CCEA GCSE PHYSICS (2003 SPECIFICATION)

PHYSICS



EXAM QUESTION PACK

PAPER 2 FOUNDATION TIER G7603 PAPERS

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012

Science: Physics

Paper 2
Foundation Tier

[G7603]

G7603

MONDAY 25 JUNE, AFTERNOON

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all five** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Quality of written communication will be assessed in Question **2(c)(i)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated with numerical answers where appropriate.

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	

Total Marks	

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Examiner Only	
Marks	Remark

1 (a) (i) Two forces each of 10 N act on a toy car. For each case shown below describe the possible motion of the toy car.



The car is _____

_____

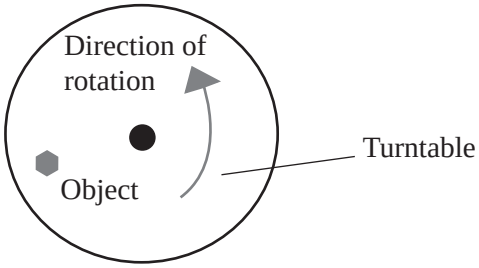


The car is _____

_____

[2]

The diagram below shows a flat object sitting on a turntable. As the turntable rotates in a circle so does the object.



(ii) What provides the centripetal force for the object to move in a circle and in what direction does it act?

The centripetal force is provided by _____

This force acts _____

[2]

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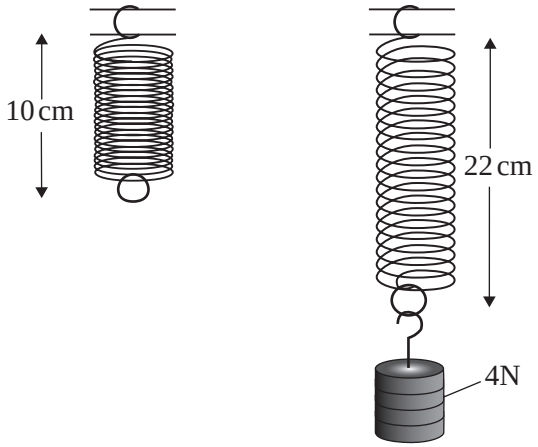
(iii) As the speed of rotation of the turntable is increased the object will eventually fly off the turntable. Explain why this happens and state the direction in which the object flies off.

_____

_____

_____ [2]

(b) A spring has an unstretched length of 10 cm. When a weight of 4 N is attached its length becomes 22 cm.



(i) When an unknown weight is attached to the spring its length becomes 16 cm.
Calculate the value of this unknown weight.
You are advised to show clearly how you get your answer.

Unknown weight = _____ N [3]

(ii) A weight of 100 N is added to spring. Explain why it is unlikely that the extension of the spring can be calculated.

_____

_____

_____ [1]

Examiner Only

Marks	Remark

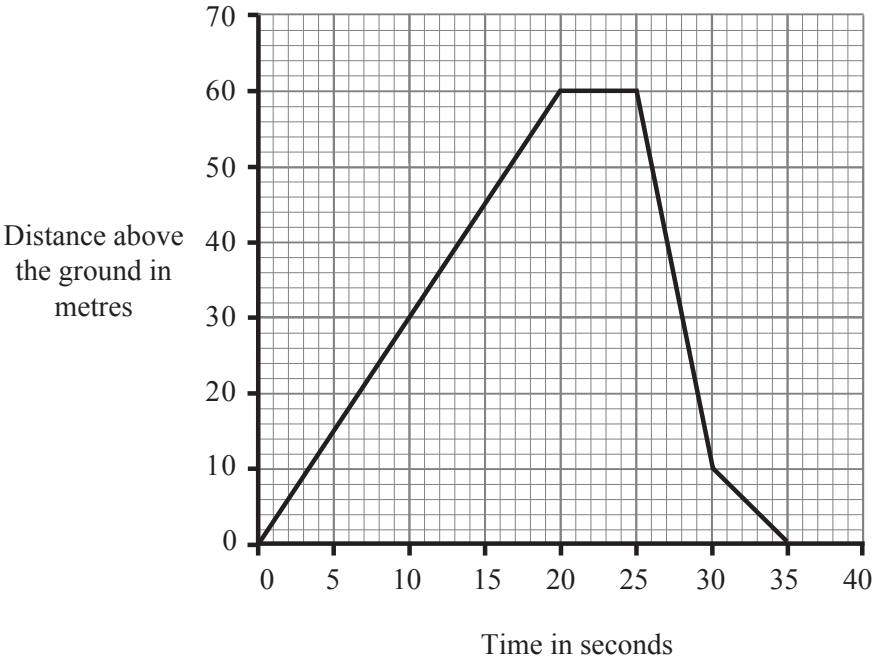
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(c) A theme park ride is shown in the picture below.
The passengers are lifted to a height and then dropped.



© *iStockphoto / Thinkstock*

The graph below shows how the distance above the ground of the passengers changes with time.



Examiner Only

Marks	Remark

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(i) Calculate the speed of the passengers as they travel to the top of the rise.
You are advised to show clearly how you get your answer.

Speed = _____ m/s [3]

(ii) How long do the passengers remain at the top?

_____ s [1]

(iii) What total distance do the passengers travel during the complete round trip?

_____ m [1]

(iv) Calculate the average speed for the complete round trip.
You are advised to show clearly how you get your answer.

Average speed = _____ m/s [3]

(v) What is the displacement of the passengers at the end of the ride? Explain your answer.

Displacement = _____ m

Explanation _____

_____ [2]

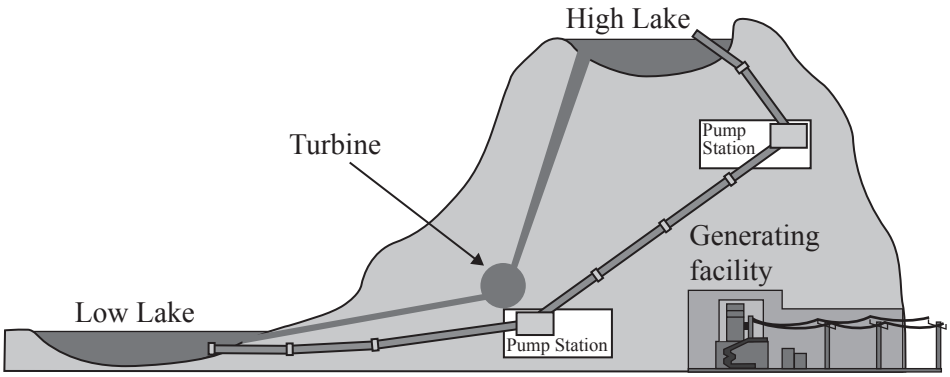
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

2 **(a)** The Dinorwig power station in Wales is described as a pumped storage scheme. Electricity is used to pump water into a high level lake as shown in the diagram below. This is done during the night when the demand for electricity is much lower than during the day.



© V Ryan www.technologystudent.com

(i) A hydroelectric power station uses a renewable source of energy to generate electricity. What is a renewable energy source?

_____

_____ [1]

(ii) Unlike a hydroelectric power station, the Dinorwig scheme **cannot** be described as a renewable energy source. Explain why.

_____

_____

_____ [2]

(iii) Does the generation of electricity in the Dinorwig scheme produce atmospheric pollution? Explain your answer.

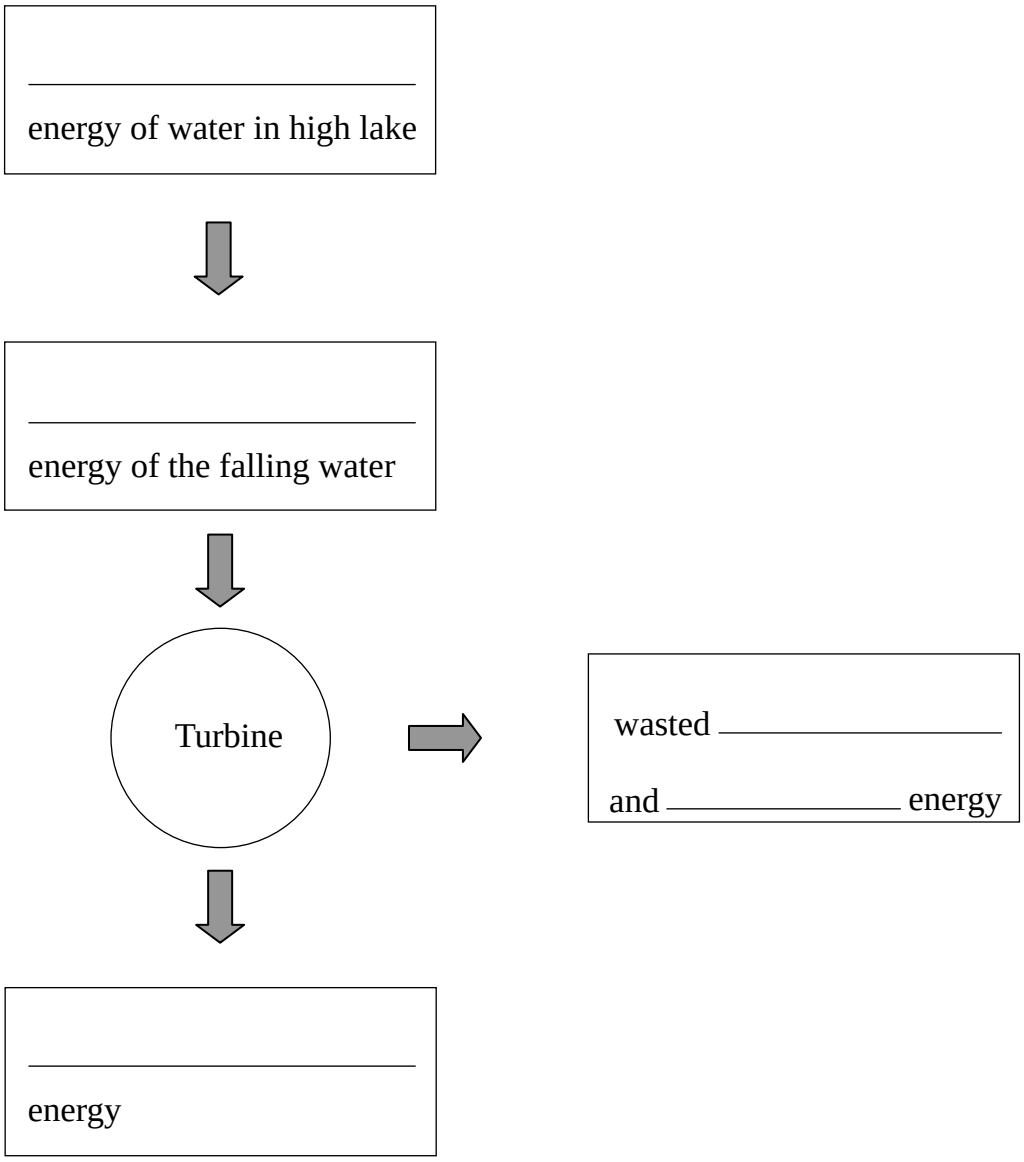
_____

_____

_____ [1]

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(iv) During the day, when the demand for electricity increases, water is allowed to flow from the high lake to the low lake passing through the turbine on its way. Complete the energy flow diagram for this process.



[5]

(v) Describe how the Principle of Conservation of Energy applies to the energy changes shown above.

_____

_____ [1]

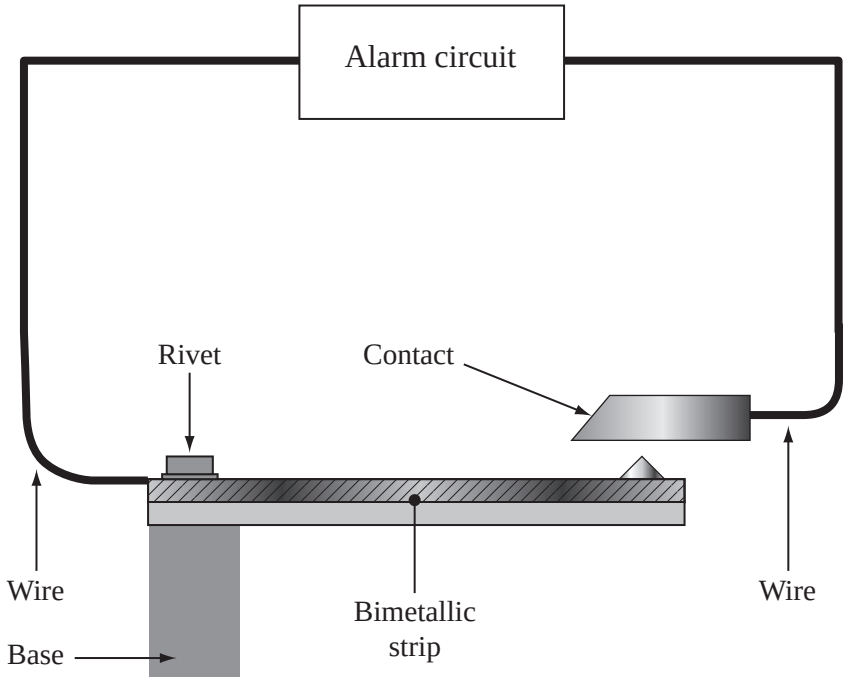
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(b) A bimetallic strip consists of two different metals. For the same increase in temperature one metal expands more than the other. The diagram below shows how a bimetallic strip might be used to operate an alarm should the temperature in a storeroom become too high. When the circuit is completed the alarm will sound.



(i) Describe how the bimetallic strip should behave to set the alarm off.

_____ [1]

(ii) Describe how the metals should be arranged on this bimetallic strip so that the alarm will work correctly.
Remember one metal expands more than the other.

_____

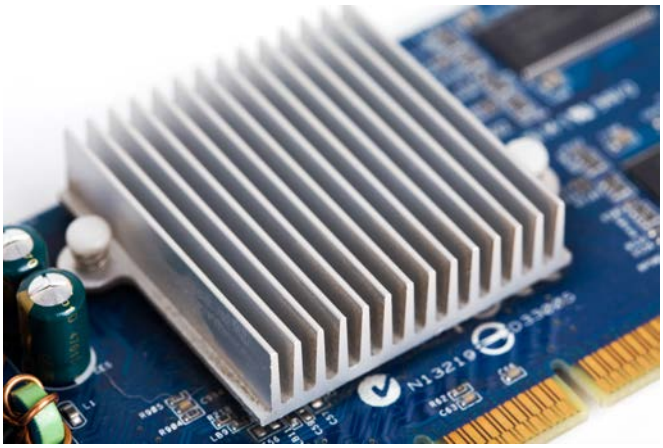
_____

_____ [1]

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Examiner Only	
Marks	Remark

(c) The processor in a computer generates a lot of heat. This heat must be removed otherwise the processor may fail to work properly.
The processor is placed in contact with a metal structure similar to the one shown below.



© iStockphoto / Thinkstock

(i) Describe how the three processes of heat transfer remove heat from the processor.

_____

_____

_____

_____ [3]

Quality of written communication [2]

(ii) Explain why painting the metal structure black makes it more efficient at removing heat from the processor.

_____

_____

_____ [1]

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(d) Water in a saucepan is heated as shown in the diagram below.



© Erich Schrempp / Science Photo Library

(i) On the diagram above show the path taken by convection currents in the water as it is heated. [2]

The body of the saucepan is made of metal and the handle is made of plastic.

(ii) Explain, in terms of heat transfer, the choice of material for each of the two parts of the saucepan.

The body of the saucepan _____

_____

The handle _____

_____ [2]

(iii) In terms of the movement of particles, describe fully the process of heat conduction in insulators.

_____

_____

_____ [3]

Examiner Only

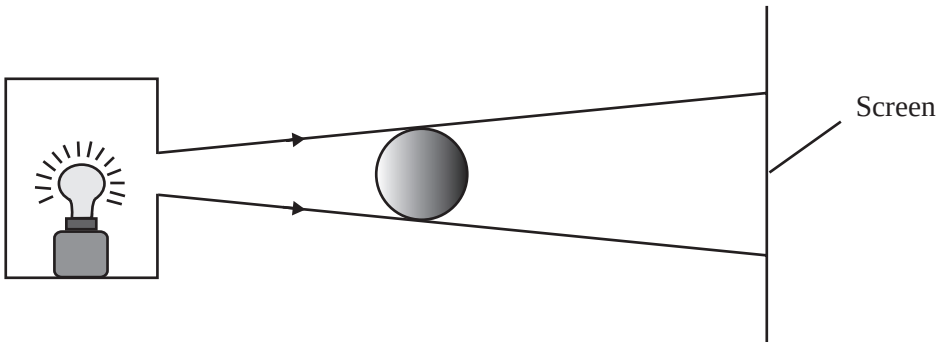
Marks	Remark

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3 **(a)** Below are listed four objects. Ring those that are luminous.

planet **candle flame** **star** **pencil** [2]

(b) A light source produces a shadow of a ball on a screen as shown. Two rays are shown to indicate the region of total shadow on the screen.



(i) What name is given to this type of light source?

_____ [1]

(ii) What is the shape of the shadow on the screen?

_____ [1]

(iii) Using a ruler, draw two further rays on the diagram above which will allow you to indicate the regions of partial shadow (penumbra). [2]

(iv) Label a region of partial shadow on your diagram with the letter P. [1]

(v) What is the effect, if any, of the following changes on the size of the complete shadow on the screen? Indicate your response by ticking (✓) the appropriate box.

	Shadow's size decreases	**No change in size of shadow**	**Shadow's size increases**
Using a larger screen			
Moving the screen away from the ball			
Moving the light source away from the ball			

[3]

Examiner Only

Marks	Remark

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(c) (i) What is the focal length of a converging lens?

Examiner Only

Marks	Remark

_____

_____ [1]

(ii) Describe an experiment to measure the focal length of a converging lens using a distant object. You should

- list the apparatus you need (other than the lens and the distant object)
- describe carefully what you would do
- state the measurement you must make to find the focal length.

You may find it helpful to draw a diagram of the apparatus below.

_____

_____

_____

_____

_____

_____

_____

_____

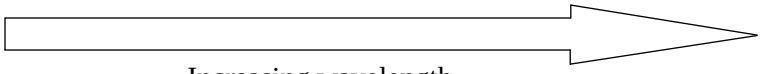
_____ [5]

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Examiner Only	
Marks	Remark

(d) (i) Below is an incomplete table which shows the electromagnetic spectrum in order of increasing wavelength.
Complete the diagram by writing the names of the missing electromagnetic waves in the boxes provided.

		Ultraviolet	**Visible**	**Infrared**		



Increasing wavelength

[2]

(ii) State one property that **only** electromagnetic waves have.

_____

_____ [1]

(iii) What particular danger is there when working with infrared radiation?

_____ [1]

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Examiner Only	
Marks	Remark

4 **(a)** Electromagnets are used with cranes in scrapyards to move steel objects.



© Brainerd Dispatch

Give a reason why permanent magnets are **not** suitable for this use.

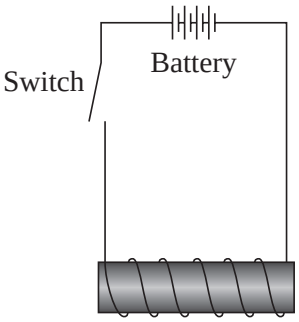
_____

_____

_____

_____ [1]

(b) Insulated copper wire is wound around a cardboard tube to make a simple electromagnet. The ends of the wire are joined to a battery and an iron rod is placed in the coil as shown below.



(i) How do you turn on this electromagnet?

_____ [1]

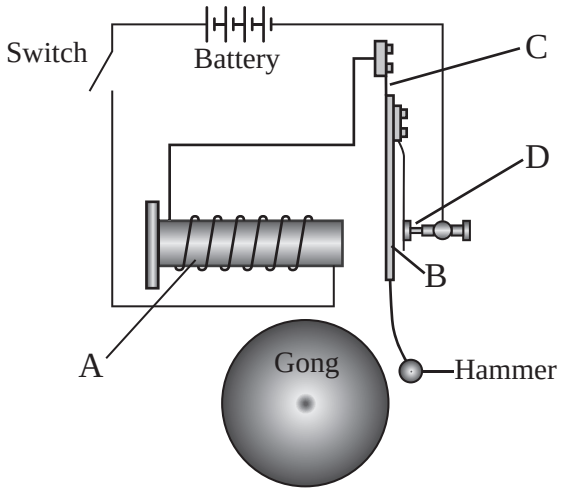
(ii) State three different ways to make the electromagnet **weaker**.

1. _____

2. _____

3. _____ [3]

(c) The diagram below shows an electric bell and its circuit.



(i) What material(s) are the following parts made of ?

A _____

B _____ [2]

(ii) What two particular properties must part C have to allow the bell to work?

1. _____

2. _____ [2]

(iii) When the bell is ringing what is continuously happening at the part marked D?

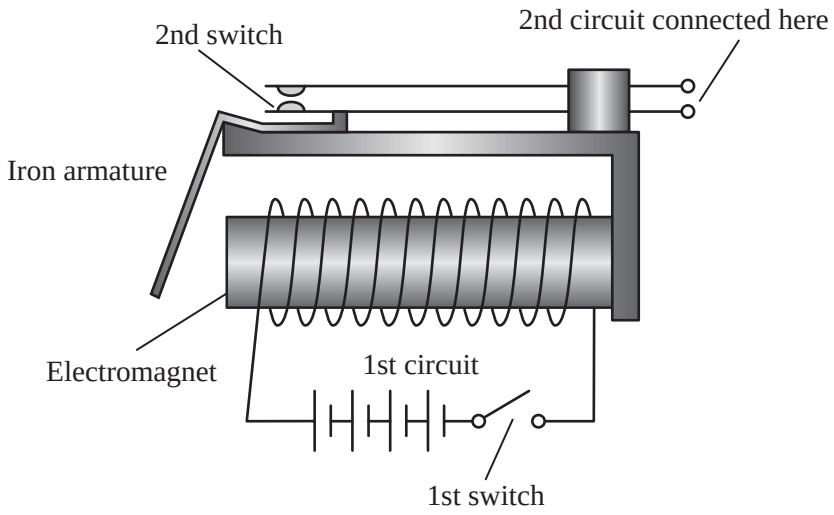
_____

_____ [1]

Examiner Only

Marks	Remark

(d) The diagram below shows an electromagnetic relay.



Explain how closing the 1st switch of the 1st circuit allows the 2nd switch to turn on an electrical appliance, such as a motor.

_____

_____

_____

_____

_____

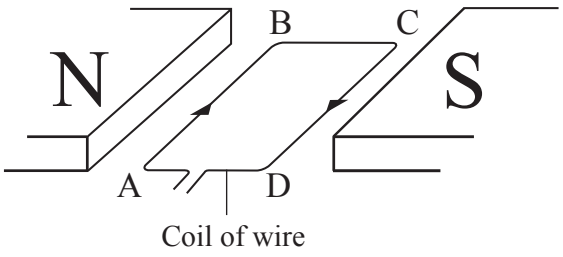
_____ [3]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

(e) The diagram below shows a loop of wire placed between the north (N) and south (S) poles of a magnet. The direction of the magnetic field is from north to south.
An electric current flows in the loop in the direction shown.
As a result of this some parts of the loop will experience a force.



(i) Complete the table below to show which of the sections of the wire loop experience a force. Some information is already shown in the table.

Section of the loop	Force acting? Yes or No	Direction of the force if any
AB	Yes	Down
BC		
CD		

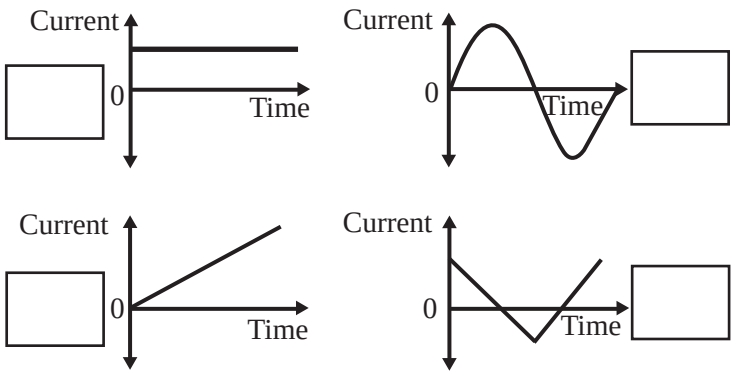
[2]

(ii) What electrical device is based on the arrangement of coil and magnet shown above?

_____ [1]

(f) The graphs below show how different electric currents vary with time. The currents are either alternating (a.c.) or direct current (d.c.).

Identify the current shown in each case by writing a.c. or d.c. in the boxes provided.



[4]

Examiner Only	
Marks	Remark

5 **(a)** The Universe is made up of millions of very large systems of objects, one of which is shown below.



Source – Courtesy: NASA/JPL-Caltech/Harvard-Smithsonian CfA

(i) Name these very large systems of objects.

_____ [1]

(ii) What is this large system a collection of?

_____ [1]

(iii) What force holds this system of smaller objects together?

_____ [1]

(iv) The light emitting objects in the collection emit large amounts of energy.
What is the process that produces these large amounts of energy?

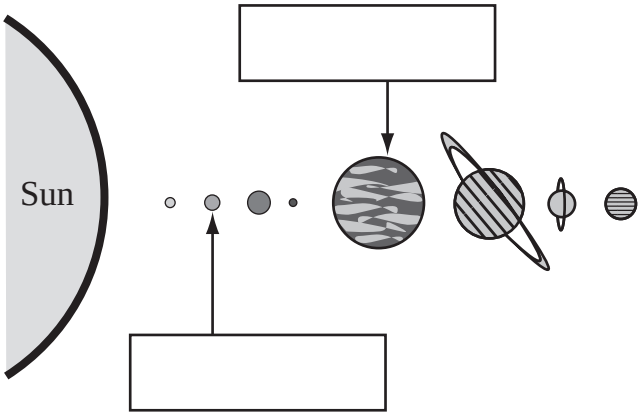
_____ [1]

(v) What two elements make up most of these light-emitting objects?

1. _____ 2. _____ [2]

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(b) The diagram below shows some of the planets in our solar system.



(i) What is a solar system?

_____

_____ [2]

(ii) On the diagram above write the names of the marked planets in the boxes. [2]

(iii) The modern model of our solar system is called the Heliocentric Model. The model in use about 500 years ago was called the Geocentric Model.

Complete the two sentences below to describe the **major** difference between these two models.

In the Heliocentric Model, _____

_____

_____

In the Geocentric Model, _____

_____

_____ [2]

Examiner Only

Marks	Remark

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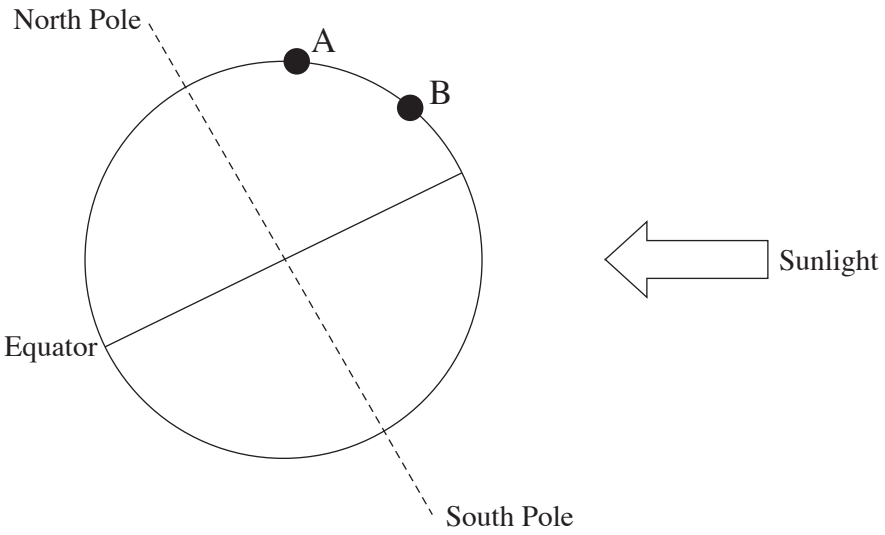
Examiner Only	
Marks	Remark

(iv) Give one scientific observation which can be explained well by the Heliocentric Model and cannot be satisfactorily explained by the Geocentric Model.

_____

_____ [1]

(c) The diagram below shows the Earth illuminated by sunlight.



(i) Shade the part of the Earth that is in night. [1]

(ii) A and B are two cities. Which has the greater number of hours of daylight?

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2012

Science: Physics

Paper 2
Foundation Tier

[G7603]

MONDAY 25 JUNE, AFTERNOON

MARK SCHEME

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Subject-specific instructions

1 In numerical problems, the marks for intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the correct final answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote units for intermediate numerical quantities.

Note that this "correct answer" rule does not apply to formal proofs and derivations, which must be valid in all the stages shown in the mark scheme to obtain full credit.

2 Do not reward wrong physics. No credit is given for substitution of numerical data, or subsequent arithmetic, in a physically incorrect equation.

However, answers to later parts of questions that are consistent with an earlier incorrect numerical answer, and are based on a physically correct equation, must gain full credit. Annotate this by writing **ECF** (Error Carried Forward) by your text marks.

3 The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer mark, but 10^n errors (e.g. writing 550 nm as 550×10^{-6} m) count only as arithmetical slips and lose the answer/unit mark.

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					AVAILABLE MARKS
1	**(a)**	**(i)**	Accelerating [1] At rest/moving at constant speed [1]	[2]	
		(ii)	Friction (between object and turntable) [1] Towards the centre (of the turntable) [1]	[2]	
		(iii)	Friction is not large enough to provide the needed centripetal force [1] At a tangent [1]	[2]	
	(b)	**(i)**	4 N causes extension = 22 – 10 = 12 cm [1] 16 cm is an extension of 6 cm [1] Unknown weight = 2 N [1]	[3]	
		(ii)	Elastic limit of spring has been exceeded	[1]	
	(c)	**(i)**	Speed = gradient = distance/time [1] = 60/20 [1] = 3 (m/s) [1]	[3]	
		(ii)	5 seconds	[1]	
		(iii)	120 m	[1]	
		(iv)	Average speed = 120/35 [2] e.c.f. from **(iii)** = 3.4 m/s [1]	[3]	
		(v)	Displacement = 0 [1] They are back where they started from [1]	[2]	20

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AVAILABLE MARKS

2 **(a)** **(i)** Unlimited supply/suitable alternative/never runs out/replaced in a lifetime
but **exclude** can be used again [1]

(ii) It uses electricity [1]
which is not a renewable energy resource [1] [2]
or reference to use of fossil fuels [2] or non-renewable

(iii) Explanation consistent with pollution response [1]

(iv) Potential to Kinetic to Electrical
Wasted Heat and Sound
[1] for each energy correctly named [5]

(v) The (sum of) the heat + sound + electrical =
the potential of the water in the high lake [1]

(b) **(i)** It should bend upwards/towards contact [1]
move up [0]

(ii) The metal with greater rate of expansion should be further from the contacts or on the bottom [1]
outside [0] inside [0]

(c) **(i)** Heat is conducted (from the processor) by the metal [1]
Air is heated by **convection** [1]
Heat is also **radiated** from the structure [1] [3]
Giving conduction, convection, radiation [1]
2 out of 3 give [2] for QWC

Quality of written communication [2]

Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar the main points shown above. The form and style is of a high standard and specialist terms are used appropriately at all times.	[2]
Candidates make some reference to the main points shown above using satisfactory spelling, punctuation and grammar. The form and style is of a satisfactory standard and they have made some reference to specialist terms.	[1]
Response not worthy of credit.	[0]

(ii) Black is the best emitter of radiant heat absorber [0] [1]
emitter **and** absorber [1]

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(d) **(i)** Convection current shown rising from centre to the top [1]
and curving downwards to the base [1] [2]

(ii) Body – metal a good conductor of heat [1]
Handle – plastic – insulator [1] [2]

(iii) Molecules/atoms [1]
vibrate more when heated [1]
vibrations passed along to neighbouring molecules/atoms [1] [3]

AVAILABLE MARKS

25

3 **(a)** Candle flame [1]
Star [1]
If more than 2 ringed deduct [1] for each incorrect one [2]

(b) **(i)** Extended/large [1]

(ii) Circular/round [1]

(iii) Ray from top of source glancing bottom of ball [1] } must be extended
Ray from bottom of source glancing top of ball [1] } to screen [2]
Poorly drawn rays [–1]

(iv) Region of partial shadow identified – correct rays before this can be given [1]

(v)

	Shadow's size decreases	No change in size of shadow	Shadow's size increases
Using a larger screen		✓	
Moving the screen away from the ball			✓
Moving the light source away from the ball	✓		

[3]

(c) **(i)** Focal length is distance between principal focus (focal point)
and (optical centre of) lens [1]

(ii) Apparatus: ruler, (white paper) screen [1]
Move lens (or screen) further from screen (or lens) until [1]
Image of distant object seen on screen [1]
Image is sharp [1]
Measure distance between lens and screen to find focal length [1] [5]

(d) **(i)**

Gamma	X-rays	UV	Visible	IR	Microwaves	Radio
[$\frac{1}{2}$] each **round down**						

[2]

(ii) All travel (at same speed) in vacuum [1]

(iii) Causes burns [1]

20

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				AVAILABLE MARKS
4	**(a)**	Permanent magnet not strong enough Permanent magnet cannot be turned off/retains magnetism	[1]	
	(b)	**(i)** Switch on current/close switch	[1]	
		(ii) Reduce number of turns [1] Reduce the current/reduce number of cells [1] Remove the iron core [1]	[3]	
	(c)	**(i)** A iron [1] B iron [1]	[2]	
		(ii) Conducts electricity [1] Springy/flexible [1]	[2]	
		(iii) Open and close/make and break	[1]	
	(d)	Closing first switch allow current to flow around first circuit [1] the electromagnet is energised [1] and attracts iron armature the contacts of second switch is closed [1]	[3]	
	(e)	**(i)** BC – No None [1] CD – Yes Up [1]	[2]	
		(ii) Electric motor/generator/moving coil meter	[1]	
	(f)	Top left DC [1] Top right AC [1] Bottom left DC [1] Bottom right AC [1]	[4]	20

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					AVAILABLE MARKS
5	**(a)**	**(i)**	Galaxies	[1]	
		(ii)	Stars or star systems	[1]	
		(iii)	Gravity	[1]	
		(iv)	Nuclear fusion	[1]	
		(v)	Hydrogen and helium [1] each	[2]	
	(b)	**(i)**	A number of planets [1] in orbit around a star (sun) [1]	[2]	
		(ii)	Venus [1] Jupiter [1]	[2]	
		(iii)	Heliocentric – Sun at the centre (of the solar system) [1] Geocentric – Earth at the centre (of the solar system) [1]	[2]	
		(iv)	Retrograde motion or looping of the planets Strange motion [0]	[1]	
	(c)	**(i)**	Shading to the left	[1]	
		(ii)	B	[1]	15
				Total	**100**

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011

Science: Physics

Paper 2
Foundation Tier

[G7603]

G7603

WEDNESDAY 15 JUNE, MORNING

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all five** questions.

INFORMATION FOR CANDIDATES

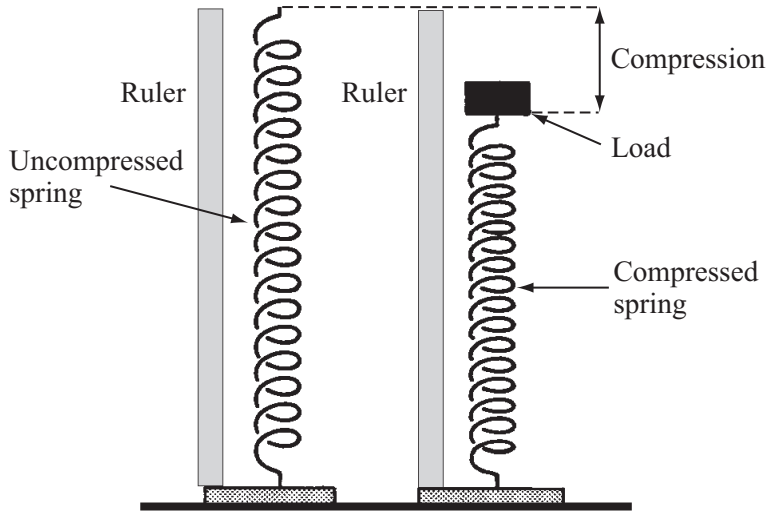
The total mark for this paper is 100.
Quality of written communication will be assessed in Question **4(a)(iii)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated with numerical answers where appropriate.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
Total Marks	

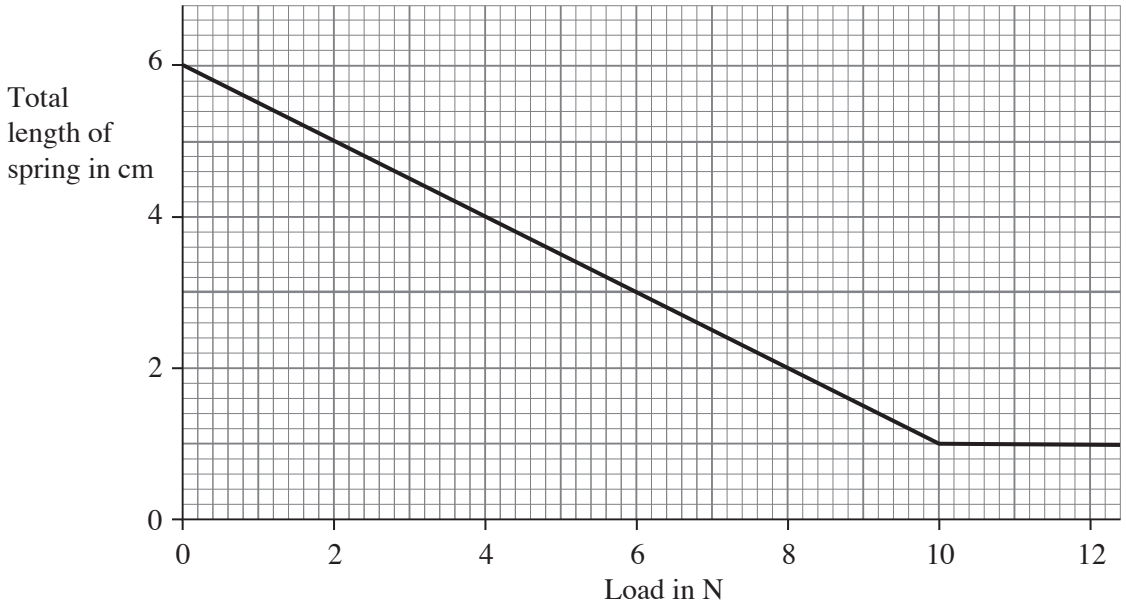
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Examiner Only	
Marks	Remark

1 **(a)** Albert carries out an experiment using the apparatus shown in the diagram below, to see how the compression of a spring depends on the load applied. He measures the total length of the spring when different loads are applied.



A graph of his results is shown below.



(i) Explain why the total length of the spring remains constant when the applied load is 10 N or more.

_____

_____ [1]

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(ii) What was the length of the spring when no load was placed on it?

_____ [1]

For a given load placed on the spring the compression is defined as;

Compression of spring = *Length of spring with no load* – *Length of spring with a load*

(iii) Complete the table below to show how the compression changes for different loads.

Load in N	0	2	4	8
Compression in cm	0			

[3]

(iv) What relationship between compression and load does Albert's measurements indicate? Explain your answer.

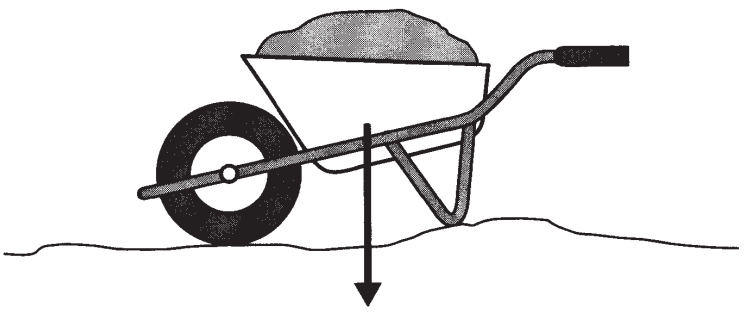
Relationship _____

Explanation _____

_____ [2]

(b) A wheelbarrow, shown in the diagram below, is an example of a lever. The total weight of the wheelbarrow and the load is marked.

(i) On the diagram below, mark, carefully:
- the position of the pivot with the letter P
- the position of the centre of gravity of the wheelbarrow and its load, with the letter X
- the position where the effort is applied and its direction. [3]



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Marks	Remark

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(ii) What feature of the design of the wheelbarrow makes it possible to lift it and its load using a smaller effort?

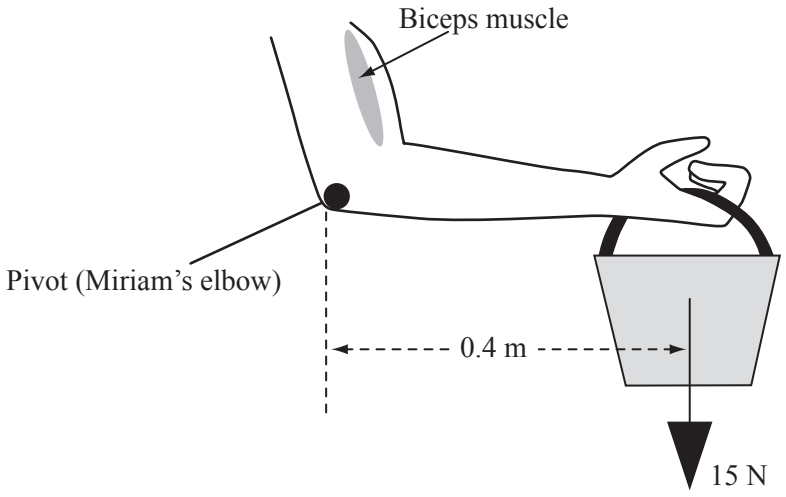
_____

_____

_____ [1]

(c) The diagram below shows Miriam holding a bucket. Miriam's forearm is stationary and horizontal.

(i) Calculate the moment of the 15 N force about the pivot and state its direction.
Remember to include the correct unit for moment.
You are advised to show clearly how you get your answer.



Moment = _____

Direction = _____ [4]

(ii) The biceps muscle exerts a force. This force creates an anticlockwise moment about the pivot, which is Miriam's elbow.
On the diagram mark the position and direction of this force. [1]

Examiner Only

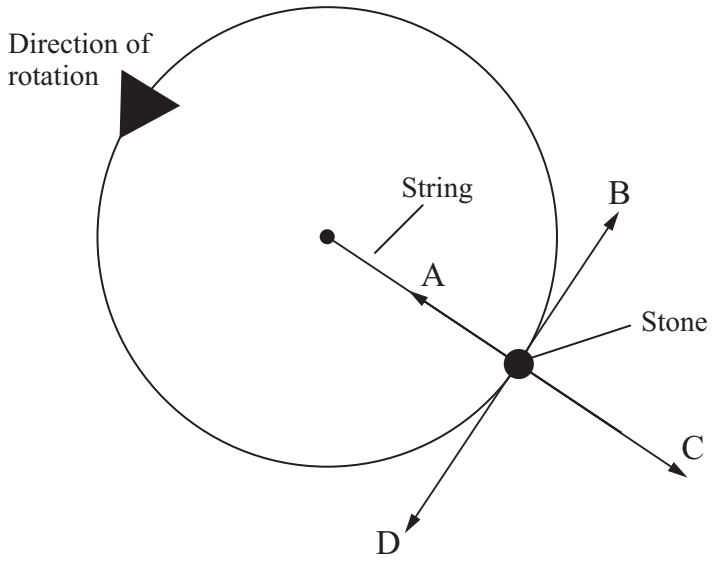
Marks	Remark

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(iii) Miriam's forearm acts like a lever. In the diagram opposite it is horizontal and stationary. What does this tell you about the clockwise and anticlockwise moments of the forces acting on her forearm?

_____ [1]

(d) A stone is tied to a length of string. The diagram below shows the stone being made to move in a circle.



(i) When it moves in a circle a centripetal force acts on the stone. Which of the arrows labelled A, B, C or D shows the direction of this force?

_____ [1]

(ii) What provides this centripetal force?

_____ [1]

(iii) If the string broke which of the arrows shows the direction the stone would then move?

_____ [1]

Examiner Only

Marks	Remark

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2 (a) (i) Devices convert energy from one form to another.
Complete the table below for some common devices.
The first one has been done for you.

 © http://www.china-electric-motor.com	An electric motor is designed to change _____ *Electrical* _____ energy to _____ *kinetic* _____ energy
 © Stockbyte/Getty Images	**(i)** A Bunsen burner is designed to change _____ energy to _____ energy
 © iStockphoto/Thinkstock	**(ii)** A catapult is designed to change _____ energy to _____ energy
 © Affordable Cebu http://www.affordablecebu.com/load/technology/8_effective_ways_in_using_your_microphone_up_to_more_than_5_years/7-1-0-1451	**(iii)** A microphone is designed to change _____ energy to _____ energy

[3]

Examiner Only

Marks	Remark

All energy transfers obey the Principle of Conservation of Energy.

(ii) State the Principle of Conservation of Energy.

_____

_____ [2]

(b) Most fuels used today are fossil fuels. One such fuel is coal.

(i) Explain how the energy stored in coal was dependent on the Sun's energy.

_____

_____

_____ [3]

(ii) Name two **other** fossil fuels widely used in Britain and Ireland.

_____

_____ [2]

Many people today are concerned about global warming.

(iii) Describe how energy from the Sun is trapped in the Earth's atmosphere.

_____

_____

_____

_____ [3]

(iv) Outline one harmful effect on the environment of Northern Ireland if global warming was to continue unchecked.

_____

_____

_____ [1]

Examiner Only	
Marks	Remark

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Recently the UK government gave approval for the construction of more nuclear power stations. This has been met with approval from some people and disapproval from others.

(v) State one **environmental** reason why building nuclear power stations may be a **good** idea.

_____

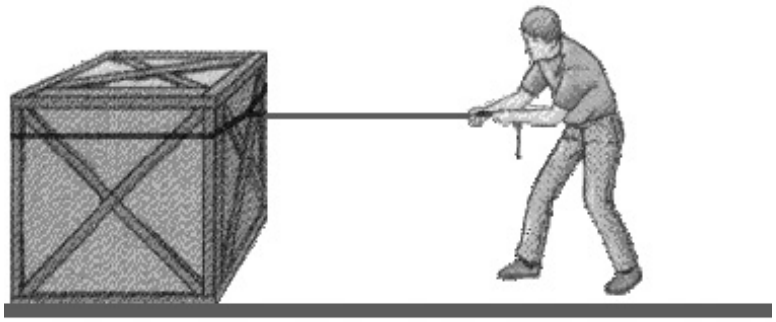
_____ [1]

(vi) State one **environmental** reason why building nuclear power stations may be a **bad** idea.

_____

_____ [1]

(c) John pulls a crate over rough ground using a force of 200 N.
He moves the crate 3 m.



Calculate the work done by John.
You are advised to show clearly how you get your answer.

Work done = _____ J [3]

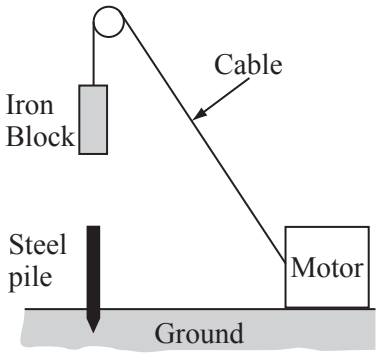
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(d) On building sites, a steel pile is driven into the ground by allowing a heavy iron block to fall vertically onto the pile. The diagram below shows the main parts of this arrangement.



The motor does 30 **kJ** of **useful** work in raising the iron block above the steel pile. The electrical energy required to do this is 40 **kJ**.

(i) Calculate the efficiency of the motor.
You are advised to show clearly how you get your answer.

Efficiency = _____ [3]

(ii) The motor takes 12 seconds to raise the iron block above the pile. Calculate the **output power** of the motor.
You are advised to show clearly how you get your answer.

Output power of the motor = _____ kW [3]

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Examiner Only	
Marks	Remark

3 **(a)** **(i)** Waves can be described as transverse or longitudinal. Give an example of each type.

Transverse _____

Longitudinal _____ [2]

(ii) State the difference between transverse and longitudinal waves in terms of the vibrations of the atoms of a material as they pass through the material.

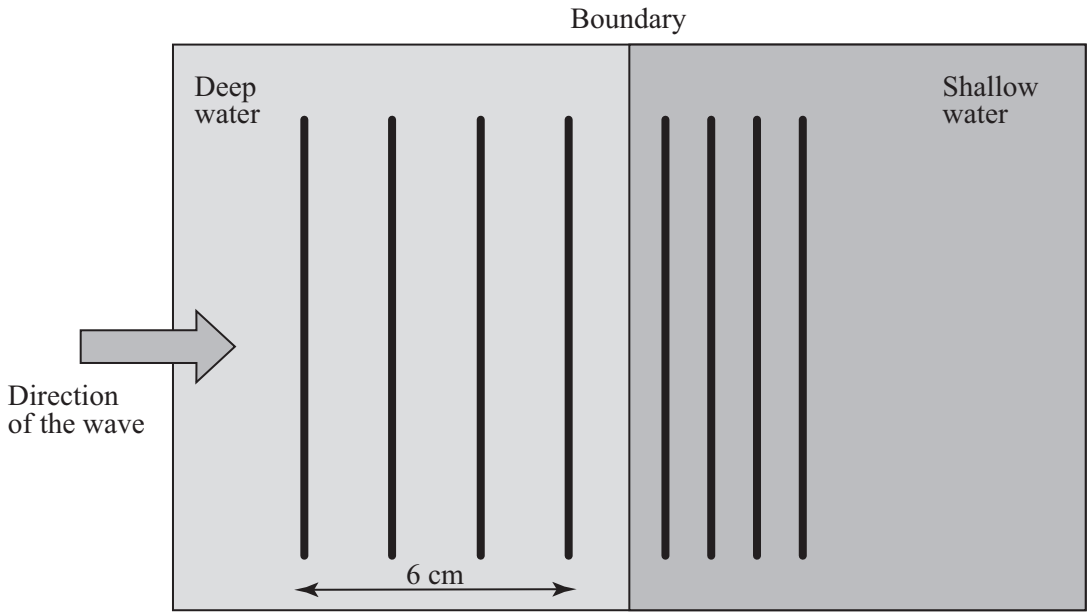
_____

_____

_____

_____ [3]

(b) The diagram below shows what happens when a water wave moves from deep water to shallow water. The diagram is not full scale.



(i) What is the wavelength of the water wave in the deep water?

Wavelength in deep water = _____ cm [1]

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The water wave is made by a long bar vibrating in the water.

Examiner Only	
Marks	Remark

(ii) The long bar makes 20 vibrations in 5 seconds.
Calculate the frequency of the water wave produced.
You are advised to show clearly how you get your answer.
Include the appropriate unit in your answer.

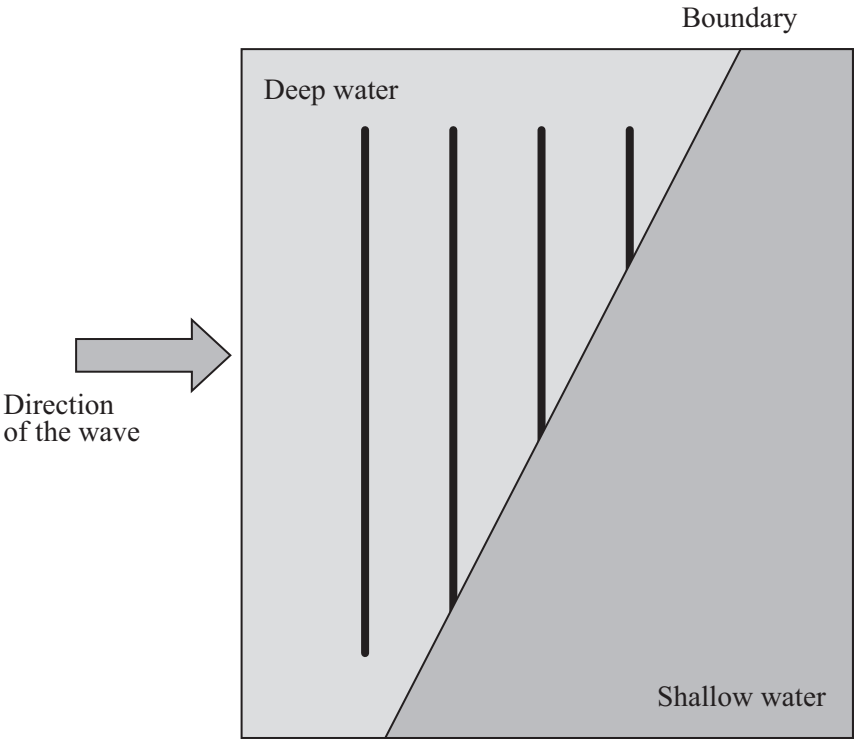
Frequency = _____ [3]

(iii) Using your answers to parts **(i)** and **(ii)** calculate the speed of the water wave in the deep water.
You are advised to show clearly how you get your answer.

Speed in deep water = _____ cm/s [4]

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The direction of the boundary is now changed so that the water wave enters the shallow water at an angle as shown in the diagram below.



(iv) Complete the diagram to show the water wave in the shallow water. [4]

(v) What is the name for this change in direction of the water wave?

_____ [1]

(vi) State what causes this change of direction.

_____ [2]

Examiner Only

Marks	Remark

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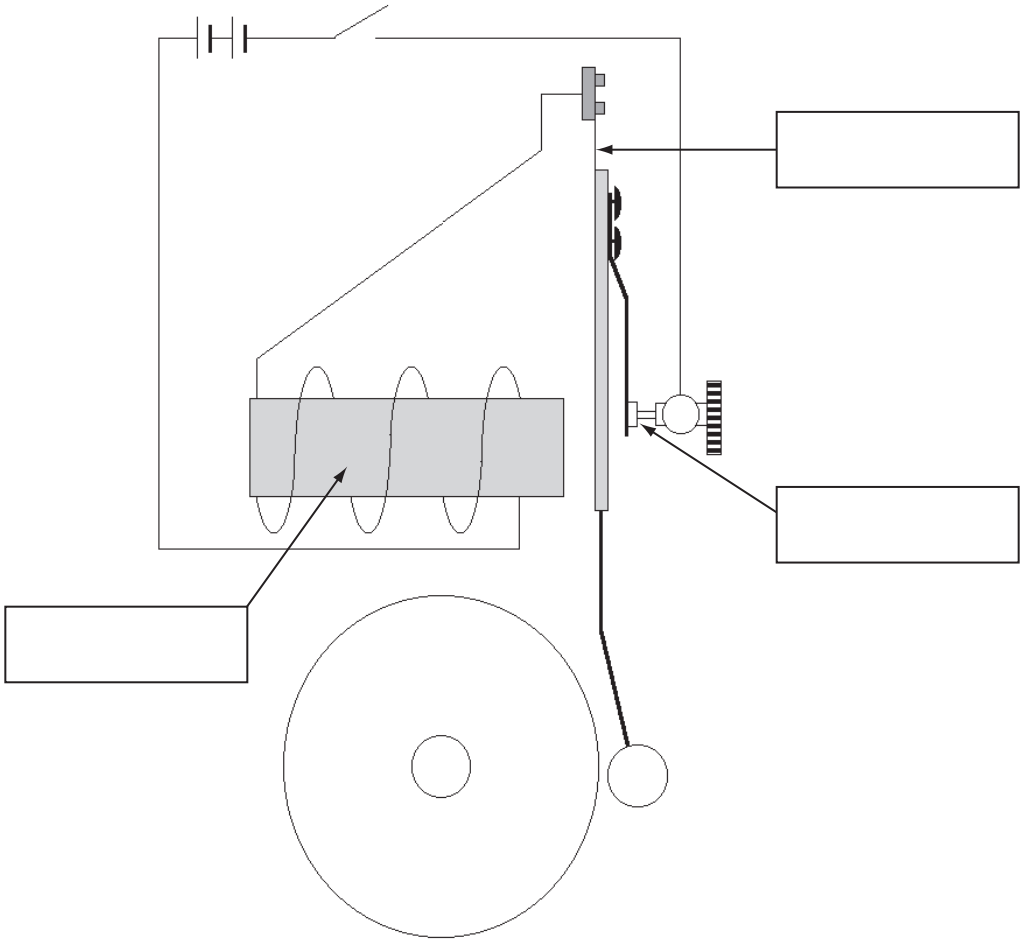
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Examiner Only	
Marks	Remark

4 **(a)** The diagram below shows a simple make and break electric doorbell.

(i) Label the parts marked by arrows and write the name inside the box. Choose your labels from the list below.

Armature	**Soft iron core**	**Springy metal strip**
Make and break contact	**Hammer**	**Gong**



[3]

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(ii) Explain why the hammer strikes the gong when the switch is closed.

_____

_____

_____

_____ [3]

(iii) Although the switch remains closed, the hammer moves back to its starting position. There are two reasons why this happens. State what they are.

_____

_____

_____

_____ [2]

Quality of written communication [1]

(iv) When the hammer returns to its starting position it again moves towards the gong.
What action causes this to happen?

_____

_____ [1]

(b) (i) Describe the difference between alternating current (a.c.) and direct current (d.c.).

_____

_____

_____ [2]

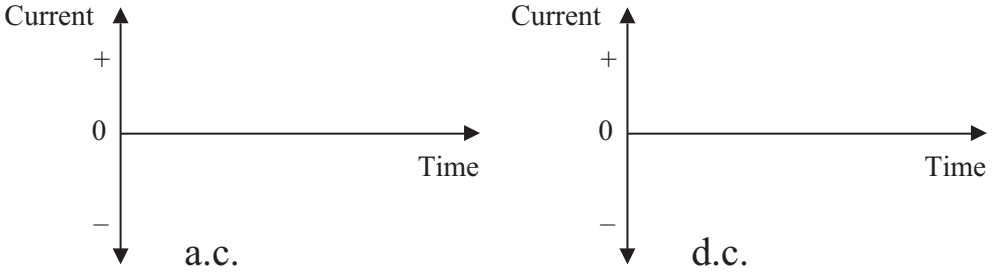
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(ii) On the axes below show how an a.c. and a d.c. might vary, if at all, with time.



[2]

(iii) Name the type of current, alternating or direct, produced by the following.

A battery _____

Mains electricity _____ [2]

(c) An electric fire has a power rating of 1kW.

(i) How many joules of electrical energy does it use every second?

_____ J [1]

(ii) How many kWh does it use in 3 hours?

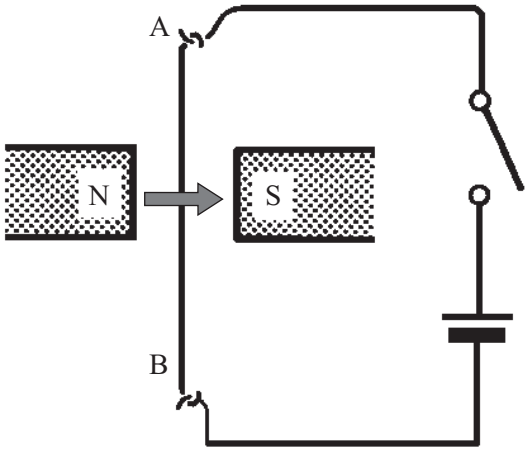
No of kWh = _____ [1]

(iii) Electricity costs 13p per kWh. How much does it cost to run this electric fire for the three hours?

Cost = _____ pence [1]

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(d) The diagram shows a wire suspended between the poles of a magnet.
The wire is free to move in any direction.
The magnetic field direction is shown by the arrow from the north pole (N) to the south pole (S).



When a current is passed along the wire from A to B what will the wire do?
Tick the correct response from those listed below.

The wire will not move. ☐

The wire will move towards the south (S) pole. ☐

The wire will move towards the north (N) pole. ☐

The wire moves out of the page towards you. ☐ [1]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

5 **(a)** The list below contains several statements about the Solar System. Some of these are true and others false. Tick (✓) those that are true.

1. The Sun is a star. ☐
2. All planets move around the Sun. ☐
3. The space between the Earth and Sun is mostly oxygen. ☐
4. Our solar system is larger than the Milky Way galaxy. ☐
5. Mercury is the planet closest to the Sun. ☐
6. Jupiter is closer to the Earth than Mars. ☐
7. Some comets orbit the Sun. ☐
8. Our Solar System is part of the Milky Way galaxy. ☐ [5]

(b) **(i)** What is the name of the Earth's natural satellite? _____ [1]

(ii) State two uses of man-made satellites orbiting the Earth.

_____

_____ [2]

(c) **(i)** What is a light year?

_____

_____

_____ [2]

(ii) Give one reason why, at present, it is not possible for humans to travel to a planet which orbits a star that is 5 light years away.

_____

_____

_____ [1]

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Examiner Only	
Marks	Remark

(d) Nebulae are clouds of gas in space. Nebulae are places where stars are formed.

(i) Describe and explain what happens in nebulae in the first stage of a star's formation.

Description _____

Explanation _____ [2]

In the later stages of star formation the nebula flattens as it spins with a bulge in the centre as shown below. The bulge eventually becomes a star.

(ii) What has to happen to the gas in this bulge at this stage before the star gives out light?

_____

_____ [1]

(iii) What is the name of the process by which the star produces energy?

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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111060

Rewarding Learning

General Certificate of Secondary Education
2011

Science: Physics

Paper 2
Foundation Tier

[G7603]

WEDNESDAY 15 JUNE, MORNING

MARK SCHEME

STEMUP.CO.UK

1	(a)	(i)	The coils touch/spring cannot be compressed further	[1]	AVAILABLE MARKS
		(ii)	6 (cm)	[1]	
		(iii)	Load 0 2 4 8 Compression 0 1 2 4 ½ each round down	[3]	
		(iv)	Compression proportional to load/they are proportional	[1]	
			Double the load doubles the compression/ $\frac{\text{compression}}{\text{load}}$ = 0.5 or constant	[1]	
	(b)	(i)	Pivot P at centre of wheel	[1]	
			X at the end of arrow showing weight/directly above arrow	[1]	
			Effort at handles acting upwards through the handle	[1]	
		(ii)	Effort is further from pivot than the load/ Load is closer to pivot than effort	[1]	
	(c)	(i)	Moment = force × distance		
			= 15 × 0.4 or 15 × 40	[1]	
			= 6 600	[1]	
			Nm or Ncm if work in cm	[1]	
			Direction – clockwise or ↻ [not down]	[1]	
		(ii)	Upward force at the biceps/within the upper arm	[1]	
		(iii)	They are equal/balanced/in equilibrium	[1]	
	(d)	(i)	A	[1]	
		(ii)	Tension	[1]	
		(iii)	B	[1]	20

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					AVAILABLE MARKS
2	**(a)**	**(i)**	Bunsen burner chemical to heat	[1]	
			Catapult strain (elastic) to kinetic	[1]	
			Microphone sound to electricity	[1]	
		(ii)	Energy cannot be created or destroyed	[1]	
			It can only change its form/be converted	[1]	
	(b)	**(i)**	Plants/vegetation absorb sunlight	[1]	
			Plants are buried/over a long time, $\geqslant 10^6$ yrs, many years	[1]	
			High temperature/pressure convert them to coal	[1]	
		(ii)	Oil/gas/turf Two needed – [1] mark each	[2]	
		(iii)	Solar radiation heats up the surface or short λ radiation gets through the atmosphere [1] Heat re-radiated from surface/ absorbed by atmosphere [1]	[3]	
		(iv)	Climate change/flooding	[1]	
		(v)	Gases such as carbon dioxide/sulphur dioxide not released	[1]	
		(vi)	Radioactive waste products/nuclear waste products or possibility of nuclear accident/radiation release	[1]	
	(c)		Work done = force × distance	[1]	
			= 200 × 3	[1]	
			= 600 (J)	[1]	
	(d)	**(i)**	Efficiency = useful output energy/total input energy	[1]	
			= 30/40	[1]	
			= 0.75 or 75% not 0.75% not 0.75J	[1]	
		(ii)	Power = work done/time taken	[1]	
			= 30 (kJ)/12	[1]	
			= 2.5 kW unit needed or 2500W or 2500J/S	[1]	25

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					AVAILABLE MARKS
3	**(a)**	**(i)**	Transverse – examples water, on a string, em waves or a named em Longitudinal – example – sound/ultrasound	[2]	
		(ii)	Transverse – atoms move perpendicular to direction of wave travel Longitudinal – atoms move along direction of wave travel If "vibrate" used give [1] mark	[3]	
	(b)	**(i)**	Wavelength in deep water = 2 cm	[1]	
		(ii)	20/5 – [1] = 4 [1] Hz [1] indep mark	[3]	
		(iii)	v = fλ = 4 × 2.0 allow ecf for wavelength from (c) (i) = 8 (cm/s)	[1] [2] [1]	
		(iv)	Wavefronts refracted towards the boundary Straight and parallel Shorter wavelength only if refraction is correct Refracted wavefronts continuous with incident waves.	[1] [1] [1] [1]	
		(v)	Refraction	[1]	
		(vi)	Wave slows down [2] change of speed only give 1	[2]	20

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					AVAILABLE MARKS
4	**(a)**	**(i)**	Clockwise Springy metal strip Make and break contact Soft iron core	[1] [1] [1]	
		(ii)	Current flows Electromagnet energised/IRON CORE MAGNETIZED Soft iron bar /ARMATURE attracted	[1] [1] [1]	
		(iii)	Circuit is broken/current stops/contact broken Springy metal strip pulls it back QWC	[1] [1] [1]	
		(iv)	The contact closed/circuit is complete again/current flows again	[1]	
	(b)	**(i)**	Direct current flows in one direction Alternating current reverses direction	[1] [1]	
		(ii)	a.c. waveform d.c. any line/curve that does not cross the zero	[1] [1]	
		(iii)	battery – d.c. mains – a.c.	[1] [1]	
	(c)	**(i)**	1000 (J)	[1]	
		(ii)	1 × 3 = 3kWh	[1]	
		(iii)	3 × 13 = 39 pence ecf from (ii)	[1]	
	(d)		Wire moves out of the page	[1]	20

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			AVAILABLE MARKS
5	**(a)** Ticks at 1, 2, 5, 7 and 8 1 mark each	[5]	
	(b) **(i)** The Moon	[1]	
	(ii) Communications Sat nav, Weather	[2]	
	(c) **(i)** The distance Light travels in a year	[1] [1]	
	(ii) Take too long/insufficient fuel/food/life support	[1]	
	(d) **(i)** (Gas) particles are drawn closer together/contract/condenses Due to gravity (independent marks)	[1] [1]	
	(ii) The gas needs to heat up/temperature has to rise/be compressed	[1]	
	(iii) Nuclear Fusion	[1]	15
		Total	**100**

Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2010

Science: Physics

Paper 2
Foundation Tier

[G7603]

G7603

WEDNESDAY 16 JUNE, MORNING

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all five** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Quality of written communication will be assessed in question **2(b)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated with numerical answers where appropriate.

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** Mass is an unchanging property of an object whereas weight is the force that gravity exerts on the object. State the units in which each quantity is measured.

Mass is measured in _____

Weight is measured in _____ [2]

(b) A large steel beam weighs 20 000 N.



(i) On the diagram mark carefully, with an X, the point where all of its weight can be regarded as acting. [1]

(ii) What is this point called?

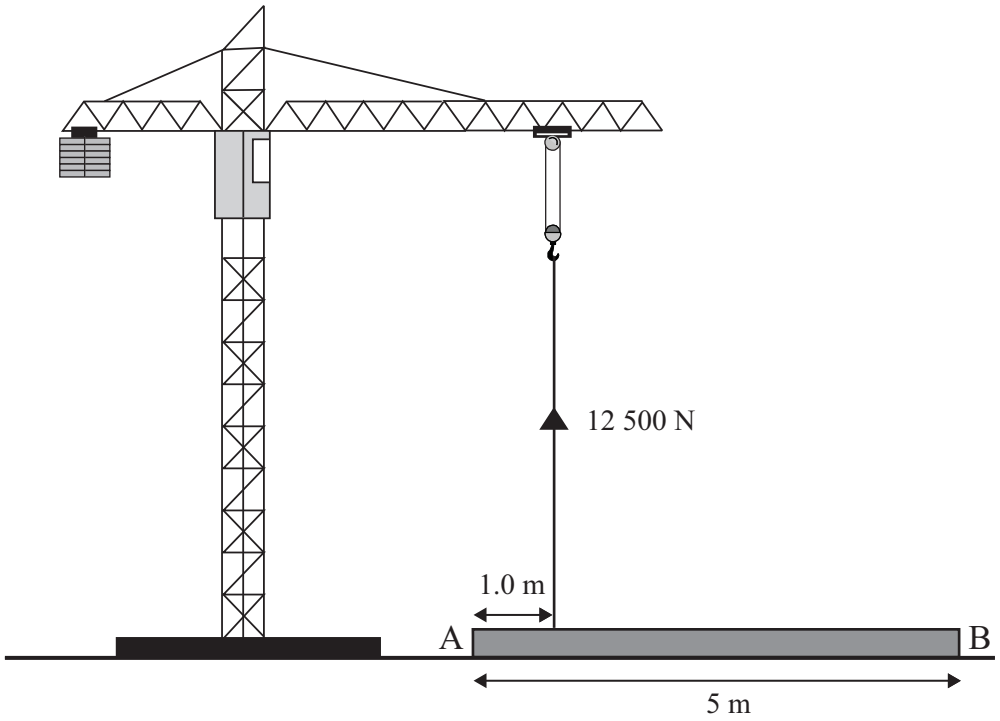
_____ [1]

(iii) When the beam rests on the ground its area of contact with the ground is 8 m^2.
Calculate the pressure that the beam exerts on the ground.
Remember to include the unit with your answer.
You are advised to show clearly how you get your answer.

Pressure = _____ [4]

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A crane is used to raise this large steel beam into a vertical position. The crane exerts a force of 12 500 N to just lift the end A off the ground. The length of the beam is 5 m.



(iv) The beam can be treated as a lever. Mark the pivot with the letter P. [1]

(v) Calculate the moment of the 12 500 N force about the pivot. Remember to include the unit with your answer.
You are advised to show clearly how you get your answer.

Moment = _____ [4]

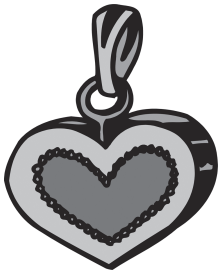
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Marks	Remark

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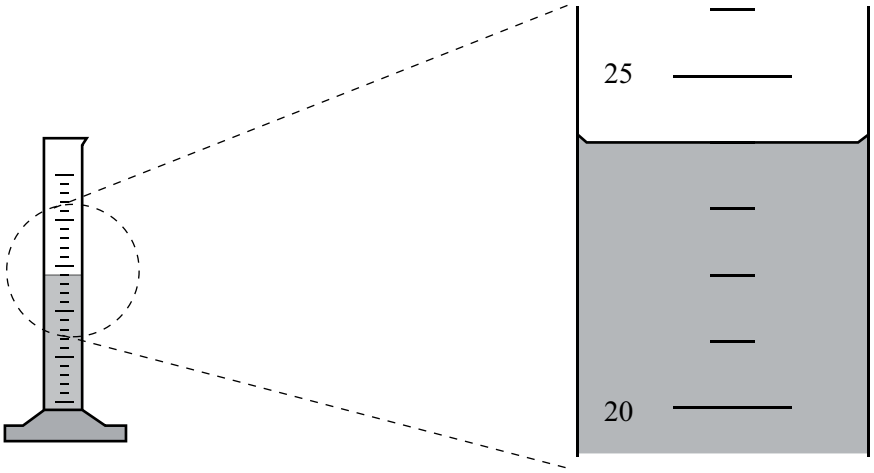
Examiner Only	
Marks	Remark

(c) Gail has a pendant which she believes to be gold.



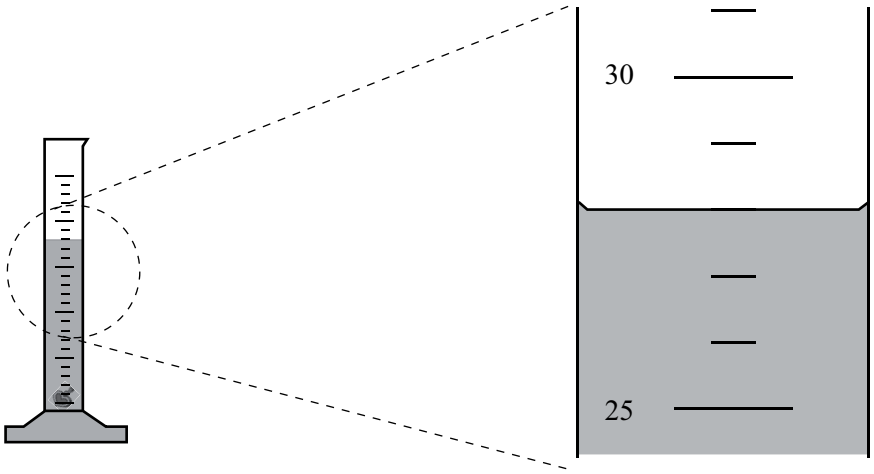
To verify this she carries out an experiment to measure the density of the material used to make the bracelet.

She pours some water into a measuring cylinder.



(i) The volume of water in the cylinder is _____ cm^3 [1]

She carefully places the pendant in the measuring cylinder so that it is completely covered by the water.



(ii) What is the volume of the pendant?

Volume of pendant = _____ cm^3 [2]

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When she measures the mass of the pendant, it is found to be 42 g.

(iii) Calculate the density of the material of the pendant.
You are advised to show clearly how you get your answer.

Density = _____ g/cm^3 [3]

The table shows the densities of some metals.

Metal	Density in g/cm^3
Aluminium	2.7
Brass	8.8
Silver	10.5
Gold	19.3

(iv) Using your answer to part **(iii)**, decide what Gail's pendant is made of.

_____ [1]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

2 **(a)** The diagrams below show a cyclist moving in various ways. For each diagram, how are the kinetic energy and potential energy changing, if at all?
Choose your answers from the words in the box below.

increasing	**decreasing**	**constant**

(i)



Constant speed on a **level road**.

The kinetic energy is _____

The potential energy is _____ [2]

(ii)



Speeding up on a **level road**.

The kinetic energy is _____

The potential energy is _____ [2]

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(iii) What type of energy does the cyclists's body convert into kinetic and potential energy?

_____ [1]

(iv) The cyclist travels 8 m in 1 second. She does work against an opposing force of 25 N. Calculate the work that she does in 1 second.

Work done in 1 second = _____ J [2]

(v) Using the information given above and your answer to part **(iv)**, what is her power?
Remember to include the correct unit in your answer.

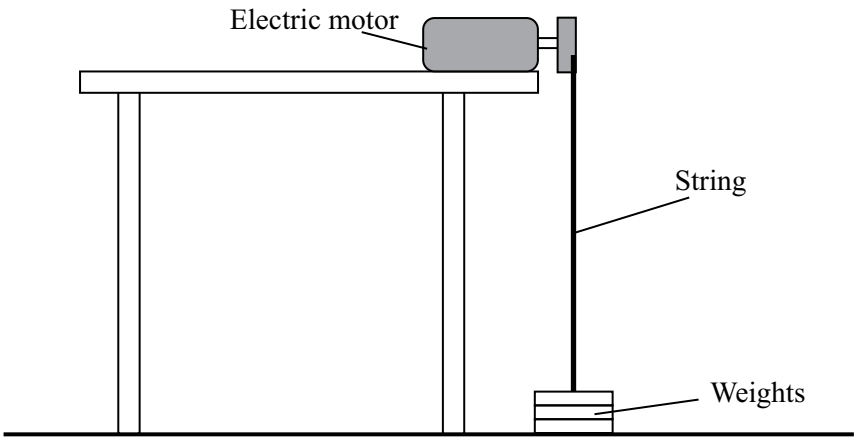
Power = _____ [2]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

(b) An electric motor is used to raise a load. Describe how the apparatus could be used to measure the output power of the motor. In your account you need to clearly state the measurements to take and the apparatus used to take them.



[5]

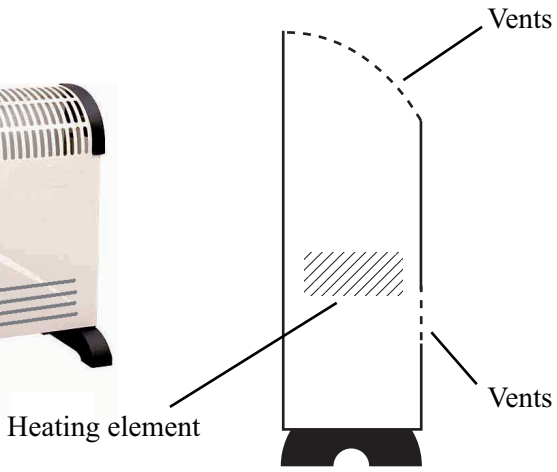
Quality of written communication [1]

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Examiner Only	
Marks	Remark

(c) The picture below shows a convector heater. The heating element is connected to the electricity supply. The diagram on the right shows some of the internal parts of the heater.





(i) On the diagram on the right, mark carefully the flow of air in and out of the heater. [2]

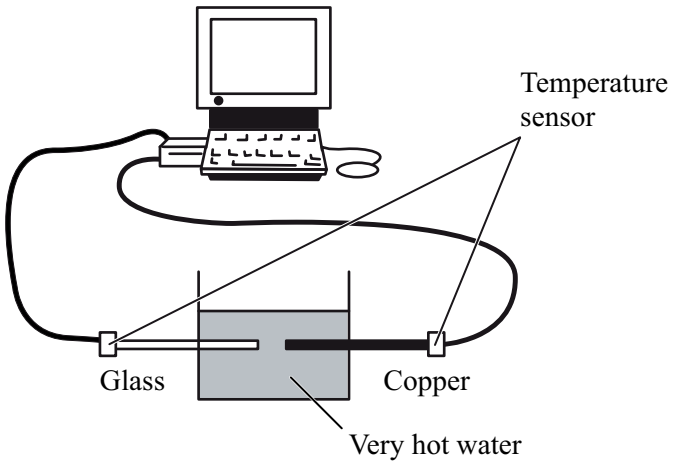
(ii) Convection is how heat is transferred through a gas such as air. Apart from gases, name another material where heat is transferred by convection.

_____ [1]

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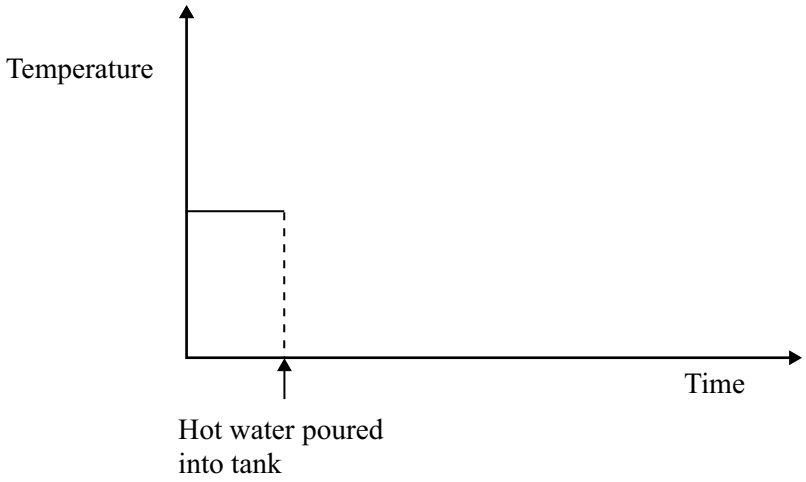
Examiner Only	
Marks	Remark

(d) Temperature sensors and a computer can be used to compare the thermal conduction of two materials. A sensor is attached to each material as shown in the diagram below.
The tank is filled with very hot water.



One rod is made of copper, the other is made of glass.

(i) Using the axes below, sketch the graphs that would be obtained for these two materials. Label each one. The sensor readings are equal until the water is poured into the tank.



[2]

(ii) The conduction process in metals involves electrons. How do these electrons transfer the heat energy to the copper atoms?

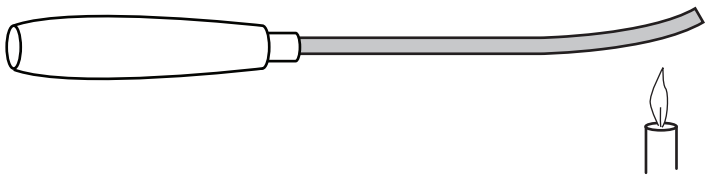
_____ [1]

(iii) Materials such as glass do not have free electrons. How is the heat energy transferred from one atom to the next?

_____ [1]

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(e) A bimetal strip bends when it is heated.



(i) Explain why this happens.

_____ [1]

The photograph shows an expansion joint on a bridge.



© *JLM Visuals*

(ii) Describe how it moves and explain what is likely to happen if the bridge is not fitted with an expansion joint.

_____

_____

_____ [2]

Examiner Only

Marks	Remark

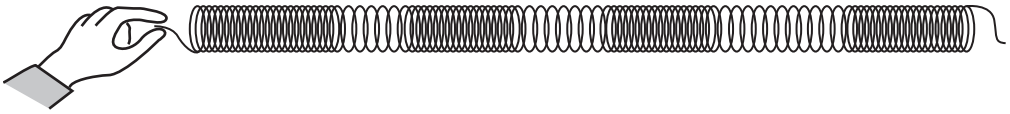
Examiner Only	
Marks	Remark

3 **(a)** Pat uses a length of rope and a slinky coil to demonstrate different types of wave motion. The wave patterns obtained are shown in the diagrams below.

(i) Beside each diagram, state the type of wave being produced.



_____

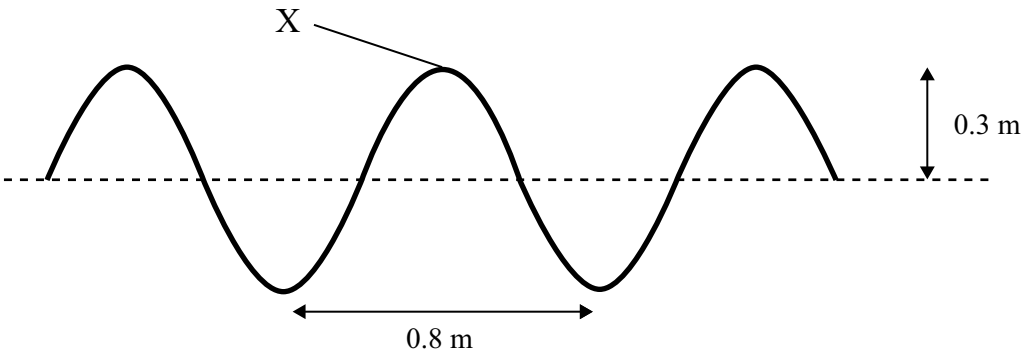


_____ [2]

(ii) What do the waves transfer as they move from left to right?

_____ [1]

The wave pattern obtained with the rope is shown again below.



(iii) Describe, fully, how the point X moves as the wave passes along the rope.

_____

_____ [2]

(iv) State the amplitude of the wave.

Amplitude = _____ m [1]

(v) State the wavelength of the wave.

Wavelength = _____ m [1]

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The end of the rope makes 24 vibrations in 8 seconds.

(vi) Calculate the frequency of the wave.

Frequency = _____ Hz [2]

(vii) Use your answers to parts **(v)** and **(vi)** to calculate the speed of the wave.

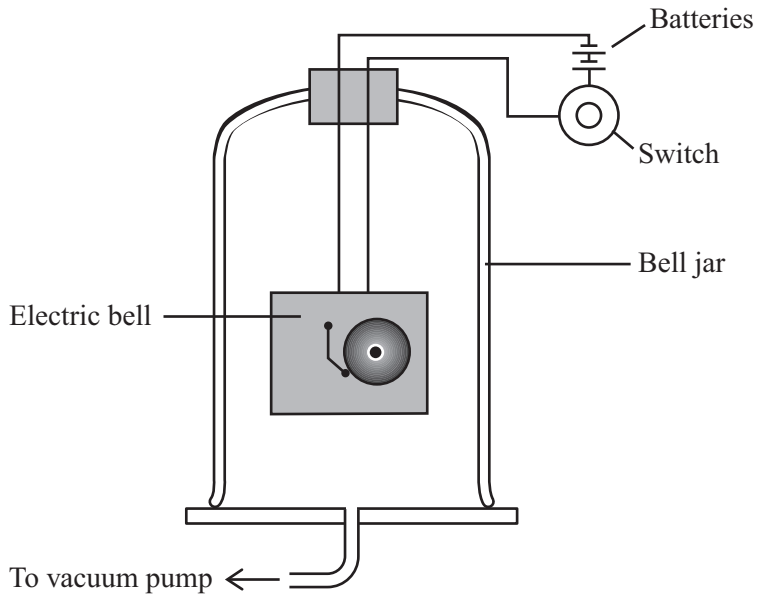
Speed = _____ m/s [3]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

(b) The diagram below shows the apparatus frequently used in school laboratories to illustrate an important property of sound.



The bell is made to ring by pressing the switch. The vacuum pump is switched on.

(i) Describe carefully two important observations that can be made, when all the air is pumped out of the jar.

1. _____

2. _____ [2]

(ii) What conclusion can be drawn from this experiment?

_____

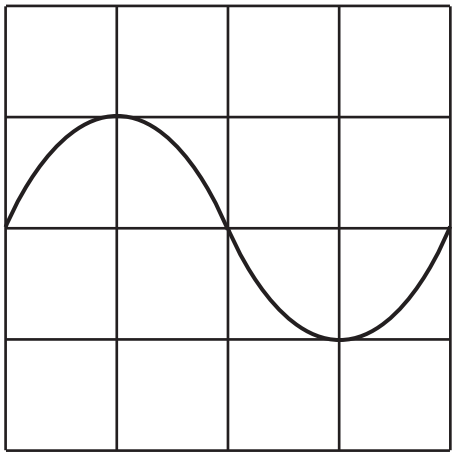
_____ [1]

(iii) What name is given to sound of frequency greater than 20 kHz?

_____ [1]

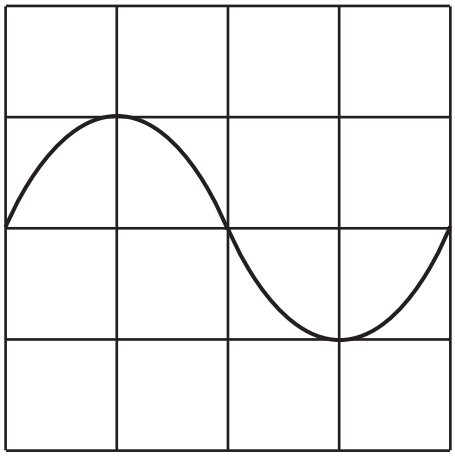
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(c) The waveform of the sound produced by a loudspeaker is displayed on a CRO. The diagram below shows the trace obtained.



(i) On the same grid, sketch the trace you expect to see when the loudspeaker produces a **louder** sound of the same frequency. Assume the settings of the CRO are unaltered. [2]

(ii) The sound is now returned to its original loudness.
The diagram below shows this waveform.
On the grid below, sketch the waveform you expect to see when the loudspeaker produces a sound of **twice the frequency**, but the same loudness.



[2]

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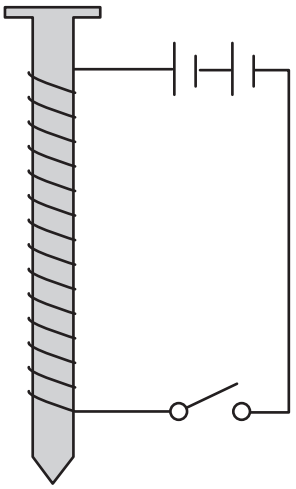
Marks	Remark

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Examiner Only	
Marks	Remark

4 **(a)** An electromagnet can be made by wrapping insulated copper wire around an iron nail as shown below.



(i) How would you turn on this electromagnet?

_____[1]

(ii) Other than reducing the current, state two other ways to make the electromagnet **weaker**.

1. _____

2. _____[2]

(iii) Why is it essential to use insulated wire rather than bare wire for the coil?

_____

_____[1]

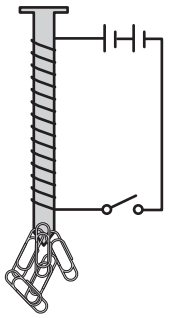
(iv) Why is steel **not** a suitable core for an electromagnet?

_____[1]

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Examiner Only	
Marks	Remark

(b) To investigate how the current affected the strength of the electromagnet, it was used to pick up paper clips. The current was changed to different values and the number of paper clips that were attached to the electromagnet was counted. The results are shown in the table below.



Current in the coil in amps	Number of paper clips attached to the nail
0	0
0.5	4
1.0	9
1.5	12
2.0	17

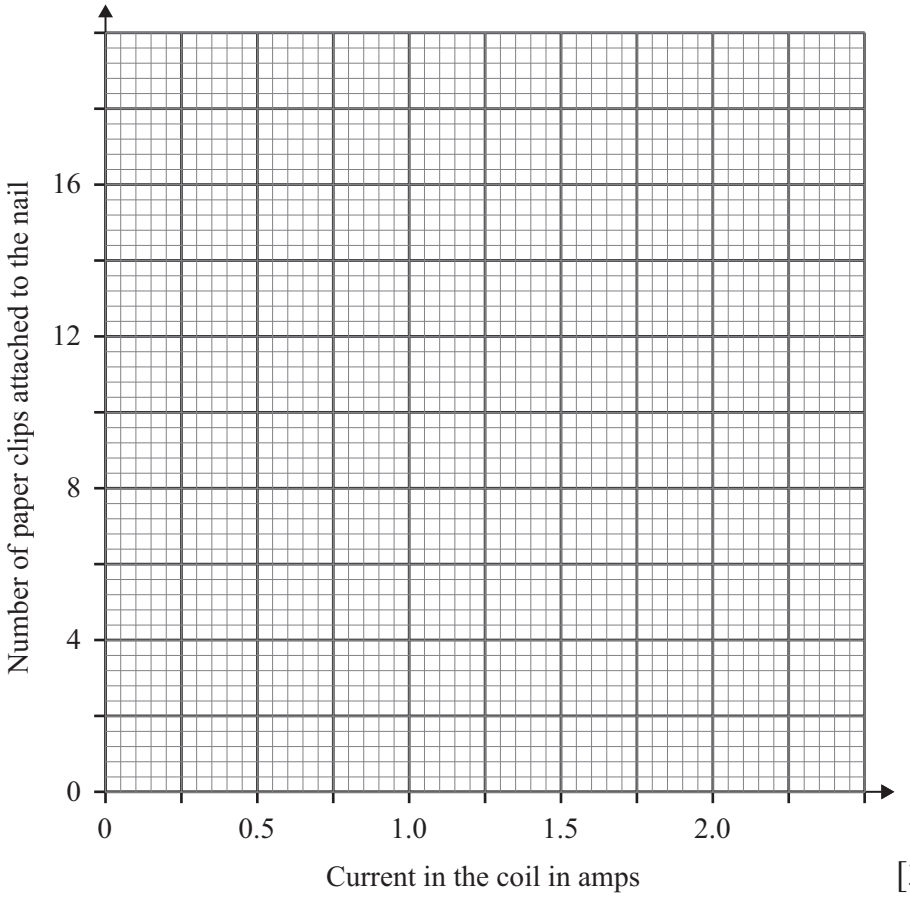
(i) What should be added to the circuit above to allow the current in the coil to be varied?

_____ [1]

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Examiner Only	
Marks	Remark

(ii) On the graph paper below, plot the graph of the number of paper clips attached to the nail against the current in the coil.



[3]

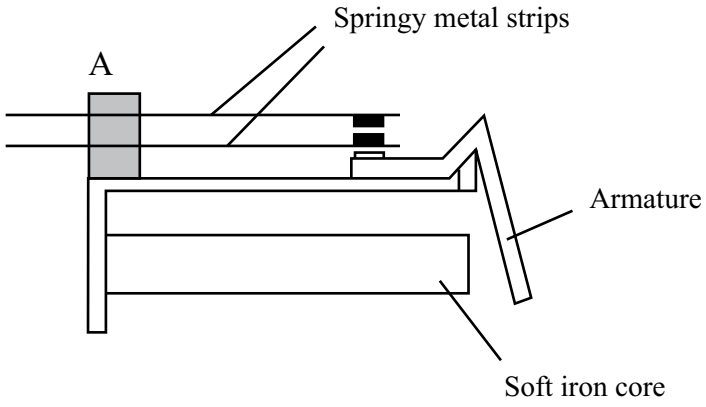
(iii) Using the graph, how many complete paper clips can be lifted by the electromagnet when the current in the coil is 1.2 A?

Number of complete paper clips lifted = _____ [1]

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Examiner Only	
Marks	Remark

(c) The diagram below shows a simple electromagnetic relay. It is not complete, some parts of the relay and circuits are missing.



(i) On the diagram, add the parts needed to make the relay operate (switch on). [3]

(ii) What should the part labelled armature be made of? Explain your answer.

Material _____

Explanation _____ [2]

(iii) The relay is used to switch on a second circuit. On the diagram above, mark the points X and Y where the second circuit should be connected. [1]

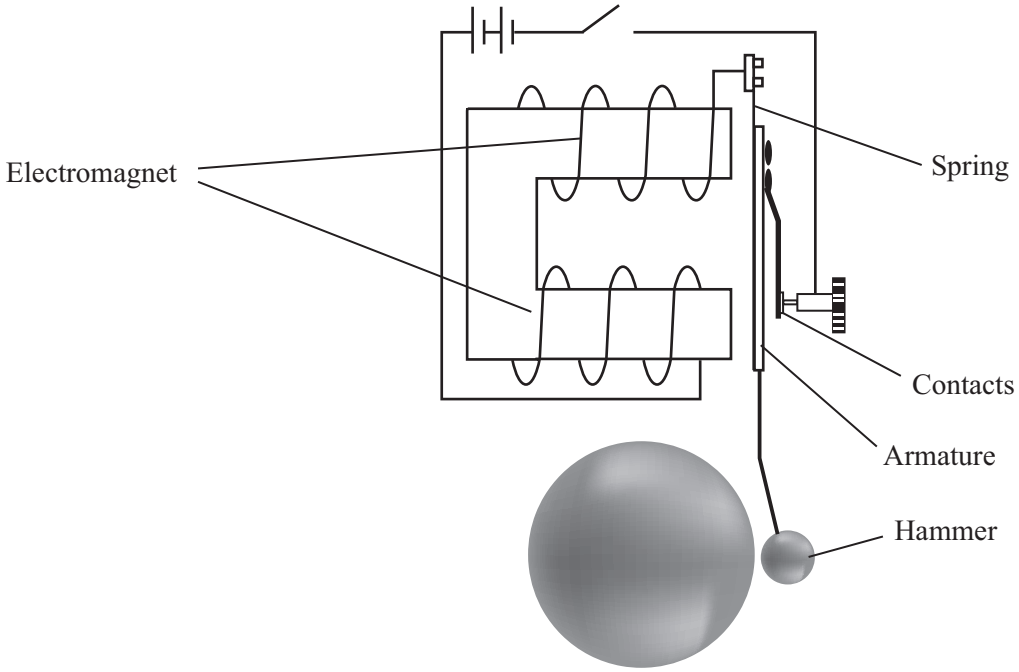
(iv) What type of material should the part labelled A be made of? Explain your choice of material.

Material _____

Explanation _____ [2]

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(d) The diagram below shows the electromagnetic doorbell.



6. Electromagnet is turned off
3. Armature is attracted towards the electromagnet.
5. When the switch is closed a current flows and the electromagnet is switched on.
2. Armature springs back to starting position.
4. Contacts open and circuit is broken.
1. Contacts touch and circuit is again complete.

The statements above describe how the doorbell works, however, they are **not** in the correct order. Place the above statements in the correct order. Write the numbers in the boxes below. The first one has been done for you.

5					

[2]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

5 **(a)** **(i)** What is a galaxy?

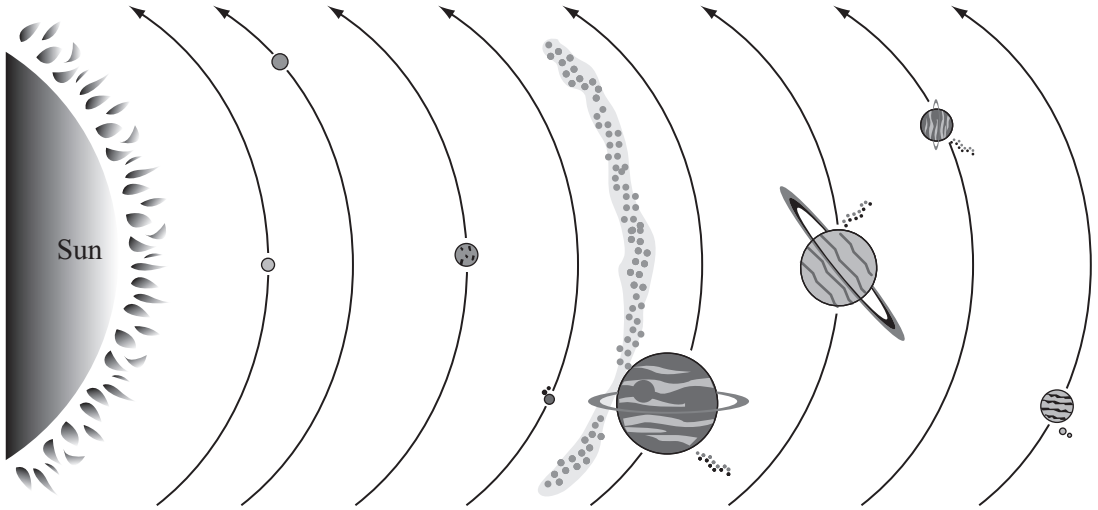
_____

_____[1]

(ii) What is the Milky Way an example of?

_____[1]

(b) There are eight planets which orbit the Sun.



(i) Which planet is furthest from the Sun? _____[1]

(ii) Which planet is closest to the Sun? _____[1]

(iii) Which two planets orbit between the Sun and Earth?

_____ and _____[2]

(iv) Between which two planets are the asteroids located?

_____ and _____[1]

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Examiner Only	
Marks	Remark

(c) The Earth has one natural satellite and a large number of artificial satellites.

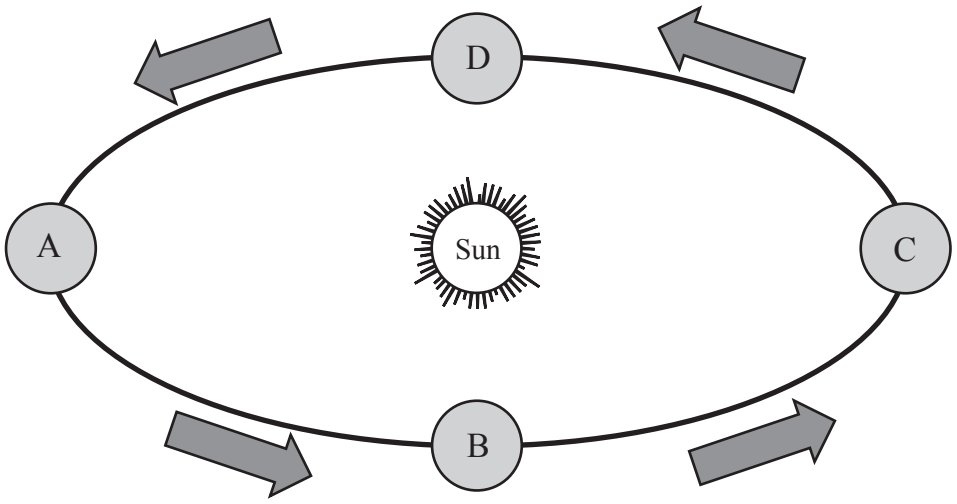
(i) Name the Earth's natural satellite._____[1]

(ii) One use of the Earth's artificial satellites is weather forecasting. State two other uses of artificial satellites in orbit around the Earth.

1. _____

2. _____[2]

(d) The diagram below shows the orbit of the Earth around the Sun. Four different positions along its path are marked A, B, C and D. The arrows show the direction of the Earth's motion around the Sun. In the Northern hemisphere, it is autumn when the Earth is at position B in its orbit.



(i) How long does it take the Earth to complete one orbit? Give your answer in days.

Time = _____ [1]

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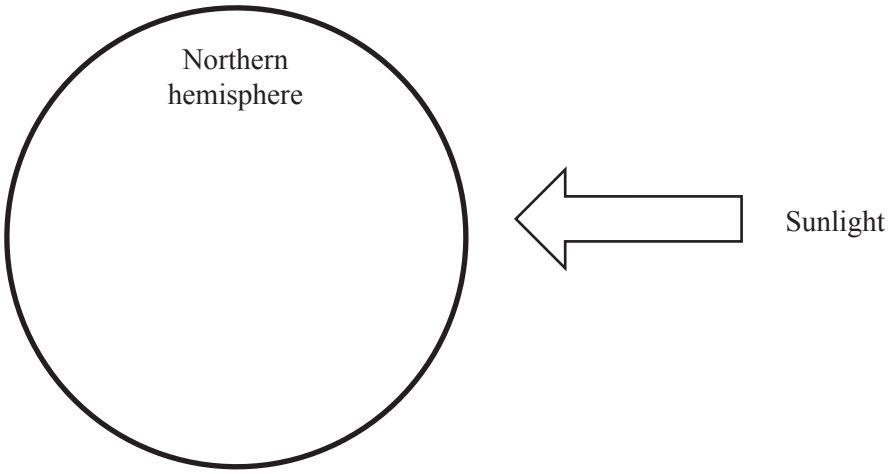
Examiner Only	
Marks	Remark

(ii) What are the seasons in the **Northern** hemisphere when the Earth is at positions A and C in its orbit?

A is _____

C is _____ [2]

The diagram below shows Earth when it is at position A in its orbit.



(iii) With a ruler, carefully mark on the diagram the axis about which the Earth spins. [1]

(iv) On the diagram, carefully shade the portion of the Earth in darkness. [1]

THIS IS THE END OF THE QUESTION PAPER

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1847-018-1

GCSE

Science: Physics

Summer 2010

Mark Schemes

Issued: October 2010

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Rewarding Learning

General Certificate of Secondary Education
2010

Science: Physics

Paper 2
Foundation Tier

[G7603]

WEDNESDAY 16 JUNE, MORNING

MARK SCHEME

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Subject-specific instructions

1 In numerical problems, the marks for intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the correct final answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote units for intermediate numerical quantities.

Note that this "correct answer" rule does not apply to formal proofs and derivations, which must be valid in all the stages shown in the mark scheme to obtain full credit.

2 Do not reward wrong physics. No credit is given for substitution of numerical data, or subsequent arithmetic, in a physically incorrect equation.

However, answers to later parts of questions that are consistent with an earlier incorrect numerical answer, and are based on a physically correct equation, must gain full credit. Annotate this by writing **ECF** (Error Carried Forward) by your text marks.

3 The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer mark, but 10^n errors (e.g. writing 550 nm as 550×10^{-6}m) count only as arithmetical slips and lose the answer/unit mark.

					AVAILABLE MARKS
1	**(a)**	Mass in kilograms/grams kg, g	[1]		
		Weight in newtons/N	[1]	[2]	
	(b)	**(i)** CoG marked with an X at the centre of beam on or in the beam		[1]	
		(ii) The centre of mass or centre of gravity		[1]	
		(iii) P = F/A	[1]		
		= 20 000/8	[1]		
		= 2500	[1]		
		Pa or N/m^2	[1]	[4]	
		(iv) Pivot P marked as the RH end		[1]	
		(v) Moment = force × distance (from pivot)	[1]		
		= 12 500 × (5 – 1)	[1]		
		= 50 000 (ecf for position of pivot)	[1]		
		Nm	[1]	[4]	
	(c)	**(i)** 24 cm^3		[1]	
		(ii) 28 – 24	[1]		
		= 4 cm^3	[1]	[2]	
		(iii) D = M/V	[1]		
		= 42/4 (ecf from **(ii)** for volume)	[1]		
		= 10.5	[1]	[3]	
		(iv) Silver ecf from **(iii)**		[1]	20

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AVAILABLE MARKS

2 **(a)** **(i)** Kinetic energy is CONSTANT [1]
Potential energy is CONSTANT [1] [2]

(ii) Kinetic energy is INCREASING [1]
Potential energy is CONSTANT [1] [2]

(iii) CHEMICAL [1]

(iv) 8×25 **or** $w = f \times d$ [1]
$= 200$ (J) [1] [2]

(v) 200 ecf from **(iv)** for work [1]
W [1] [2]

(b) Any **four** from:
Known weight or known mass or use of newtonmeter or balance to find it
Two points a measured distance apart/length of string
Switch on motor
Time to move between points/measured with stopclock
Repeat or take average
Plus:
Power = $\frac{\text{work done}}{\text{time taken}}$ **or** Power = weight × speed (essential for full marks) [5]

Quality of written communication [1]

(c) **(i)** Air IN at bottom [1]
Air OUT at the top [1] [2]

(ii) Liquid [1]

(d) **(i)** Upward curve or line starting at same level [1]
Copper rising more quickly [1] [2]

(ii) Collisions } insist on these terms [1]
(iii) Vibrations } insist on these terms electrons vibrate [0] atoms vibrate [0] [1]

(e) **(i)** Metals expand by different amounts [1]

(ii) Gap narrows when it heats up or gap widens when it cools [1]
Forces will damage bridge/cause collapse etc. [1] [2] 25

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						AVAILABLE MARKS
3	(a)	(i)	Transverse	[1]		
			Longitudinal	[1]	[2]	
		(ii)	Energy, KE, PE or mechanical energy		[1]	
		(iii)	Vibrates/oscillates	[1]		
			Perpendicular to the direction of energy transfer/motion of wave	[1]		
			moves up or down [1]			
			moves up **and** down [2]		[2]	
		(iv)	0.3 (m)		[1]	
		(v)	0.8 (m)		[1]	
		(vi)	f = no. of vibrations/time taken (or f = 24/8 or equivalent)	[1]		
			f = 3 (Hz)	[1]	[2]	
			$f = \frac{I}{T}$ give [1]			
		(vii)	$v = f\lambda$	[1]		
			$v = 3 \times 0.8$ ecf from **(v)** for wavelength and **(vi)** for frequency	[1]		
			v = 2.4 (m/s)	[1]	[3]	
	(b)	(i)	1. Hammer seen striking gong or bell still working	[1]		
			2. No sound heard from bell or fainter sound	[1]	[2]	
		(ii)	Sound cannot travel in a vacuum **or** sound needs particles for propagation **or** equivalent **or** light can travel through a vacuum		[1]	
		(iii)	Ultrasound/ultrasonic		[1]	
	(c)	(i)	One wave shown over the four grid squares	[1]		
			of **greater the amplitude** as before	[1]	[2]	
		(ii)	**Two waves shown** over the four grid squares	[1]		
			Same amplitude	[1]	[2]	20

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						AVAILABLE MARKS
4	(a)	(i)	Close the switch		[1]	
		(ii)	Less turns [1] Remove the iron nail [1] Use one cell [0]		[2]	
		(iii)	So that current flows around the nail		[1]	
		(iv)	It retains its magnetism		[1]	
	(b)	(i)	Variable resistor/rheostat/variable power supply		[1]	
		(ii)	4 points plotted ± $\frac{1}{2}$ smallest square [1] joining points [0] max [0] Best fit line [1] Through 0, 0 ± 1 square [1]		[3]	
		(iii)	10 clips 1.2 A intersects line at approx 10.5 clips **or** look at intercept on candidate's graph Answer must be integer (lower one)		[1]	
	(c)	(i)	Battery, switch [1] in series with coil – complete circuit [1] Coil wound around soft iron core **essential point** before further credit [1] Ignore ammeters/voltmeter – other additional components [–1]		[3]	
		(ii)	Iron steel [0] and no further mark [1] Is attracted when electromagnet switched on [1] Is an electromagnet/temporary magnetism/magnetic		[2]	
		(iii)	X and Y **both** correct		[1]	
		(iv)	An insulator (may be a named insulator) dependent marking [1] Otherwise device at XY always ON, there is a short circuit [1] Second circuit always on		[2]	
	(d)	(5)	3 4 6 2 1 3 4 2 1 6	[1]	[2]	20

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						AVAILABLE MARKS
5	**(a)**	**(i)**	A collection of stars		[1]	
		(ii)	A galaxy		[1]	
	(b)	**(i)**	Neptune		[1]	
		(ii)	Mercury		[1]	
		(iii)	Venus and Mercury		[2]	
		(iv)	Mars and Jupiter		[1]	
	(c)	**(i)**	Moon	[1]		
		(ii)	Communications/spying/navigation/research any **two**	[2]	[3]	
	(d)	**(i)**	365 days **or** $365\frac{1}{4}$ days		[1]	
		(ii)	A: summer	[1]		
			C: winter	[1]	[2]	
		(iii)	Line { close to / through } the earth's centre inclined to the vertical consistent with answer to **(ii)**		[1]	
		(iv)	Area to left of **vertical** terminator shaded		[1]	15
					Total	**100**

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GCSE

Science: Physics

Summer 2009

Mark Schemes

Issued: October 2009

Rewarding Learning

General Certificate of Secondary Education
2009

Science: Physics

Paper 2
Foundation Tier

[G7603]

FRIDAY 19 JUNE, MORNING

MARK SCHEME

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Subject-specific instructions

1 In numerical problems, the marks for intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the correct final answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote correct units for intermediate numerical quantities.

Note that this "correct answer" rule does not apply to formal proofs and derivations, which must be valid in all the stages shown in the mark scheme to obtain full credit.

2 Do not reward wrong physics. No credit is given for substitution of numerical data, or subsequent arithmetic, in a physically incorrect equation.

However, answers to later parts of questions that are consistent with an earlier incorrect numerical answer, and are based on a physically correct equation, must gain full credit. Annotate this by writing **ECF** (Error Carried Forward) by your text marks.

3 The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer mark, but 10^n errors (e.g. writing 550 nm as 550×10^{-6} m) count only as arithmetical slips and lose the answer/unit mark.

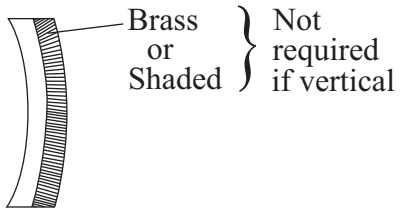
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		AVAILABLE MARKS
1 **(a)**	B [1] Wide base [1] Low CoG [1] [3]	
(b) **(i)**	**Pivot** – centre of the wheel [1] **Effort** – at the handle, must touch or pass through handle [1] **Direction** – upwards, only if line of action when extended passes through handle [1] [3]	
(ii)	The effort is further from the pivot [1] So smaller force can produce same moment as the weight [1]/or larger moment (Moment is essential in the answer) [2] Also accept increases moment of (effort) Force multiplier [0] unless further explanation. Moving effort [0] Larger effort [0] Turning force [0]	
(c) **(i)**	Moment = force × distance from pivot [1] if perpendicular given [1] [2]	
(ii)	Moment = 5000 × 5 [2] = 25 000 (Nm) [1] [3]	
(iii)	Pressure = Force/Area [1] **or** equivalent = 30 000/120 [1] = 250 [1] Pa or N/m^2 [1] [4] **or** N/cm^2 [1] if no working present If working present, unit credit given for Pa or N/m^2	
(d) **(i)**	Tension in the string [1]	
(ii)	Move away in a straight line [1] at a tangent to the circle [1] [2]	20

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AVAILABLE MARKS

2 **(a)** **(i)** Sketch showing:
Bending [1]
With brass on outside [1]



[2]

(ii) As the temperature increases [1] gets hot/warms up/
strip bends away (from the knob) or to the left [1] away from contact
strip bends and breaks contacts [2]
opening the contacts/breaking circuit [1] [3]

Quality of written communication [1]

(iii) To set the temperature (at which thermostat switches (off)) or on
control/change/raise or lower temperature [1]
Adjust the distance strip has to bend [1]
Reset heater [0] Sensitivity [0]

(iv) Substance:
Insulator or named insulator (e.g. polythene) [1] wood
Reason:
Otherwise heater permanently on **or**
Otherwise thermostat is short circuited [1] [2]
does not conduct **electricity**
does not conduct heat [0]

(b) Pin breaks (or bends) [1]
Force on pin due to contracting flat iron bar [1] [2]
It contracts [1] Increasing force/pressure on pin
Pin contracts [0] shrinks [1] shortens [1]

(c) **(i)** Conduction
Convection
Radiation
Evaporation
Any **three** [3]

(ii) Convection [1]
Atoms in solids are bound **or** unable to translate **or** unable to move
long distances [1] [2]

(iii) Polystyrene (beads) **or** urea formaldehyde **or** foam [1]

(iv) Feathers trap air [1]
Air is a good insulator [1] [2]

(d) **(i)** Electrons [1]

(ii) Atoms **or** molecules [1]

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				AVAILABLE MARKS
	(iii)	Electrons absorb KE from flame/Electrons move faster Electrons collide with atoms/Passing KE to vibrating atoms in each collision Any **three**	[3]	
	(e)	Good absorbers of radiation more than one tick [0]	[1]	25
3	**(a)**	The number of vibrations per second	[1]	
	(b) **(i)**	Wavelength correctly marked and labelled	[1]	
	(ii)	Amplitude correctly marked	[1]	
	(c) **(i)**	Longitudinal or pressure wave	[1]	
	(ii)	Sound waves consist of vibrations of particles/molecules Needs particles to pass through/propagation	[1]	
	(iii)	Electric bell in a chamber (bell jar) Hammers seen striking gong Sound of the bell is audible Chamber/bell jar connected to vacuum pump Pump switched on/air removed from chamber/bell jar Loudness of sound decreases Sound becomes inaudible Even though the hammer is seen still striking gong Any **six**	[6]	
	(iv)	20 Hz [1] to 20 kHz [1]	[2]	
	(v)	Upper limit reduces [2] (Range reduces [1] lower limit changes [0])	[2]	
	(d) **(i)**	Speed = frequency × wavelength **or** $v = f\lambda$	[1]	
	(ii)	Speed = 200 × 1.7 [2] = 340 [1] = m/s [1]	[4]	20

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					AVAILABLE MARKS
4	(a)	(i)	The electric current	[1]	
		(ii)	Inside the coil	[1]	
		(iii)	More cells/bigger current [1] More turns on the coil [1] Any magnetic core (any named magnetic substance) [1]	[3]	
	(b)	(i)	Coil	[1]	
		(ii)	The core	[1]	
		(iii)	Iron	[1]	
		(iv)	Iron is more easily/strongly magnetised [1] Iron loses its magnetism when current stops [1]	[2]	
		(v)	Conducts current/acts as part of the circuit [1] Pulls armature back to complete the circuit [1]	[2]	
		(vi)	Weaker field [1] **or** Insufficient force [1] The magnetic field would be too weak [1] To pull the armature over/break the circuit [2]	[3]	
		(vii)	Use weaker spring Adjust contact to press less strongly Move coil tighter to armature Increase number of turns Increase the current (more cells) Any **three**	[3]	
	(c)		It experiences a force/is pulled or pushed/movement [1] Up the page/down the page/perpendicular to field and current [1]	[2]	20

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					AVAILABLE MARKS
5	**(a)**	**(i)**	A = Earth or a planet	[1]	
		(ii)	B = Moon	[1]	
		(iii)	C = Star	[1]	
	(b)	**(i)**	Orbit	[1]	
		(ii)	Communication Navigation (GPS) Weather monitoring } or similar Any **two**	[2]	
	(c)	**(i)**	Galaxy	[1]	
		(ii)	Star	[1]	
		(iii)	Gravity	[1]	
		(iv)	The distance [1] light travels in one year [1]	[2]	
		(v)	The distance is too great **or** spacecraft is too slow [1] Takes too long **or** time to get there greater than a human lifetime **or** too much fuel **or** equivalent (e.g. life resources) [1] Expense [0]	[2]	
	(d)	**(i)**	Hydrogen	[1]	
		(ii)	Nuclear fusion	[1]	15
				Total	**100**

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