Electromagnetic Waves Uses and Dangers 4

Q:1 Radio waves and microwaves are two types of electromagnetic wave. Both waves:

- can be used for communications
- travel at the same speed through air.

(a) Give two more properties that are the same for both radio waves and microwaves.

1 _____

_____

2 _____

_____

(2 marks)

(b) Some satellites are used to transmit television programmes. Signals are sent to, and transmitted from, the satellites using microwaves.

What is the property of microwaves that allows them to be used for satellite communications?

_____

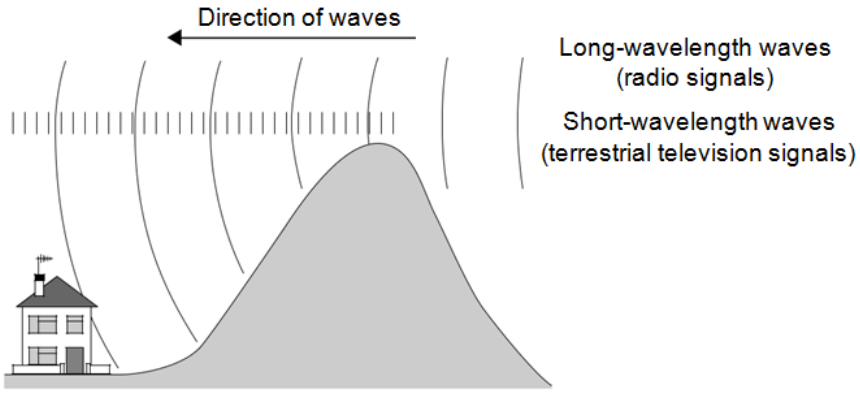
_____

(1 mark)

(c) Terrestrial television does not use satellites.

Terrestrial television signals and radio signals both use radio waves.

Radio signals are transmitted at a longer wavelength than terrestrial television signals.



In hilly areas it may be possible to receive radio signals but not receive terrestrial television signals.

Explain why.

_____

_____

_____

_____

_____

(3 marks)

(d) Electromagnetic waves travel at a speed of $3.0\ 10^8$ m/s

A radio station transmits waves with a wavelength of $2.5\ 10^2$ m

Calculate the frequency of the radio waves.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer and give the unit.

_____

_____

_____

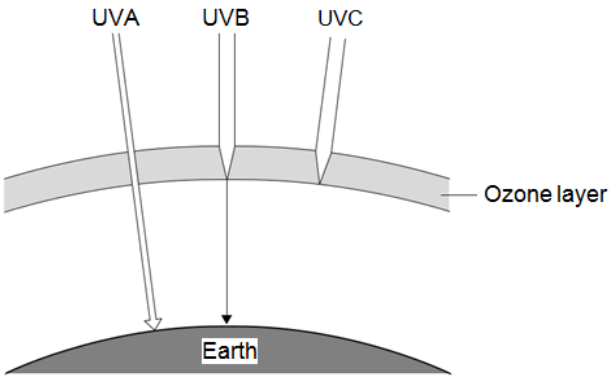
_____

Frequency = _____

(3 marks)

Q:2 When outside, we need to protect our skin and eyes from the harmful effects of ultraviolet (UV) radiation. There are three types of UV radiation.

(a) The diagram shows the effect of the ozone layer on each of the three types of UV radiation. The width of the arrow represents the amount of UV radiation.



(a) (i) Which type of UV radiation will not have a harmful effect on our skin or eyes?

Draw a ring around your answer.

UVA UVB UVC

Give a reason for your answer.

_____

_____

(2 marks)

(a) (ii) The ozone layer above some places on the Earth's surface is very thin.

Explain the effect of a decrease in the thickness of the ozone layer on the risk to health from UV radiation, for people living at these places.

_____

_____

_____

_____

(2 marks)

(b) Scientists have investigated the effect that the type of ground surface has on the amount of UV radiation entering the eye.

Two dummies, each fitted with UV sensors in the eyes, were used to measure the intensity of the UV radiation over the same period of time. The measurements were taken with one dummy facing the Sun, and the other dummy facing away from the Sun.

Measurements were taken in two places, one on a snow-covered area, the other on a sandy beach.

The results of their investigation are given in the table.

Position of the dummy head	Intensity of UV radiation in the snow-covered area in arbitrary units	Intensity of UV radiation in the sandy beach area in arbitrary units
Facing the Sun	650	250
Facing away from the Sun	520	50

(b) (i) What was the independent variable in this investigation?

_____

(1 mark)

(b) (ii) How could the reliability of the data collected in this investigation have been improved?

_____

_____

(1 mark)

(b) (iii) Some of the UV radiation measured by the sensors has been reflected from the surface of the ground.

Which surface is the best reflector of UV radiation, sand or snow?

Draw a ring around your answer. sand snow

Give one reason for your answer.

