

Candidate forename						Candidate surname					
Centre number						Candidate number					

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE
A332/02
TWENTY FIRST CENTURY SCIENCE
PHYSICS A

Unit 2: Modules P4 P5 P6 (Higher Tier)

MONDAY 21 MAY 2012: Morning
DURATION: 40 minutes
plus your additional time allowance

MODIFIED ENLARGED

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. HB pencil may be used for graphs and diagrams only.**
- **Answer ALL the questions.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**

INFORMATION FOR CANDIDATES

- **The number of marks is given in brackets [] at the end of each question or part question.**
- **The total number of marks for this paper is 42.**
- **A list of physics equations is printed on pages 4–5.**

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TWENTY FIRST CENTURY SCIENCE EQUATIONS

USEFUL RELATIONSHIPS

EXPLAINING MOTION

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\begin{array}{l} \text{change of} \\ \text{momentum} \end{array} = \text{resultant force} \times \text{time for which it acts}$$

$$\begin{array}{l} \text{work done} \\ \text{by a force} \end{array} = \text{force} \times \begin{array}{l} \text{distance moved in the} \\ \text{direction of the force} \end{array}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

ELECTRIC CIRCUITS

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

THE WAVE MODEL OF RADIATION

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

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Answer ALL the questions.

1 A car is travelling along a motorway.

- (a) (i) The car takes 60 s to travel 1.2 km.
What is its speed?**

Put a ring around the correct answer.

0.02 m/s 1.2 m/s 20 m/s

72 m/s 1200 m/s

[1]

- (ii) How should the speed you found in part (a)(i)
be described, and why?**

**Draw ONE line to link the correct
DESCRIPTION to the correct EXPLANATION.**

DESCRIPTION

average speed

**instantaneous
speed**

velocity

EXPLANATION

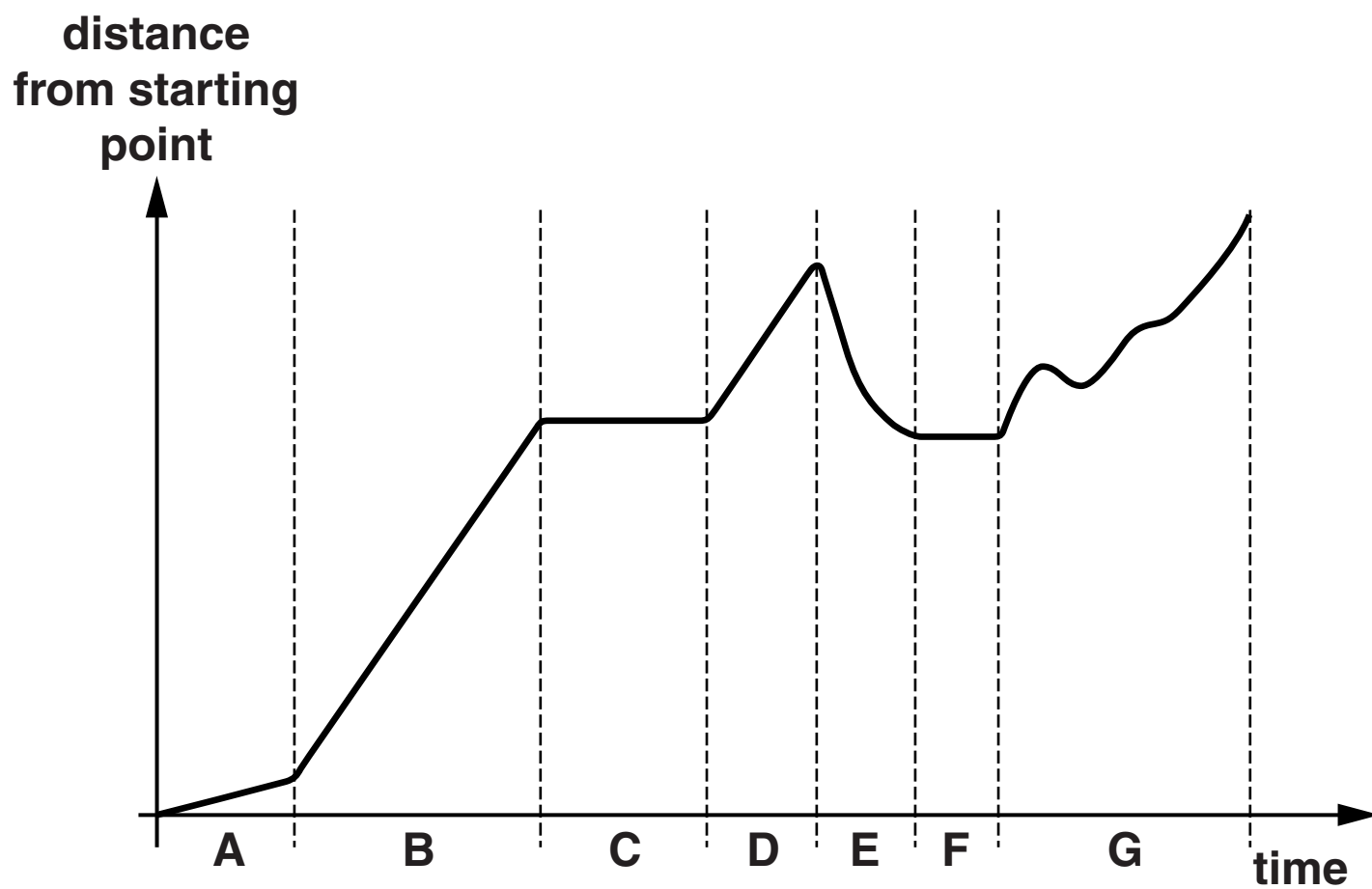
**It is the speed in a
particular direction.**

**It is the speed shown at
a particular time by the
car's speedometer.**

**It takes into account
the fact that the car will
speed up and slow down
as it travels.**

[1]

(b) (i) The graph below is a distance-time graph for a car travelling along a straight track.

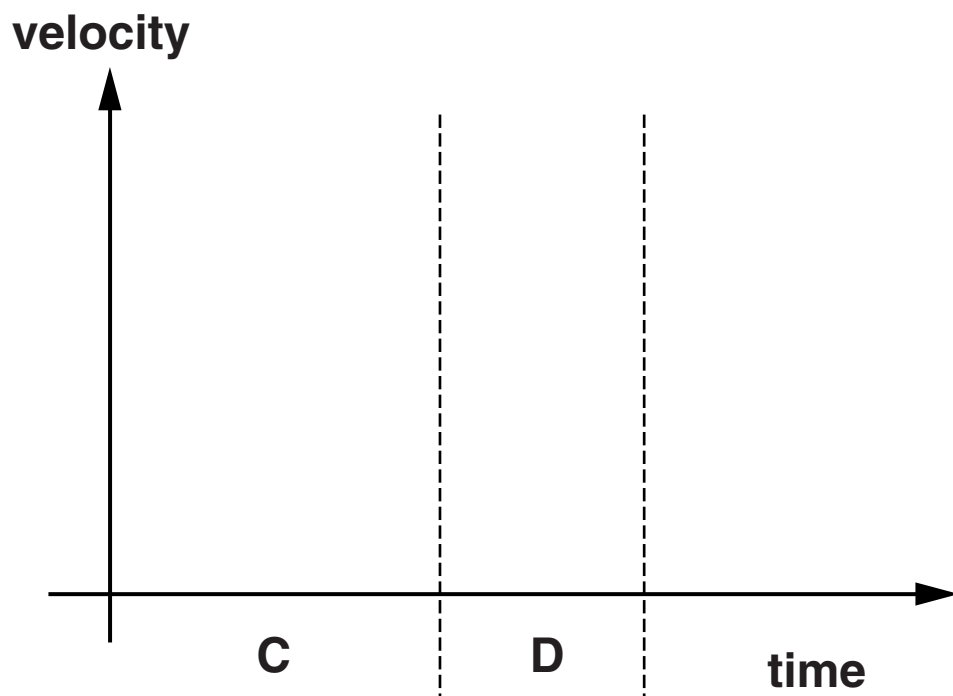


Some of the following statements about the WHOLE JOURNEY are true and some are false. Put a tick (✓) in the correct box next to each statement to show whether it is TRUE or FALSE.

	TRUE	FALSE
The car's slowest speed was in section A.	<input type="checkbox"/>	<input type="checkbox"/>
The car was always moving forwards.	<input type="checkbox"/>	<input type="checkbox"/>
The car was going at the same speed in sections B and D.	<input type="checkbox"/>	<input type="checkbox"/>
The velocity of the car varied the most within section G.	<input type="checkbox"/>	<input type="checkbox"/>

[2]

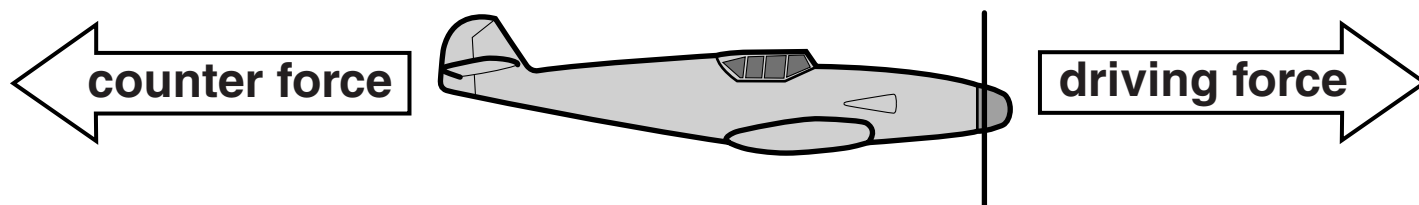
- (ii) On the axes below, sketch a velocity-time graph for sections C and D.
You do not need to include any numbers.



[1]

[Total: 5]

- 2 The picture shows a toy plane.
The plane has a motor that pushes it along.
Two of the forces that act on the plane are shown.



Here is some information about the plane at one particular time.

mass	0.5 kg
speed	8 m/s
driving force	10 N
counter force	3 N

- (a) Use the information to calculate the momentum of the plane at this time.

momentum = _____ unit _____ [2]

(b) Use the information to explain why the momentum of the plane increases over the next few seconds.

[2]

[Total: 4]

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TURN OVER FOR QUESTION 3

- 3 There are many sports that take place in the Olympics.
All of the sports involve forces and energy.**
- (a) One of the events in gymnastics is the rings.**



The forces opposite are involved in this gymnastic event.

When one object exerts a force on another, it always experiences a force in return.

From the forces below, identify TWO interaction pairs.

Draw a line between the two forces that make each interaction pair.

Draw TWO lines only.

**the weight
of the
gymnast**

**friction
between the
gymnast's
hands and
the rings**

**the pull
from the
gymnast on
the Earth**

**the pull of
the gymnast
on the rings**

**the force
from the
rings acting
on the
gymnast**

**air
resistance
as the
gymnast
moves**

[2]

(b) A weightlifter lifts a barbell above her head.

- (i) The barbell is lifted to a height of 2.5 m above the ground.
It gains 3750 J of gravitational potential energy.**

What is the weight of the barbell?

Put a ring around the correct answer.

0.000 66 N 1500 N

3747.5 N 3752.5 N 9375 N

[1]

- (ii) Another weightlifter lifts a barbell with a mass of 100 kg.
The barbell gains 2000 J of gravitational potential energy.
She then drops the barbell.**

Calculate the maximum speed that the barbell could reach just before hitting the ground.

maximum speed = _____ m/s [2]

[Total: 5]

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TURN OVER FOR QUESTION 4

4 Rob is trying to choose between two different types of walkie talkie.

(a) Before radio signals are sent, they have to be modulated.

Modulation can change either the amplitude or the frequency of a carrier wave.

Draw three straight lines to join each DESCRIPTION to the SIGNAL that it describes.

