MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2018/2019 ACADEMIC YEAR
SECOND YEAR *SECOND* SEMESTER

SCHOOL OF SCIENCE
BACHELOR OF SCIENCE IN PHYSICS

COURSE CODE: PHY 2212

COURSE TITLE: LABORATORY IV

DATE: TIME:

INSTRUCTIONS TO CANDIDATES

- Answer Question **ONE** and any other TWO.
- Use of sketch diagrams where necessary and brief illustrations are encouraged.
- Read the instructions on the answer booklet keenly and adhere to them.
  *This paper consists of **seven** printed pages. Please turn over.*

QUESTION ONE [COMPULSORY]   (20 MARKS)
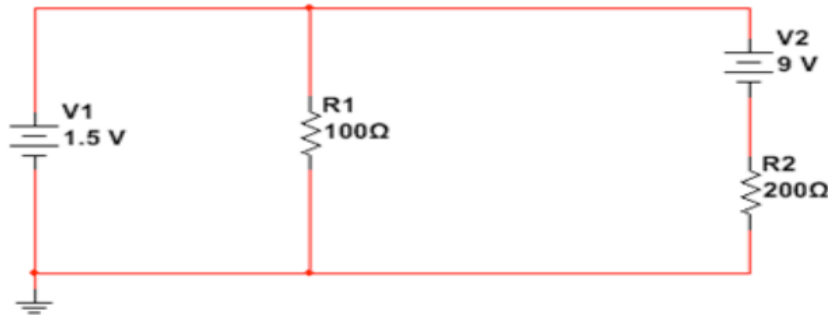
Consider figure 1 below.

Figure 1

Kirchhoff's Current Law states that the current entering a point in a circuit is equal to the summation of the currents exiting. Kirchhoff's Voltage Law states that the summation of all voltage drops in a closed loop must equal to zero which is a result of the electrostatic field being conservative. (Conventional) current flowing through the cell has a positive voltage (gains energy) whereas current going through a resistor has a negative voltage (loses energy). This information is simplified in figure 2.
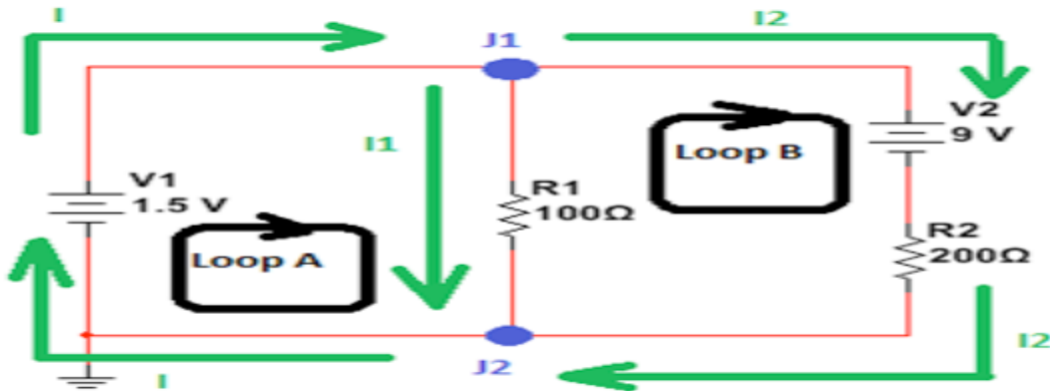

Figure 2

a) Express the current I in terms of I_1 and I_2 **(1 mark)**
b) Use the Kirchhoff's Laws described above to solve for the following;
a) (i) I_1 **(2 marks)**

    (ii) I_2 **(3 marks)**

(iii) I **(1 mark)**

b) Determine the voltage drops V_{R1} and V_{R2} across each resistor
   (i) V_{R1} **(1 mark)**

   (ii) V_{R2} **(1 mark)**

c) You are required to implement the above circuit during a practical session.
   (i) Re-sketch the diagram illustrating how you should configure the DMM to measure voltage across R_1 and R_2 **(2 marks)**
   (ii) Re-sketch the diagram illustrating how you should configure the DMM to measure current through R_1 and R_2 **(2 marks)**
   (iii) State **two** precautions that you should observe in this experiment **(2 marks)**
   (iv) State **two** sources of error in this experiment and how each can be mitigated **(4 marks)**

(d) State one application of the circuits represented in figure 1 **(1mark)**

QUESTION TWO (10 MARKS)

The following is part of a student's report of an experiment to investigate the variation of current I with potential difference V for a semiconductor diode. ''I put the diode in forward bias as shown in the circuit diagram. I increased the potential difference across the diode until a current flowed. I measured the current flowing for different values of the potential difference. I recorded the following data.''

V(V)	0.60	0.64	0.68	0.72	0.76	0.80
I (mA	2	4	10	18	35	120

(a) What was wrong with the student's report? **(1 mark)**
(b) Draw a circuit diagram used by the student. **(2 marks)**

(c) Plot a graph of I_D against V_D to show how the current varies with the potential difference. **(4 marks)**

(d) Estimate from your graph the junction voltage of the diode. **(1mark)**

(e) The student then put the diode in reverse bias and repeated the experiment. What changes did the student make to the initial circuit? **(2 marks)**

QUESTION THREE (10 MARKS)

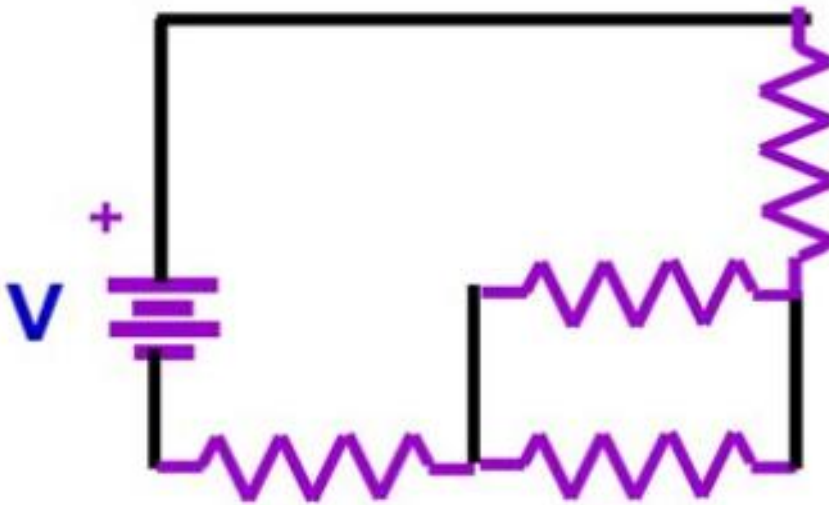Consider the electrical schematic drawing shown in figure 3 below.

Figure 3

(a) On the breadboard (figure 5), show how the electrical circuit corresponding to the above schematic drawing should appear. Assume all resistors have the same resistance R and that the power supply has a potential difference V. **(5 marks)**

(b) Express the current flowing through the entire circuit in terms of V and R only. **(5 marks)**

QUESTION FOUR (10 MARKS)

The circuit in figure 4 below shows four light-emitting diodes connected to a resistor R and a 6 V a.c. supply of frequency 1 Hz.
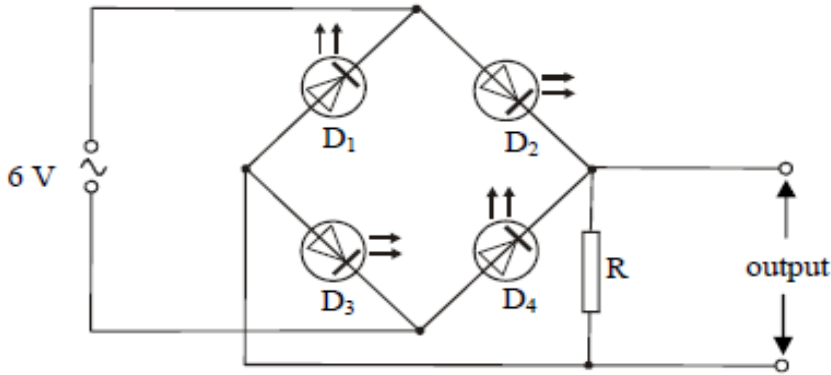
Figure 4

(a) Which was the likely aim of this experiment?   **(1 mark)**
(b) What is observed when the circuit is operating?   **(2 marks)**
(c) What is observed when the frequency of the a.c. supply is increased to 50 Hz?   **(1 mark)**
(d) Give **one** function of the resistor R   **(1 mark)**
(e) How was the output voltage displayed?   **(1 mark)**
(f) Draw graphs to show the differences between the input voltage and the output voltage.   **(3 marks)**
(g) It is noticed that the output voltage is lower than the input voltage. Explain why.   **(1 mark)**

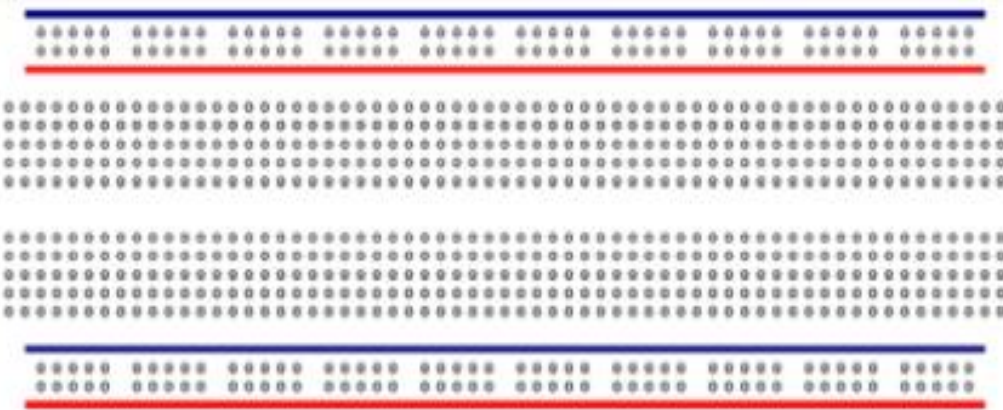*After answering on figure 5, detach this page and insert in your answer booklet*

Figure 5

*Plot the graph **only** on this sheet and do your calculations in the answer booklet! After answering, detach this page and insert in your answer booklet*