OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

PHYSICS B

Unit 1 Modules P1 P2 P3 (Higher Tier)

B651/02

Candidates answer on the question paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Wednesday 19 January 2011
Morning

Duration: 1 hour

B651021

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- A list of physics equations is printed on page two.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

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

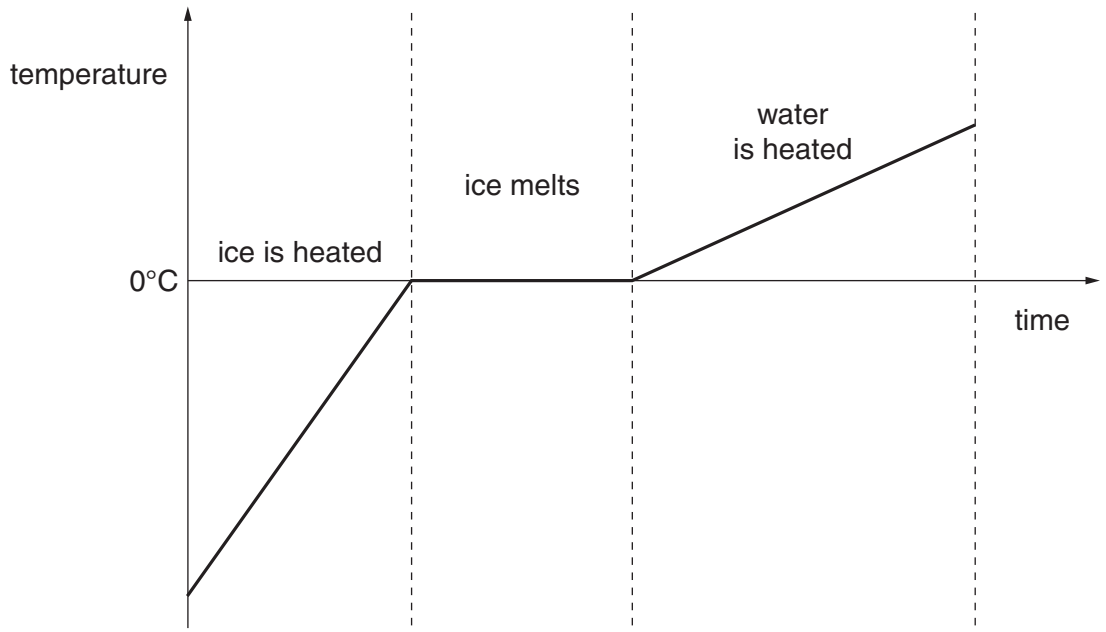
Answer **all** the questions.

Section A – Module P1

1 This question is about ice melting.

Look at the graph.

It shows what happens when ice is heated, ice melts and the water produced is heated.



(a) As the ice melts energy is still supplied but the temperature does **not** change.

Explain what happens to the **energy** supplied.

.....

..... **[1]**

(b) In an experiment it takes 1 400 000 J of energy to melt 4 kg of ice.

Calculate the specific **latent** heat of ice.

The equations on page 2 may help you.

.....

.....

.....

answer ..... J / kg **[2]**

[Total: 3]

2 Ravi wants to reduce energy loss from his house.

He is given some information about methods of insulation from an energy adviser.

Look at the information.

method	cost to fit	money saved each year in fuel bills	payback time in years
cavity-wall insulation	£360	£120	.....
double glazing	£5000	£250	20
loft insulation	£280	£40	.....

(a) Complete the **table** by calculating the missing payback times.

[1]

(b) The adviser tells Ravi that cavity-wall insulation is the most **cost effective**.

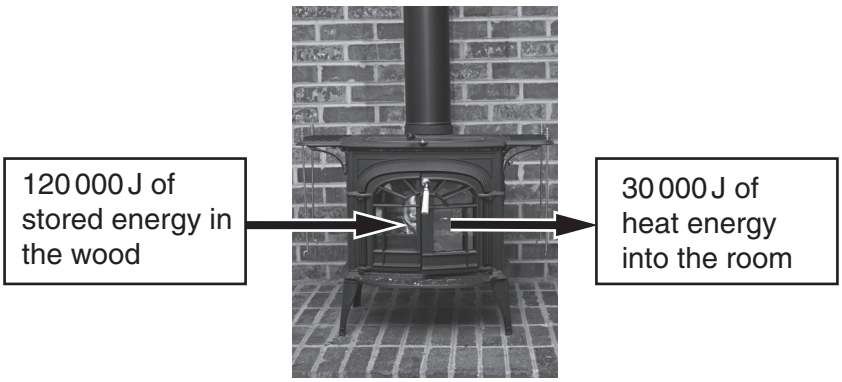
Use the table to suggest why the energy adviser is correct.

..... **[1]**

(c) Ravi has a fire in his house.

He uses wood as a fuel for the fire.

The fire transfers the **stored energy** in the wood into **heat energy** in the room.



For every 120 000 J of stored energy in the wood 30 000 J of heat energy goes into the room.

Calculate how **efficient** the fire is at transferring heat energy to the room.

The equations on page 2 may help you.

.....

.....

.....

.....

answer ..... **[2]**

(d) The fire heats air in the room.

This causes convection currents to circulate in the room.

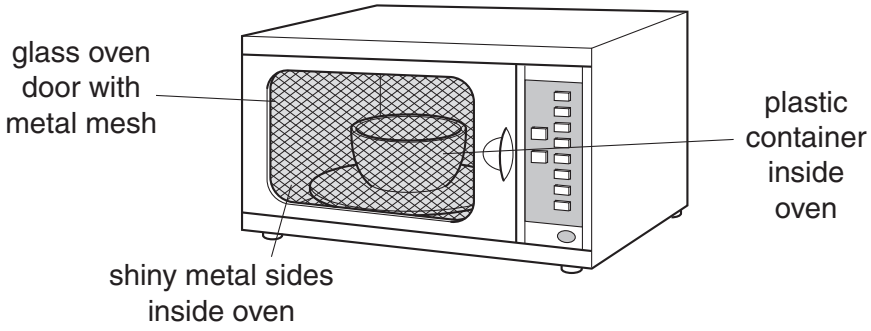
Complete the sentences that explain how the convection currents are formed.

When the air is heated the density ..... because the air has ..... .

This causes the air to ..... . **[2]**

[Total: 6]

3 Microwave ovens cook food quickly.



Asif cooks some food using the microwave oven.

He puts the food in a plastic container.

Look at the statements about microwave cooking.

- the microwaves do not penetrate to the centre of the food
- plastic and glass containers are often used in microwave cooking
- the glass in the door has a mesh of metal in it
- to stop microwaves escaping there must be no gaps in the oven

Use these statements to describe how the food is cooked safely in the microwave oven.

.....

.....

.....

.....

..... **[3]**

[Total: 3]

4 TV and radio signals are transmitted using **two** types of signal.

(a) One type of signal is **analogue**.

Analogue signals are being replaced by digital signals.

This type of signal only has two values, 1 and 0.

How is an **analogue** signal different?

.....

..... **[1]**

(b) TV signals can be transmitted using optical fibres.

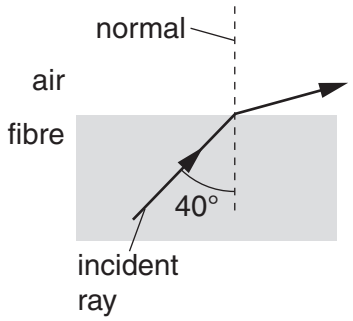
The signals travel along the fibre using total internal reflection (TIR).

The critical angle for the optical fibre in the diagrams below is **45°**.

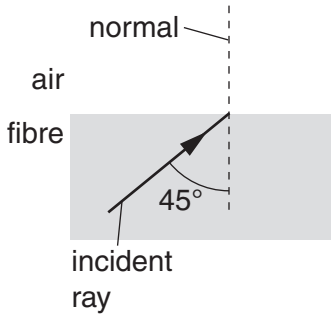
Complete the paths of the rays in the diagrams.

Diagram **A** has been done for you.

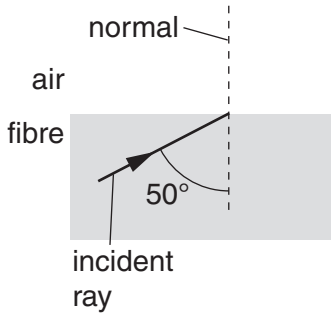
A



B



C



[2]

(c) Two nearby radio stations transmit their signals at **similar** frequencies.

