

MR SULLY UNFOLDS PHYSICS ANSWERS

The electromagnetic spectrum

AQA 4.6.2.1–4.6.2.4
Waves · Paper 2
Foundation & Higher

Name _____ Class _____ Date _____

Electromagnetic waves are transverse waves that transfer energy from a source to an absorber. They all travel at the same speed in a vacuum.

KEY IDEAS

- Order (long → short wavelength): radio, microwaves, infrared, visible, ultraviolet, X-rays, gamma rays.
- All EM waves travel at 3×10^8 m/s in a vacuum. Our eyes only detect visible light.
- UV, X-rays and gamma rays can **harm body tissue**. X-rays and gamma rays are **ionising**: they can cause gene mutations and cancer.

Section A · Recall

Grade 4–5

1 Give one use of each type of EM wave. [7]

Type	Use
Radio	**TV and radio**
Microwaves	**Satellite communications, cooking**
Infrared	**Heaters, cooking, infrared cameras**
Visible light	**Fibre optic communications**
Ultraviolet	**Energy-efficient lamps, sun tanning**
X-rays	**Medical imaging**
Gamma rays	**Medical imaging and treatment**

2 Which type of EM wave has the highest frequency? [1]

Gamma rays

Section B · Explain

Grade 5–6

3 State one hazard of each: ultraviolet; X-rays and gamma rays. [2]

UV: premature skin ageing / increased risk of skin cancer.

X-rays and gamma: mutation of genes / cancer.

4 A radio station broadcasts at 100 MHz. Calculate the wavelength. ($v = 3 \times 10^8$ m/s) [3]

100 MHz = 1×10^8 Hz

$\lambda = v \div f = 3 \times 10^8 \div 1 \times 10^8 = 3$ m

Section C · Stretch

Grade 7+

5 Explain why microwaves are used for satellite communications. (Higher) [2]

Microwaves can pass through the Earth's atmosphere

to reach satellites in space.

6 Explain how radio waves can be used to produce a signal in an aerial. (Higher) [2]

When radio waves are absorbed by the aerial,

they create an alternating current with the same frequency as the wave.

Exam-style question

AQA style

7 X-rays are used in hospitals to take images of broken bones.

a Explain how X-rays can be used to form an image of a bone. [3]

X-rays pass through soft tissue but are absorbed by bone.

A detector behind the patient records where X-rays reach it,

so the bones show up as a shadow.

b Explain why the radiographer stands behind a screen while the X-ray is taken. [2]

X-rays are ionising and can damage cells / cause cancer;

the radiographer is exposed many times a day, so must reduce their dose.

c What is the unit of radiation dose? [1]

The sievert (Sv)

Total: _____ / 23

How confident am I?	Not yet	Nearly	Got it
I can list the EM spectrum in order	☐	☐	☐
I can give uses of each EM wave	☐	☐	☐
I can explain the dangers of ionising EM radiation	☐	☐	☐