Candidate Name	Centre Number	Candidate Number
		0

GCSE

237/02

SCIENCE
HIGHER TIER
PHYSICS 1

A.M. WEDNESDAY, 19 January 2011

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark awarded**
1.	**5**	
2.	**7**	
3.	**12**	
4.	**7**	
5.	**12**	
6.	**7**	
Total	**50**	

0237
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2. In calculations you should show all your working.

EQUATIONS

power = voltage × current

energy transfer = power × time

units used (kWh) = power (kW) × time (h)

cost = units used (kWh) × cost per unit

$$\%\ \text{efficiency} = \frac{\text{useful power transfer}}{\text{total power input}} \times 100$$

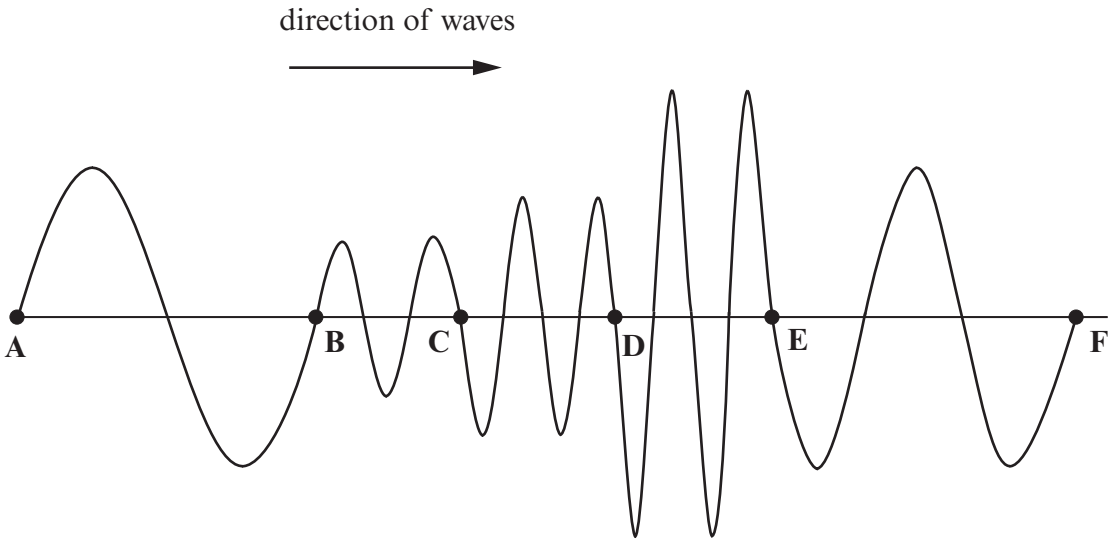
$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

wave speed = wavelength × frequency

Commonly used prefixes			
Multiplier	Symbol	Meaning	
Micro	μ	0.000 001	10^{-6}
Milli	m	0.001	10^{-3}
Centi	c	0.01	10^{-2}
Kilo	k	1 000	10^{3}
Mega	M	1 000 000	10^{6}
Giga	G	1 000 000 000	10^{9}

Answer **all** *questions.*

1. The diagram shows a train of waves.



(a) How many waves are shown between A and C? ..... [1]

(b) **Between which two of the points**, A, B, C, D, E and F is

(i) the wavelength biggest? .....

(ii) the amplitude smallest? ..... [2]

(c) (i) The eight waves between A and F cover a distance of 240 cm.
Calculate the **average** wavelength of the waves. [1]

Average wavelength = ... cm

(ii) The frequency of these waves is 10 Hz.

Use the equation:

Wave speed = wavelength × frequency

to calculate the average speed of these waves. [1]

Wavespeed = ... cm/s

Examiner only

2. A number of windfarms are due to be built around Britain in the near future. The following table shows where they are to be built. The highlands of Scotland which are some of the windiest places in Britain face the Atlantic Ocean.

WINDFARMS BEING BUILT FOR FUTURE USE				
Location	Onshore (on land)		Offshore (at sea)	
	Number	Total power output (MW)	Number	Total power output (MW)
England	3	21	5	1450
Northern Ireland	1	20	0	0
Scotland	18	810	0	0
Wales	3	33	0	0
Totals	**25**	**884**	**5**	**1450**
Average power output		**35.4**		**290**

Source: *Information adapted from: http://www.bwea.com/statistics*

(a) In which part of Britain is the largest number of windfarms due to be built?

..... [1]

(b) Give **two** reasons why offshore wind farms are expected to produce much more energy than onshore wind farms. [2]

.....

.....

.....

.....

(c) Calculate the average (mean) power expected from the Scottish wind farms. [2]

Average (mean) power = ... MW

Examiner only

(d) Give **two** objections that could be used against the plans to build offshore wind farms. [2]

.....

.....

.....

.....

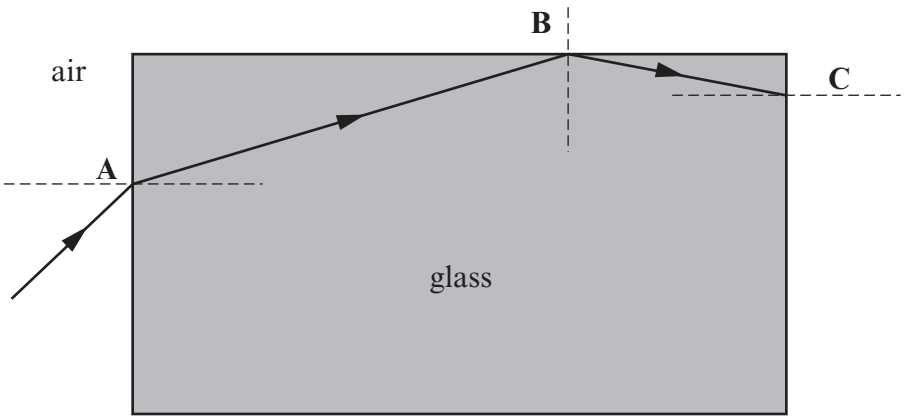
.....

7

0237
020005

Examiner only

3. The diagram shows light travelling from air into a glass block.



(a) (i) What name is given to the bending of light at point **A**? ..... [1]

(ii) Give a reason why the light changes direction at **A**. [1]

.....

.....

(b) State what is happening to the light at point **B**. [1]

.....

(c) At point **C**, the light passes out into the air.

(i) Give **one** reason why it does not go back into the block as it does at point **B**. [1]

.....

.....

(ii) **Draw** the ray direction into the air at point **C**. [1]

Examiner only

(d) A long and very thin glass block becomes an optical fibre.

(i) Name a type of the electromagnetic radiation (other than visible light) that can be used to send messages along an optical fibre. [1]

.....

(ii) State **two** advantages of passing signals along optical fibres rather than using electrical signals in wires. [2]

1. .....

.....

2. .....

.....

(iii) The speed of signals along optical fibres is 2.0×10^8 m/s. Write down an equation from page 2 and use it to find the time that a signal would take to travel from London to New York along an optical fibre if the distance is 4.8×10^7 m.
Give the correct unit for your answer.

Equation: .....

..... [1]

Calculation: [3]

Time = ... Unit: .....

0237 020007

12

Examiner only

4. *(a)* Describe how stars are created and start to produce energy. [3]

.....

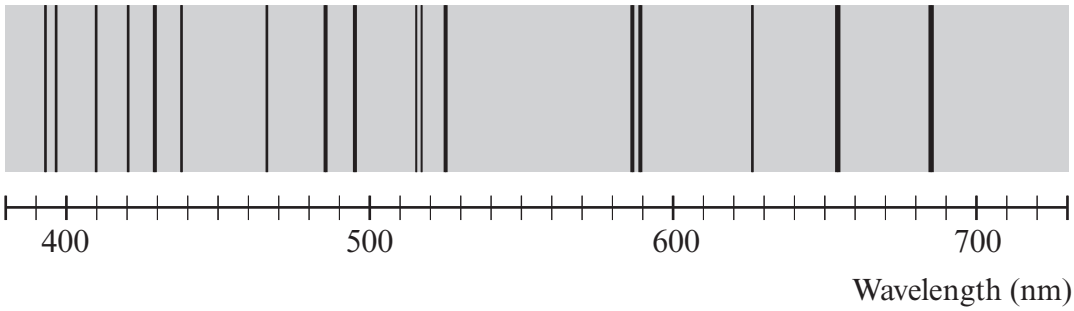
.....

.....

.....

.....

(b) The spectrum of white light (ROYGBIV) from the Sun has dark lines in it showing the presence of gases in the Sun's atmosphere. The diagram shows some of the more prominent lines.



Explain how the study of spectral lines from galaxies has led to the theory of the Big Bang. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

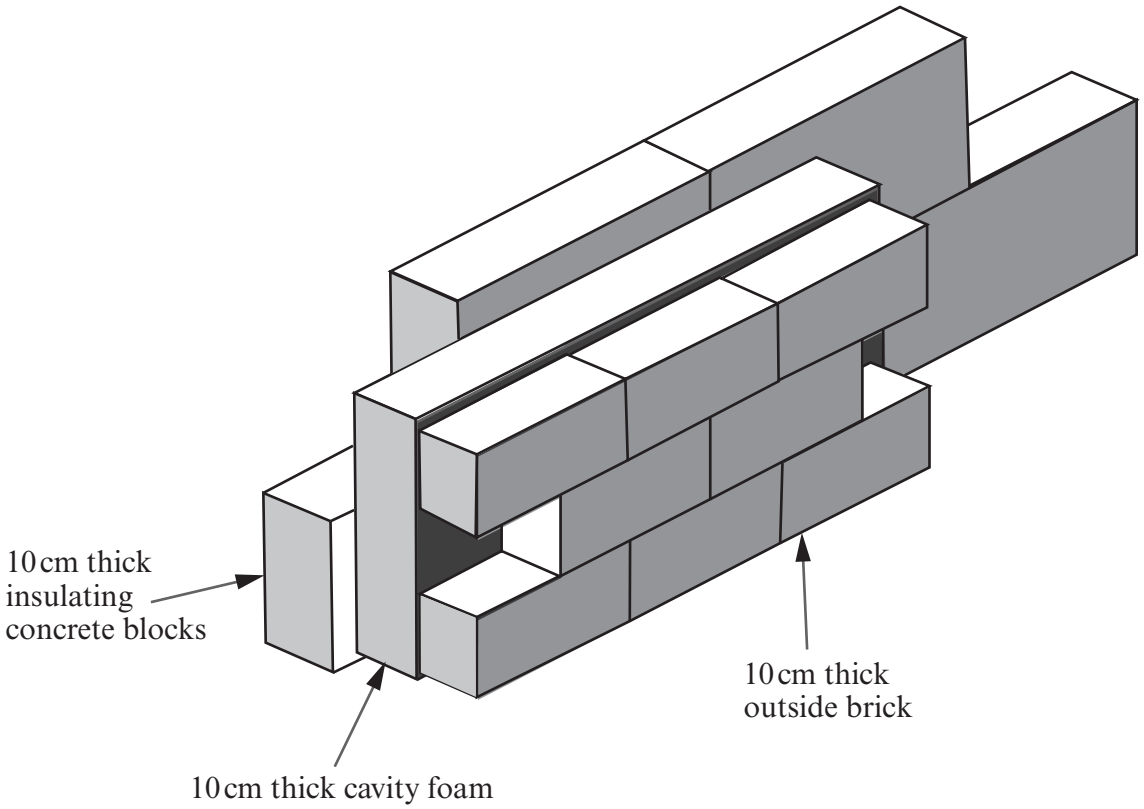
7

BLANK PAGE

Turn over.

Examiner only

5. A house wall is built in the way shown below. Its cavity is totally filled with foam.



The insulating effectiveness of a material is given by a quantity called its R value.
The R values for some common materials are shown in the table below.
R values just add together to give the total R value.

Material	R value (Units)
Air that is free to move	0.02
10 cm-thick attic fibre glass	2.40
A standard 10 cm thick brick	.....
10 cm cavity wall insulating foam	3.60
10 cm thick insulating concrete block	2.08
Total R value for <u>this type</u> of wall	**6.0**

Examiner only

(a) **Use only the information in the table** to answer the following questions.

(i) State why cavity wall insulation reduces the heat lost from a house. [1]

.....

.....

(ii) The total R value for the wall is 6.0. Calculate the R value for the brick. [1]

R value for brick = ... units

(b) The power lost through the wall is given by the following equation.

$$\text{Power lost (W)} = \frac{\text{Outside wall area} \times \text{temperature difference between inside and outside}}{\text{Total R value}}$$

A typical house has a total outside wall area of $300\,m^2$.
On a winter's day, the temperature outside is –4°C and the inside is kept at 21°C.

(i) Use the equation above to calculate the power lost from the house. [2]

Power = ... W

(ii) Use the following equations to find the cost of maintaining the inside temperature at 21°C for 24 hours if the cost of a unit of electricity is 12p. [4]

Units used (kWh) = power (kW) × time (h)
Cost = units used × cost per unit

Cost = ...

(iii) Why would a semi detached house prove to be cheaper to heat than a detached house of similar size? [1]

.....

.....

Examiner only

(c) The attic of a house is a major source of heat loss. This can be reduced by laying fibre glass on the attic floor.

(i) The R value of a well-insulated attic should be at least 7.2. Calculate the minimum thickness of fibre glass that is required. [1]

Thickness = ... cm

(ii) Explain how fibre glass reduces heat transfer through the attic. [2]

.....

.....

.....

.....

.....

12

Examiner only

6. A coal-fired power station is 34.3% efficient. It has a power output of 1200 MW which it supplies to the national grid.

(a) Write down an equation from page 2 and use it to calculate the power input to the power station.

Equation: .....

..... [1]

Calculation: [3]

Power = ... MW

(b) The output power is shared equally between 10 power lines. Step-up transformers are used to raise the voltage to 440 000 Volts.
Use the equation

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

to calculate the current in **each of** the overhead power lines. [3]

Current in each power line = ... A

7