Rewarding Learning

71

Candidate Num

General Certificate of Secondary Education
2011

Science: Physics

Paper 2
Higher Tier

[G7605]

G7605

WEDNESDAY 15 JUNE, MORNING

TIME

1 hour 45 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.

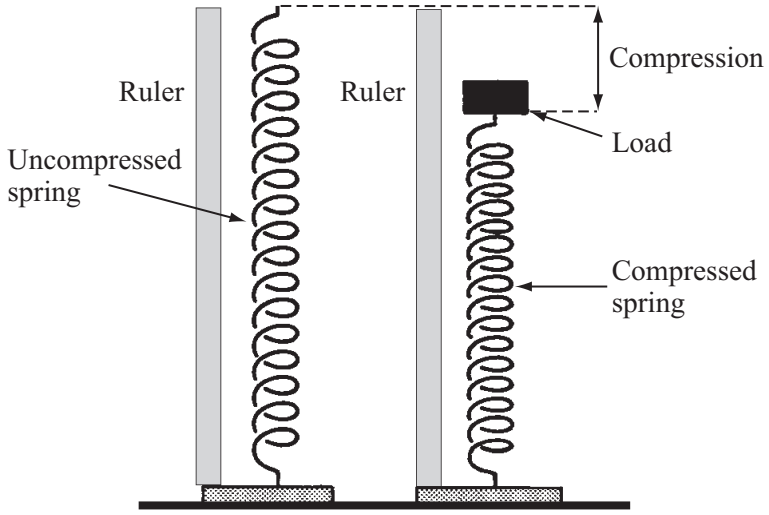
INFORMATION FOR CANDIDATES

The total mark for this paper is 125.
Quality of written communication will be assessed in Question **3(c)**.
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.

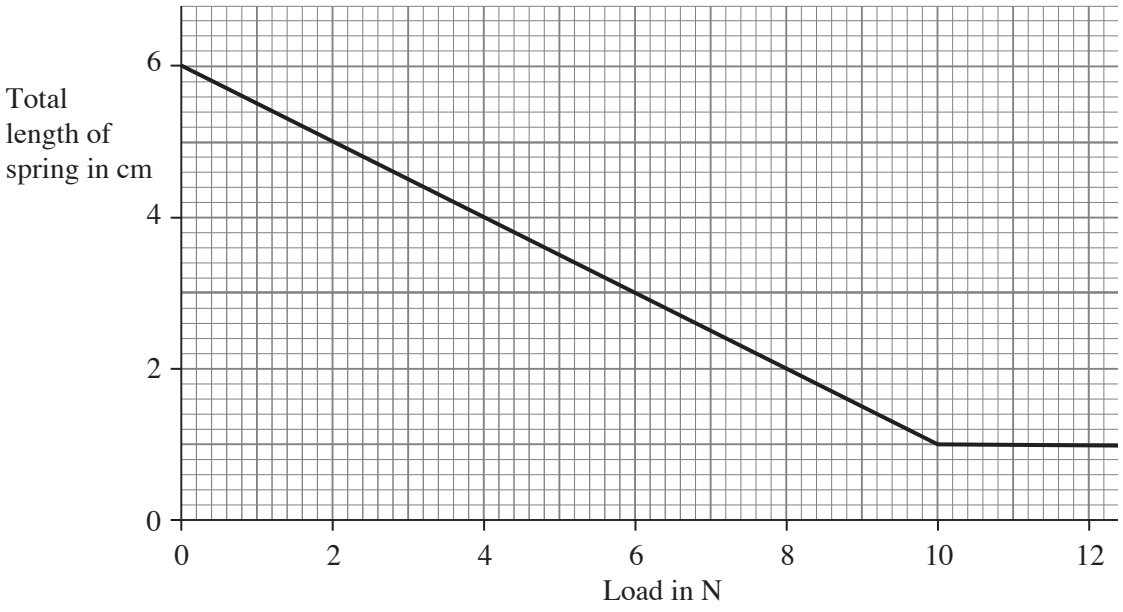
For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
Total Marks	

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]

