

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Secondary Education



CYD-BWYLLGOR ADDYSG CYMRU
Tystysgrif Gyffredinol Addysg Uwchradd

237/02

SCIENCE

HIGHER TIER (Grades D-A*)

PHYSICS 1

A.M. MONDAY, 25 June 2007

(45 minutes)

For Examiner's use only	
Total Marks	

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.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

EQUATIONS

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

$$\text{energy transfer} = \text{power} \times \text{time}$$

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

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

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

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

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

Answer **all** questions.

1. The table below gives information about heat loss from a house.

It also shows how this heat loss can be reduced by using different types of insulation.

House part	Type of insulation	Heat loss per second (W)		Energy saving per second (W)
		Without insulation	With insulation	
Windows & doors	Double glazing	500	200	300
Outside walls	Cavity insulation	4000	3500
Floors	Carpet underlay	1500	700	800
Roof	Loft insulation	8000	4600

- (a) Complete the table. [2]
- (b) (i) Name the house part through which heat is lost by convection. [1]
- (ii) Give a reason why double glazing reduces heat loss through windows and doors. [1]
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- (iii) State which type of insulation is most effective in reducing heat loss. [1]
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- (c) Use the information in the table to calculate how much energy is saved in one minute when all the house parts shown are insulated. [2]

Energy saved in one minute = J

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2. Some information about the power sources that can be used in cars is shown in the table.

Power source	Input energy (J)	Useful output energy (J)	'Wasted' energy (J)	Distance covered	Cost
Battery	500	400	100	60 km per charge	90p / charge
Petrol	500	150	350	8 km per litre	90p / litre
Gas	500	230	270	7 km per litre	45p / litre

- (i) **Write down** an equation from page 2 and **use it** to find the efficiency of using gas as the power source.

Equation:

..... [1]

Calculation: [2]

Efficiency = %

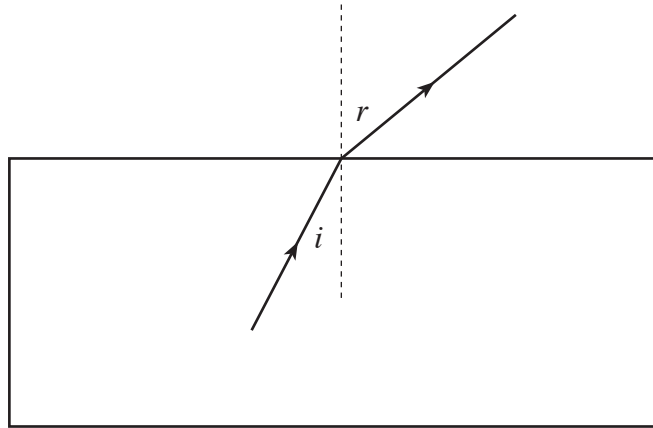
- (ii) Use information from the table to explain why the battery is the **most efficient** power source. [1]

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- (iii) Use information from the table to explain why the battery is the **cheapest** power source. [1]

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3. The diagram shows what happens to a beam of light as it emerges from a glass block.



(a) (i) Name this effect. [1]

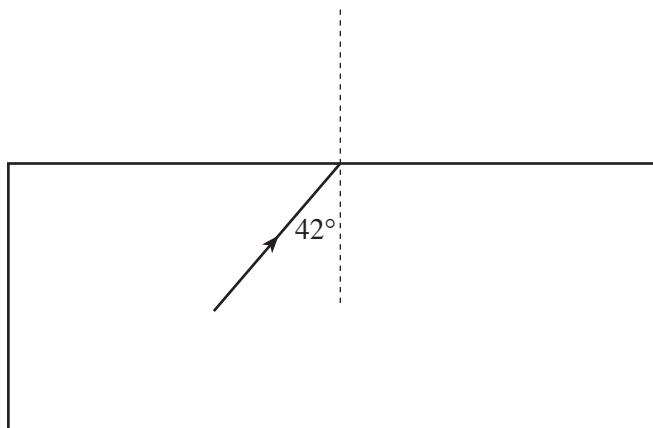
(ii) Give a reason why the beam changes direction. [1]

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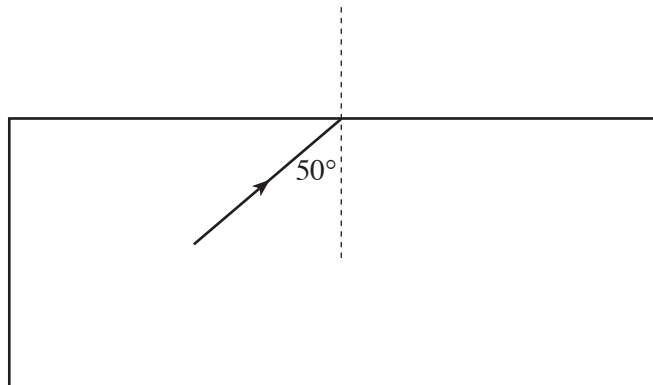
(b) When angle i is 42° angle r is 90° .

Show this on the diagram below.

[1]



- (c) (i) In the space below, complete the diagram to show what happens to the beam of light if angle i is 50° . [1]



- (ii) What is the name given to this effect? [1]

- (iii) Hence state two conditions needed for this effect to occur in optical fibres. [2]

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- (d) Infra-red radiation of frequency 4×10^{13} Hz has a wavelength of 5×10^{-6} m in a glass fibre.

- (i) **Write down** an equation from page 2 and **use it** to calculate the speed of the infra-red radiation in the glass fibre.

Equation: [1]

Calculation: [2]

Speed = m/s

- (ii) **Write down** an equation from page 2 and **use it** to calculate the time taken by an infra red signal to travel along a glass fibre 10 km long.

Equation: [1]

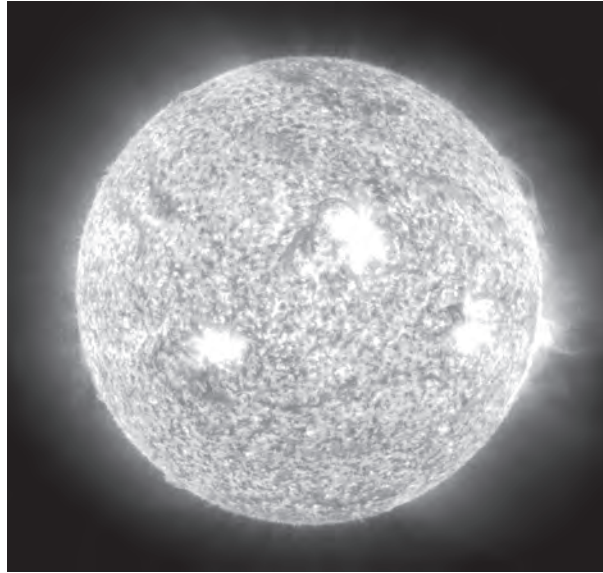
Calculation: [3]

Time = s

Turn over.

4. (a) (i) Describe briefly how hydrogen gas and dust in a nebula became the Sun. [1]

- (ii) Scientists originally thought that the Sun was powered by chemical energy.



- Give a reason why this idea changed. [1]

- (b) Our Sun has stayed the same size for billions of years. When the Sun has little hydrogen left, it will become much bigger in size. Explain in terms of forces how this change will occur. [2]

- (c) From the study of light from our Sun and other stars, scientists know that they are composed of mainly hydrogen and helium. Scientists have found evidence to show the presence of heavier elements in the universe. Explain how these heavier elements are generated. [2]

(d) In the early 20th Century, Edwin Hubble observed that light from all distant galaxies experienced a red shift.

(i) What is red shift? [1]

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(ii) Explain how the observation of red shift led to the big bang theory. [2]

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5. Homeowners are encouraged to reduce the demand they place on the national grid for their electricity. They can achieve this by using more efficient electrical devices or by generating some electricity themselves.

(a) Engineers calculate the electrical power used by dishwashers. They label each dishwasher with a letter from **A** to **G**. Dishwashers labelled **A** are more efficient and cheaper to run than those labelled **G**.

Label	Power (W)	Voltage (V)	Current (A)	Units of energy used per year (kWh)
A	920	230	4	210
B	1380	230	320
C	230	8	420

(i) **Write down** an equation from page 2 and **use it** to calculate answers to complete the table.

Equation:

..... [1]

Calculation: [3]

(ii) **Write down** an equation from page 2 and **use it** to calculate the money saved in one year if a dishwasher labelled **A** is used as compared to a dishwasher labelled **B**. Assume one unit of electricity costs 8p.

Equation:

..... [1]

Calculation: [2]

Saving =

- (b) Homeowners can generate some electricity by installing solar cells in the roof. A set of solar cells costs £10 000 and has a life expectancy of 200 000 hours. Its average (mean) output is 0.2 kW. Calculate the cost of each kWh of electricity produced by a set of these cells during its lifetime. [3]

Cost per kWh = p

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6. Read the following newspaper article carefully and then answer the questions that follow.

Global warming: Your chance to change the climate



Global warming will be caused by the greenhouse effect. This will happen because greenhouse gases like methane, carbon dioxide and CFCs will trap infrared radiation inside the atmosphere causing it to warm. Higher temperatures will cause the ice caps to melt causing flooding.

Although most scientists agree that our greenhouse gases cause global warming, some scientists do not agree.

(i) One piece of evidence used by scientists comes from observing the planets that orbit the Sun. The table below gives information about four of these planets.

Planet	Mercury	Venus	Earth	Jupiter
Surface temperature (K)	480	720	290	120
Distance from Sun (AU)	0.4	0.7	1.0	9.2
Main part of the atmosphere	no atmosphere	Carbon dioxide 97%	Nitrogen and Oxygen 99%	Hydrogen 89%

Explain how the information in the table supports the idea that greenhouse gases will cause global warming. [2]

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- (ii) Other evidence, taken from a website, is shown in another table below.

Year	Atmospheric carbon dioxide concentration (parts per million)	Average global temperature change since 1890 (°C)
1890	295	0.00
1900	297	0.18
1910	298	0.20
1920	298	0.22
1930	299	0.43
1940	300	0.54
1950	312	0.48
1960	325	0.43
1970	335	0.40

Explain whether this data fully supports the idea that the larger the concentration of greenhouse gases in the atmosphere, the higher the average global temperature. [3]

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