

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
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10	
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**.



J A N 1 1 P H Y B 2 0 1

WMP/Jan11/PHYB2

PHYB2

Section A

Answer **all** questions in this section.

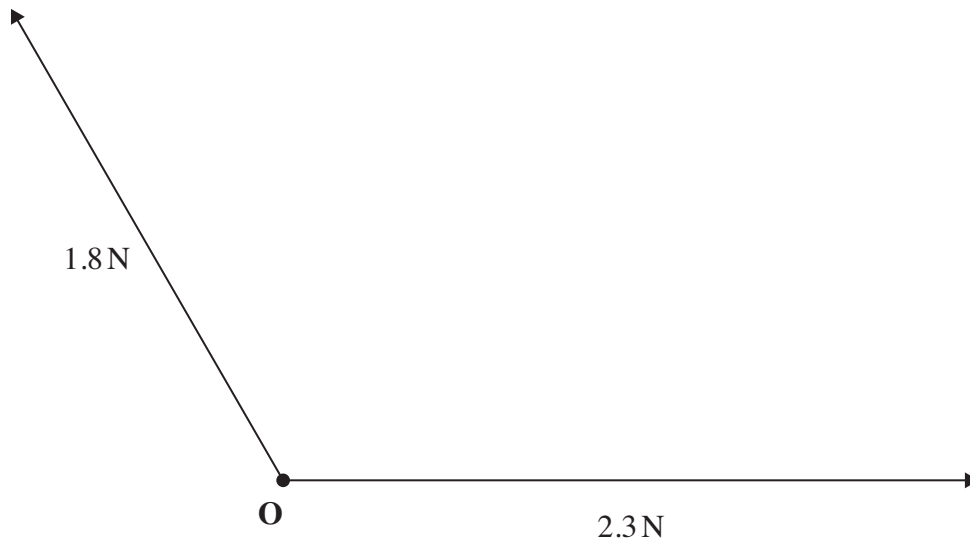
There are 20 marks in this section.

- 1 (a)** What is meant by a scalar quantity?

.....
(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)

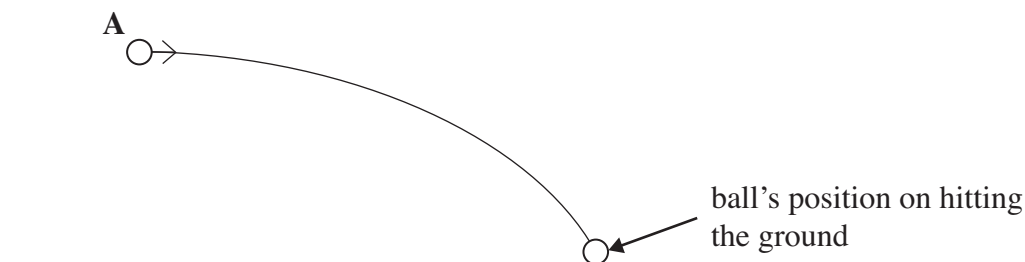
- 1 (b) (ii)** Complete the scale drawing, **Figure 1**, to determine the magnitude of the resultant force.

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
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- 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**.

.....

(1 mark)

Turn over ►



- 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 $1.03 \times 10^3 \text{ kg m}^{-3}$.

- 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 $1.00 \times 10^3 \text{ N}$.
State and explain what happens to the diver when he is fully submerged in the water.

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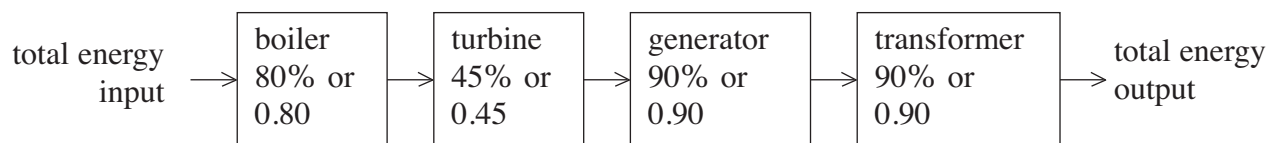
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(2 marks)



