Centre Number				Examination Number									
			.										

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

5124-1-048-844

Science 5124/1

Paper 1

2020

Additional Material(s):

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

1 Write the **centre number** and your **examination number** on every page of this question paper and on the separate Answer Booklet/paper provided.

2 There are **three** sections in this paper.

(i) Section A

There are **twenty** questions in this section. Answer all questions. For each question, there are four possible answers, **A**, **B**, **C** and **D**. Choose the one you consider correct and record your choice by marking it with a cross (X) on the **answer grid provided** on the question paper.

(ii) Section B

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

Read very carefully the instructions on the answer sheet.

(iii) Section C

Answer any **two** questions. Write your answer on a separate **answer booklet provided**.

Candidate's Use	Examiner's Use
Section A	
Section B	
Section C 1	
2	
3	
Total	

Information for candidates

1 Any rough working should be done in this question paper.

2 **At the end of the examination:**

(i) Fasten the separate answer booklet/papers used securely to the question paper.

(ii) Circle the numbers of the section C questions you have answered in the grid below.

3 The **Periodic Table** is printed on page **18**.

4 **Cell phones are not allowed in the examination room.**

5 **Do not open this booklet until you are told to do so.**

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			.									

ANSWER GRID FOR SECTION A

Put a cross (X) on the letter indicating your choice of answer.

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D

11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D

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SECTION A [20 marks]

Answer **all** the questions on the answer grid provided.

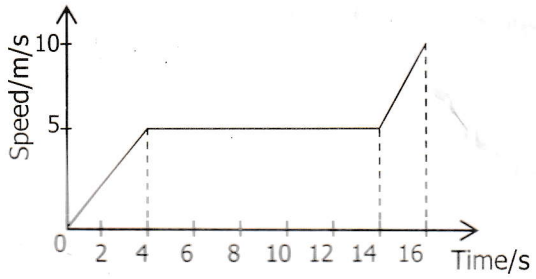
A1 How many significant figures are there in the number 0.050200?

A 2
B 3
C 5
D 6

A2 A stone of mass 400g is lowered into a measuring cylinder containing water. The water level rises from 300cm^3 to 500cm^3. What is the density of the stone?

A 0.50g/cm^3
B 0.80g/cm^3
C 1.33g/cm^3
D 2.00g/cm^3

A3 The graph below shows the speed of an athlete during a race.



What is the distance travelled by the athlete?

A 50m
B 65m
C 75m
D 90m

A4 A 4kg brick is dropped from the top of a building whose height is 30m. What is the velocity with which it reaches the ground?

A 7.5m/s
B 24.5m/s
C 120.0m/s
D 1 200.0m/s

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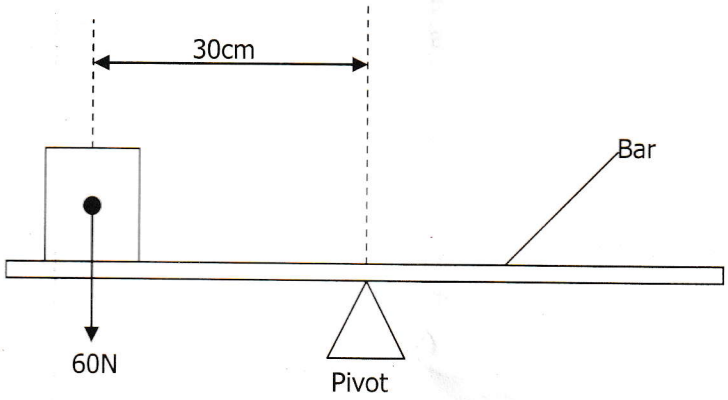
A5 The diagram below shows an object moving with a constant velocity when a force E of 30N is applied.

What is the value of the opposing force **F**?

A 0N
B 15N
C 30N
D 300N

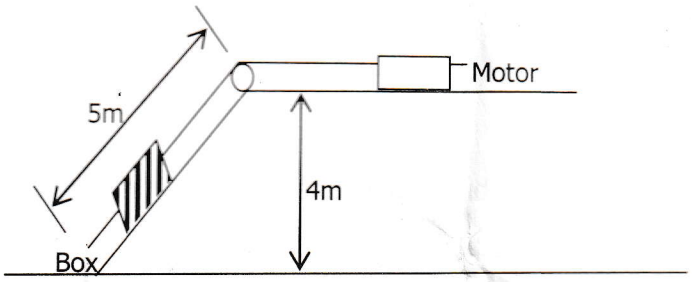
A6 A 60N object is placed on a uniform bar that was balanced at its mid-point as shown in the diagram below.



Which of the following will rebalance the beam?

	Magnitude of force	Position of force
A	30N	60cm to the left of the pivot
B	30N	60cm to the right of the pivot
C	45N	45cm to the right of the pivot
D	90N	20cm to the left of the pivot

A7 A motor is used to pull a 10kg box along a 5 meter long incline to the top of the decline as shown in the diagram below.



Ignoring all frictional forces, determine the work done against gravity in pulling the box from the foot of the incline to the top of the decline. (Take g as 10N/kg)

A 40J
B 50J
C 400J
D 500J

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A8 A girl whose mass is 50kg climbs a ladder of height 8m in 10 seconds. What is the power developed by the girl?

A 40W

B 400W

C 500W

D 5 000W

A9 A machine with a velocity ratio of 6 requires 800J of work to raise a load of 60kg through a vertical distance of 1m.

Find the efficiency of the machine.

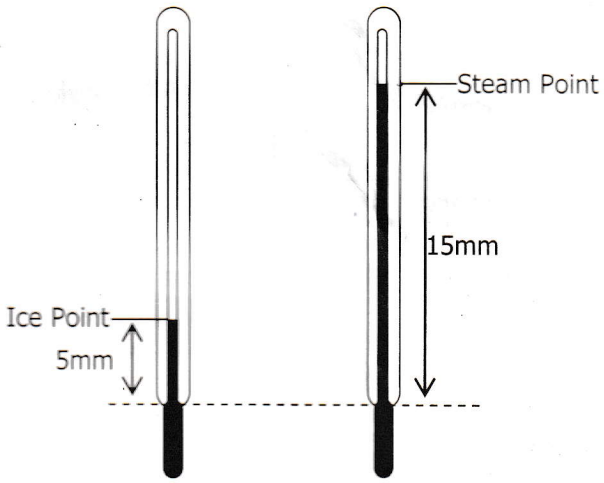
A 0.45

B 0.75

C 4.5

D 75.0

A10 The diagrams below show the length of mercury threads at the ice and steam points.



What will be the temperature if the length of the mercury thread is 25mm?

A 5°C

B 8°C

C 33°C

D 50°C

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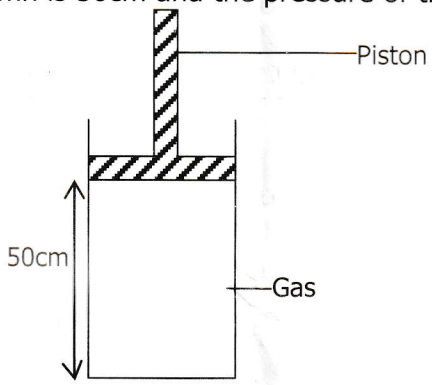
A11 The diagram below shows a cylinder with a gas trapped inside at a constant temperature. The length of the gas column is 50cm and the pressure of the gas is 20Pa.



If the piston is pushed a distance of 30cm inside, what is the new pressure of the gas?

A 8Pa

B 12Pa

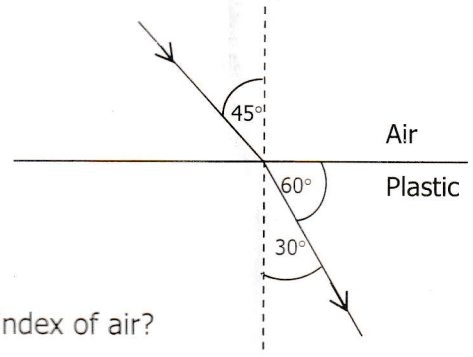
C 30Pa

D 50Pa

A12 Which of the following correctly gives the properties of a sound wave?

	Nature	**Speed in air**
A	Longitudinal	340m/s
B	Longitudinal	3.0×10^8m/s
C	Transverse	340m/s
D	Transverse	3.0×10^8m/s

A13 The diagram below shows the movement of a ray of light from air to plastic.



Which ratio is the refractive index of air?

A $\frac{Sin\ 45°}{Sin\ 60°}$

B $\frac{Sin\ 45°}{Sin\ 30°}$

C $\frac{Sin\ 30°}{Sin\ 45°}$

D $\frac{Sin\ 60°}{Sin\ 45°}$

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A14 The diagram below shows the main sections of the electromagnetic spectrum in order of increasing frequency.

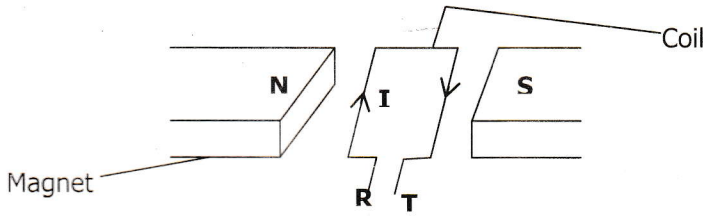
Radio waves		Q	Light			Gamma rays

Increasing frequency →

Which of the following is an application used by **Q**?

A Sterilisation
B Satellite television
C Killing cancerous cells
D Television remote controller

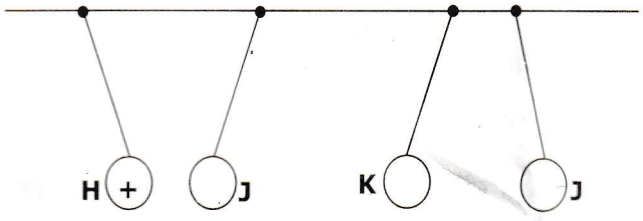
A15 The diagram below shows a coil in a magnetic field, connected to a DC supply.



As the current I flows in the coil, in which direction will the coil rotate and what must be connected to parts **R** and **T**?

	Direction of rotation of coil	**Part Connected to R and T**
A	Clockwise	Split-ring commutator
B	Clockwise	Slip-rings
C	Anticlockwise	Split-ring commutator
D	Anticlockwise	Slip-rings

A16 The diagram below illustrates what happens when metal balls **H**, **J** and **K** suspended by insulating threads are brought closer to each other.



If the charge on **H** is positive, what charges are on ball **J** and **K**?

	J	**K**
A	Negative	Positive
B	Negative	Negative
C	Positive	Negative
D	Negative	Positive

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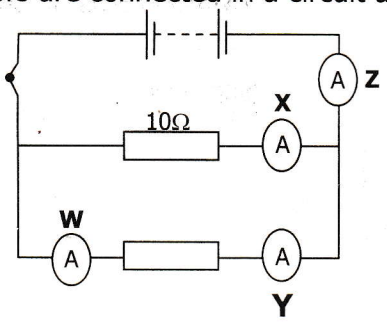
A17 Two resistors are connected in a circuit as shown in the diagram below.



Which labelled ammeter has the highest current reading?

A W

B X

C Y

D Z

A18 What is the cost of running a 100W lamp for 30 minutes if electrical energy costs K10 per unit.

A K0.05

B K0.50

C K30.0

D K300.0

A19 The following can be used in detecting alpha particles, beta particles and gamma rays.

1 Photographic film

2 Diffusion cloud chamber

3 G-m tube

4 Spark-counter

Which of the above **cannot** be used to detect beta particles and gamma rays?

A 4

B 1 and 4

C 2 and 4

D 1, 2 and 3

A20 A radioactive source which has a half-life of 1 hour gives a count rate of 100 counts per second at the start of an experiment and 25 counts per second at the end.

How long in hours did the experiment take?

A 1

B 2

C 3

D 4

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Section B [45 marks]

Answer **all** questions in this section.

Write your answers in the spaces provided on the question paper.

B1 An object of mass 75kg on earth is taken to the moon where the gravitational field strength is 1.6N/kg.

(a) What is the mass of the object on the moon?

..... [1]

(b) Calculate the weight of the object on the moon.

Weight: ..... [2]

(c) Give **two** differences between mass and weight.

(i) .....

..... [1]

(ii) .....

..... [1]

[Total: 5 marks]

B2 A bullet of mass 50g moving with an initial speed of 500m/s penetrates a wall and comes to rest in 0.2 seconds.

(a) Calculate the deceleration of the bullet over the 0.2 seconds.

Deceleration: ..... [2]

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(b) Determine the retarding force acting on the bullet.

Force:..... [2]

[Total: 4 marks]

B3 **Figure B3.1** below shows a pulley systems.

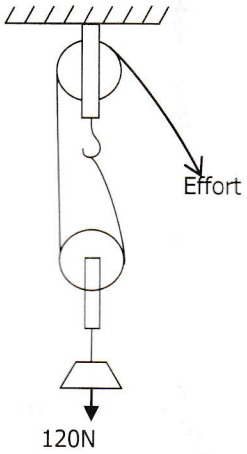

Figure B3.1

(a) State the velocity ratio of the pulley shown in **figure B3.1** above.

..... [1]

(b) If the efficiency of the pulley is 75%, what is its M.A?

M. A: ..... [2]

(c) If the load is 120N, what is the size of the effort?

Effort:..... [2]

(d) What work is done by the effort if the load is lifted 0.5m?

Work done: ..... [2]

[Total: 7 marks]

B4 Waves travel at a speed of 30m/s through a medium. If 10 waves pass through a point per second,

(a) calculate the

(i) frequency of the wave,

Frequency: ..... [2]

(ii) wavelength of the wave.

Wavelength: ..... [2]

(b) What does loudness of a sound depend on?

..... [1]

[Total: 5 marks]

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B5 **Figure B5.1** below shows a ray of light moving from one medium to another.

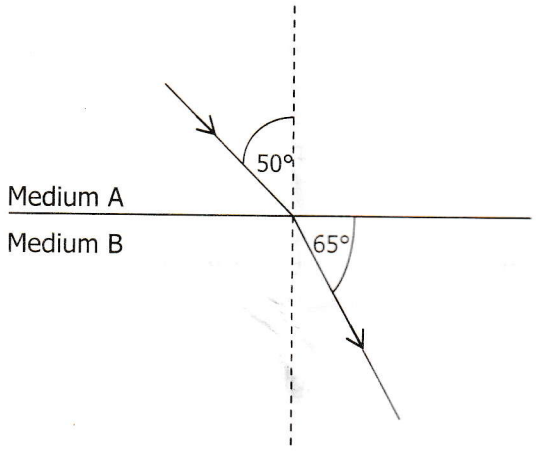

Figure B5.1

(a) Find the angle of refraction.

Angle of refraction: ..... [1]

(b) Calculate the refractive index of medium **B**.

Refractive index: ..... [2]

(c) Which of the two media is denser than the other?

..... [1]

[Total: 4 marks]

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B6 **Figure B6.1** shows an object **O** placed in front of a thin converging lens of focal point **F**.

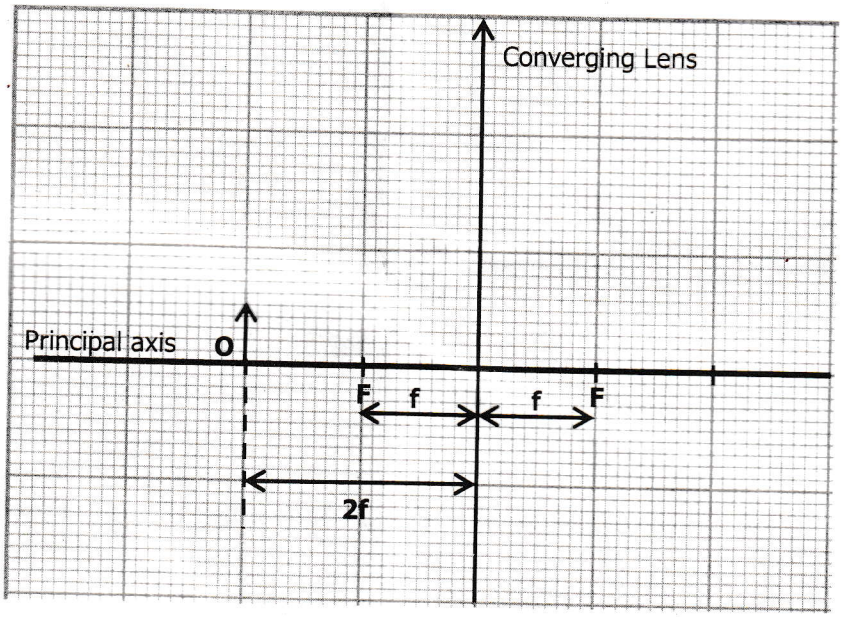

Figure B6.1

(a) Complete the ray diagram to locate the position of the image formed by the converging lens. [2]

(b) State the characteristics of the image formed.

..... [1]

(c) Calculate the magnification of the lens.

Magnification: ..... [2]

[Total: 5 marks]

B7 A step-up transformer increases the voltage of an a.c. supply from 110V to 220V. The primary coil dissipates a power of 1.1 kW and the transformer has an efficiency of 100%.

(a) If the number of turns in the primary coil is 400, how many turns are in the secondary coil?

Turns in secondary coil: ..... [2]

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(b) How much current flows in the

(i) primary coil,

Ip: ..... [2]

(ii) secondary coil?

Is: ..... [2]

[Total: 6 marks]

B8 **Figure B8.1** below shows two pairs of 3.0Ω resistors connected to a 6.0V battery.

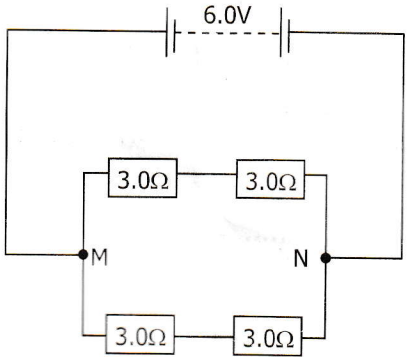

Figure B8.1

Calculate the

(a) resistance in the circuit between **M** and **N**,

Resistance:..... [2]

(b) current through the battery,

Current: ..... [2]

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(c) power developed in the battery.

Power: ..... [2]

[Total: 6 marks]

B9 Radioactive iodine is used to treat tumours of the thyroid gland. It decays by emitting beta particles and gamma radiation.

The beta emitting process is represented by the following equation:

$$^{131}_{53}\mathrm{I} \rightarrow {}^{A}_{Z}\mathrm{Xe} + {}^{0}_{-1}\mathrm{e}$$

(a) What is the nucleon number of the new nucleus Xe formed?

Nucleon Number: ..... [1]

(b) The half-life of iodine-131 is 8 days. The total dose of iodine given to a patient initially emits 4×10^8 rays per second.

How many gamma rays does the total dose of iodine emit each second after 24 days?

Number of gamma rays: ..... [2]

[Total: 3 marks]

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Section C [20 marks]

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

C1 **(a)** **(i)** Explain the term absolute zero temperature. [1]

(ii) State Charles' law. [1]

(b) The table **C1.1** below displays results of temperature against volume of air at a constant pressure of 720mm Hg.

