



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.

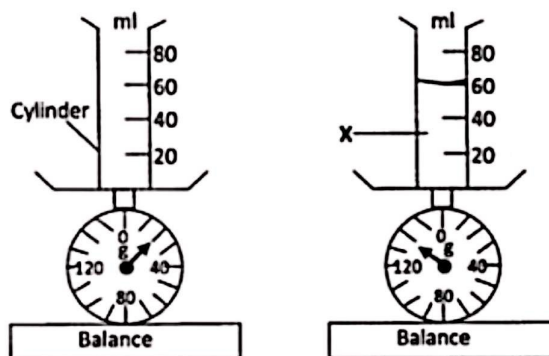
For Candidate's Use	For Examiner's Use	
	Marks Obtained	Examiner's Initials
Section A		
Section B		
1		
2		
3		
4		
5		
6		
7		
8		
9		
Section C		
Total		

Centre Number	Examination Number										

- 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
A	Micrometer screw gauge	Rule
B	Rule	Vernier calipers
C	Tape measure	Micrometer screw gauge
D	Vernier calipers	Micrometer screw gauge

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

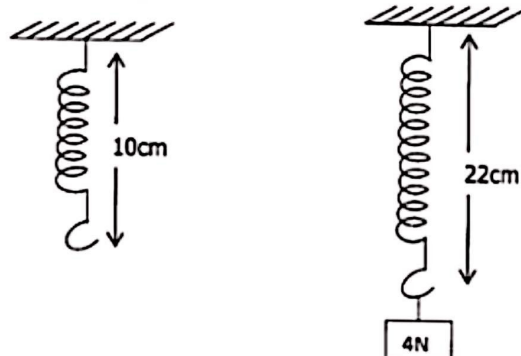


What is the mass and volume of the liquid?

	Mass (g)	Volume (cm ³)
A	140	60
B	120	60
C	20	60
D	20	80

Centre Number	Examination Number

- 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?
- 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
A	L	Fixed pattern	Close together	Very mobile
B	M	Random	Far apart	Very mobile
C	N	Fixed pattern	Close together	Only vibrate
D	O	Random	Far	Only vibrate

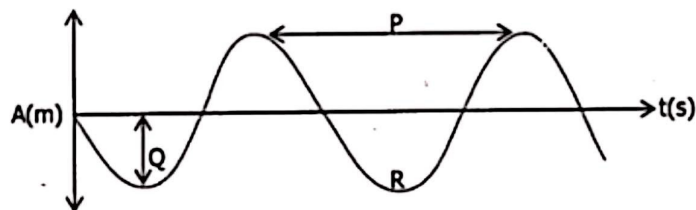
- A6** If 1 200cm³ of an ideal gas is heated at constant pressure from 27°C to 127°C, what will be its final volume?
- A** 900cm³
B 1 600cm³
C 4 600cm³
D 5 644cm³

Centre Number	Examination Number

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.



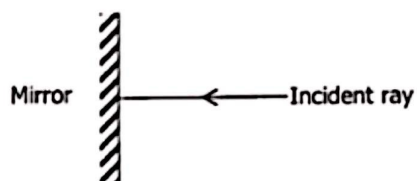
Which of the following correctly identifies the amplitude, trough and wavelength?

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

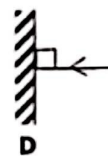
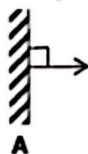
A9 What is the upper limit of human hearing?

- 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° .

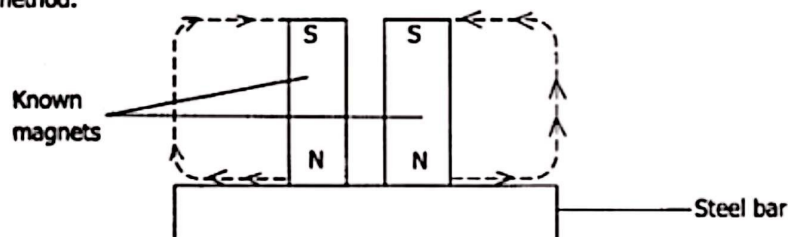


Which diagram shows the reflected ray?

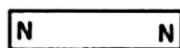


Centre Number				Examination Number											

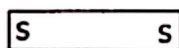
- A11** A transparent material has a refractive index of 2.0. What is the critical angle of the transparent material?
- A** 30°
B 40°
C 50°
D 60°
- A12** A steel bar was being magnetised using an electrical method. Which of the following will increase the strength of the magnet produced?
- A** Decreasing 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.



Which diagram shows the magnet made?



A



B

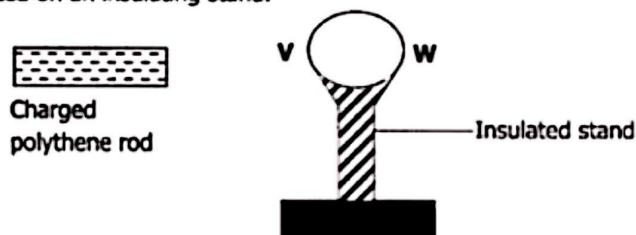


C



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.



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



A



B



C

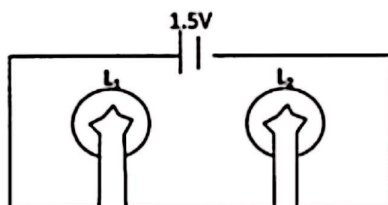


D

Centre Number	Examination Number

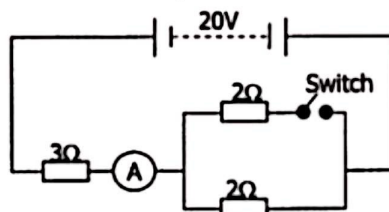
Page 7 of 18

- 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.

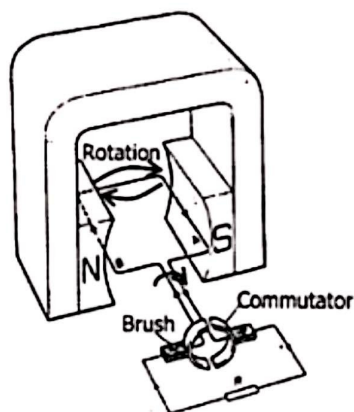


Find the reading of the ammeter when the switch is open and when it is closed.

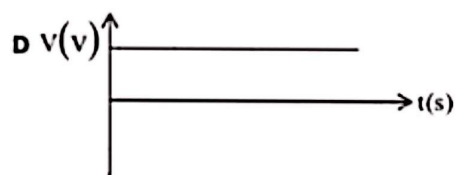
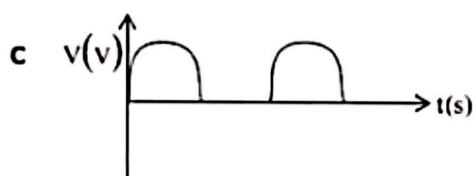
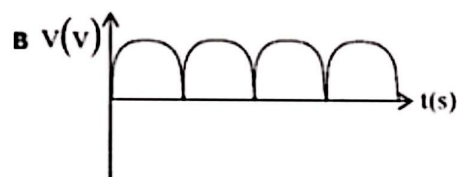
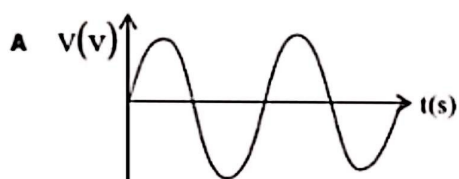
	Open	Closed
A	0.20A	0.25A
B	0.25A	0.20A
C	4.0A	5.0A
D	5.0A	4.0A

Centre Number	Examination Number

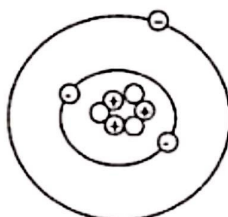
A17 The following diagram shows a device that is used to generate electricity.



Which diagram shows the graph of the electricity generated?



A18 The diagram shows the structure of an atom.

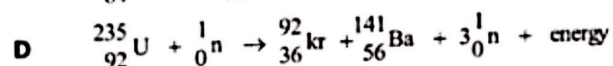
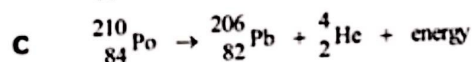
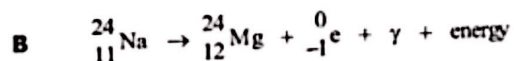
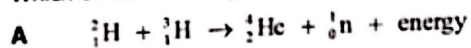


Which of the following shows the correct number of protons, neutrons and electrons?

	Protons	Neutrons	Electrons
A	1	2	6
B	3	3	3
C	5	3	1
D	6	2	1

Centre Number	Examination Number

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



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.

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

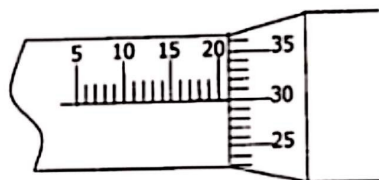


Figure B1.1

(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]

Centre Number				Examination Number											

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

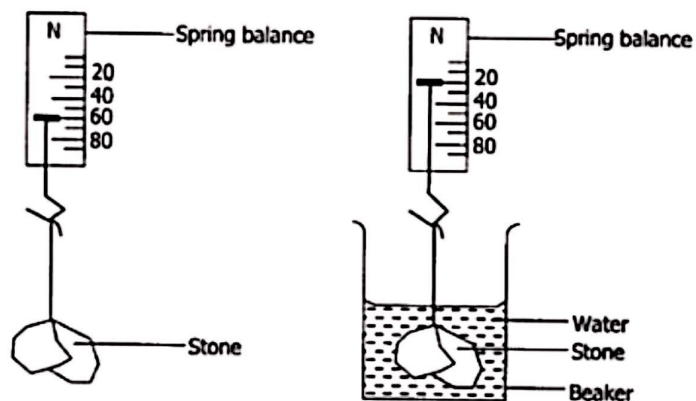


Figure B2.1

(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 10N/kg)

Mass of stone: [2]

[Total: 6 marks]

Centre Number	Examination Number									

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

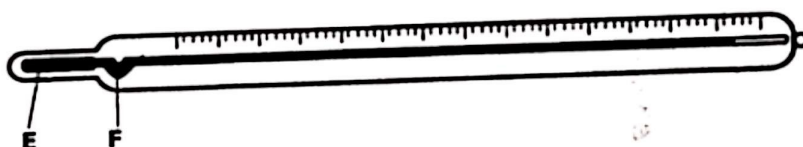


Figure B3.1

(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]

Centre Number				Examination Number															

- (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.

- (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]

Centre Number	Examination Number

- (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.

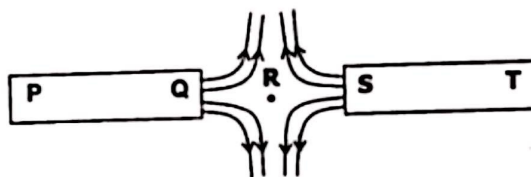


Figure B6.1

- (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]

Centre Number				Examination Number							

B7 Figure B7.1 shows a graph of voltage (V) against time (t) when charging a phone battery.

