Centre Number	Candidate Number

Candidate Name _____

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level

Physics 5054/2

Paper 2

Additional Information:

Graph paper
Electronic calculator/Mathematical tables
Answer Booklet

Time 2 hours

Instructions to Candidates

Write your name, centre number and candidate number in the spaces at the top of this page and on the Answer Booklet used.

Section A

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

Section B

Answer any **three** questions.
Write your answers in the separate Answer Booklet provided.
At the end of the examination:

1 fasten the Answer Booklets used securely to the question paper,
2 tick the numbers of the Section **B** questions you have answered in the grid on the bottom right side corner.

Candidate's Use		Examiner's
Section A		
Section B	9	
	10	
	11	
	12	
Total		

Information for candidates

The number of marks is given in brackets [ ] at the end of each question or part question. Candidates are reminded that all quantitative answers should include appropriate units.
Tick the questions answered in Section **B** in the grid.
Candidates are advised to **show all their working** in a clear and orderly manner, as more marks are awarded for correct working than for correct answers.

Cell phones are not allowed in the examination room.

This question paper consists of 14 printed pages

Section A [50 marks]

Answer all the questions in the spaces provided on the question paper.

1 **Figure 1.1.** below shows a vernier caliper indicating a measurement.

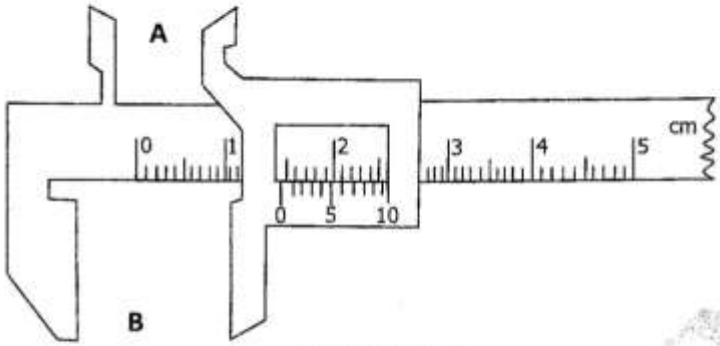

Figure 1.1

(a) **(i)** Which jaw **A** or **B** can be used to measure thickness of a wire nail?

.....

..... [1]

(ii) Explain the function of the vernier scale in this instrument.

.....

.....

..... [1]

(iii) What is the reading indicated in the diagram?

..... [1]

(b) **(i)** In the space below draw a section of a micrometre screw gauge (sleeve and thimble sections) showing a measurement of 4.35mm.

[2]

(ii) If the spindle of a micrometer screw gauge moves through 0.5mm for each complete turn, what would be the pitch of the screw?

..... [1]

(iii) When a micrometer screw gauge is zeroed, the spindle and sleeve surfaces touch with a reading 0.25mm showing. What is the actual measurement of the diameter of a ball bearing measured to be 3.05mm by the micrometer screw gauge?

.....

.....

..... [1]

(c) Why would one opt to use a micrometer screw gauge compared to a vernier calipers in determining how thick a kwacha note is?

.....

.....

..... [1]

Total 8 marks

2 **Figure 2.1** below shows the motion of a body of mass 6×10^5 kg.

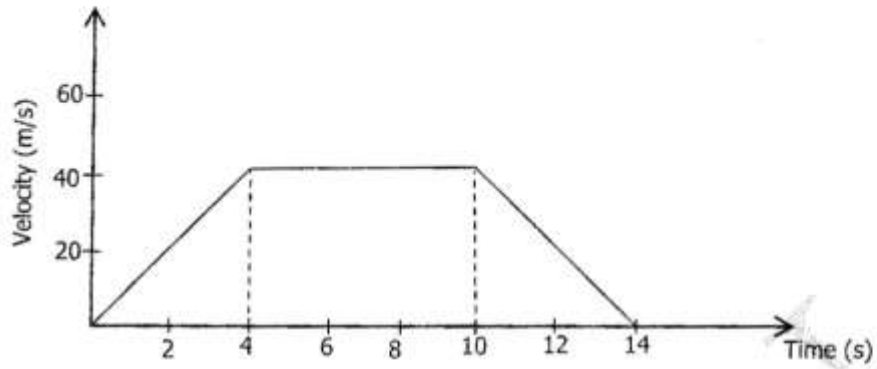

Figure 2.1

The total friction force acting on the body is 0.5×10^6N

(a) Calculate the acceleration of the body in the first 4 seconds.

.....

.....

.....

..... [1]

(b) What is the total distance travelled by the body in 10 seconds?

.....