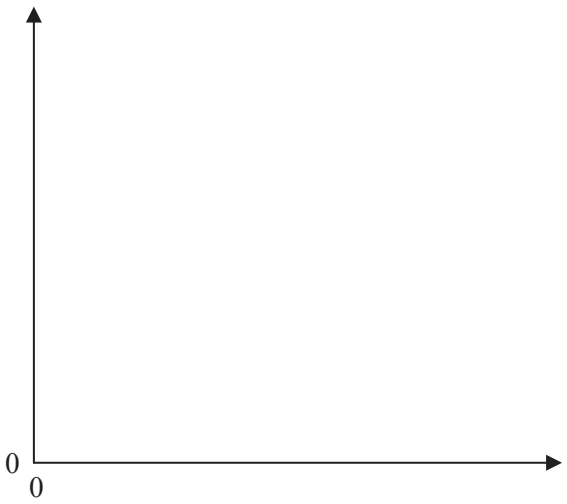
(ii) For a given load placed on the spring the compression is defined as;

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

The compression of the spring is directly proportional to the load placed on the spring.
To show that this is true data must be taken from the graph.
Complete the table below using data **derived** from the graph opposite.
Add column headings with the correct units.
Insert 6 pairs of values in the table.

[7]

(iii) On the axes below sketch the graph that John would plot to show that the compression and the load added to the spring are directly proportional.
Label each axis with the quantity plotted.



[3]

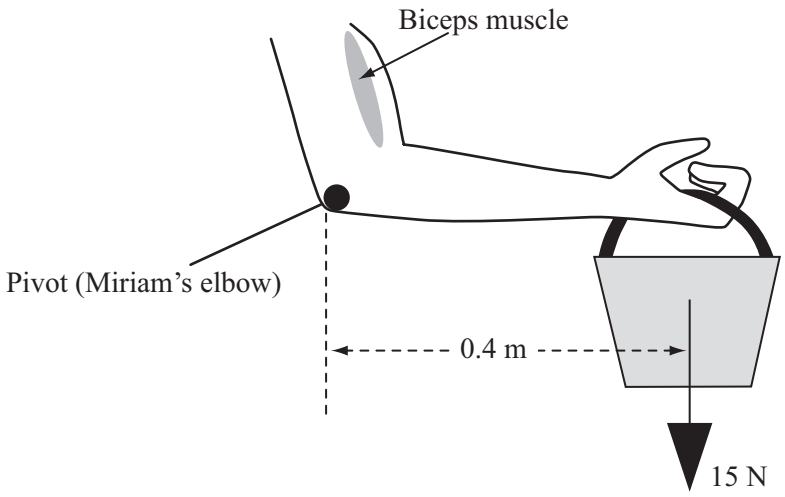
Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

(b) 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]

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

_____ [1]

(c) When an object moves in a circle, a force called a centripetal force, must act on it.

(i) In what direction does the centripetal force always act?

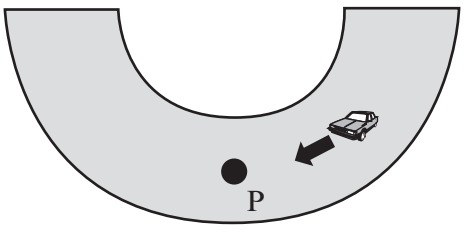
_____ [1]

(ii) For each of the examples given below, state what provides the centripetal force. One has already been completed.

Example	**What provides the centripetal force**
An artificial satellite orbits the earth	*Gravitational force between the satellite and the earth*
A chestnut whirled in a horizontal circle at the end of a length of string	
An electron orbits a nucleus	
A racing car travelling around a circular track	

[6]

(iii) The diagram below represents a racing car, moving in a clockwise direction around a circular track. At the point P there is oil on the track which causes the centripetal force to disappear very suddenly. Mark, carefully, on the diagram the direction the racing car at P will now move.



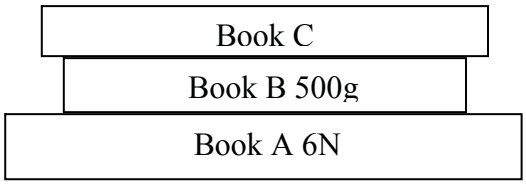
[1]

Examiner Only

Marks	Remark

(d) A pile of books has a total weight of 14 N.

