Candidate Name _____

Centre Number	Candidate Number

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level

Physics 5054/2

Paper 2

Thursday **3 NOVEMBER 2016**

Additional Information:

Graph paper
Electronic calculator (non-programmable)/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.

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 marks are awarded for correct working and for correct answers.

Cell phones are not allowed in the examination room.

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

This question paper consists of 13 printed pages

Section A [50 marks]

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

1 **Figure 1.1.** shows a vernier caliper being used to measure external diameter of a metal tube.

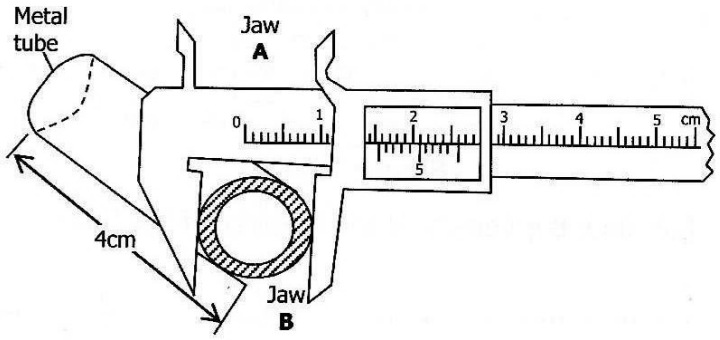

Figure 1.1

(a) **(i)** What is the measurement indicated in the diagram?

.....

.....

(ii) Calculate the volume of the tube? (Take $\pi = \frac{22}{7}$)

.....

.....

(b) Given that the cross sectional area of the shaded portion of the tube is $0.5cm^2$,

(i) Calculate the volume of the material of the tube.

.....

.....

(ii) The mass of the tube was measured by an electronic balance as shown in **Figure 1.2** below.

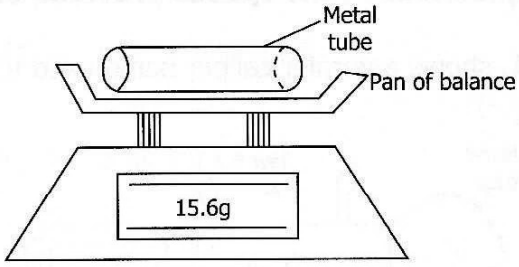

Figure 1.2

Calculate the density of the material of the tube.

.....

.....

..... [2]

(iii) Name the metal the tube was made of.

..... [1]

Total 8 marks

2 A small boat travels with a velocity of 4.0m/s due south in an area of still water.

(a) State what is meant by velocity.

.....

..... [1]

(b) The boat enters the area where the velocity of the water is 2.0m/s towards south east as shown in **Figure 2.0**.

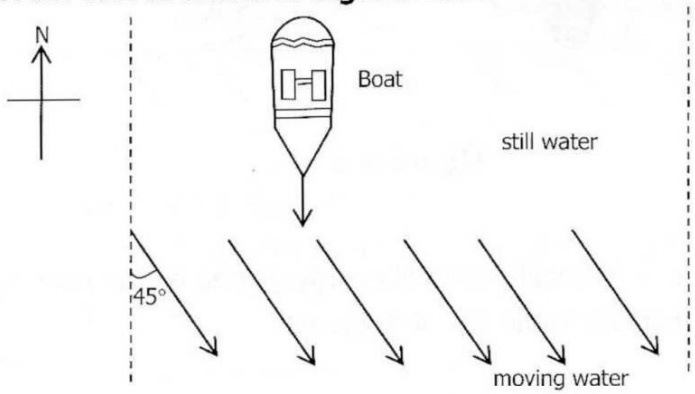

Figure 2.0

Combining the initial velocity of the boat with the velocity of the water gives the resultant velocity of the boat.

(i) In the space below, draw a scale vector diagram to show the resultant velocity.

[2]

(ii) Use your graph/diagram to find the size and direction of the resultant velocity.

