Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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11	
12	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
January 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 17 January 2011 1.30 pm to 2.45 pm

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

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 (a) What is meant by a scalar quantity?

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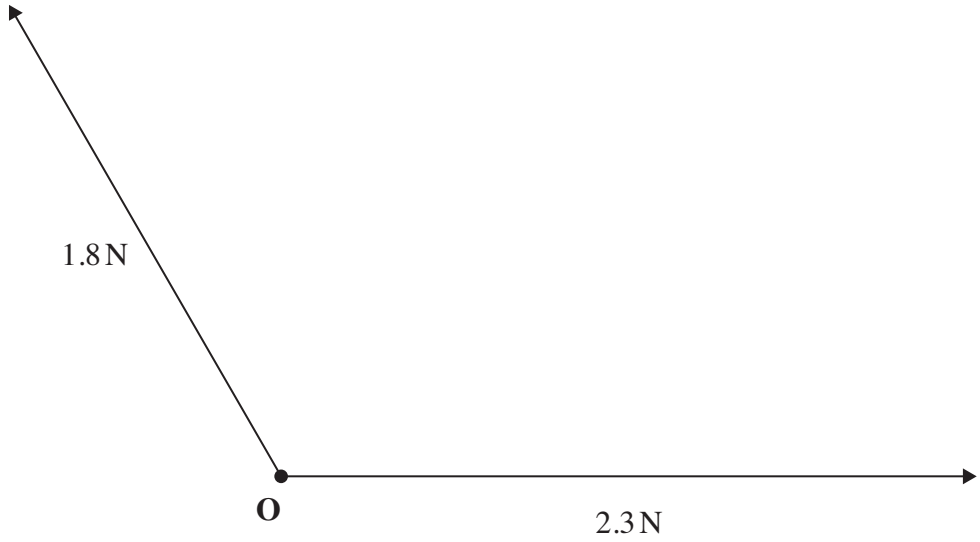
(1 mark)

1 (b) **Figure 1** shows two forces acting on an object at **O**. The forces have been drawn to scale.

Figure 1



1 (b) (i) State the scale used in **Figure 1** .....

(1 mark)

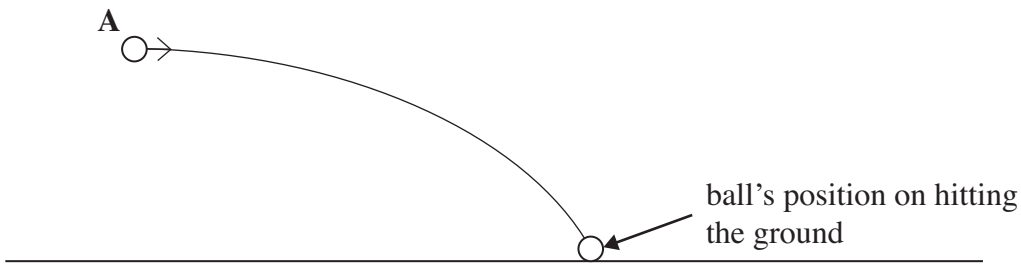
1 (b) (ii) Complete the scale drawing, **Figure 1**, to determine the magnitude of the resultant force.

magnitude of resultant force ..... N

(3 marks)

2 **Figure 2** shows the path that a tennis ball would follow in the absence of air resistance, after being hit horizontally at **A**.

Figure 2



2 (a) Explain why the path of the ball is curved in this way.

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(2 marks)

2 (b) Draw onto **Figure 2** the path of a ball, hit in the same way at **A**, that is affected by air resistance.

(1 mark)

3 **Figure 3** shows the electromagnetic spectrum.

Figure 3

radio	microwave	**A**	visible light	**B**	**C**	gamma ray

3 (a) Name the radiation that is in position **A**. .....

(1 mark)

3 (b) Give a typical wavelength for radiation in position **B**. ..... m

(1 mark)

3 (c) State a possible effect on the human body of radiation in position **C**. .....

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(1 mark)

4 When a diver is fully submerged, after jumping into the sea, the weight of water displaced is 1020 N. The sea water has a density of 1.03×10^3 kg m^{-3}.

4 (a) Calculate the volume of the diver. Give your answer to 3 significant figures.

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volume ..... m^3

(3 marks)

4 (b) The diver's weight is 1.00×10^3 N.
State and explain what happens to the diver when he is fully submerged in the water.