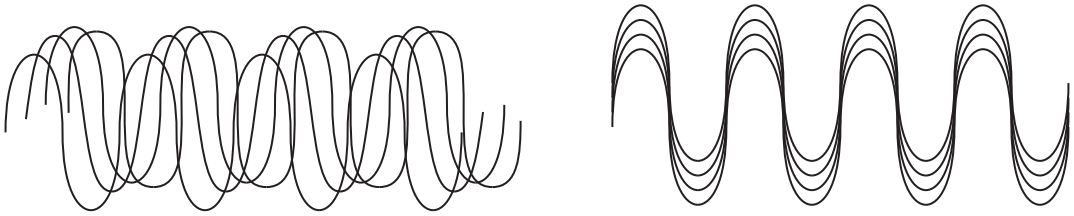
What problem can this cause?

.....

..... **[1]**

[Total: 4]

5 The simple diagrams show waves from an ordinary light bulb and from a red laser.



light bulb waves

red laser waves

Lasers produce an **intense** beam of light.

Complete the two sentences that explain how the beam is intense.

All the waves in a laser beam have the same ..... .

All parts of the wave are in ..... with each other. **[2]**

[Total: 2]

6 Earthquakes produce **seismic waves**.

The seismic waves travel through the Earth.

There are two types of seismic wave

- p-waves
- s-waves.

The waves are detected at different places on the Earth's surface.

This can provide evidence for the Earth's structure.

Complete the sentences about p-waves and s-waves.

Choose words from the list.

The words may be used **once**, **more than once** or **not at all**.

countries

crust

gas

inner core

layers

liquid

outer core

solid

The p-waves travel through ..... and ..... rock.

The p-waves travel through all ..... of the Earth.

The s-waves cannot travel through ..... rock.

The s-waves cannot travel through the Earth's ..... . **[2]**

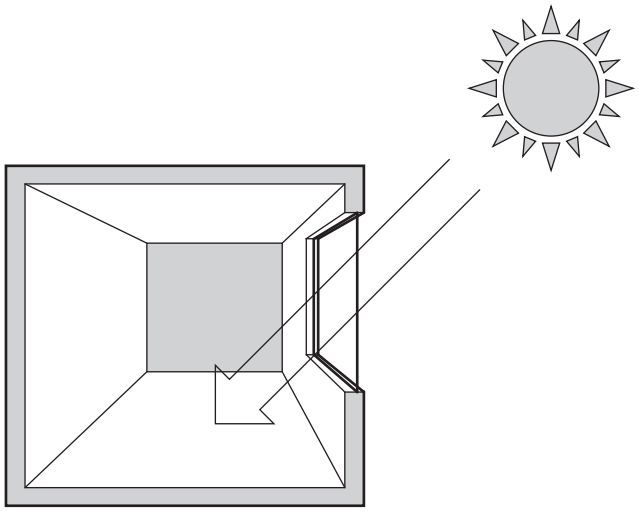
[Total: 2]

Section B – Module P2

7 This question is about using energy from the Sun.

(a) Look at the diagram. It shows a room with a large south facing window.

It is daytime.



The house uses **passive solar heating**.

Passive solar heating keeps the room warm during the night.

Describe how this works.

In your answer, write about what happens during the day and what happens at night.

During the day .....

.....

At night .....

..... **[2]**

(b) The picture shows an electric fence around a field.

The energy for the electric fence comes from a photocell.

(i) Write down one **advantage** of using photocells to produce electricity.

..... **[1]**

(ii) Write down one **disadvantage** of using photocells to produce electricity.

..... **[1]**

(iii) Describe how electricity is produced in a photocell.

.....

.....

..... **[2]**

[Total: 6]

8 Power stations generate electricity.

There are many different types of power station.

(a) Describe how energy is obtained from a fossil fuel.

..... **[1]**

(b) Methane can be produced from biomass.

Write down the name of this process.

..... **[1]**

(c) Nuclear power stations produce radioactive waste.

Give **two** reasons why the disposal of radioactive waste can cause problems for the environment.

1 .....

.....

2 .....

..... **[2]**

(d) Electricity is generated at 23 kV.

It is transmitted around the country at 400 kV.

