OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE PHYSICS A

A332/02

Unit 2: Modules P4 P5 P6 (Higher Tier)

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)

Wednesday 25 May 2011
Morning

Duration: 40 minutes

OCE/33691

A33202

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- 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).
- Answer **all** the questions.
- Do **not** write in the bar codes.

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 page two.
- This document consists of **16** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved in the direction of the force

change in energy = work done

change in GPE = weight × vertical height difference

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

Electric Circuits

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

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

energy transferred = power × time

power = potential difference × current

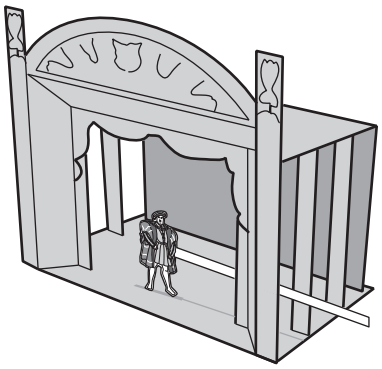
$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\,\%$$

The Wave Model of Radiation

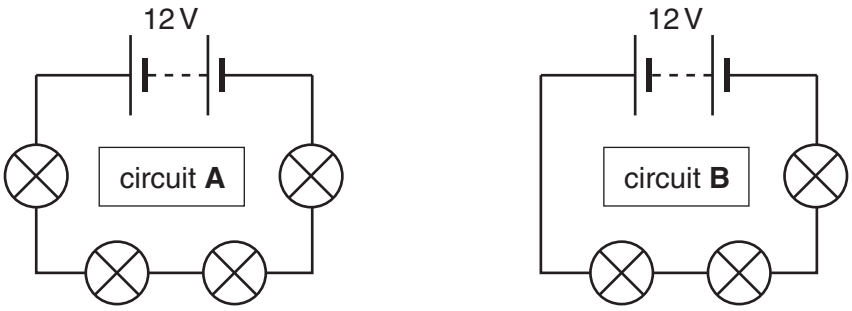
wave speed = frequency × wavelength

Answer **all** the questions.

1 Grace is building a set of lights for a model theatre.



She tests two different circuits.



(a) All the lamps are identical.
How do the following compare in circuits **A** and **B**?
Put a tick (✓) in the correct box in each row.

	greater in circuit A	**the same in circuits A and B**	**greater in circuit B**
total resistance of the circuit			
current in the circuit			
voltage across each lamp			

[2]

(b) Grace measures the current in circuit **A** and finds that it is 0.3 A.
Calculate the total resistance of the circuit.
State the unit of resistance.

answer = ... unit ..... **[3]**

[Total: 5]

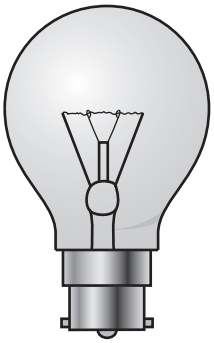
2 Draw a straight line from the **start** of each sentence to its correct **end**.

start	end
Potential difference is a measure of …	… largest in the component with the smallest resistance.
The potential difference across a battery in a parallel circuit is equal to …	… the 'push' of the battery on the charges in a circuit.
The potential difference across a battery in a series circuit is equal to …	… the voltage across each component.
In a parallel circuit, the current is …	… the sum of the voltages across the components.

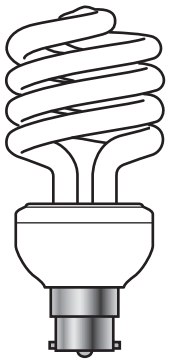
[3]

[Total: 3]

3 This question is about two different types of light bulb.



filament light bulb



energy saving light bulb

The following information was given on the box of the energy saving light bulb

- filament light bulbs have a power of 40W
- energy saving light bulbs have a power of 9W
- filament light bulbs last 1,000 hours
- energy saving light bulbs last 10 times longer than filament light bulbs.

(a) Use this information to work out the **total energy** used by an **energy saving** light bulb in its lifetime in **joules**.