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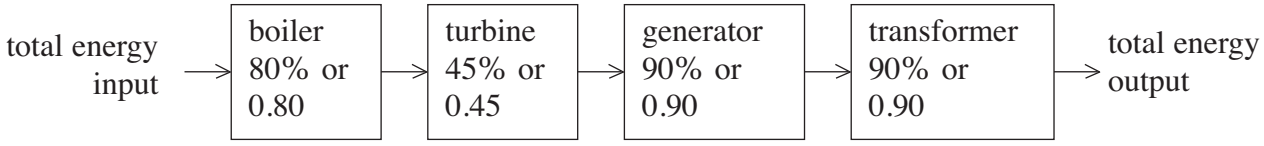
(2 marks)

5 **Figure 4** is a flow diagram for a power station. The efficiency of each stage is shown on the diagram.

Figure 4



Calculate the efficiency of the multi-stage process.

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efficiency .....

(2 marks)

6 Explain, in terms of electrons, how electrical energy is transformed into thermal energy when there is a current in a metallic resistor.

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(2 marks)

20

Turn over for next question

Section B

Answer **all** questions in this section.

There are 50 marks in this section.

7 A climber falls 2.3 m before being stopped by his climbing rope that is secured above him.
The weight of the climber is 840 N.

7 (a) Calculate the loss in gravitational potential energy of the climber.

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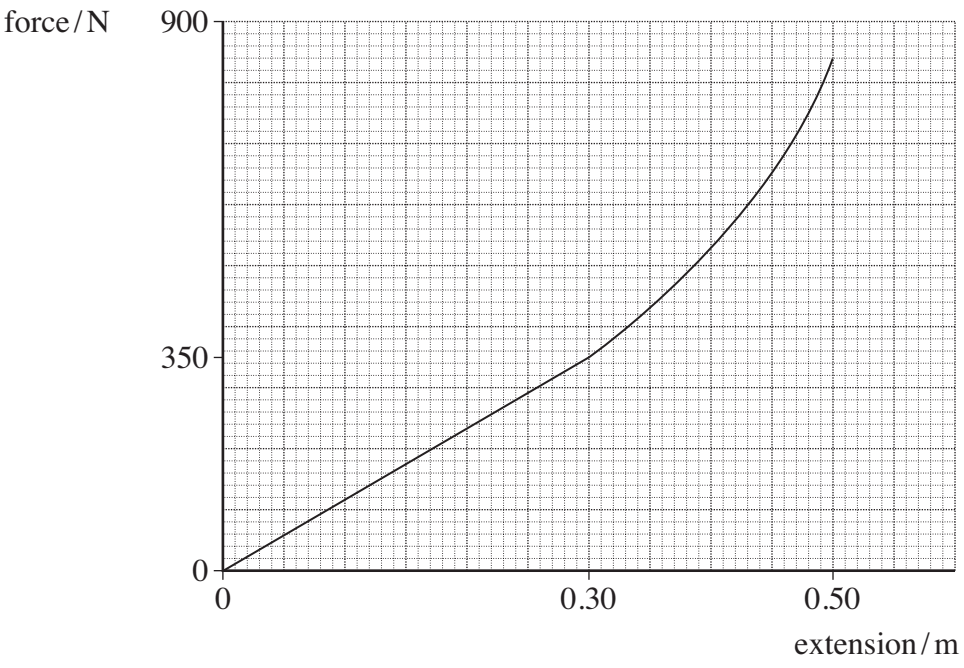
loss in potential energy ..... J
(2 marks)

7 (b) **Figure 5** shows a force – extension graph for the rope being used.

Figure 5



7 (b) (i) Use **Figure 5** to find the stiffness of the rope when it is being used with forces up to 350 N. Give the appropriate unit.

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stiffness .....

unit .....

(4 marks)

7 (b) (ii) Use **Figure 5** to determine the energy stored in the rope when it is stretched by 0.25 m.

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energy ..... J

(3 marks)

9

Turn over for the next question

8 (a) Explain why the resistance of an NTC thermistor decreases when its temperature increases.

