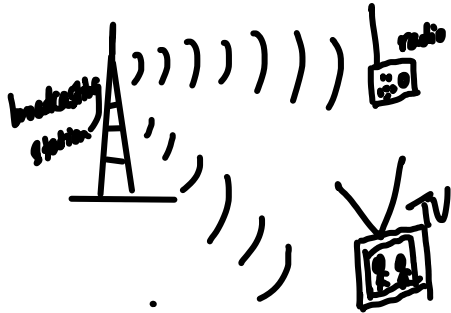


state that all electromagnetic waves are transverse waves that travel with the same speed in vacuo and state the magnitude of this speed

Electromagnetic Waves

Dr K M Hock

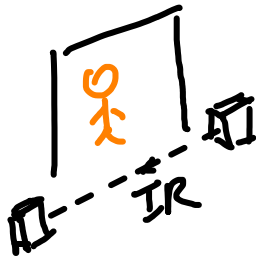
Radio waves



Microwaves



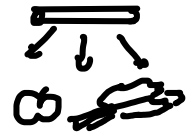
Infra-red



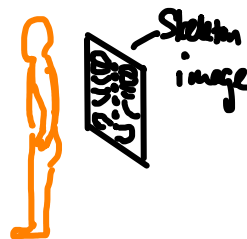
Light



UltraViolet



X-rays



Gamma rays

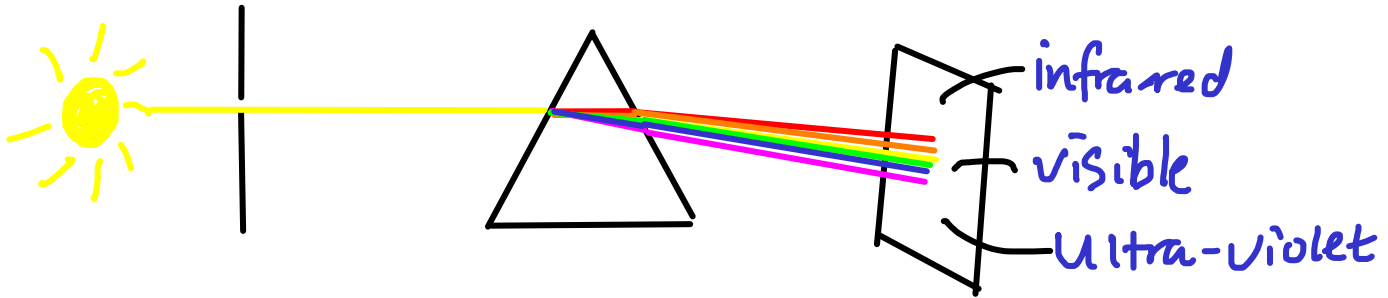



Similarities

All are waves - electric and magnetic in nature
All are transverse electric/magnetic change \perp wave.
All can travel in vacuum.
All travel at same speed = 3×10^8 m/s
(in vacuum)

Electromagnetic Spectrum

Dr K M Hock



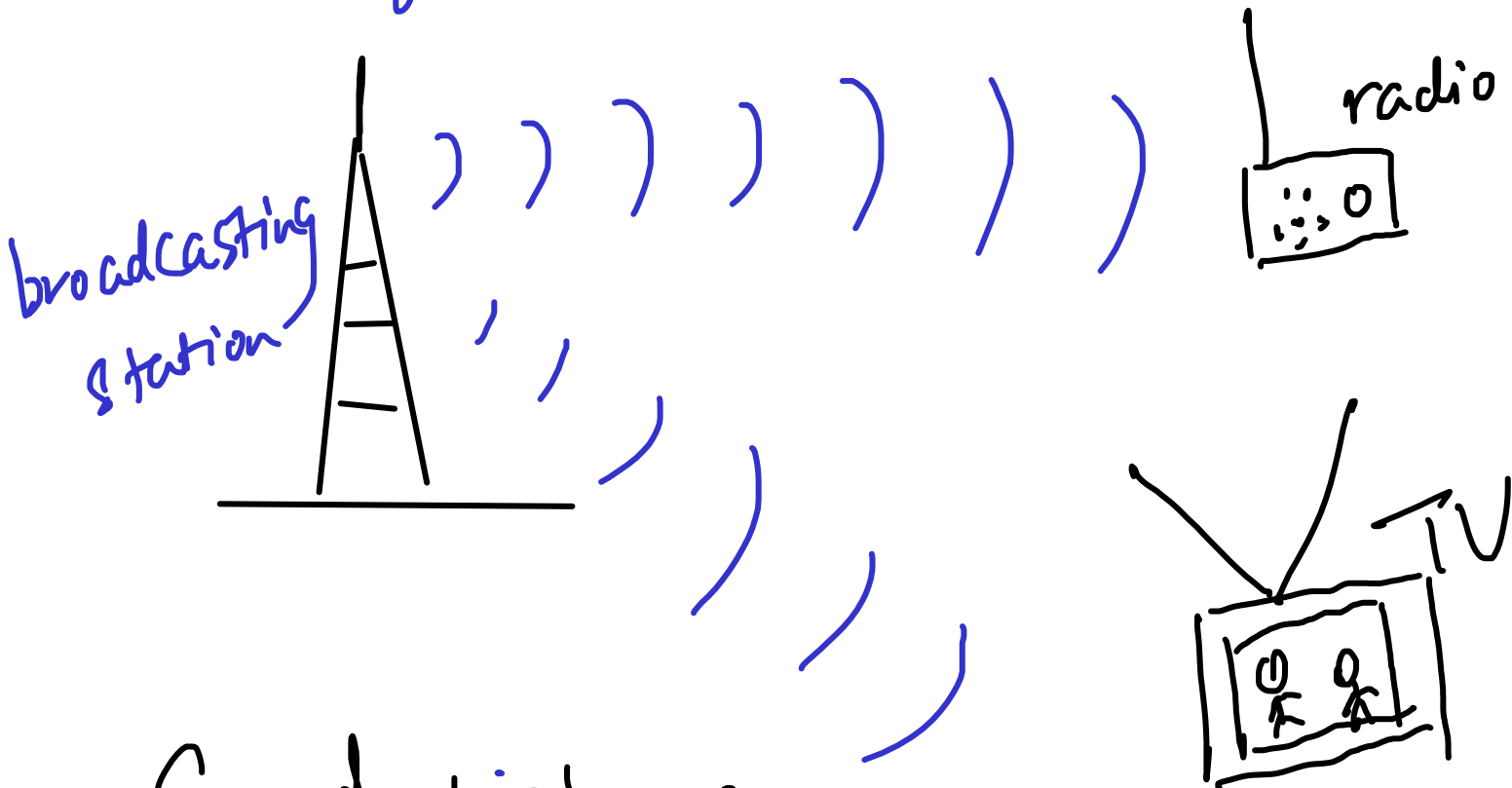
example	frequency	wavelength		uses
	300MHz	1m	radio waves	radio, TV
	3GHz	10cm	microwaves	oven, TV
	3×10^{13} Hz	10 μ m	infra-red	- remote control, alarms
	6×10^{14} Hz	0.5 μ m	 visible	- optical fibres
	3×10^{15} Hz	0.1 μ m		ultra-violet
	3×10^{17} Hz	1nm	X-rays	radiological, engineering
	3×10^{20} Hz	1pm	gamma rays	medical

state examples of the use of the following components:
(i) radio waves (e.g. radio and television communication)

Radio waves

Dr K M Hock

Generated by electric current changing rapidly



Sound, pictures
sent as codes by change
amplitudes/frequencies.