Show your working.

answer = ... joules **[4]**

(b) Domestic energy meters do not measure the energy in joules.
State the unit they do use, and explain why.

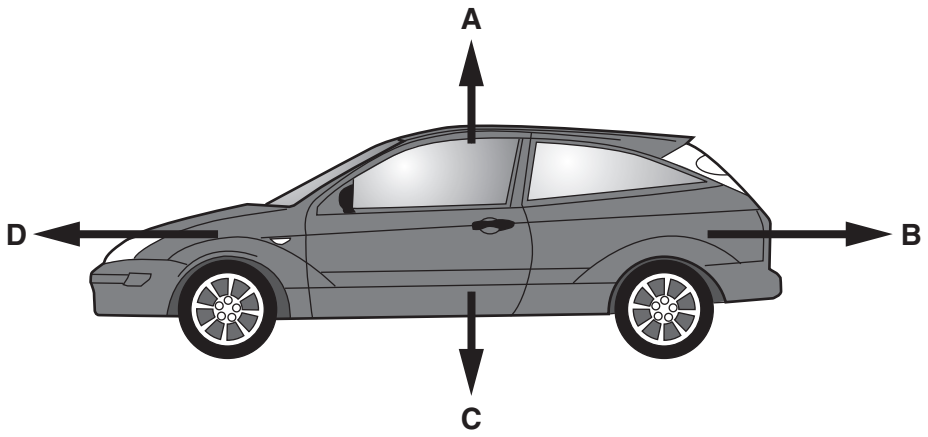
.....

.....

..... **[2]**

[Total: 6]

4 A car is travelling at constant velocity.
The diagram below shows the direction of the four forces that act on the car.



(a) What are the four forces that act on the car?
Draw a straight line from each **letter** to the type of **force**.

letter	force
	weight
A	reaction force
B	counter forces
C	repulsive force
D	resultant force
	driving force

[3]

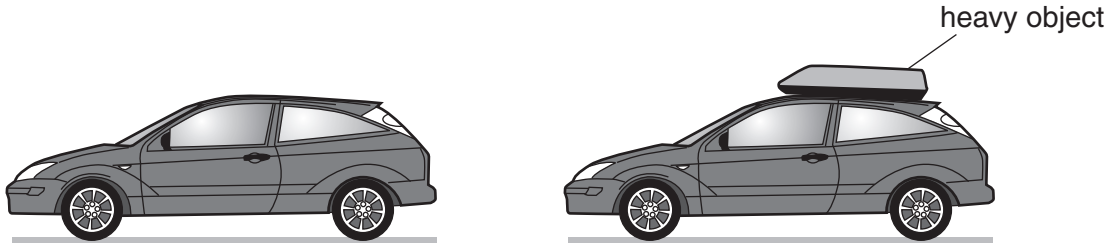
(b) Each force is one of an interaction pair.
None of the forces **A**, **B**, **C** or **D** form an interaction pair with each other.
Describe the 'partner' of force **C**.
Include in your answer

- the nature of the force
- what the force acts on.

.....

..... **[2]**

(c) Two identical cars, **A** and **B**, are driven along a level road.
They travel at the same speed in the same direction.
Car **B** has a heavy object which is strapped to its roof.



car A **car B**

(i) How will the following quantities compare between the two cars?
Put a tick (✓) in the correct box in each row.

	greater for car A	**greater for car B**	**the same for both cars**	**cannot tell which car is greater**
the velocity				
the momentum				
the kinetic energy				

[3]

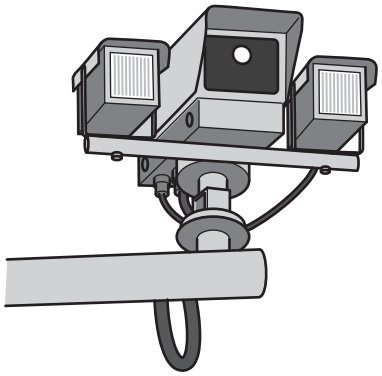
(ii) Car **A** brakes suddenly.
The braking force is 10 000 N.
Car **A** takes 80 m to stop.