.....

.....

..... [2]

Total 5 marks

3 **Figure 3.1.** shows a ramp being used to move a load which has a mass of 180kg, onto a lorry. The ramp is 4m long and the end of the lorry is 1m above the ground.

A force of 600N is needed to pull the load up the ramp. (Take g = 10N/kg)

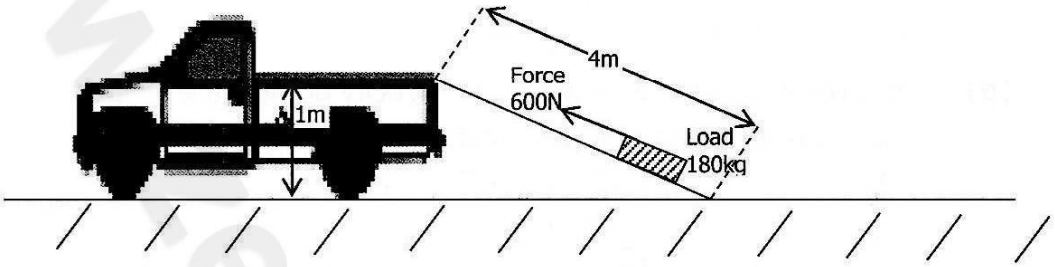

Figure 3.1

(a) Calculate

(i) the gravitational potential energy gained by the load as it goes from the bottom to the top of the ramp.

.....

.....

..... [1]

(ii) work done by the 600N force in pulling the load up the ramp.

.....

.....

..... [1]

(iii) the efficiency of the system

.....

.....

..... [1]

(b) The load topples off the lorry and falls to the ground. What is the kinetic energy of the load just before it hits the ground?

.....

.....

..... [2]

Total 5 marks

4 **Figure 4.1.** shows apparatus used when determining the specific heat capacity of aluminium.

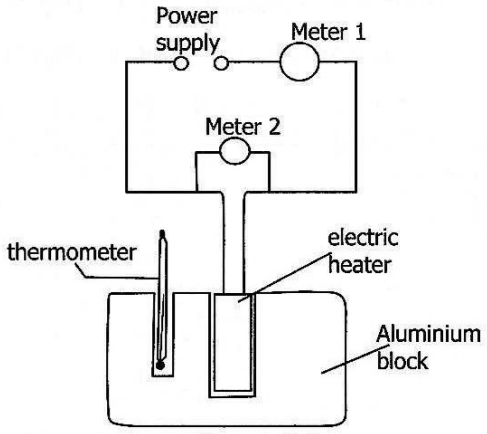

Figure 4.1

Meter **1** and meter **2** are electrical meters.

(a) State the quantities measured by meter **1** and meter **2**.

Meter **1** ..... [1]

Meter **2** ..... [1]

(b) The following results are obtained in an experiment.

Initial temperature of block = 18°C
Final temperature of block = 40°C
Mass of block = 0.85kg
Energy supplied by heater = 17000J

Assuming that heat is not lost during the experiment, calculate the specific heat capacity of aluminium.

.....

.....

..... [2]

(c) In practice, some heat is lost from the block and the air above it becomes hot.

(i) Describe and explain the process by which the hot air moves away from the block.

.....

.....

..... [2]

(ii) Suggest **two** ways on how to reduce the loss of heat from the block in the experiment.

.....

..... [2]

Total 6 marks

5 An ATM card of height 1.5cm is viewed through a lens. The lens is 2.0cm from the card. The image has a linear magnification of 3.0. The card, the image of the card and the position of the lens are shown full scale in **Figure 3.1**.