.....

.....

..... [1]

(c) Calculate the net force acting on the body in the first 4 seconds.

.....

.....

.....

..... [1]

(d) What is the force exerted by the engine on the body in the first 4 seconds?

.....

.....

.....

..... [1]

Total 4 marks

3 A learner set up an experiment to determine the density of an insoluble substar **X**. She used a spring, scale pan with a pointer, a 20g standard mass and a half metre rule. **Figure 3.1** below shows how the apparatus was arranged.

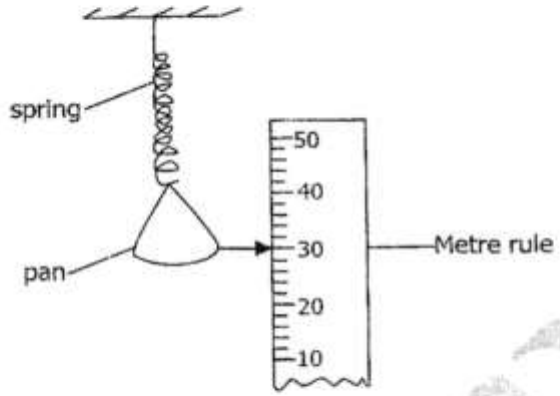

Figure 3.1

When the 20g mass was added to the pan the pointer rested on the 20cm mark. When substance **X** was added to the scale pan with the 20g mass, the pointer moved to the 5cm mark.

(a) Define density.

.....

.....

.....

(b) What is the mass of substance **X**?

.....

.....

.....

(c) **(i)** Briefly describe how the volume of substance **X** can be determined

.....

.....

.....

.....

(ii) Given that the volume of substance **X** is $0.01dm^3$. Find the density of substance **X**. (Take $1dm^3 = 1000cm^3$)

.....

.....

..... [1]

(iii) Calculate the relative density of substance **X**.

.....

.....

.....

..... [1]

Total 7 marks

4 **Figure 4.1.** shows a car of mass 1 ton moving on a level road. The total driving force of the car and the frictional force opposing its motion are 3000N and 1000N respectively.

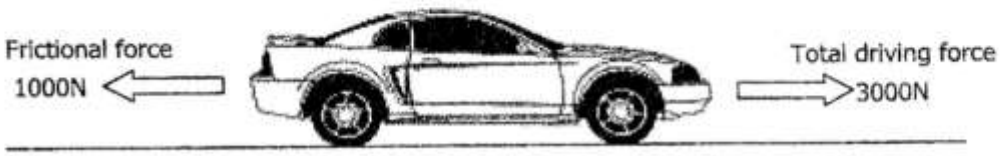

Figure 4.1

(a) Calculate the acceleration of the car.

.....

.....

.....

..... [2]

(b) If the car started from rest, calculate;

(i) the kinetic energy gained by the car in 10s.

.....

.....

.....

.....

..... [3

(ii) the power developed by the car engine in 10s.

.....

.....

.....

..... [

Total 7 mark

5 A learner poured 100cm^3 of water in beaker **S** and 100cm^3 of water in beaker **T**. Beaker **S** was kept at 40°C and beaker **T** was kept at 80°C in the same part of the room. **Figure 5.1** shows the two beakers after 3 days.

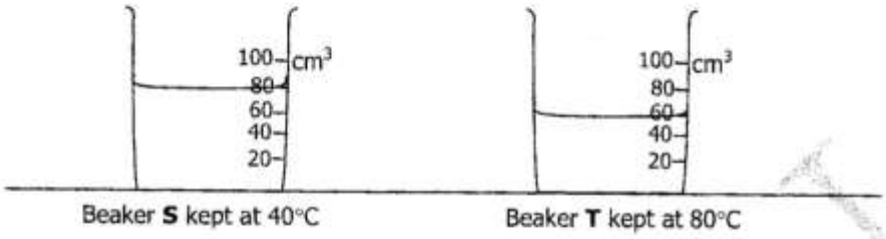

Figure 5.1

(a) **(i)** Explain why more water evaporates when the water is kept at 80°C.

.....

.....

.....

.....

..... [2]

(ii) Apart from an increase in temperature, state one change that causes water to evaporate faster.

.....

.....

..... [1]

(b) The following information was collected and recorded during an experiment to determine the specific heat capacity of water.

- Heater rating: 60W, 12V
- Mass of water: 200g
- Initial water temperature: 20°C
- Final water temperature: 48.2°C
- Time taken to heat the water: 10 minutes

(i) Calculate the specific heat capacity of water from the data collected.

.....

.....

.....

.....

..... [2]

(ii) To the 200g of water at 48.2°C, 100g of cold water at 20°C was added. Calculate the final temperature of the mixture.

.....

.....

.....

.....

..... [3]

Total 8 marks

6 (a) A learner wrote the information in **Figure 6.1** in her note book.

Gamma rays	x-rays	Ultra sound	Micro waves	Infra-red waves	Radio waves

Increasing wavelength ⟶

Figure 6.1

List **two** errors in the learners' notes.

(i) .....

(ii) ..... [2]

(b) State and explain an application of x-rays in engineering.

.....

.....

..... [2]

Total 4 marks

7 **Figure 7.1** below shows a solenoid made from wire wound around a plastic cylinder.

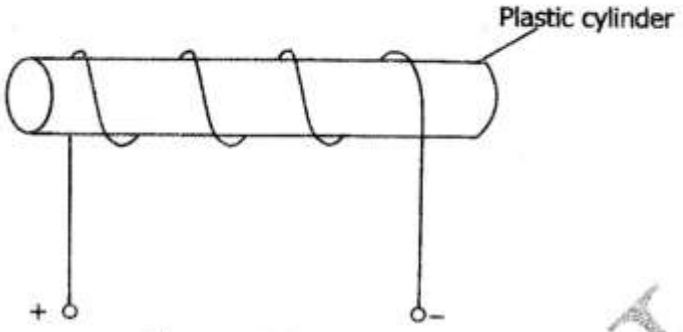

Figure 7.1

A current in the solenoid produces a magnetic field.

(a) On **Figure 7.1** draw the pattern of the magnetic field lines inside and outside the cylinder. [2]

(b) **Figure 7.2** shows a beam of beta particles in a vacuum passing into a magnetic field.

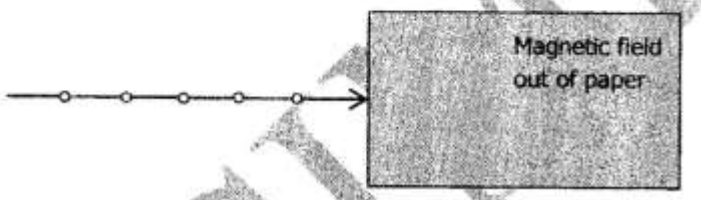

Figure 7.2

The movement of beta-particles from left to right is an electric current.

(i) On **Figure 7.2** draw an arrow to show direction of the conventional current. [2]

(ii) The direction of current in the solenoid is reversed.
State what happens to the path of the beta-particle. [1]

Total 5 marks

8 **Figure 8.1** shows a thunder cloud with a flat, positively charged base it passes over a tall tree standing in a flat, open land.

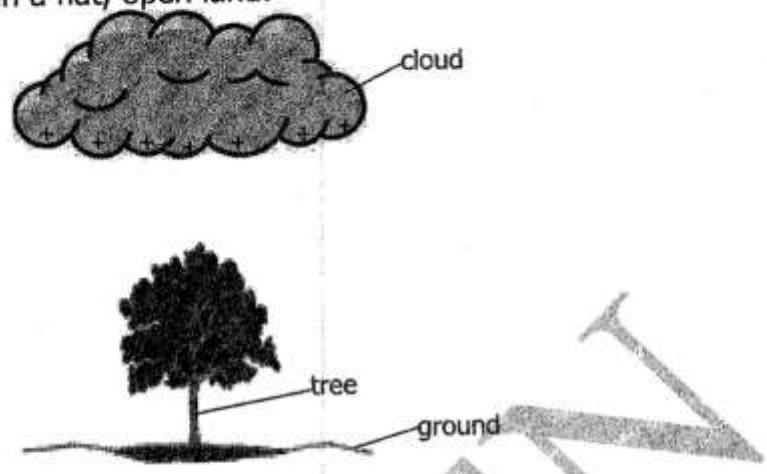

Figure 8.1

(a) **(i)** On **Figure 8.1**, mark the charge on the tree. [1]

(ii) Explain how the tree becomes charged.

.....

.....

.....

..... [2]

(b) A lightning strike occurs and in 2.0×10^{-4} s a charge of 560C passes from the cloud to the tree. The size of the charge on an electron is 1.6×10^{-19}C.

(i) Calculate the number of electrons that pass between the tree and the cloud.

.....

.....

.....

.....

..... [2]

(ii) Calculate the average current in the lightning strike.

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..... [2]

Total 7 marks

Section B [30 marks]

Answer any three questions. Each question carries 10 marks.

9 **Figure 9.1** shows a section of a tyre of a wheelbarrow. The tyre exerts pressure on the ground.

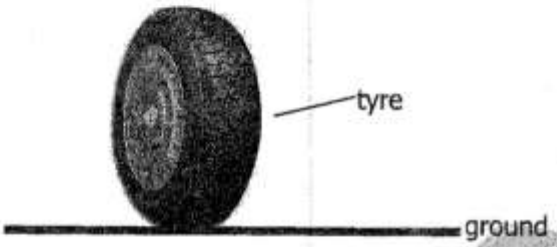

Figure 9.1

(a) Pressure can be measured in Pascal (Pa).

(i) What is a pascal? [2]

(ii) The mass resting on the wheelbarrow tyre is 60kg. The area of the tyre in contact with the ground is $0.0024m^2$.

Calculate the pressure exerted on the ground. [3]

(iii) As the wheelbarrow was being pushed, the tyre went over a small stone. Describe and explain how the pressure changes. [2]

(b) The temperature of the tyre increased due to friction with the road and heat from the surroundings. Using kinetic theory, explain what happens to the pressure inside the tyre if the size of the tyre does not change. [3]

Total 10 marks

10 **Figure 10.1** shows part of a cathode ray oscilloscope in which cathode rays are produced.

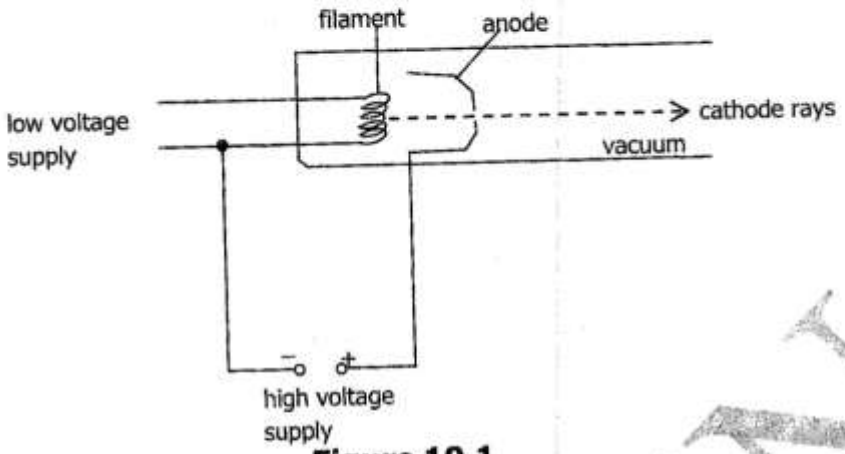

Figure 10.1

(a) Explain why the filament emits electrons and explain how the electrons are made to move at high speed. [3]

(b) Describe an experiment to show that cathode rays are not electromagnetic radiation. [5]

(c) In each second, 8.0×10^{14} electrons pass through the hole in the anode. The charge on an electron is 1.6×10^{-19}C. Calculate the current in the electron beam. [2]

Total 10 marks

11 **(a)** A transistor is another kind of semi-conductor. It is used to amplify current in a circuit. Draw the structure and symbols of the transistor. [2]

(b) **Figure 11.1** below shows a transistor switch in a circuit.

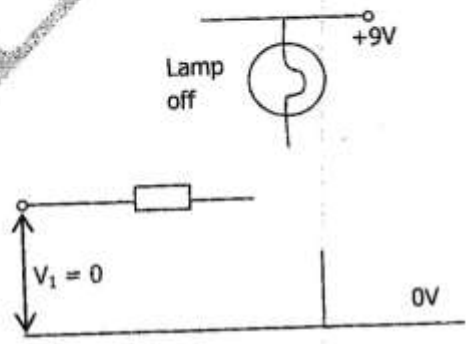

Figure 11.1

(i) Copy and complete the incomplete circuit above by placing in a transistor in the correct position. [2]

(ii) Using the completed circuit of **Figure 11.1** above, describe how the transistor operates as a switch. [6]

Total 10 marks

[Turnover

12 In an experiment to determine the half-life of radon 220 $\left({}^{220}_{86}Rn\right)$, the following results were obtained as shown in the table below after allowing for the background count.

Time/s	0	10	20	30	40	50	60	72
Count rate/s^{-1}	30	26	23	21	18	16	14	12

(a) **(i)** What is the origin of the background count? [1]

(ii) How is the background count determined? [3]

(b) By plotting the graph of count rate (vertically) against the time (horizontally), determine the half-life of $\left({}^{220}_{86}Rn\right)$. Show clearly on your graph how you obtain your answer. [6]

Total 10 marks