Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0237/02

SCIENCE
HIGHER TIER
PHYSICS 1

A.M. WEDNESDAY, 30 January 2013

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**5**	
3.	**5**	
4.	**5**	
5.	**8**	
6.	**8**	
7.	**7**	
8.	**7**	
Total	**50**	

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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.

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EQUATIONS

power = voltage × current

energy transfer = power × time

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

cost = units used (kWh) × cost per unit

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

wave speed = wavelength × frequency

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

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}

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Answer **all** *questions.*

1. A gas customer had double glazing installed on 1st February.
The table shows the gas meter readings 3 months before installation and 3 months after.

Date	1st November	1st February	1st May
Readings (units)	5 100	6 325	7 335

(a) Calculate:

(i) the number of units used in the 3 months **before** the double glazing was installed. [1]

Number of units = ...

(ii) the number of units used in the 3 months **after** the double glazing was installed. [1]

Number of units = ...

(b) If each gas unit cost 43 p, calculate how much money **was saved** on the gas bill after installing double glazing. [2]

Money saved = ... p

(c) The gas customer claimed that the money saved was entirely due to the installation of the double glazing.
Give a reason why this claim is not scientifically correct. [1]

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Turn over.

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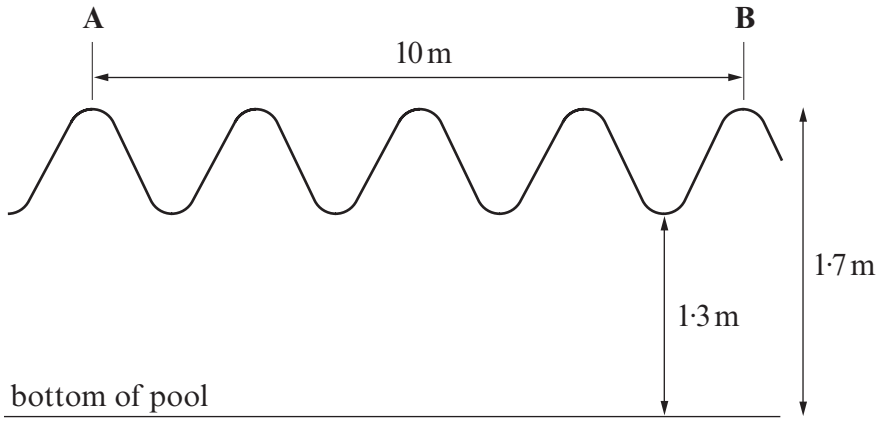
2. The diagram shows a side view of the water waves, produced in a swimming pool by a wave machine.



(a) Use information given on the diagram to find:

(i) the amplitude of the waves; [2]

Amplitude = ... m

(ii) the number of complete waves between **A** and **B**; ..... [1]

(iii) the wavelength of the water waves. [1]

Wavelength = ... m

(b) State what happens to the wavelength of the water wave when the frequency of the wave machine is increased. [1]

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3. The Solar System consists of the Sun and its planets.

The table gives data on four planets in the Solar System.

Planet	Distance from the Sun (million km)	Time for one orbit (years)	Average surface temperature
Earth	150	1·0	15 °C
Mars	228	1·9	–23 °C
Jupiter	778	11·9	–120 °C
Saturn	1 427	29·5	–180 °C

Ceres is a large asteroid which orbits the Sun in the asteroid belt.

(a) What is the asteroid belt? [1]

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(b) Use the data in the table to make a reasonable estimate of: [2]

(i) the distance of Ceres from the Sun; ..... million km

(ii) the temperature on the surface of Ceres. ..... °C

(c) Astronomers believe that, after the Sun formed 4·5 billion years ago, the remaining gas, dust and ice collected together to form the planets.
The 4 inner planets have a different make up (structure) from the 4 outer planets (excluding Pluto).

(i) State how the inner planets are structurally different from the outer planets. [1]

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(ii) Explain how the structural difference between the planets was influenced by the energy from the newly-formed Sun. [1]

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4. The table below gives information about three household appliances.

Appliance	Power (W)	Power (kW)	Time used per day	Units used per day (kWh)
Washing machine	1 200	1·2	2 hours	2·4
Kettle	.....	.....	1½ hours	3
Food mixer	720	0·72	5 minutes	.....

Use the information given about the kettle and food mixer to complete the table. [5]

Space for working.

5

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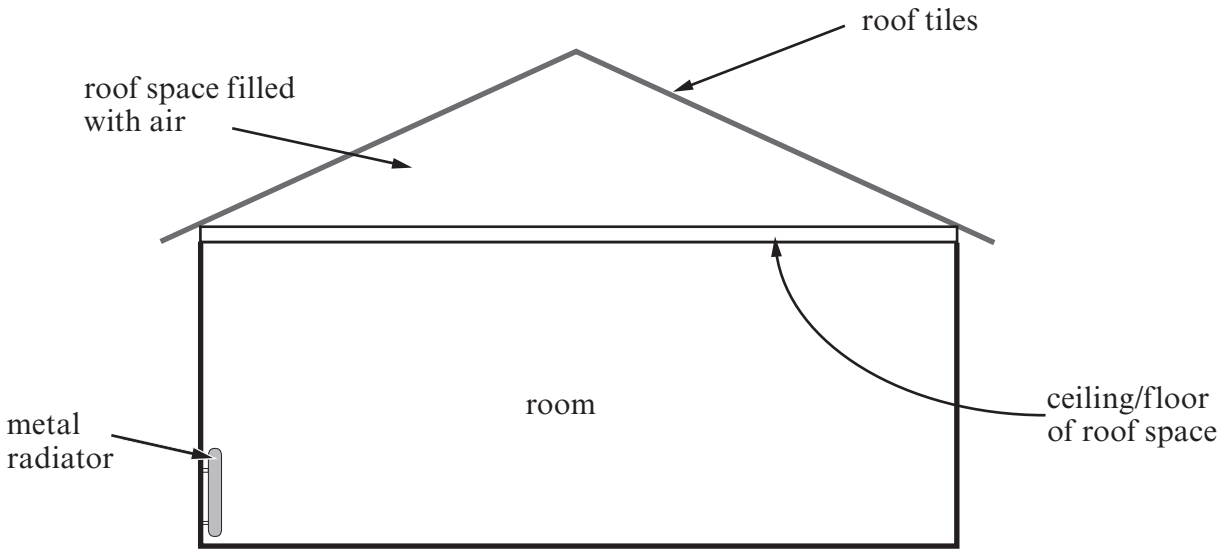
5.



The room of the above house is heated by a metal radiator which receives hot water from the boiler of the central heating system of the house.

(a) (i) Describe the processes involved by which the room becomes heated from the hot water circulating in the radiator. [3]

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(ii) Give a reason why painting the radiator a dark colour would improve heat transfer from the radiator to the room. [1]

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(b) (i) State the processes by which heat is lost from the room through the ceiling and then the roof space. [2]

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(ii) Explain how covering the floor of the roof space with fibre glass would reduce heat loss from the room. [2]

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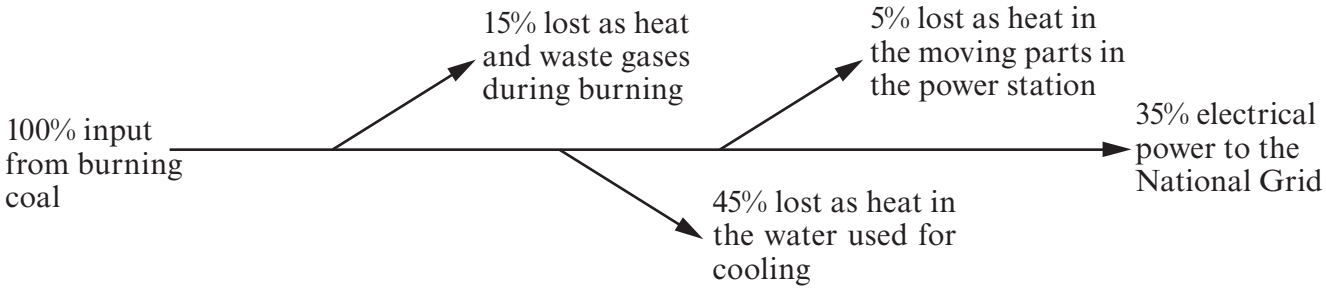
6. *(a)* Use the information below to explain what effects coal-fired power stations have on the environment. [3]



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(b) Combined heat and power (CHP) stations are replacing some conventional ones. These make use of the heat in the water that is used for cooling purposes. The water is piped to provide central heating for the power station and houses nearby. A particular CHP station receives 400 MW of power from burning coal. It is 82% efficient. Of the useful power output 118 MW is transferred to the National Grid.

(i) Select an equation from page 2 and use it to calculate the total amount of useful power transferred by the CHP station.

Equation: ..... [1]

Total useful power = ... MW
[2]

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(ii) Calculate the amount of power available for district heating. [1]

Power for district heating = ... MW

(iii) Suggest a reason why CHP stations should be located near to large communities. [1]

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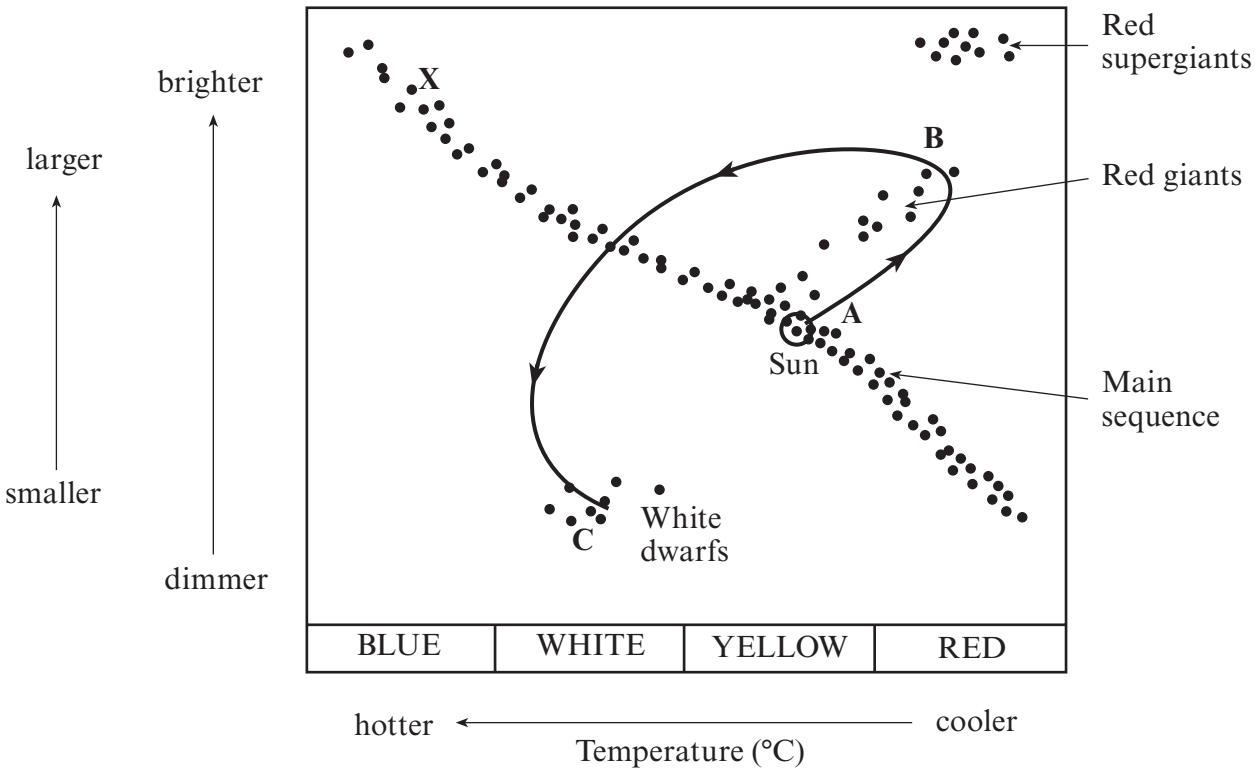
7. The diagram shows how the size, brightness and colour of a star are related to its temperature,



Our Sun is currently a main sequence star. Main sequence stars produce energy by the fusion of hydrogen into helium. In a stable star, the fusion process produces an outward pressure (a combination of gas pressure and radiation pressure) which exactly balances the gravitational force.

The bold line **ABC** shows the changes the Sun will undergo when it comes to the end of its life.

(a) When all the hydrogen runs out our Sun will fuse helium.

(i) State how this will affect the forces acting on the Sun. [1]

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(ii) Use the diagram to explain how the appearance of the Sun will change. [2]

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(b) (i) Star X is larger than our Sun. Suggest a reason why it is hotter and brighter than our Sun. [1]

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(ii) Explain what is likely to happen to star X when all its hydrogen runs out. [3]

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TURN OVER FOR QUESTION 8

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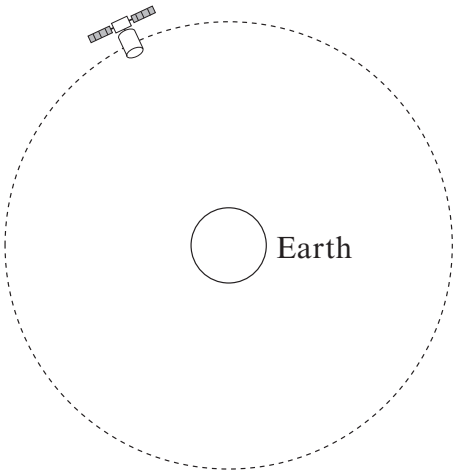
8. The diagram shows a communications satellite in a geostationary orbit around the Earth.



(a) Explain why a satellite in a geostationary orbit appears to be in a fixed position even though it is moving in orbit. [2]

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(b) A microwave signal, of frequency 5×10^9 Hz and speed 3×10^8 m/s, carries TV pictures from a studio to a geostationary satellite $3{\cdot}6 \times 10^7$ m above the equator. The satellite receives the signal and then transmits it back to Earth, where it is received by homes with 'satellite dishes'.

Use the equations: $\text{wavelength} = \dfrac{\text{wave speed}}{\text{frequency}}$ and $\text{time} = \dfrac{\text{distance}}{\text{speed}}$

(i) to calculate the wavelength of the microwave signal

wavelength = ... m

(ii) to calculate how long it takes for the TV pictures to travel from the studio to the homes of the viewers.

time = ... s

[5]

END OF PAPER

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