Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
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7	
8	
9	
10	
11	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2011

Physics (B): Physics in Context PHYB2

Unit 2 Physics Keeps Us Going

Module 1 Moving People, People Moving
Module 2 Energy and the Environment

Monday 6 June 2011 1.30 pm to 2.45 pm

For this paper you must have:
- a pencil and a ruler
- a calculator
- a Data and Formulae Booklet.
- a protractor

Time allowed
- 1 hour 15 minutes

Instructions
- Use black ink or black ball-point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show all your working.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 70.
- You are expected to use a calculator where appropriate.
- A *Data and Formulae Booklet* is provided as a loose insert.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- You are advised to spend about 20 minutes on **Section A** and about 55 minutes on **Section B**.

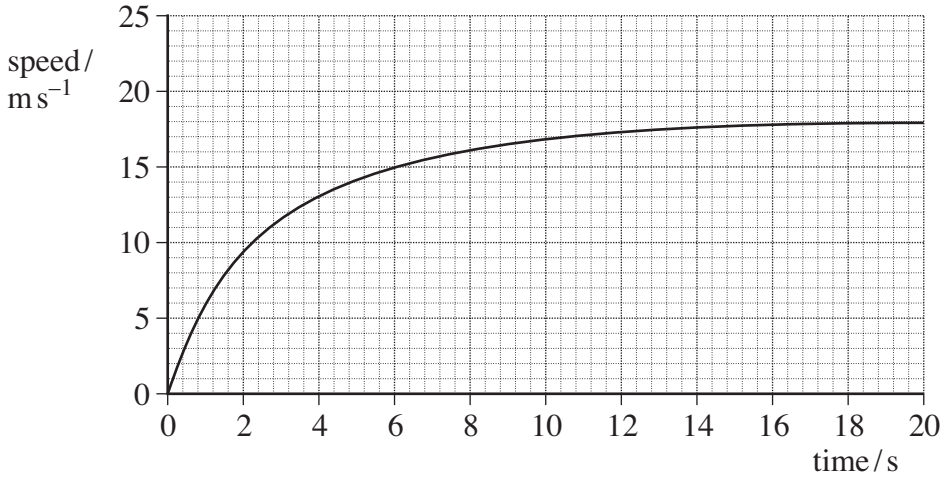
Section A

Answer **all** questions in this section.

There are 20 marks in this section.

1 **Figure 1** is a speed-time graph for a cyclist at the start of a race.

Figure 1



1 (a) Calculate the initial acceleration of the cyclist.

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acceleration ..... m s^{-2}

(3 marks)

1 (b) Some athletes take steroids or other performance enhancing drugs.

1 (b) (i) Draw on **Figure 1**, another graph to show how the cyclist's motion might be different if he had taken performance enhancing drugs.

(1 mark)

1 (b) (ii) Explain how the performance enhancing drugs may have affected the shape of the graph.

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(1 mark)

1 (b) (iii) State any adverse effects that the taking of performance enhancing drugs may have on the cyclist.

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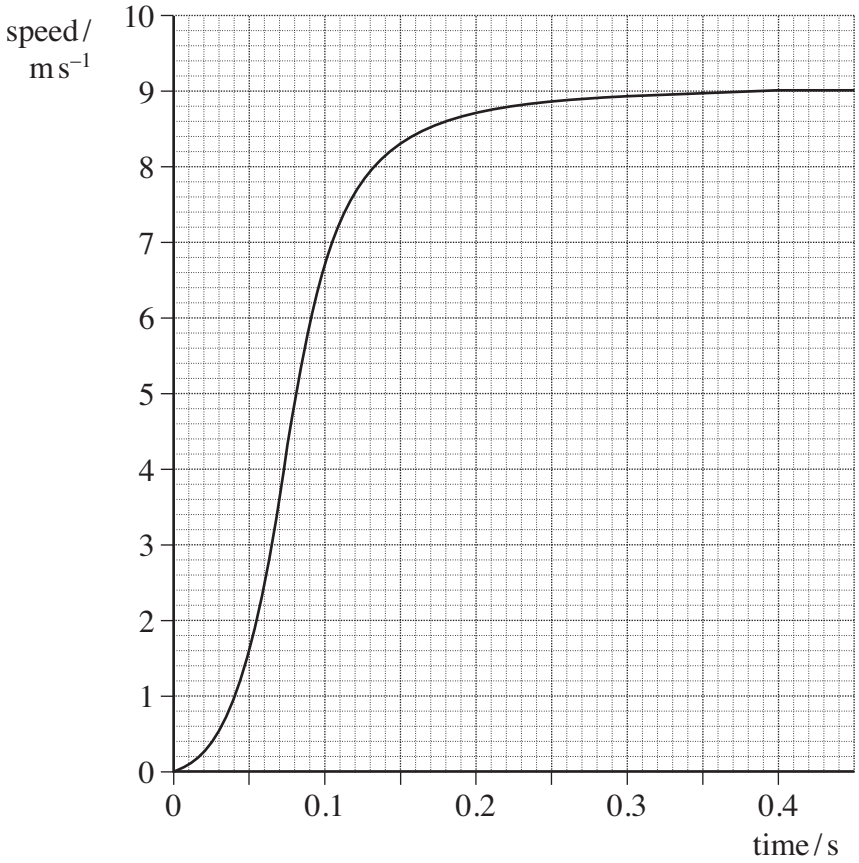
(1 mark)

2 **Figure 2** is a speed-time graph for a sprinter at the start of a race.

Figure 2



Determine the distance covered by the sprinter in the first 0.3 s of the race.

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distance ..... m

(3 marks)

Turn over for the next question

3 **(i)** In the space below, sketch a graph of resistance (on the *y*-axis) against temperature (on the *x*-axis) for a superconducting material. Show temperatures up to 100ºC. Label the critical temperature T.

(2 marks)

3 **(ii)** State an approximate maximum value for critical temperature, in K, for superconducting materials that are currently available.

critical temperature ..... K

(1 mark)

4 A cricket ball is travelling at a speed of 32.5 m s^{-1} when it is hit by a bat. After impact, the ball has the same speed but is travelling in the opposite direction.
The mass of the ball is 0.156 kg.

4 (a) Calculate the change in momentum of the cricket ball. State an appropriate unit for your answer.

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change in momentum .....

unit .....

(3 marks)

4 (b) The bat is in contact with the ball for 3.80 ms.
Calculate the force exerted by the bat on the ball.

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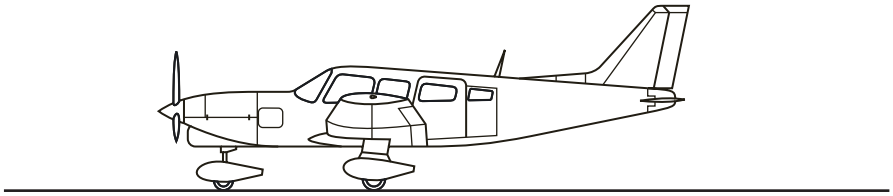
force .....N
(2 marks)

5 **Figure 3** shows an aircraft at the moment of take-off. At this moment, it is still accelerating in a horizontal direction.

Figure 3



Draw labelled arrows onto **Figure 3** to represent the forces acting on the aircraft at the moment of take-off.
Label each arrow with the name of the force.
Take care to show where each force acts on the aircraft.
Make sure that the relative lengths of the arrows represent the relative magnitudes of the forces.

(3 marks)

20

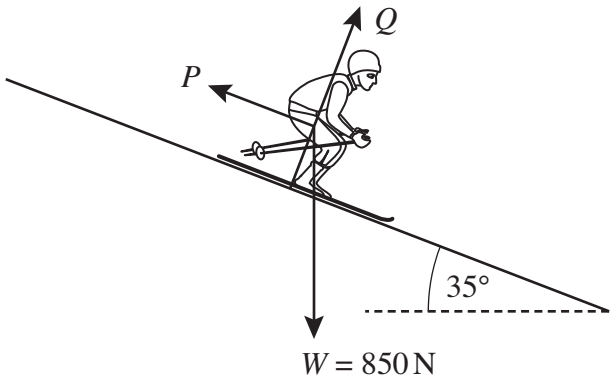
Section B

Answer **all** questions in this section.

There are **50** marks in this section.

6 (a) **Figure 4** shows a skier travelling at constant speed down a slope of 35°. The force labelled **P** is parallel to the slope. The force labelled **Q** is perpendicular to the slope. Assume that there is no friction between the skis and the snow.

Figure 4



not to scale

6 (a) (i) Identify the forces labelled **P** and **Q**.

P .....

Q .....

(2 marks)

6 (a) (ii) State the condition necessary for the skier to be travelling at a constant velocity.

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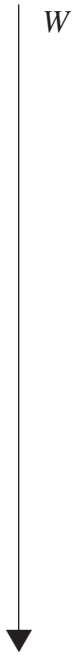
(1 mark)

6 (b) **Figure 5** shows an arrow representing the weight, W, of the skier. The arrow has been drawn to scale.

Figure 5

scale 1cm:100N



By drawing the forces **P** and **Q** onto **Figure 5**, complete the scale diagram and determine the magnitude of the force **P**.

magnitude of force **P** ..... N

(4 marks)

Question 6 continues on the next page

6 (c) (i) The skier moves onto level snow. Initially the magnitude of force **P** remains constant. The mass of the skier is 87kg.
Calculate the initial deceleration of the skier.

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deceleration ..... m s^{-2}

(2 marks)

6 (c) (ii) State and explain what would happen to the deceleration as the skier continues along the level snow.

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(2 marks)

11

7 (a) A constantan wire has a radius of 0.430 mm and a resistance of 5.60 Ω. The resistivity of constantan is 4.90×10^{-7} Ω m.

7 (a) Calculate the length of the wire in m.

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length ..... m

(3 marks)

7 (b) A wire of resistance 5.60 Ω is connected across the terminal of a cell. The cell has an emf of 1.50 V and an internal resistance of *r*.

7 (b) (i) The current through the wire is 0.247 A.
Calculate the total resistance of the circuit.

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resistance ..... Ω

(2 marks)

7 (b) (ii) Determine the internal resistance, *r*, of the cell.

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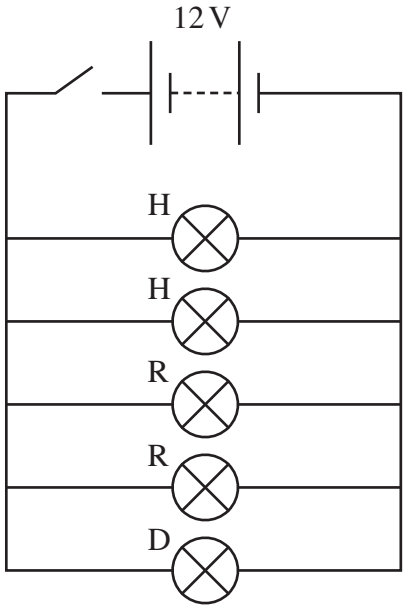
resistance ..... Ω

(1 mark)

6

8 **Figure 6** shows a simplified circuit for the main lights on a car.
The battery has an emf of 12 V and no internal resistance.

Figure 6



The table below gives data about the lamps being used in the circuit. The resistances given are correct when the lamp is operating at its normal operating voltage.

LAMP	OPERATING VOLTAGE V	RESISTANCE Ω
H, headlight lamp	12	3.8
R, rear lamp	12	5.6
D, dashboard lamp	12	72

8 (a) (i) Calculate the power of a single headlight lamp when operating at 12 V.

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power ..... W
(2 marks)

8 (a) (ii) Calculate the resistance of the combination of lamps when operating at 12 V.

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resistance ..... Ω

(3 marks)

8 (a) (iii) Calculate the total power of the combination of lamps when operating at 12 V.

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power ..... W

(2 marks)

8 (b) The battery is replaced with one of a lower emf. State and explain how the resistance of the lamps would have to change in order to achieve the same brightness.

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(2 marks)

9

9 (a) The Sun radiates a power of 3.8×10^{26} W.
The radius of the Earth's orbit around the Sun is 1.5×10^{8} km.
Calculate the intensity of the Sun's radiation falling at a distance of 1.5×10^{8} km from the Sun.
State the appropriate unit.

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intensity .....

unit .....

(4 marks)

9 (b) Spain, in southern Europe, generates more than 3 GW of electricity using solar power. Explain why, unlike Spain, the United Kingdom does not use solar power but is beginning to exploit other types of renewable resources for electricity production.

The quality of your written communication will be assessed in this question.

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(6 marks)

10

Turn over for the next question

10 (a) Explain what is meant by *convection* and distinguish between *forced* and *natural convection*.

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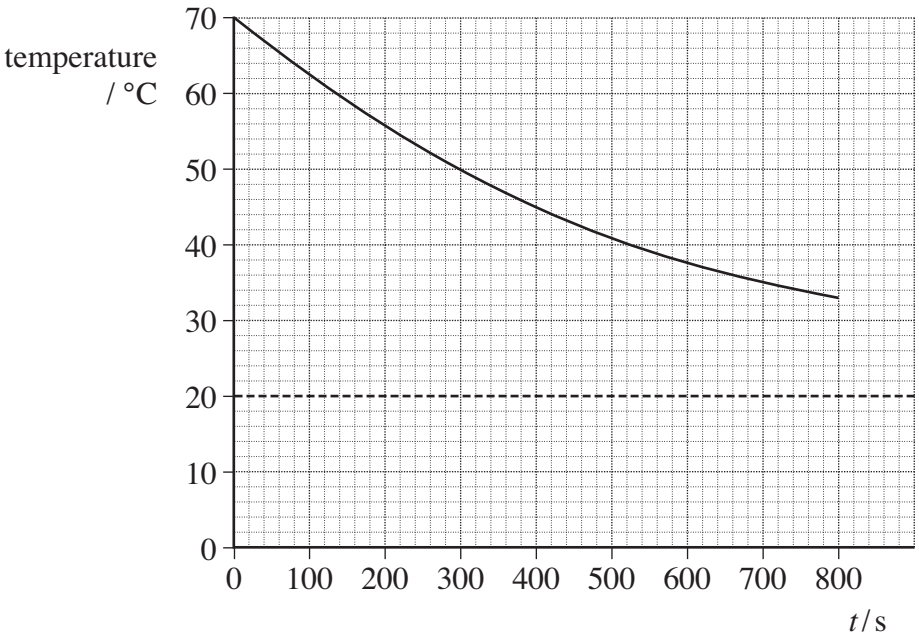
(3 marks)

10 (b) **Figure 7** is a graph of temperature against time for an object being cooled by forced convection in a room where the temperature is 20ºC.

Figure 7



10 (b) (i) Determine the length of time taken for the temperature difference between the object and the room to halve. Show your working on the graph.

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time ..... s

(2 marks)

10 (b) (ii) Determine the time taken for the temperature of the object to fall from 70ºC to 23ºC.

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time ..... s

(3 marks)

8

Turn over for the next question

11 (a) Explain briefly why scientists believe that human activity produces global warming.

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(2 marks)

11 (b) Suggest reasons why the causes and effects of activities producing global warming might be considered to be unfairly divided between the developed world and the developing world.

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(4 marks)

6

END OF QUESTIONS