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 | | |

**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.

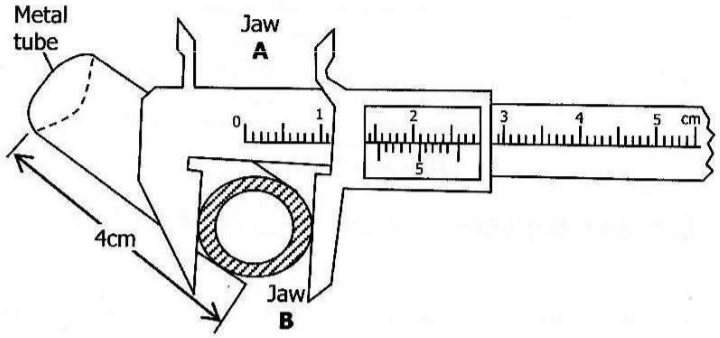


**Figure 1.1**

**(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.

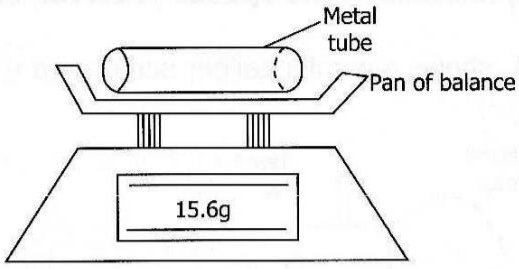


**Figure 1.2**

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**.

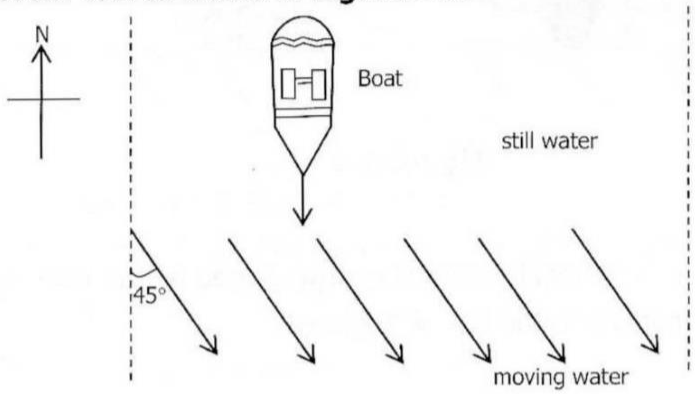


**Figure 2.0**

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)

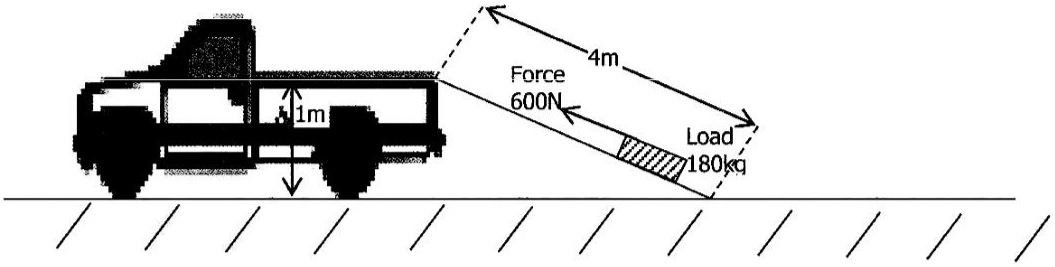


**Figure 3.1**

**(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.

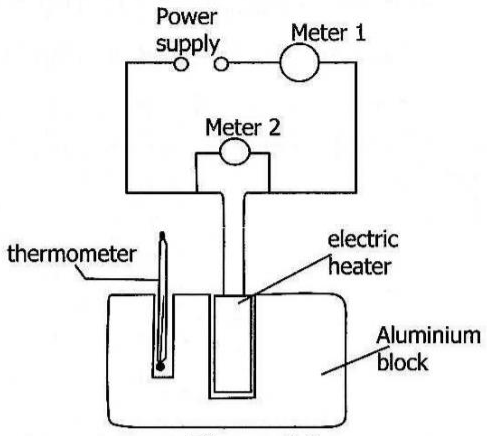


**Figure 4.1**

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**.

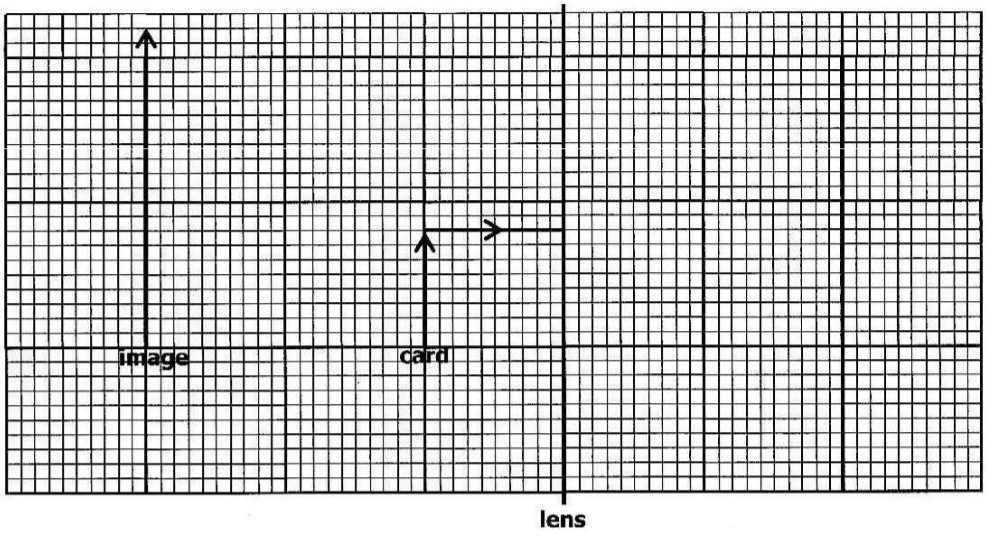


**Figure 5.1**

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.

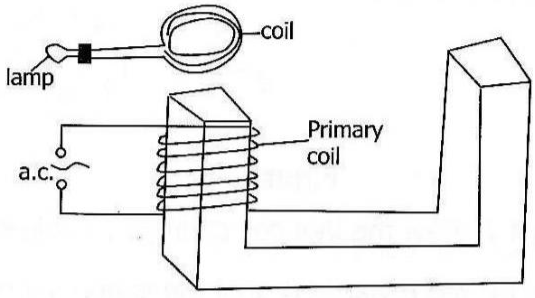


**Figure 6.1**

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.

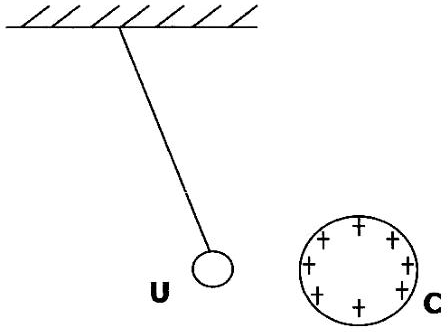


**Figure 7.1**

**(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.

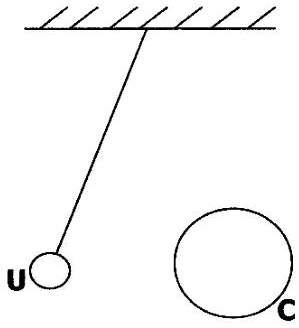


**Figure 7.2**

**(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.

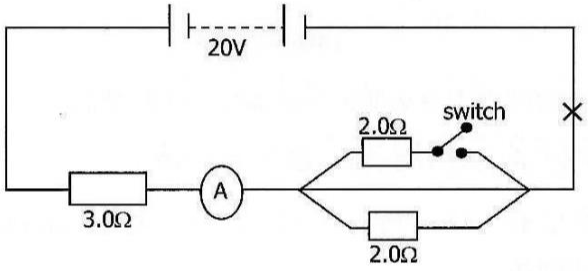


**Figure 8.1**

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**.

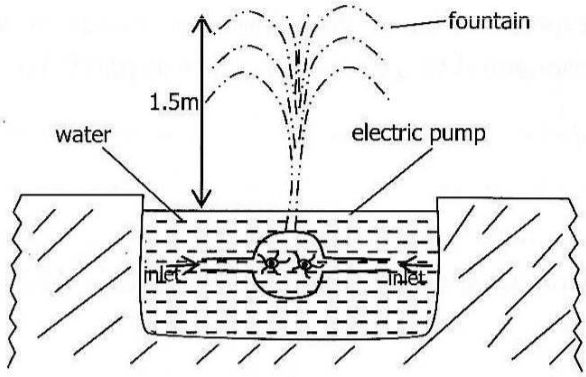


**Figure 9.1**

**(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.

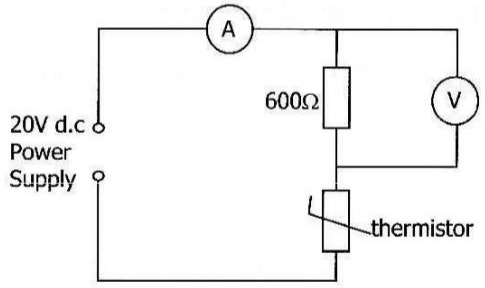


**Figure 11.1**

**(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.

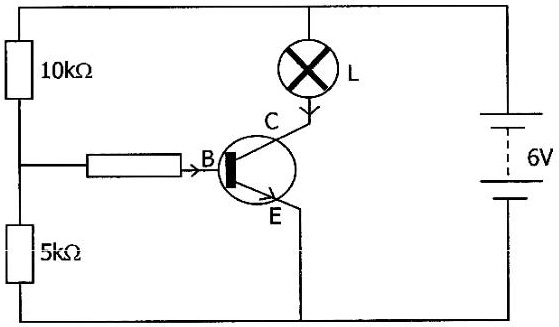


**Figure 11.2**

**(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.

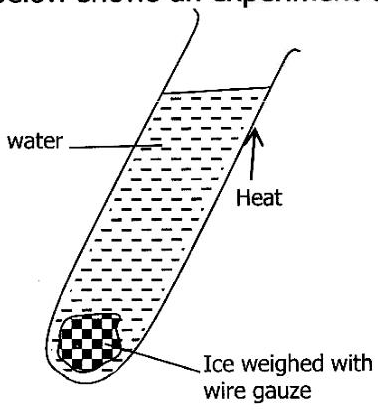


**Figure 12.1**

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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