

Centre Number	Examination Number



# EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level



5124/1

## Science

### Paper 1

Friday

11 NOVEMBER 2022

- Additional Materials:**  
 Answer Booklet  
 Electronic calculator (non programmable) and / or Mathematical tables  
 Graph paper  
 Soft clean eraser  
 Soft pencil (type B or HB is recommended)

Time: 2 hours

Marks: 85

#### Instructions to Candidates

- Write the **centre number** and your **examination number** on **every page** of this question paper and on the separate **Answer Booklet/Paper provided**.
- There are **three** sections in this paper; Section A, B and C.

**(i) Section A**

There are **twenty** questions in this section. Answer **all**. For each question, there are four possible answers, **A, B, C** and **D**. Choose the best one and mark it with a cross (X) on the **Answer Grid provided** in this question paper.

**(ii) Section B**

There are **nine** questions in this section. Answer **all** questions. Write your answers in the **spaces provided** in this question paper.

**(iii) Section C**

There are **three** questions in this section. Answer any **two** questions. Write your answers on a separate **Answer Booklet/Paper provided**.

**3 At the end of the examination:**

- Enter the numbers of the questions you have answered from Section C in the grid provided.
- Fasten the separate Answer Booklet/Papers used securely to the question paper.

#### Information for Candidates

- Any rough working should be done in this question paper.
- Cell phones are **not allowed** in the examination room.

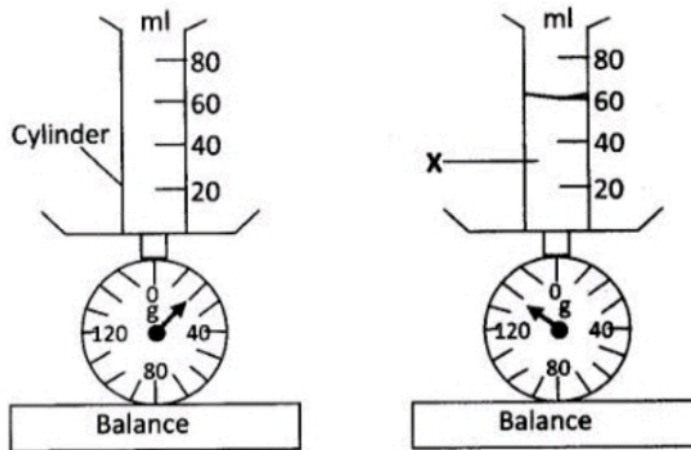
For Candidate's Use	For Examiner's Use	
	Marks Obtained	Examiner's Initials
Section A		
Section B		
1		
2		
3		
4		
5		
6		
7		
8		
9		
Section C		
Total		

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**A1** A wire has a length of 1.3m and a diameter of 0.4mm. Which of the following instruments will be most suitable to use to measure the length and the diameter?

	Length	Diameter
<b>A</b>	Micrometer screw gauge	Rule
<b>B</b>	Rule	Vernier calipers
<b>C</b>	Tape measure	Micrometer screw gauge
<b>D</b>	Vernier calipers	Micrometer screw gauge

**A2** The following diagrams show a measuring cylinder and a balance used to measure the density of liquid X.



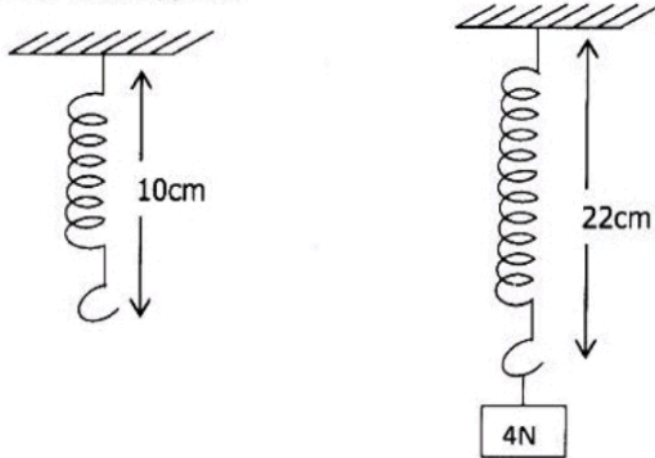
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What is the mass and volume of the liquid?

