

## 4.6 ELECTRICITY (448)

### 4.6.1 Electricity Paper 1 (448/1)

#### SECTION A (48 marks)

Answer *all* the questions in this section in the spaces provided.

- 1 (a) Outline the procedure of connecting an ammeter to take a measurement in a circuit. (2 marks)
- (b) **Figure 1** shows a resistor with colour bands.

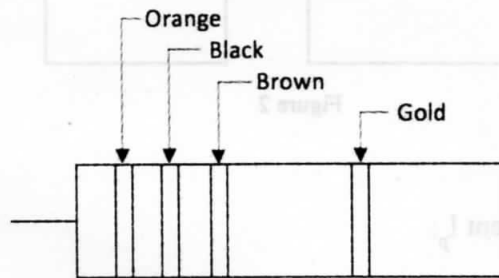


Figure 1

Determine its:

- (i) nominal resistance; (1 mark)
  - (ii) maximum resistance. (2 marks)
- 2 (a) State **two** reasons for using a circuit diagram when troubleshooting an electrical equipment. (2 marks)
  - (b) State **four** components of a bill of materials in project fabrication. (2 marks)
- 3 (a) Explain the effect of each of the following in a p-n junction: (2 marks)
    - (i) forward bias;
    - (ii) reverse bias.
  - (b) State the meaning of each of the following ratings of a light emitting diode: (2 marks)
    - (i)  $I_{F(max)}$ ;
    - (ii)  $V_{F(typ)}$ .

- 4 **Figure 2** shows a transformer whose primary impedance is  $1\text{ k}\Omega$ .

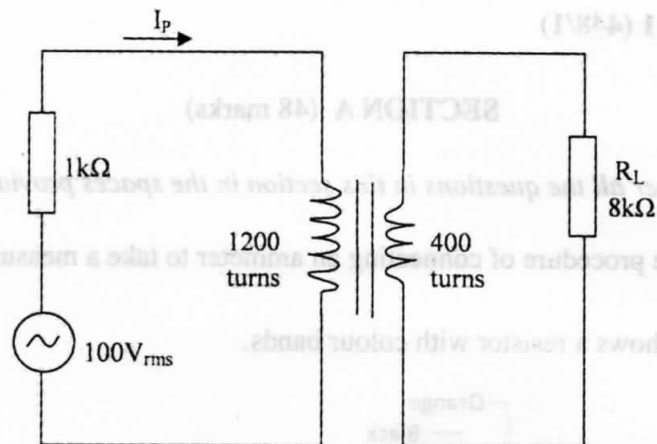


Figure 2

Determine the:

- primary current  $I_p$ ;
- voltage across  $R_L$ .

- 5 With the aid of labelled diagrams, illustrate the arrangement of magnetic domains in:

- unmagnetised material;
- magnetised material.

(3 marks)

- 6 (a) **Figure 3** shows a voltage divider circuit.

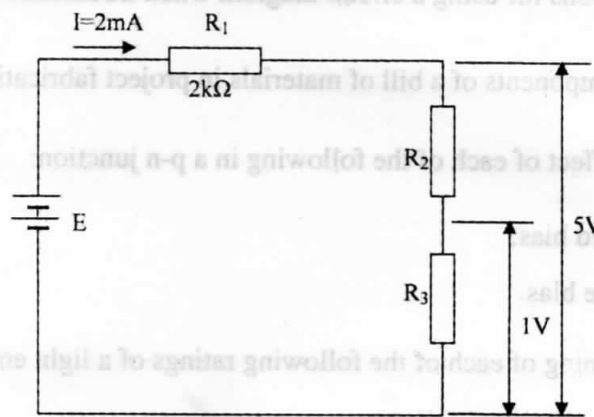


Figure 3

Determine the value of;

- $E$ ;

- (ii)  $R_2$ ;
- (iii)  $R_3$ . (4 marks)
- (b) A consumer has the following loads connected to the supply:
- (i) five 60 W lights for 4 hours;
  - (ii) one 2 kW kettle for  $\frac{1}{2}$  hour.
- Calculate the total:
- (i) energy consumed;
  - (ii) cost of energy used if the rate is 80 cents per unit. (3 marks)
- 7 (a) State **three** safety precautions to be observed by an operator using a portable electric drill. (3 marks)
- (b) Name **four** communication service provider companies currently operating in Kenya. (2 marks)
- 8 (a) Name **four** types of insulating materials used in electrical circuits. (2 marks)
- (b) State **three** advantages of PVC conduit wiring systems. (3 marks)
- 9 (a) Calculate the inductance required to cause resonance at 150 kHz when the capacitance is 1.0 pF. (2 marks)
- (b) In a 240V circuit, the load current is 2.5 A. If the power factor is 0.6, calculate:
- (i) apparent power;
  - (ii) true power. (3 marks)
- 10 Make a free hand isometric drawing of a conduit saddle. (5 marks)

