

## Topic 6 Waves

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

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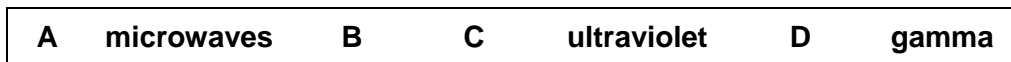
Time: **41 minutes**

Marks: **41 marks**

Comments:

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**Q1.**The figure below shows an incomplete electromagnetic spectrum.



(a) What name is given to the group of waves at the position labelled **A** in the figure above?

Tick **one** box.

infrared

radio

visible light

X-ray

(1)

(b) Electromagnetic waves have many practical uses.

Draw **one** line from each type of electromagnetic wave to its use.

**Electromagnetic  
wave**

**Use**

Gamma rays

For fibre optic  
communications

For communicating with a  
satellite

Microwaves

Ultraviolet

To see security markings

To sterilise surgical instruments

(3)

(c) Complete the sentence.

Use an answer from the box.

**black body**                      **ionising**                      **nuclear**

X-rays can be dangerous to people because X-rays are  
..... radiation.

(1)  
(Total 5 marks)

**Q2.(a)** Ultrasound is sound above the maximum frequency that humans can hear.

Tick (✓) **one** box.

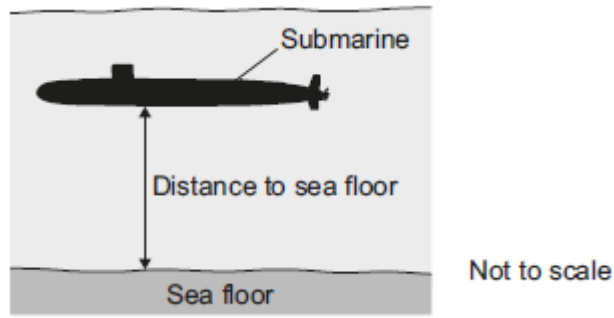
20 Hz                     

2000 Hz                     

20 000 Hz                     

(1)

(b) The image shows a submerged submarine.



The submarine sends a pulse of ultrasound to the sea floor.  
 The pulse takes 0.25 seconds to travel from the submarine to the sea floor.

The speed of sound in water is 1600 m/s.

Calculate the distance from the submarine to the sea floor.

.....

.....

.....

.....

Distance = ..... m

(2)

- (c) The ultrasound is reflected from the sea floor back to the submarine.  
 Use the correct answer from the box to complete the sentence.

|             |                    |              |
|-------------|--------------------|--------------|
| <b>half</b> | <b>the same as</b> | <b>twice</b> |
|-------------|--------------------|--------------|

The total distance the ultrasound pulse travelled is ..... the distance to the sea floor.

(1)

- (d) The submarine moves through the sea and every few seconds sends a pulse of ultrasound to check the distance to the sea floor.

The table shows the time taken for five ultrasound pulses to travel from the submarine to the sea floor and back to the submarine.

| Pulse number | Time for pulse to return in seconds |
|--------------|-------------------------------------|
| 1            | 0.50                                |
| 2            | 0.45                                |

|   |      |
|---|------|
| 3 | 0.38 |
| 4 | 0.40 |
| 5 | 0.48 |

Describe how the distance from the submarine to the sea floor changed over these five pulses.

.....

.....

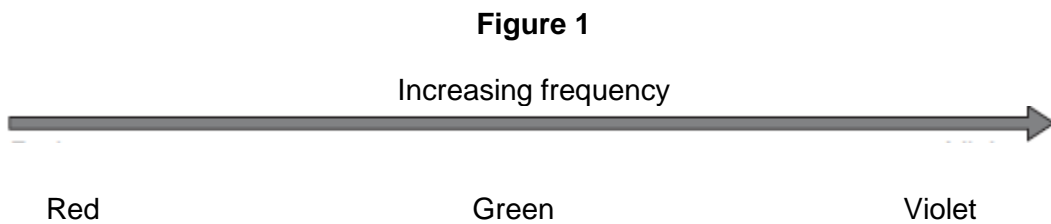
.....

.....

(2)  
(Total 6 marks)

Q3.(a) The visible light spectrum has a range of frequencies.

Figure 1 shows that the frequency increases from red light to violet light.



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

|                  |                       |                  |
|------------------|-----------------------|------------------|
| <b>decreases</b> | <b>stays the same</b> | <b>increases</b> |
|------------------|-----------------------|------------------|

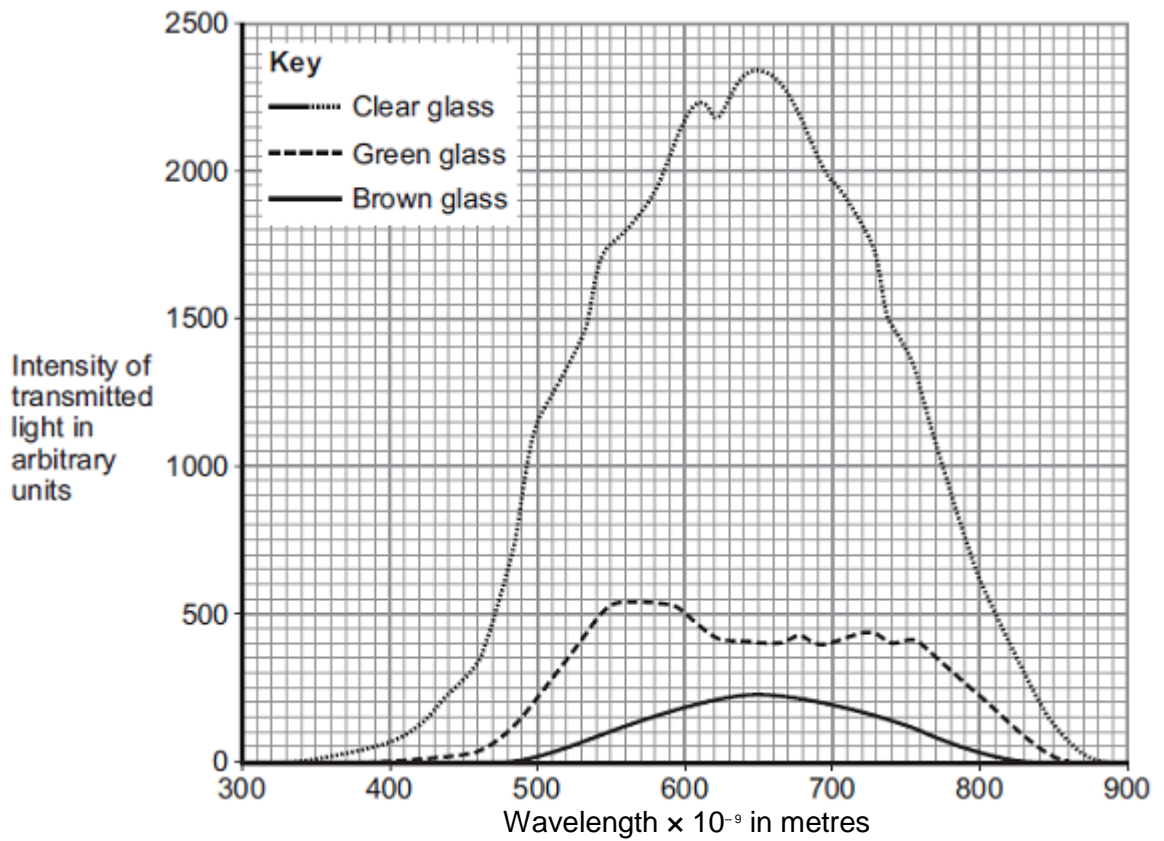
As the frequency of the light waves increases, the wavelength of the light waves ..... and the energy of the light waves .....

(2)

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

Figure 3 shows the intensity of the light that is transmitted through three different pieces of glass.

**Figure 3**



- (i) The pieces of glass all had the same thickness.

Suggest why.

.....  
 .....

(1)

- (ii) Bottles made of brown glass are suitable for storing beer.

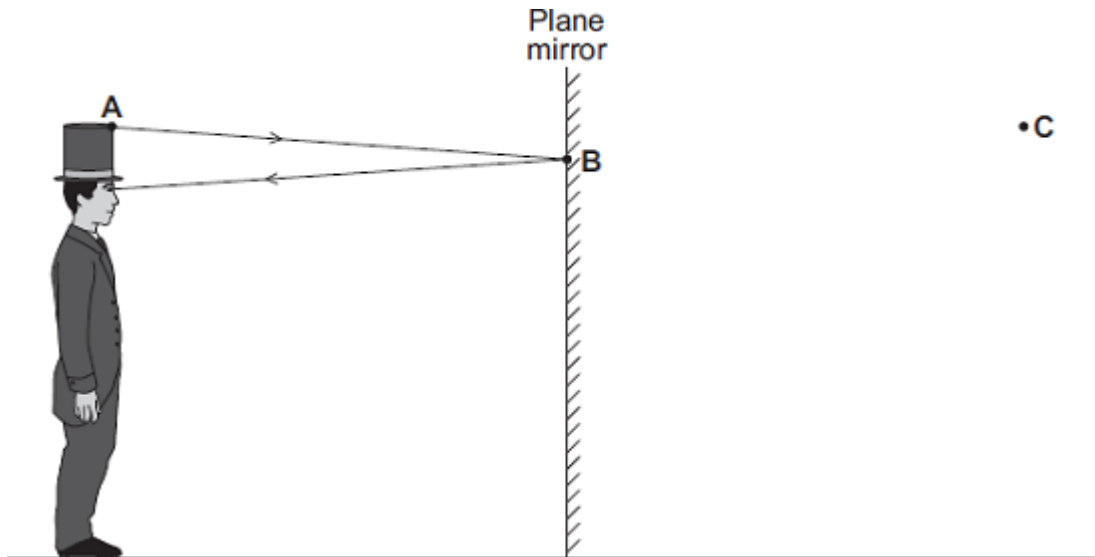
Suggest why.

.....  
 .....

(1)

(Total 4 marks)

**Q4.**A person can see an image of himself in a tall plane mirror.



The diagram shows how the person can see his hat.

- (a) Which point, **A**, **B** or **C**, shows the position of the image of his hat?

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

(1)

- (b) On the diagram, use a ruler to draw a light ray to show how the person can see his shoe.

(3)

- (c) Which **one** of the words in the box is used to describe the image formed by a plane mirror?

Draw a ring around the correct answer.

|                  |             |                |
|------------------|-------------|----------------|
| <b>imaginary</b> | <b>real</b> | <b>virtual</b> |
|------------------|-------------|----------------|

(1)

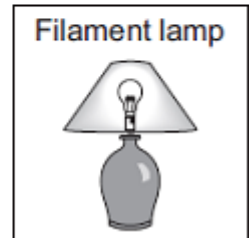
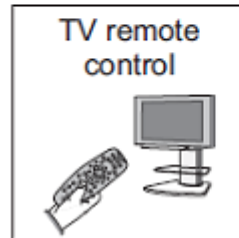
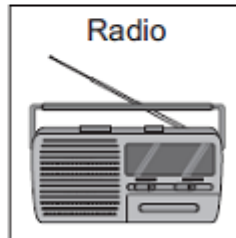
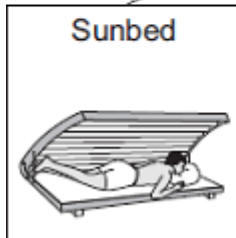
(Total 5 marks)

- Q5.(a)** The diagram shows the electromagnetic spectrum.  
The pictures show four devices that use electromagnetic waves. Each device uses a different type of electromagnetic wave.

Draw a line from each device to the type of electromagnetic wave that it uses. One

has been done for you.

|            |        |                  |               |                |            |             |
|------------|--------|------------------|---------------|----------------|------------|-------------|
| Gamma rays | X-rays | Ultraviolet rays | Visible light | Infra red rays | Microwaves | Radio waves |
|------------|--------|------------------|---------------|----------------|------------|-------------|



(3)

(b) A headline from a recent newspaper article is shown below.

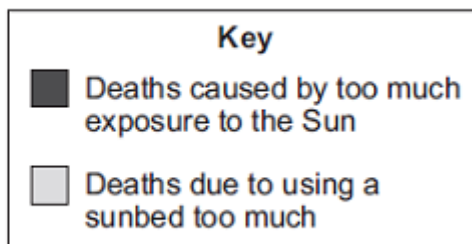
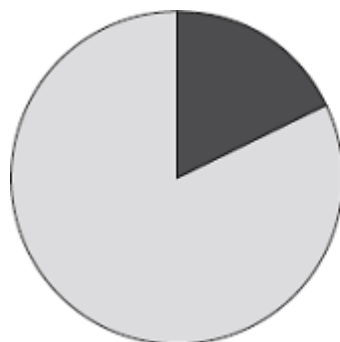


(i) What serious health problem may be caused by using a sunbed too much?

.....

(1)

(ii) The pie chart compares the number of deaths in Britain each year which may have been caused by using sunbeds too much, with those which may have been caused by too much exposure to the Sun.



It is difficult for a doctor to be certain that a person has died because of using



a sunbed too much.

Suggest why.

.....  
.....

(1)

(iii) A spokesperson for a leading cancer charity said:

‘We want people, especially young people, to know the possible dangers of using a sunbed.’

Why is it important that you know the possible dangers of using a sunbed?

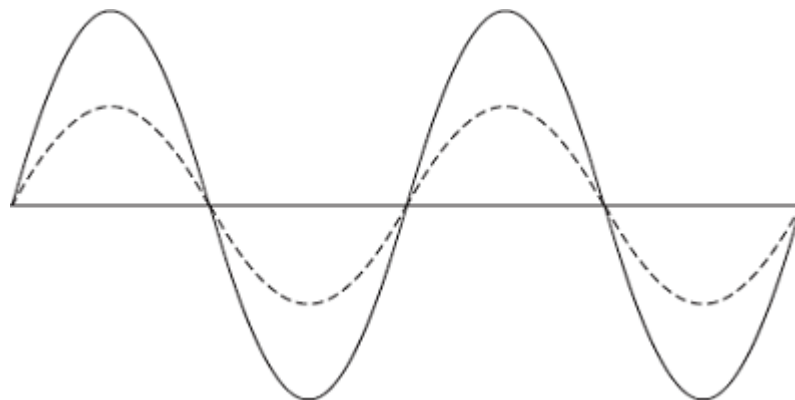
.....  
.....

(1)

(Total 6 marks)

**Q6.(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**

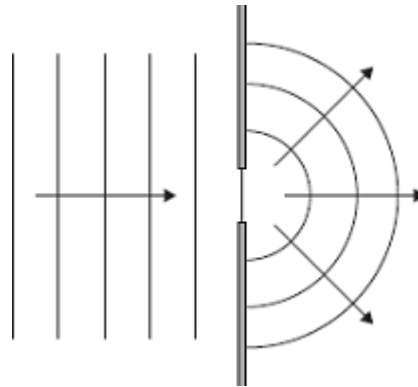
**sound**

**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**



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.

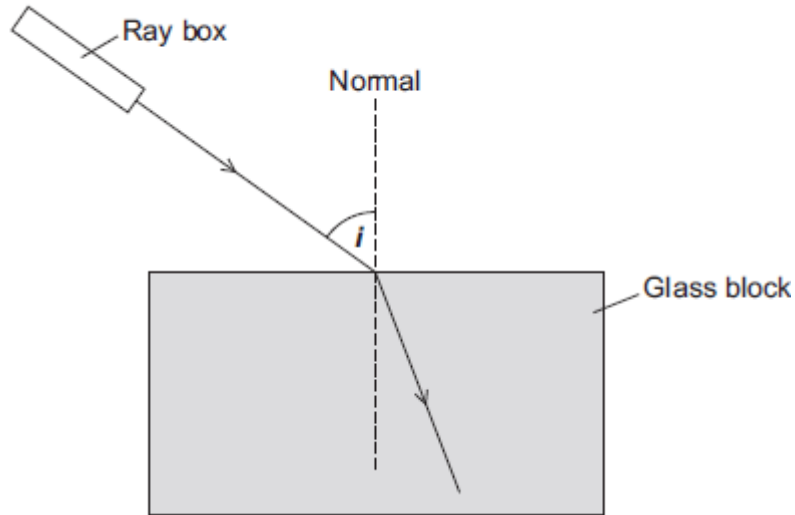
.....  
.....  
.....

Speed = .....

(3)  
(Total 6 marks)

**Q7.(a)** **Figure 1** shows a ray of light entering a glass block.

**Figure 1**

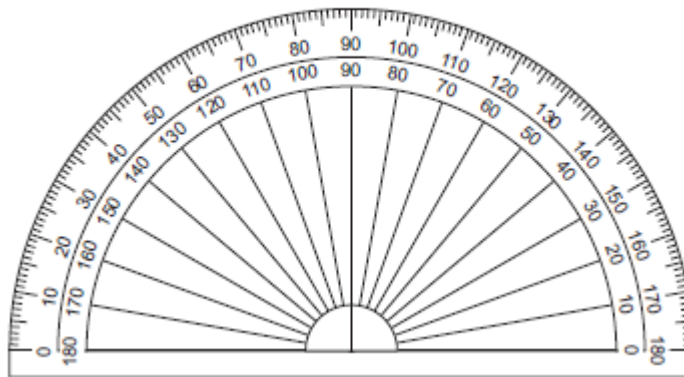


- (i) The angle of incidence in **Figure 1** is labelled with the letter  $i$ .  
On **Figure 1**, use the letter  $r$  to label the angle of refraction.

(1)

- (ii) **Figure 2** shows the protractor used to measure angles  $i$  and  $r$ .

**Figure 2**



What is the resolution of the protractor?

Tick (✓) **one** box.

1 degree       5 degrees       10 degrees

(1)

- (iii) The table shows calculated values for angle  $i$  and angle  $r$  from an investigation.

| Calculated values |
|-------------------|
| $\sin i = 0.80$   |
| $\sin r = 0.50$   |

Use the values from the table to calculate the refractive index of the glass.

.....  
 .....  
 .....

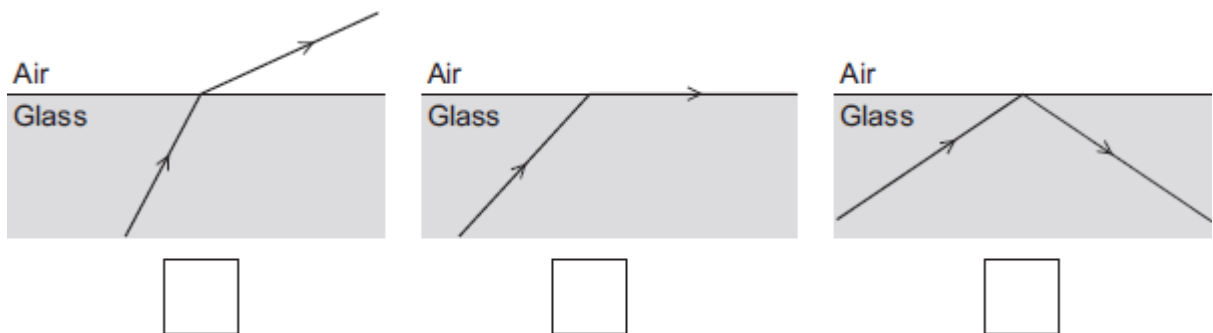
Refractive index = .....

(2)

(b) The diagrams below show a ray of light moving through glass.

Which diagram correctly shows what happens when the ray of light strikes the surface of the glass at the critical angle?

Tick (✓) **one** box.