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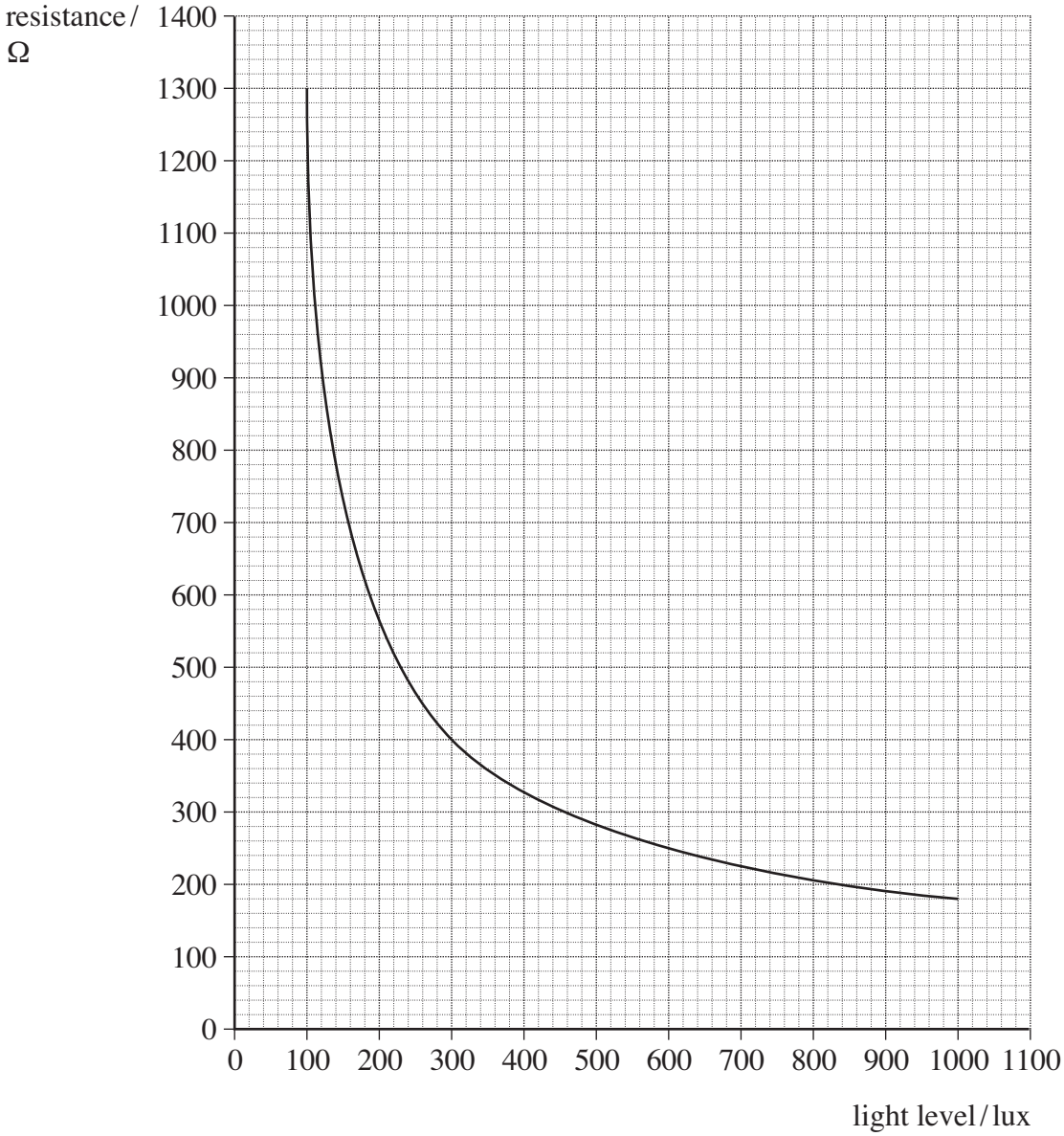
(3 marks)

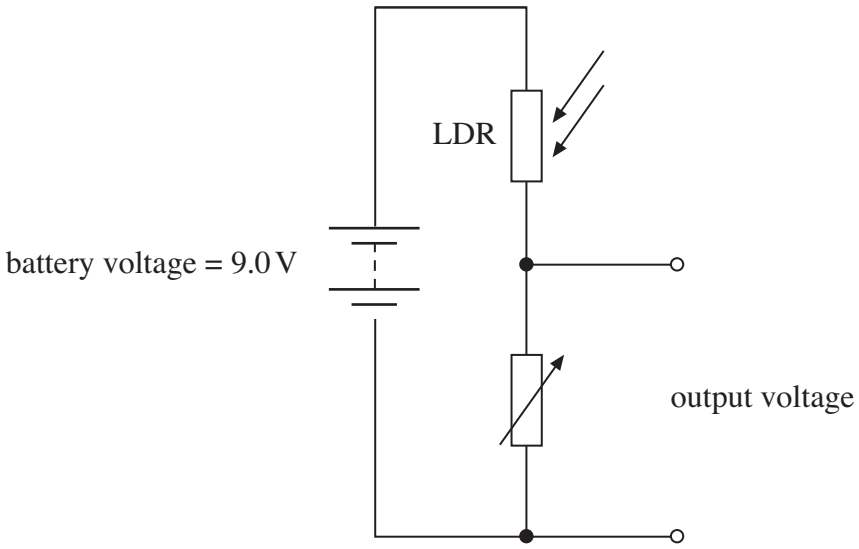
8 (b) **Figure 6** shows the variation of resistance with light level for a light dependent resistor (LDR).

Figure 6



8 (b) An LDR is used in the circuit in **Figure 7** to monitor light levels.

Figure 7



8 (b) (i) Calculate the output voltage of the circuit when the light level at the LDR is 300 lux and the resistance of the variable resistor is 150 Ω. Assume that the battery has no internal resistance.

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output voltage V

(3 marks)

8 (b) (ii) State and explain the effect on the output voltage of an increase in light level at the LDR.

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(2 marks)

8

9 The table below gives the surface areas and *U*-values for the external parts of a house before and after additional insulation has been added.

part of house	walls	doors	windows	roof
area / m^2	90	4	16	70
***U*-value with standard insulation / $W\,m^{-2}\,K^{-1}$**	1.0	2.4	5.0	0.6
***U*-value with additional insulation / $W\,m^{-2}\,K^{-1}$**	0.6	2.4	2.9	0.3

9 (a) The temperature in a house with standard insulation is 23°C when the external temperature is 11°C. Calculate the total rate of heat transfer from the house.

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rate of heat transfer ..... W

(4 marks)

9 (b) Using data from the table above, determine which single part of the house should be insulated to give the best reduction in the rate of heat transfer. Justify your answer.

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(3 marks)

7

10 (a) The frequency of the most intense radiation emitted by the Sun is 5.96×10^{14} Hz. Calculate the surface temperature of the Sun. Give your answer in °C.

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surface temperature ..... °C

(3 marks)

10 (b) Explain how Wien's law and knowledge of the nature of the Earth's atmosphere can be used to account for the greenhouse effect.

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

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(6 marks)

9

11 The table below gives test data relating to three types of petrol driven car used commonly on roads in the UK.

car	A	B	C
mass / kg	1250	1340	1610
maximum power / kW	74	81	171
time, in second, taken to accelerate from 0 to 96 km per hour	10.9	12.5	6.9
fuel economy / litre per 100 km	7.7	5.0	9.1
maximum speed / km h^{-1}	187	177	230

11 (a) (i) Calculate the average acceleration, from rest, of car **A** during the test. Give your answer in m s^{-2}.

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

(3 marks)

11 (a) (ii) Calculate the resultant force required to make car **B** accelerate at 2.10 m s^{-2}.

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force ..... N

(2 marks)

11 (b) Suggest reasons why the data given for car **C** may cause environmental and social concerns.

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(3 marks)

8

Turn over for the next question

12 (a) A wind turbine sweeps out on an area of 1500 m^2. The density of the air is 1.23 $kg\,m^{-3}$. The wind speed is 14 $m\,s^{-1}$.
Calculate the maximum power available from the wind moving past the turbine blades.

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maximum power ..... W

(2 marks)

12 (b) At high tide, a tidal barrage cuts off an area of 7.5×10^7 m^2 of water from the sea. During 5 hours when the tide is going out, the water level drops by 3.4 m. The water has a density of 1030 $kg\,m^{-3}$.

12 (b) (i) Calculate the reduction in gravitational potential energy of the water during this 5-hour period.

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reduction in gravitational potential energy ..... J

(3 marks)

12 (b) (ii) Calculate the average power that is available from the water during this 5-hour period.

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average power ..... W

(2 marks)

12 (b) (iii) Suggest why no tidal barrage generation scheme has yet been built in the United Kingdom.

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(2 marks)

9

END OF QUESTIONS

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED