



General Certificate of Secondary Education

Centre Number

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Candidate Number

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# Physics

Unit 2

Higher Tier



[GPY22]

\*GPY22\*

## Assessment

### TIME

1 hour 30 minutes.

### Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

### INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

**You must answer the questions in the spaces provided.**

**Do not write outside the boxed area on each page or on blank pages.**

Complete in black ink only. **Do not write with a gel pen.**

Answer **all** questions.

### INFORMATION FOR CANDIDATES

The total mark for this paper is 100.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in questions **1(f)** and **3(a)**.



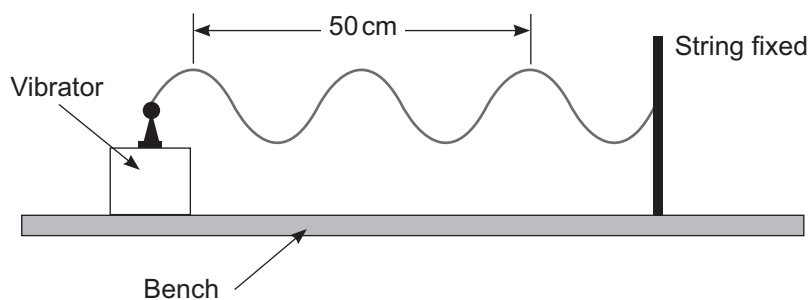
1 (a) When a guitar string is plucked it vibrates to produce a sound wave of frequency 100 Hz.

(i) What type of wave is a sound wave? \_\_\_\_\_ [1]

(ii) Calculate the time it takes for the string to make 1 complete vibration.  
You are advised to show clearly how you get your answer.

\_\_\_\_\_ s [2]

(b) The apparatus shown below is used to produce waves in a string.  
The vibrator moves one end of the string up and down vertically.



Source: Chief Examiner

(i) Calculate the wavelength of the waves produced on the string.

Wavelength = \_\_\_\_\_ cm [2]



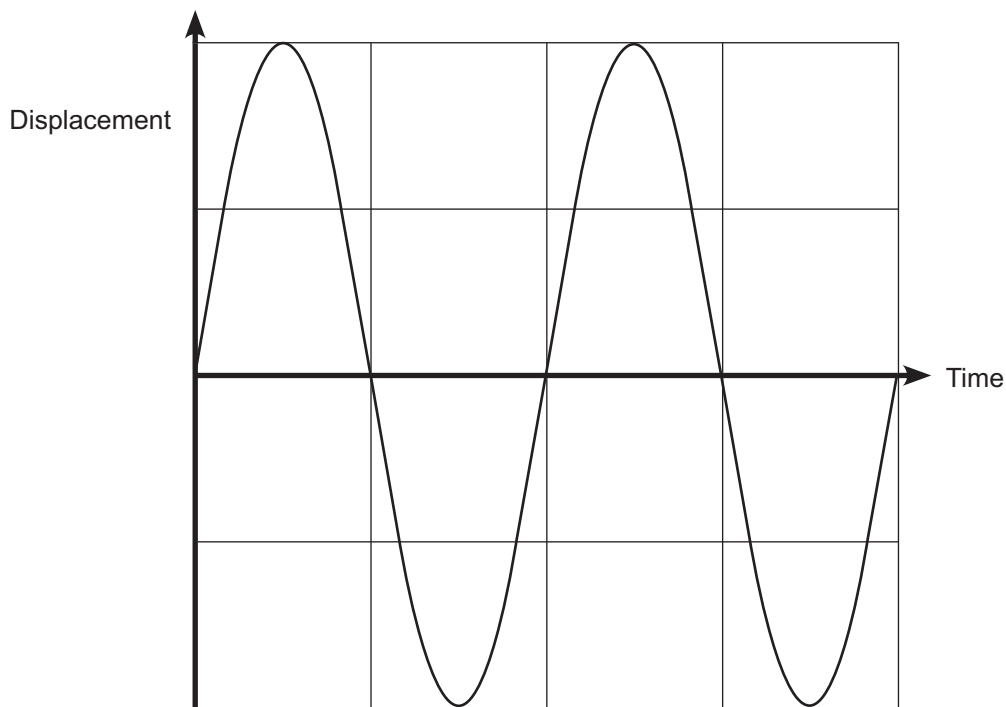
(ii) The speed of the waves on the string is **10.0 m/s**.