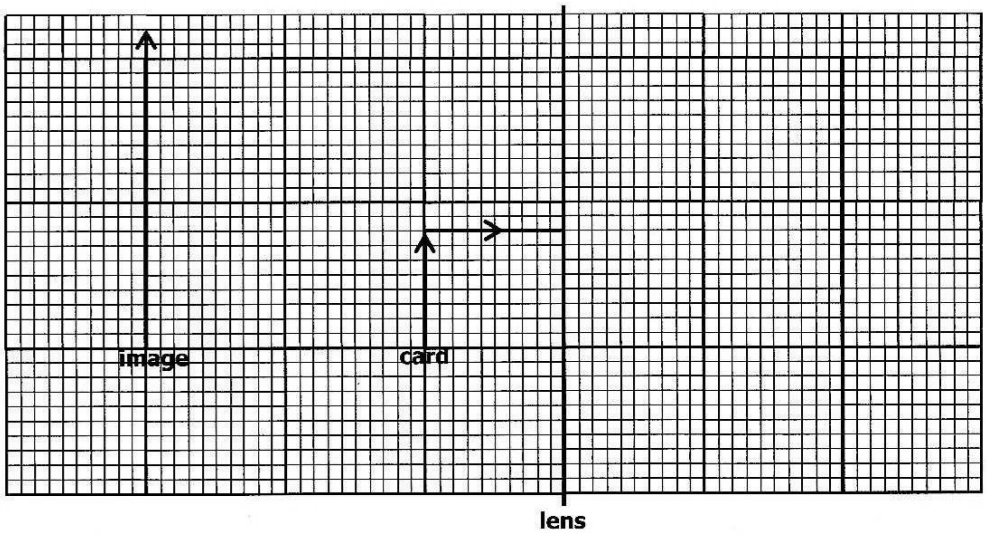

Figure 5.1

A ray of light from the top of the card to the lens is shown in **Figure 5.1**.

(a) State the type of lens used.

..... [1]

(b) State what is meant by linear magnification.

..... [1]

(c) **(i)** On **Figure 5.1** complete the path of the ray from the top of the card after it passes through the lens. [1]

(ii) Use your drawing to determine the focal length of the lens.

..... [1]

(iii) On **Figure 3.1** draw two additional rays from the top of the card to show how the image is formed. [1]

Total 5 marks

6 **(a)** Explain carefully how the transformer works.

.....

..... [2]

(b) **Figure 6.1** shows a primary coil connected to an a.c supply and a small coil connected to a low voltage lamp placed as shown.

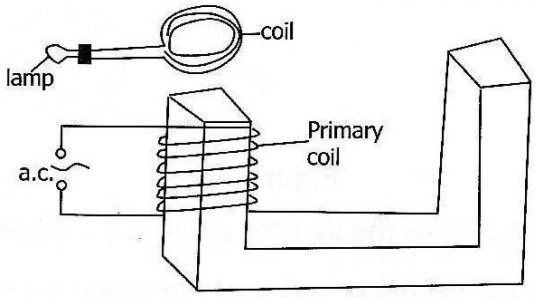

Figure 6.1

Explain the following observations:

(i) the lamp lights

.....

..... [1]

(ii) if the coil is moved upwards, the lamp gets dimmer

.....

..... [1]

(iii) if an iron rod is now placed through the coil, the lamp brightens again

.....

..... [1]

(c) What will be the effect of

(i) reducing the turns in the small coil?

.....

..... [1]

(ii) using a d.c. supply instead of an a.c supply?

.....

..... [1]

Total 7 marks

7 A positively charged sphere **C** is brought close to a small uncharged sphere **U**. Sphere **U** is suspended from an insulating thread as shown in **Figure 7.1** below.

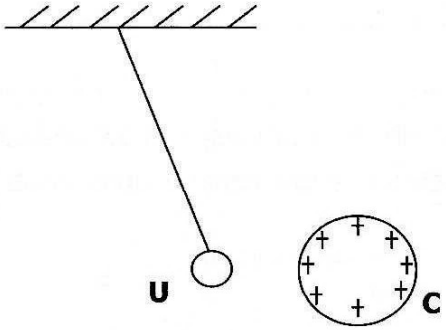

Figure 7.1

(a) On **Figure 7.1** draw the induced charges on sphere **U**. [1]

(b) Sphere **C** is moved towards **U** until the spheres touch each other. Sphere **U** is then repelled by sphere **C**, as shown in **Figure 7.2**. The charges on **C** and **U** are not shown.

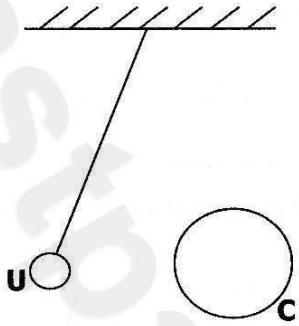

Figure 7.2

(i) State and explain what happens to the charges on the two spheres as they touch.

Charge on **C** .....

Charge on **U** ..... [2]

(ii) Explain why **U** is repelled by **C**.

.....

..... [1]

Total 4 marks

8 **(a)** State ohm's law and define resistance

Ohm's law .....

.....

Resistance .....

..... [2]

(b) Derive an expression for determining total resistance when two resistors in series are connected to a pair of resistors in parallel in the same circuit.

.....

.....

..... [2]

(c) **Figure 8.1** below shows a circuit designed for a desired effective resistance.

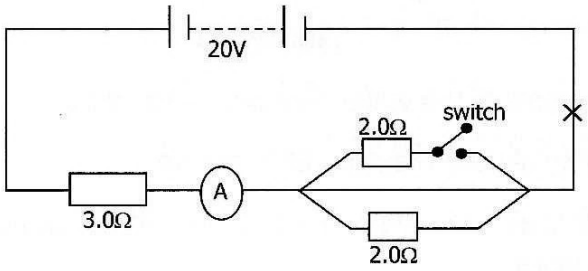

Figure 8.1

Neglecting the battery resistance, calculate the ammeter reading when the

(i) switch is open

.....

.....

..... [1]

(ii) switch is closed

.....

.....

..... [1]

(d) A 12V electric bulb is connected at point **X** in **Figure 8.1** when switch is closed. Will the bulb light or not? Explain your answer.

.....

.....

..... [2]

Total 8 marks

Section B [30 marks]

Answer any three questions

9 A garden pond contains a small fountain. An electric pump in the water causes the water rise above the surface of the water to a height of 1.5m as shown in **Figure 9.1**.

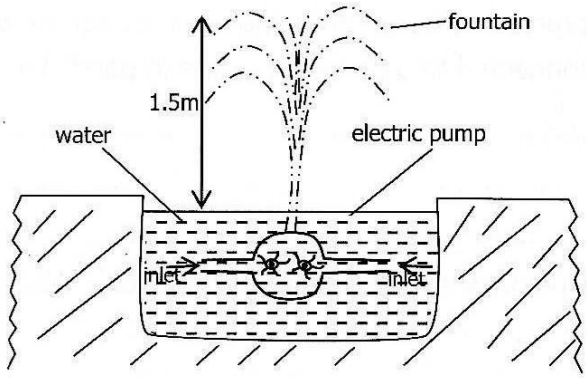

Figure 9.1

(a) The pressure of the water increases with depth.

(i) Explain the meaning of 'pressure'. [1]

(ii) Explain why the pressure of the water surface increases with depth. [1]

(b) A volume of $0.78m^3$ of water pushes through the pump in one hour. The density of water is $1000kg/m^3$.

(i) Calculate the mass of water that passes through the pump in one hour. [2]

(ii) The water rises 1.5m. The gravitational field strength is 10N/kg. Calculate the useful work done in one hour raising the water to the top of the fountain. [2]

(iii) Calculate the minimum power output of the pump. [2]

(c) Describe an experiment to check that the density of water is $1000kg/m^3$. [2]

Total 10 marks

10 Acceleration is the rate of change of velocity with time. The acceleration against gravity is $-10m/s^2$.

(a) Two stones are thrown vertically upwards from the same point with the same velocity of 20m/s but at an interval of 2s. When they meet, the second stone is rising at 10m/s.

(i) For what time is the first stone in the air before they meet? [2]

(ii) What is the velocity of the stone when they meet? [2]

(iii) State any assumptions you make in obtaining your answers. [2]

(b) An electric train moves from rest with a uniform acceleration of $1.5m/s^2$ for the first 10s and continues accelerating at $0.5m/s^2$ for a further 20s. It continues at constant speed for 90s and finally takes 30s to decelerate uniformly to rest.

(i) Draw a graph of speed against time for the journey. [2]

(ii) From your graph or otherwise deduce the total distance travelled. [1]

(iii) What is the average speed of the train for the whole journey? [1]

Total 10 marks

11 A 600Ω resistor and thermistor are connected in series with an ammeter and a 20V d.c. power supply. A voltmeter is in parallel with the resistor.

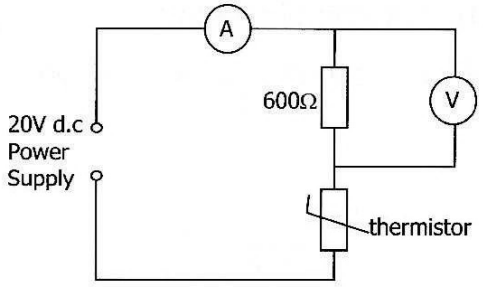

Figure 11.1

(a) Calculate

(i) the voltmeter reading.

(ii) the resistance of the thermistor. [2]

(b) The temperature of the thermistor increases.

(i) State what happens to the resistance of the thermistor [1]

(ii) What will the ammeter and voltmeter readings be? [2]

(c) **Figure 11.2** below shows an application of transistor.

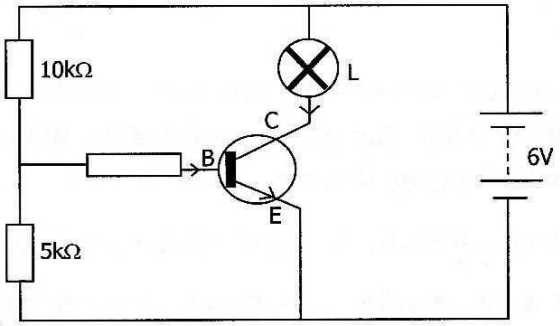

Figure 11.2

(i) Is the lamp **L** on or off? Explain your answer. [2]

(ii) Explain what will be the effect of replacing the lower resistor with a short piece of connecting wire. [1]

(iii) Name **one** use of a thermistor. [1]

(iv) State **one** way in which the resistance of a thermistor can be altered. [1]

Total 10 marks

12 **(a)** **(i)** Describe an experiment which you would carry out to show how the nature of a surface affects the heat radiated from that surface in a given time. [4]

(ii) State any precaution which you would take in **(i)** above. [1]

(b) How would you show that the surface which is the better radiator was also the better absorber of radiation? [3]

(c) **Figure 12.1** below shows an experiment on conduction.

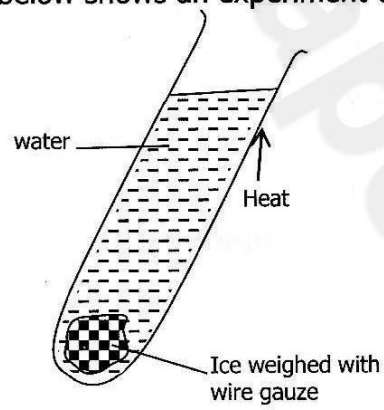

Figure 12.1

The experiment shows that the ice remains intact for several minutes as heating progresses.

(i) Explain how this is so. [1]

(ii) How does the ice cube melt after some time? Explain. [1]

Total 10 marks

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