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RECOGNISING ACHIEVEMENT

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B651/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

PHYSICS B

Unit 1 Modules P1 P2 P3 (Higher Tier)

WEDNESDAY 11 JUNE 2008

Afternoon
Time: 1 hour

Candidates answer on the question paper.
Additional materials (enclosed):
None

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T52632

Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- A list of physics equations is printed on page two.

FOR EXAMINER'S USE		
Section	**Max.**	**Mark**
A	**20**	
B	**20**	
C	**20**	
TOTAL	**60**	

This document consists of **19** printed pages and **1** blank page.

[Turn over

EQUATIONS

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

fuel energy input = waste energy output + electrical energy output

power = voltage × current

energy supplied = power × time

energy (kilowatt hours) = power (kW) × time (h)

wave speed = frequency × wavelength

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

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

force = mass × acceleration

work done = force × distance

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{kinetic energy} = \frac{1}{2}mv^2$$

potential energy = mgh

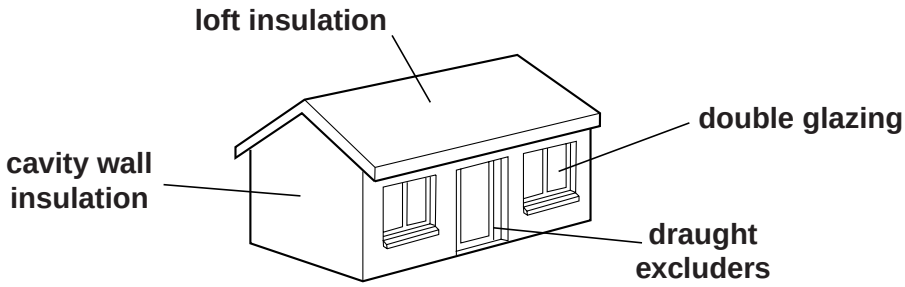
weight = mass × gravitational field strength

Answer **all** the questions.

Section A – Module P1

1 Sam wants to reduce her fuel bills.

She needs more insulation in her home.



(a) Look at the information in the table.

insulation method	cost to fit in £	money saved each year in fuel bills in £	payback time in years
cavity wall insulation	1000	250	4
double glazing	3000	200	
draught excluders		100	0.5
loft insulation	200		2

Some information is missing from the table.

(i) What is the payback time for her **double glazing**?

.....

answer..... years [1]

(ii) What is the cost to fit **draught excluders**?

.....

answer £..... [1]

(iii) What is the money saved each year by fitting **loft insulation**?

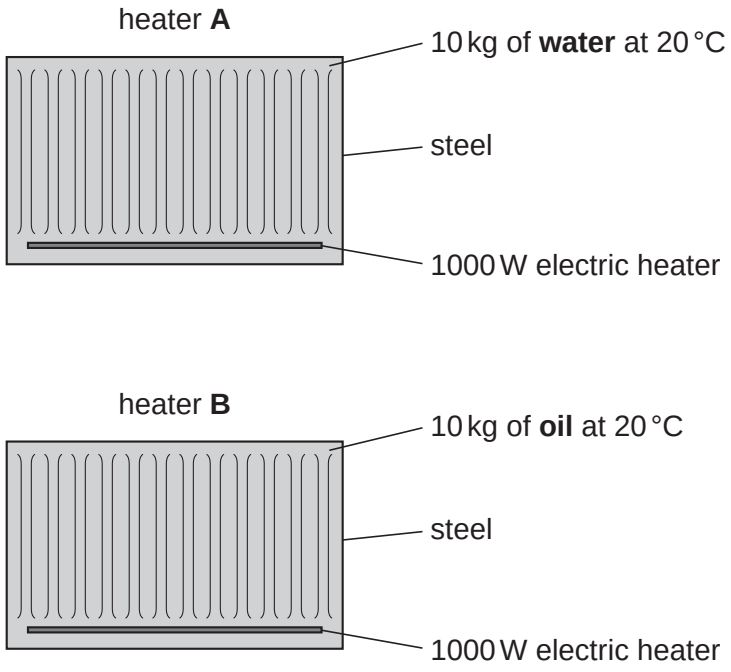
.....

answer £..... [1]

[Turn over for the remainder of question 1

(b) Sam has two types of heater. They are filled with different liquids.

Look at the diagrams of Sam's heaters.



Heater **A** is filled with water. Heater **B** is filled with oil.

(i) The water in heater **A** is at 20 °C.

Sam switches on heater **A**.

The electric heater heats the water.

The heater supplies 2 100 000 J of energy to the 10 kg of water.

The specific heat capacity of water is 4200 J/kg °C.

Calculate the maximum **temperature** of the water.

The equations on page 2 may help you.

.....

.....

.....

answer ..... °C [3]

(ii) The water does not reach this temperature.

Suggest **two** reasons why.

reason 1 .....

.....

reason 2 .....

..... [2]

(iii) Sam switches on heater **B**.

The specific heat capacity of oil is 1670 J/kg °C.

The temperature of the oil heater increases more quickly than the water heater.

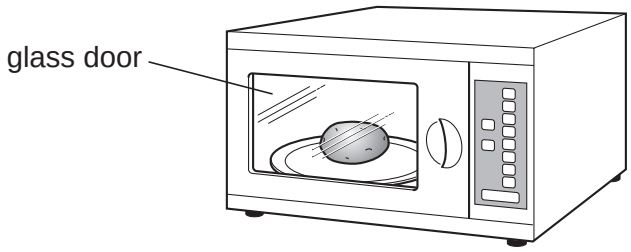
Give **one** reason why.

.....

..... [1]

[Total: 9]

2 Harry puts a potato into his microwave oven.



He heats the potato for 4 minutes.

He removes the potato. Only the outer layers are cooked.

(a) What **material** in the potato absorbs microwaves?

..... [1]

(b) The oven door is made of glass.

There is a **metal** coating on the glass.

Suggest **one** reason why.

..... [1]

[Turn over for the remainder of question 2

(c) Harry wraps the partly cooked potato in shiny foil. This keeps it hot.

The energy from the cooked outer layers conducts to the centre.

This cooks the potato.

Explain how the particles in the potato **conduct** energy to the centre.

.....

.....

..... [2]

[Total: 4]

3 Optical fibres are made of glass.

They carry infrared waves. These waves carry information.

(a) How does infrared radiation travel along optical fibres?

.....

..... [1]

(b) Information can also be carried along copper wires.

Using optical fibres can be a better way to carry information.

Suggest **one** reason why.

.....

..... [1]

[Total: 2]

4 Earthquakes produce shock waves.

Scientists measure these shock waves with seismometers.

(a) Scientists study two types of shock wave:

- p-waves
- s-waves

The p-waves and s-waves behave differently when they reach rock.

There are two states of rock:

- solid rock
- liquid rock

(i) Which state(s) of rock will p-waves go through?

Choose from the list.

solid only **liquid only** **solid and liquid**

answer ..... [1]

(ii) Which state(s) of rock will s-waves go through?

Choose from the list.

solid only **liquid only** **solid and liquid**

answer ..... [1]

(iii) Which of these statements is correct?

A p-waves travel faster

B p-waves and s-waves travel at the same speed

C s-waves travel faster

Choose from **A**, **B** or **C**. ..... [1]

(b) There are different types of wave.

(i) What type of wave is a p-wave?

..... [1]

(ii) What type of wave is an s-wave?

..... [1]

[Total: 5]

Section B – Module P2

5 This question is about the Sun's energy.

(a) The Sun's energy can be transferred into electricity using photocells.

Look at the picture of a photocell.

(i) Write down **one advantage** of using a photocell to provide electricity.

advantage ..... [1]

(ii) Write down **one disadvantage** of using a photocell to provide electricity.

disadvantage ..... [1]

(b) Light produces electricity in a photocell.

Explain how light produces electricity in a photocell.

In your answer, write about

- energy
- electrons
- light intensity.

.....

.....

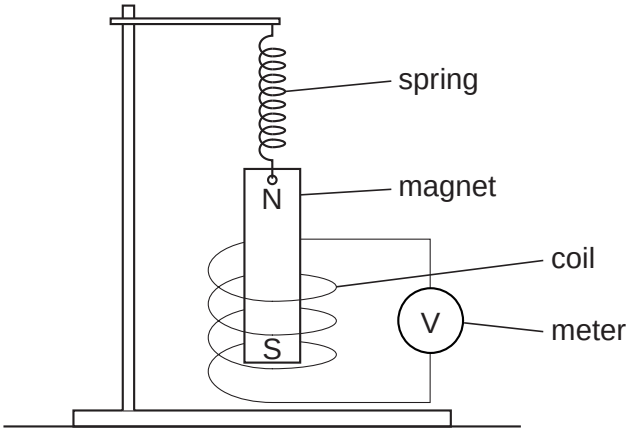
.....

.....

..... [3]

[Total: 5]

6 Wendy sets up the following apparatus.



(a) When the magnet bounces (oscillates) up and down inside the coil, an alternating current (AC) is produced.

Explain why an AC current is produced.

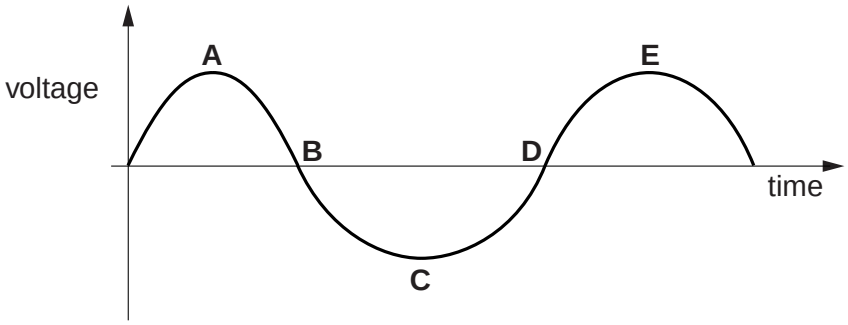
.....

.....

..... [2]

(b) Wendy measures the output voltage from the coil.

Look at the voltage-time graph for the output.



Which points represent the magnet being at the top and bottom of its oscillation?

Choose from **A**, **B**, **C**, **D** or **E**.

answer ..... and ..... [1]

[Total: 3]

7 This question is about paying for electricity.

(a) Alan uses an electric iron.

Look at the picture.

The iron is connected to the 230V mains.

Alan switches the iron on. A current of 3.5A flows through the circuit.

Calculate the **power rating** of the iron.

The equations on page 2 may help you.

.....

.....

answer.....W [2]

(b) When he irons his clothes, Alan watches a television.

The TV is rated at 200 watts and it is on for 1.5 hours.

Electricity costs 12p per unit.

Calculate the cost of using the television for 1.5 hours.

.....

.....

answer.....pence [2]

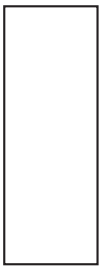
[Total: 4]

8 This question is about radioactivity.

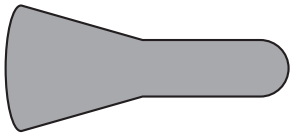
(a) Claire investigates the penetrating power of different radiations.

Look at the diagram of her apparatus.

radioactive source
(alpha, beta or gamma emitter)



absorber
(aluminium, lead or paper)



radiation detector

The boxes show the different radiations and their penetrating power.

Draw straight lines to show which **penetrating power** relates to which **radiation**.

radiation	**penetrating power**
alpha	stopped by several centimetres of lead
beta	stopped by a few millimetres of aluminium
gamma	stopped by one millimetre of paper

[2]

(b) Alpha radiation causes ionisation.

What is an ion?

.....

.....

How are ions produced?

.....

..... [2]

[Total: 4]

9 **(a)** Scientists have discovered that light from other galaxies is shifted to the red end of the spectrum.
This is called red shift.

How does this discovery give evidence for the Big Bang Theory?

.....

..... [1]

(b) Black holes have been identified in parts of the Universe.

Write down **two** properties of a black hole.

1 .....

2 ..... [2]

(c) Astronomers use the term 'light year'.

What is a light year?

.....

..... [1]

[Total: 4]

Section C – Module P3

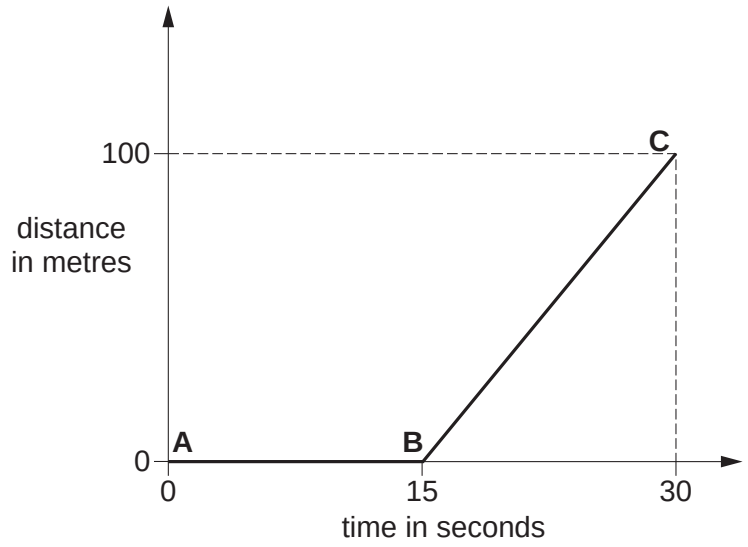
10 This question is about motion and speed.

Brian runs a hundred metre race.

The distance he travels is measured **before the start** of the race **and** during the first part of the race.

Brian draws a graph of his results. It is a **distance-time** graph.

Look at the graph.



(a) When does the race start?

..... seconds [1]

(b) Brian runs at a steady speed between **B** and **C**.

Calculate Brian's steady speed between **B** and **C**.

The equations on page 2 may help you.

.....

.....

answer .....m/s [2]

(c) Alice starts the race at the same time as Brian. She runs the race at a **faster** speed.

What would the second part of Alice's graph look like?

You may draw your answer on the graph.

..... [1]

[Total: 4]

11 This question is about cars **accelerating**.

(a) Complete this sentence about acceleration.

Acceleration is how much the ..... changes each ..... . [1]

(b) Pat measures the speed of two cars. Both cars had started **from rest** (speed = zero).

The speeds were measured at the same time.

Look at the diagram.

speed of **car A** = 10 m / s

speed of **car B** = 15 m / s

Pat measured the speed of **both** cars after 3 seconds.

Calculate the acceleration of **car A**.

The equations on page 2 may help you.

.....

.....

answer .....m / s^2 [2]

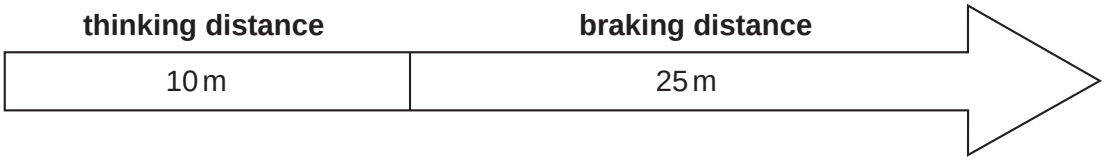
(c) Pat thinks that **car B** has a greater acceleration in the 3 seconds.

Why?

..... [1]

(d) The driver of **car B** presses the brakes. The car stops.

Look at this information about the car stopping.



Write down **one** factor that could **increase**

thinking distance ..... [1]

braking distance ..... [1]

(e) The driver of **car B** loads up the boot of the car with heavy objects.

He then drives the car at the **same speed**.

The driver has to brake to stop the car.

Suggest how the braking distance changes.

Explain your answer.

.....

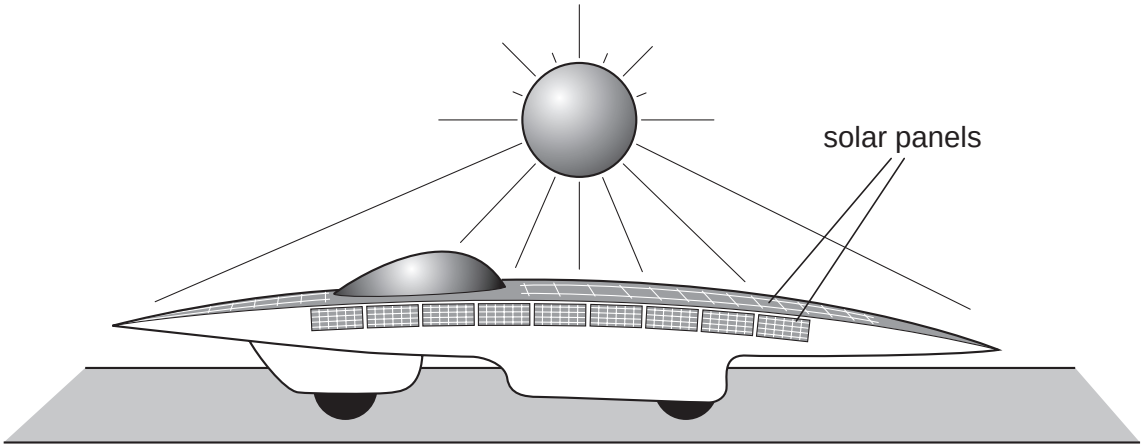
.....

..... [2]

[Total: 8]

12 This question is about energy. Energy can be converted from one form to another.

Look at the diagram. It shows a car powered by energy from the Sun.



(a) Electrical energy from the solar panels can be used to charge batteries.

The energy in the batteries is then used to provide power for the car.

Describe an advantage that solar powered cars have over ones that use petrol or diesel.

.....

..... [1]

(b) The solar powered car has a mass of 800 kg and moves at a speed of 8 m/s.

Calculate the kinetic energy of the car.

The equations on page 2 may help you.

.....

.....

.....

answer ..... J [2]

[Total: 3]

13 This question is about **work done**.

Manisha walks up the stairs in her house.

Work is being done.

The work done when Manisha walks up the stairs is 2000 J.

The **power** developed as Manisha walks up the stairs is 500 W.

Calculate the time taken to walk up the stairs.

The equations on page 2 may help you.

.....

.....

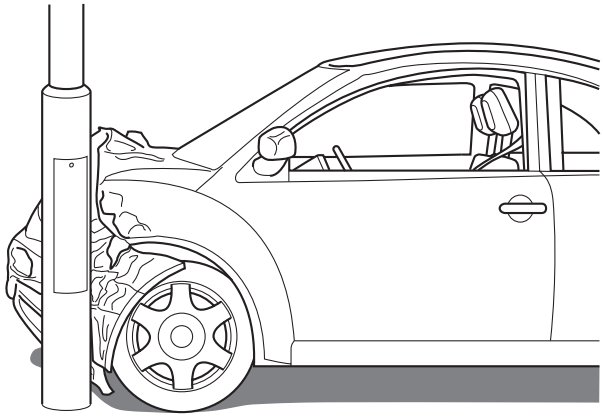
.....

answer ..... seconds [2]

[Total: 2]

14 Cars have many safety features.

Look at the diagram of a car that has been in a crash.



(a) Some parts of the **car body** are designed to change shape in a crash.

These parts are called **crumple zones**. They reduce the risk of injury in a crash.

How do these parts reduce injuries in a crash?

.....

..... [1]

(b) Air bags are another active safety feature in cars.

Explain how air bags reduce the forces on the driver in a crash.

In your answer, write about

- stopping distance or time
- acceleration.

.....

.....

..... [2]

[Total: 3]

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