Calculate the frequency of the waves.

**Show clearly your calculation, starting with the equation you plan to use to get your answer.**

Frequency = \_\_\_\_\_ Hz [4]

(c) The graph below shows how the displacement of a wave changes with time. On the grid draw the wave that has **half the amplitude** of the one shown and has **half the frequency**.

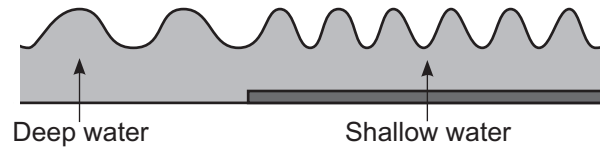


Source: Chief Examiner

[2]



(d) The diagram below shows water waves passing from deep water into shallow water.



Source: Chief Examiner

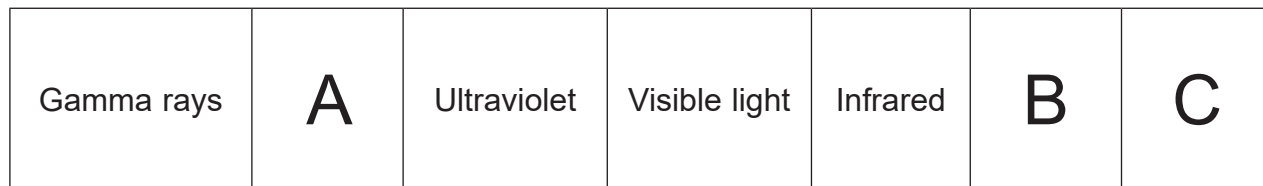
The table below lists three quantities associated with the water waves. Complete the table by placing a tick (✓) in the box that describes what happens, if anything, to each quantity as the water waves move from deep water into the shallow water.

	Increases	Decreases	Stays the same
Speed			
Wavelength			
Frequency			

[3]



(e) The diagram below shows the different regions of the electromagnetic spectrum. The diagram is incomplete.



Increasing wavelength  $\longrightarrow$

(i) Name the electromagnetic waves missing from boxes A, B and C.

A \_\_\_\_\_

B \_\_\_\_\_

C \_\_\_\_\_

[3]

(ii) Use the information given in the diagram to explain why gamma rays are likely to cause most damage to the human body.

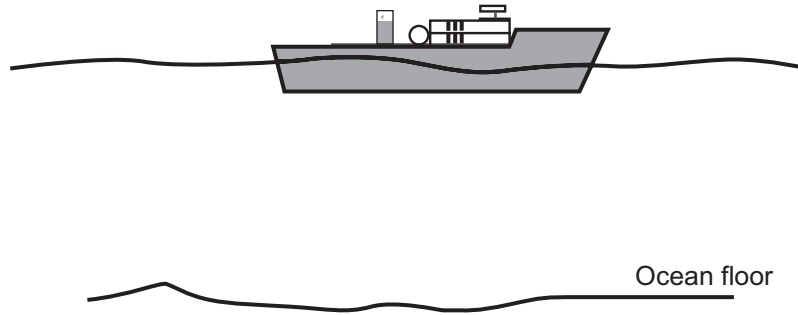
\_\_\_\_\_

\_\_\_\_\_

[1]



- (f) Echo sounding uses ultrasound waves to measure the depth of an ocean. Describe, in detail, how this process is carried out.



Source: Chief Examiner

In your description you should state the following:

- the difference between sound waves and ultrasound waves;
- what happens to the ultrasound wave when it reaches the ocean floor;
- why the ultrasound is emitted as short pulses rather than continuously;
- what measurement is made;
- what property of the ultrasound is needed for the calculation of the depth of an ocean;
- the calculation used to determine the depth of the ocean.

**In this question you will be assessed on your written communication skills including the use of specialist science terms.**

Write your answers in the spaces below and on the opposite page.

Difference between sound and ultrasound

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What happens to the ultrasound at the ocean floor

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Why short pulses of ultrasound are emitted

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Measurement made

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Property of the ultrasound wave needed

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Calculation used

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[6]

[Turn over



2 (a) The image in a plane mirror is virtual.

(i) What is a virtual image?

\_\_\_\_\_ [1]  
\_\_\_\_\_

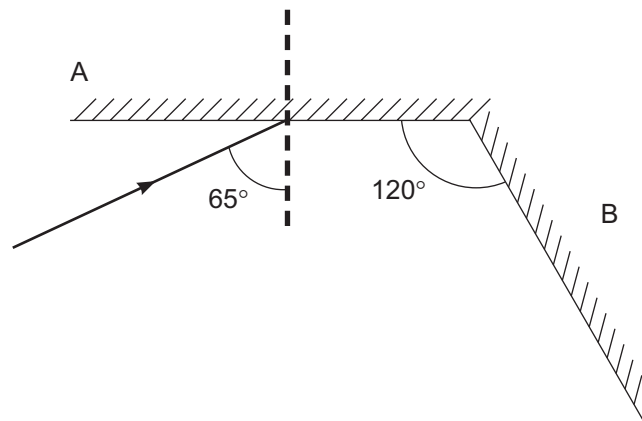
(ii) State **three other** properties of the image in a plane mirror.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_ [3]

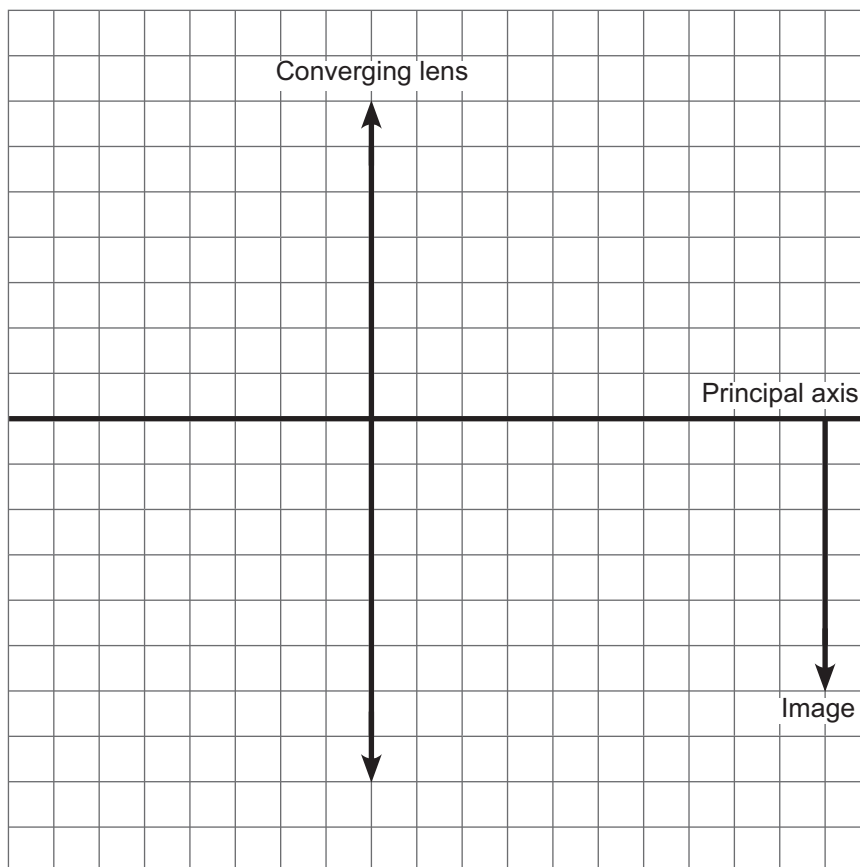
Two mirrors A and B are arranged at  $120^\circ$  as shown below.  
A ray of light is incident on mirror A.