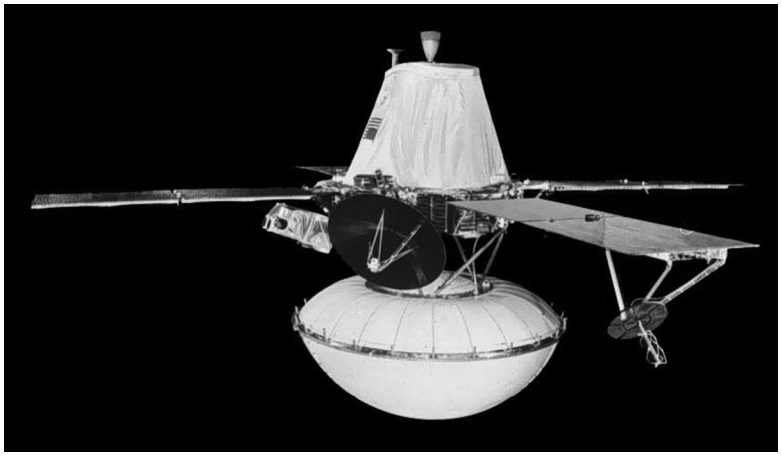
Explain why electricity is transmitted at high voltages.

.....

..... **[2]**

[Total: 6]

9 Viking 1 was sent to orbit Mars in 1975.



Viking 1 was an **unmanned** spacecraft.

There are plans to send a **manned** spacecraft to Mars.

(a) Manned space travel is very costly.

Suggest one **other** difficulty in sending a manned spacecraft to Mars.

..... **[1]**

(b) Unmanned spacecraft can send back useful information about a planet.

One example is a photograph of the surface of the planet.

What other information about a planet can an **unmanned** spacecraft send back?

..... **[1]**

(c) The comet Tempel 1 was photographed six minutes before it collided with an unmanned spacecraft.

Finish the sentence.

A comet is mainly made of ..... and ..... . **[1]**

(d) Some comets and asteroids are **Near Earth Objects** (NEOs).

They are monitored using telescopes and satellites.

NASA has identified over one thousand potentially hazardous asteroids.

There are plans in place in case an asteroid is in danger of colliding with Earth.

Suggest what action could be taken to avoid such a collision.

.....

..... **[1]**

[Total: 4]

10 This question is about using electricity in the home.

(a) Electricity costs 12p per kilowatt-hour.

Brian watches television for 5 hours.

His television has a power rating of 0.12 kW.

Calculate the cost of the energy supplied.

.....

.....

.....

answer ..... pence **[2]**

(b) Brian heats his home with night storage heaters.

He programmes his washing machine, dishwasher and tumble dryer to work overnight.

By doing this he makes use of cheaper electricity and saves money.

Suggest reasons why energy companies encourage people to use **off-peak** electricity by charging less for it.

.....

.....

.....

..... **[2]**

[Total: 4]

Section C – Module P3

11 Alice jumps out of an aeroplane.

She falls for a few seconds. There are two forces acting on Alice.

The forces are called **weight** and **drag**.

(a) Alice's **speed** increases just after she jumps out of the aeroplane.

Explain why.

In your answer write about **weight** and **drag**.

.....

..... **[1]**

(b) Alice reaches a **steady** maximum speed.

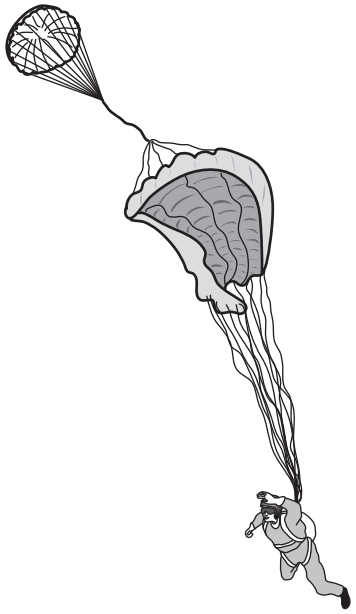
Explain why.

In your answer write about **weight** and **drag**.

.....

..... **[1]**

(c) Alice opens her parachute.



She slows down **very quickly**.

Explain why.

In your answer write about **weight** and **drag**.

.....

..... **[1]**

(d) There are lots of **energy** changes when Alice sky dives.

Complete the following sentences.

When Alice jumps from the aeroplane she has potential energy.

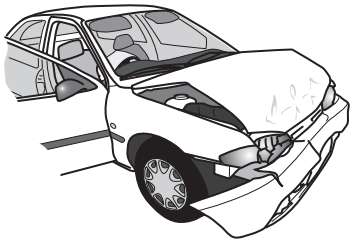
This potential energy changes into ..... energy.

When she reaches terminal speed the ..... energy does **not** change.

At this speed the potential energy does work against ..... . **[3]**

[Total: 6]

12 Cars have safety features. These features can reduce injuries in a crash.



(a) Energy is absorbed by the brakes before a crash.

The work done by the brakes is 50 000 J. The brakes are on for 2 s.

Calculate the average **power** of the brakes.

The equations on page 2 may help you.

.....

.....

answer ..... watts **[2]**

(b) The airbag absorbs energy in the crash.

This reduces injuries to the driver.

Explain why.

In your answer, write about

- time
- acceleration.

.....

.....

..... **[2]**

(c) Electric windows in cars can improve car safety.

Suggest how.

.....

..... **[1]**

[Total: 5]

13 Dave drives his car.

The car accelerates. Look at the diagram.

It takes Dave 2 s to accelerate from 3 m/s to 11 m/s.

(a) Calculate the **acceleration** of the car.

The equations on page 2 may help you.

.....

.....

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

(b) The car has kinetic energy when it moves.

What happens to the car's kinetic energy when its **speed** doubles?

Choose from

kinetic energy **halves**

kinetic energy **stays the same**

kinetic energy **doubles**

kinetic energy **quadruples**

answer ..... **[1]**

(c) The mass of Dave's car is 1000 kg.

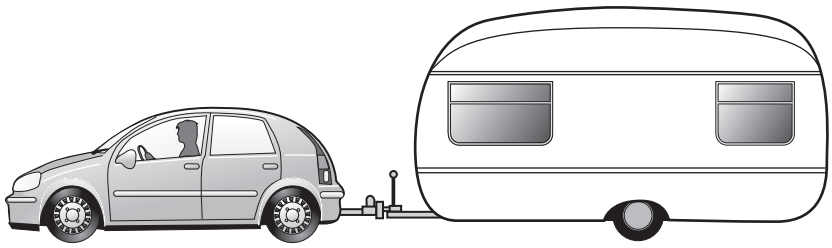
Dave attaches a caravan to his car. This increases the mass to 2000 kg.

He drives again at 11 m/s.

Look at the diagram.

mass = 2000 kg

speed = 11 m/s



(i) What happens to the total kinetic energy when the **mass** doubles?

Choose from

kinetic energy **halves**

kinetic energy **stays the same**

kinetic energy **doubles**

kinetic energy **quadruples**

answer ..... **[1]**

(ii) The car's fuel consumption **increases** when it tows the caravan.

Dave drives at the **same** speed and uses the **same** driving style.

Explain why the fuel consumption **increases**.

.....

.....

.....

..... **[2]**

(d) Dave is worried that there is not enough force to safely brake both the car and the caravan.

He tests the brake performance of the car **on its own**.

He repeats the test **with the caravan**.

Look at the information in the diagrams.

mass of car = 1000 kg

car breaking force = 4000 N

deceleration = 4 m/s^2

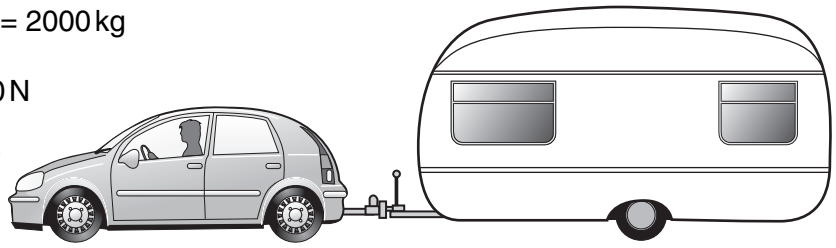
The caravan also has brakes.

mass of car and caravan = 2000 kg

car breaking force = 4000 N

caravan braking force = ?

deceleration = 3 m/s^2



Calculate the braking force **of the caravan**.

The equations on page 2 may help you.

.....

.....

.....

answer ..... N **[3]**

[Total: 9]

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