### SECTION B (52 marks)

*Answer any four questions from this section in the spaces provided.*

- 11 **Figure 4**, in the next page, shows the front elevation, end elevation and an incomplete plan of an object.
- (a) Complete the plan;
  - (b) On the isometric grid provided, draw the isometric projection of the object making X the lowest point. (13 marks)

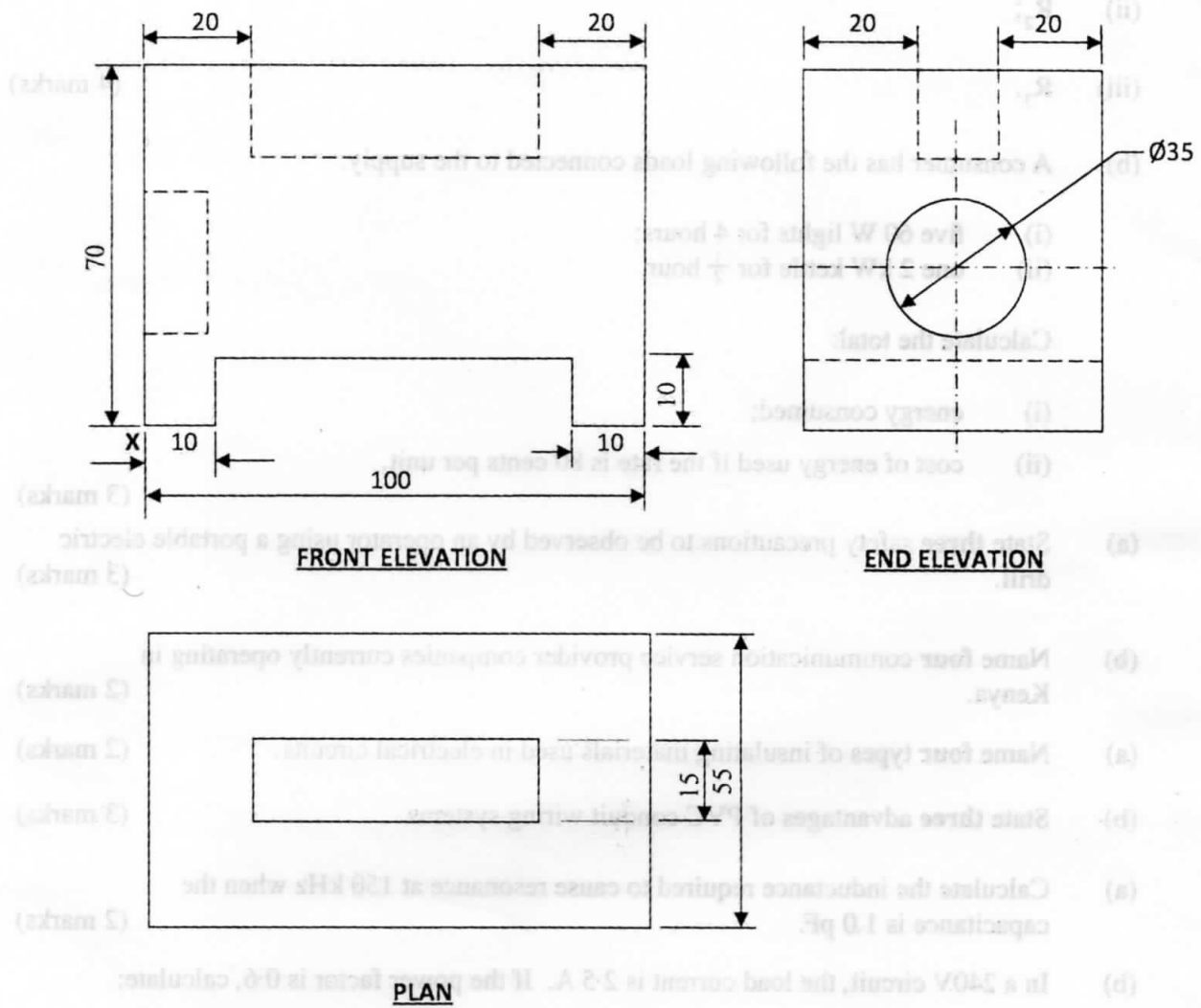


Figure 4

12 Figure 5 shows waveforms A and B. Their vertical and horizontal scales are given.

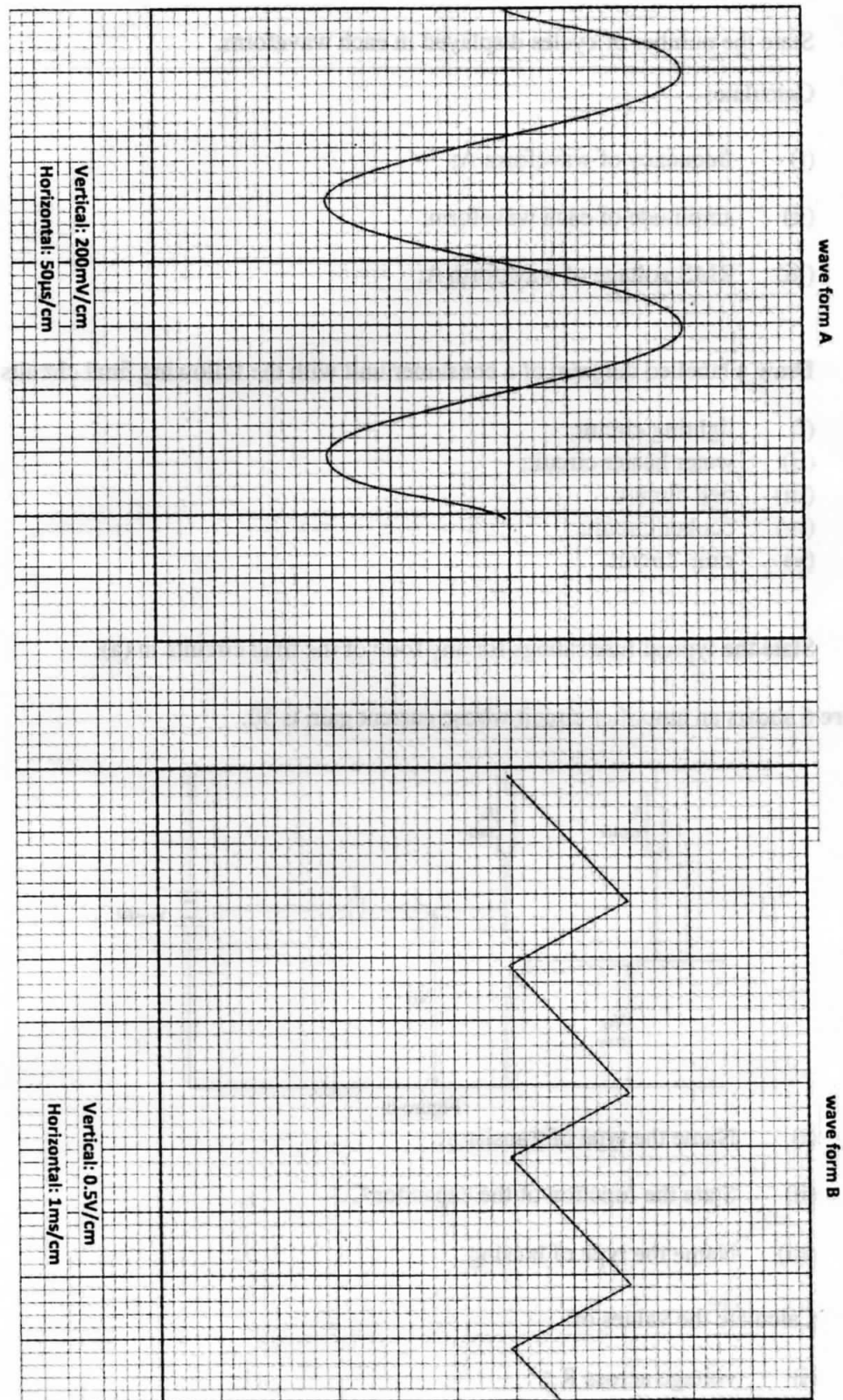


Figure 5

- (a) Name each of the **two** waveforms. (1 mark)
- (b) State the number of cycles displayed in each waveform. (2 marks)
- (c) Calculate:
- (i) frequency of waveform A;
  - (ii) amplitude of each waveform;
  - (iii) RMS voltage of waveform A.
- (10 marks)

**13** (a) Draw a labelled diagram of a consumer unit with the following final circuits.

- (i) lighting circuit;
- (ii) water heater circuit;
- (iii) bell circuit;
- (iv) cooker circuit;
- (v) ring circuit.

(11 marks)

(b) State the typical fuse ratings for any **four** of the final circuits in (a).

(2 marks)

**14** Figure 6 shows an amplifier circuit whose current gain is 50.

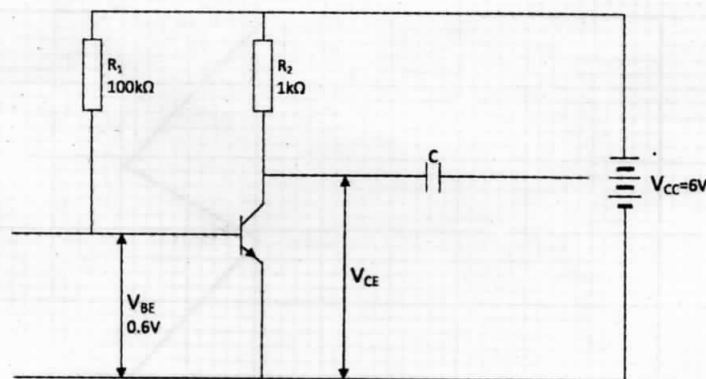


Figure 6

- (a) (i) Name the type of transistor;
- (ii) State the function of the capacitor C.
- (iii) Name the type of biasing.

(3 marks)

(b) Calculate the values of:

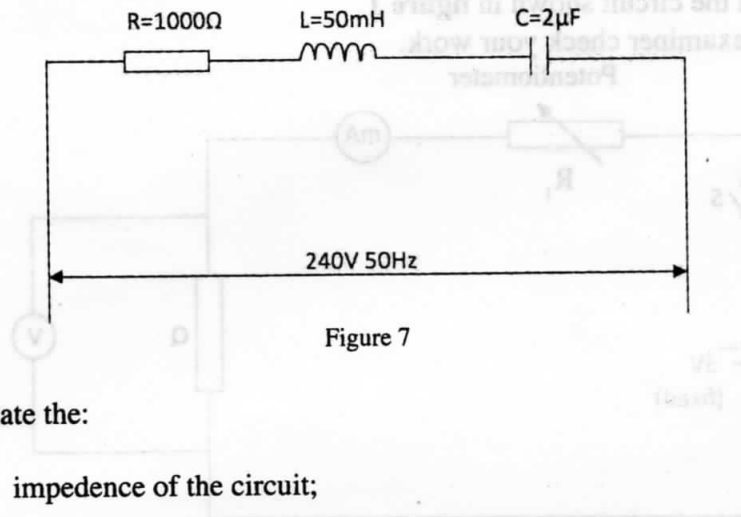
(10 marks)

- (i) voltage across  $R_1$ ;
- (ii) base current  $I_B$ ;

(iii) collector current  $I_C$ ;

(iv) voltage  $V_{CE}$ .

15 Figure 7 shows an R-L-C circuit.



(a) Calculate the:

(i) impedance of the circuit;

(7 marks)

(ii) current.

(3 marks)

(b) Draw the phasor diagram.

(3 marks)

Current $I$ (mA)	Voltage $V$ (V)	$V$
40		
100		
200		
240		
260		

- (iv) Calculate the values of  $V$  and record them in the spaces provided in the table.
- (v) Use the values in the table to draw a graph of voltage against current.
- (vi) Determine the slope of the graph.
- (vii) From the graph, determine the voltage  $V$  when the current  $I = 100$  mA.
- (viii) State the purpose of the experiment.

## 4.6.2 Electricity Paper 2 (448/2)

### EXERCISE 1

1 Using materials, components and equipment provided, perform the following tasks.

- (i) Connect the circuit shown in figure 1. Let the examiner check your work. (3 marks)

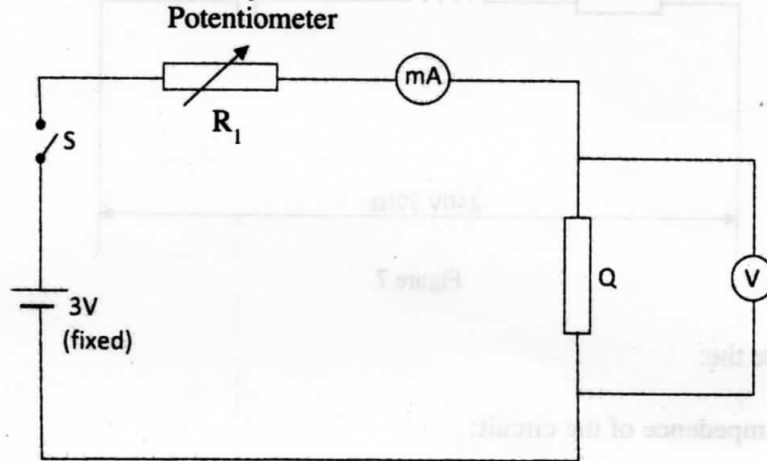


Figure 1

- (ii) Close switch S.
- (iii) Adjust the potentiometer for the ammeter to obtain current values in table 1 and in each case record the corresponding voltage values. (7½ marks)

Table 1

Current $I_{(mA)}$	40	100	200	240	260
Voltage (V)					
$\frac{V}{I}$					

- (iv) Calculate the values of  $\frac{V}{I}$  and record them in the spaces provided in the table.
- (v) Use the values in the table to draw a graph of voltage against current. (5½ marks)
- (vi) Determine the slope of the graph. (2 marks)
- (vii) From the graph, determine the voltage, V when the current  $I = 160$  mA.  
 $V = \dots\dots\dots$  (1 mark)
- (viii) State the purpose of the experiment. (1 mark)



## EXERCISE 2

- 2 Use the tools, equipment and materials provided to make the bracket shown in figure 2. (20 marks)

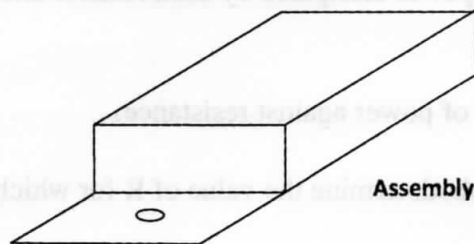
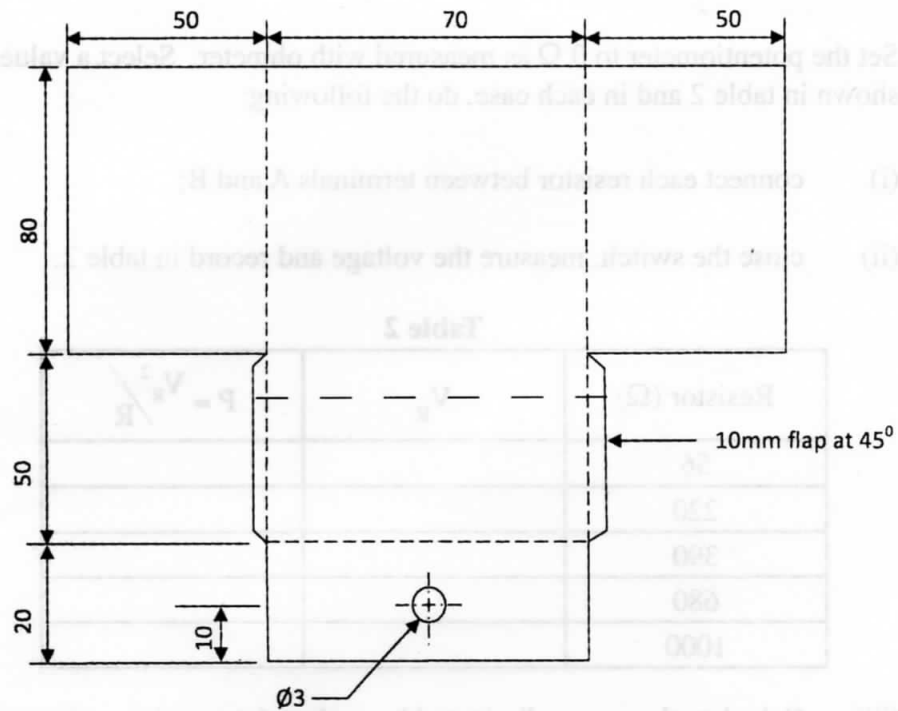


Figure 2

## EXERCISE 3

- 3 Figure 3 shows a block diagram of the electronic circuit provided.

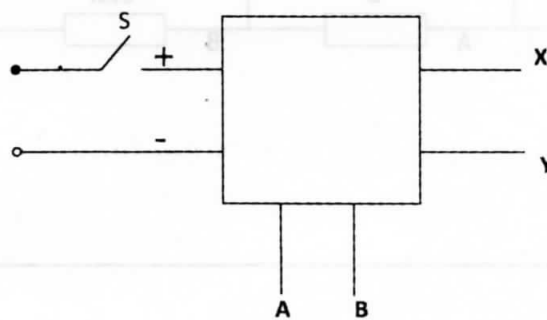


Figure 3

Perform the following tasks:

- (a) With the switch S open, connect the circuit to the DC power source. Let the examiner check your work. (1 mark)
- (b) Set the potentiometer to  $0\ \Omega$  as measured with ohmmeter. Select a value of resistor shown in table 2 and in each case, do the following:
  - (i) connect each resistor between terminals A and B; (2½ marks)
  - (ii) close the switch, measure the voltage and record in table 2. (5 marks)

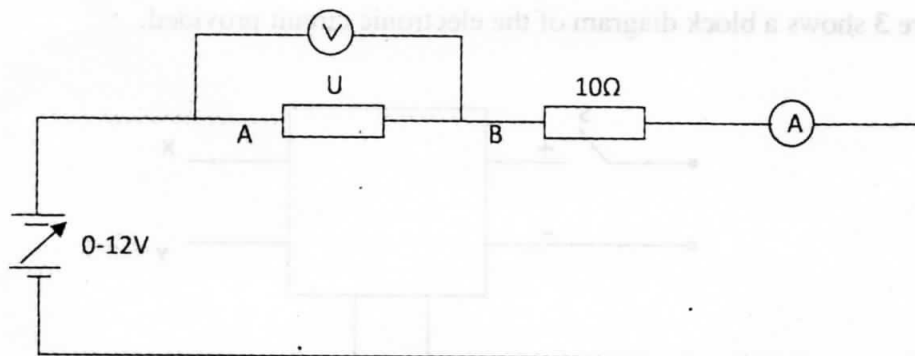
**Table 2**

Resistor ( $\Omega$ )	$V_R$	$P = \frac{V_R^2}{R}$
56		
220		
390		
680		
1000		

- (iii) Calculate the power dissipated by each resistor and complete table 2. (5 marks)
- (iv) Draw a graph of power against resistance. (5½ marks)
- (v) From the graph, determine the value of R for which there is maximum power transfer. (1 mark)

#### EXERCISE 4

- 4 Use the components and equipment to connect the circuit illustrated in figure 4. Let the examiner see your work. (2½ marks)



**Figure 4**

Perform the following tasks:

- Switch on the power supply.
- Adjust the power supply to obtain each of the voltage values across U as shown in **table 3** and in each case, record the corresponding current: (5 marks)

**Table 3**

V	0.4	0.5	0.6	0.7	0.8
I					

- Switch off the power supply and reverse its connections.
- Adjust the power supply to obtain each of the voltage values across U as shown in **table 4** and in each case, record the corresponding current. (5 marks)

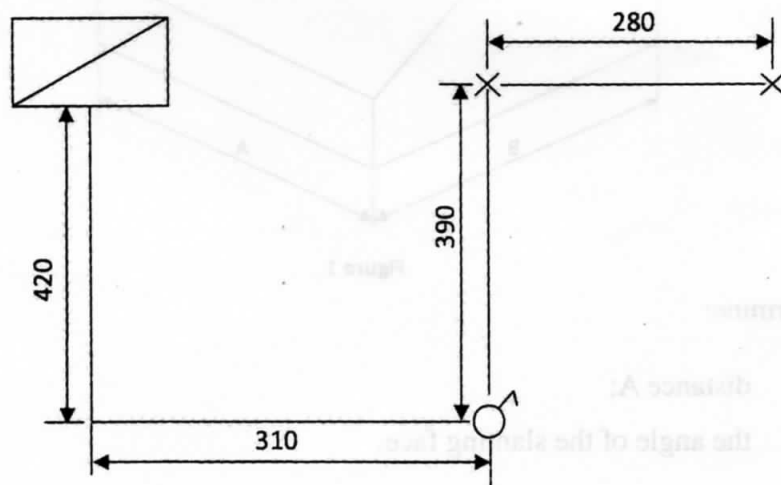
**Table 4**

V	-0.5	-1	-3	-4	-5
I					

- Use the values of I and V from tables 3 and 4 to draw the graph of current (I) against voltage (V) on the same axes. (7 marks)
- From the shape of the graph, identify component U. ( $\frac{1}{2}$  marks)

### EXERCISE 5

- Figure 5** shows the layout of a lighting installation. Using PVC sheathed cables, install the circuit such that the lamps are controlled at one point. (20 marks)



**Figure 5**