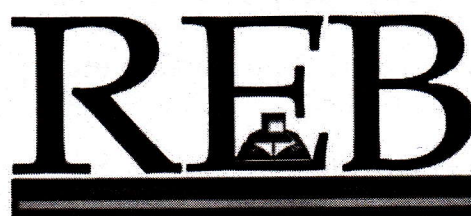| PHYSICS I |
| 011 |
| 22/11/ 2018   8.30 AM - 11.30 AM |

REB
Rwanda Education Board

ORDINARY LEVEL NATIONAL EXAMINATIONS, 2018

SUBJECT: **PHYSICS I**

DURATION: 3 HOURS

INSTRUCTIONS :

1) Write your names and index number as they appear on your registration form and **DO NOT** write your names and index number on additional sheets of paper if provided.

2) Do not open this question paper until you are told to do so.

3) This paper has **THREE** sections: **A** ,**B** and **C.**

   SECTION A : This section is **compulsory**.   **(55 marks)**

   SECTION B : Attempt any **three** questions.   **(30 marks)**

   SECTION C : This section is **compulsory**.   **(15 marks)**

4) Calculators and mathematical instruments may be used.

5) **Use only a blue or black pen for writing and a pencil for drawing**

SECTION A: ATTEMPT ALL QUESTIONS (55 Marks)

1) Identify 3 renewable energy sources that are actually used
   in Rwanda.   **(3marks)**

2) (a) Copy and draw the magnetic field lines of force around the bar
      magnet below (figure 1).   **(2marks)**
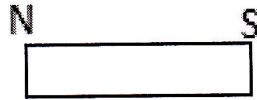

Figure 1

   (b) Suppose that the bar magnet is divided into two parts as shown
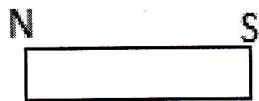   below (figures 2 and 3)

   Bar magnet before its division
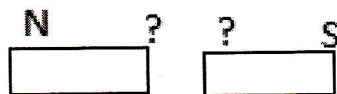

Figure 2

   Bar magnet after the division

Figure 3

   Copy and name the missing magnetic poles as shown in figure 3.
                                                                          (1mark)

   (c) Propose one method that you can use to demagnetize
      a magnet.   **(1mark)**

3) (a) (i) Use of electricity in homes can be dangerous.
         Explain how a fire breakout due to an electric fault can
         be prevented.   **(1mark)**
      (ii) Suggest a reason for power losses that might occur in
         electrical power transmission lines.   **(1mark)**

   (iii) Determine the role of a transformer in electrical power transmission.

                                                                          (1mark)

(b) Give two advantages of alternating current over direct current. **(2marks)**

4) (a) Explain how the potential energy can be used to do work. **(2marks)**

(b) What energy transformations do take place when a battery operated

radio is in use? **(2marks)**

5) For each of the following statements; indicate whether the statement

is true or false.

(a) Pressure decreases when the surface area over which a force is applied

decreases. **(1mark)**

(b) A fluid applies pressure perpendicular to all sides of an object in

contact with the fluid. **(1mark)**

(c) If the weight of an object that is submerged in a fluid is 10N and
the buoyant force on it is 20 N. The object will sink initially then
remain underwater/submerged. **(1mark)**

(d) A and B are non miscible liquids and have densities of 0.75 g/ml

and 1.14 g /ml respectively.

When both liquids are poured into a container, B floats on the

top of A. **(1mark)**

(e) Buoyant force is the weight of the mass of water displaced by an

immersed object. **(1mark)**

6) (a) How can induced current be produced? **(2 marks)**

(b) Suggest two ways that may be used to increase the induced

current in a coil. **(2 marks)**

7) How does a diode work as a rectifier? **(3 marks)**

8) (a) Is a wheelbarrow a simple or compound machine? Explain.   **(2marks)**

   (b) The mechanical advantage of a simple machine is 4.

   Explain what this means.   **(1mark)**

9) (a) Kelvin temperature scale is the best scale for measuring temperature.

   It is more commonly used in industry and sciences.

   Explain the reason behind.   **(1 mark)**

   (b) Why does

   (i) a liquid have a definite volume but not a fixed shape?   **(1mark)**

   (ii) a gas have no fixed shape and volume?   **(1mark)**

   (iii) a solid have fixed shape and definite volume?   **(1mark)**

10) Predict what will happen when the pressure and the temperature

    of a fixed amount of an ideal gas decrease simultaneously .

    Justifications are required.   **(3 marks)**

11) Pascal's principle states that when a change in pressure is
    applied to an enclosed fluid at rest, it is transmitted undiminished
    to all portions of the fluid and to the walls of its container.

    (a) Specify the fundamental characteristics of the mentioned fluid. **(1mark)**

    (b) How is Pascal's principle used in everyday life?   **(2marks)**

12) A certain object weighs 294.3 N at the earth's surface.

    Determine the mass of the object in kilograms then in centigrams.

    Take g= 9.81 m/s^2.   **(3marks)**

13) A force of 400 N is applied to a 40 kg object moving on a horizontal

    surface of which the friction force is 200 N.

    (a) Find the net force acting on this body.   **(1mark)**

(b) Find the acceleration of the moving object. **(2marks)**

14) (a) Determine the quantity of heat needed to raise the temperature
of 1000 g of water from 20°C to 100°C.
The specific heat capacity of water is 4 200 J kg^{-1} K^{-1} . **(2marks)**

(b) What will happen to the temperature of this quantity of water
at 100°C if the heating continues? Explain your answer. **(2marks)**

15) (a) The small distance between two positive charged particles Q_1 and Q_2
placed in free space is d.

(i) Draw the electric field lines of force between Q_1 and Q_2. **(1mark)**

(ii) Name any one factor that affects the magnitude of Coulomb's
force between Q_1 and Q_2. **(1mark)**

(b) A point p is at 100 cm from a positive point charge $Q = 2nC$
placed in vacuum . Calculate the electric potential due to Q at p.

The permittivity of free space $\varepsilon_0 = 8.85 x 12^{-12} F/m$ **(2marks)**

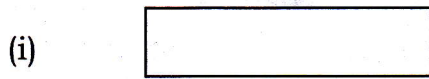**SECTION B: ATTEMPT ANY THREE QUESTIONS (30 Marks)**

16) (a) Describe an experiment to find the centre of mass of an
irregular lamina like the diagram below. (figure 5) . **(3marks)**
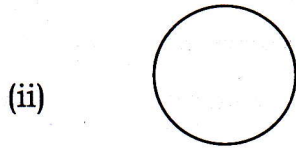

Figure 5

(b) Copy and label with a dot the centre of gravity of each of the following

objects (figures 6,7,8,9). Use the diagram to show how this centre of
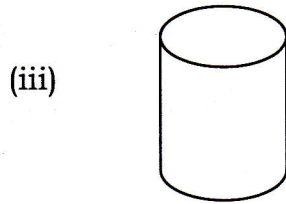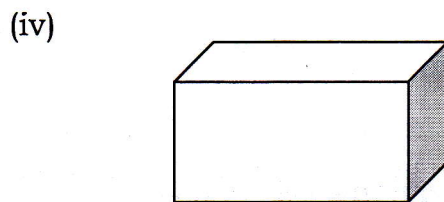mass is obtained.

(i)

Rectangular lamina (figure 6) **(1mark)**

(ii)

Circular object (figure 7) **(1mark)**

(iii)

Cylindrical object (figure 8) **(1mark)**

(iv)

Rectangular parallelepiped object (figure 9) **(1mark)**

(c) Use the terms unstable equilibrium, stable equilibrium and neutral equilibrium to complete the following statements. Respect the order of the question when answering it and don't copy the entire statement.

(i)..................................occurs when a simple object is placed in such a position that any slight disturbance would not change the level of its centre of mass. **(1mark)**

(ii)....................occurs when a simple object is placed in such

a position that any slight disturbance effort would raise its

centre of mass. **(1mark)**

(iii)....................occurs when a simple object is placed in such

a position that any slight disturbance effort would lower its

centre of mass. **(1mark)**

17) Study the following velocity-time graph of a 5 kg moving body (figure 10)

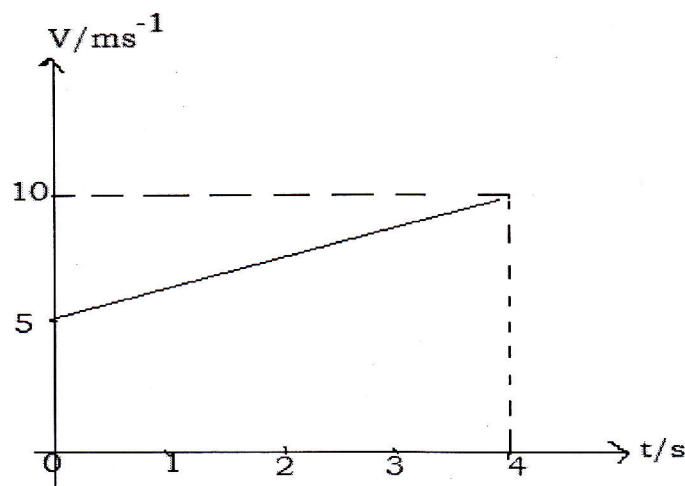and answer the questions that follow:

Figure 10

(a) Is this motion rectilinear motion with constant acceleration or

uniform rectilinear motion ? **(1mark)**

(b) From the graph, determine the initial velocity of the body. **(1mark)**

(c) Find the slope of the graph. This is the acceleration of the

moving body. **(3marks)**

(d) Use the result obtained from 17. (c) and plot the acceleration-time

Graph. **(3marks)**

(e) Determine the distance covered/travelled from the given

velocity- time graph. **(2marks)**

18) The diagram below (figure 11) shows an arrow 1cm long placed at

6 cm in front of a concave mirror.

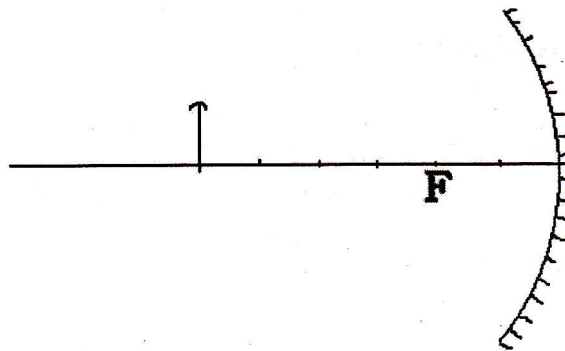The focal length of this concave mirror is 2 cm.

Figure 11

(a) Draw a ray diagram on the graph paper provided at the end of your

answer booklet to illustrate the image formation of the arrow.   **(3marks)**

(b) From your graph, describe the characteristics (position, size,

nature, direction) of the image obtained.   **(2marks)**

(c) Use calculations to determine the position, the size, the direction

and the nature of the image of the above arrow.   **(3marks)**

(d) Do your mathematical answers and the description above match

the image formed by your ray diagram? Justify your answer. · **(2marks)**

19) (a) Identify the common electrical symbols below (figures 12, 13, 14)
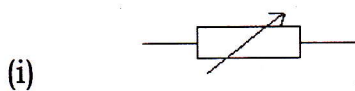

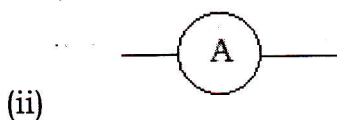(i)   Figure 12   **(1mark)**

(ii)   Figure 13   **(1mark)**

(iii) ⊏▭⊐ Figure 14 (1mark)

(b) You are provided with 2 resistors, 3 dry cells, a voltmeter, a switch, and sufficient number of connecting wires.

Use all the given electrical components to design a circuit satisfying the condition below:

Two resistors are connected in series such that when the switch is closed; the current flows through the circuit. All the 3 dry cells are in series and the voltmeter measures the potential difference across all connected resistors. **(4marks)**

(d) The internal resistance of the dry cell in the following diagram (Figure 15) is negligible and its electromotive force, E= 4 V. The resistance R= 10 Ω.
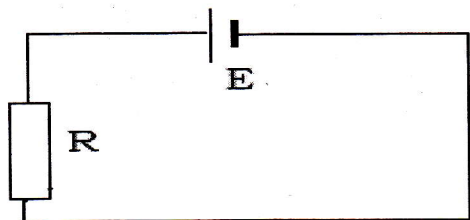

Figure 15

(i) Find the potential difference across the 10 Ω resistor. **(1mark)**

(ii)Calculate the current passing through the circuit. **(2marks)**

20) Describe the environmental factors that affect the growth rate of a plant and explain how they do so.

N.B : These environmental factors can include both physical and chemical factors. **(10marks)**

SECTION C: THIS QUESTION IS COMPULSORY (15 Marks)

21) Answer this question on the graph paper provided at the end of your answer booklet.

A group of students carried out an experiment **to investigate** how the electric current flowing through a constant **resistor increases** when the voltage applied to its ends increases gradually .

The following table shows the results obtained.

Voltage U /V	1.0	3.0	5.0	7.0	9.0	11.0
Current I /mA	1.0	2.9	5.0	6.9	9.0	11.0

(a) Plot a graph of voltage (along y-axis) against current (along x-axis).
    Draw the best fit straight line. **(8marks)**

(b) From your graph, determine the slope/gradient of the graph. **(2marks)**

(c) What does the result obtained in 21.b represent? **(1mark)**

(d) Predict the value of the current if the voltage reaches 16 V.
    Support your answer with evidence. **(2marks)**

(e) Explain why some values of the current do not obey the law of proportionality between current and voltage. **(2marks)**