Candidate Name	Centre Number	Candidate Number
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WJEC CBAC

GCSE

237/02

SCIENCE
HIGHER TIER
PHYSICS 1

A.M. FRIDAY, 20 June 2008

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**9**	
3.	**6**	
4.	**10**	
5.	**7**	
6.	**6**	
7.	**6**	
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 of the examination paper. 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 × cost per unit

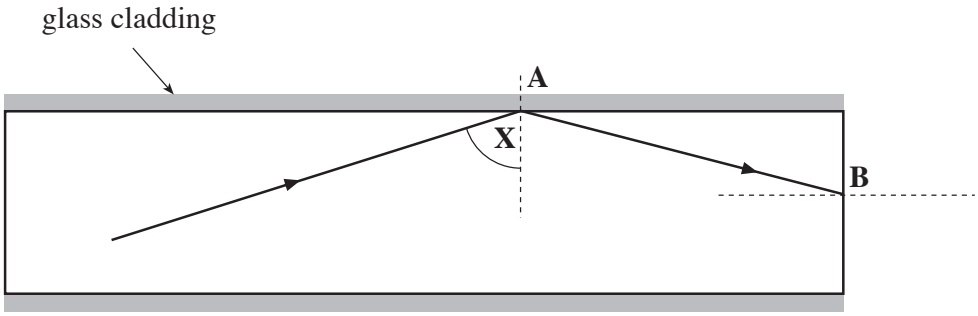
$$\text{efficiency} = \frac{\text{useful energy transfer}}{\text{total energy input}} \times 100\%$$

$$\text{wavelength} = \frac{\text{wave speed}}{\text{frequency}}$$

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

*Answer **all** questions*

1. The diagram shows a ray of light passing through **part** of an optical fibre. The thin fibre is covered by glass cladding.



(a) When a ray of light hits the side of the glass fibre at **A** it follows the path shown.

(i) What name is given to the change of direction of the light at **A**? [1]

.....

(ii) What can you say about the angle labelled **X**? [1]

.....

(b) How does the density of the glass cladding compare with the density of the glass fibre? [1]

.....

(c) **Complete the diagram** to show how the ray emerges into the air at point **B**. [1]

(d) State **two** advantages of using optical fibres to transmit signals instead of using wires. [2]

1. .....

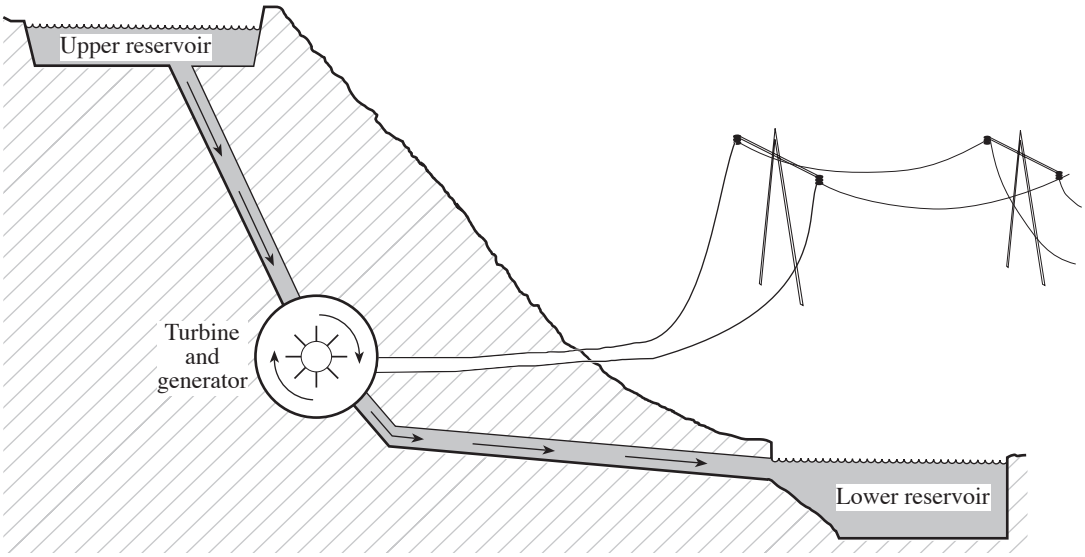
.....

2. .....

.....

6

2. The diagram shows how electricity is generated in a hydroelectric power station that is in a National Park – an area of outstanding natural beauty.



The electricity that is generated is passed to a transformer. It is then sent along wires that are underground for the first few kilometres and along wires supported by pylons after that.

The power station is only used when we need more electricity than the rest of the power stations around the country can supply.

(a) State one advantage of generating electricity in a hydroelectric power station. [1]

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(b) (i) Give a reason why the electrical wires are taken underground for the first few kilometres. [1]

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(ii) The transformer is used before the electricity is sent along the wires. Explain what the transformer does to the electricity and why it is used. [2]

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(iii) Electricity that is generated in a power station is passed through power lines at 110 000 V. The current in the wires is 2 000 A.

Write down **in words** an equation **as it appears on page 2** and use it to calculate the power being sent through the wires.

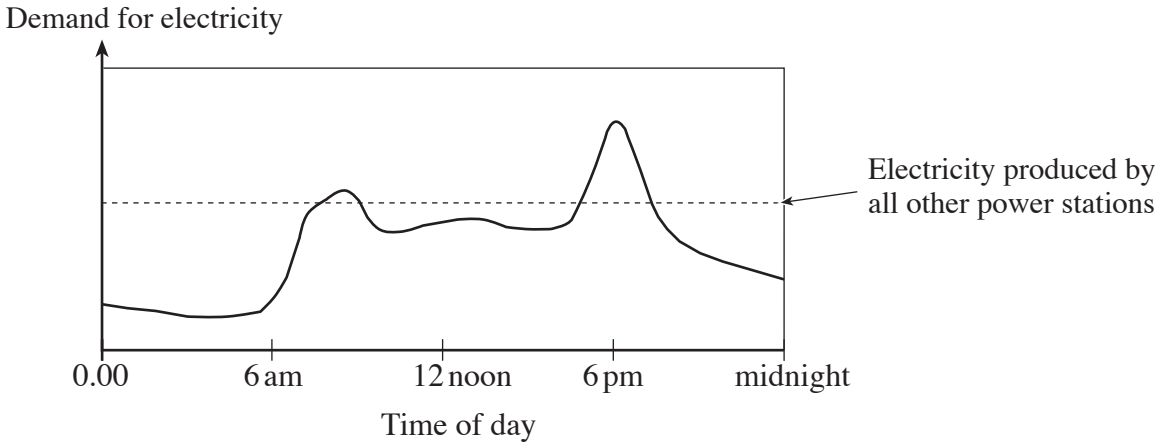
Equation: .....

..... [1]

Calculation: [1]

Power = ... W

(c) The need for electricity changes through the day in the way shown below.



(i) (I) The demand for electricity is greatest around 6 pm. At what other time is demand greater than the supply from all other power stations? [1]

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(II) Give **one** reason why the demand for electricity is highest at these times. [1]

.....

.....

(ii) In the early hours of the morning, the water in the lower lake of this power station is pumped back up to the upper reservoir. By looking at the graph above, suggest why it is done at this time. [1]

.....

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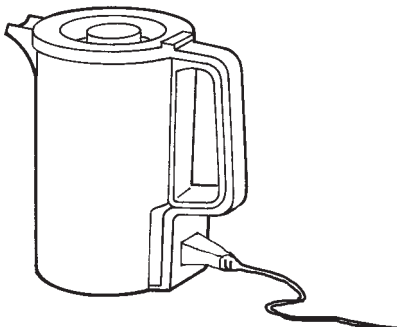
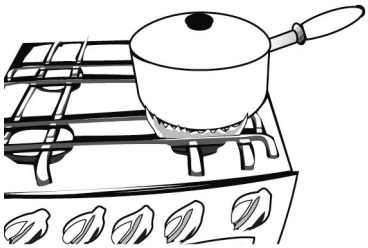
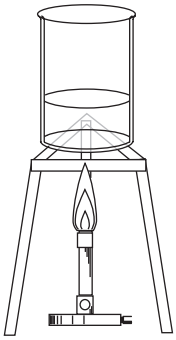
3. The same volume of water is heated in three different ways for the same length of time as shown below.



Plastic kettle



Metal saucepan



Glass beaker

Type of heater	Total heat energy supplied (J)	Heat transferred to the water (J)	Efficiency
Kettle	30 000	24 000	
Gas hob	20 000	12 000	60%
Bunsen burner	18 000	9 900	55%

(a) Write down **in words**, an equation **as it appears on page 2** and **use it** to calculate the efficiency of the kettle.

Equation: .....

..... [1]

Calculation: [2]

Efficiency = ... %

Examiner only

(b) (i) Give a reason why the kettle loses less heat than the saucepan by the process of conduction. [1]

.....

(ii) The water at the bottom of the kettle is heated. Name the process by which all the water in the kettle becomes hot. [1]

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(c) Use the information in the table to give **one** reason why the water in the kettle will boil first. [1]

.....

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6

4. The table shows the amount of heat energy lost through different parts of a house and how it depends on the temperature in the house.
It shows how these figures change as improvements are made.
The figures show how much energy is lost **per minute**.

Part of house	Type of insulation	Energy lost (J) per minute at each given temperature		
		House temperature of 21°C	House temperature of 22°C	House temperature of 23°C
Loft	No insulation	49 700	58 110	61 300
	Fibre glass insulation	14 340	15 610	17 460
Windows	Single glazed	27 680	29 560	34 760
	Double glazed	12 060	13 820	17 100
Walls	No insulation	39 920	43 800	47 580
	Foam in the cavity	12 760	17 300	14 220

(a) (i) A house holder spends money on installing **loft insulation** and **cavity wall insulation**. Using the figures in the table, find the heat energy savings achieved **each minute** if the householder maintains a temperature of **23 °C** in the home. [2]

Heat energy saving = ... J per minute.

(ii) Power is energy transferred per second.
Use your answer to part (i) to calculate the power saving to the home in kW. [2]

Power saving = ... kW

Examiner only

(b) (i) A different householder, who uses electrical central heating, maintains a temperature of 22 °C and has power savings of 1·15 kW as a result of improved insulation. The house is heated by electricity for 12 hours per day.

Use the equations:

$$\text{Units used (kWh)} = \text{power (kW)} \times \text{time (h)}$$

$$\text{Cost} = \text{units used} \times \text{cost per unit}$$

to calculate the money saved **each week**. [4]
(1 unit of electricity costs 8p)

Money saved each week = ...

(ii) Using the weekly saving you have found in part (i), calculate how many weeks it would take to pay back the cost of the insulation which was £1 500. [1]

Payback time = ... weeks

(iii) Give an environmental benefit of reducing the heat energy lost from houses. [1]

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10

5. Yellow light travels to us from the Sun at a speed of 3×10^8 m/s.
It has a frequency of 5×10^{14} Hz.

(a) Write down **in words**, an equation **as it appears on page 2** and **use it** to calculate the wavelength of this yellow light.

Equation: .....

..... [1]

Calculation: [2]

Wavelength = ... m

(b) (i) The yellow light received from the stars in distant galaxies is dimmer than the yellow light we get from our Sun.
Explain why. [1]

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(ii) The yellow light is red shifted. State what *red shift* means. [1]

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(iii) State what this red shift tells us about the distant galaxies and about the Universe. [2]

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7

Examiner only

6. If you live on the coast of Britain, the area may be ideal for building a power station nearby. The choice of power station is between having a nuclear or a coal-fired power station built.

(a) People often object to power stations because of their appearance. Write a paragraph describing **three other** objections you could raise to **nuclear** power stations. [3]

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(b) Write a paragraph describing **three** objections you could raise, apart from appearance, to coal-fired power stations. [3]

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6

Turn over.

Examiner only

7. In the 19th Century, the accepted theory was that the planets and Sun were formed at the same time. The source of the Sun's energy was thought to be the chemical energy in its gases.

(a) Geologists then discovered that the Earth was millions of years old.

Explain how this discovery led to the rejection of the theory about the source of the Sun's energy. [2]

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(b) What is the current explanation of the source of the Sun's energy? [2]

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(c) Explain how substances heavier than helium are formed in the Universe. [2]

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6