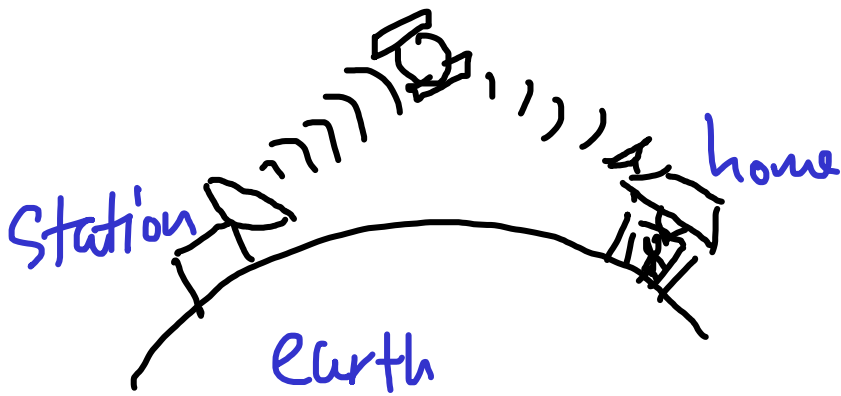
state examples of the use of the following components:

(ii) microwaves (e.g. microwave oven and satellite television)

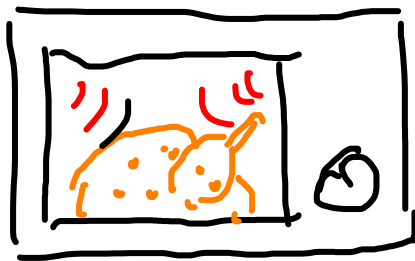
Microwaves

Dr K M Hock

Carries picture and sound signals



Satellite
TV



Microwave
oven

heats up water in food

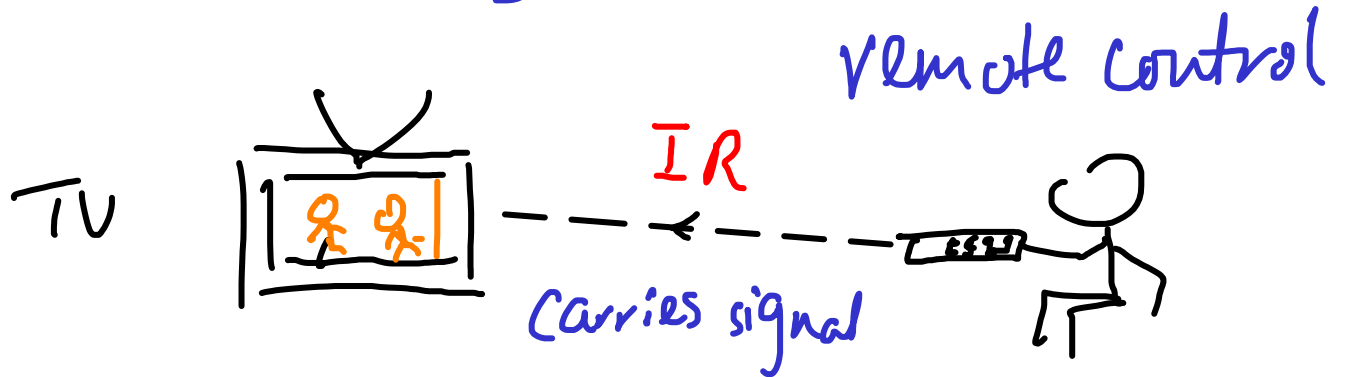
! increases vibration of molecules

state examples of the use of the following components:
(iii) infra-red (e.g. infra-red remote controllers and intruder alarms)

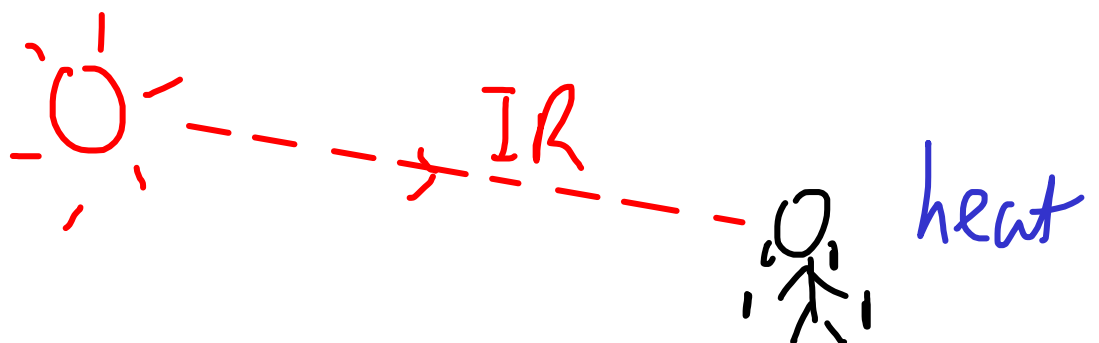
Infra-red

Dr K M Hock

Generated by electronic devices :



Generated by hot objects



state examples of the use of the following components:
(iv) light (e.g. optical fibres for medical uses and telecommunications)

Light

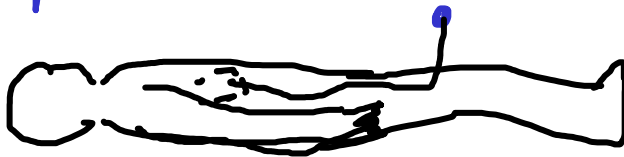
Dr K M Hock

See things:



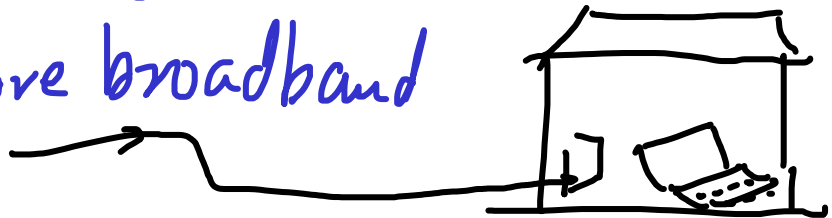
Optical fibres

e.g. Surgery



Telecommunication:

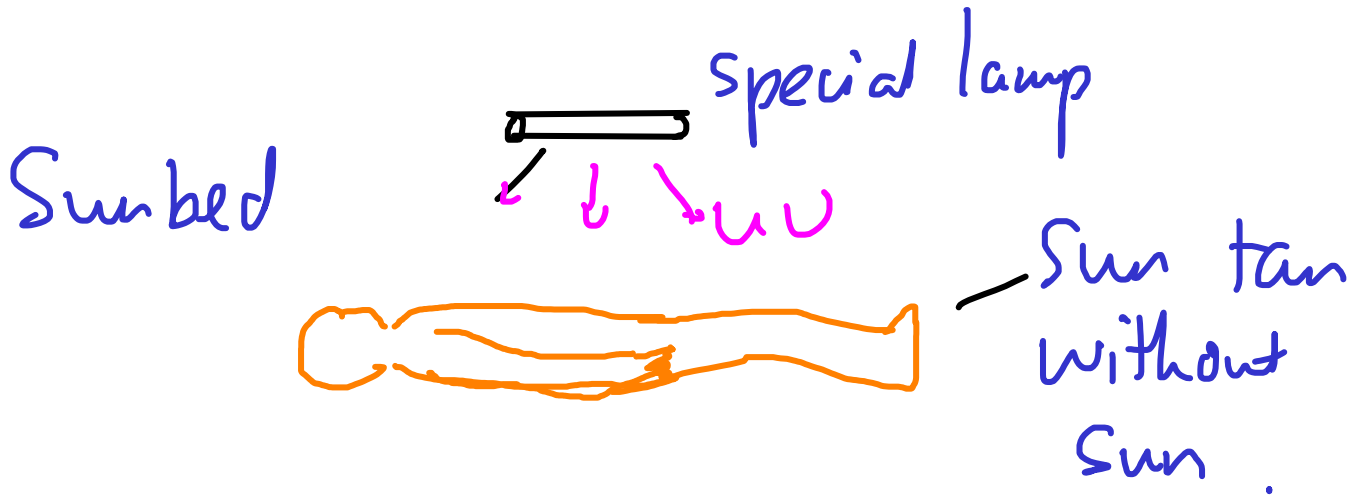
fibre broadband



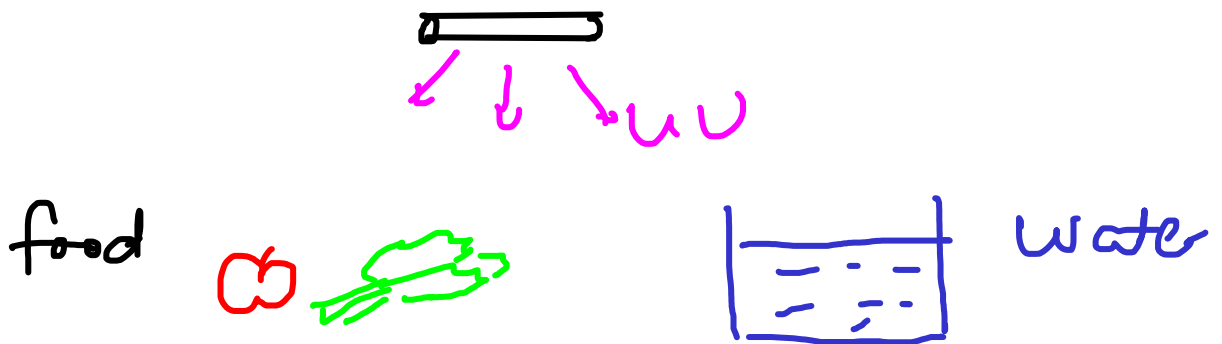
state examples of the use of the following components:
(v) ultra-violet (e.g. sunbeds and sterilisation)

Ultra-violet

Dr K M Hock



Sterilisation



state examples of the use of the following components:
(vi) X-rays (e.g. radiological and engineering applications)

X-rays

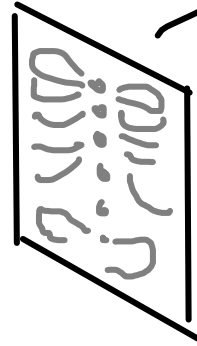
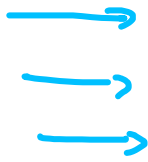
Dr K M Hock

Radiology

special machine



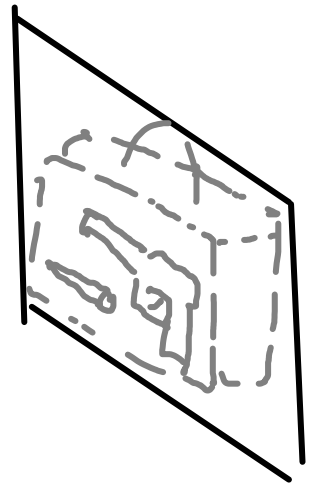
X ray



Skeleton image

Airport security

X-ray

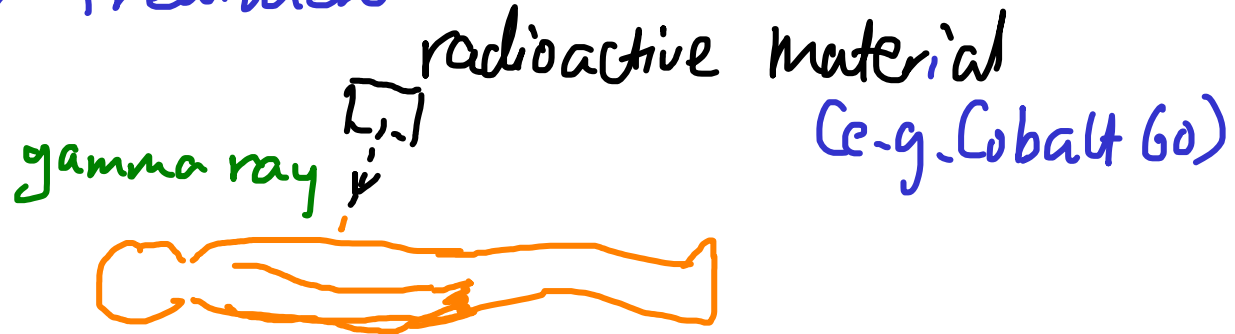


state examples of the use of the following components:
(vii) gamma rays (e.g. medical treatment)

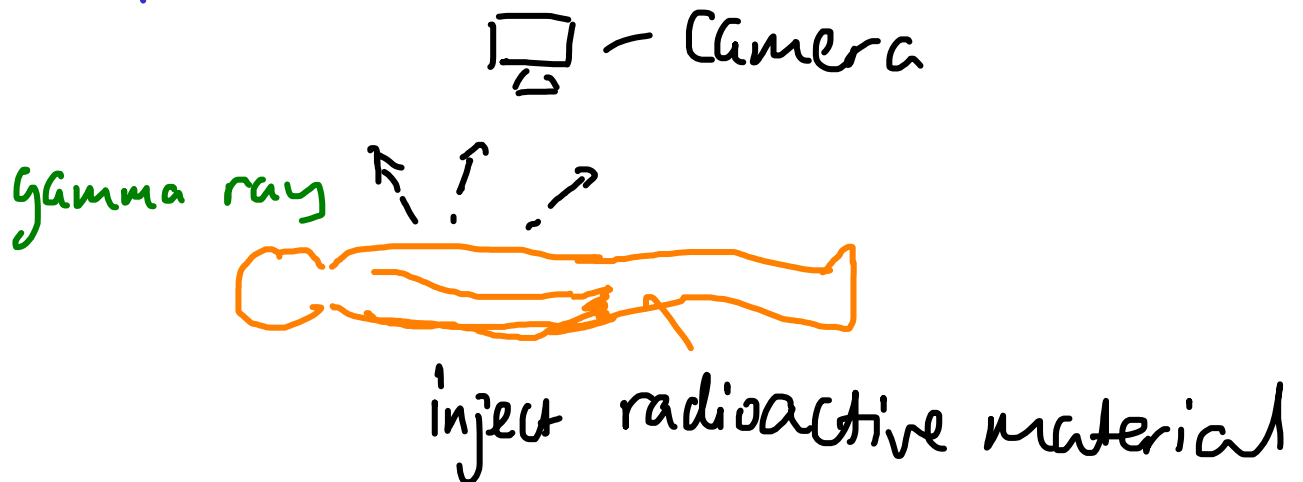
Gamma ray

Dr K M Hock

Cancer treatment



Take pictures of organs.



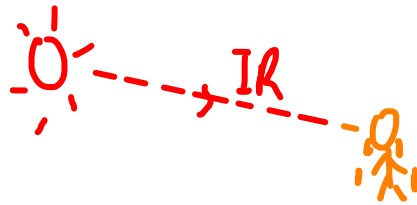
Effects of EM Waves

Dr K M Hock

Heating

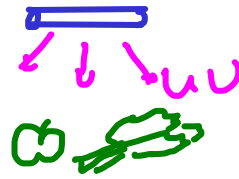


Microwave
→ water molecule vibration



infra-red
→ skin molecules vibration

Ionisation



- removes electrons from molecules
- break up bonds



Tissue damage

good

- kill bacteria
- destroy cancer

bad

- damage healthy tissue
- side effect
- accident.