Questions are for both separate science and combined science students unless indicated in the question

Q1.

A group of stars is called a galaxy. **(Physics only)**

(a) What is the name of our galaxy?

Tick (✓) **one** box.

Black Eye	☐
Hockey Stick	☐
Milky Way	☐
Sculptor Dwarf	☐

(1)

(b) The Sun is one of the stars in our galaxy.

What was the Sun originally formed from?

Tick (✓) **one** box.

Dust and gas	☐
Heavy elements	☐
Oxygen	☐

(1)

(c) Which of the following forces was involved in the formation of the Sun?

Tick (✓) **one** box.

Electrostatic force ☐

Gravitational force ☐

Magnetic force ☐

(1)

(d) Stars produce light because they release energy.

Complete the sentence.

Choose the answer from the box.

combustion	**conduction**	**fusion**

The process which releases energy inside stars is _____

(1)

(e) Visible light and infrared radiation travel from the Sun to the Earth.

Which statement describes the time taken for visible light and infrared radiation to travel from the Sun to the Earth?

Tick (✓) **one** box.

Visible light takes less time than infrared radiation ☐

Visible light takes the same time as infrared radiation ☐

Visible light takes more time than infrared radiation ☐

(1)

(f) Infrared radiation has a longer wavelength than visible light.

Complete the sentence.

Choose the answer from the box.

smaller	**the same**	**greater**

Compared with the frequency of infrared radiation, the frequency of visible light is _____ .

(1)

(g) The Sun and the Earth both emit infrared radiation.

How does the rate of infrared radiation emitted by the Sun compare with the rate of infrared radiation emitted by the Earth?

Give a reason for your answer.

Tick (✓) **one** box. **(Physics only)**

Lower rate than the Earth ☐

Same rate as the Earth ☐

Greater rate than the Earth ☐

Reason _____

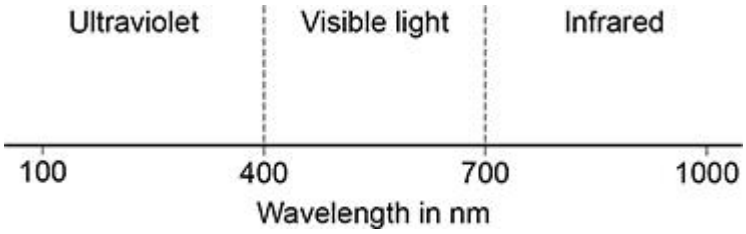
_____

(2)

(Total 8 marks)

Q2.

The figure below shows the wavelengths of some types of electromagnetic radiation. **(Physics only)**



(a) Suggest **one** piece of equipment that can be used to detect infrared radiation.

_____

(1)

(b) Which of the following values is a wavelength of red light?

Tick (✓) **one** box.

320 nm ☐

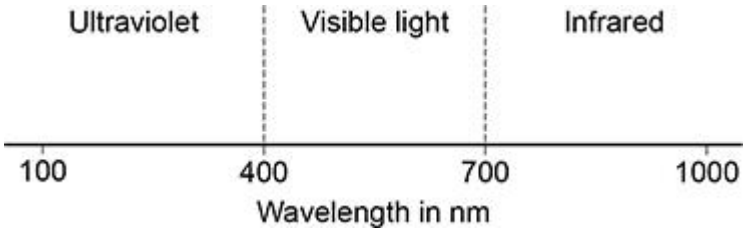
410 nm ☐

690 nm ☐

750 nm ☐

(1)

The figure above is repeated below.



(c) The eyes of a bee can detect electromagnetic radiation with wavelengths between 300 nm and 600 nm.

Give **two** ways the radiation detected by the eyes of a bee is different from the radiation detected by human eyes.

1 _____

_____

2 _____

_____

(2)

(d) Complete the sentences.
Choose the answers from the box.

absorbed	**emitted**	**reflected**	**refracted**

When sunlight shines on a red flower, the red light is _____.

All other colours of light shining on the red flower are _____.

(2)

(e) A gardener looks at a red flower through a green filter.

How does the flower appear to the gardener?

Tick (✓) **one** box.

Black ☐

Green ☐

Red ☐

White ☐

(1)

(f) The leaves of the plant reflect light.

The leaves have a rough surface.

What type of reflection happens at the leaf surface?

_____

(1)

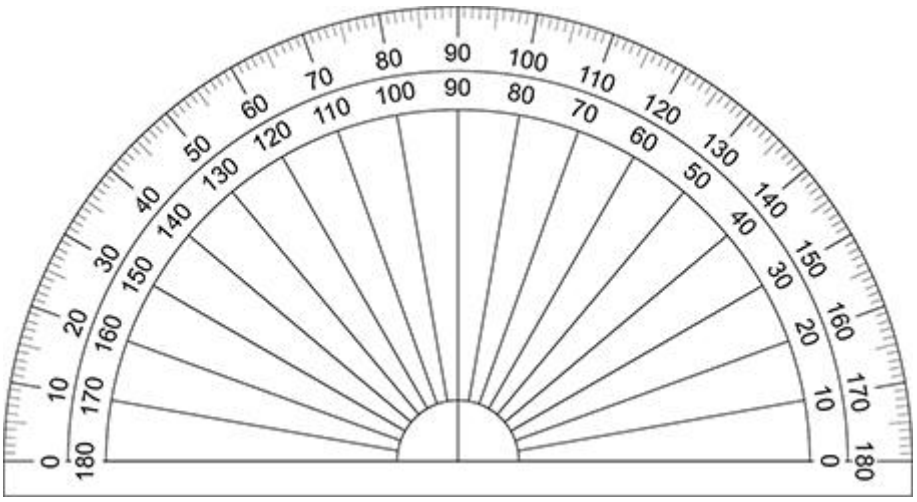
(Total 8 marks)

Q3.

A student investigated the refraction of light by a glass block. **(Physics only)**

Figure 1 shows the protractor used to measure the angles of incidence and the angles of refraction.

Figure 1



(a) What is the resolution of the protractor used to measure the angles?

Resolution = _____ °

(1)

Table 1 shows the results.

Table 1

Angle of incidence in degrees	Angle of refraction in degrees
10	6
20	12
30	18
40	23
50	28
60	32

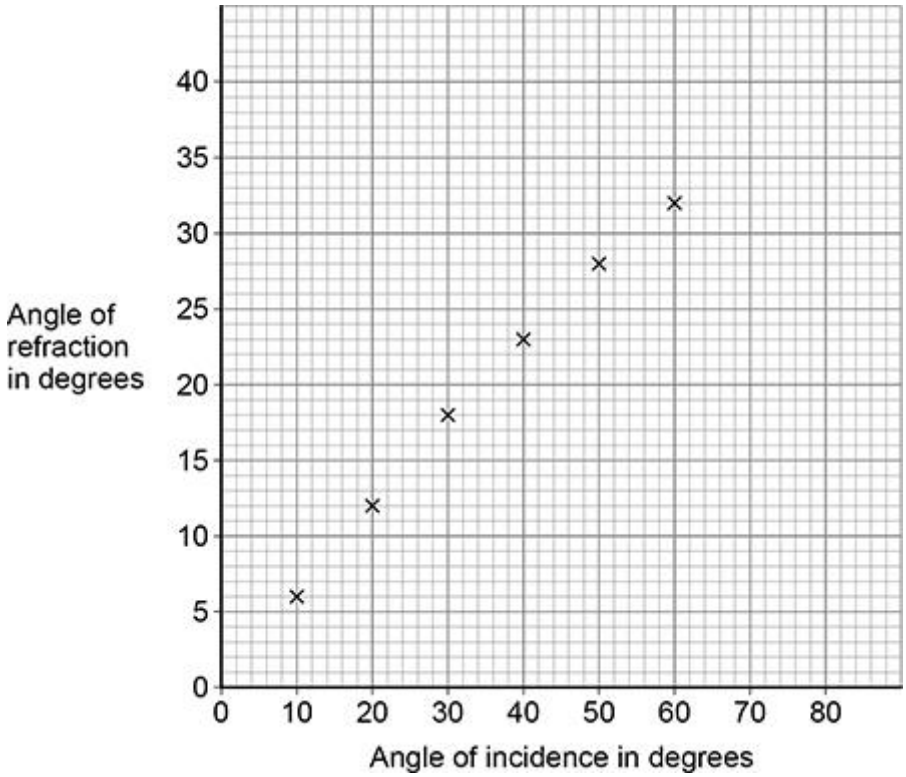
(b) Describe a method the student could have used to obtain the data in **Table 1**.

You may include a labelled diagram.

(6)

Figure 2 shows some of the results.

Figure 2



The student measured the angles of refraction for two additional angles of incidence.

Table 2 shows the additional results.

Table 2

Angle of incidence in degrees	Angle of refraction in degrees
70	35
80	37

(c) Complete **Figure 2**.

You should:

- plot the results from **Table 2**
- draw the line of best fit.

