Name ..... Class ..... Date .....

Communicate – stay in touch

Specification references:

- P6.1.2 Properties of waves
- P6.2.4 Uses and applications of electromagnetic waves

Aims

Electromagnetic waves are all around us. They are how we communicate over short and long distances.

After completing this worksheet, you should know the order of the parts of the spectrum, some of their properties and how microwaves and radio waves interact with the ionosphere.

Learning outcomes

After completing this activity, you should be able to:

- state that radio waves and microwaves are used in communications through the atmosphere
- identify the position of EM waves in the spectrum in order of wavelength and frequency
- describe the relationship between speed, wavelength and frequency.

Questions

1 The table below shows some parts of the electromagnetic spectrum drawn by a student. The parts of the spectrum and values of the wavelengths are placed **in the wrong order**.

Short wavelength						Long wavelength
microwaves	radio waves	ultraviolet	infrared	gamma rays	X-rays	visible
10^{3} m	10^{-14} m	10^{-10} m	10^{-8} m	10^{-2} m	10^{-6} m	10^{-5} m

a In the table below, place the parts of the electromagnetic spectrum in the correct order. Give the correct wavelengths in the boxes below.

Remember 10^{-14} is smaller than 10^{-10}.

Small wavelength						Long wavelength
						radio waves
						10^{3} m

Name ..... Class ..... Date .....

(*12 marks*)

b i Every part of the electromagnetic spectrum travels at a speed of 3.0×10^8 m/s in a vacuum.

Name **two** other properties common to all electromagnetic waves.

.....

.....

..... (*2 marks*)

ii State which type of electromagnetic wave has the highest energy.

..... (*1 mark*)

iii Radio waves have longer wavelengths than microwaves. Rearrange the following formula and use the numbers in your answer to part **a** above to show that microwaves have a higher frequency than radio waves.

wave speed = frequency × wavelength

.....

.....

..... (*3 marks*)

2 The table gives information about some radio waves and microwaves. The ionosphere is a layer of the Earth's atmosphere which changes constantly in its ability to reflect some radio waves.

Wave name	Frequency range	Effect of ionosphere
microwaves	above 3000 MHz	passes through
ultra-high frequency radio (UHF)	300 – 3000 MHz	passes through
very high frequency radio (VHF)	30 – 300 MHz	reflects
high frequency radio (HF)	2 – 30 MHz	reflects

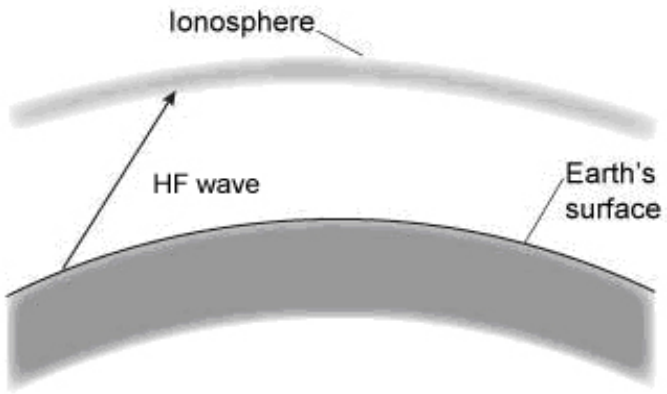
Name ..... Class ..... Date .....

a On the diagram show,

i what happens to the HF radio wave as it hits the ionosphere. (*1 mark*)

ii the position of a satellite used to transmit TV pictures to Earth. (*1 mark*)

iii a microwave travelling from the satellite to the Earth. (*1 mark*)



b Use the table to decide what frequencies can be used to send a signal to the satellite.

.....

c Explain how it is possible to use HF radio to talk to someone on the other side of the Earth.

.....

.....

.....

..... (*3 marks*)

d You are listening to an HF radio programme from another country. Suddenly the signal fades. Explain why this may have happened.

.....

.....

.....

..... (*3 marks*)

Name ..... Class ..... Date .....

e Infrared radiation emitted by the surface does not escape from the Earth. It is absorbed by the atmosphere. Explain the difference between absorption and reflection.

.....

.....

.....

..... (*3 marks*)

f Give two examples of how microwaves are used around the home for communication?

.....

..... (*2 marks*)

Student follow-up

The ozone layer is another layer in the atmosphere. It absorbs some of the Sun's ultraviolet radiation. The ozone layer started to decrease in size some years ago.

What might happen if this continues?

Some people confuse the loss of the ozone layer with greenhouse warming. What is the difference?