What is the work done by the brakes?

work done = ... J **[1]**

[Total: 9]

5 This question is about speed cameras.



One system of measuring speed uses two cameras placed a known distance apart. It times how long a car takes to move between the two cameras.

(a) One car is travelling at 16 m/s.
The cameras are 800 m apart.
Calculate the time it takes for the car to travel between the cameras.

time = ... s **[1]**

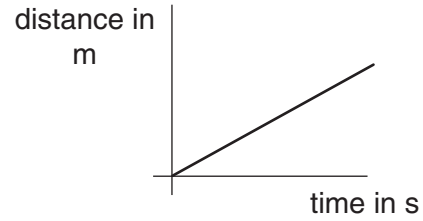
(b) Speed can be described as either "instantaneous" or "average".
Draw **two** straight lines to show the meaning that best matches each phrase.

	the speed of the car as it passes one camera
instantaneous speed	the total speed of the car
	the speed measured by timing how long the car takes to travel 800 m
average speed	the speed of the car in a particular direction
	momentum × mass

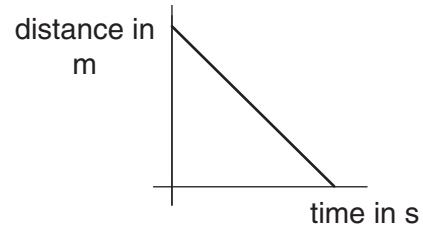
[2]

(c) Another car slows down as it passes between the two cameras.
Here are some distance-time graphs that could show the car's journey.

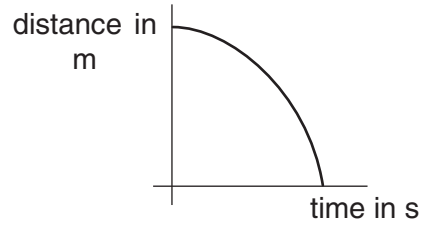
A



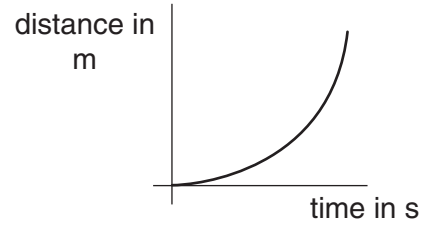
B



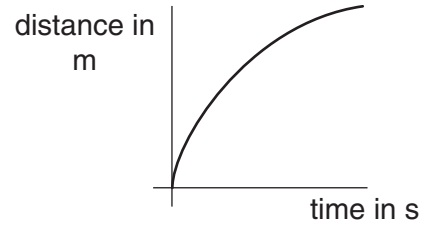
C



D



E

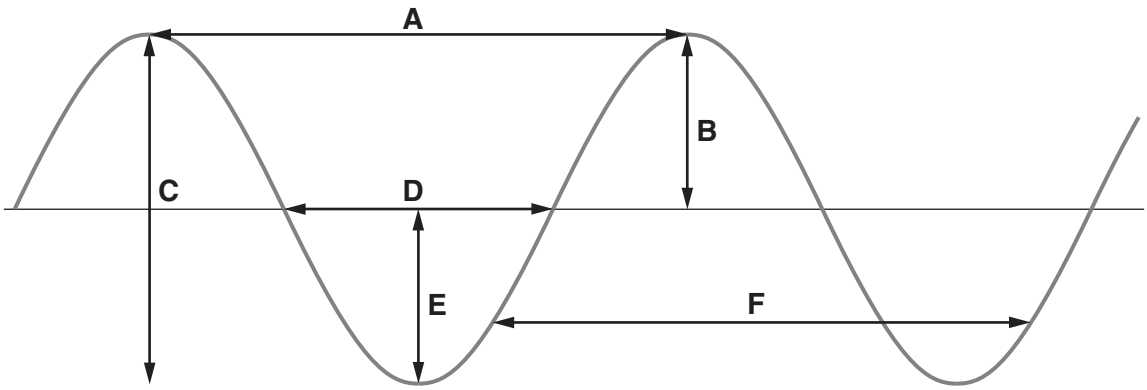


Which of the graphs, **A**, **B**, **C**, **D** or **E**, could show the car slowing down?