Temp (°C)	17	28	39	60	80	100
Volume (cm^3)	7.5	7.9	8.1	8.7	9.1	9.6
Temp (K)						

Table C1.1

(i) Copy and complete the table above. [2]

(ii) Plot a graph of volume (cm^3) against temperature (K). [4]

(iii) From the graph, determine the volume of the air when the temperature was 77°C. [2]

[Total: 10 marks]

C2 **Figure C2.1** below shows how a solar heater on a house roof is used to warm up water for a house.

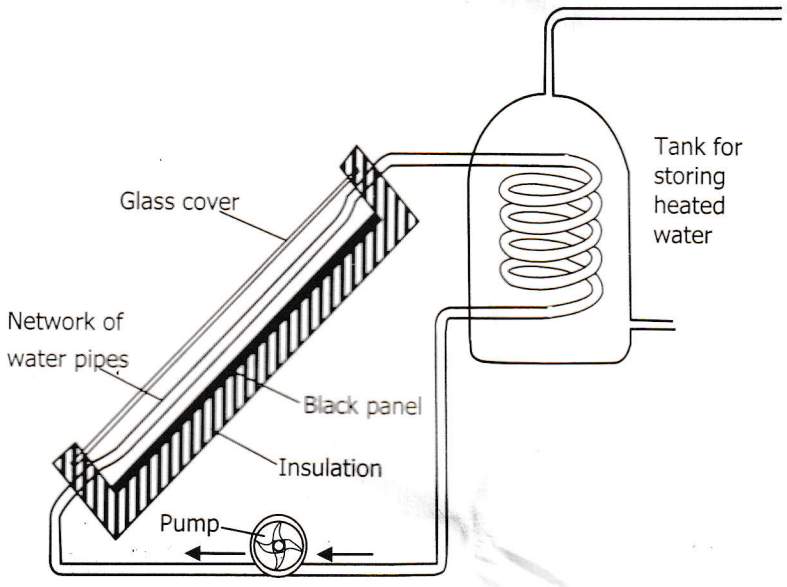

Figure C2.1

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(a) Why is the panel in the solar heater black? [1]

(b) Why is there an insulating layer behind the panel? [1]

(c) How does the water in the tank get heated? [2]

(d) On average, each square metre of the solar panel receives 1 000 Joules of energy from the sun every second. Using this information, calculate the power input in kilowatts of the panel if its surface area is $2m^2$. [3]

(e) The solar heater in the diagram has an efficiency of 60% (it wastes 40% of the solar energy it receives). What area of panel would be needed to deliver heat at the same rate, on average, as a 3kW immersion heater? [3]

[Total: 10 marks]

C3 A radioactive substance **B** has a half-life of 4 years and undergoes radioactivity by giving out beta (β) radiation.

(a) Which of the containers aluminium, thin plastic or lead, lined would you use to safely store substance **B?** [1]

(b) Copy and complete the **table C3.1**

Date	Mass of original radioactive substance left
1 July 2008	8kg
1 July 2012	
1 July 2020	

[2]

Table C3.1

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		·											

(c) A Geiger counter was used to measure the activity (in counts per minute) from a radioactive sample in the laboratory over a period of years. Over this period, the background radiation was regularly measured at 4 counts/minute.

Table C3.2 shows the results.

Time in years	0	1	2	3	4	5	6
Recorded activities in counts/min	124	80	52	34	23	16	12
Activity due to sample alone	120						8

Table C3.2

(i) Copy and complete the **table C3.2** on the activity of the sample alone. [1]

(ii) Explain what is meant by background radiation. [1]

(iii) Plot a graph of the values for **activity due to the sample alone** against the time.

[4]

(iv) Using your graph determine the half-life of the substance. [1]

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[Total: 10 marks]

DATA SHEET

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li ium	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
3 a ium	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
9 K sium	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
5 b ium	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Tchnetium 43	104 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
3 s um	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mecury 80	204 T/ Thallium 81	207 Pb lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
	226 Ra Radium 88	227 Ac Actinium 89 +															

1 Lanthanoid series
03 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadoliniu m 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Yitterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrenciu m 103

a
X
b

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

$N_A = 6.0 \times 10^{23}$/mol; 1F = 96500C.