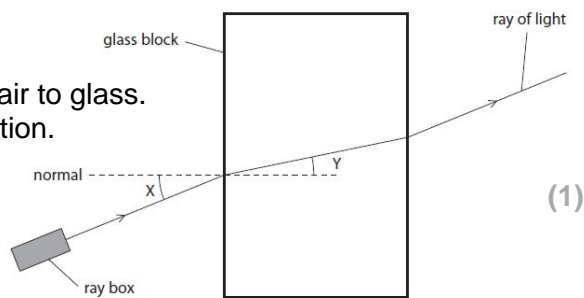


Q1.

A student investigates what happens when light travels from air to glass. Figure 15 shows some of the apparatus used in the investigation.

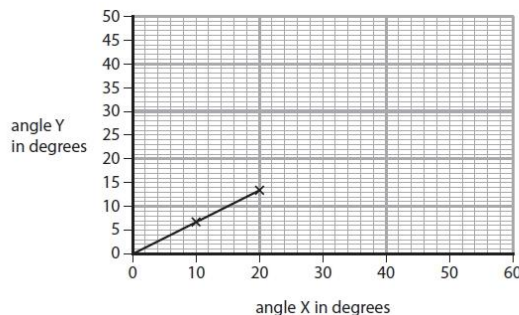
(i) In Figure 15, angle Y is the angle of

- A deflection
- B incidence
- C reflection
- D refraction



(1)

(ii) Figure 16 is a graph of the student's results. Use the graph to calculate a value for



(2)

$$\frac{\text{angle Y}}{\text{angle X}} =$$

(iii) The student concludes that angle Y is directly proportional to angle X. Explain what the student must do to test this conclusion in more detail.

Q2.

Figure 1 shows how the visible spectrum of white light is shown on a screen.

(i) Which of these is the best piece of equipment to produce the white light?

- A ray box
- B ruler
- C measuring cylinder
- D ammeter

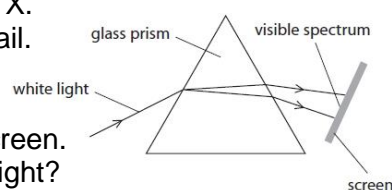


Figure 1

(3)

(1)

(ii) Which colour is seen between yellow and blue in the spectrum on the screen?

- A red
- B orange
- C green
- D violet

(1)

Q3.

A person warms their hands in front of a hot fire as shown in Figure 2. Use words from the box to complete the following sentences.



(Source: © Andreas Saldavs/Shutterstock)

Figure 2

chemical	infrared	radio	thermal	ultraviolet
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(2)

The electromagnetic waves that the fire mostly emits are waves. These waves transfer energy to the hands.

Q4.

Figure 2 shows the main parts of the electromagnetic spectrum.

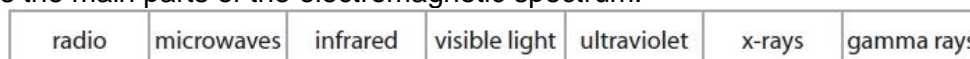


Figure 2

Complete the following sentences using information from Figure 2. Each part of the electromagnetic spectrum may be used once, more than once or not at all.

(i) The part of the electromagnetic spectrum used to detect broken bones is

(1)

(ii) The part of the electromagnetic spectrum used in thermal imaging is

(1)

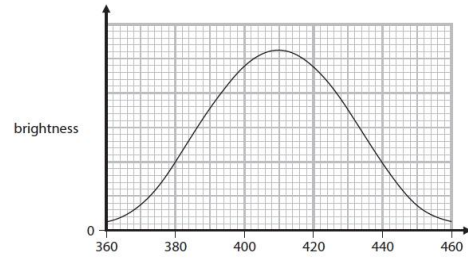
(iii) The part of the electromagnetic spectrum that

- is used to cook food AND • has a shorter wavelength than microwaves is(1)
- (iv) The part of the electromagnetic spectrum that is used to sterilise medical equipment AND has a shorter wavelength than x-rays is(1)

Q5.

Figure 1 shows how the brightness of a source of light changes with wavelength.

Describe how the brightness changes with wavelength.



(2)

Q6.

The electromagnetic spectrum has many parts. One of these parts is called visible light.

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)

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

(2)

Q7.

The electromagnetic spectrum is continuous.

Different regions of the spectrum have different properties.

* Radiation from different regions of the electromagnetic spectrum can affect the human body in many ways.

Discuss the different ways in which excessive exposure to electromagnetic radiations of various frequencies may cause damage to the human body.

(6)

Q8.

Draw one line from each **use of wave** to the matching **electromagnetic wave**.

One line has been drawn for you.

(3)

use of wave	electromagnetic wave
to detect forged banknotes •	radio waves •
to detect broken bones •	microwaves •
for night-vision cameras •	infrared waves •
to sterilise medical equipment •	visible light •
	ultraviolet waves •
	X-rays •
	gamma rays •

Q9.

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.

- A five
- B seven
- C nine
- D eleven

(1)

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

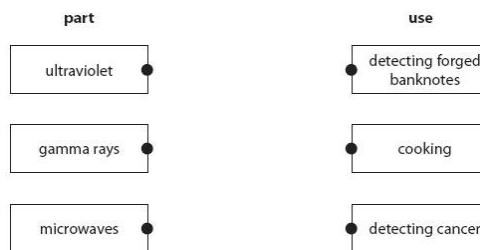
Three colours of the spectrum of visible light in the correct order are

- A green, red, yellow
- B blue, red, green
- C red, orange, yellow
- D violet, orange, green

(1)

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

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



(2)

Q10.

The electromagnetic spectrum is continuous. Different regions of the spectrum have different properties.

(a) (i) Name an electromagnetic wave that is also an ionising radiation.

(1)

(ii) Genuine banknotes contain a special ink. This ink is invisible under normal light.

Suggest why the ink glows when ultraviolet radiation is shone on it.

(2)

(b) An electromagnetic wave has a frequency of 7×10^9 Hz.

The speed of the wave is 3×10^8 m/s.

Calculate the wavelength of the wave.

(3)

*(c) Radiation from different regions of the electromagnetic spectrum can affect the human body in many ways.

Discuss the different ways in which excessive exposure to electromagnetic radiations of various frequencies may cause damage to the human body.

(6)

Q11.

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

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

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

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

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

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

(1)

(1)

(1)

(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)

Q12.
Which of these is correct for all electromagnetic waves in a vacuum? (1)

- A they have the same frequency
- B they have the same wavelength
- C they are transverse waves
- D they are longitudinal waves

Q13.
(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? (1)

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

	their speeds are	their frequencies are
<input type="checkbox"/> A	different	different
<input type="checkbox"/> B	different	the same
<input type="checkbox"/> C	the same	different
<input type="checkbox"/> D	the same	the same

(b) X-rays are ionising radiation. (1)

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

(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)

Q14.
Some television remote controls use infrared radiation and other remote controls use radio waves.
Explain why an infrared remote control may not switch on the television from behind an armchair but a radio wave remote control always will. (2)

Q15.
Mobile phones emit microwaves.
Microwave ovens emit microwaves.
Explain why a mobile phone does not have the same heating effect as a microwave oven. (2)

Q16.
Which colour of visible light has the longest wavelength? (1)

- A blue
- B green
- C red
- D yellow

Q17.

Ultraviolet light has a higher frequency than infrared light.
Which of these colours of visible light has the highest frequency?

(1)

- A blue
- B green
- C orange
- D yellow

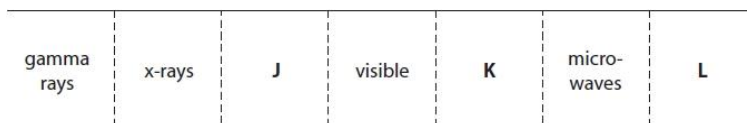


Figure 1

Q18.

Figure 1 shows the parts of the electromagnetic spectrum.

(i) Which row of the table names the parts **J**, **K** and **L** of the electromagnetic spectrum?

(1)

	J	K	L
<input type="checkbox"/> A	infrared	radio	ultraviolet
<input type="checkbox"/> B	radio	infrared	ultraviolet
<input type="checkbox"/> C	ultraviolet	infrared	radio
<input type="checkbox"/> D	ultraviolet	radio	infrared

(ii) All electromagnetic waves can travel in a vacuum.

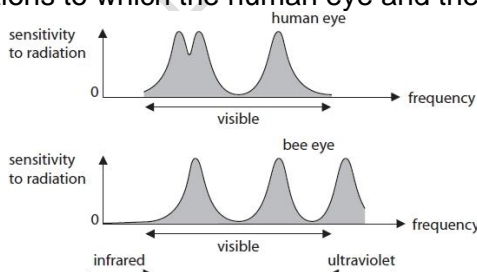
Which of these is the same for all electromagnetic waves travelling in a vacuum?

(1)

- A amplitude
- B frequency
- C speed
- D wavelength

Q19. Q20.

(a) 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)

(b) 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 at the graphs above.

(2)

Q21.

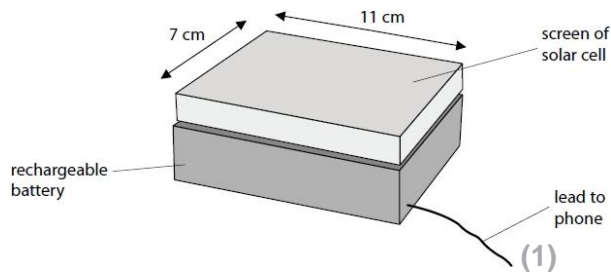
A satellite orbits the Moon.
Radio waves from this satellite transfer

(1)

- A matter only
- B energy and matter
- C information and matter
- D energy and information

Q22.

Figure 1 shows a solar-powered charger for a mobile phone. The screen of the solar cell takes in energy from the Sun. State how energy gets from the Sun to the screen.



Q23.

X-rays can be useful and harmful to humans.

(i) State **one** way that x-rays are useful to humans.

(1)

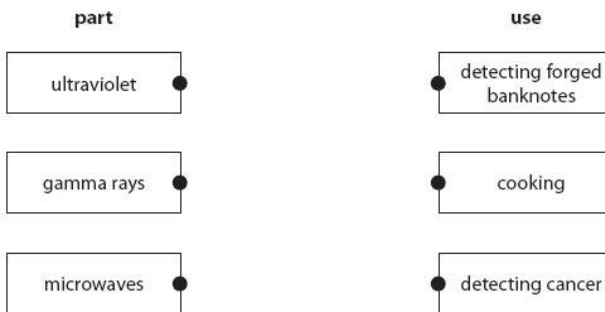
(ii) State **one** way that x-rays are harmful to humans.

(1)

Q24.

Skin cancer can be caused by radiation from the Sun. The radiation that causes skin cancer is

- A ultraviolet radiation
- B radio waves
- C microwaves
- D infrared radiation



(1)

Q25.

The electromagnetic spectrum has many parts. One of these parts is called visible light. Different parts of the electromagnetic spectrum have different uses. Draw **one** straight line from each part to its use.

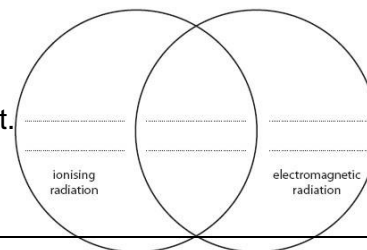
(2)

Q26.

The electromagnetic spectrum is continuous. Different regions of the spectrum have different properties. (i) Name an electromagnetic wave that is also an ionising radiation.

(1)

(ii) Genuine banknotes contain a special ink. This ink is invisible under normal light. Suggest why the ink glows when ultraviolet radiation is shone on it.



(2)

Q27.

The word box contains the names of three types of radiation. gamma rays infrared radiation alpha particles Use this diagram to classify the three types of radiation given in the word box. Write the name of the radiation in the correct section of the diagram.

(2)

Q28..

Too much exposure to ultraviolet radiation may cause

(1)

- A deafness
- B heating of internal body cells
- C damage to the eyes
- D damage to the bone cells

(ii) Three signals, ultraviolet, visible light and infrared, are sent from the surface of the Moon to an orbiting spacecraft. The three signals are sent at the same time. Which of these is correct for the signals arriving at the spacecraft?

(1)

- A the visible light signal arrives first
- B the ultraviolet signal arrives first
- C the infrared signal arrives first
- D all three signals arrive at the same time

(iii) Describe **one** use of ultraviolet radiation.

(2)

Q29.

(i) Use words from the box to complete the sentences below about ions.

absorbing	gaining	inner	losing	outer
-----------	---------	-------	--------	-------

Atoms may form positive ions by electrons. (2)

The electrons involved in forming positive ions are the electrons.

(ii) Which of these radiations is both electromagnetic and ionising? (1)

- A alpha
- B beta minus
- C gamma
- D neutron

(iii) Which type of radiation will travel the shortest distance in air? (1)

- A alpha
- B beta minus
- C beta plus
- D gamma

Q30.

Describe a use of gamma radiation. (2)

Q31. Q32.

The electromagnetic spectrum has many parts.

One of these parts is called visible light.

(i) How many different colours are there in visible light? (1)

- A five
- B seven
- C nine
- D eleven

(ii) 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

$$\text{frequency} = \frac{\text{speed}}{\text{wavelength}}$$

Q33.

The speed of light is 3.0×10^8 m/s.

The wavelength of yellow light is 5.8×10^{-7} m.

(i) Give **one** colour of light that has a longer wavelength than yellow light. (1)

(ii) Give **one** colour of light that has a higher frequency than yellow light. (1)

Q34.

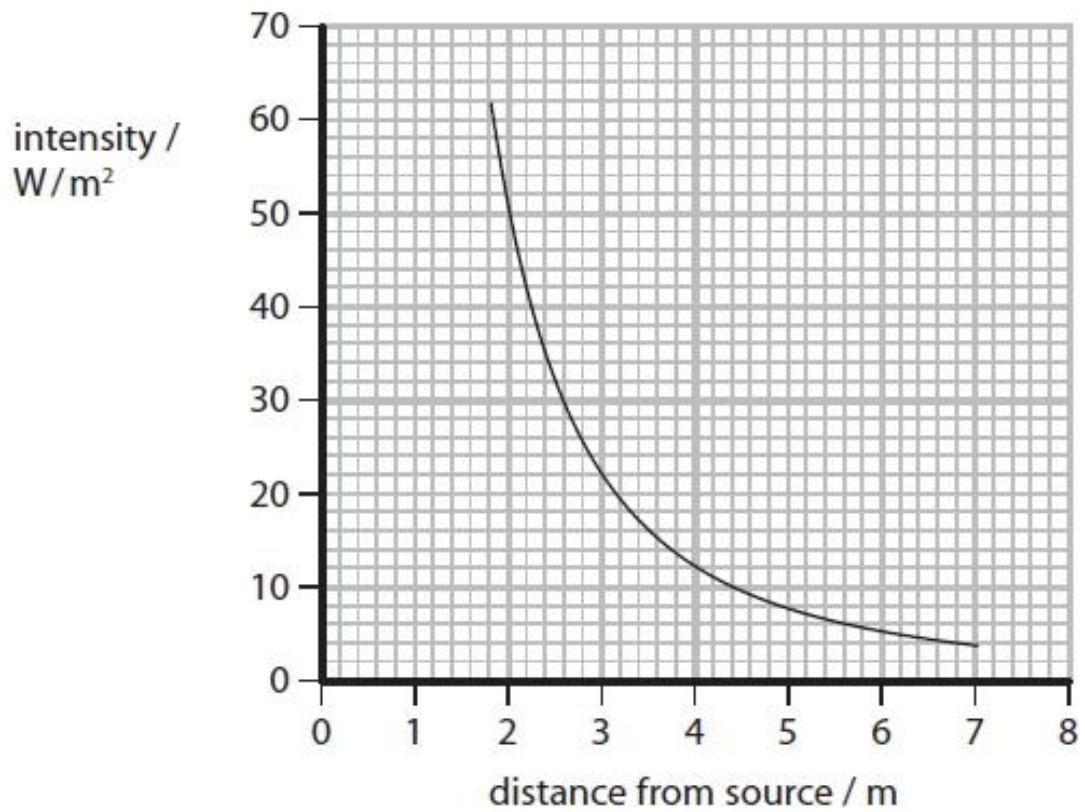
X-rays are electromagnetic radiation.

(a) The graph shows how the intensity of electromagnetic radiation changes with distance from the source.

(i) State the intensity when the distance from the source is 2m. (1)

$$\text{intensity} = \frac{200}{(\text{distance})^2}$$

(ii) The equation linking the intensity of this radiation to the distance from the source is
Calculate the intensity when the distance is 0.9 m. (3)



(b) X-rays have many uses.

Which of the following uses X-rays?

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

- A CAT scan
- B endoscope
- C pulse oximeter
- D ultrasound scan

(1)

(c) State one harmful effect of X-rays.

(1)

Q35