

**GENERAL CERTIFICATE OF SECONDARY EDUCATION
GATEWAY SCIENCE
PHYSICS B**

B651/02

Unit 1 Modules P1 P2 P3 (Higher Tier)

**Friday 28 May 2010
Morning**

Duration: 1 hour

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)



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use 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. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

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

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

$$\text{energy} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{fuel energy input} = \text{electrical energy output} + \text{waste energy output}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{energy (kilowatt hours)} = \text{power (kW)} \times \text{time (h)}$$

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

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

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

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{work done} = \text{force} \times \text{distance}$$

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

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

$$\text{potential energy} = mgh$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

3
BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

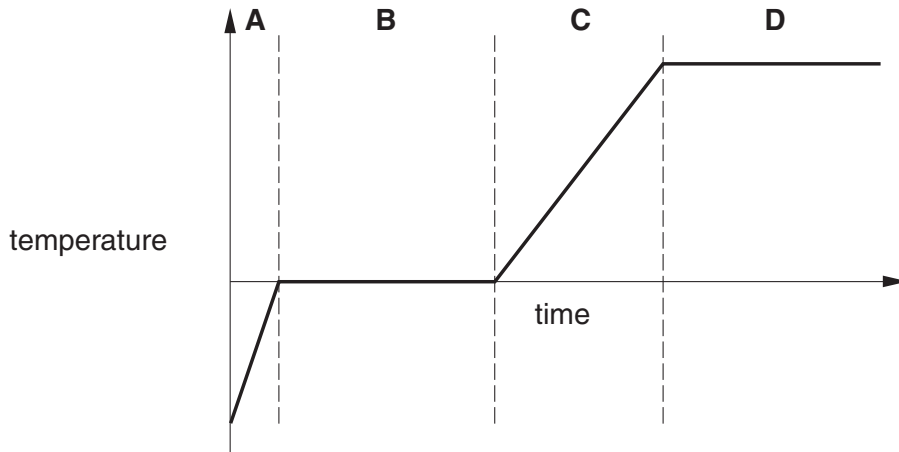
Answer **all** the questions.

Section A – Module P1

1 Dan heats some ice using a Bunsen burner.

He measures the temperature until the ice turns to water and boils.

Look at the graph of his results.



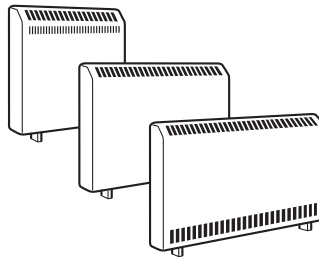
(a) The ice melts during part **B**. The water boils during part **D**.

How does the graph show this?

.....

..... [1]

(b) Storage heaters are used to heat some houses.



They store heat energy at night time and then let the heat out during the day.

Storage heaters can contain concrete, oil or water.

Look at the table.

material	mass in kg	specific heat capacity in J/kg °C
concrete	100	800
oil	100	1900
water	100	4200

- (i) Which material can store the **most** heat?

Choose from:

concrete oil water

answer [1]

- (ii) The mass of concrete in the storage heater is 100 kg.

It is heated and 4 000 000 J of energy is supplied to the concrete.

Look at the table.

Calculate the **temperature rise** of the concrete.

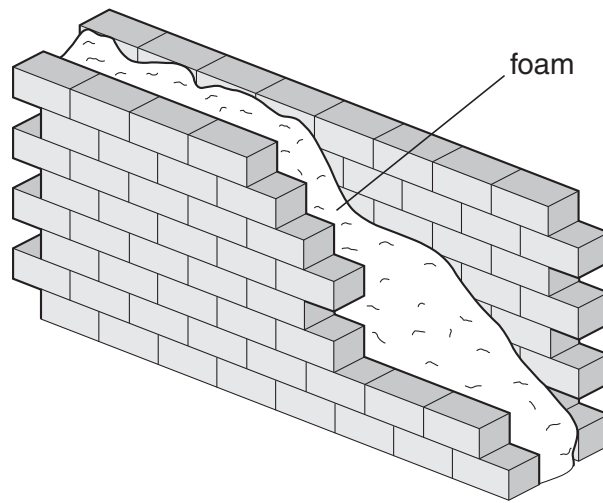
The equations on page 2 may help you.

.....

answer °C [2]

[Total: 4]

(b) Jake has cavity wall insulation fitted.



Cavity wall insulation costs £1200 to fit.

This reduces Jake's heating bill by £300 every year.

Calculate the payback time for cavity wall insulation.

.....
.....

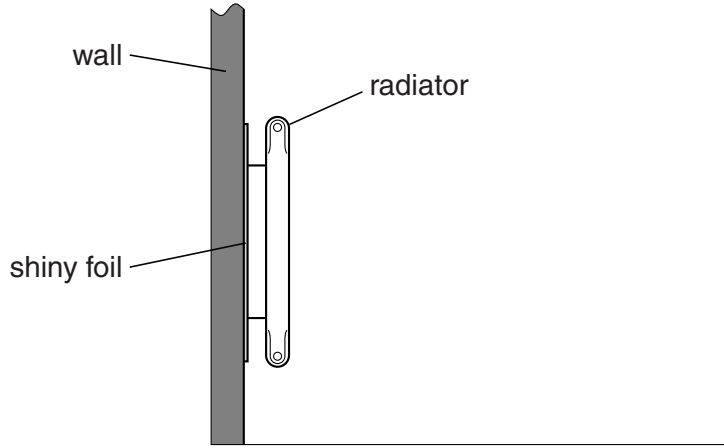
answer years

[1]

(c) Jake puts shiny foil behind each radiator.

This reduces heat loss.

Look at the diagram.



Explain how the foil reduces his heating bills.

.....

.....

..... [2]

[Total: 5]

3 Waves carry energy.

(a) A wave has a frequency of 0.2 Hz.

(i) Explain what **frequency** means.

.....
 [1]

(ii) The wave has a wavelength of 5 m.

Its frequency is 0.2 Hz.

Calculate the **speed** of the wave.

The equations on page 2 may help you.

.....

 answer m/s [2]

(b) Earthquakes produce p and s seismic waves.

Complete the table for **p-waves**.

wave	speed	type	part(s) of the Earth they will pass through
p-wave	fast
s-wave	slow	transverse	crust and mantle

[2]

(c) A **laser** produces an intense narrow beam of light.

The waves in a laser beam are in phase.

What does **in phase** mean?

.....
.....

What is special about the **frequency** of the waves in a laser beam?

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

[Total: 7]

4 Microwaves are used for mobile phones.

These waves are passed across the country by a series of transmitters and receivers.

(a) Digital or analogue signals can be used.

Write down two advantages of **digital** signals.

advantage 1

.....

.....

advantage 2

.....

..... [2]

(b) Signal loss occurs between transmitters and receivers.

What two things can engineers do to **reduce** this signal loss?

1

.....

2

..... [2]

[Total: 4]

Section B – Module P2

5 This question is about electrical power.

Look at the table of electrical appliances.

appliance	power rating in W	time used per week in hours
hair dryer	1500	0.5
iron	2000	3
microwave oven	1000	1
toaster	1500	2
vacuum cleaner	1900	1

(a) The power rating of the toaster is 1500 watts (W).

When converted to **kilowatts** (kW) the power rating is 1.5 kW.

Calculate how many kilowatt hours (kWh) of electrical energy are used by the toaster in two hours.

The equations on page 2 may help you.

.....

answer kWh [2]

(b) The cost of a kilowatt hour of electrical energy is 12 pence.

Calculate the cost of the electrical energy used by the toaster in two hours.

.....
 answer pence [1]

(c) The vacuum cleaner has a power rating of 1900W.

It works from a voltage of 230 volts.

Calculate the current in the vacuum cleaner when it is being used.

The equations on page 2 may help you.

.....
.....
.....

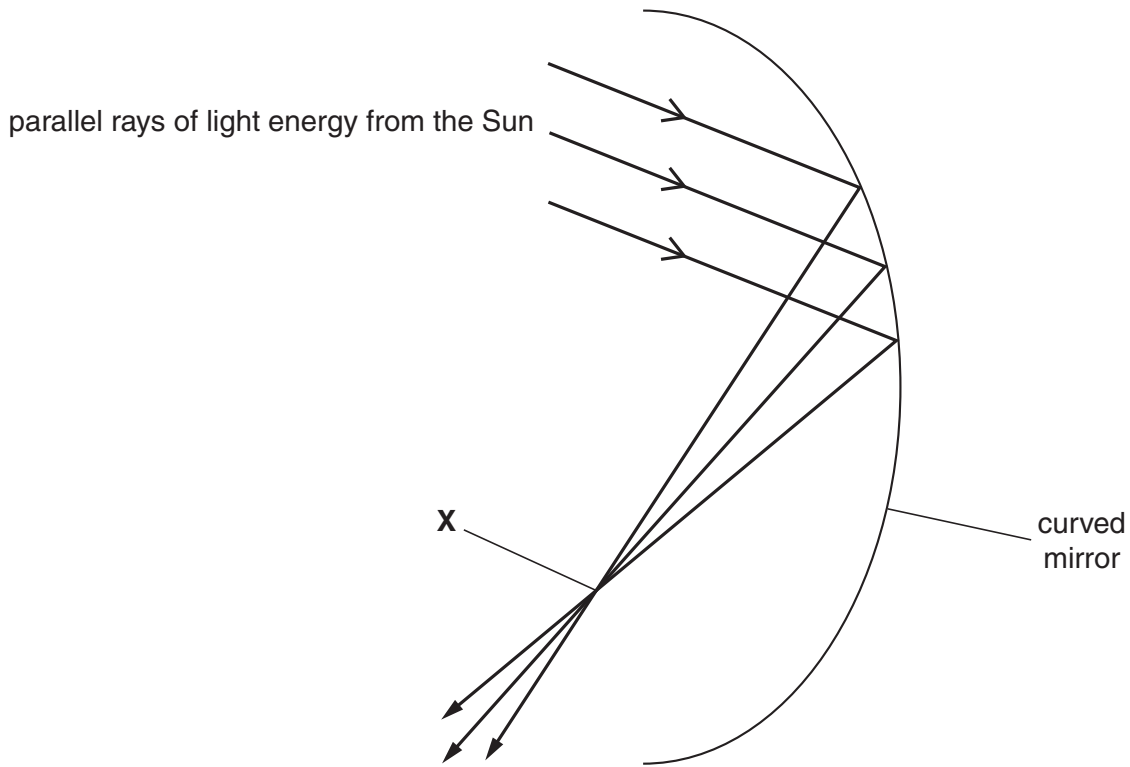
answer amps [2]

[Total: 5]

6 The Sun's energy can be harnessed.

A power station in Ukraine uses lots of curved mirrors to do this.

The diagram shows one of the mirrors.



Complete the following sentences.

Light rays from the Sun are by the curved mirror.

The rays then cross at point **X**.

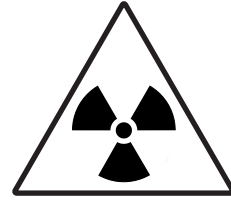
The rays have been brought to a by the mirror.

[2]

[Total: 2]

7 There are three types of nuclear radiation.

- alpha (α)
- beta (β)
- gamma (γ)



(a) Which type of nuclear radiation has the greatest penetrating power?

..... [1]

(b) Nuclear radiation can pass through substances.

The radiation can collide with atoms in the substance.

What happens to these atoms?

..... [1]

(c) Background radiation is all around us in the atmosphere.

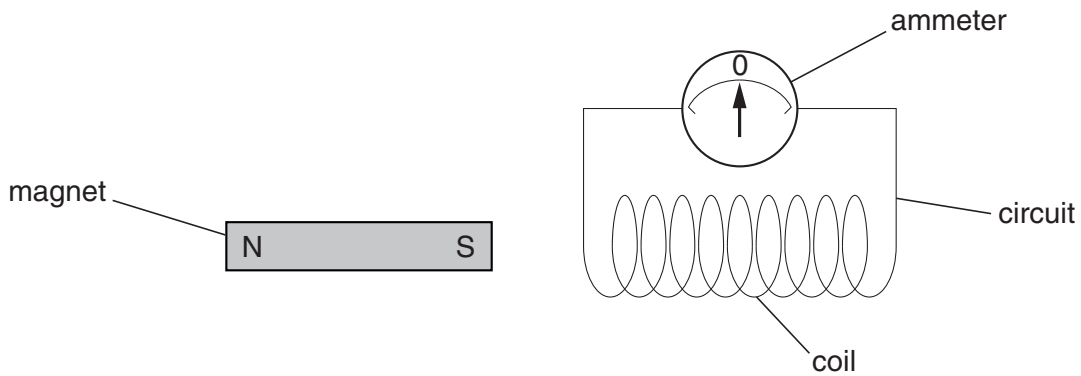
What causes background radiation?

..... [1]

[Total: 3]

8 Emily is investigating the **dynamo effect**.

She sets up the experiment shown in the diagram.



Emily moves the magnet towards the coil. A current flows in the circuit.

(a) Describe **two** things that Emily can do to make a **bigger** current flow in the circuit.

.....

.....

..... [2]

(b) A dynamo produces **alternating** current.

The current changes direction continually.

(i) What is meant by the **frequency** of alternating current (AC)?

Complete the sentence.

Frequency of AC is the number of per [1]

(ii) Batteries produce **direct** current (DC).

Describe the direction of DC in a circuit.

..... [1]

[Total: 4]

9 Stars in the Universe took millions of years to form.

The statements below briefly describe the formation and life of a star.

They are **not** in the correct order.

gravity makes dust particles spiral together

thermonuclear fusion takes place

main sequence star formed

protostar formed

temperature becomes very high

dust and gas clouds form

Put the statements in the correct order.

Write each statement in the correct box below.

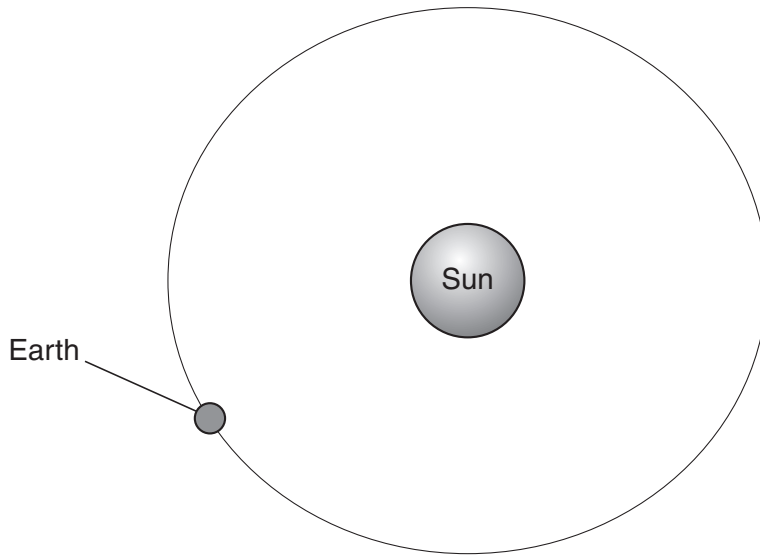
One has been done for you.

order	statement
1	
2	
3	protostar formed
4	
5	
6	

[3]

[Total: 3]

10 The Earth orbits the Sun.



(a) The orbit is almost **circular**.

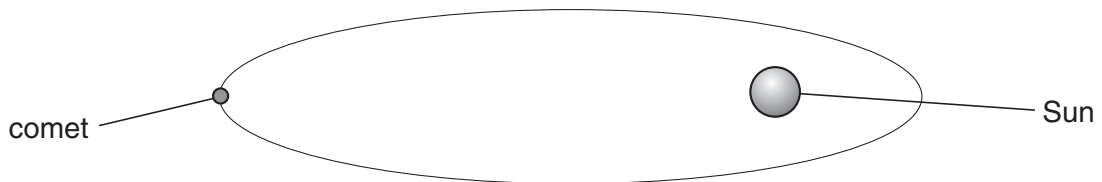
Gravity provides the force to maintain circular motion.

What name is given to the force acting towards the centre of a circle?

..... [1]

(b) Comets also orbit the Sun.

A comet's orbit is very **elliptical**.



As a comet moves closer to the Sun, its speed **increases**.

Explain why.

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

(c) Cosmic rays travel towards the poles when they reach the Earth.

What causes this to happen?

..... [1]

[Total: 3]

Section C – Module P3

11 Most road vehicles use fuels made from a fossil fuel.

(a) Look at the information on the fuel economy of some vehicles.

vehicle	fuel economy in kilometres per litre	number of people carried
car	15	5
bus	5	60
motorbike	25	1
van	8	2

All the vehicles travel a distance of 50km.

(i) The bus uses the most fuel.

Look at the table.

Calculate how much fuel the bus uses travelling 50 km.

.....
answer litres [1]

(ii) The car uses less fuel than the bus.

Suggest why using the bus is a more sensible use of fuel.

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

(b) The fuel economy for the van is 8 kilometres per litre (km/l).

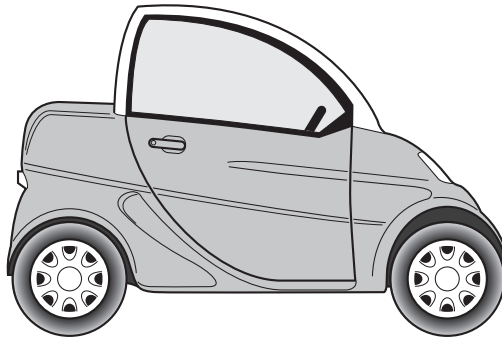
This fuel economy can change.

It can be anything from 5 km/l to 11 km/l.

Suggest two reasons why the fuel economy can change.

1
.....
2
..... [2]

(c) Electricity can be used to power cars.



They use batteries that need to be recharged.

(i) Electric cars reduce pollution in cities where they are used.

Suggest why.

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

(ii) Battery powered cars do not pollute when they are being driven.

But they still cause pollution.

Explain how.

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

[Total: 6]

12 Look at the information on stopping distances for a car travelling at different speeds.

speed of car in m/s	thinking distance in m	braking distance in m
8	6	7
16	12	28
32	24	112

(a) Higher speed increases thinking distance.

Write down one other thing that **increases thinking** distance.

..... [1]

(b) Look at the speeds and thinking distances in the table.

Calculate the driver's **thinking time**.

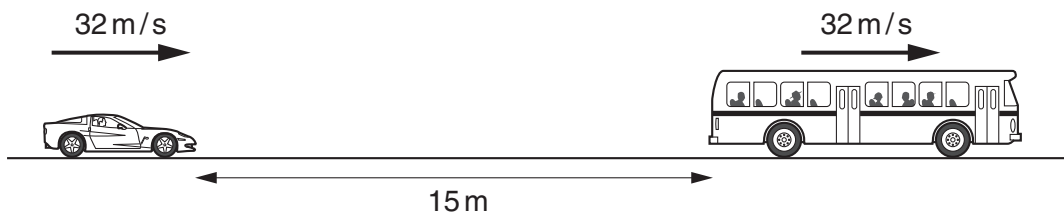
The equations on page 2 may help you.

.....

answer s [2]

(c) A car and a coach travel at 32 m/s on the motorway.

Look at the diagram.



The car is only 15 m behind the coach.

This is dangerous.

Explain why. The information in the table may help you.

.....

 [2]

(d) Look at the table of braking distances.

speed of car in m/s	braking distance in m
8	7
16	28
32	112

Explain the relationship between **speed** and **braking distance**.

In your answer use ideas about

- speed
- kinetic energy
- braking distance.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 8]

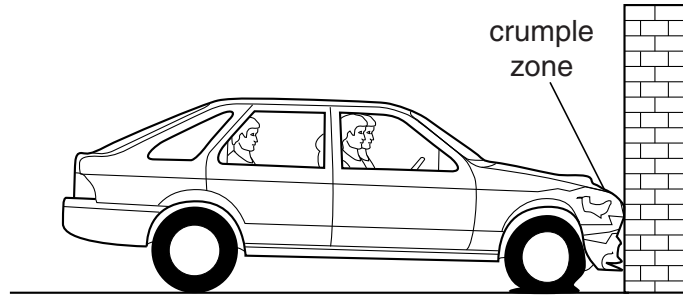
13 Safety equipment is fitted to cars.

(a) **Traction control** can make driving safer.

Suggest how.

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

(b) Crumple zones are fitted to cars.



The car hits a wall. The crumple zone collapses.

Complete the sentences.

The crumple zone collapses and absorbs the during the crash.

The collision time and distance are by the crumple zone.

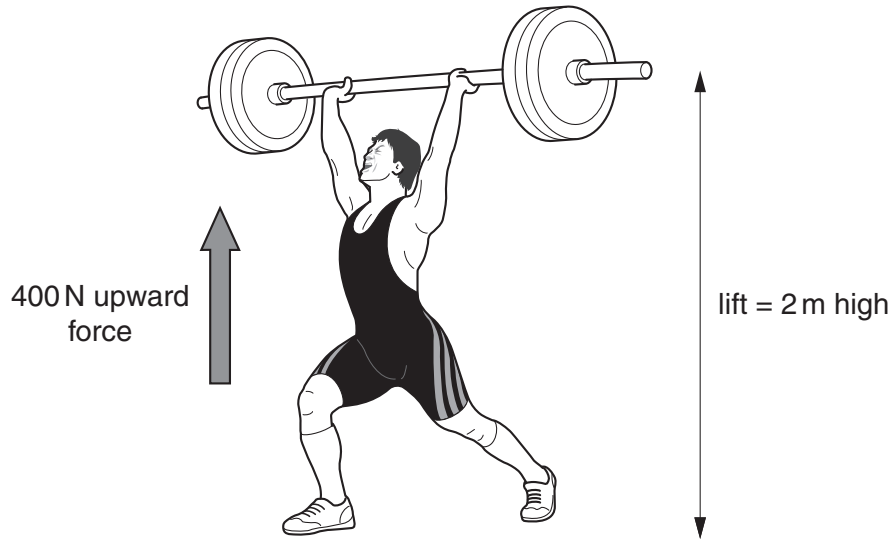
During the collision, the acceleration and the force are by the crumple zone. [3]

[Total: 4]

14 Neil works out in the gym.

He lifts the bar from the floor to above his head.

Look at the diagram.



Neil does work when he lifts the bar.

He pushes up with a force of 400 N.

He lifts the bar 2 m.

Calculate the **work done** on the bar.

The equations on page 2 may help you.

.....
.....

answer J [2]

[Total: 2]

END OF QUESTION PAPER



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