Candidate Name	Centre Number	Candidate Number
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General Certificate of Secondary Education

237/02

SCIENCE
HIGHER TIER (Grades D-A*)
PHYSICS 1

P.M. MONDAY, 21 January 2008

(45 minutes)

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**6**	
3.	**4**	
4.	**9**	
5.	**11**	
6.	**6**	
7.	**9**	
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.

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

EQUATIONS

power = voltage × current

energy transfer = power × time

units used = power (kW) × time (h)

cost = units used × cost per unit

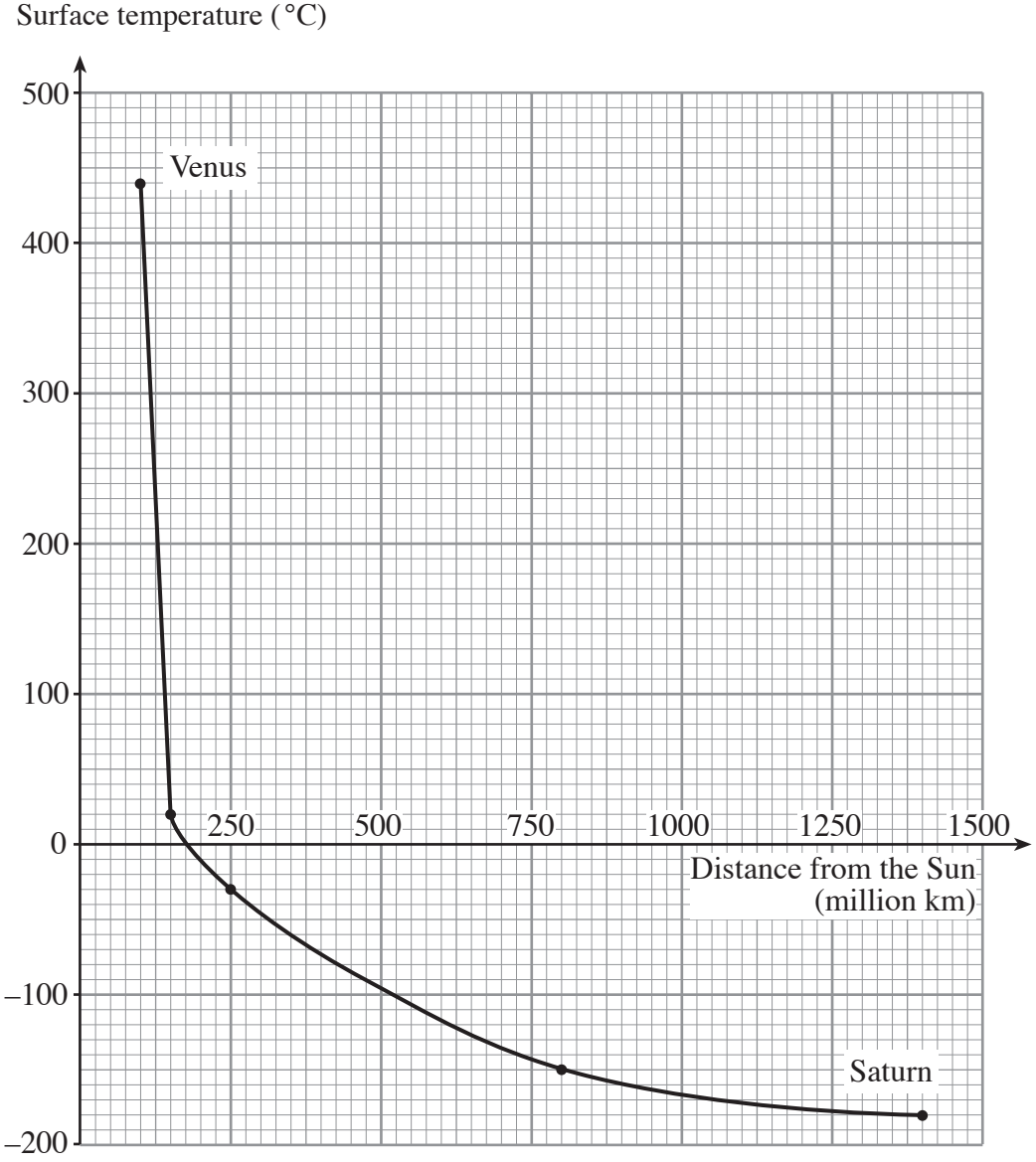
$$\text{efficiency} = \frac{\text{useful energy transfer}}{\text{total energy input}} \times 100\%$$

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

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

*Answer **all** questions*

1. The graph gives information about 5 planets that orbit the Sun.
Two of the planets are named.



(a) Describe carefully how the temperature changes as the distance from the Sun increases. [2]

.....

.....

(b) The fourth planet from the Sun is 250 million km from it.

(i) What is its surface temperature? .....°C [1]

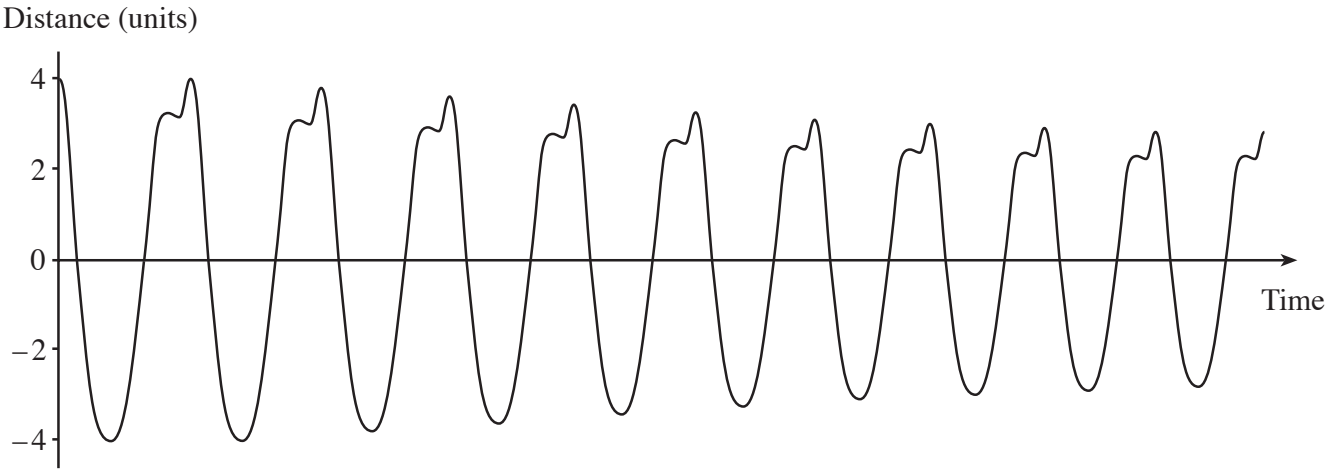
(ii) What is the name of this planet? ..... [1]

(c) How many of the 5 planets shown are gas giants? ..... [1]

5

2. On December 26th 2004, an earthquake under the Indian Ocean sent out a tsunami wave that travelled with terrific speed.

The diagram shows the earthquake's shock wave that was detected in China.



(i) Write down the maximum amplitude of the wave. ..... units [1]

(ii) How many complete waves are shown? ..... [1]

(iii) The frequency of the shock wave is 50 Hz and it travelled with a speed of 5 000 m/s

Explain what a frequency of 50 Hz means. [1]

.....

.....

(iv) Write down **in words**, an equation **as it appears on page 2** and **use it** with the data in part (iii) to calculate the wavelength of the wave.

Equation: .....

..... [1]

Calculation: [2]

Wavelength = ... m

6

3. A house owner improves the insulation in his home by laying fibre glass on the floor of the attic and spraying the inside of the roof tiles with foam insulation.

Here is some in formation about both types of insulation.

The payback time is the number of years taken for the savings to cover the cost of putting in the insulation.

Type of insulation	Cost of insulation (£)	Savings per year (£)	Payback time (years)
Attic floor fibre glass	.....	112	3
Under-roof foam spray	1750	175	.....

(a) **Complete the table.** [2]

(b) Explain why both foam and fibre glass are good insulators of heat. [2]

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4

Examiner only

4. A power station delivers 2 x 10^8 Watts of electricity at 50 000 Volts for the National Grid. The voltage is transformed from 50 000 V to 400 000 V before the electrical energy is sent through the cables.

(a) (i) Write down, **in words**, an equation **as it appears on page 2** and **use it** to calculate the current that flows through the National Grid cables at the voltage of 400 000 V.

Equation: .....

..... [1]

Calculation: [2]

Current = ... A

(ii) Show clearly why the current would be 8 times as big if the electrical energy were transmitted at 50 000 V. [1]

.....

.....

(b) Explain why it is necessary to step up the voltage when it is transmitted from power stations. [2]

.....

.....

.....

(c) The power station has an efficiency of 25% in producing electricity.
Write down, **in words**, an equation **as it appears on page 2** and **use it** to calculate the total input energy to the power station each second.

Equation: .....

..... [1]

Calculation: [2]

Energy input per second = ... W

9

5. Look at the information below which compares two light bulbs. They both give out the same amount of light.

Low energy light bulbs cost a lot
Do they really save you money?

Type of bulb	Power (kW)	Power (W)	Lifetime (hours)
Conventional filament type	0·1	100	1 000
Low energy	0·02	20	15 000

(a) Write down, **in words**, an equation **as it appears on page 2** and **use it** to calculate the number of units of electricity used by a low energy bulb in its lifetime.

Equation: .....

..... [1]

Calculation: [1]

Number of units = ... units.

(b) How many units of energy would the equivalent filament bulb use in 15 000 hours? [2]

Number of units = ... units.

(c) Write down **in words**, an equation **as it appears on page 2** and then **use it** with your answers to (a) and (b) to find the money saved over 15 000 hours by changing to a low energy bulb.

[The cost of electricity = 10 p per unit]

Equation: .....

..... [1]

Calculation: [2]

Money saved = ...

(d) If a 20W low energy bulb costs £2.50, how many of them could you buy with the money that you would save? [1]

Number of bulbs which could be bought = ...

(e) Explain how and why the environment would benefit if everybody switched to low energy bulbs. [3]

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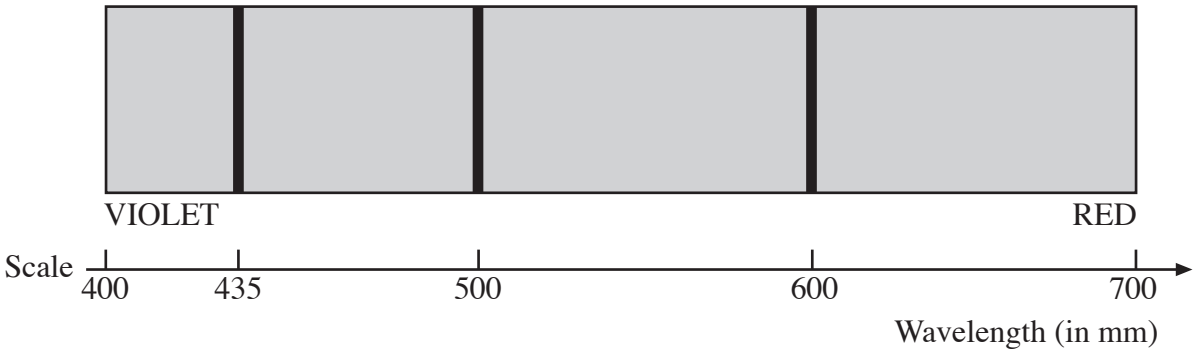
11

6. A spectrum is the range of colours that comes from a source of light.
The diagram shows the same part of the spectrum from 2 similar sources of light.
Diagram **A** is the spectrum of light from a distant galaxy.
Diagram **B** is from the same source of light in a laboratory.

Diagram **A**. Light from a distant galaxy.

Diagram **B**. Same source of light in a laboratory.



(a) (i) Describe carefully the difference between the two spectra. [2]

.....

.....

.....

(ii) State what the difference in the spectra tells us about the movement of the galaxy. [1]

.....

.....

(iii) Explain how these observations led scientists to the BIG BANG theory of the Universe. [1]

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Examiner only

(b) (i) How would Diagram **A** be different for a more distant galaxy? [1]

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.....

(ii) Give a reason for your answer to *(b)* (i). [1]

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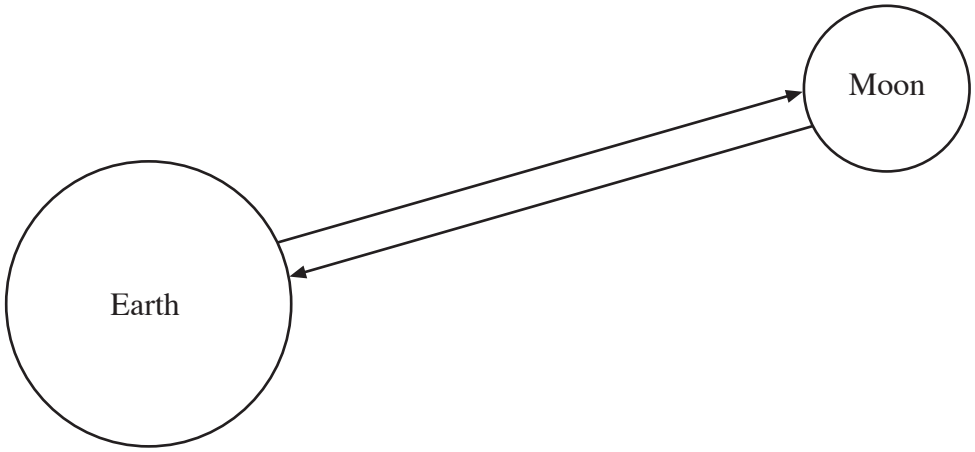
6

7. One of the things that Neil Armstrong (the first astronaut to land on the Moon) left on the Moon was a reflector about the size of a suitcase.

The distance from the Earth to the Moon is now measured very accurately using laser light from Earth to strike that reflector on the Moon. The light is reflected back and received on Earth a short time later.



Light travels at $3{\cdot}00 \times 10^8$ m/s through space, and the Moon is at a distance of $3{\cdot}85 \times 10^8$ m away.

(a) Write down **in words**, an equation **as it appears on page 2** and **use it** to calculate the time taken for the light to travel to the Moon and back.

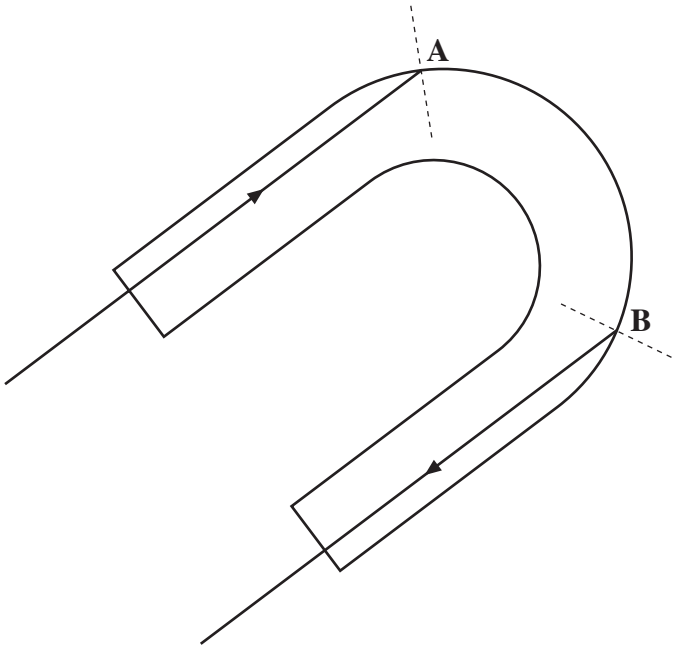
Equation: .....

..... [1]

Calculation: [3]

Time taken= ..... s

(b) The reflector could be made of a bundle of tiny optical fibres, one of which is shown below. The ray enters and strikes the inside surface of the optical fibre at A.



(i) **Complete the diagram** to show the path of the ray through the fibre from **A** to **B**. [2]

(ii) State what is happening to the light in the fibre at point A. [1]

.....

(iii) Explain why no light passes out of the fibre at point A. [2]

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9