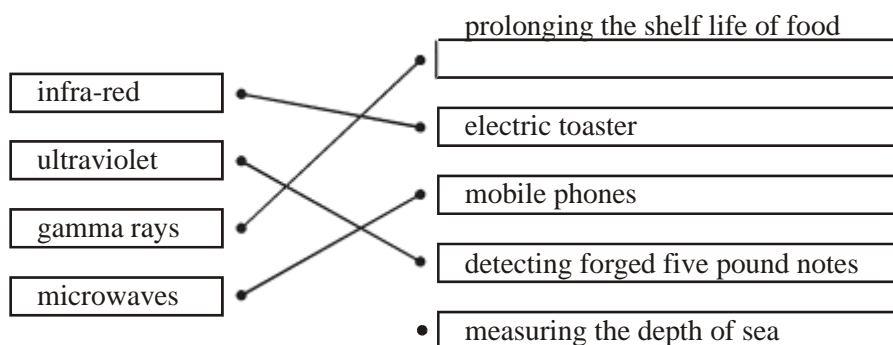
2

[8]

5. (a) (i) microwave; 1
 (ii) ultraviolet; 1
 (iii) looking at broken bones / any **correct** use; 1
 (iv) cell damage / cancer / sterility / damage to unborn babies; 1
 (v) Any two from: 2
 1. transverse;
 2. same speed (in vacuum);
 3. travels in a vacuum;
 [Accept any **correct** wave property]
- (b) at least three waves shown (after the gap);
 diffracted (arc spreading out) – no flat bits;
 no change in wavelength; 3
- (c) **Either** a suggestion to include:
 1. light is not diffracted / light travels in straight lines;
 2. not a wave / a particle;
or a suggestion to include two from:
 1. light is a wave;
 2. wavelength is very small;
 3. gap too large; 2
- plus 1 communication mark for use of a suitable structure and style
 of writing 1

[12]

6.



[Do not credit two lines from one box]

[4]

7. (a) (i) higher the frequency the greater the energy / ORA; 1
 (ii) An explanation to include:
 1. can penetrate body / skin;
 [Allow absorb / enter]
 2. causing effects such as mutations, skin cancer etc /
 ionise the cells / damage cells / tissue; 2
 (iii) as the frequency increases the wavelength decreases; 1
 (may write $v = \lambda \times f$)

- (b) Any two correct statements, for example:
1. ultrasound are sound waves, radio waves are electromagnetic waves;
 2. ultrasound are longitudinal, radio waves are transverse;
 3. radio waves travel at the speed of light, ultrasound are much slower;
[Allow faster than]
 4. radio waves can travel through a vacuum, ultrasound needs a medium;
- [NB **comparison** has to be made]
[Ignore references to uses, wavelength and frequency]

[6]

8. (a) ultraviolet / uv; 1
- (b) gamma (rays) / γ ; 1
- (c) gets longer / increases; reject wider 1
- (d) infra-red (rays) / IR; 1
- (e) An explanation to include three of;
pulses / (radio) / (micro) waves / radar transmitted/
/ sent out / emitted / given off by aerial; [ignore signals]

reflected off the aeroplane; [reject bounces off]
(reflected pulses) received/ detected by the aerial;
time taken (difference) between transmission and
detection (indicates position / flight path of aeroplane)
/some indication of use of time (difference) /angle
(to provide position);
may draw on diagram – possibly 2. 3

[7]

9. (a) refraction towards normal in block; (must emerge at bottom surface)
emergent ray correctly refracted; (approx parallel to incident) 2
- (b) (i) sunbeds/ security marking – detection of forged bank notes/
fluorescent lamps/treatment of skin complaints/ sterilisation of
water/hardening fillings;
IGNORE: uv lamps 1
- (ii) uv higher frequency/visible lower frequency;
uv shorter wavelength/visible longer wavelength;
travel at the same speed; accept labelled diagram 2
- (c) (i) X-rays absorbed stopped/by bone;
pass through/flesh/(soft) tissue/muscle;
IGNORE arm/see through skin etc.
they affect a photographic film/darken photographic plate; 3
- (ii) kills/damages cells/DNA/genes/chromosomes/cause cancer/mutations/
infertility;
ionisation;
IGNORE damages tissue; 1

[9]

- è 10. (a) television remote control to infra-red; 3
loudspeaker to sound; 3
sunbed to ultraviolet; 3
- (b) sound; 1
- (c) ultraviolet; 1
- [5]
-
11. (a) Decreases/goes down/gets less/lower/reduces/OWTEE; 1
- (b) (i) Cooking/heating food/drinks/things/drying 1
flowers/herbs/communications/satellite transmissions/send
signals; 1
(ignore messages)
- (ii) sunbeds/securitymarking/fluorescent lamps/detecting 1
forgeries/hardening fillings in teeth/checking banknotes;
- (iii) sterilising/treating cancer/killing cancer cells/tracing/examining welds; 1
(ignore cleaning surgical instruments)
- (c) Any two from: 2
speed decreases/goes down/gets less/lowers/reduces;
wavelength decreases/goes down/gets less/lowers/reduces;
direction changes/bends/angle changes(accept refraction);
- [6]