Examiner Only	
Marks	Remark



(i) Use the information in the diagram to calculate the weight of book C.
You are advised to show clearly how you get your answer.

Weight of book C = _____ N [2]

(ii) The area of book A in contact with the table is 700 cm^2.
Calculate the total pressure that the books exert on the table.
You are advised to show clearly how you get your answer.

Pressure = _____ N/cm^2 [3]

2 **(a)** 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]

Many people today are concerned about global warming.

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

_____

_____

_____

_____

_____

_____

_____ [3]

(b) 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.

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

_____

_____

_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

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

_____

_____

_____ [1]

(iii) Name the fuel used in nuclear power stations and state if it is a renewable or a non-renewable source of energy.

_____

_____ [2]

At the end of their useful lives all power stations are de-commissioned.

(iv) Explain fully why it is more expensive to de-commission a nuclear power station than one that used fossil fuels.

_____

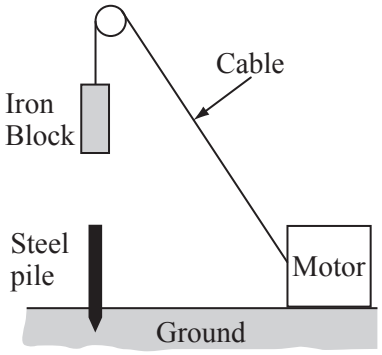
_____

_____

_____

_____ [2]

(c) 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.



(i) State the Principle of Conservation of Energy.

_____

_____ [2]

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

(ii) How much of the input energy is converted into **unwanted** forms?

_____ [1]

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

Efficiency = _____ [3]

(iv) The motor takes 12 seconds to raise the iron block.
Calculate the output power of the motor.
Remember to include the correct unit for power in your answer.
You are advised to show clearly how you get your answer.

Output power of the motor = _____ [3]

When the steel pile is struck, it penetrates 0.03 m into the ground against an average friction force. In doing so the steel pile does 15kJ of useful work.

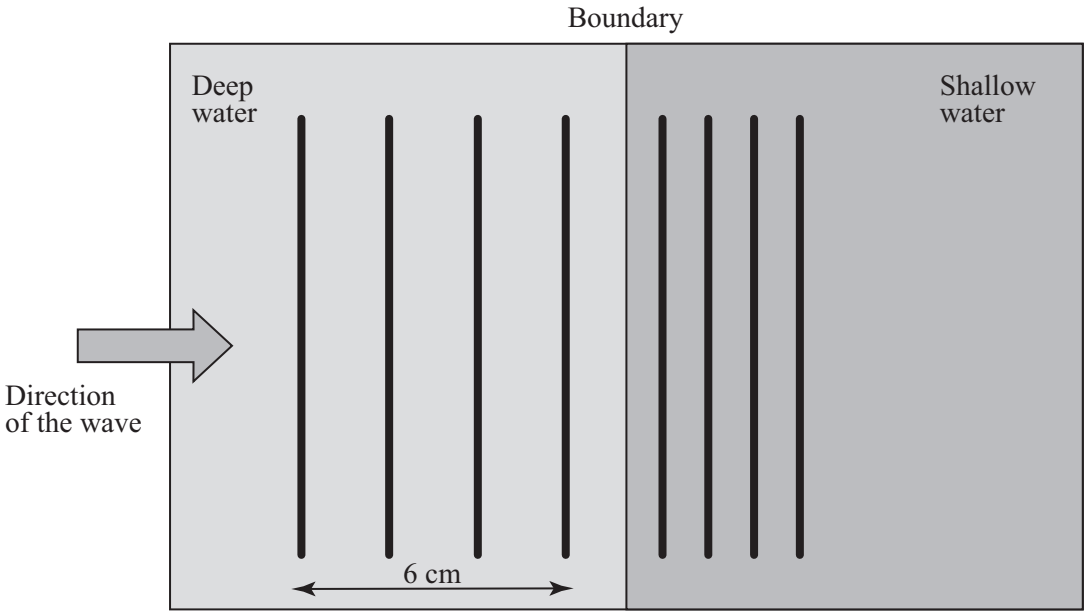
(v) Calculate the size of the friction force between the steel pile and the ground.
You are advised to show clearly how you get your answer.