(iii) Calculate the angle of reflection of the ray reflected by **mirror B**.

Angle of reflection = \_\_\_\_\_  $^\circ$  [2]



(b) A converging (convex) lens is used to produce the real, magnified and inverted image that is shown in the diagram below.



The image is **twice** the size of the object.

- (i) Draw two rays to show how the image is formed. [2]
- (ii) Place arrows on the rays to show their directions. [1]
- (iii) Mark the object using an arrow,  $\uparrow$ , the tip of which is the top of the object. [1]
- (iv) Mark the principal focus of the lens with the letter F. [1]



(c) John can see distant objects clearly, but finds that near objects, about 25 cm away from his eye, appear blurred.

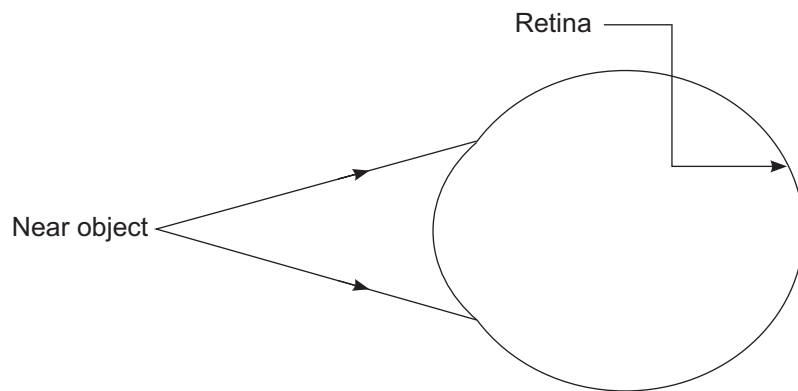
(i) What name is given to this defect of vision? \_\_\_\_\_ [1]

(ii) What is the main cause of this defect of vision?

\_\_\_\_\_  
\_\_\_\_\_ [1]

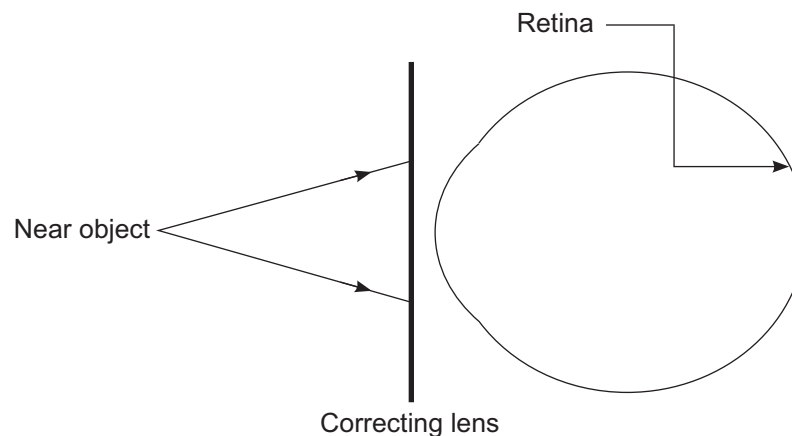
(iii) What type of lens is used to correct this defect of vision? \_\_\_\_\_ [1]

(iv) On the diagram below show what happens to two rays of light from a near object when they enter John's unaided eye.



[2]

(v) On the diagram below show how the correcting lens changes the paths of the rays of light to enable John to see near objects clearly.



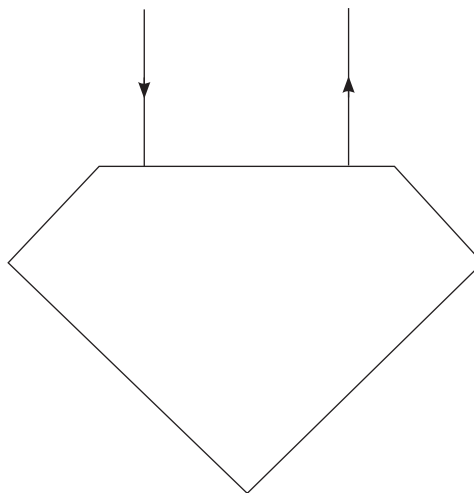
[2]



(d) Diamonds sparkle because light that enters the diamond undergoes total internal reflection.

The diagram below shows a ray of light entering and leaving a diamond.

(i) Complete the path of the ray of light through the diamond.



[2]

(ii) Explain why total internal reflection occurs within the diamond.

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[2]

[Turn over



**3 (a)** Materials can be classified as electrical conductors or electrical insulators. When current flows through a conductor it causes heat to be generated. You are asked to provide an explanation of the above statements.

In your answer you should:

- in terms of named charge carriers, explain the difference between conductors and insulators;
- state clearly the direction of movement of charge carriers in an electrical circuit;
- explain how heat is generated when a current flows in a conductor;
- state how the resistance of a filament lamp changes as the current flowing increases.

**In this question you will be assessed on your written communication skills including the use of specialist science terms.**

Conductors and insulators

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Direction of movement

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## Generation of heat in conductors

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## How resistance changes

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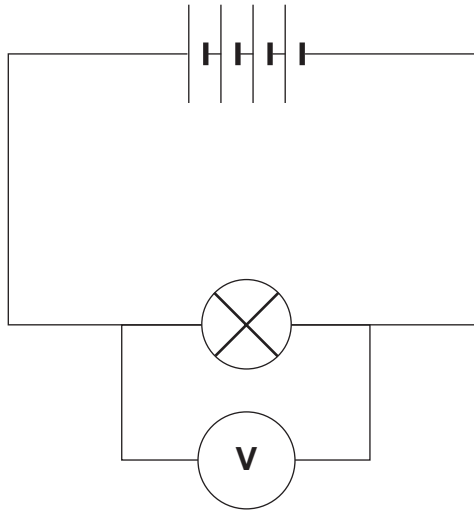
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[6]



- (b) The circuit diagram below shows a battery of four cells supplying current to a lamp.  
Each cell provides a voltage of 1.5V.



- (i) What would the voltmeter read?

Voltmeter reading = \_\_\_\_\_ V [1]

- (ii) When the lamp is lit a current of 2A flows through it.  
Calculate the resistance of the lamp when it is lit.  
**Show clearly your calculation, starting with the equation you plan to use to get your answer.**

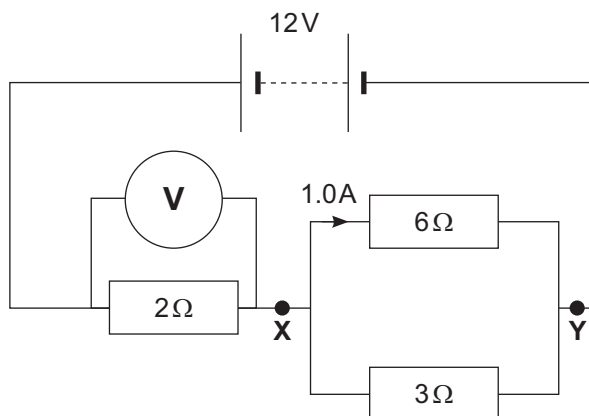
Resistance = \_\_\_\_\_  $\Omega$  [3]

- (iii) Calculate the charge that flows through the lamp when it is lit for a time of 30 s.  
**Show clearly your calculation, starting with the equation you plan to use to get your answer.**

Charge = \_\_\_\_\_ C [3]



(c) The circuit diagram below shows three resistors connected to a 12 V battery.



- (i) Calculate the resistance between the points X and Y in the circuit.  
**Show clearly your calculation, starting with the equation you plan to use to get your answer.**

Resistance = \_\_\_\_\_  $\Omega$  [3]

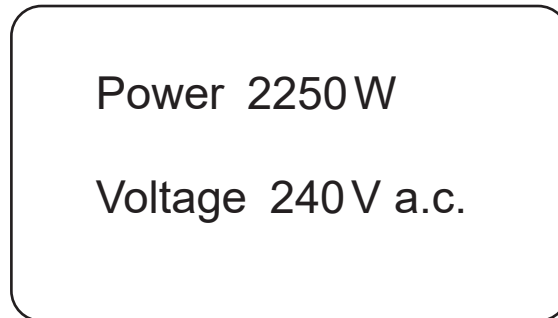
- (ii) The current flowing through the  $6\Omega$  resistor is 1.0A, as shown on the diagram. Calculate the current flowing through the  $2\Omega$  resistor.

Current = \_\_\_\_\_ A [3]

[Turn over



- (d) The diagram below shows some of the details from a label on a household electric kettle.



- (i) Using the information from the label above, calculate the current in the kettle when in normal use.  
**Show clearly your calculation, starting with the equation you plan to use to get your answer.**

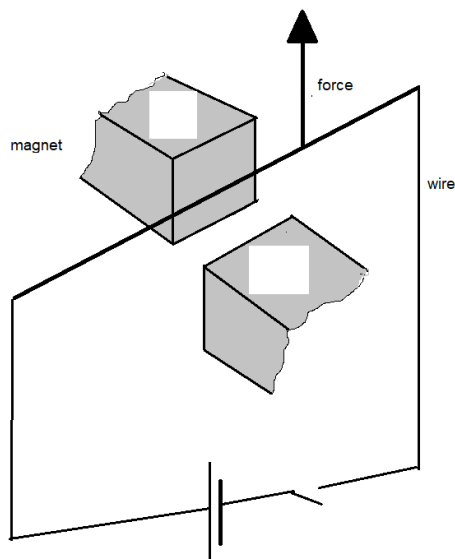
Current = \_\_\_\_\_ A [3]

- (ii) Select a suitable fuse for the plug attached to the kettle.  
The fuses available to you are rated 1A, 3A, 5A and 13A.

Fuse = \_\_\_\_\_ A [1]



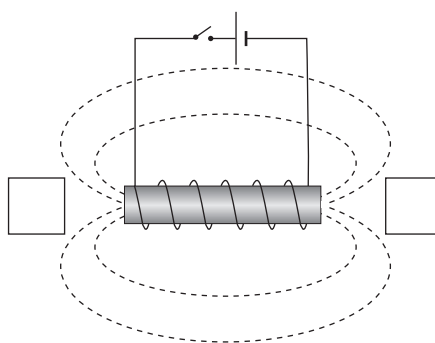
- 4 (a) A flexible wire is set up at right angles to a magnetic field as shown in the diagram below.  
The wire experiences a force as shown by the labelled arrow.  
Label the poles of the magnet, in the boxes provided, to show the direction of the magnetic field.



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[1]

- (b) When a current is passed through a coil of wire a magnetic field is created around the coil.



Source: Chief Examiner

- (i) On the diagram mark the north pole (N) and south pole (S) of the magnetic field created. Write your answers in the boxes provided. [1]
- (ii) On the diagram mark the direction of the magnetic field lines. [1]

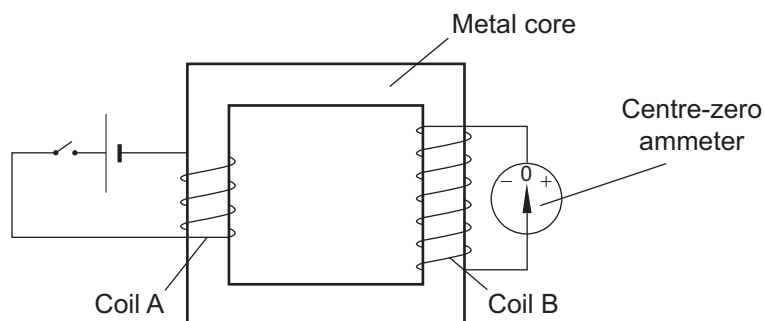
[Turn over



(c) Electromagnetic induction can be demonstrated using two coils of wire as shown below.

Coil A is in a circuit consisting of a cell and a switch.

Coil B is connected to a sensitive centre-zero ammeter.



Source: Chief Examiner

(i) The metal core is designed to increase the strength of the magnetic field.  
What metal is it made of?

\_\_\_\_\_ [1]



- (ii) Various actions are carried out using the apparatus shown on the opposite page.  
Below is a list of possible observations that describes the movement of the pointer on the centre-zero ammeter when the various actions are carried out in the order step 1, step 2, step 3 and finally step 4.

- A. Momentary deflection**
- B. Pointer is deflected and does not return to zero**
- C. No deflection**
- D. Pointer moves to one side then to the other continuously**

For each of the actions described below write the letter that corresponds to the observation in the boxes provided.

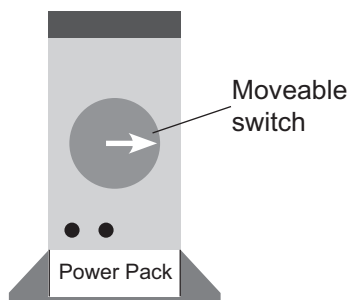
	Action	Observation (A to D)
Step 1	The switch in the circuit connected to coil A is closed.	
Step 2	The switch in the circuit connected to coil A remains closed.	
Step 3	The switch in the circuit connected to coil A is now opened.	
Step 4	The switch in the circuit connected to coil A is opened and closed repeatedly.	

[4]

[Turn over

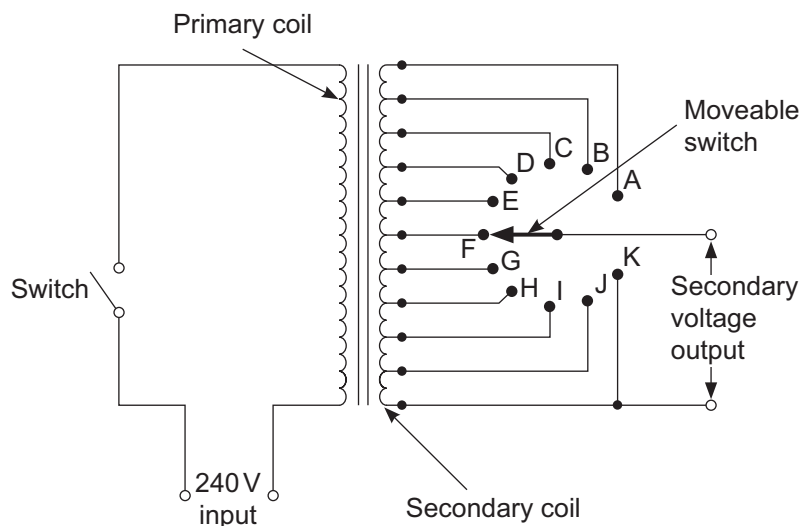


- (d) Power packs, like the one shown below, are used in schools. These power packs contain a transformer. The moveable switch is used to change the output voltage in steps.



Source: Chief Examiner

The circuit below shows the primary and secondary coils of the transformer used in the power pack. Moving the moveable switch from A to K allows the output voltage to be changed in fixed voltage steps.



Source: CCEA GCSE Physics G76-1H Paper 1 Higher 2000



- (i) The primary coil has a total of **3000 turns**.  
There are **250 turns** between terminals A and K on the secondary coil.  
Determine the maximum output voltage from the transformer.

The maximum secondary voltage output = \_\_\_\_\_ V [3]

- (ii) There are **25 turns** of wire between consecutive pairs of terminals  
e.g. between A and B or between B and C and so on.  
In what voltage steps can the voltage output be varied?  
**Show clearly how you get your answer.**

Voltage steps = \_\_\_\_\_ V [2]

- (iii) The 240 V input voltage is alternating current (a.c.).  
Describe what this means.