graph ..... **[1]**

[Total: 4]

6 Julie draws the side view of a water wave.



(a) Julie tries to remember which labels should be added to the diagram.
Which arrows fit each label?
Put a tick (✓) in the correct box in each row.
Each row can have one or more ticks.

label	arrow						not shown
	A	B	C	D	E	F	
wavelength							
frequency							
amplitude							

[3]

(b) Julie copies notes that her teacher has written on the whiteboard, but misses out a phrase.
Put a (ring) around the correct words.

"The speed of the wave is usually

not affected by
the same as
bigger than
similar to

its frequency and amplitude."

[1]

(c) Julie's notes include the following:

"An electromagnetic wave has a frequency of 5×10^{11} kHz"

(i) Which equation should she use to calculate the wavelength?

Write the letter in the space below.

A	$\text{frequency} = \frac{\text{wavelength}}{\text{wave speed}}$
B	$\text{wavelength} = \frac{\text{frequency}}{\text{wave speed}}$
C	$\text{wavelength} = \frac{\text{wave speed}}{\text{frequency}}$
D	wavelength = wave speed + frequency
E	frequency = wave speed × wavelength

equation ..... **[1]**

(ii) Julie wants to find the wavelength in **metres**. She finds out that the wave speed is 300 000 km/s. Which numbers must she use in the equation?
Choose the **row** that has the correct pair of numbers.
Write the letter below.

	wave speed in m/s	**frequency in Hz**
A	3×10^5	5×10^{11}
B	3×10^8	5×10^8
C	3×10^5	5×10^{14}
D	3×10^8	5×10^{14}
E	3×10^{11}	5×10^8

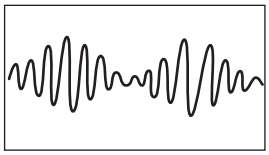
row ..... **[1]**

[Total: 6]

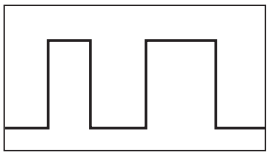
7 Cordless phones have two parts, a handset and a base unit.
These send signals to each other using radio waves.

There are two types of cordless phone.
One phone uses signal **A** and one phone uses signal **B**.

signal **A**



signal **B**



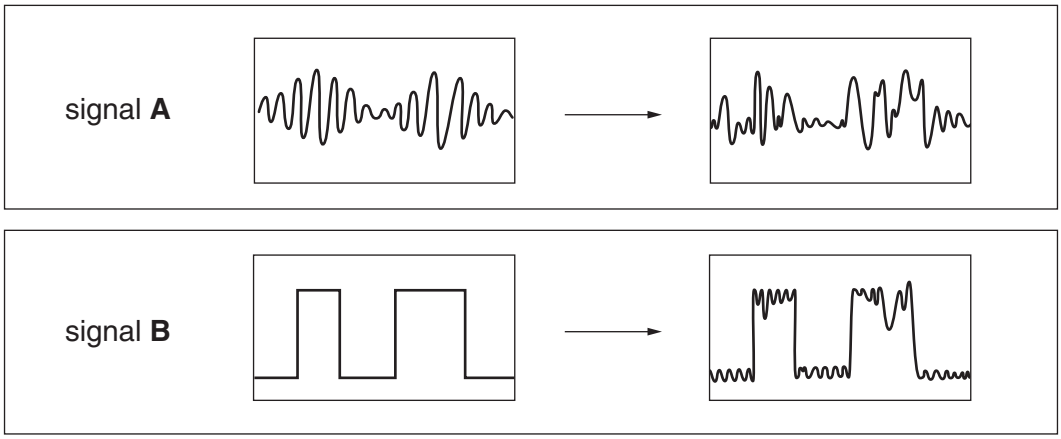
(a) Join the boxes to explain the types of signal used by each phone.
Draw a line from each **signal** to the **type of signal** and another line from this **type of signal** to the correct **description of signal**.
You should have a total of **four** lines.

signal	type of signal	description of signal
	an analogue signal	made from just two values
A	an amplitude signal	the same as the original sound wave
	a digital signal	has no amplitude
B	an interference signal	has only one possible frequency
	a longitudinal signal	varies continuously

[1]

(b) Sometimes **noise** is picked up by the radio signal as it travels.
This reduces the quality of the signal.

The pictures below show this happening to signals **A** and **B**.



Explain why signal **B** can give a clearer sound than signal **A**.

.....

.....

.....

..... **[2]**

(c) In **this** communication system, the received signal needs to be amplified.
Which two statements, when taken together, explain why?
Put ticks (✓) in the boxes next to the **two** correct answers.

The intensity of a wave depends on its amplitude.	☐
The amplitude of the signals is modulated.	☐
Sound waves reduce in intensity as they travel.	☐
Signals can be carried through optical fibres.	☐
The intensity of a signal will reduce as it travels.	☐
The intensity of a signal depends on its modulation.	☐

[2]

[Total: 5]

8 Jack is trying to set up a television using an indoor aerial. The television receives radio waves.

(a) Why are radio waves used to transmit television signals?

Put a tick (✓) in the box next to the correct answer.

They are strongly absorbed by water molecules. ☐

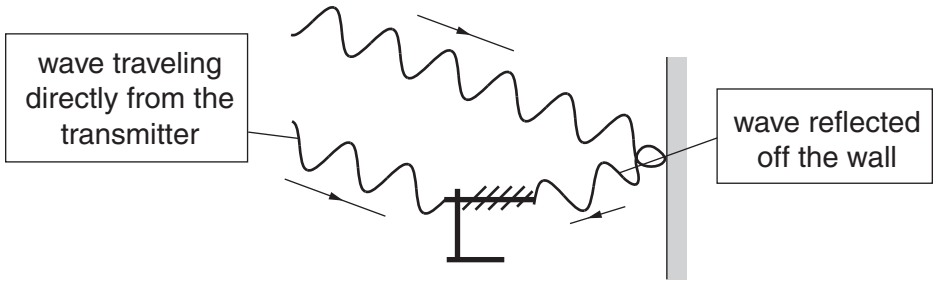
They can travel through a vacuum. ☐

They are transverse waves. ☐

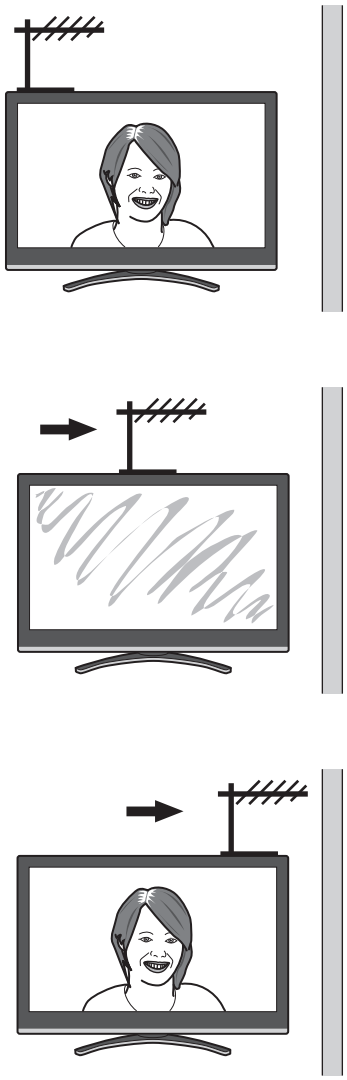
They are not strongly absorbed by the atmosphere. ☐

[1]

(b) Jack realises that the radio waves reach the aerial in two ways.
Some arrive directly from the transmitter and some are reflected off the wall.



As Jack moves the aerial towards the wall, the quality of the picture gets better, then worse, then better again.



Explain why the picture quality changes.
Include in your answer

- what wave effect causes the change in picture quality
- what happens to the waves when the picture is good
- what happens to the waves when the picture is bad.

.....

.....

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..... **[3]**

[Total: 4]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE