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Student number

Name _____

Date _____

Attempt/Time taken _____

GCSE
PHYSICS

Topic Paper: 1.2.2 & 1.3 Efficiency, national and global energy resources
Part 1

Time allowed: 40 minutes

Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

34 Marks

Q1. **Table 1** shows information about different light bulbs.

The bulbs all have the same brightness.

Table 1

Type of bulb	Input power in watts	Efficiency
Halogen	40	0.15
Compact fluorescent (CFL)	14	0.42
LED	7	0.85

(a) (i) Calculate the useful power output of the CFL bulb.

Use the correct equation from the Physics Equations Sheet.

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Useful power output = ... watts

(2)

(ii) Use your answer to part **(i)** to calculate the waste energy produced each second by a CFL bulb.

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Waste energy per second = ... joules

(1)

(b) (i) A growth cabinet is used to investigate the effect of light on the rate of growth of plants.

The figure below shows a growth cabinet.

In the cabinet the factors that affect growth can be controlled.

A cooler unit is used to keep the temperature in the cabinet constant. The cooler unit is programmed to operate when the temperature rises above 20 °C.

The growth cabinet is lit using 50 halogen bulbs.

Changing from using halogen bulbs to LED bulbs would reduce the cost of running the growth cabinet.

Explain why.

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(4)

(ii) A scientist measured the rate of growth of plants for different intensities of light.

What type of graph should be drawn to present the results?

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Give a reason for your answer.

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(1)

(c) **Table 2** gives further information about both a halogen bulb and a LED bulb.

Table 2

Type of bulb	Cost to buy	Lifetime in hours	Operating cost over the lifetime of one bulb
Halogen	£1.50	2 000	£16.00
LED	£30.00	48 000	£67.20

A householder needs to replace a broken halogen light bulb.

Compare the cost efficiency of buying and using halogen bulbs rather than a LED bulb over a time span of 48 000 hours of use.

Your comparison must include calculations.

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(4)

(Total 12 marks)

Q2. (a) In the UK, over 70% of the electricity is generated in power stations that burn fossil fuels.

(i) Explain **one** effect that burning fossil fuels has on the environment.

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(2)

(ii) Give **one** way the effect on the environment described in part (a)(i) could be reduced.

Assume the amount of fossil fuels burnt stays the same.

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(1)

(b) Electricity can also be generated in a pumped storage hydroelectric power station.

An advantage of pumped storage hydroelectric power stations is the short start-up time they have.

(i) What is the importance of the short start-up time?

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(1)

(ii) Give **one** other advantage of a pumped storage hydroelectric power station.

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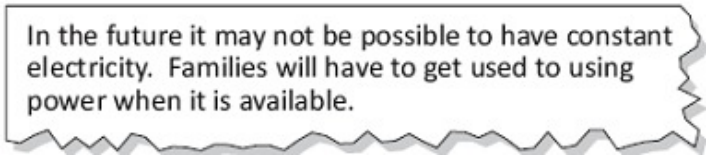
(1)

(c) Read the extract below from a newspaper article.



(i) In the UK, the proportion of electricity generated using wind turbines is due to increase a lot. Some opponents of wind turbines think this increase will cause big fluctuations in the electricity supply.

Suggest **one** reason why this may be true.

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(1)

(ii) Between 2002 and 2008 the amount of electricity used for lighting in homes in the UK decreased.

Suggest **one** reason why.

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(1)
(Total 7 marks)

Q3.

(a) The table gives information about some ways of reducing the energy consumption in a house.

Method of reducing energy consumption	Installation cost in £	Annual saving on energy bills in £
Fit a new hot water boiler	1800	200
Fit a solar water heater	2400	100
Fit underfloor heating	600	50
Fit thermostatic radiator valves	75	20

Which way of reducing energy consumption is most cost effective over a 10-year period?

To obtain full marks you must support your answer with calculations.

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(3)

(b) Explain why using an energy-efficient light bulb instead of an ordinary light bulb reduces the amount of carbon dioxide emitted into the atmosphere.

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(2)

(Total 5 marks)

Q4. The picture shows a food processor, which is used to grate, shred, liquidise and mix food. The table gives some information about the food processor.

Energy input	Electrical
Useful energy output	Kinetic
Power rating	1200 watts
Efficiency	0.8

(a) The food processor is used for a total of 30 minutes a day.

Calculate the cost of the energy **wasted** by the food processor each day.

Electricity costs 15 p per kilowatt-hour.

Write down the equations you use, and then show clearly how you work out your answer.

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Cost of **waste** energy = ... p

(4)

(b) Explain what happens to the waste energy.

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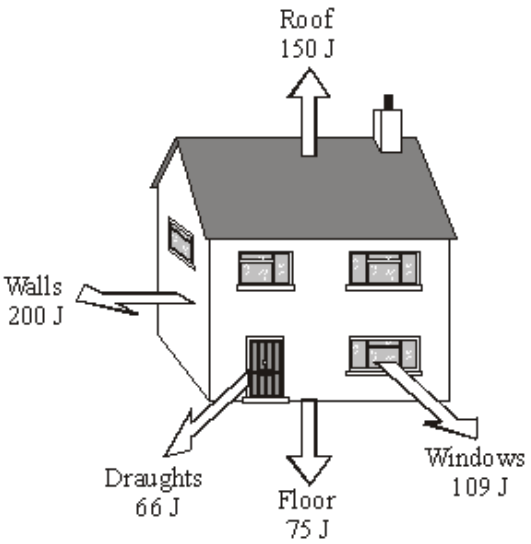
(2)
(Total 6 marks)

Q5. (a) The diagram shows how much heat is lost each second from different parts of an uninsulated house.



(i) Each year, the house costs £760 to heat.

How much money is being wasted because of heat lost through the roof?

Show clearly how you work out your answer.

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(2)

(ii) Insulating the loft would cut the heat lost through the roof by 50 %.

The loft insulation has a payback time of $1\frac{1}{2}$ years.

How much did the loft insulation cost to buy?

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Cost of loft insulation = £ .....

(1)

(b) What happens to the wasted energy?

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(1)

(Total 4 marks)