Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

B651/02

GATEWAY SCIENCE

PHYSICS B

Unit 1 Modules P1 P2 P3 (Higher Tier)

FRIDAY 28 MAY 2010: Morning
DURATION: 1 hour

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

DC (NF/JG) MEP60459 30819/1

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **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.**
- **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 three.**
- **The total number of marks for this paper is 60.**

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 = electrical energy output + waste 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

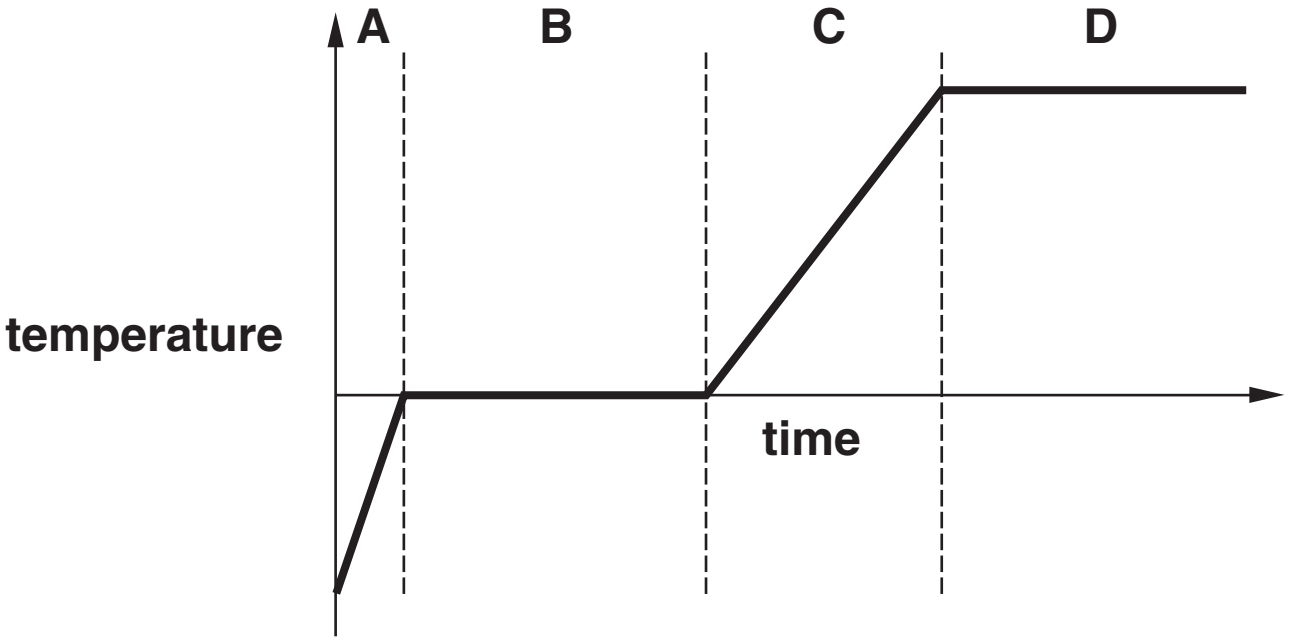
Answer ALL the questions.

SECTION A – MODULE P1

1 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 <u>MOST</u> 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 <u>TEMPERATURE RISE</u> of the concrete.

The equations on page 3 may help you.

_____

_____

answer _____ °C [2]

[Total: 4]

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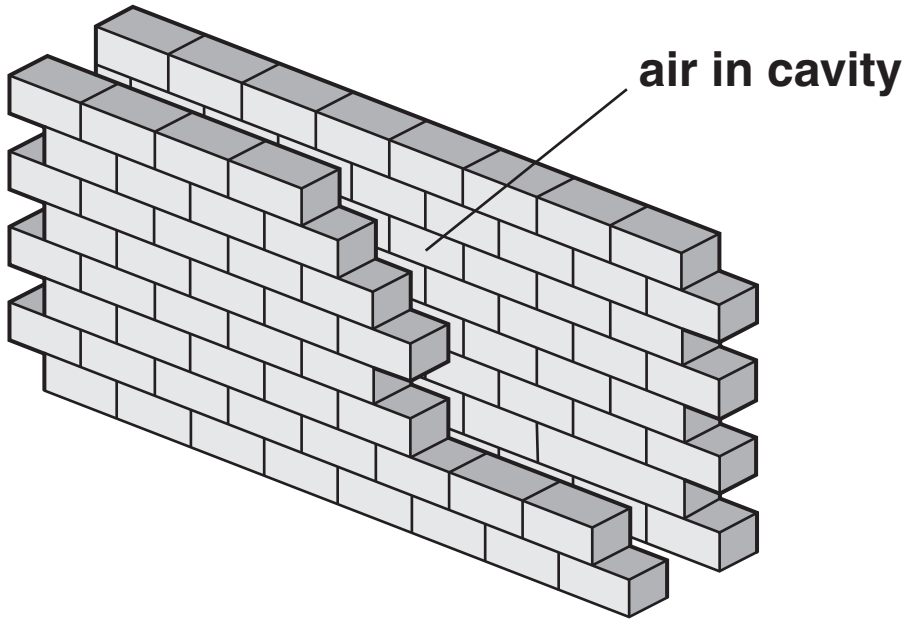
2 Jake's house costs a lot to heat.

(a) His house has a cavity wall.

The cavity contains air.

Look at the diagram.



Explain how heat is lost through the wall.

In your answer write about

- **<u>CONDUCTION</u> and where it happens**
- **<u>CONVECTION</u> and where it happens.**

_____

_____

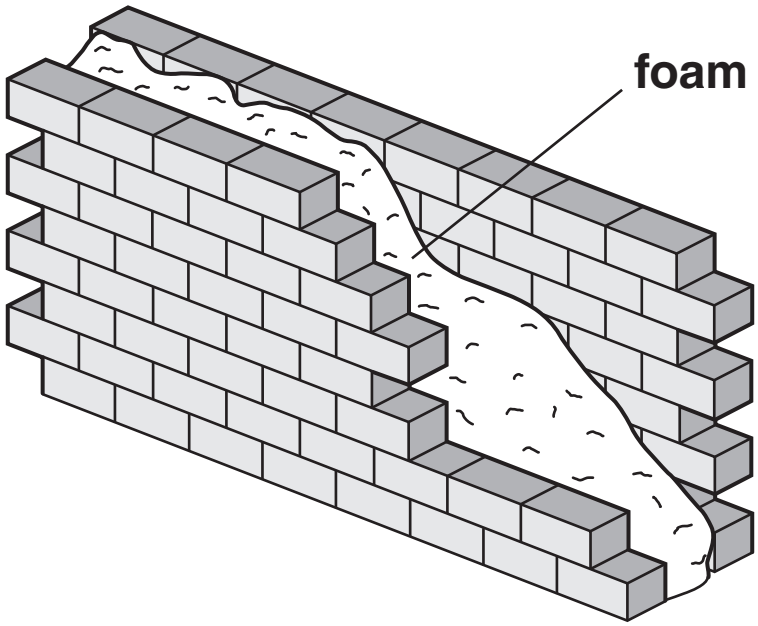
_____

_____

_____

_____ **[2]**

(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.

_____

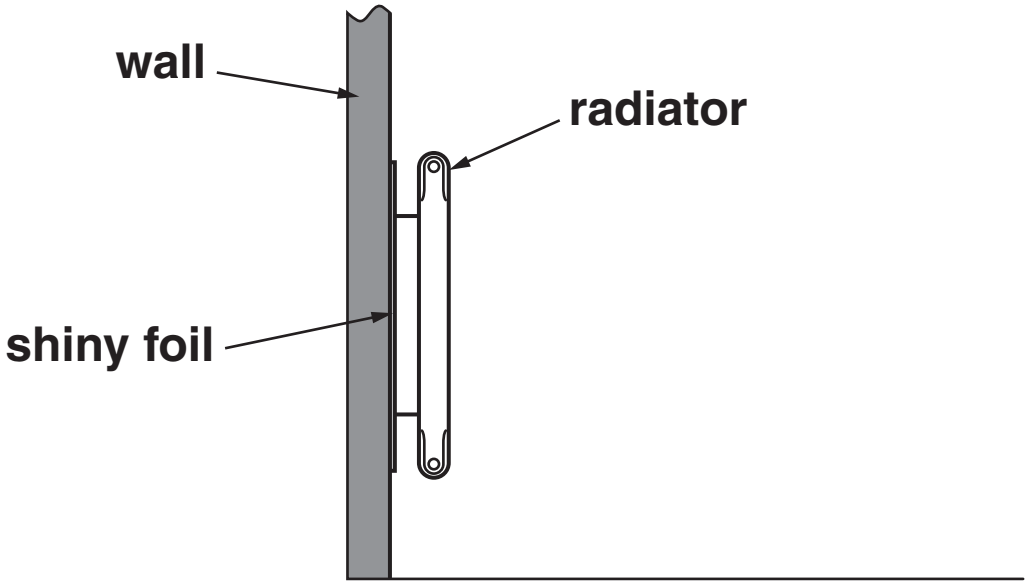
_____

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]

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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 3 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 <u>DIGITAL</u> signals.

advantage 1 _____

_____

_____

advantage 2 _____

_____

_____ **[2]**

(b) Signal loss occurs between transmitters and receivers.

What two things can engineers do to <u>REDUCE</u> this signal loss?

1 _____

_____

2 _____

_____ **[2]**

[Total: 4]

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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 3 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 3 may help you.

_____

_____

_____

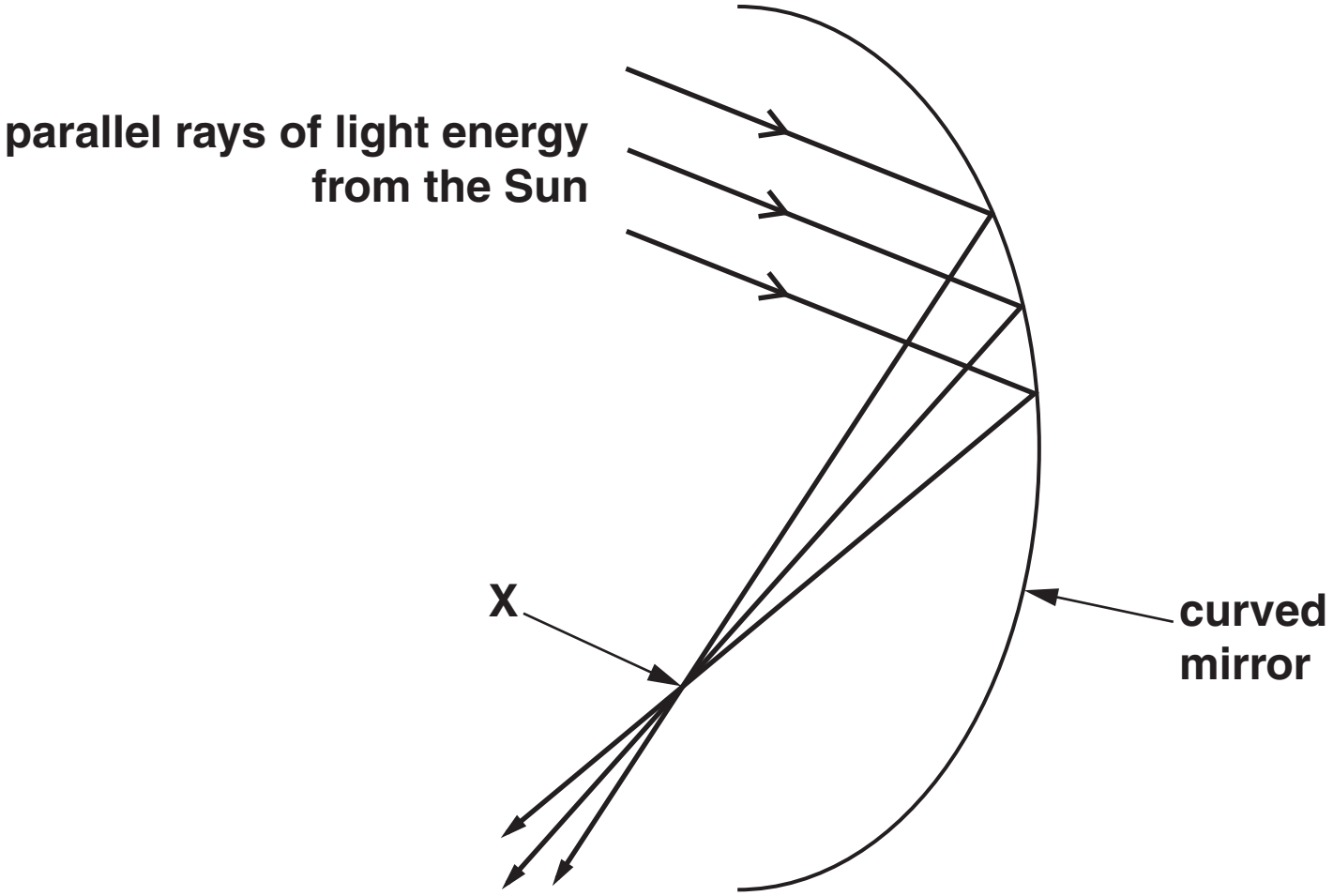
answer _____ amps [2]

[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]

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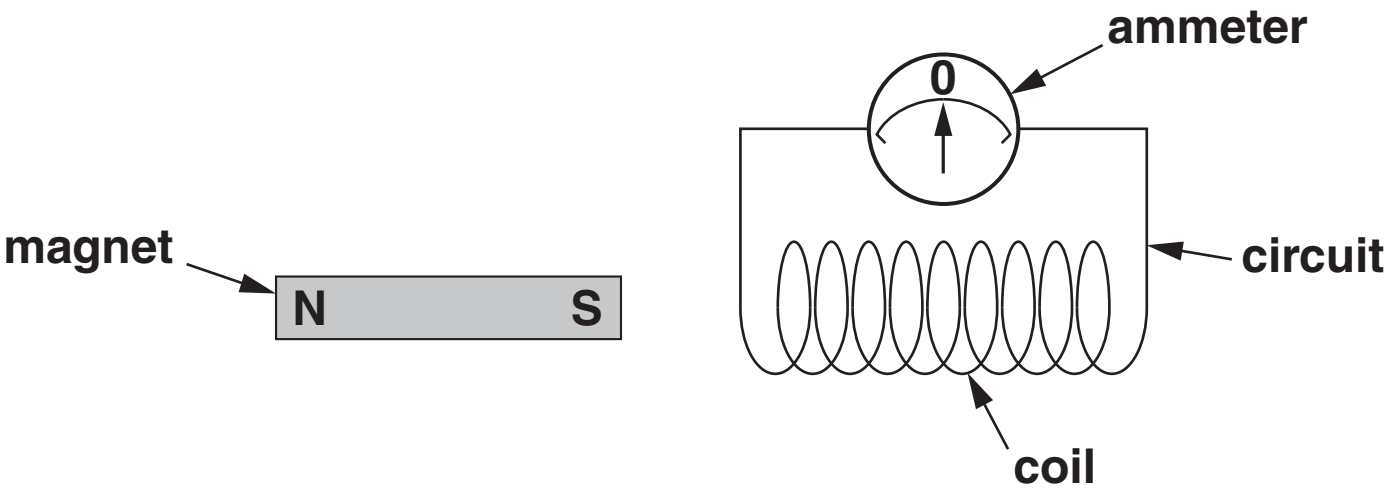
8 Emily is investigating the <u>DYNAMO EFFECT</u>.

She sets up the experiment shown in the diagram.



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

(a) Describe <u>TWO</u> things that Emily can do to make a <u>BIGGER</u> 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.

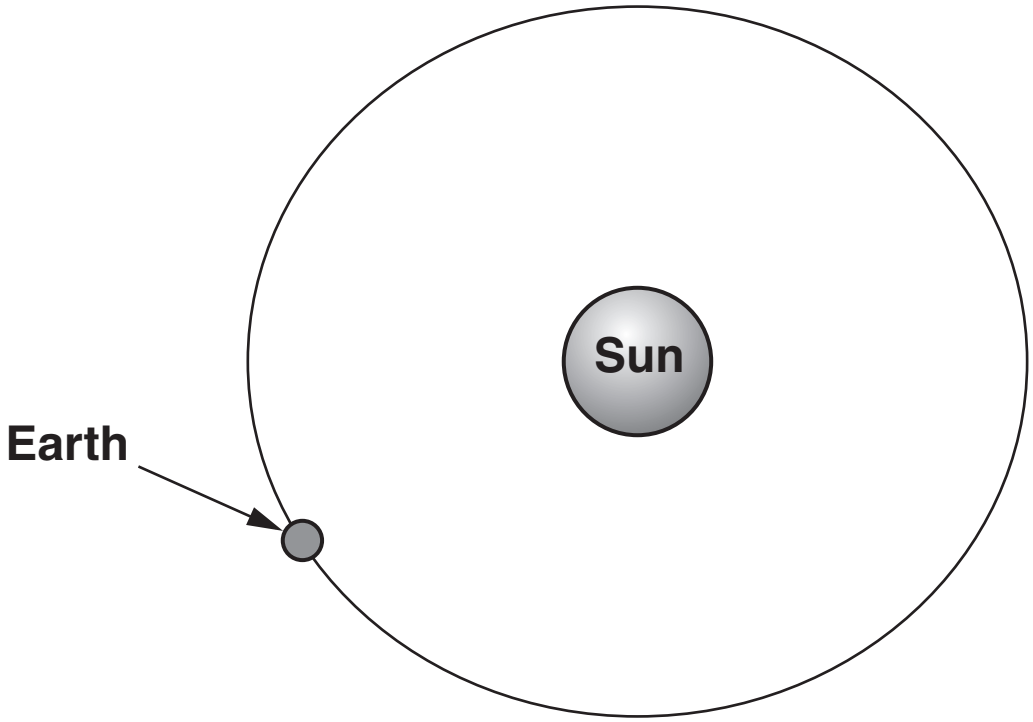
One has been done for you.

ORDER	STATEMENT
1	
2	
3	protostar formed
4	
5	
6	

[3]

[Total: 3]

10 The Earth orbits the Sun.



(a) The orbit is almost <u>CIRCULAR</u>.

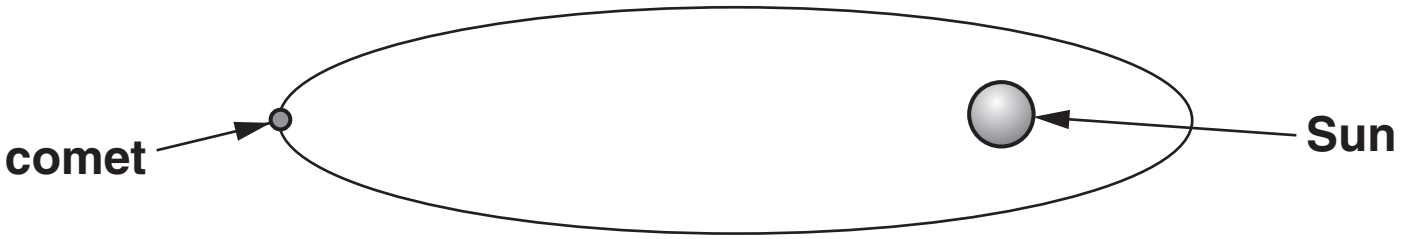
Gravity provides the force to maintain circular motion.

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 <u>ELLIPTICAL</u>.



As a comet moves closer to the Sun, its speed <u>INCREASES</u>.

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 50 km.

(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.

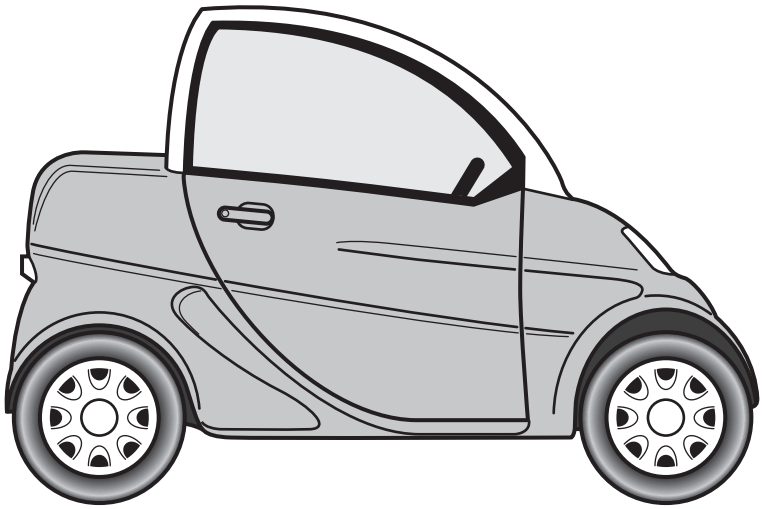
1 _____

_____

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]

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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 <u>INCREASES THINKING</u> distance.

_____ **[1]**

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

Calculate the driver's <u>THINKING TIME</u>.

The equations on page 3 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 <u>SPEED</u> and <u>BRAKING DISTANCE</u>.

In your answer use ideas about

- **speed**
- **kinetic energy**
- **braking distance.**

_____

_____

_____

_____

_____

_____ **[3]**

[Total: 8]

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13 Safety equipment is fitted to cars.

(a) <u>TRACTION CONTROL</u> 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

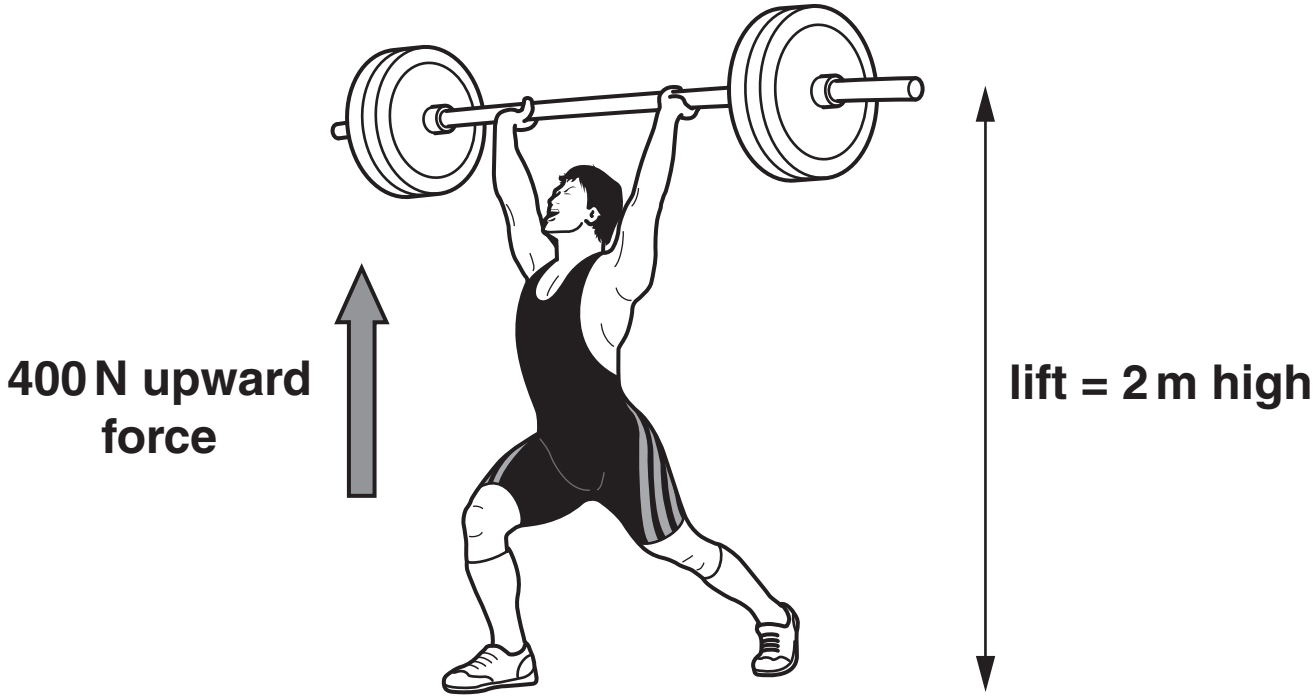
are _____ **by the crumple zone. [3]**

[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 3 may help you.

_____

_____

answer _____ J [2]

[Total: 2]

END OF QUESTION PAPER

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