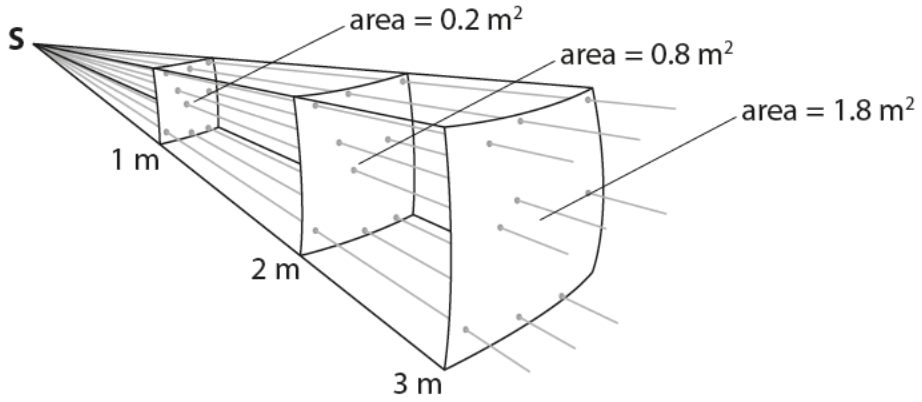
Uses of radiation

1 The diagram shows light from a point source, **S**, spreading out as it gets further from **S**.



(a) The intensity of light passing through the surface which is 1 m from **S** is 2.5 W/m².

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The intensity of light, in W/m², passing through the surface which is 2 m from **S** is

(1)

☒ **A** 2.5

☒ **B** 2.5

☒ **C** 2.5

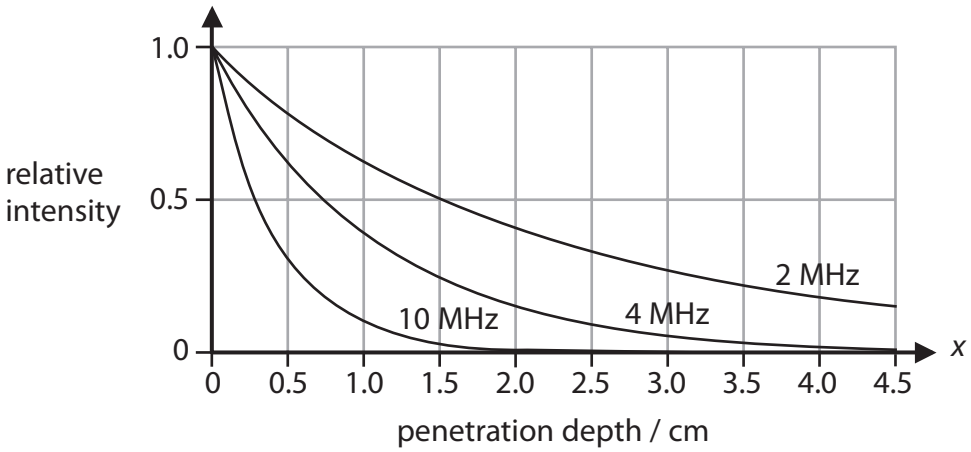
☒ **D** 2.5

(ii) Calculate the power of the light passing through the surface which is 1m from **S**.

(2)

power = ... W

(b) The graph shows how the intensity of ultrasound waves of different frequencies decreases as they penetrate soft tissue.



(i) Estimate how far a 2 MHz wave has penetrated into the soft tissue when its intensity is 25% of its original value.

(1)

penetration depth = ... cm

(ii) Explain which of these frequencies of ultrasound can be used to scan organs deep inside the body.

(2)

.....

.....

.....

.....

*(c) Medical physicists have developed endoscopes and many other devices to help doctors diagnose medical problems.

Compare the use of electromagnetic radiation in endoscopes and in one other diagnostic device.

(6)

(Total for Question 5 = 12 marks)

2 A radioactive source emits three types of ionising radiation

alpha
beta
gamma

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

Radioactive sources emit radiation

(1)

☐ **A** all the time

☐ **B** at regular intervals

☐ **C** every few minutes

☐ **D** only when they are heated

(b) Use words from the box to complete the table.

(3)

atom	en gy	molecu
particle	ce	wave

radiation	type	transfer
alpha	ticle	energy
beta	.....	energy
gamma	.....	.....

(c) State **two** uses of gamma radiation.

(2)

.....

.....

.....

.....

(d) Stars can emit gamma waves and light waves.
Gamma waves and light waves are both parts of the electromagnetic spectrum.

Explain why it takes the same time for both of these waves to travel from the star to a space telescope.

(2)

.....

.....

.....

.....

(Total for Question 2 = 8 marks)

Electromagnetic waves

3 (a) The diagram shows the parts of the electromagnetic spectrum.

radio waves	microwaves	infrared	visible light	ultraviolet	X-rays	gamma rays

(i) Which parts of the electromagnetic spectrum are used for both communication and cooking?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** infrared and microwaves

☐ **B** infrared and radio waves

☐ **C** microwaves and radio waves

☐ **D** radio waves and X-rays

(ii) Fluorescent substances absorb ultraviolet and emit visible light.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Visible light has a

(1)

☐ **A** faster speed than ultraviolet

☐ **B** higher frequency than ultraviolet

☐ **C** lower frequency than ultraviolet

☐ **D** smaller wavelength than ultraviolet

(b) Ultraviolet radiation and infrared radiation are emitted by the Sun and reach the surface of the Earth.

(i) Describe a harmful effect of ultraviolet radiation.

(2)

.....

.....

.....

.....

(ii) Explain why ultraviolet radiation is likely to be more dangerous to humans than infrared radiation.

(2)

.....

.....

.....

.....

*(c) Herschel discovered invisible rays beyond one end of the visible spectrum.
Ritter discovered invisible rays beyond the other end of the visible spectrum.

Compare and contrast the two experiments leading to these discoveries.
You may draw labelled diagrams to help with your answer.

(6)

(Total for Question 6 = 12 marks)

Electromagnetic spectrum

4 (a) The chart shows the electromagnetic spectrum

Most of the parts have been labelled.

gamma rays	X-rays	ultraviolet	visible light		microwaves	

(i) Use words from the box to complete the chart.

(2)

infrared	infrasound	radio waves	seismic waves	ultrasound

(ii) Which part of the electromagnetic spectrum has the highest frequency?

(1)

.....

(b) A special ink is invisible when looked at under normal light.
It glows when ultraviolet radiation is shone on it.

(i) Describe how this ink could be used.

(2)

.....

.....

.....

(ii) State **one** harmful effect of ultraviolet radiation.

(1)

.....

.....

(c) X-rays have many uses.

Describe **one** use for X-rays other than medical uses.

(2)

.....

.....

.....

.....

(Total for Question 1 = 8 marks)