OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

A332/02

PHYSICS A

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)

Tuesday 27 January 2009
Afternoon

Duration: 40 minutes

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

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.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	4	
2	9	
3	4	
4	7	
5	4	
6	4	
7	5	
8	5	
TOTAL	**42**	

TWENTY FIRST CENTURY SCIENCE EQUATIONS
Useful Relationships

Explaining Motion

- $\text{speed} = \dfrac{\text{distance travelled}}{\text{time taken}}$
- momentum = mass × velocity
- change of momentum = resultant force × time for which it acts
- work done by a force = force × distance moved by the force
- change in energy = work done
- change in GPE = weight × vertical height difference
- kinetic energy = $\frac{1}{2}$ × mass × [velocity]^2

Electric Circuits

- $\text{resistance} = \dfrac{\text{voltage}}{\text{current}}$
- $\dfrac{V_p}{V_s} = \dfrac{N_p}{N_s}$
- energy transferred = power × time
- power = potential difference × current
- $\text{efficiency} = \dfrac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$

The Wave Model of Radiation

- wave speed = frequency × wavelength

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Question 1 starts on page 4

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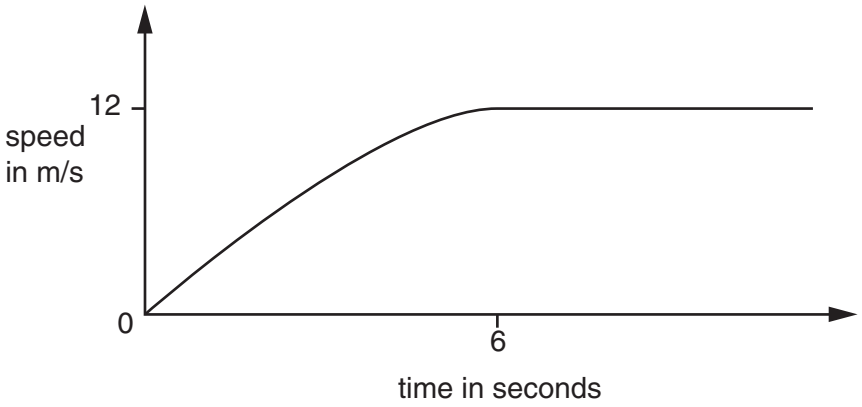
Answer **all** the questions.

1 A sprinter runs a 100 m race.
The graph shows how his speed changed during the race.



(a) The highest speed of the sprinter was 12 m/s.

Which two of the following statements together explain why the average speed was less than 12 m/s.

Put ticks (✓) in the **two** boxes next to the correct answers.

The sprinter's speed was 12 m/s only for the last part of the race. ☐

The sprinter gets tired at the end of the race. ☐

The sprinter increases his speed at the beginning of the race. ☐

The sprinter moves at a constant speed of 10 m/s. ☐

[2]

(b) Which of the following is the best meaning of instantaneous speed?

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

A very quick speed. ☐

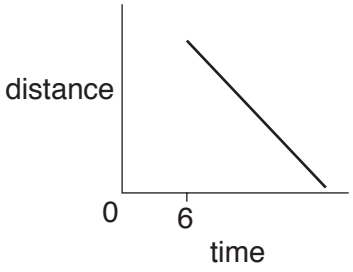
An average speed over a very short time. ☐

A constant speed. ☐

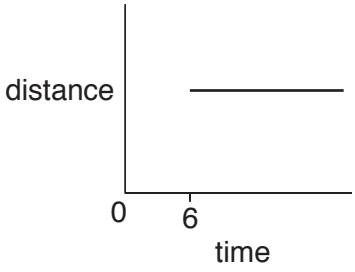
[1]

(c) Which of the following graphs **A**, **B**, **C** and **D** could be the distance-time graph for the sprinter during the last part of the race?

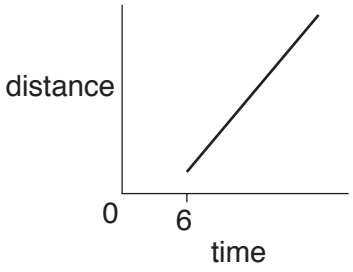
A



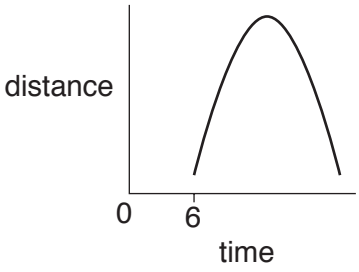
B



C



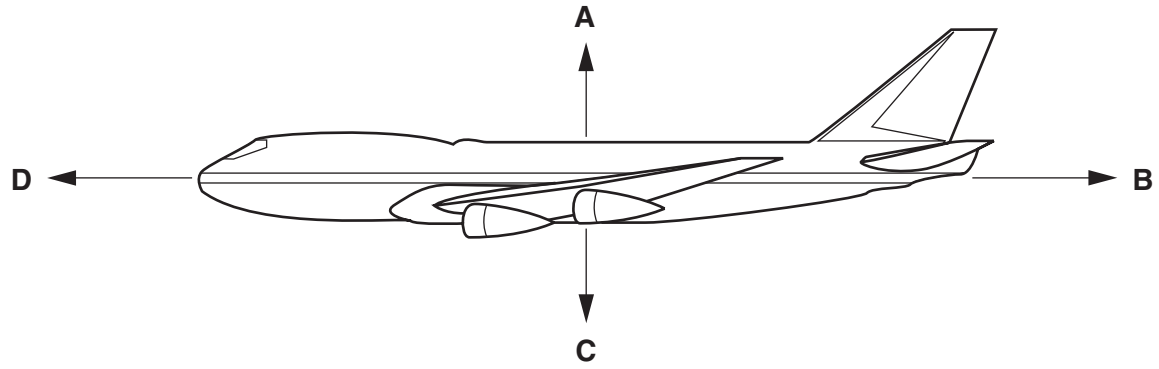
D



answer ..... **[1]**

[Total: 4]

2 There are four forces **A**, **B**, **C**, and **D**, acting on an aeroplane as it flies.



(a) When the plane is flying at a steady speed and a constant height, which of the following combinations of forces must equal zero?

Put ticks (✓) in the boxes next to the correct answers.

A and **B** ☐

A and **C** ☐

A and **D** ☐

B and **C** ☐

B and **D** ☐

C and **D** ☐

[2]

(b) Each of the forces on the plane is one of an interaction pair.

One force of the interaction pair acts on the plane, the other force acts on a different object.

Draw a straight line from each **force on the plane** to the **object its interaction pair is acting on**.

force on the plane		object its interaction pair is acting on
A		exhaust particles from jet engine
B		the Earth
C		molecules of air
D		

[4]

(c) The table below has four statements about energy changes for the plane.

You must decide if the statement is correct when the plane is:

- taking off and climbing
- in level flight at a steady speed
- descending and landing

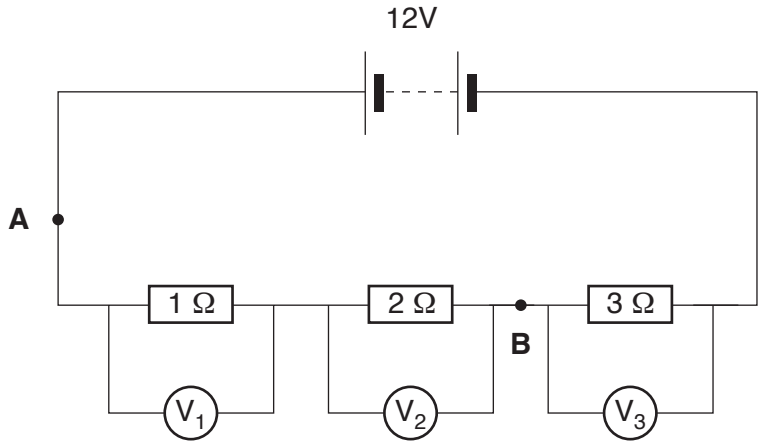
For each statement put ticks (✓) in the box or boxes that are correct for each statement.

	take off and climb	level flight	descent and landing
gains kinetic energy and gains gravitational potential energy	☐	☐	☐
work done by the engine is dissipated as heat	☐	☐	☐
energy is conserved	☐	☐	☐

[3]

[Total: 9]

3 Jilly builds a circuit to test some ideas about voltage and current.



(a) Jilly records the voltmeter readings.

(i) Which of the equations is correct?

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

$V_1 + V_2 + V_3 = \frac{12}{3}$ Volts ☐

$V_1 + V_2 + V_3 = 12$ Volts ☐

$V_1 + 2V_2 + 3V_3 = 12$ Volts ☐

$\frac{V_1 + V_2 + V_3}{3} = 12$ Volts ☐

[1]

(ii) What will be the voltage between points **A** and **B**?

Put a (ring) around the correct answer.

1V **2V** **4V** **6V** **8V** **12V**

[1]

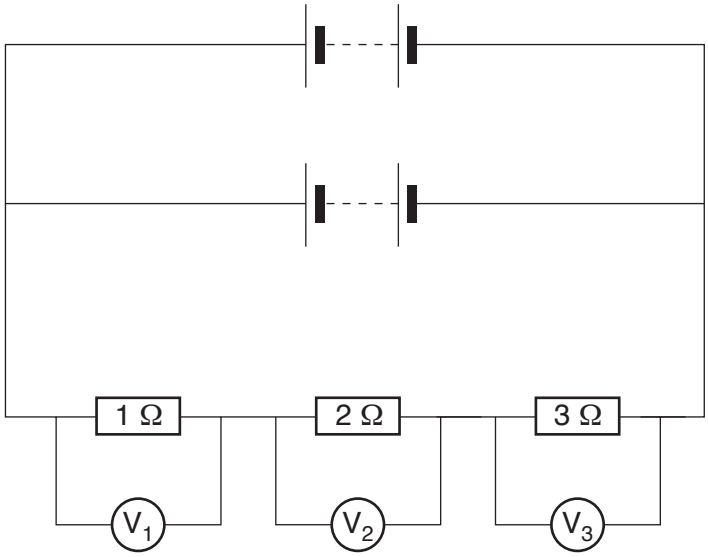
(iii) What is the current through the 2 Ω resistor?

Put a (ring) around the correct answer.

2 A **4 A** **6 A** **12 A** **24 A**

[1]

(b) Jilly adds another 12V battery **in parallel** with the first battery.



What effect will the additional battery have on the voltage across the resistors?

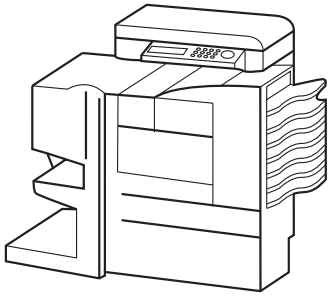
Put a tick (✓) in the box next to the correct answer.

voltage increases but does not double	☐
voltage doubles	☐
no change to voltage	☐
voltage halves	☐
voltage decreases but does not halve	☐

[1]

[Total: 4]

4



Photocopiers usually plug into the mains electrical supply.

But the internal workings need a variety of different voltages.

Transformers are used to change the voltages.

(a) Which of the following statements describe how a transformer works?

Put ticks (✓) in the **three** boxes next to the best answers.

A moving magnet induces a voltage in a coil of wire.	☐
Two separate coils of wire are wound around an iron core.	☐
A changing magnetic field is produced by a changing electric current.	☐
An iron core is a good conductor of electric current.	☐
A changing magnetic field induces a voltage in a coil of wire.	☐
The voltage is changed by the transformer but the electric current stays the same.	☐

[3]

(b) One transformer in a photocopier is used to produce 6000V from 600V.

The transformer has 100 coils on the 600V side.

(i) How many coils will the transformer have on the 6000V side?

Put a (ring) around the correct answer.

10 **600** **1000** **6000** **10 000**

[1]

(ii) Which formula would allow you to correctly calculate the number of coils?

Put ticks (✓) in the box next to the correct answers.

$N_s = \frac{V_p}{V_s} + N_p$ ☐

$N_s = N_P \frac{V_p}{V_s}$ ☐

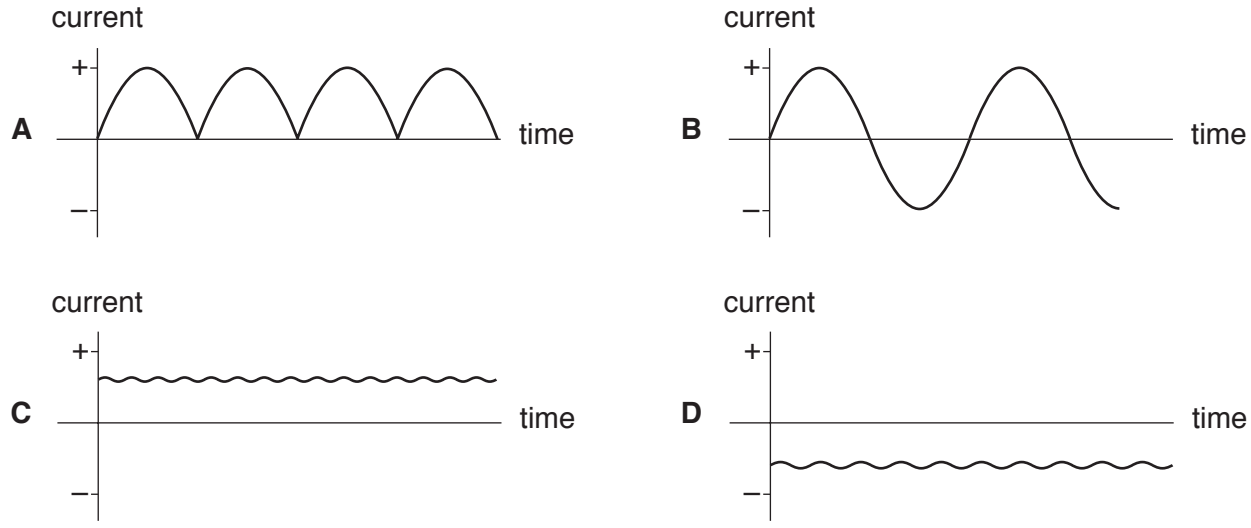
$N_s = N_P \frac{V_s}{V_p}$ ☐

$N_s = N_P + \frac{V_s}{V_p}$ ☐

[1]

(c) The alternating current from the transformer is converted into a direct current.

The graphs show how different currents change with time.



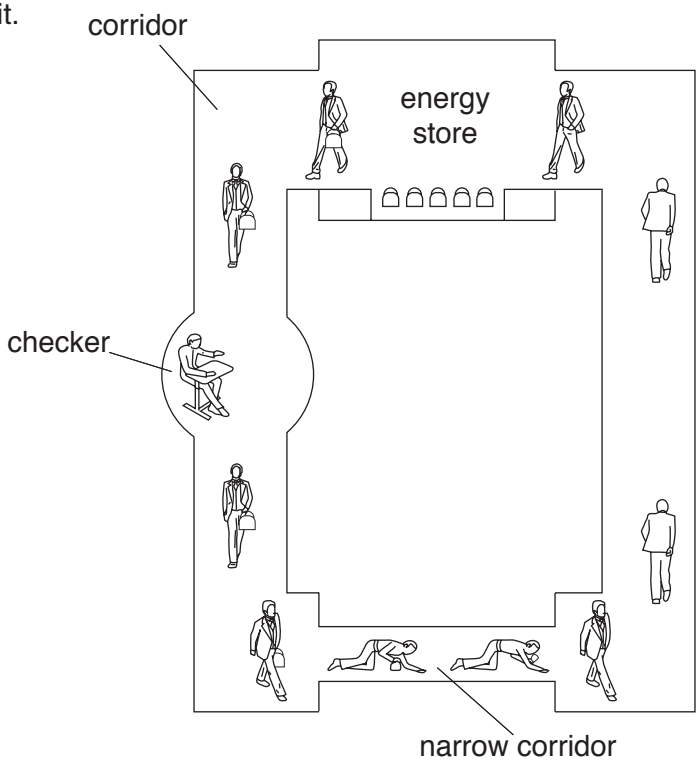
Which of the graphs **A**, **B**, **C** and **D**, show direct current?

Write down the letters of the graphs.

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

[Total: 7]

5 Barry suggests a model of an electric circuit.



The **people** pick up bags of sugar from the **energy store**.

The **narrow corridor** is hard to get through. It gets very warm as people struggle through it.

The **checker** uses a stopwatch to measure the rate that the people pass him.

The boxes show parts in the model and parts in an electric circuit.
Draw a straight line from each **part in the model** to the correct **part in an electric circuit**.

part in the model	part in an electric circuit
narrow corridor	electrons
people	resistor
energy store	voltmeter
checker	ammeter
	battery

[4]

[Total: 4]

6 Katie plays a domino game in a lesson about waves.

Each domino has a word and a meaning of a different word.

word
meaning of a different word

Dominoes must be put down with the correct word **below** its meaning.

The first one has been done for you.

Frequency x wavelength is speed, so **F** is the domino placed below **A**.

Write the correct letter in the boxes beside the grey dominoes.

A	**amplitude** frequency x wavelength			
F	**speed** a wave bounces from a surface		**B**	**diffraction** direction of a wave changes as it enters a different medium
			C	**interference** waves spread out from a narrow gap
			D	**reflection** two waves meet and their effects add together
			E	**refraction** the distance from the height of the wave to the undisturbed position
			F	**speed** a wave bounces from a surface

[4]

[Total: 4]

7 This question is about different scientific models for light.

(a) Which of the following are evidence for the model that light is a wave?

Put ticks (✓) in the boxes next to the correct answers.

light travels at a very high speed	☐
two light beams can produce an interference pattern	☐
light reflects from mirrors	☐
light can be different colours	☐
light is diffracted through small slits	☐

[2]

(b) In the photon model a beam of light is a stream of photons.

The intensity of a beam of light is the energy it delivers per second.

(i) In the photon model which of the following affect the intensity of light?

Put ticks (✓) in the boxes next to the correct answers.

the speed of the photon	☐
the number of photons arriving each second	☐
the amplitude of the photon	☐
the energy carried by each photon	☐

[2]

(ii) In the photon model the energy of an individual photon depends on light wave properties.

To increase the energy of a photon, which light wave property must be increased?

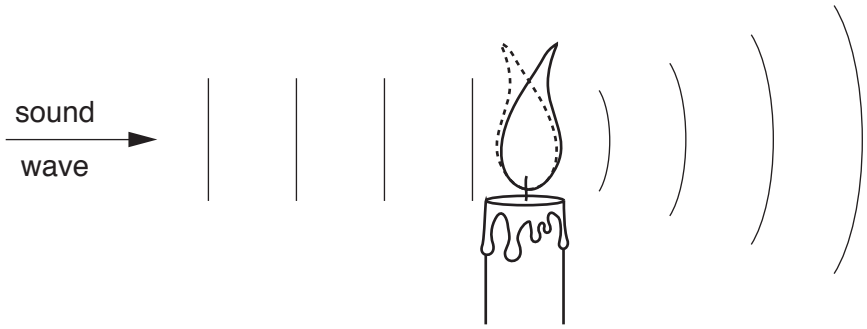
Put a (ring) around the correct answer.

wave speed **frequency** **wavelength**

[1]

[Total: 5]

8 When a sound wave passes through a candle flame it makes the candle flicker backwards and forwards.



not to scale

(a) The sound wave has a frequency of 30 Hz and a speed of 300 m/s.

(i) Calculate the wavelength of the wave.

wavelength = ... m **[1]**

(ii) How often will the flame flick backwards and forwards in 4 seconds?

answer = ... **[1]**

(b) The following observations were made during the experiment.

A	The flame acts like a lens for sound waves.
B	The size and brightness of the flame stays the same.
C	The louder the sound the bigger the flicker of the flame.
D	The flame flickers backwards and forwards in the direction the wave is moving.

Some of the observations provide evidence for the statements below.

For each statement write the letter for the observation that provides the best evidence.

the sound wave is a longitudinal wave ☐

the wave speed is greater in the flame than in the air ☐

the energy of the sound wave is related to the amplitude ☐

[3]

[Total: 5]

END OF QUESTION PAPER

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