(2)

(d) How does **Figure 2** show that the angle of refraction is **not** directly proportional to the angle of incidence?

_____

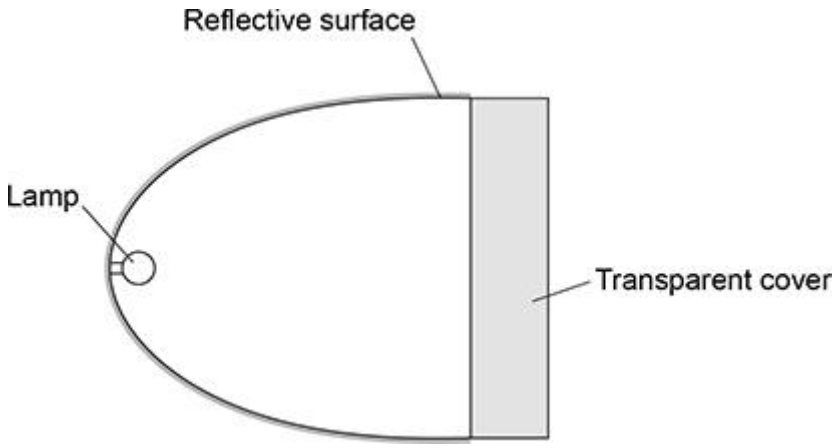
_____

(1)

Figure 3 shows a diagram of a car headlight.

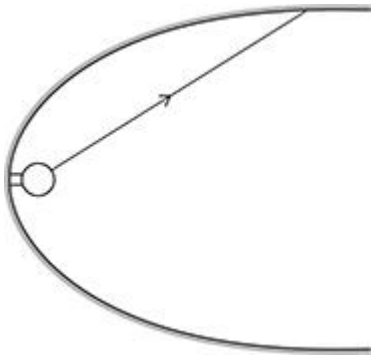
The headlight has a lamp, a reflective surface and a transparent cover.

Figure 3



(e) **Figure 4** shows a ray of light incident on the reflective surface.

Figure 4



Complete **Figure 4** to show the reflected ray of light.

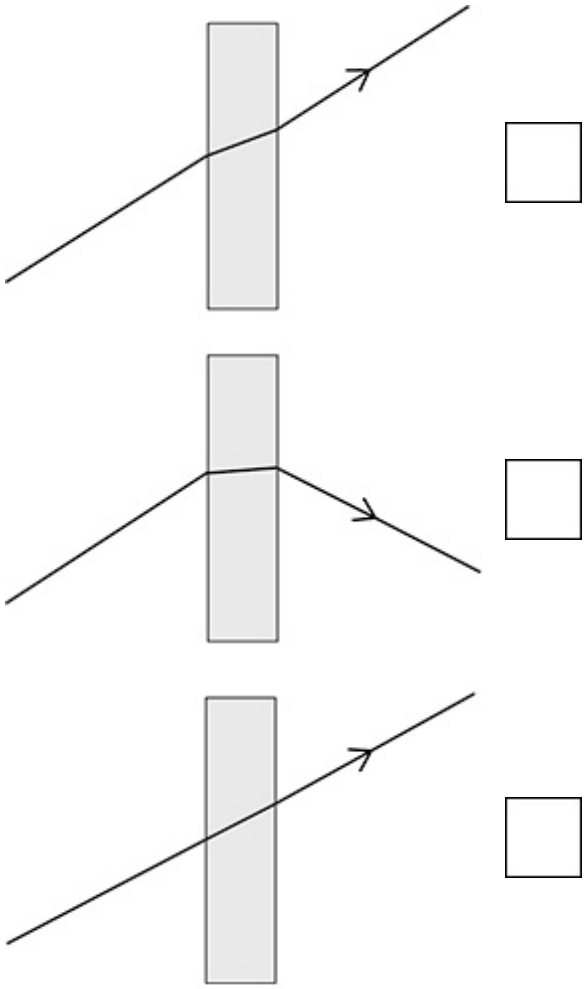
You should include the normal line at the point where the incident ray meets the reflecting surface.

(2)

(f) Rays of light pass through the transparent cover of the headlight.

Which diagram shows how a ray of light passes through the transparent cover?

Tick (✓) **one** box.



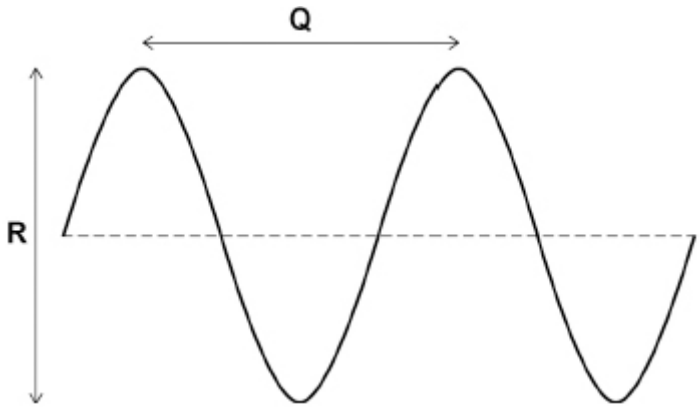
(1)

(Total 13 marks)

Q4.

Electromagnetic waves are transverse.

The figure below represents a transverse wave.



(a) Which of the following gives the wavelength of the transverse wave?

Tick (✓) **one** box.

wavelength = $\frac{Q}{2}$ ☐

wavelength = Q ☐

wavelength = 2 Q ☐

(1)

(b) Which of the following gives the amplitude of the transverse wave?

Tick (✓) **one** box.

amplitude = $\frac{R}{2}$ ☐

amplitude = R ☐

amplitude = 2 R ☐

(1)

(c) Microwaves are electromagnetic waves used for mobile phone communications.

Which other type of electromagnetic wave is also used for communications?

Tick (✓) **one** box.

Radio waves	☐
Ultraviolet	☐
X-rays	☐

(1)

(d) Microwaves from a mobile phone take 0.000 009 s to reach a mobile phone mast.

speed of microwaves = 300 000 000 m/s

Calculate the distance between the mobile phone and the mobile phone mast.

Use the equation:

distance = speed × time

_____

_____

_____

Distance = _____ m

(2)

(e) Mobile phone communications is only one of the uses for microwaves.

Give **one** other use of microwaves.

_____

_____

(1)

(Total 6 marks)

Q5.

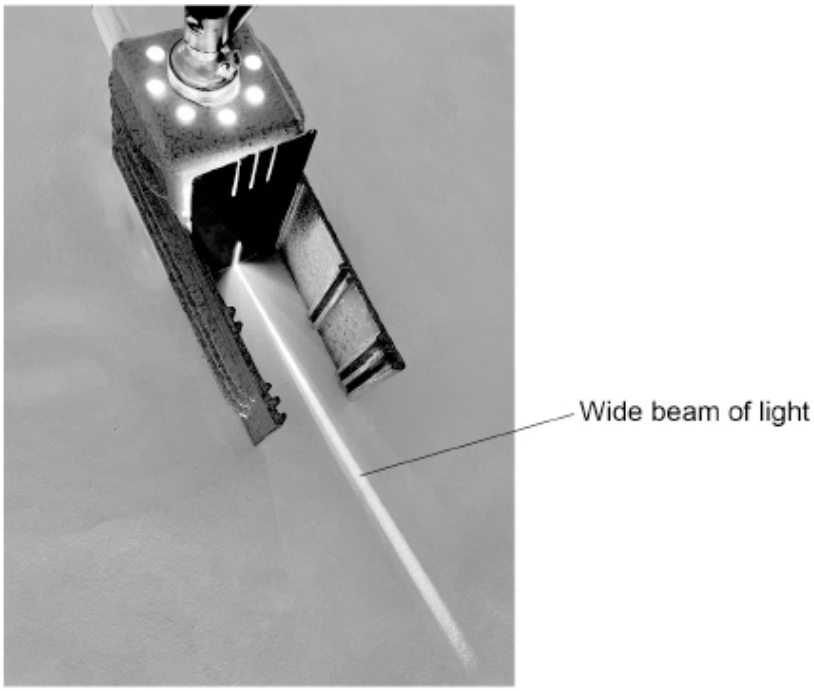
A student investigated the refraction of light through a glass block.

Figure 1 shows the ray box used.

The student aimed the beam of light from the ray box towards a glass block.

The student measured the angle of incidence at the point where the light entered the glass block. **(Physics only)**

Figure 1



The student placed a red filter in front of the white beam of light.

Only red light passes through the filter.

(a) Complete the sentence.

When white light is incident on the red filter, all colours except for red are

_____ by the filter.

(1)

Use the Physics Equations Sheet to answer parts (f) and (g).

(b) Write down the equation which links frequency (*f*), wave speed (*v*) and wavelength (*λ*).

_____

(1)

(c) Light has a wave speed of 3.0×10^8 m/s in air.

The frequency of the red light is 4.0×10^{14} Hz.

Calculate the wavelength of the red light in air.

_____

_____

_____

_____

_____

Wavelength = _____ m

(3)

(Total 5 marks)

Q6.

Ultraviolet and visible light are both parts of the electromagnetic spectrum.

(a) How does the speed of ultraviolet in a vacuum compare to the speed of visible light in a vacuum?

Tick (✓) **one** box.

Ultraviolet travels at a faster speed than visible light. ☐

Ultraviolet travels at a slower speed than visible light. ☐

Ultraviolet travels at the same speed as visible light. ☐

(1)

(b) **Figure 1** shows parts of the electromagnetic spectrum.

Figure 1

Radio waves	**A**	**B**	**C**	**D**	**X-rays**	**Gamma rays**

Which letters represent the positions of ultraviolet and visible light in the electromagnetic spectrum?

Ultraviolet _____

Visible light _____

(2)

(c) **Table 1** shows the range of wavelengths for different types of ultraviolet.

Table 1

Type	Range of wavelength in nanometres
Ultraviolet **A** (UVA)	315–400
Ultraviolet **B** (UVB)	280–315
Ultraviolet **C** (UVC)	100–280

Determine which type of ultraviolet shown in **Table 1** has the largest range of wavelengths.

To gain full marks you must calculate the range of wavelengths for each type of ultraviolet.

_____

_____

_____

_____

Type of ultraviolet with the largest range of wavelengths

_____

(3)

Figure 2 shows how different types of ultraviolet are absorbed by the ozone layer in the Earth's atmosphere.

Table 2 shows the relative ionising power from each type of ultraviolet.

Figure 2

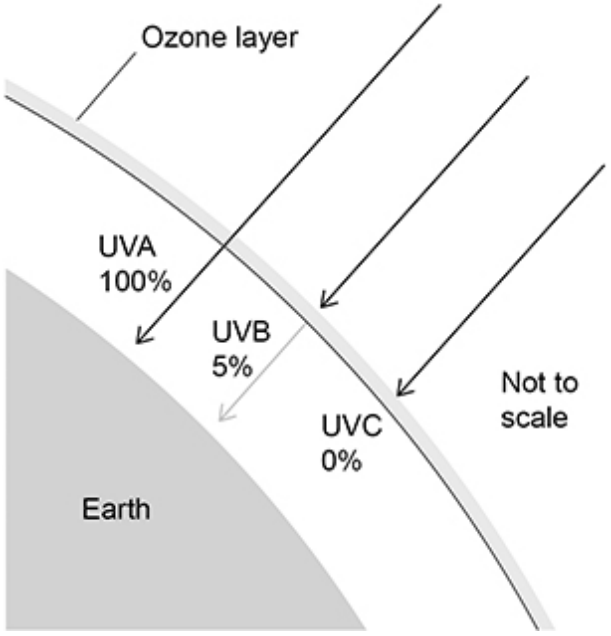


Table 2

Type	Relative ionising power
UVA	Low
UVB	Medium
UVC	High

(d) Explain the importance of the ozone layer in reducing the risk to people from all types of ultraviolet.

Use **Figure 2** and **Table 2**.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(e) The Sun emits visible light.

A student concludes that visible light is **not** absorbed by the ozone layer.

Give **one** piece of evidence that shows the student's conclusion is correct.

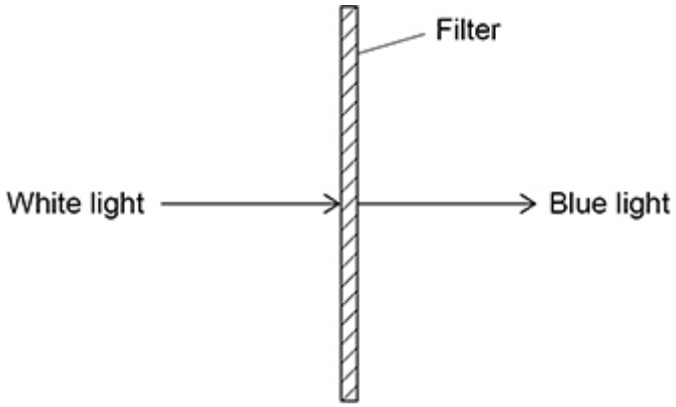
_____

_____

(1)

(f) **Figure 3** shows white light incident on a colour filter. **(Physics only)**

Figure 3



Complete the sentence.

Choose the answers from the box.

absorbed	**radiated**	**reflected**	**refracted**	**transmitted**

When white light is incident on the filter, only blue light is _____

and all other colours of light are _____.

(2)

(Total 13 marks)