- 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

Turn over ►



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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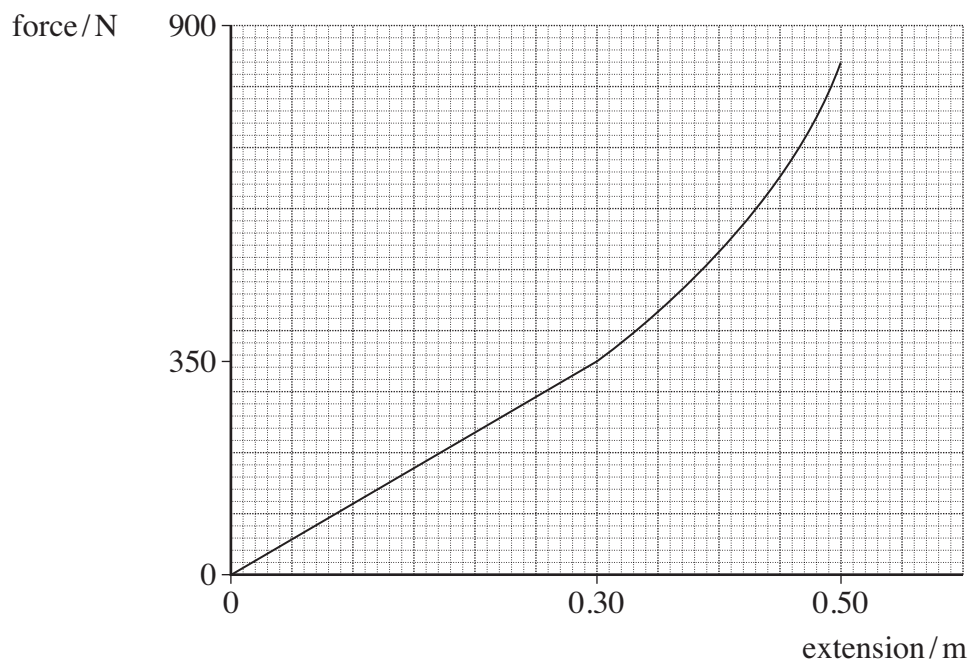
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loss in potential energy J
(2 marks)

- 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)

Turn over for the next question

Turn over ►



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

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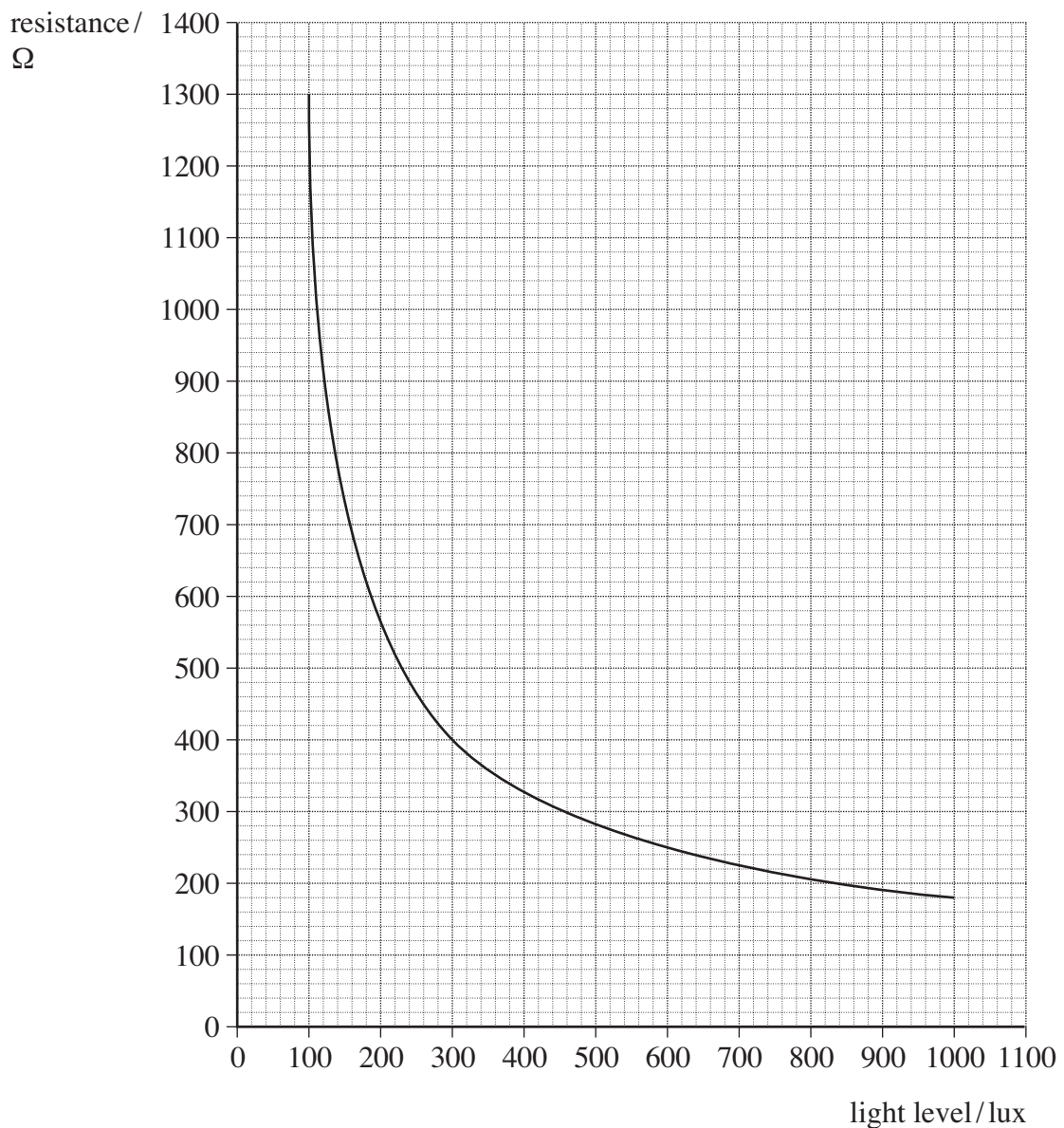
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(3 marks)

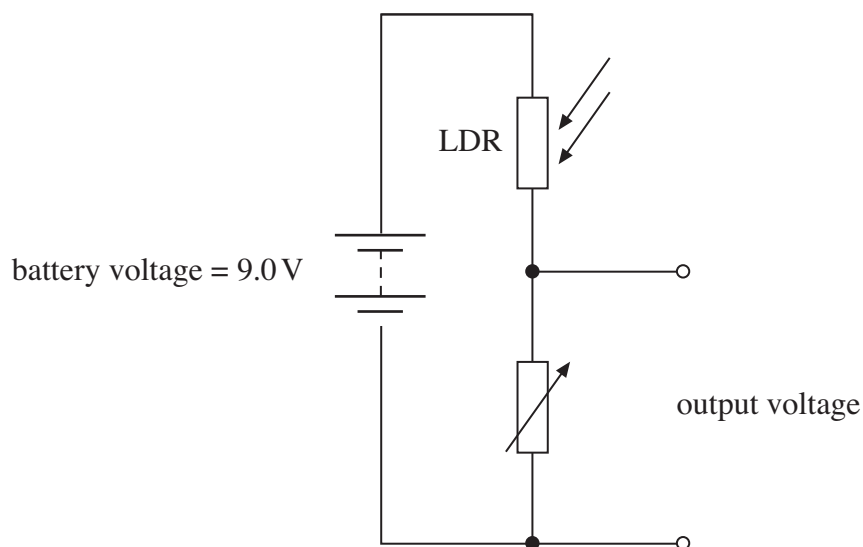
- 8 (b)** **Figure 6** shows the variation of resistance with light level for a light dependent resistor (LDR).

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 $150\ \Omega$. 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)



- 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)



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.

[illegible]

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

Turn over ►



- 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 $7.5 \times 10^7 \text{ m}^2$ 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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