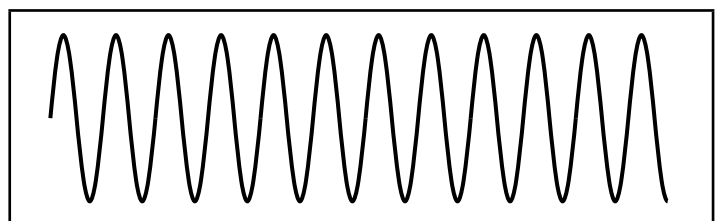
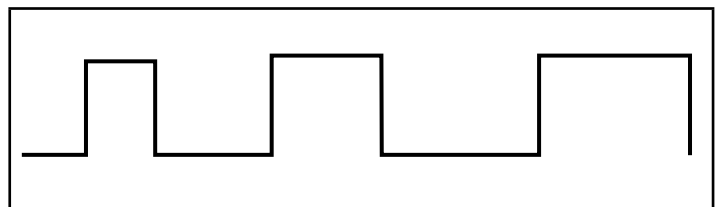
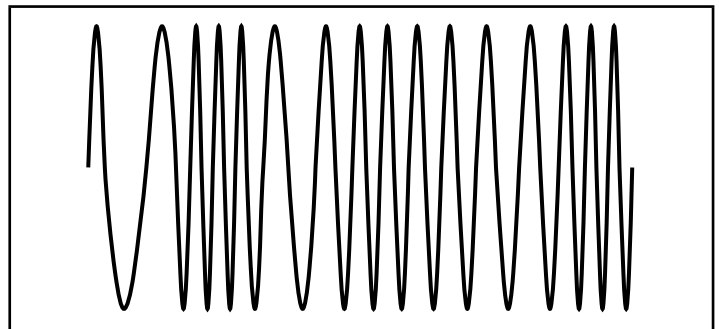
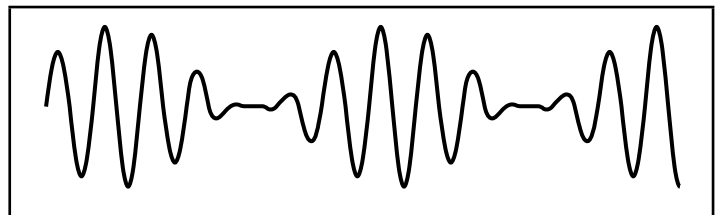
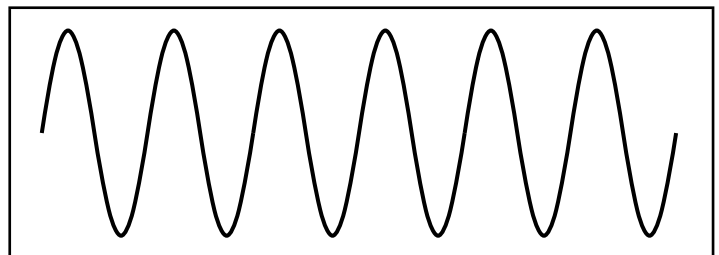
DESCRIPTION

SIGNAL

digital signal

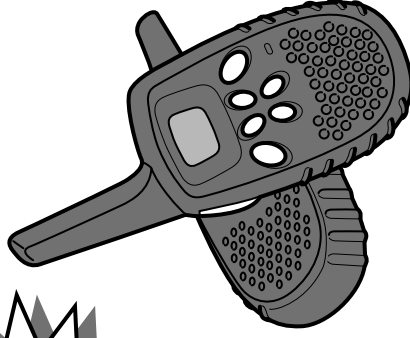
analogue signal
with amplitude
modulation

analogue signal
with frequency
modulation



digital walkie talkie

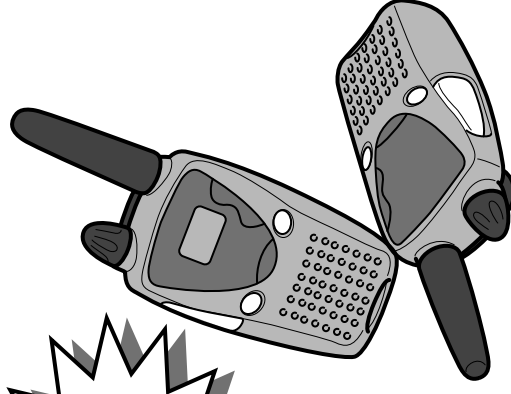
£199



**Great signal over long distances!
Amazing signal quality!**

analogue walkie talkie

£70



**Cheap and easy to use!
Perfect for short distances!**

(b) Which three of the following statements, when taken together, can be used to explain why a digital walkie talkie can be used over longer distances than an analogue walkie talkie? Put ticks (✓) in the boxes next to the THREE correct answers.

As signals travel, their amplitudes become smaller and they pick up noise.

☐

Digital signals travel at the speed of light.

☐

When a signal is amplified, noise is also amplified.

☐

Radio waves are not strongly absorbed by the atmosphere.

☐

Analogue signals vary continuously.

☐

The information in digital signals can usually be recognised despite some noise picked up.

☐

The job of the receiver is to reproduce the original sound from a signal.

☐

[2]

- (c) The two walkie talkies both use radio waves with a wavelength of 1.5 m.
Which calculation shows how the frequency in hertz of the wave can be calculated?

Put a **ring** around the correct answer.

$$\frac{3 \times 10^2}{1.5}$$

$$\frac{3 \times 10^8}{1.5}$$

$$1.5 \times 3 \times 10^2$$

$$1.5 \times 3 \times 10^8$$

$$\frac{1.5}{3 \times 10^2}$$

$$\frac{1.5}{3 \times 10^8}$$

[1]

[Total: 5]

5 Millie is taking a picture using a camera with a flash.

(a) The diagram (opposite) shows one path of light through the camera.

(i) When light travels, it can be DIFFRACTED, REFLECTED or REFRACTED, or undergo TOTAL INTERNAL REFLECTION. Only two of these effects happen along the light path in the camera.

Put rings around the TWO effects that are shown on the diagram.

DIFFRACTION

REFLECTION

REFRACTION

TOTAL INTERNAL REFLECTION

[1]

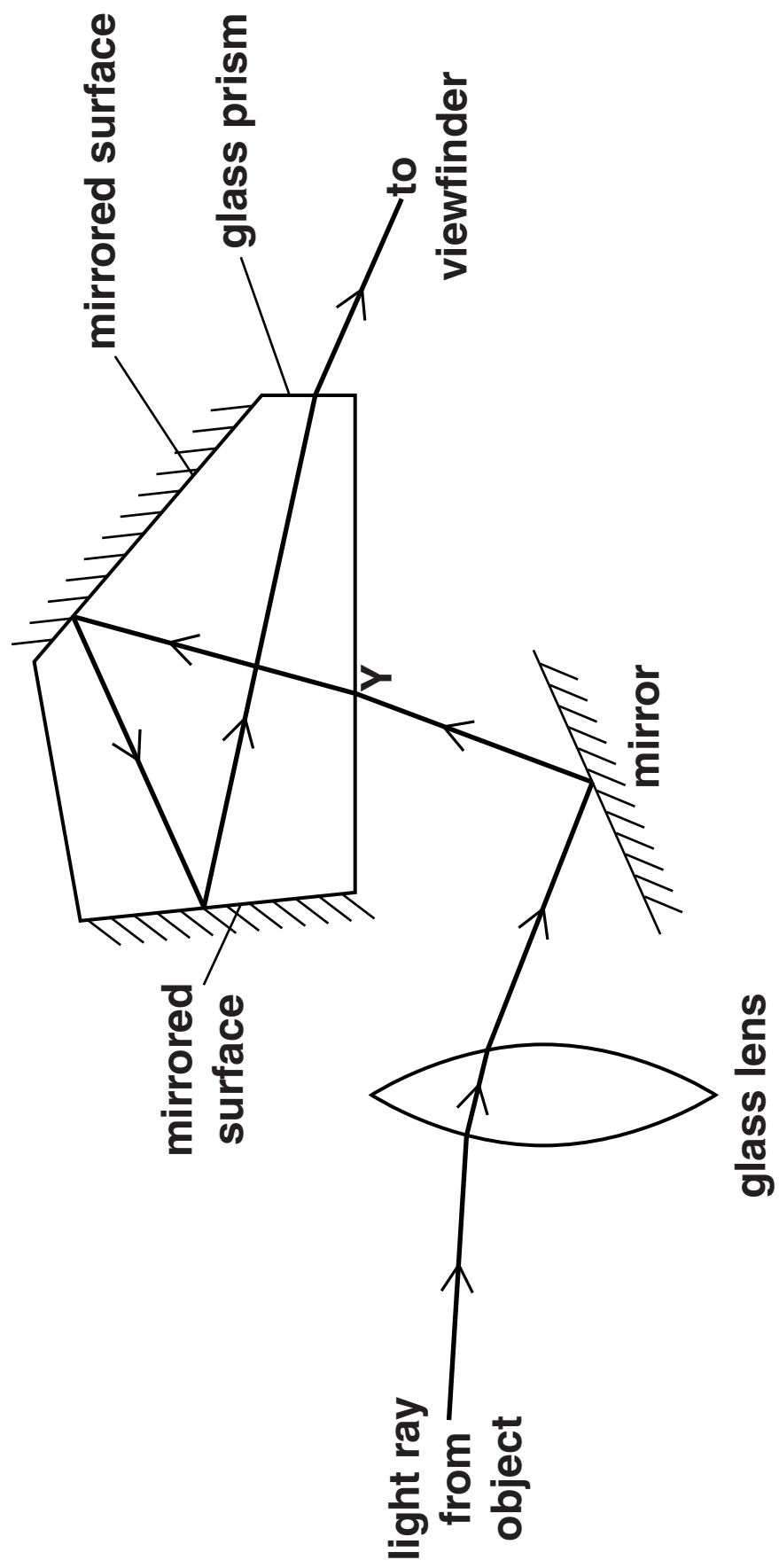
(ii) As light travels into and out of glass, its speed changes.

Complete the following sentences by putting a ring around the correct choice in each sentence.

When light slows down, the wavelength INCREASES / STAYS THE SAME / DECREASES.

When light slows down, the frequency INCREASES / STAYS THE SAME / DECREASES.

[1]



**(b) Millie takes a picture of a dog with her camera.
She uses the camera flash.**

**(i) Which two of the following would increase the
INTENSITY of the light reaching the dog?
Put ticks (✓) in the boxes next to the TWO
correct statements.**

**more photons hitting the dog per
second**

☐

increasing the distance to the dog

☐

changing the speed of the light

☐

using photons of lower energy

☐

using photons of shorter wavelength

☐

using photons of lower frequency

☐

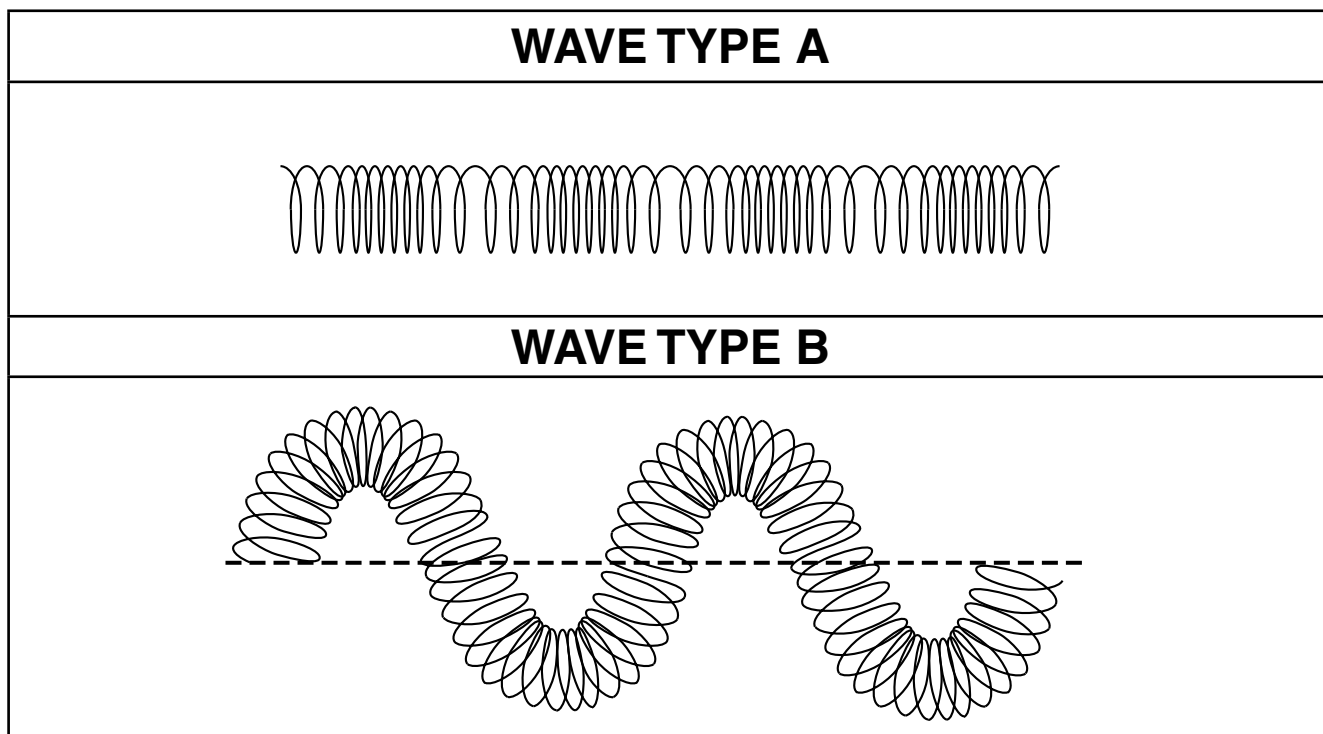
[2]

**(ii) Light does NOT diffract noticeably when
it enters the camera through the aperture
(opening).
Explain why.**

[2]

[Total: 6]

- 6 A long spring can be used to demonstrate different types of wave.



- (a) Which type of wave is shown in each of the diagrams above?

wave type A _____

wave type B _____

[1]

- (b) (i) Which of the following describes the WAVELENGTH of wave type B?
Put a tick (✓) in the box next to the correct answer.**

the distance from one end of the spring to the other end

☐

the distance from the wave crest to the wave trough of the spring

☐

the thickness of the spring

☐

the distance from the first wave crest to the second wave crest

☐

the distance from a wave crest to the dotted line

☐

[1]

- (ii) Which of the following describes the **AMPLITUDE** of wave type B?
Put a tick (✓) in the box next to the correct answer.

the distance from one end of the spring to the other end

☐

the distance from the wave crest to the wave trough of the spring

☐

the thickness of the spring

☐

the distance from the first wave crest to the second wave crest

☐

the distance from a wave crest to the dotted line

☐

[1]

- (c) To make wave type A, one end of the spring is moved 4 times every second.
The wavelength is 50 cm.
How fast is the wave travelling?
Put a **ring** around the correct answer.

0.5 m/s

2 m/s

4 m/s

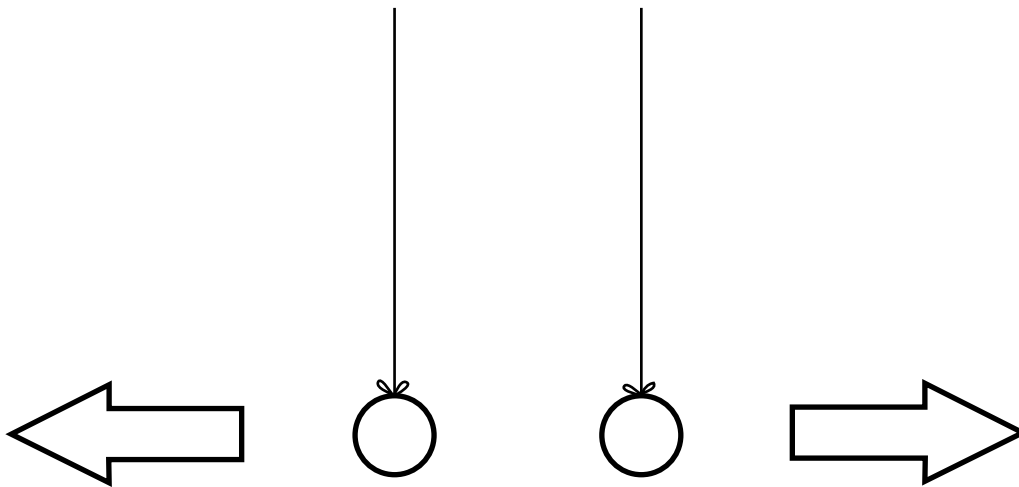
8 m/s

200 m/s

[1]

[Total: 4]

- 7 George charges two identical plastic rods by rubbing them with a cloth.
He hangs the rods close to each other.
The rods move away from each other.**



- (a) Explain why the rods move away from each other.
Include in your answer**
- **what happens when the rods are rubbed with the cloth**
 - **why the rods move away from each other.**

[3]

(b) George repeats the experiment with metal rods.

The rods do not move.

Join two boxes to make a sentence that helps to explain why the rods do not move.

You should draw ONE straight line.

**Metal rods
contain lots
of charges...**

**...which can
not move.**

**Metal rods
contain few
charges...**

**...which are
free to move.**

**Metal rods
contain no
charges...**

**...which move
only when
connected to a
battery.**

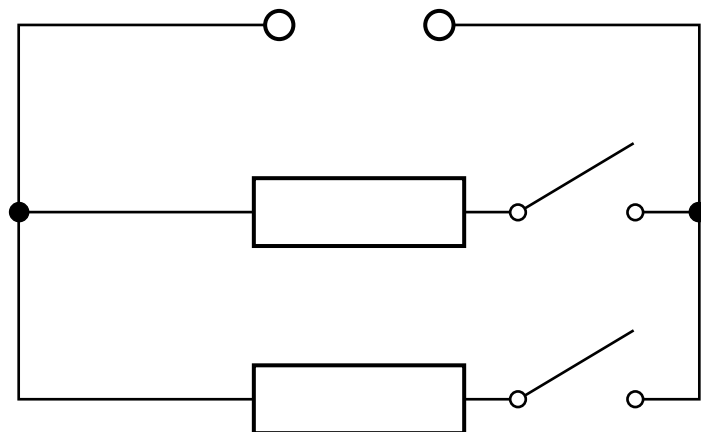
[1]

[Total: 4]

8 Ella buys a new electric heater.

The bars in the heater are resistors.

The circuit for the heater can be represented in this way.



(a) Ella plugs the heater into the mains electricity supply.

When both bars are switched on, the total resistance is $23\ \Omega$.

What current is drawn from the mains?

Show your working.

current = _____ amps [2]

(b) Ella switches off one of the bars.

The table shows four quantities which may change as Ella switches off the bar.

For each quantity in the table, put a tick (✓) in the correct box to show whether it will INCREASE, DECREASE or STAY THE SAME.

QUANTITY	INCREASE	DECREASE	STAY THE SAME
the number of paths for the charges			
the potential difference across the hot bar			
the current drawn from the mains			
the total resistance of the circuit			

[2]

(c) Ella is worried that using the heater is going to cost her a lot of money.

How long could she use the heater for if she only spends £2.30 on the electricity?

The cost for one kilowatt-hour is 20p.

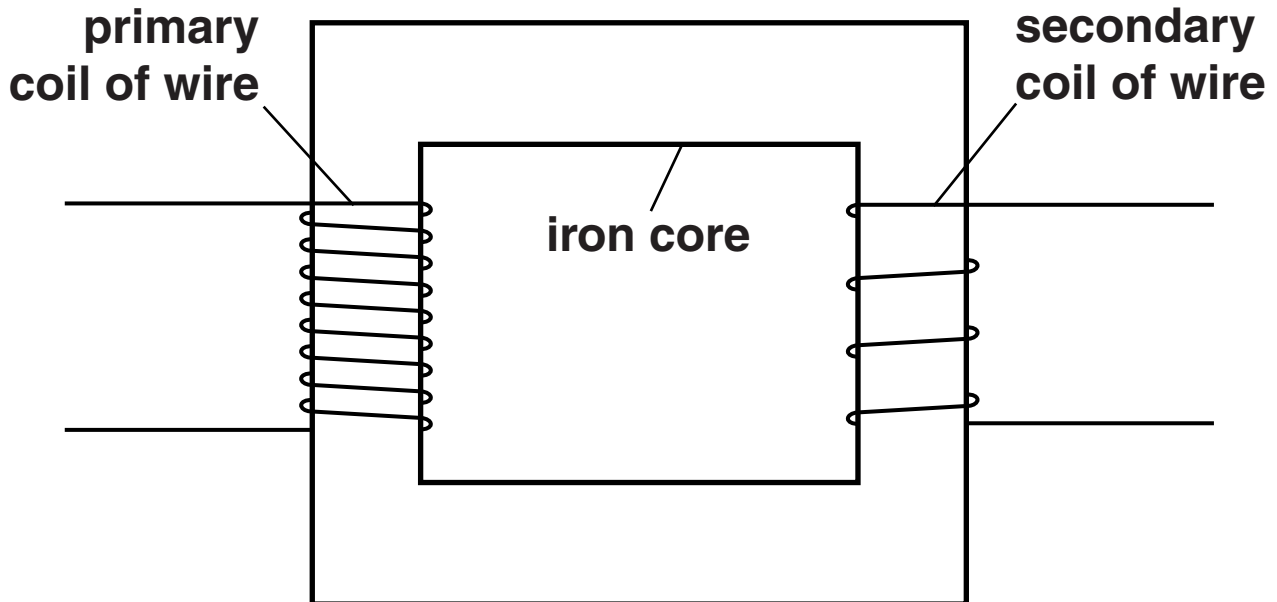
The heater has an average power of 2300 watts.

answer = _____ hours [2]

[Total: 6]

- 9 Vikram's laptop computer has a transformer in its charging cable.

The diagram below shows the construction of the transformer.



Explain how a transformer produces a voltage across the secondary coil.

[3]

[Total: 3]

END OF QUESTION PAPER

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