	Mass (g)	Volume (cm <sup>3</sup> )
<b>A</b>	140	60
<b>B</b>	120	60
<b>C</b>	20	60
<b>D</b>	20	80

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**A3** The following diagrams show an unstretched spring of 10cm and a stretched spring of 22cm when a force of 4N is applied.



Calculate the total length of the spring when a force of 6N is applied.

- A** 8cm
  - B** 18cm
  - C** 28cm
  - D** 38cm
- A4** A motor is used to lift a load of 400N through a height of 12m in 20s. What is the efficiency of the motor if the input power is 300W? [www.eczpastpapers.com](http://www.eczpastpapers.com)
- A** 60%
  - B** 65%
  - C** 75%
  - D** 80%
- A5** The following is a table containing information about particles in different states. Which of the substances is a solid?

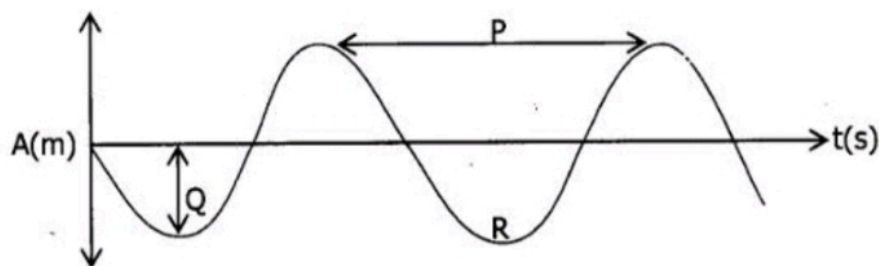
	Substance	Arrangement of particles	Spacing of particles	Movement of particles
<b>A</b>	L	Fixed pattern	Close together	Very mobile
<b>B</b>	M	Random	Far apart	Very mobile
<b>C</b>	N	Fixed pattern	Close together	Only vibrate
<b>D</b>	O	Random	Far	Only vibrate

- A6** If 1 200cm<sup>3</sup> of an ideal gas is heated at constant pressure from 27°C to 127°C, what will be its final volume?
- A** 900cm<sup>3</sup>
  - B** 1 600cm<sup>3</sup>
  - C** 4 600cm<sup>3</sup>
  - D** 5 644cm<sup>3</sup>

**A7** Which of the following is **not** an electromagnetic wave?

- A** Gamma ray
- B** Infra-red
- C** Ultra sound
- D** Ultra violet

**A8** The following diagram shows a water wave.



Which of the following correctly identifies the amplitude, trough and wavelength?

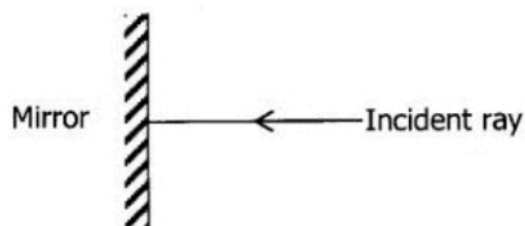
	Amplitude/cm	Trough	Wavelength/cm
<b>A</b>	P	Q	R
<b>B</b>	Q	R	P
<b>C</b>	Q	P	R
<b>D</b>	R	Q	P

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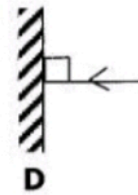
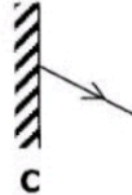
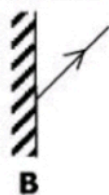
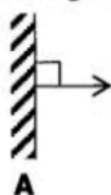
**A9** What is the upper limit of human hearing?

- A**  $2 \times 10^1 \text{ Hz}$
- B**  $2 \times 10^2 \text{ Hz}$
- C**  $2 \times 10^3 \text{ Hz}$
- D**  $2 \times 10^4 \text{ Hz}$

**A10** The following diagram shows a ray of light incident on a plane mirror at an angle of  $90^\circ$ .

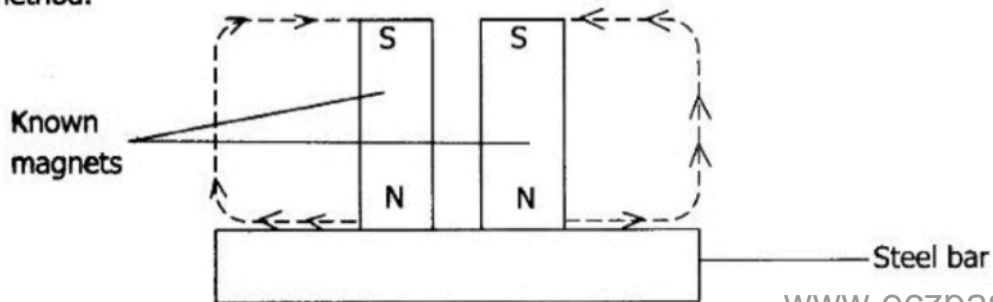


Which diagram shows the reflected ray?



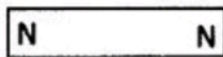
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- A11** A transparent material has a refractive index of 2.0. What is the critical angle of the transparent material?  
**A** 30°  
**B** 40°  
**C** 50°  
**D** 60°
- A12** A steel bar was being magnetised using an electrical method. Which of the following will increase the strength of the magnet produced?  
**A** Decreasing the alternating current passing through the coil.  
**B** Decreasing the direct current passing through the coil.  
**C** Increasing the alternating current passing through the coil.  
**D** Increasing the direct current passing through the coil.
- A13** The following diagram shows a steel bar being made into a magnet using double touch stroking method.

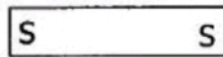


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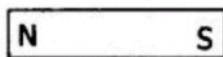
Which diagram shows the magnet made?



**A**



**B**

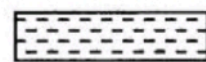


**C**

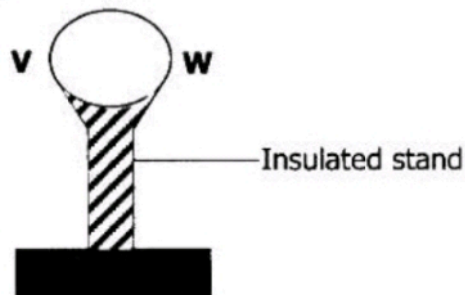


**D**

- A14** The following diagram shows a charged polythene rod which is moved near end **V** of the metal sphere mounted on an insulating stand.



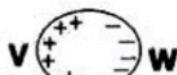
Charged polythene rod



Which of the following diagrams shows the correct charge distribution on the sphere?



**A**



**B**



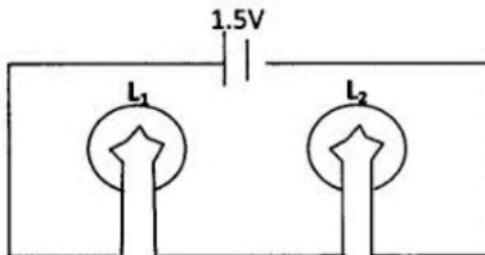
**C**



**D**

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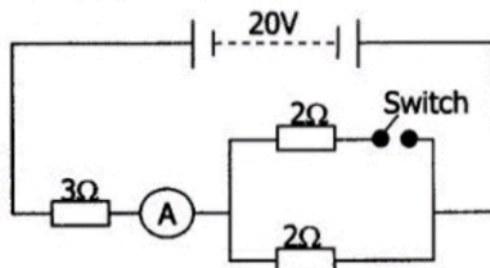
**A15** The diagram shows an electric circuit with two identical lamps  $L_1$  and  $L_2$ , connected in series to a 1.5V supply.



Which statement is correct?

- A** Both  $L_1$  and  $L_2$  will light with same brightness because they are at the same potential.
- B**  $L_1$  lights brighter than  $L_2$  because it is at a higher potential.
- C**  $L_1$  lights brighter than  $L_2$  because it is at a lower potential.
- D**  $L_2$  lights brighter than  $L_1$  because it is at a higher potential.

**A16** The diagram shows a circuit containing two resistors in parallel while one is in series with the two. The e.m.f from the battery is 20V.



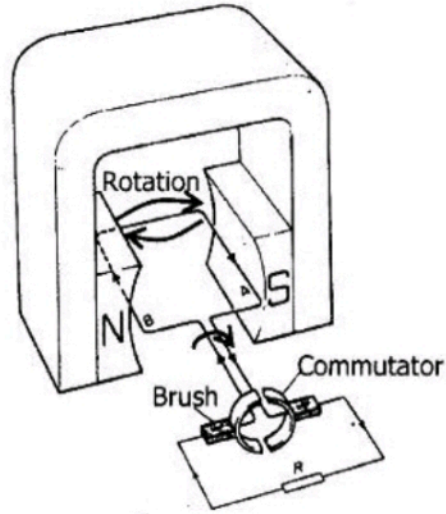
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Find the reading of the ammeter when the switch is open and when it is closed.

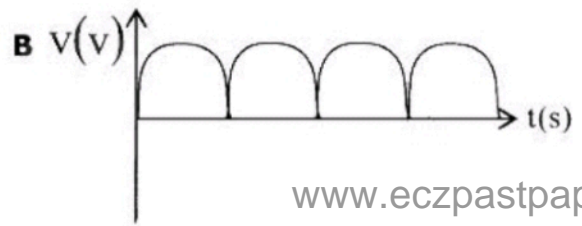
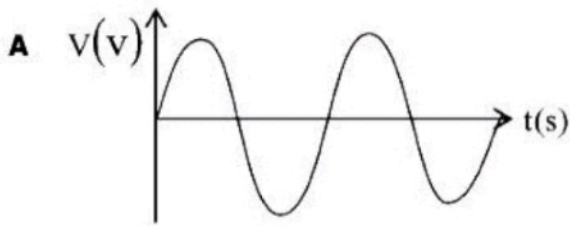
	Open	Closed
<b>A</b>	0.20A	0.25A
<b>B</b>	0.25A	0.20A
<b>C</b>	4.0A	5.0A
<b>D</b>	5.0A	4.0A

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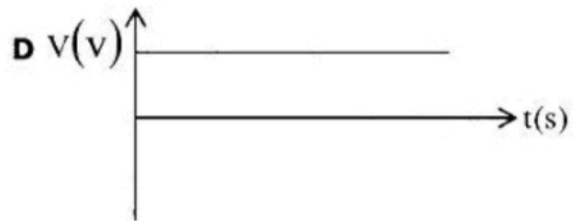
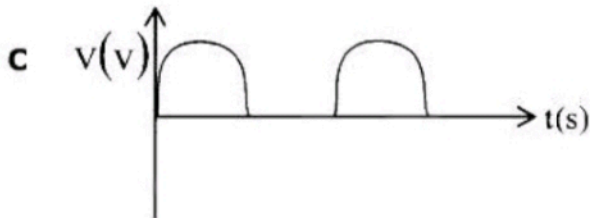
**A17** The following diagram shows a device that is used to generate electricity.



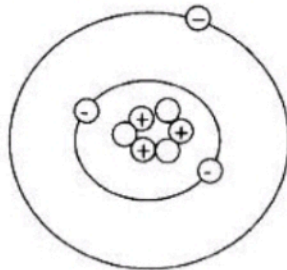
Which diagram shows the graph of the electricity generated?



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**A18** The diagram shows the structure of an atom.



Which of the following shows the correct number of protons, neutrons and electrons?

	Protons	Neutrons	Electrons
<b>A</b>	1	2	6
<b>B</b>	3	3	3
<b>C</b>	5	3	1
<b>D</b>	6	2	1

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**A19** Which of the following equations correctly shows a fusion reaction?

- A**  ${}^2_1\text{H} + {}^3_1\text{H} \rightarrow {}^4_2\text{He} + {}^1_0\text{n} + \text{energy}$
- B**  ${}^{24}_{11}\text{Na} \rightarrow {}^{24}_{12}\text{Mg} + {}^0_{-1}\text{e} + \gamma + \text{energy}$
- C**  ${}^{210}_{84}\text{Po} \rightarrow {}^{206}_{82}\text{Pb} + {}^4_2\text{He} + \text{energy}$
- D**  ${}^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{92}_{36}\text{kr} + {}^{141}_{56}\text{Ba} + 3{}^1_0\text{n} + \text{energy}$

**A20** Given that, the half-life of thoron is 52s, how long will it take for the activity of the thoron sample to be reduced to  $\frac{1}{64}$  of its initial value?

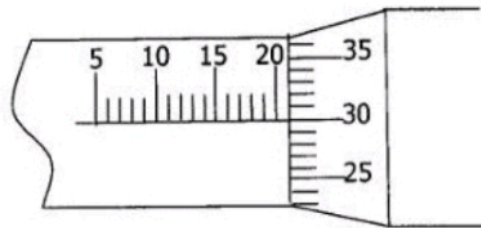
- A** 156s
- B** 208s
- C** 260s
- D** 312s

**SECTION B: [45 MARKS]**

Answer **all** questions in this section. Write your answers in the spaces provided in this question paper.

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**B1** Figure B1.1 shows part of a micrometer screw gauge.



**Figure B1.1**

(a) (i) What is the reading on the micrometer screw gauge?

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

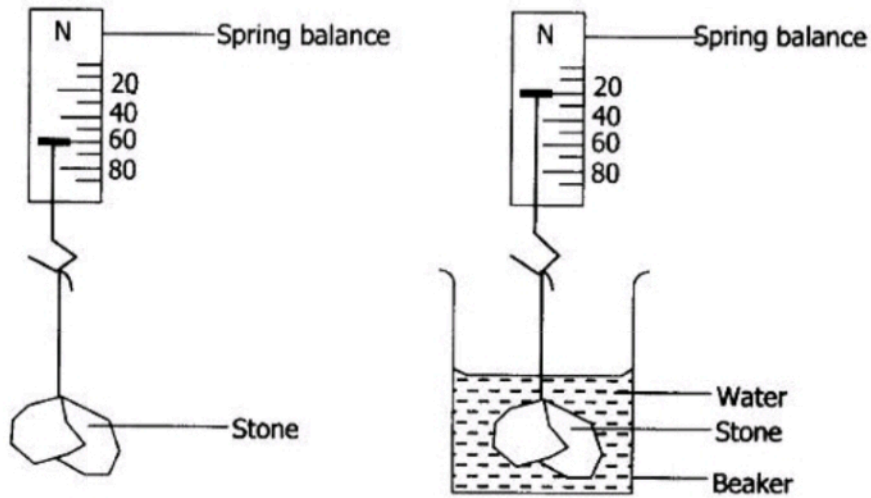
(ii) State **one** use of a micrometer screw gauge.

..... [1]

**[Total: 2 marks]**

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**B2** Figure B2.1 shows an object first weighed in air and then when it was immersed in water.



**Figure B2.1**

(a) Determine the weight of the stone in air.

..... [1]

(b) (i) Define upthrust.

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

(ii) From the diagrams shown in **Figure B2.1**, determine the upthrust of the water.

Upthrust of water: ..... [2]

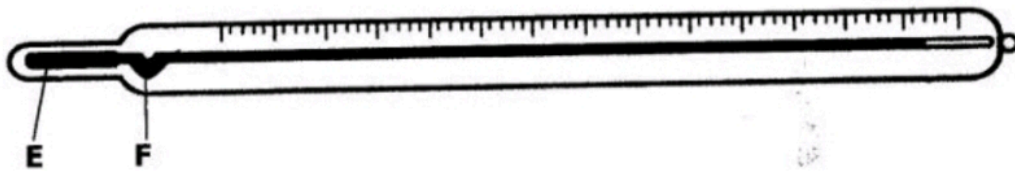
(c) Calculate the mass of the stone. (Take  $g$  as  $10\text{N/kg}$ )

Mass of stone: ..... [2]

**[Total: 6 marks]**

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**B3** Figure B3.1 shows a device used to measure temperature.



**Figure B3.1**

(a) Define thermal expansion.

..... [1]

(b) (i) Identify the parts labelled **E** and **F**.

**E** ..... [1]

**F** ..... [1]

(ii) Name a liquid that can be used in the device shown in **Figure B3.1**.

..... [1]

(iii) Mention **one** way in which the sensitivity of the device shown in **Figure B3.1** can be improved.

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

**[Total: 5 marks]**

**B4** (a) Two successive crests of approaching water waves are separated by a distance of 1.8m. It takes 0.3s for one crest to cover the distance of 1.8m.

(i) At what speed is the wave travelling?

Speed = ..... [1]

(ii) What distance is covered by the wave in 2 minutes?

Distance = ..... [1]

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- (b) (i) Calculate the frequency of a sound wave with speed 340m/s and wavelength 0.5m?

Frequency = ..... [1]

- (ii) Could this sound with the frequency calculated in **b(i)** be heard?  
 ..... [1]

- (iii) Justify your answer to **b(ii)**.  
 ..... [1]

**[Total: 5 marks]**

- B5 (a)** Infra-red and radio waves are components of the electromagnetic spectrum.

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- (i) Mention **one** use of each of infra-red radiation and radio waves.  
 Infra-red: ..... [1]

Radio waves: ..... [1]

- (ii) Mention **one** common property of infra-red and radio waves.  
 ..... [1]

- (iii) Give **one** harmful effect of electromagnetic waves.  
 ..... [1]

- (b) Give **one** difference (in propagation) between sound waves and electromagnetic waves.  
 ..... [1]

- (c) Mention **one** factor that affects the loudness of a sound wave.  
 ..... [1]

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- (d) A learner sees a flash of lightning and hears the thunder after 4.5 seconds. How far is the lightning from the learner? (Take speed of sound in air to be 340m/s)

Distance from the learner = ..... [2]

[Total: 8 marks]

- B6 Figure B6.1 shows magnetic field lines between the poles of two magnets.

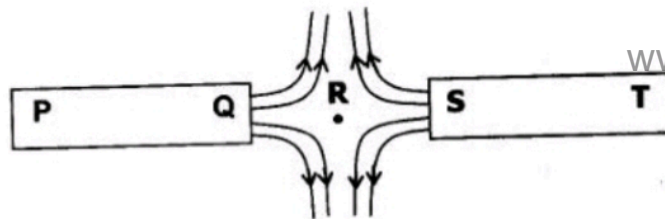


Figure B6.1

- (a) Name point R. .... [1]
- (b) If P is a south pole, what are the poles Q and T?  
 Q: ..... [1]  
 T: ..... [1]

[Total: 3 marks]



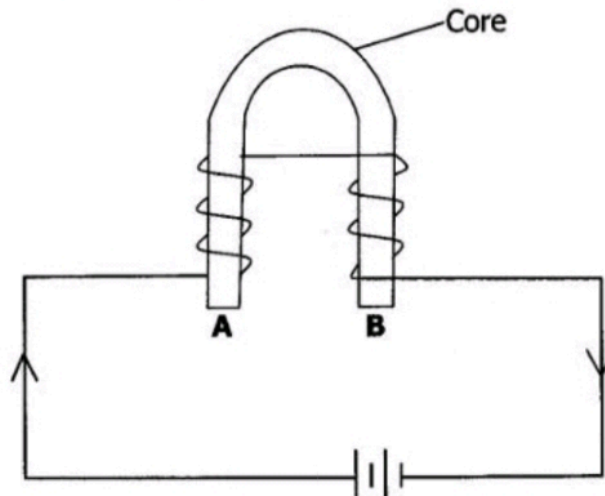
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(ii) power of the phone when fully charged.

Power = ..... [1]

[Total: 6 marks]

**B8** Figure B8.1 shows a coil of insulated wire wound around a U-shaped core **AB** and connected to a battery to make an electromagnet.



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Figure B8.1

(a) State the property of end **A**.

..... [1]

(b) Describe **one** way of increasing the strength of this electromagnet.

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

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(c) (i) What material must be used for the core?  
 ..... [1]

(ii) Justify your answer in B8 c(i).  
 ..... [1]

[Total: 4 marks]

B9 (a) (i) Define half-life.  
 ..... [1]

(ii) Iodine ( $^{132}_{53}\text{I}$ ) decays by emitting a beta particle to produce a new element Xe and a gamma ray. Write an equation for this decay.  
 ..... [2]

(iii) Give one property of a beta particle.  
 ..... [1]

(b) (i) Mention one medical use of radioactive substances.  
 ..... [1]

(ii) Explain the effect of radioactive substances on the environment.  
 ..... [1]

[Total: 6 marks]

**SECTION C: [20 MARKS]**

Answer any two (2) questions from this section in the separate Answer Booklet provided.

C1 Figure C1.1 shows the velocity and time recorded for an athlete running in a race. The mass of the athlete is 75kg.

<b>Velocity m/s</b>	0.0	3.5	7.1	8.2	9.1	9.5	9.8	10.0	10.1	10.2
<b>Time (s)</b>	0	1	2	3	4	5	6	7	8	9

Figure C1.1

(a) Plot a velocity-time graph for results recorded in Figure C1.1. [4]

(b) Calculate the acceleration of the athlete in the first 2 seconds. [2]

(c) Calculate the

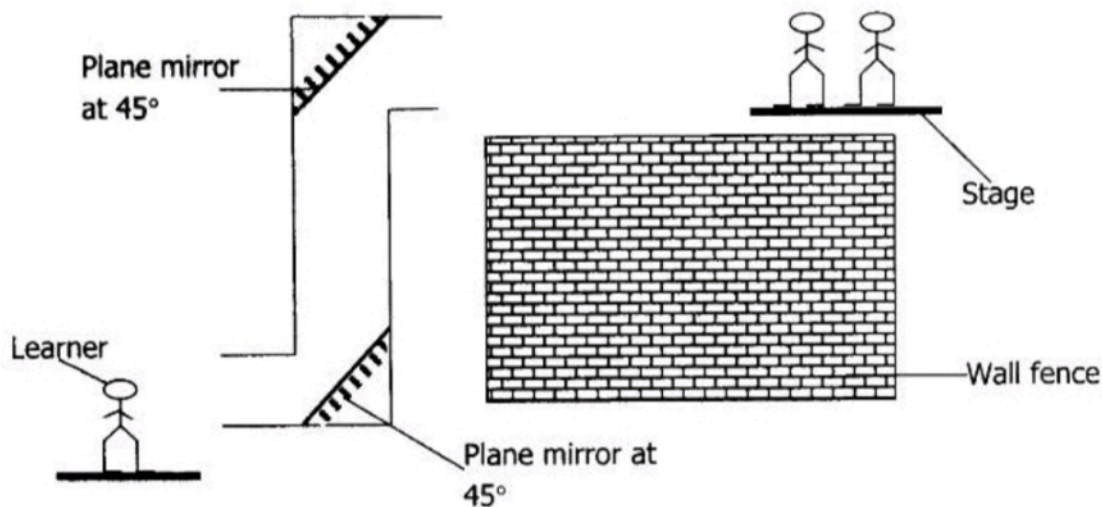
(i) force that caused the acceleration in the first 2 seconds; [2]

(ii) kinetic energy during the first 2 seconds of the race. [2]

[Total: 10 marks]

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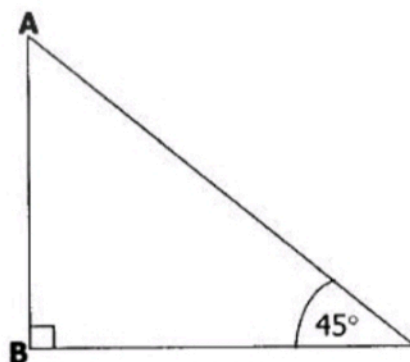
**C2 (a) Figure C2.1** shows a learner viewing an activity over a wall fence using the instrument shown in **Figure C2.1**.



**Figure C2.1**

- (i) Name the instrument used in **Figure C2.1**. [1]
- (ii) Copy and complete **Figure C2.1** by drawing a ray of light to show how the learner viewed the activity on stage. [2]

**(b) Figure C2.2** shows a glass prism with one face labelled **AB**. The refractive index of the glass prism is 1.5.



**Figure C2.2**

- (i) Define critical angle. [1]
- (ii) Copy and complete **Figure C2.2** to show a narrow beam of light which is incident on the face **AB** of the glass prism until it emerges out of the prism. [2]
- (iii) Calculate the critical angle of the glass prism. [2]
- (iv) Give **two** uses of total internal reflection. [2]

**[Total: 10 marks]**

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- C3 (a)** Define radioactivity. [1]
- (b)** Radon nuclide ( $^{222}_{86}\text{Ra}$ ) decays to form polonium (Po) by emission of an alpha particle. Write the decay equation. [2]
- (c)** **Figure C3.1** shows the results obtained to determine the half-life of the radioactive element.

<b>Activity (counts/min)</b>	42.0	34.0	24.0	18.5	14.0	9.0	7.5	5.0
<b>Time (min)</b>	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5

**Figure C3.1**

- (i)** Plot a graph of activity (counts/min) against time (min) for the element. [4]
- (ii)** Determine from the graph the half-life of the element. [2]
- (iii)** State **one** possible source of background radiations. [1]

**[Total: 10 marks]**