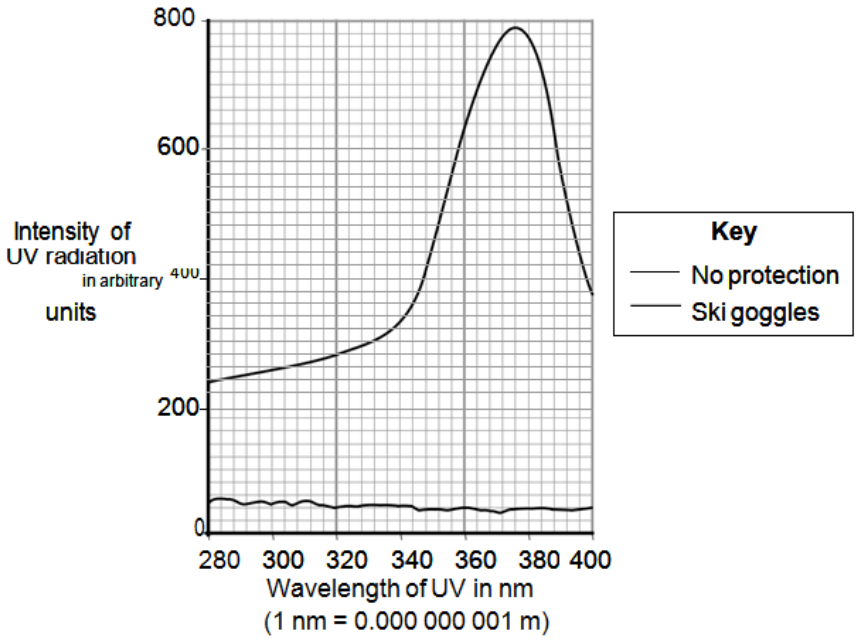
_____

_____

(1 mark)

(c) Ski goggles are designed to block UV radiation. The manufacturer of one brand of ski goggles claims that the goggles block 100 % of all UV radiation. These goggles were tested using UV radiation with a range of different wavelengths.

The results of the test are shown in the graph.



Do the results of the test support the claim made by the manufacturer?

Draw a ring around your answer. Yes No

Explain the reason for your answer.

_____

_____

_____

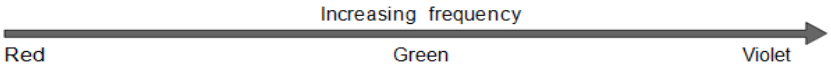
_____

(2 marks)

Q:3 (a) The visible light spectrum has a range of frequencies.

Figure 8 shows that the frequency increases from red light to violet light.

Figure 8



Use the correct answers from the box to complete the sentence.

decreases	stays the same	increases

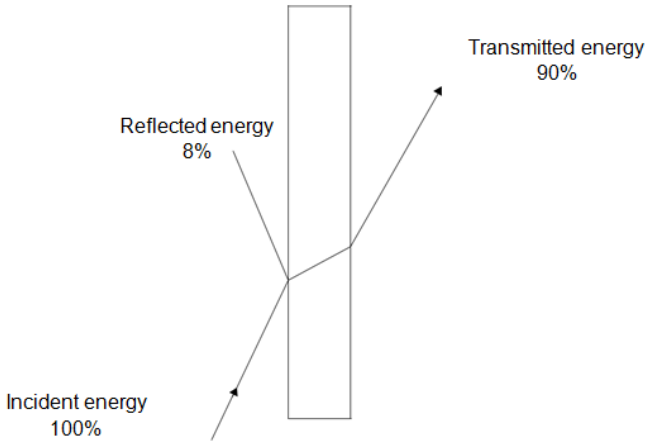
As the frequency of the light waves increases, the wavelength of the light waves

_____ . and the energy of the light waves _____

[2 marks]

(b) Figure 9 shows what happens to the light energy when a ray of light hits a glass block.

Figure 9



What happens to the other 2% of the incident energy?

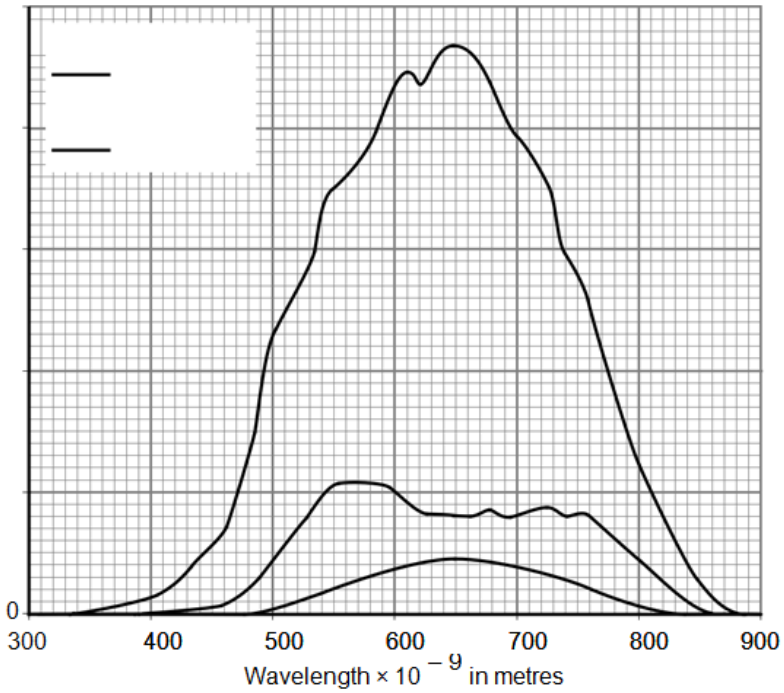
_____

_____

[1 mark]

(c) Bottled beer will spoil if the intensity of the light passing through the glass bottle into the beer is too high.

Figure 10 shows the intensity of the light that is transmitted through three different pieces of glass.



(c) (i) The pieces of glass all had the same thickness. Suggest why.

_____

_____

[1 mark]

(c) (ii) Bottles made of brown glass are suitable for storing beer. Suggest why.

_____

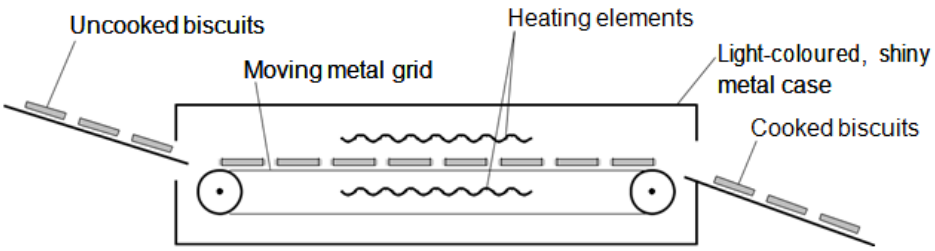
_____

[1 mark]

Q:4 Figure 11 shows one way that biscuit manufacturers cook large quantities of biscuits. The uncooked biscuits are placed on a moving metal grid.

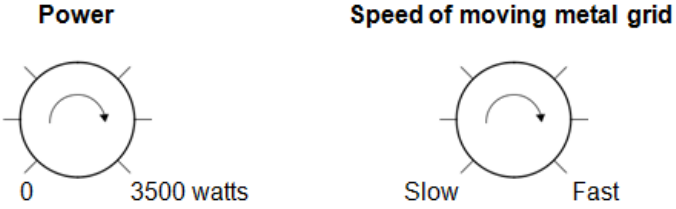
The biscuits pass between two hot electrical heating elements inside an oven. The biscuits turn brown as they cook.

Figure 11



The oven has two control knobs, as shown in Figure 12.

Figure 12



(a) Which type of electromagnetic radiation makes the biscuits turn brown?

_____

[1 mark]

(b) Suggest two ways of cooking the biscuits in this oven, to make them turn browner.

1 _____

_____

2 _____

_____ [2 marks]

(c) The inside and outside surfaces of the oven are light-coloured and shiny. Explain why.

_____

_____

_____

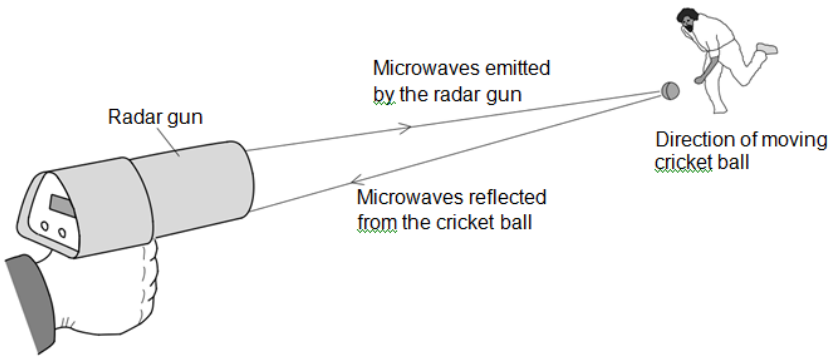
_____

_____

[3 marks]

Q:5 A radar gun is used to determine the speed of a cricket ball during a cricket match. The radar gun emits a beam of microwaves. The microwaves are reflected from the moving ball, as shown in Figure 6.

Figure 6



Comparing the microwaves emitted by the radar gun with the microwaves reflected from the cricket ball enables the speed of the ball to be determined.

(a) What is the name given to the effect used to determine the speed of the cricket ball?

_____

[1 mark]

(b) Compare the wavelength, frequency and speed of the reflected microwaves with the wavelength, frequency and speed of the microwaves emitted by the radar gun.

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_____

_____

_____

_____

[3 marks]

TOTAL MARKS=33