\_\_\_\_\_  
\_\_\_\_\_ [2]

- (iv) When the output voltage is 4 V, the current in the secondary coil is 6 A.  
Calculate the current in the primary coil.  
The efficiency of the transformer is 1 (100%).  
**Show clearly how you get your answer, starting with the equation you  
plan to use.**

Current = \_\_\_\_\_ A [2]

**[Turn over**



- 5 (a)** The various stages in the formation and evolution of the Universe are listed below. They are not in the order in which they occurred. In the box beside each statement place a number to show the correct order – 1 meaning the first to occur and 4 the last to occur.

formation of neutrons and protons

the rapid expansion and cooling of the Universe

the temperature drops so that electrons combine with neutrons and protons to form atoms of hydrogen

nuclei form

[3]

- (b)** Our Sun is a main sequence star. It has been stable for very many years. This stability occurs because two forces are in equilibrium.

- (i)** Name these two forces.

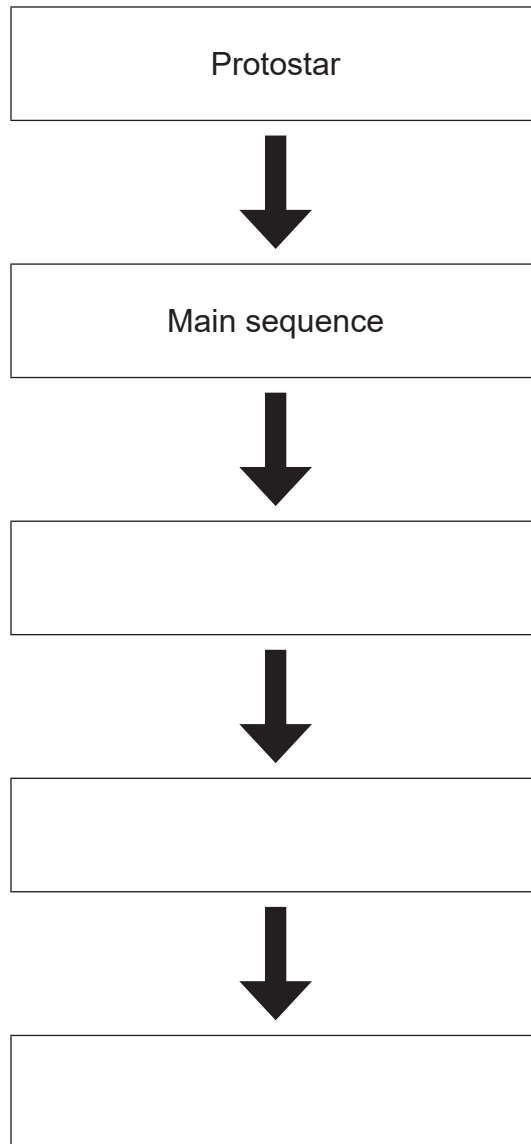
\_\_\_\_\_

\_\_\_\_\_

[2]



- (ii) Complete the sequence below to show the life cycle of a star with the mass of our Sun. The first two stages have been completed for you. Write your answers in the boxes provided.



[3]

[Turn over



**(c)** Our galaxy is called the Milky Way.  
Light from distant galaxies shows a Red Shift.

**(i)** What information is provided by this Red Shift?

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[1]

In 1964, American physicists picked up the same random noise on their radio telescope, no matter in which direction they pointed the radio telescope.

**(ii)** What is this radiation called?

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[1]

**(iii)** What explanation is given today for this radiation?

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[1]



- (d) Exoplanets are planets beyond our Solar System.  
The exoplanet called Ross 128 is  $1.05 \times 10^{17}$  m away from Earth.

Calculate the distance to Ross 128 in light years.

Give your answer to the **nearest whole number**.

There are  $3.15 \times 10^7$  seconds in one year.

The speed of light is  $3 \times 10^8$  m/s.

**Show clearly your calculation, starting with the equation you plan to use to get your answer.**

Number of light years = \_\_\_\_\_ [3]

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12410



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<b>For Examiner's use only</b>	
<b>Question Number</b>	<b>Marks</b>
1	
2	
3	
4	
5	

<b>Total Marks</b>	
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**Examiner Number**

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