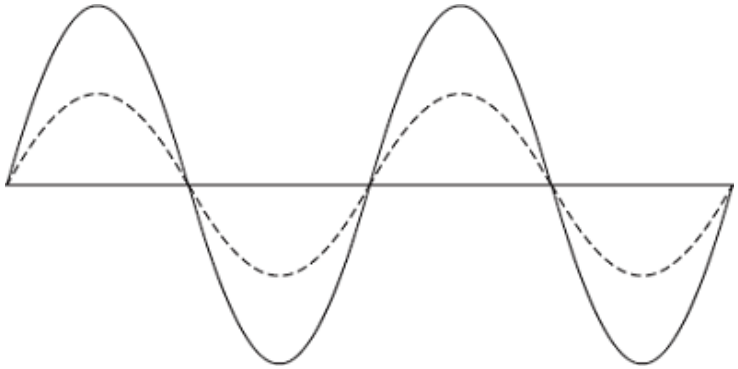
Q1. (a) **Diagram 1** shows two waves.

Diagram 1



(i) Name **one** wave quantity that is the same for the two waves.

.....

(1)

(ii) Name **one** wave quantity that is different for the two waves.

.....

(1)

(iii) The waves in **Diagram 1** are transverse.

Which **one** of the following types of wave is **not** a transverse wave?

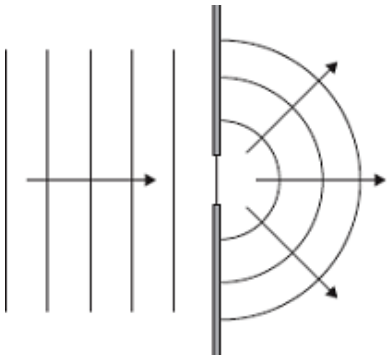
Draw a ring around the correct answer.

gamma rays **sound** **visible light**

(1)

(b) **Diagram 2** shows water waves in a ripple tank moving towards and passing through a gap in a barrier.

Diagram 2



(i) The water waves spread out after passing through the gap in the barrier.

What name is given to the process causing the waves to spread out?

.....

(1)

(ii) Every second, 8 waves pass through the gap in the barrier. The waves have a wavelength of 0.015 metres.

Calculate the speed of the water waves and give the unit.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Speed = ...

(3)

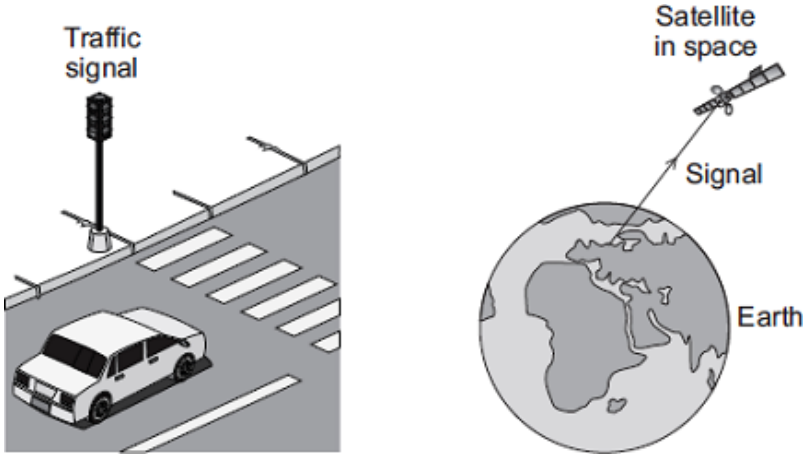
(Total 7 marks)

Q2. **Diagram 1** shows four of the seven types of wave in the electromagnetic spectrum.

Diagram 1

J	**K**	**L**	Visible light	Infrared	Microwaves	Radio waves

(a) The **four** types of electromagnetic wave named in **Diagram 1** above are used for communication.



(i) Which type of electromagnetic wave is used when a traffic signal communicates with a car driver?

.....

(1)

(ii) Which type of electromagnetic wave is used to communicate with a satellite in space?

.....

(1)

(b) Gamma rays are part of the electromagnetic spectrum.

Which letter, **J**, **K** or **L**, shows the position of gamma rays in the electromagnetic spectrum?

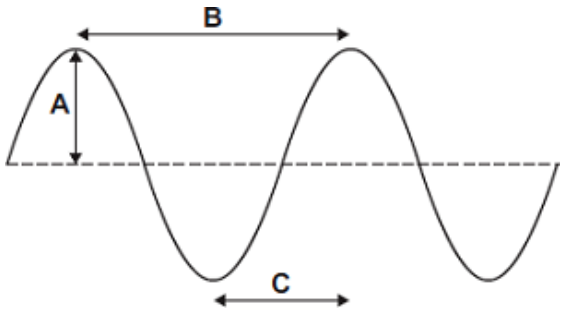
Draw a ring around the correct answer.

J **K** **L**

(1)

(c) **Diagram 2** shows an infrared wave.

Diagram 2



(i) Which **one** of the arrows, labelled **A**, **B** or **C**, shows the wavelength of the wave?

Write the correct answer, **A**, **B** or **C**, in the box. ☐

(1)

(ii) Draw a ring around the correct answer to complete the sentence.

The wavelength of infrared waves is

shorter than
the same as
longer than

the wavelength of radio waves.

(1)

(d) Mobile phone networks send signals using microwaves. Some people think the energy a person's head absorbs when using a mobile phone may be harmful to health.

(i) Scientists have compared the health of people who use mobile phones with the health of people who do not use mobile phones.

Which **one** of the following statements gives a reason why scientists have done this?

Tick (✓) **one** box.

To find out if using a mobile phone is harmful to health. ☐

To find out if mobile phones give out radiation. ☐

To find out why some people are healthy. ☐

(1)

(ii) The table gives the specific absorption rate (SAR) value for two different mobile phones.

The SAR value is a measure of the maximum energy a person's head absorbs when a mobile phone is used.

Mobile Phone	SAR value in W/kg
X	0.28
Y	1.35

A parent buys mobile phone **X** for her daughter.

Using the information in the table, suggest why buying mobile phone **X** was the best choice.

.....

.....

.....

.....

(2)

(Total 8 marks)

Q3. (a) Light waves transfer energy.

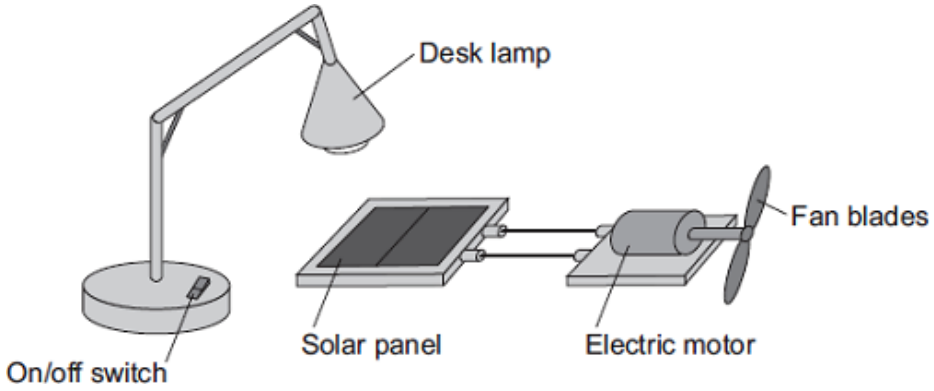
(i) Complete the following sentence.

The oscillations producing a light wave are .....

to the direction of the energy transfer by the light wave.

(1)

(ii) The apparatus in the diagram shows that light waves transfer energy.



Describe how switching the desk lamp on and off shows that light waves transfer energy.

You do **not** need to describe the energy transfers.

.....

.....

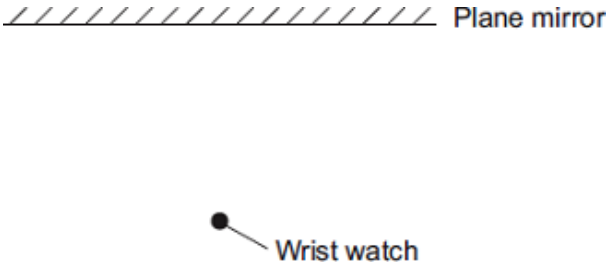
.....

.....

(2)

(b) A student holds a wrist watch in front of a plane mirror. The student can see an image of the wrist watch in the mirror.

The diagram shows the position of the wrist watch and the mirror.



Draw a ray diagram showing how the image of the wrist watch is formed.

Mark the position of the image.

(4)

(c) The image of the wrist watch seen by the student is virtual.

What is a virtual image?

.....

.....

(1)

(Total 8 marks)

Q4. Galaxies emit all types of electromagnetic wave.

(a) (i) Which type of electromagnetic wave has the shortest wavelength?

.....

(1)

(ii) State **one** difference between an ultraviolet wave and a visible light wave.

.....

.....

(1)

(b) Electromagnetic waves travel through space at a speed of 3.0×10^8 m/s.

The radio waves emitted from a distant galaxy have a wavelength of 25 metres.

Calculate the frequency of the radio waves emitted from the galaxy and give the unit.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Frequency = ...

(3)

(c) Scientists use a radio telescope to measure the wavelength of the radio waves emitted from the galaxy in part (b) as the waves reach the Earth. The scientists measure the wavelength as 25.2 metres. The effect causing this observed increase in wavelength is called red-shift.

(i) The waves emitted from most galaxies show red-shift.

What does red-shift tell scientists about the direction most galaxies are moving?

.....

.....

(1)

(ii) The size of the red-shift is **not** the same for all galaxies.

What information can scientists find out about a galaxy when they measure the size of the red-shift the galaxy produces?

.....

.....

.....

.....

(2)

(iii) What does the observation of red-shift suggest is happening to the Universe?

.....

.....

(1)

(Total 9 marks)