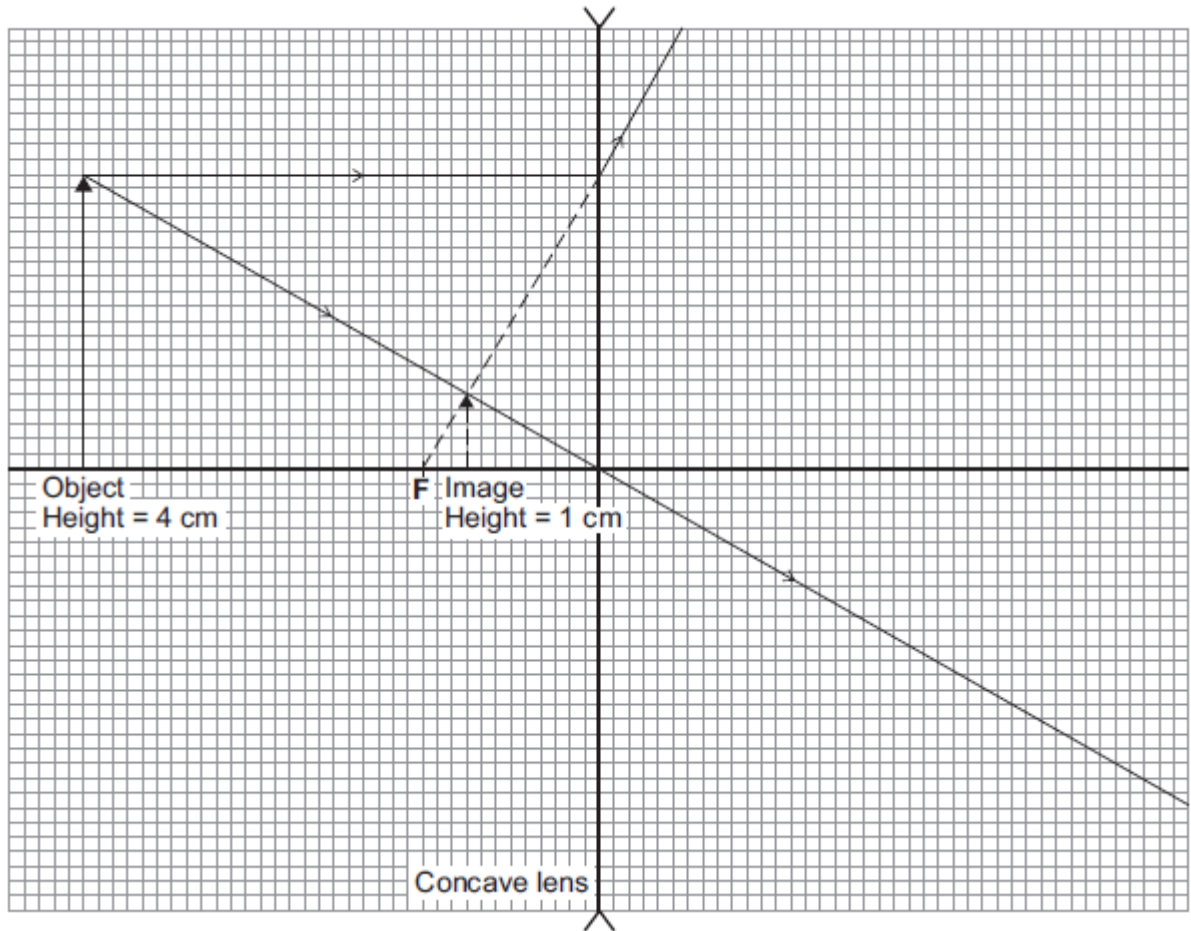


(1)

(c) A concave (diverging) lens is fitted into a door to make a security spyhole.

**Figure 3** shows how this lens produces an image.

**Figure 3**



(i) State **one** word to describe the nature of the image in **Figure 3**.

.....

(1)

(ii) Use data from **Figure 3** to calculate the magnification of the image.

.....  
 .....  
 .....

Magnification = .....

(2)

(iii) What is another use for a concave lens?

Tick (✓) **one** box.

A magnifying glass

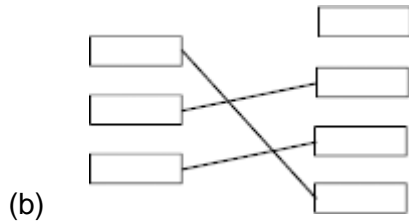
Correcting short sight

To focus an image in a camera

(1)  
(Total 9 marks)

M1.(a) radio

1



*award 1 mark for each correct line  
if more than one line is drawn from any em wave then none  
of those lines gain credit*

3

(c) ionising

1

[5]

M2.(a) 20 000 Hz

1

(b) 400 (m)

*allow 1 mark for correct  
substitution ie  $1600 \times 0.25$   
provided no subsequent steps shown  
an answer of 200 (m) gains 1 mark*

2

(c) twice

1

(d) From pulse 1 to pulse 3 the distance (to the sea floor) decreased  
*accept the sea got shallower  
or  
the submarine went deeper for the distance decreased*

1

then (after pulse 3) the distance (to the sea floor) increased

*accept the sea got deeper*

**or**

*the submarine rose for the distance increased*

*An answer of the distance decreased then increased gains 1*

*mark*

1

[6]

**M3.(a)** decreases

*correct order only*

1

increases

1

(b) (i) intensity (of transmitted light ) depends on thickness

**or**

to enable a valid comparison

**or**

it is a control variable

*accept absorption depends on thickness*

*it would affect the results is insufficient*

*fair test is insufficient*

1

(ii) transmits the least light

**or**

absorbs the most light

*accept very little light is transmitted*

*do **not** accept transmits none of the light*

*do **not** accept absorbs all of the light*

*any reference to heat negates this mark*

1

[4]

**M4.(a)** C

1



- (b) reflection at the mirror of ray from shoe to person's eye  
*may be drawn freehand*

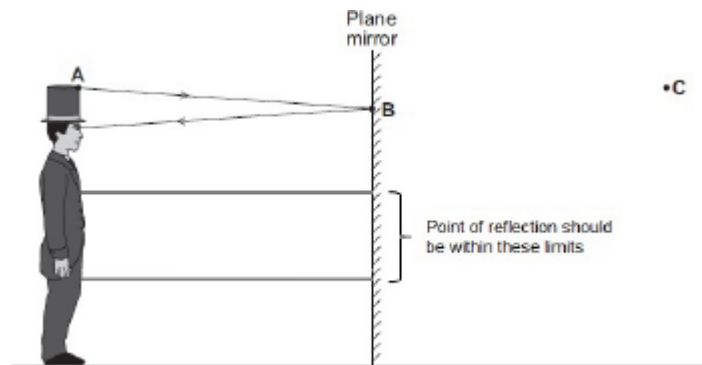
1

angle of incidence = angle of reflection  
*judged by eye*  
*a ruler must have been used*

1

arrow to show correct direction on either incident or reflected ray  
*only one arrow needed but if more drawn must be no contradiction*  
*both incident and reflected ray must be shown*

1

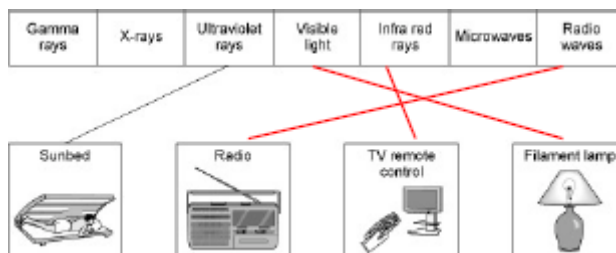


- (c) virtual

1

[5]

**M5.(a)** all three lines correct



*allow 1 mark for each correct line*  
*if more than one line goes from a device then all lines from that device are wrong*

- (b) (i) skin cancer  
 do **not** accept cancer  
 do **not** accept sunburn  
 correct answer only

1

- (ii) other factors may be involved  
 accept may have been in the Sun too long  
 accept (over)-use of sunbeds and (over)- exposure to the Sun (both) give the same symptoms  
 accept any other sensible factor that could lead to doubt  
 do **not** accept irrelevant answers eg may be run over by a car  
 do **not** accept killed by exposure to the Sun

1

- (iii) can assess risk  
 answers should be in terms of assessing our own health risk

**or**

make your own decision  
 accept so you limit its use / don't use one  
 do **not** accept so you don't get skin cancer  
 do **not** accept so you don't get sunburn

1

[6]

- M6.(a) (i) wavelength

accept frequency  
 accept speed

1

- (ii) amplitude  
 accept energy  
 height is insufficient

1

(iii) sound

1

(b) 0.12

allow 1 mark for correct substitution, ie  $8 \times 0.015$  provided no subsequent step shown

2

metre per second **or** m/s **or** metre/second

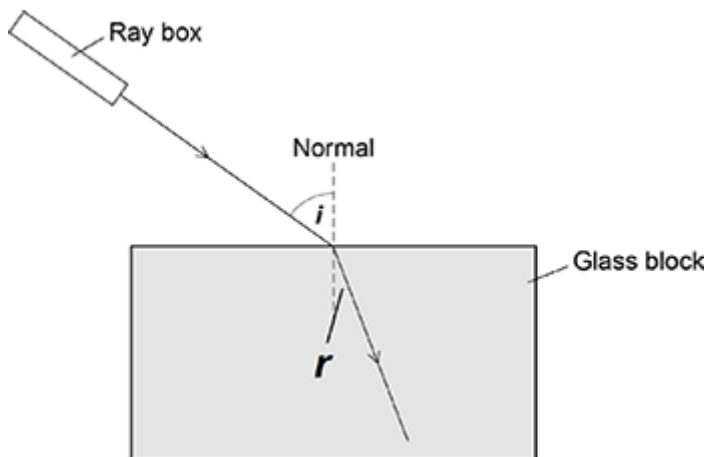
do **not** accept mps

units must be consistent with numerical answers

1

[6]

M7.(a) (i)



1

(ii) 1 degree

1

(iii) 1.6

allow 1 mark for correct substitution, ie  $0.80 / 0.5$  provided no subsequent step shown

working showing 1.59(9.....) scores zero

2

(b) 2<sup>nd</sup> diagram ticked



1

(c) (i) any **one** correct description:

- upright
- virtual
- diminished.

*treat multiple words as a list*

1

(ii) 0.25

*allow 1 mark for correct substitution, ie 1 / 4 or 5 / 20  
provided no subsequent step shown*

*ignore any unit*

2

(iii) Correcting short sight

1

[9]