Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE

General Certificate of Secondary Education

WJEC CBAC

CYD-BWYLLGOR ADDYSG CYMRU

Tystysgrif Gyffredinol Addysg Uwchradd

237/01

SCIENCE

FOUNDATION TIER (Grades G-C)

PHYSICS 1

A. M. FRIDAY, 26 January 2007

(45 minutes)

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

power $=$ voltage $\times$ current

energy transfer $=$ power $\times$ time

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

cost $=$ units used $\times$ cost per unit.

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

wave speed $=$ wavelength $\times$ frequency

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

*Answer **all** questions.*

1. This is a list of objects in the Universe:

Sun   artificial satellite   Earth   galaxy   the Moon   Jupiter

(i) From the list, name **two** objects which are larger than Jupiter. [2]

....

(ii) State **two** objects in the list that orbit a planet. [2]

....

4

2. In a fossil fuel power station, the chemical energy in the fuel produces heat energy when the fuel is burned in a furnace. This heat energy is used to produce steam which drives turbines that produce kinetic energy to turn generators.
The block diagram represents the processes described above.

fuel	→	furnace	→	turbine	→	generator
A		**B**		**C**		electrical energy
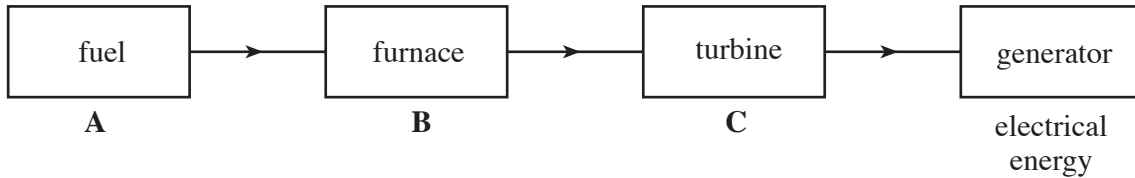
Identify the forms of energy at

(i)   **A** ....

(ii) **B** ....

(iii) **C** ....   [3]

```
┌───┐
│ 3 │
└───┘
```

3. Use one of the phrases in the boxes below to complete each sentence that follows.
Each phrase can be used once, more than once or not at all.

less than	the same as	greater than

(i)   The speed of radio waves is .... the speed of light.

(ii) The frequency of infra-red radiation is .... the frequency of X-rays.   [2]

```
┌───┐
│ 2 │
└───┘
```

Turn over.

4. *(a)* The energy flow diagram is shown for a **light bulb**.

950 J

heat energy

1000 J of electrical
energy supplied

50 J
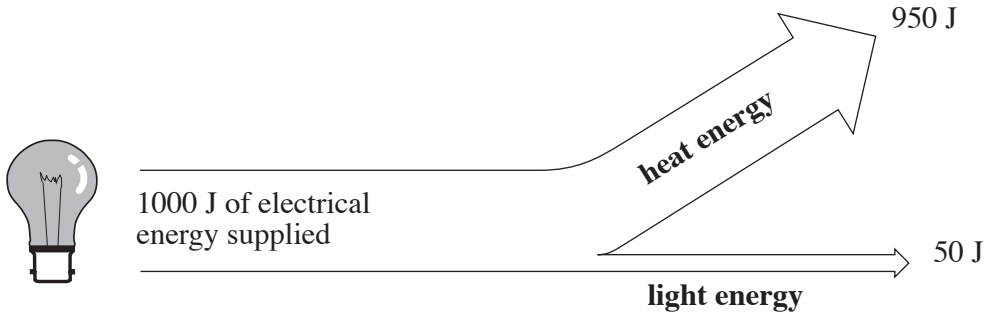
light energy

Use the equation

$$\text{Efficiency} = \frac{\text{Useful energy transfer}}{\text{total energy input}} \times 100\%$$

together with the data given in the diagram, to calculate the efficiency of the light bulb.   [2]

Efficiency = ...%

(b) An **energy-saving lamp** is 25% efficient. Complete the diagram below for this type of lamp.   [2]

................................J

heat energy

1000 J of electrical
energy supplied

................................J

light energy

4
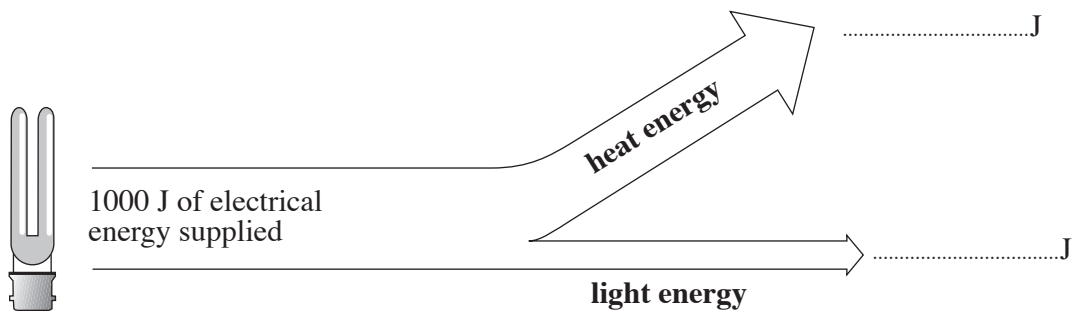
5. The following table shows five ways that are used to produce electricity, together with the cost for every unit of electricity produced.

Method of producing electricity	Cost per unit
burning oil	2·24 p
burning coal	1·94 p
nuclear power	1·42 p
hydroelectric	0·76 p
wind power	3·0 ⟶ 3·6 p

(i) Name **one** method which uses a renewable source of energy. ....

(ii) The table shows that hydroelectricity is the cheapest.
Give **one** reason for this.

....

(iii) Suggest a reason why it costs more to produce electricity from wind power.

....

[3]

3

6. The diagram shows the side view of a water wave
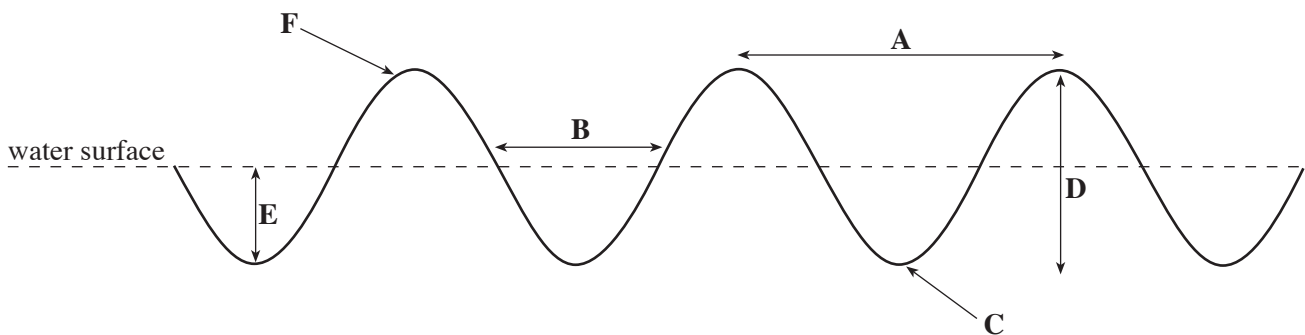
Which label, **A**, **B**, **C**, **D**, **E** or **F**, represents

(i) the wavelength of the wave? ....

(ii) the amplitude of the wave? ....

[2]

2

Turn over.

7. Last year's heating bill for a house was **£950.**
The owner decided to reduce the heating bill by improving the insulation in the house.
The table shows the cost of the improvements and an estimate of the yearly savings.

Insulation method	Cost	Estimate of yearly saving
1. Loft insulation	£200	£150
2. Cavity wall insulation	£750	£140
3. Fitting a jacket to the hot water tank	£20	£25
4. Draft proofing doors and windows	£80	£35
TOTAL	....	....

(a) **Complete the table** to show the total cost of the improvements and the total estimated yearly savings. [2]

(b) Calculate an estimate of the new yearly heating bill. [1]

New annual bill = ...

(c) Calculate the payback time for the insulation improvements. (This is the number of years it takes for the savings made to pay for the improvements.) [1]

Payback time = ... years

4

8. Electrical appliances often carry a 'rating plate' (as shown below) which gives information about the appliance.

Model No.	A7620
Serial No.	1277993
230 V ~ 50 Hz	
2 kW	

(a) Use the information on the rating plate to complete the sentences that follow.

This appliance should be connected to a mains supply voltage of .... with a frequency of .... The power of the appliance is .... which means that the appliance transfers .... joules of energy every second. [4]

(b) The appliance is used for 21 hours in a week.

(i) Use the equation

Number of units = Power (kW) × time (h)

to find the number of units used in the week.

Number of units = ...kWh

(ii) Use the equation

Cost = Number of units used × cost per unit

to find the cost of using the appliance for the week, if each unit costs 8 p.

Cost = ...
[2]

Turn over.

9. Two similar cans are partly filled with equal amounts of paraffin.
Each can holds a thermometer, is covered by a lid and stands on a cork base, the same distance (d) away from a radiant heater.
One of the cans has a dull black surface and the other has a shiny silver surface.

dull black

shiny silver

d

d

radiant
heater
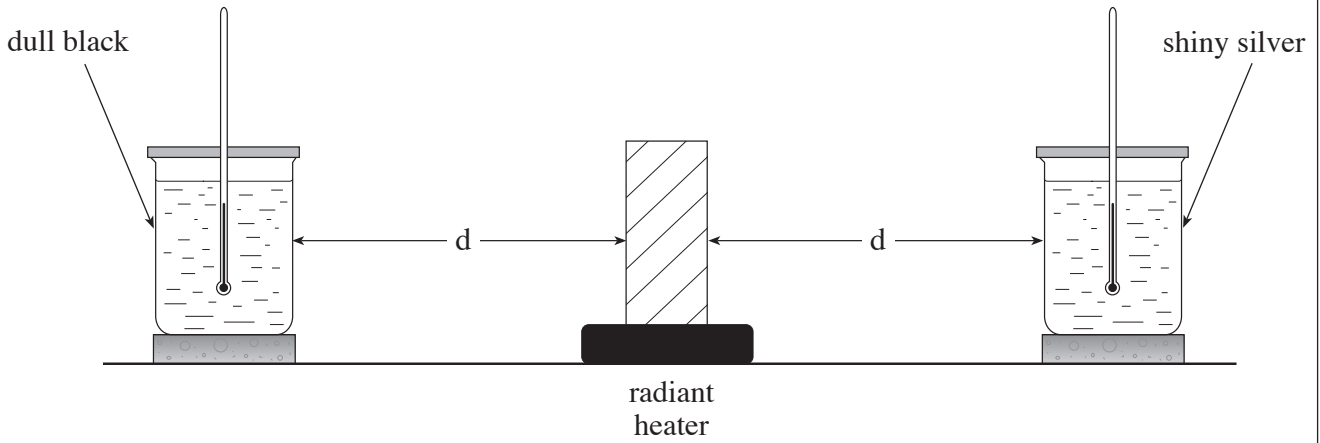
The graphs show how the temperature of the paraffin changes for the two cans.

Temperature (°C)

dull black

shiny silver

Time (minutes)
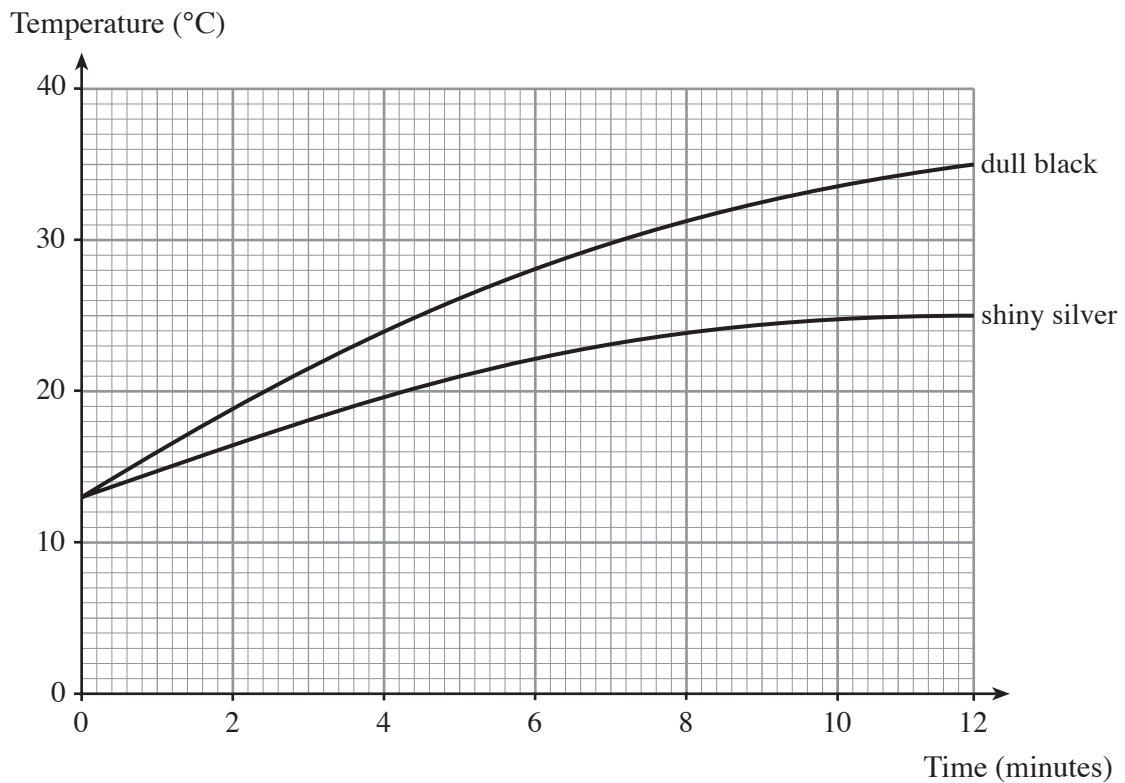
(a) State what has been done so that the cans receive the same amount of energy. [1]

....

(b) Use the graph to find the temperature difference between the two cans at 6 minutes. [1]

Temperature difference = ...°C

(c) **Underline the word** that correctly completes each of the sentences that follow.

(i) The cans receive heat energy from the heater by the process of (**conduction** / **convection** / **radiation**).

(ii) The experiment shows that the blacked can has (**emitted** / **absorbed** / **reflected**) more heat energy than the shiny silver can.

[2]

4

Turn over.

10. 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)	6500	7610	8525

(a) Calculate:

(i) the number of units used in the 3 months before the double glazing was installed;

Number of units = ...

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

Number of units = ...
[2]

(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 = ...

(c) The gas customer claimed that the money saved was entirely due to the installation of the double glazing.
Explain why this claim is not scientifically correct. [2]

....

....

....

6

11. *Read the passage carefully before answering the questions that follow.*

Over the last 5 years there has been a massive increase in the use of mobile phones by children under 10 years old.

A number of studies have suggested a possible health risk for frequent users of mobiles. They are more likely to experience cell damage leading to changes in brain function and, in extreme cases, to cancer.

The health risk is linked to the microwaves given out by the mobiles. These microwaves are absorbed by the water molecules in brain cells. This generates heat which may cause damage to the cells.

Although there is no direct evidence, some scientists believe that the risk is greater for younger rather than older people. The Government has advised that children under 8 should use mobile phones in emergencies only.

(a) Explain

(i) why brain cells absorb microwaves;

....

(ii) how microwaves may damage cells of the body.

....

[2]

(b) According to the passage, how may the health of frequent mobile phone users be affected?

[2]

....

....

(c) Suggest a reason why children under 8 years old should not use mobile phones very often.

[1]

....

....

(d) What needs to be done in the future to find out if the results mentioned in the passage are reliable and valid?

[1]

....

....

6

Turn over.

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

(a) Name the force that keeps the planets in orbit around the Sun. [1]

....

(b) (i) Apart from the Earth, name **one** planet that has a rocky structure.

....

(ii) Name **two** planets that have a gas structure.

....
[2]

(c) 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	1427	29·5	–180 °C

The **asteroid belt** lies between Mars and Jupiter. Asteroids are bits of rock, of varying size, which never collected to form a planet.

.

If the planet **had** formed from the bits of rock, use the data in the table to estimate its:

(i) distance from the Sun; ....

(ii) orbit time; ....

(iii) surface temperature. ....
[3]

6