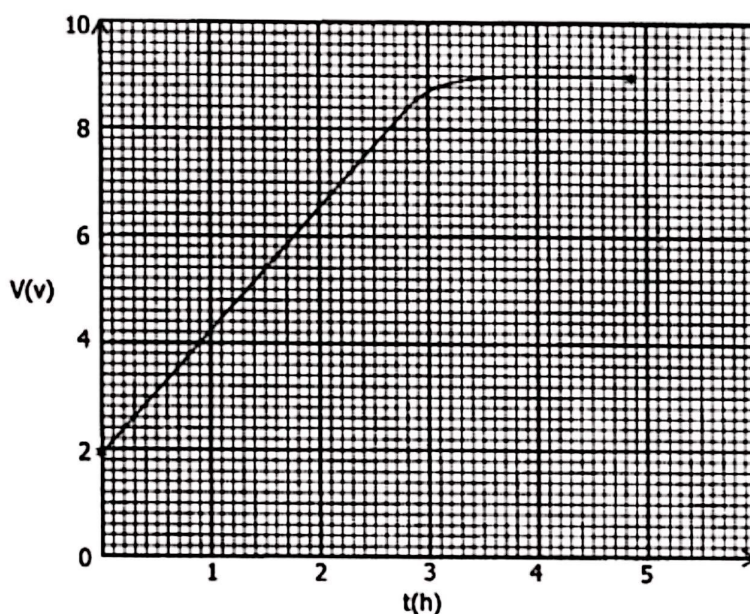


Figure B7.1

- (a) (i) What was the voltage in the phone at the start of charging?
..... [1]
- (ii) How long did it take the phone to reach full charge?
..... [1]
- (iii) What was the maximum charge voltage?
..... [1]
- (b) If the working current of the phone is 0.6A, calculate the
(i) charge accumulated by the phone in 2 hours;

Accumulated charge = [2]

Centre Number	Examination Number									

(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.

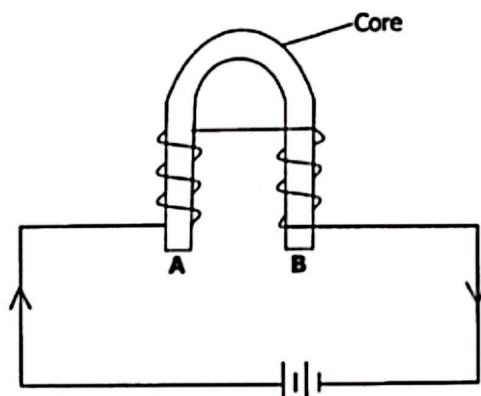


Figure B8.1

- (a) State the property of end A. [1]
.....
- (b) Describe one way of increasing the strength of this electromagnet. [1]
.....
.....

Centre Number				Examination Number											

- (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 ($^{131}_{53}\text{I}$) 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.

Velocity m/s	0.0	3.5	7.1	8.2	9.1	9.5	9.8	10.0	10.1	10.2
Time (s)	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]

Centre Number	Examination Number

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

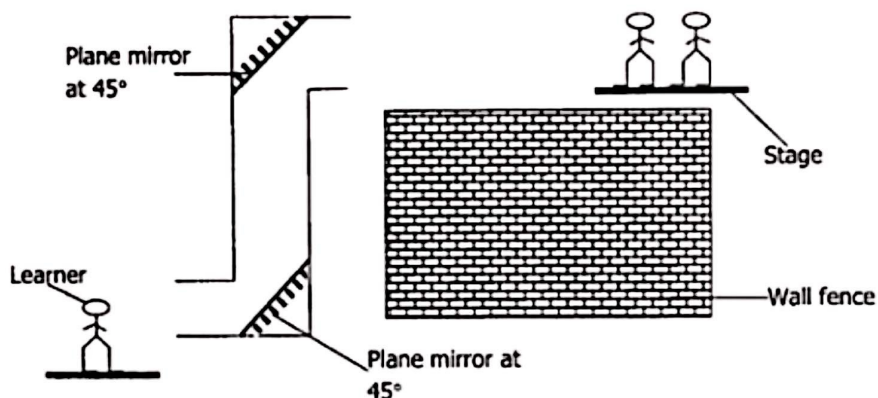


Figure C2.1

- (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.

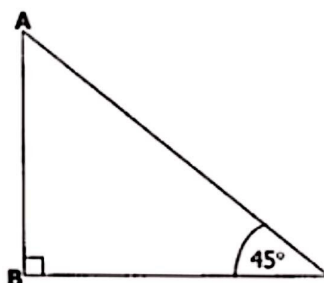


Figure C2.2

- (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]

Centre Number				Examination Number											

- 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.

Activity (counts/min)	42.0	34.0	24.0	18.5	14.0	9.0	7.5	5.0
Time (min)	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]