WJEC CBAC

GCSE

237/02

SCIENCE

HIGHER TIER

PHYSICS 1

A.M. FRIDAY, 19 June 2009

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark awarded**
1.	5	
2.	6	
3.	4	
4.	12	
5.	7	
6.	8	
7.	8	
Total	50	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

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 $\times$ current

energy transfer $=$ power $\times$ time

units used (kWh) $=$ power (kW) $\times$ time (h)

cost $=$ units used (kWh) $\times$ cost per unit

$$\text{cost per unit} = \frac{\text{cost}}{\text{units used (kWh)}}$$

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

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

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

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

wave speed $=$ wavelength $\times$ frequency

*Answer **all** questions*.

1. The table shows the electricity meter readings for a household between 1 January and 1 October.

Date	1 January	1 April	1 July	1 October
Meter reading (kWh)	6005	6840	7340	7685

(a) Calculate the number of kWh of electricity used between 1 April and 1 July. [1]

Number of kWh used = ... kWh

(b) The electricity bill for the period 1 April to 1 July was £45.

Write down an equation as it appears on page 2 and use it to find the cost of 1 kWh of electricity.

Equation: ....

....
[1]

Calculation: [2]

Cost per kWh = ... p

(c) Apart from changing to a different electricity supplier, suggest **one** thing that the householder could do to reduce electricity bills. [1]

....

....

Turn over.

2. The table gives information about planets in the Solar System.

    Look carefully at the table before attempting the questions that follow.

Planet	Surface description	Surface temperature (°C)	Atmosphere
Mercury	Rocky, craters	350	No Atmosphere
Venus	Rocky, craters Volcanic mountains	480	Thick carbon dioxide layer, sulphuric acid
Earth	Rocky, mountains, volcanoes	20	Nitrogen, Oxygen
Mars	Rocky, craters, Volcanic mountains	-25	Thin carbon dioxide layer
Jupiter	Gaseous	-120	Hydrogen, helium, ammonia, methane
Saturn	Gaseous	-180	Hydrogen, helium, ammonia, methane
Uranus	Gaseous	-210	Hydrogen, helium, ammonia, methane
Neptune	Gaseous	-220	Hydrogen, helium, methane
Pluto (Dwarf planet)	Rocky, covered in frozen water	-230	Methane

Use the information in the table to answer the questions that follow.

(a) Give a reason why Venus is hotter than Mercury, even though Mercury is nearer the Sun.
[1]

....

....

(b) Make an estimate of the temperature in the region of the Asteroid belt. ....°C [1]

(c) State **two** reasons why life, as we know it, developed on Earth and not on any other planet of the Solar System.
[2]

1. ....

....

2. ....

....

(d) What evidence is there **in the table**, to suggest that the dwarf planet, Pluto

   (i)   is the outermost of these planets?

....

....

   (ii)   could possibly have been captured from outside the Solar System?

....

....

[2]

6

3. Read the passage carefully before answering the questions that follow.

> Tetra (terrestrial trunk radio) is the private mobile radio system used only by emergency services.
>
> Tetra uses masts to transmit more powerful microwave signals than those used in the mobile phone system. Microwaves belong to the lower energy end of the e.m. spectrum. They produce heating when absorbed by the cells of the body.
>
> Some research into the use of mobile phones has found evidence of cell damage, changes in brain function and some cases of cancer. These studies are not conclusive, as they involved small numbers of users and they have not been repeated.
>
> In spite of this, the government Health Protection Agency has provided strict guidelines to Local Planning Authorities, covering the size and siting of masts.
>
> Opponents of Tetra masts remain unhappy and want installations to stop.

(a) State **two** differences between the Tetra system and the system used by the majority of mobile phone users. [2]

1. ....

   ....

2. ....

   ....

(b) What is the job of the Local Planning Authority regarding the installation of the Tetra masts? [1]

....

....

(c) Use the information contained in the passage to give **one** reason why opponents of Tetra masts want installations to stop. [1]

....

....

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Turn over.

4. *(a)* (i) Name the process by which heat is lost through the windows of a house.

.... [1]

(ii) Explain why double glazing minimises the heat lost through the windows of a house.

[1]

....

....

(b) The graph shows the results of an investigation to see how the rate of loss of energy through a double glazed window was affected by the width of the air gap between the two panes of glass. The investigation used a window of area 1 m^2 and kept a temperature difference of 20 °C between the inside and the outside.

Rate of loss of energy (W/m^2)
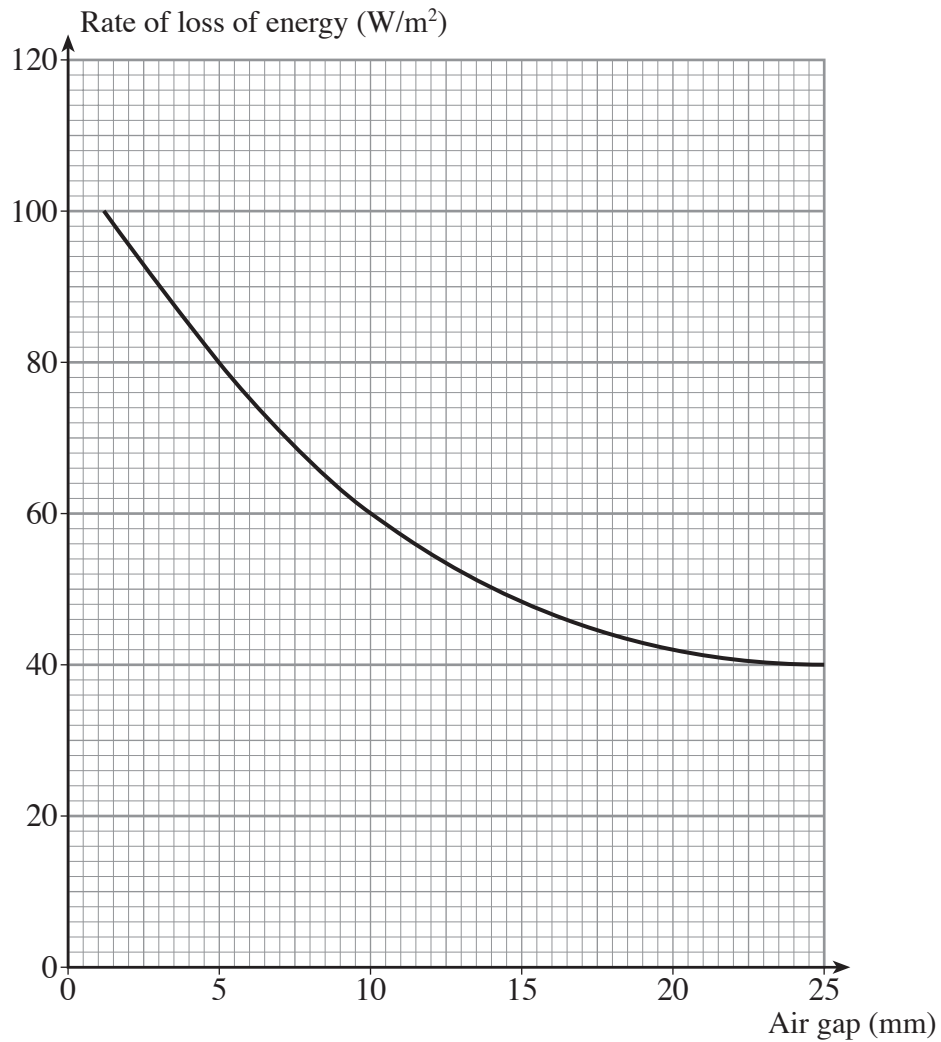
Air gap (mm)

(i) Describe how the rate of loss of energy is related to the air gap. [2]

....

....

....

(ii)   Use the graph to estimate the rate of loss of energy for an air gap of 0 mm.

Show on the graph how you obtained your answer.   [2]

Rate of energy loss = ... W

(iii) Explain why most manufacturers of double glazed windows are unlikely to use an air gap any larger than 20 mm.   [1]

....

....

(c)   (i)   A house with a window area of 30 m^2 is fitted with double glazed windows with an air gap of 10 mm.

On a particular day, there is a 20°C temperature difference between the inside and outside of the house. **Calculate** the rate of loss of energy through the windows of the house.   [2]

Rate of loss of energy = ... W

(ii)   Write down an equation as it appears on page 2 and use it to calculate the total energy, in joules, transferred through the windows in 1 hour.

Equation: ....

....
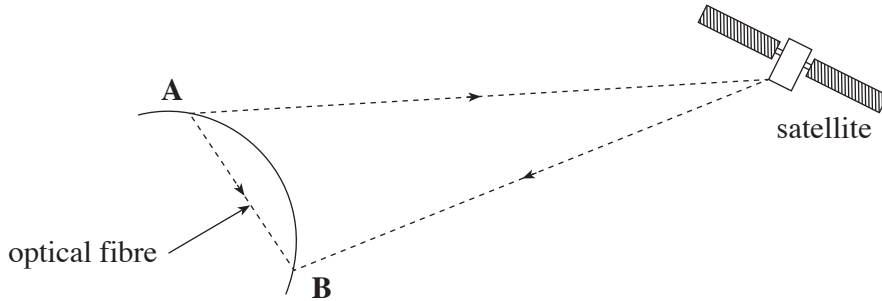   [1]

Calculation.   [2]

Energy transferred = ... J

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5. This question concerns long-distance communications between two points on the Earth's surface, **A** and **B**, using satellite and optical-fibre links.

(a) Information is passed from **A** to **B** using a satellite in geosynchronous orbit $3 \cdot 6 \times 10^4$ km above the Earth's surface. Microwaves carry the information at a speed of 3×10^8 m/s from **A** to **B** via the satellite.

Write down an equation as it appears on page 2 and use it to calculate the time delay between sending and receiving the information.

Equation: ....

....
[1]

Calculation. [3]

Time delay = ... s

(b) (i) The information could also be sent from **A** to **B** via a transcontinental optical fibre linking **A** and **B**. An infra-red signal carries the information at a speed of 2×10^8 m/s.

Give a reason why the time delay between sending and receiving this signal is much shorter than that calculated in part *(a)*. [1]

....

....

(ii) State **two** other advantages of using optical fibres to send information over long distances. [2]

1. ....

....

2. ....

....

7

Turn over.

6. The diagram shows a solar panel made up of a collection of photocells, installed on the roof of a house. The solar panel converts the Sun's radiant energy directly into electrical energy. The electrical energy charges up a battery where it is stored for later use.

solar panel of photo-cells

storage battery
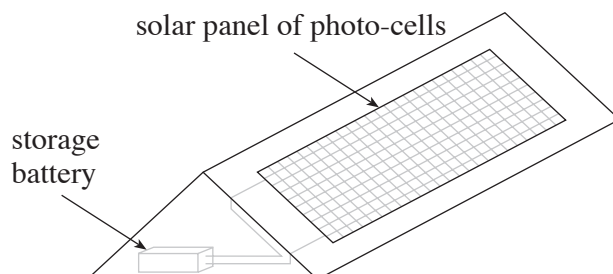
On a typical summer day in the UK, the solar radiation received at the panel is 6000 W (in the absence of cloud). The efficiency of the panel in converting solar power to electrical power is 20%.

(a) Write down an equation as it appears on page 2 and use it to calculate the output power from the panel.

Equation: ....

....

[1]

Calculation. [2]

Output power = ... W

(b) On most summer days the panel will generate electricity, as described above, for 10 hours.

Use the equation

number of kWh = power (kW) × time (hours)

to calculate the number of kWh of electrical energy produced per day. [2]

No. of kWh = ...

(c) The household in this question uses 10 kWh of energy per day on average.

Write a short paragraph to discuss whether the use of this solar panel to produce electricity is a practical option. [3]

....

....

....

....

....

....

8

Turn over.

7. The diagram shows how the size, brightness and colour of a star are related to its temperature.
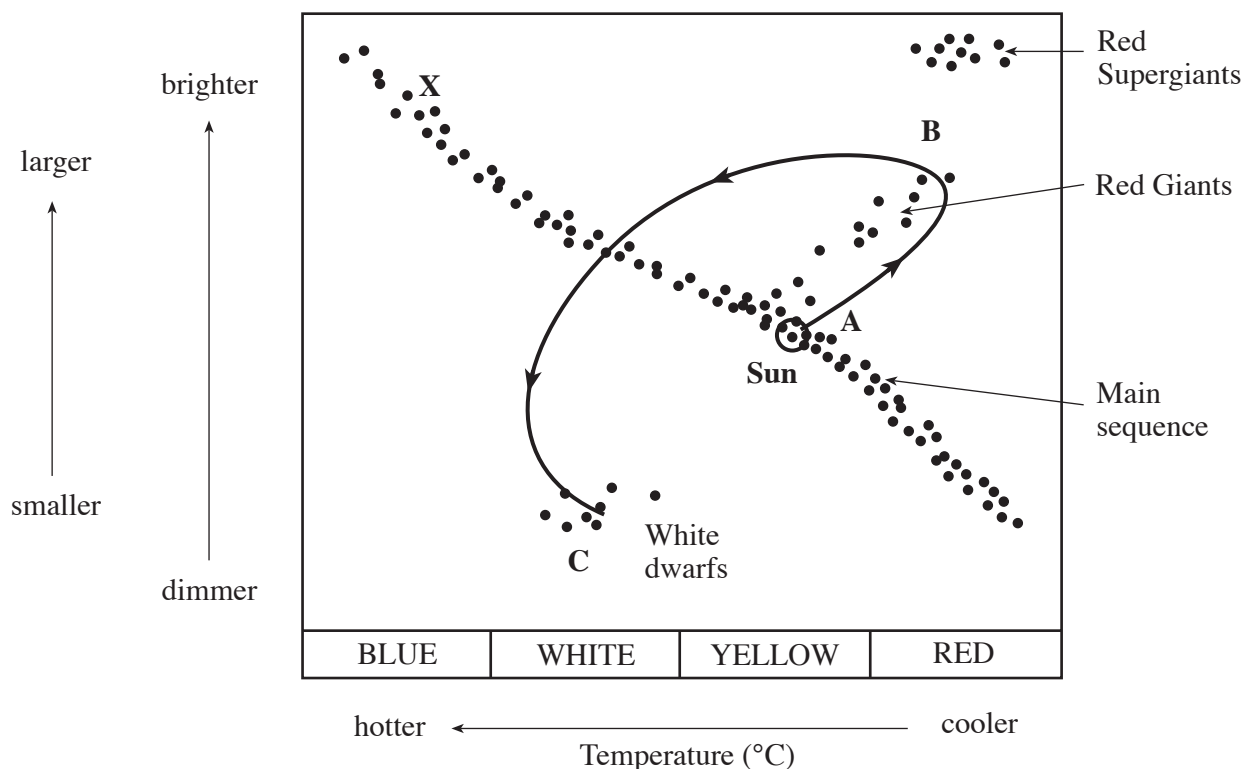
Our Sun is currently a Main Sequence star. Main Sequence stars produce energy by the fusion of hydrogen into helium. In a stable star, the fusion process produces an outward pressure (a combination of gas pressure and radiation pressure) which exactly balances the gravitational force.

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

(a) State **one way** in which the star labelled **X**:

 (i) is different from our Sun;

....

 (ii) is similar to our Sun.

....

[2]

(b) (i) Explain what changes will occur to cause the Sun to expand into the Red Giant stage.

....

....

....

(ii) Use information from the diagram to describe the effect these changes will have on the Sun.

....

....

....

....

[3]

(c) (i) Explain what changes will occur to cause the Sun to collapse into the White Dwarf stage.

....

....

....

(ii) Use information from the diagram to describe the effect these changes will have on the Sun.

....

....

....

....

[3]

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