Bees

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

A student correctly estimated the length of a bee.

The length of a bee is about 2.0

(1)

- ☒ **A** mm
- ☒ **B** cm
- ☒ **C** m
- ☒ **D** km

(b) Bees have several colours.

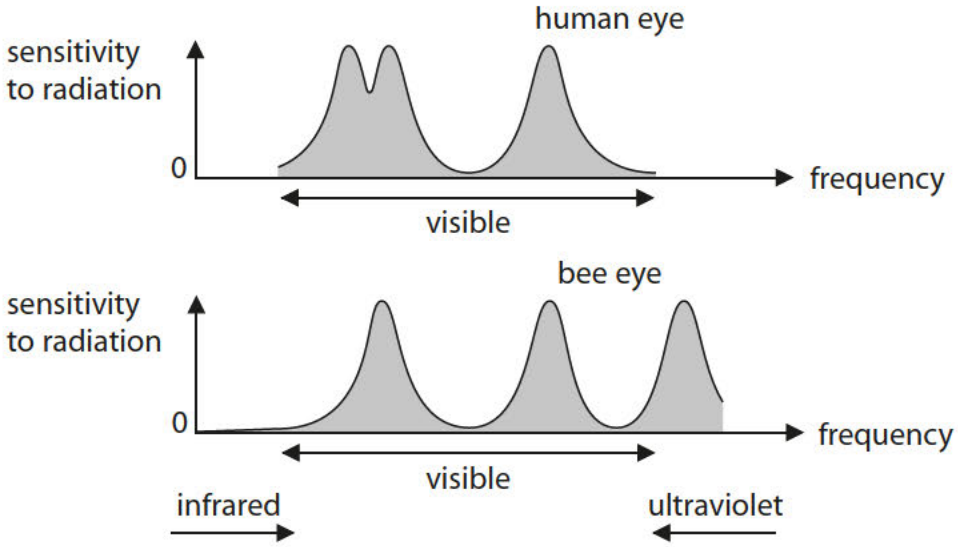
Which of these colours appears in a pure spectrum of visible light?

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

(1)

- ☒ **A** black
- ☒ **B** brown
- ☒ **C** white
- ☒ **D** yellow

(c) The diagrams show the radiations to which the human eye and the bee eye are sensitive.



Describe differences in the sensitivity to radiation of a human eye and a bee eye.

(2)

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

A bee's wings flap up and down with a frequency of 230 Hz.

This is a frequency of

(1)

☐ **A** infrasound

☐ **B** sonar

☐ **C** sound

☐ **D** ultrasound

(e) There is a piece of music called "The Flight of the Bumble Bee."
This takes 4 minutes to play.
During this time, a bee flies 1608 m.

Calculate the average speed of the bee.

(3)

speed ..... m/s

(f) A scientist wrote this sentence:

"*Ultraviolet radiation is harmful to humans but useful to honey bees.*"

Suggest what the scientist means by this sentence. You may wish to look back at the graphs in part (c).

(2)

(Total for Question 4 = 10 marks)

Electromagnetic spectrum

2 (a) The table shows most of the waves in the electromagnetic spectrum.
One type of wave is missing.

gamma rays
.....
ultraviolet
visible light
infrared
microwaves
radio waves

(i) Write the missing wave in the space in the table.

(1)

(ii) State which type of wave can be split into different colours.

(1)

.....

(iii) State which type of wave has the longest wavelength.

(1)

.....

(iv) State **one** type of wave that is ionising.

(1)

.....

(b) The Sun emits all the waves in the electromagnetic spectrum.
Explain why all these waves take the same time to travel to Earth from the Sun.

(2)

*(c) Infrared and ultraviolet waves have different frequencies.
Both types of wave can have harmful effects on human beings.

Describe the harmful effects of infrared and ultraviolet waves, relating them to the frequencies of the waves.

(6)

(Total for Question 5 = 12 marks)

Electromagnetic waves

3 (a) Microwaves and X-rays are both electromagnetic waves.

(i) Which row of the table is correct for microwaves and X-rays in a vacuum?

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

(1)

	their speeds are	their frequencies are
☐ **A**	different	different
☐ **B**	different	the same
☐ **C**	the same	different
☐ **D**	the same	the same

(ii) State **one** harmful effect of X-rays on living matter.

(1)

.....

.....

(b) X-rays are ionising radiation.

(i) State **one** other ionising radiation in the electromagnetic spectrum.

(1)

.....

.....

(ii) State **one** use of an ionising radiation.

(1)

.....

.....

(c) (i) State **one** way in which microwave radiation can be harmful to people.

(1)

.....

.....

The microwaves used in ovens have a frequency of about 2450 MHz.
Mobile phones emit microwaves with a frequency of about 2000 MHz.





Microwave ovens have shielding to protect people from the microwave radiation.

(ii) Suggest why the same shielding is **not** necessary for mobile phones.

(3)

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(Total for Question 1 = 8 marks)

Radioactive sources

4 (a) Cobalt-60 is a radioactive substance.
A nucleus of cobalt-60 contains 27 protons and 33 neutrons.

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

The number of electrons in a neutral atom of cobalt-60 is

(1)

☐ **A** 87

☐ **B** 60

☐ **C** 33

☐ **D** 27

(ii) Cobalt-60 decays by emitting gamma radiation.

Explain what happens to the mass of a cobalt-60 atom when a gamma ray is emitted.

(2)

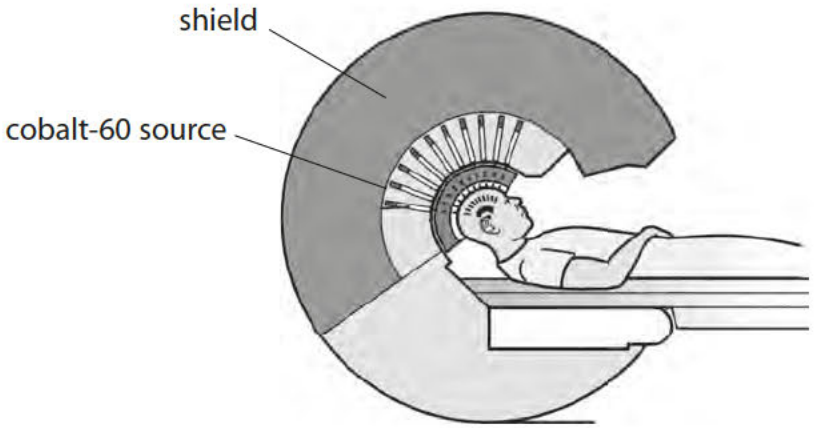
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(b) Gamma radiation from cobalt-60 can be used to destroy tumours.
The diagram shows how gamma radiation is used to destroy a brain tumour.



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

Gamma radiation is used because

(1)

☐ **A** gamma can penetrate further than alpha or beta

☐ **B** gamma is more ionising than alpha or beta

☐ **C** gamma is always safer than alpha or beta

☐ **D** gamma has a shorter half-life than alpha or beta

(ii) Describe what the shield is used for.

(2)

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.....

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.....

(iii) Suggest **two** advantages that this kind of treatment has over other forms of treatment for tumours.

(2)

1 .....

.....

2 .....

.....

(iv) Explain why several beams of gamma radiation are used instead of just one.

(2)

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(Total for Question 4 = 10 marks)

Electromagnetic spectrum

5 The electromagnetic spectrum has many parts.

One of these parts is called visible light.

(a) (i) How many different colours are there in visible light?

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

(1)

☒ **A** five

☒ **B** seven

☒ **C** nine

☒ **D** eleven

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

Three colours of the spectrum of visible light in the correct order are

(1)

☒ **A** green, red, yellow

☒ **B** blue, red, green

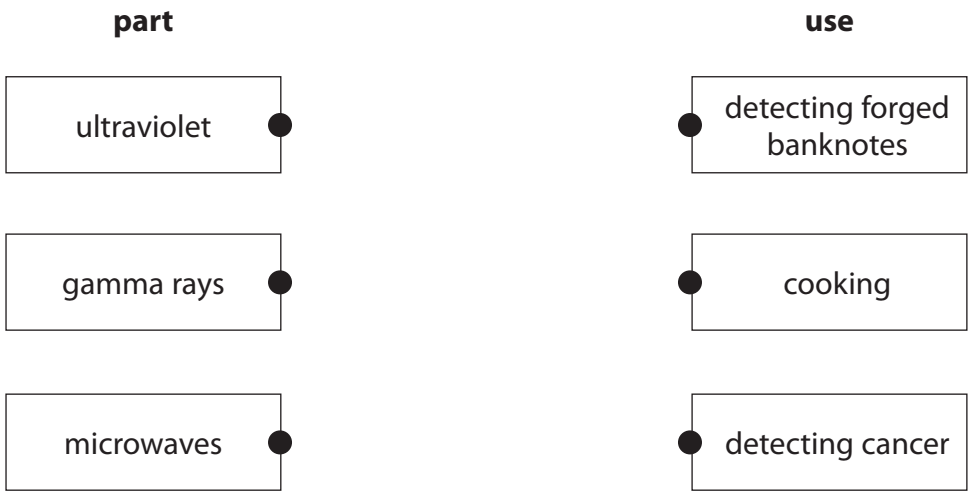
☒ **C** red, orange, yellow

☒ **D** violet, orange, green

(b) Different parts of the electromagnetic spectrum have different uses.

Draw **one** straight line from each part to its use.

(2)



(c) Images of hands can be made using different parts of the electromagnetic spectrum.



Infrared image



X-ray image

Both images give information about a hand.

(i) Suggest what information the infrared image gives about a hand.

(2)

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(ii) Explain why taking an X-ray image of a hand is more dangerous than taking an infrared image.

(2)

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(Total for Question 1 = 8 marks)