Friction Force = _____ N [4]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 **(a)** 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]

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

(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.

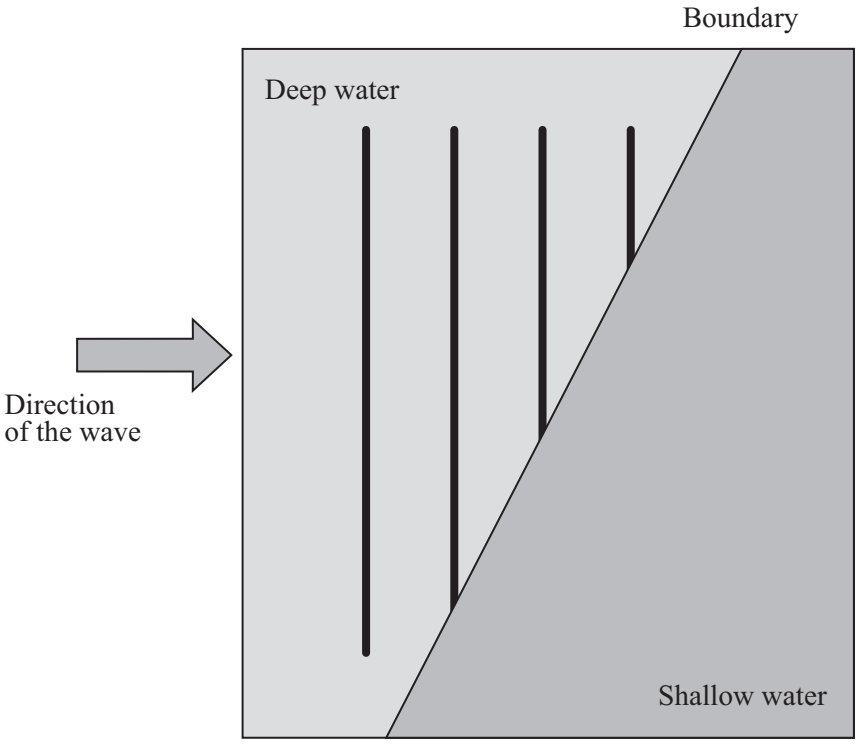
Frequency = _____ [3]

(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.

Examiner Only
Marks | Remark

Speed in deep water = _____ cm/s [3]

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 what happens to the water wave in the shallow water. [4]

(v) State what causes this change of direction.

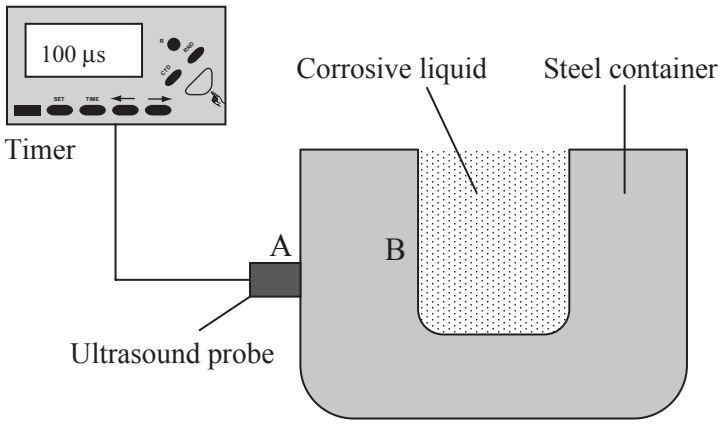
_____

_____ [2]

[Turn over

Examiner Only	
Marks	Remark

(b) A corrosive liquid is stored in a steel container. The thickness of the wall of the container is measured using ultrasound.
The diagram below illustrates the method used.



The ultrasound probe is placed in contact with the outside of the steel container at the point A. It then emits a pulse of ultrasound and 100 microseconds later detects the reflection of this ultrasound from the inner wall of the container at B.

(i) What is ultrasound?

_____

_____

_____ [2]

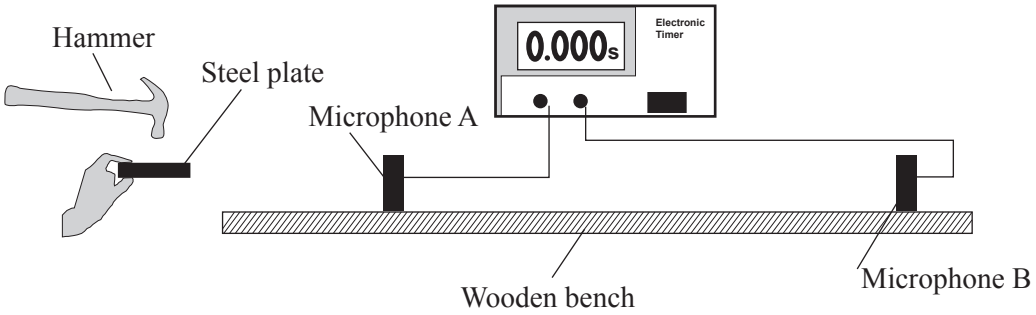
In a particular measurement, the following data was obtained.

Time elapsed = 100 µs (0.0001 s).
Speed of ultrasound in steel = 5000 m/s.

(ii) Using this data, calculate the thickness of the wall of the container.
Remember to include the correct unit for the thickness.
You are advised to show clearly how you get your answer.

Thickness = _____ [4]

(c) Roy set up the apparatus shown below. Each microphone is connected to an electronic timer. The timer starts when a sound reaches one of the microphones and stops when it reaches the other microphone.
Roy also has a hammer and steel plate as part of the apparatus.



Describe how Roy could use the above apparatus to show that sound travels faster in wood than in air. State clearly what measurement would show that this is true.

_____

_____

_____

_____

_____

_____

_____

_____ [4]

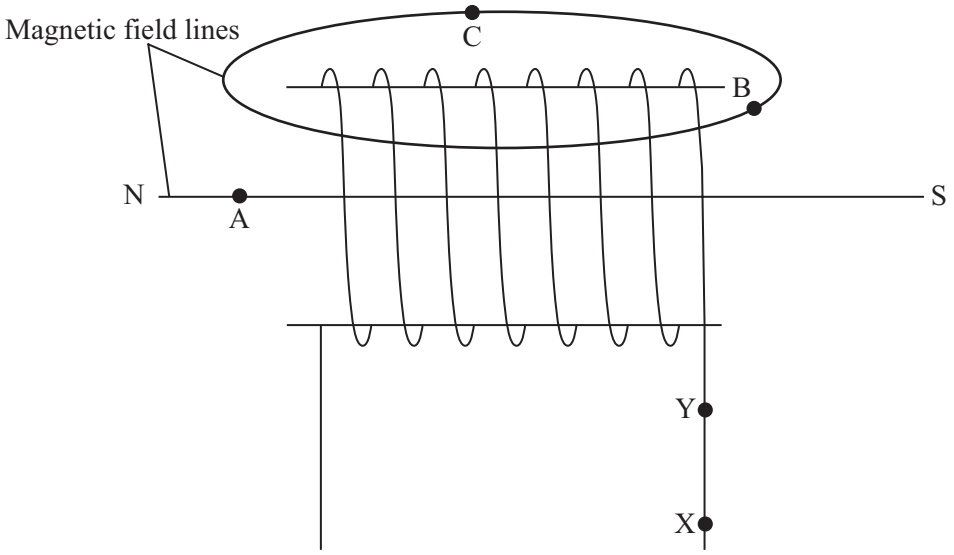
Quality of written communication [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

4 **(a)** The diagram below shows a coil of wire wrapped around a cardboard cylinder. When an electric current is passed through the coil a magnetic field is created around the coil. The ends are marked N (north pole) and S (south pole). Two magnetic field lines are also shown.



(i) On the diagram mark the direction of the current between the points X and Y that will produce the magnetic poles shown in the diagram. [1]

(ii) On the diagram mark the directions of the magnetic field lines at the points A, B and C. [3]

(iii) The arrangement above is described as an electromagnet. What does this mean?

_____

_____ [1]

(iv) What material, placed inside the cardboard cylinder, will increase the strength of the magnet?

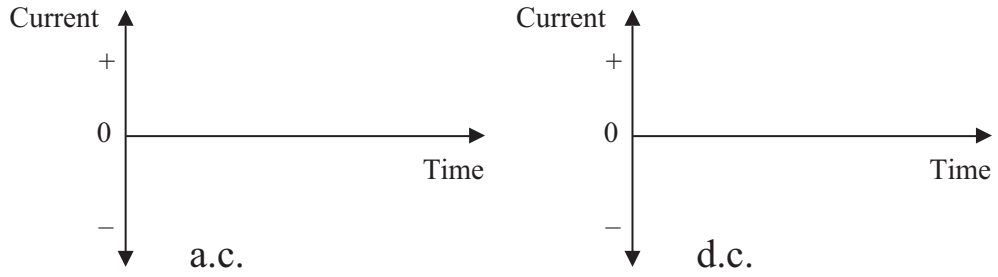
_____ [1]

(v) Apart from increasing the current in the coil, or adding a different core, what could be done to the coil shown above to increase the strength of the magnetic field at the centre of the coil?

_____ [1]

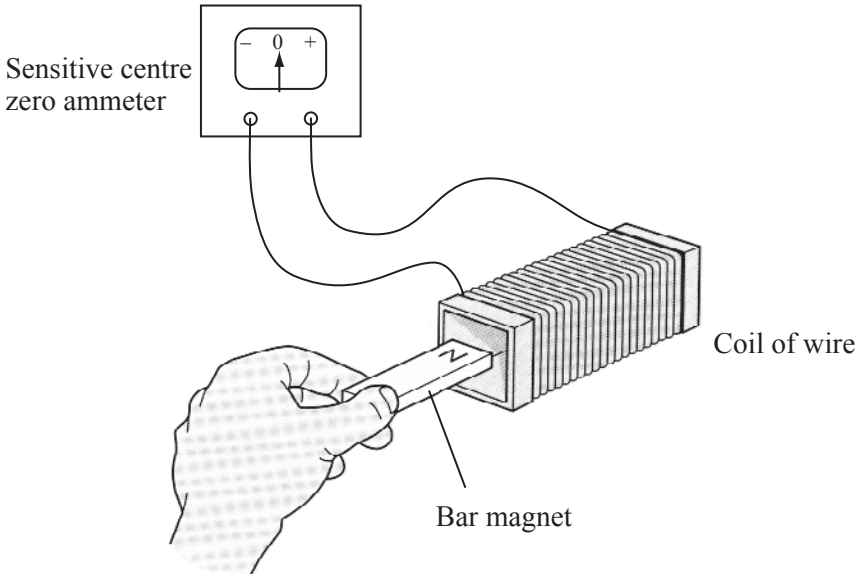
Examiner Only	
Marks	Remark

(b) (i) On the axes below show how an alternating current (a.c.) and a direct current (d.c.) might vary, if at all, with time.



[2]

The diagram below shows a magnet and a coil of wire.



(ii) Describe how an alternating current can be induced in the coil using the magnet.

_____

_____

_____

_____ [2]

(iii) Describe how a brief direct current can be induced in the coil using the magnet.

_____

_____

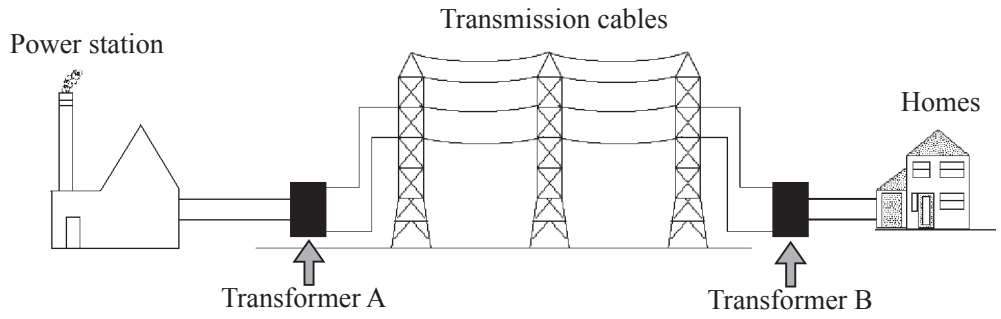
_____

_____ [2]

[Turn over

Examiner Only	
Marks	Remark

(c) The diagram below shows some of the stages in the generation of electricity and its transmission to homes using cables.



(i) Name the types of transformer marked A and B. In each case describe the feature of the construction of the transformer that allows it to change the voltage in the required way.

A _____

Feature _____

_____

_____

B _____

Feature _____

_____

_____ [4]

(ii) Explain how the system shown above improves the efficiency of the transmission of electricity.

_____

_____

_____ [1]

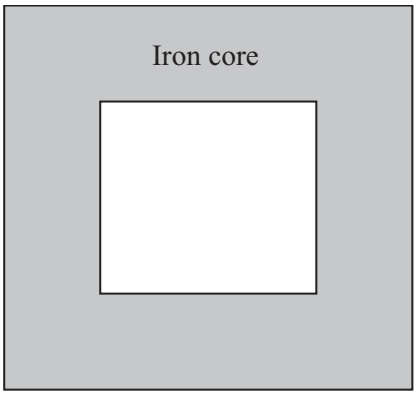
(d) Many of the circuits in a computer require a low voltage of 12 V to operate. The computer is fitted with a transformer which provides an output voltage of 12 V when an input voltage of 240 V is applied to it. The primary coil of this transformer has 300 turns.

Examiner Only	
Marks	Remark

(i) Calculate the number of turns on the secondary coil of this transformer.
You are advised to show clearly how you get your answer.

Secondary coil turns = _____ [3]

(ii) Complete the diagram below to show the primary and secondary coils. Indicate where the 240 V is applied and where the 12 V supply to the computer is obtained.



[3]

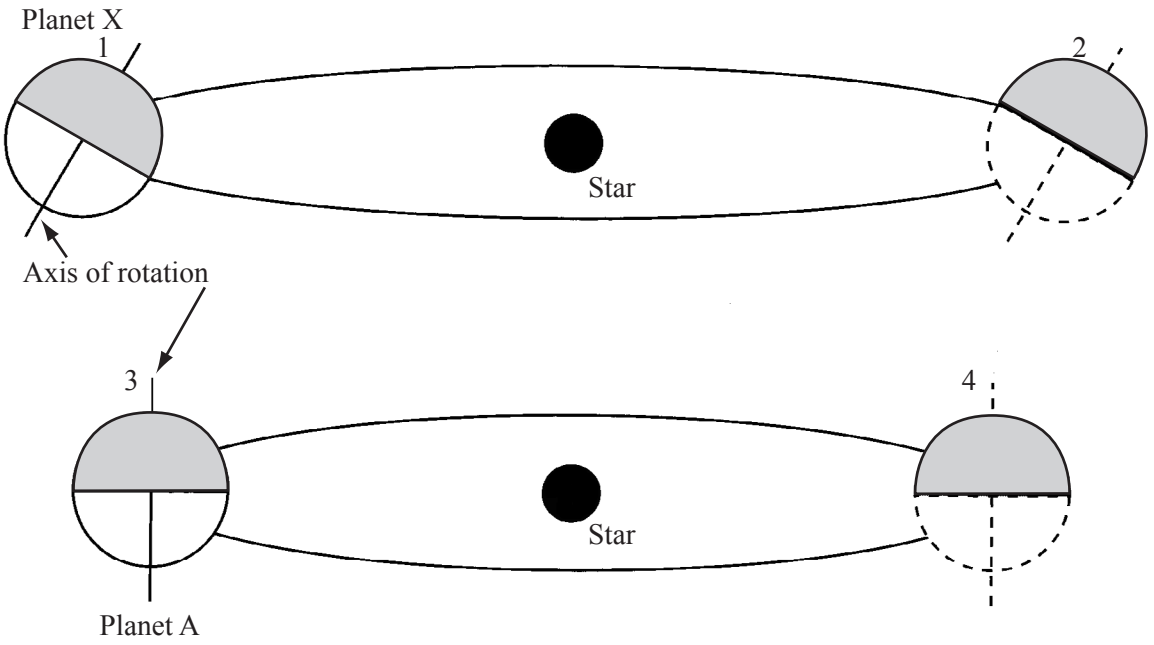
(iii) State whether the input voltage is a.c. or d.c. and similarly state whether the output voltage is a.c. or d.c.

The input voltage is _____

The output voltage is _____ [1]

Examiner Only	
Marks	Remark

5 **(a)** The diagram below shows two planets X and A.
The northern hemisphere of each planet is shaded.
The axes of rotation are shown.



What can you conclude from the diagrams about the lengths of day and night in the **northern hemisphere** of each planet?

Record your answers by placing ticks (✓) in the correct boxes in the table below.

	Day longer than night	Day same length as night	Day shorter than night
Planet X at 1			
Planet X at 2			
Planet A at 3			
Planet A at 4			

[4]

(b) What is a light year?

_____

_____

_____ [2]

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

Examiner Only	
Marks	Remark

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

Description _____

Explanation _____ [2]

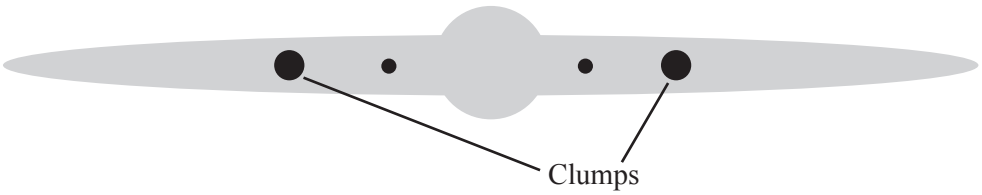
In the later stages of star formation the nebula flattens as it spins with a bulge in the centre as shown below. This bulge eventually becomes a star.

(ii) What has to happen to the gas in this bulge at this stage before nuclear fusion begins?

_____

_____ [1]

Sometimes the material in the nebula forms clumps as shown in the diagram below.



(iii) What do these clumps of material eventually become?

_____ [1]

(iv) State one feature of the motion of the planets in our solar system that suggests that they were all formed from the same nebula.

_____ [1]

Examiner Only	
Marks	Remark

(d) Our present model of the solar system is described as heliocentric. Models of the solar system proposed hundreds of years ago are described as geocentric.

(i) For each model state what is at the centre of the solar system.

_____

_____

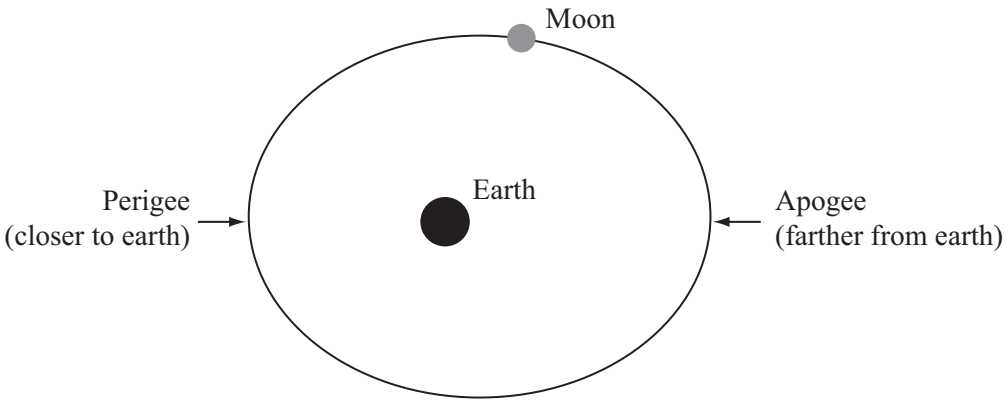
_____

_____

_____

_____ [2]

The Moon's orbit around the Earth is not circular. It is oval as shown in the diagram below.



© NASA http://science.nasa.gov/headlines/y2008/images/fullmoon/diagram.gif

(ii) What can you say about the size of the gravitational force that the Earth exerts on the Moon as the Moon orbits the Earth?

_____

_____

_____ [2]

(e) (i) What is the Big Bang theory?

_____

_____ [2]

(ii) One piece of evidence that supports this theory is known as the "Red Shift". Explain what is meant by this and what conclusion can be drawn to support the Big Bang theory.

_____

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER