

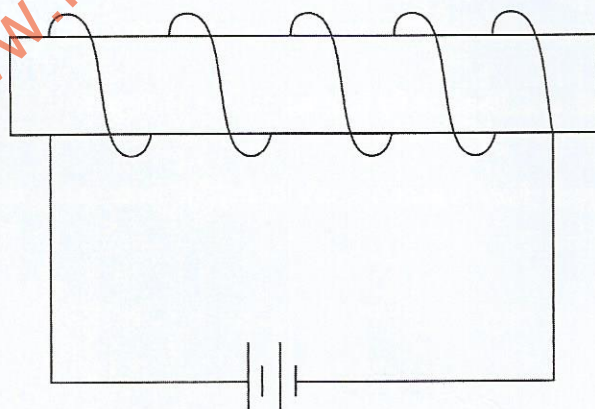
## 4.6 ELECTRICITY (448)

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

#### SECTION A (48 marks)

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

1. (a) Name **four** accessories used in a lighting circuit installation. (2 marks)
- (b) (i) List **four** types of materials used in electrical conductors. (2 marks)
- (ii) State **two** methods of disposing burnt out fluorescent tubes. (1 mark)
2. With the aid of a circuit diagram, show that for two parallel connected resistors  $R_1$  and  $R_2$  their total resistance is given by: (6 marks)
 
$$R_T = \frac{R_1 R_2}{R_1 + R_2}$$
3. For a purely resistive AC circuit, draw the:
  - (a) circuit diagram (2 marks)
  - (b) phasor diagram (2 marks)
  - (c) current/voltage waveform (2 marks)
4. **Figure 1** shows an electromagnet.



**Figure 1**

- (a) Show the direction of current. (1 mark)
- (b) Complete the direction of the field pattern. (2 marks)
- (c) Indicate the polarity of the electromagnet. (1 mark)

5. (a) Table 1 shows the comparisons between a moving-coil instrument and a moving-iron instrument.

Table 1

Instrument	Used for measuring	Method of control	Method of damping
Moving-coil			
Moving-iron			

Complete the table.

(3 marks)

- (b) Outline the steps to be followed by an electrician when writing a business plan for starting a mobile phone repair workshop. (2 marks)
6. (a) Explain two types of single phase transformer losses. (3 marks)
- (b) Draw a labelled diagram of DC series motor. (3 marks)
7. Draw and label diagrams showing the formation of a P-N junction when:
- (a) charges diffuse across the junction (3 marks)
- (b) equilibrium state is reached (2 marks)
8. Figure 2 shows the diagram of a filament lamp.

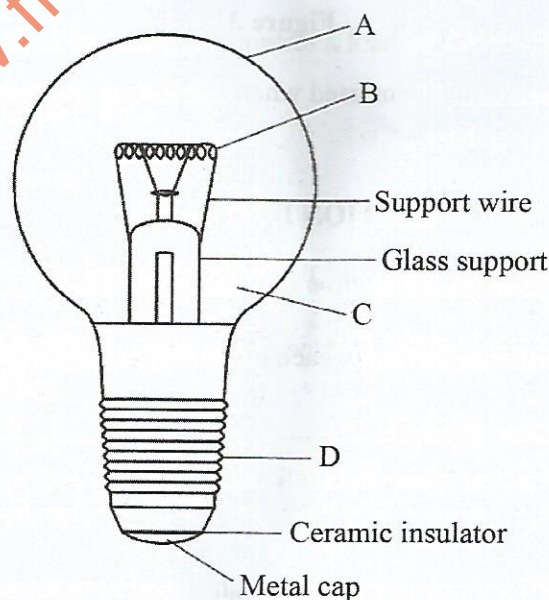


Figure 2

- (a) Name the parts labelled A to D.

(2 marks)

(b) State **two** reasons for using each of the parts labelled B and C. (2 marks)

9. Draw each of the following symbols:

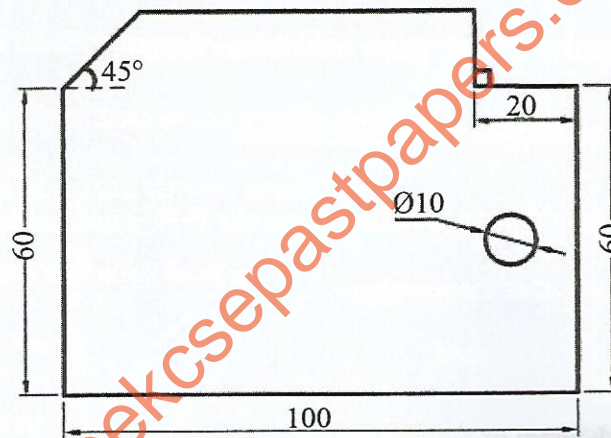
(a) Inductor (1 mark)

(b) Variable capacitor (1 mark)

(c) Electric heater (1 mark)

10. (a) Outline **four** checks to be done when trouble shooting a faulty lighting system. (2 marks)

(b) **Figure 3** shows a metal template.



**Figure 3**

List **four** tools and equipment used when fabricating the piece. (2 marks)

**SECTION B (52 marks)**

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

11. (a) Name **one** material used to make each of the following parts of electrical machines:

(i) Commutator segments .....

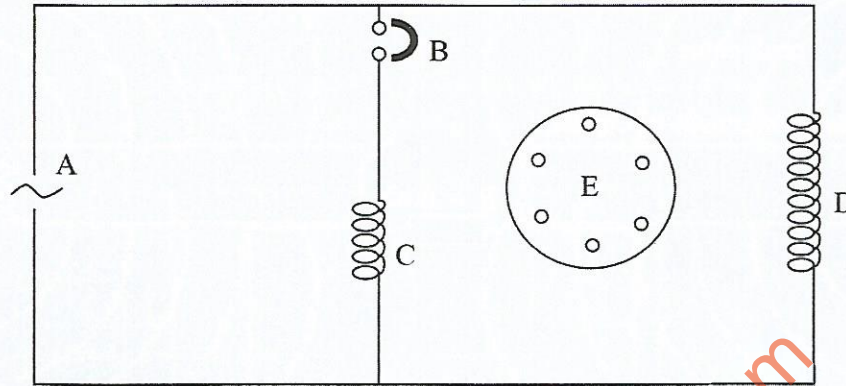
(ii) Brushes .....

(iii) Slip rings .....

(iv) Armature core .....

(2 marks)

- (b) (i) **Figure 4** shows a single phase AC induction motor. Name the parts labelled A to E.



**Figure 4**

- A ..... (1 mark)
- B ..... (1 mark)
- C ..... (1 mark)
- D ..... (1 mark)
- E ..... (1 mark)

- (ii) State the function of part labelled B. (2 marks)

- (c) A 240 V/24 V ideal transformer supplies a load of 120 W. Calculate:

- (i) transformation ratio (1 mark)
- (ii) supply current (3 marks)

12. (a) (i) List **two** circuit conditions which can cause an electric shock. (2 marks)
- (ii) State the difference between electrical power engineering and communication engineering. (2 marks)

- (b) An electric kettle has a faulty cable. State **two** possible faults in the cable and for each fault state **one** remedy. (2 marks)

- (c) Outline the procedure of installing socket outlets using a PVC conduit wiring system. (4 marks)

- (d) Draw a labelled diagram of a cartridge fuse. (3 marks)

13. (a) Draw a sinusoidal AC waveform for **two** cycles and indicate each of the following:
- (i) periodic time (2 marks)
  - (ii) peak value (2 marks)
- (b) **Figure 5** shows R-C circuit.

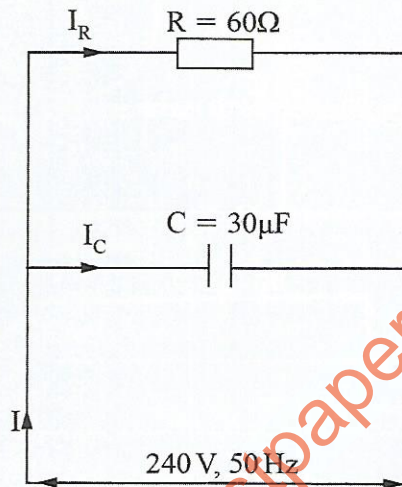


Figure 5

Determine:

- (i) the branch currents  $I_R$  and  $I_C$  (3 marks)
  - (ii) supply current  $I$  (2 mark)
- (c) **Figure 6** shows diagrams of two experiments conducted in the laboratory to study characteristics of lines of magnetic flux.

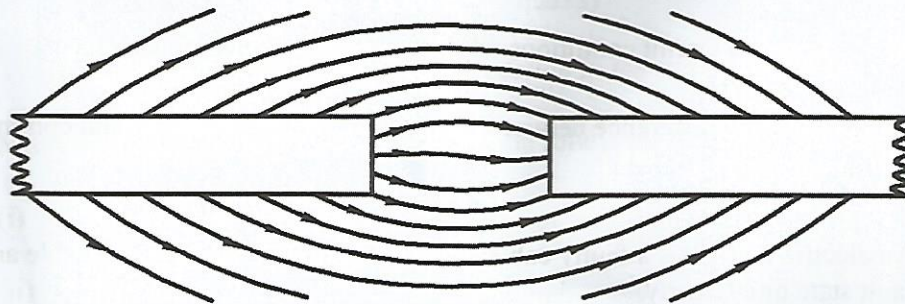


Figure 6a

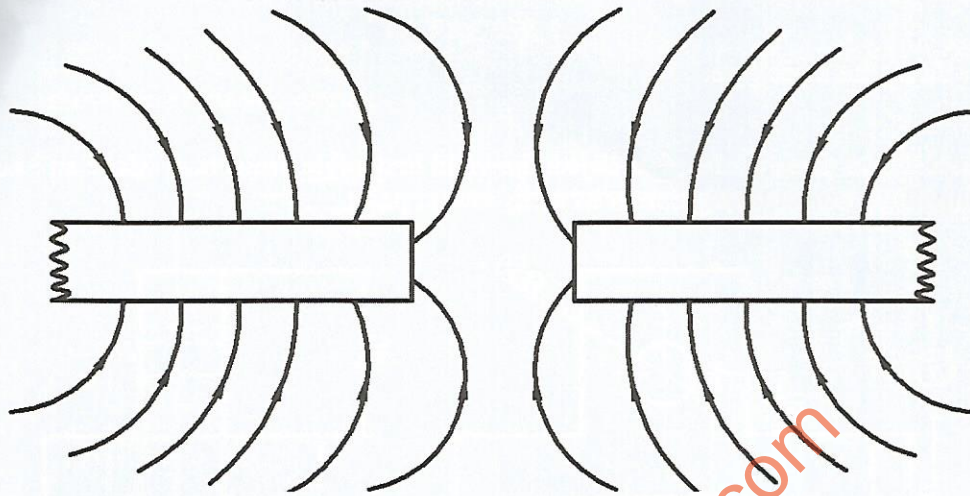


Figure 6b

- (i) Indicate the polarities of the magnets. (2 marks)
- (ii) Outline **three** characteristics of the lines of magnetic flux observed in this experiment. (2 marks)

14. (a) State **three** differences between a semiconductor diode and a transistor. (3 marks)
- (b) Sketch the I–V characteristic curve of a rectifier diode and label:
- (i) The axes
  - (ii)  $V_F$
  - (iii)  $V_R$
- (4 marks)

- (c) **Figure 7** shows the combination of AND gate and NOT gate.

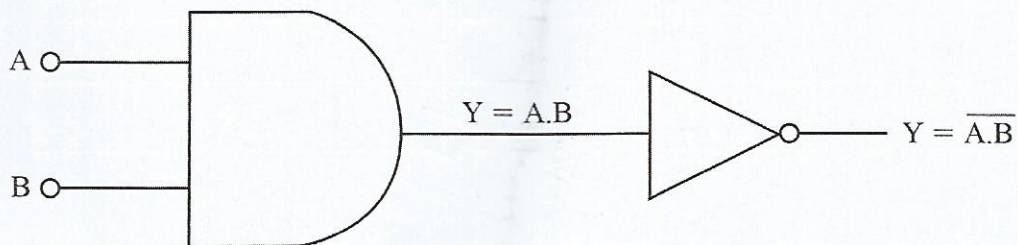


Figure 7

- (i) Draw the truth table of the combination. (4 marks)

(ii) State the name of the gate formed after combination. (1 mark)

(iii) Draw the logic gate. (1 mark)

15. **Figure 8** shows three views of an object drawn in first angle projection. Make an isometric drawing of the object taking corner M as its lowest point. (13 marks)

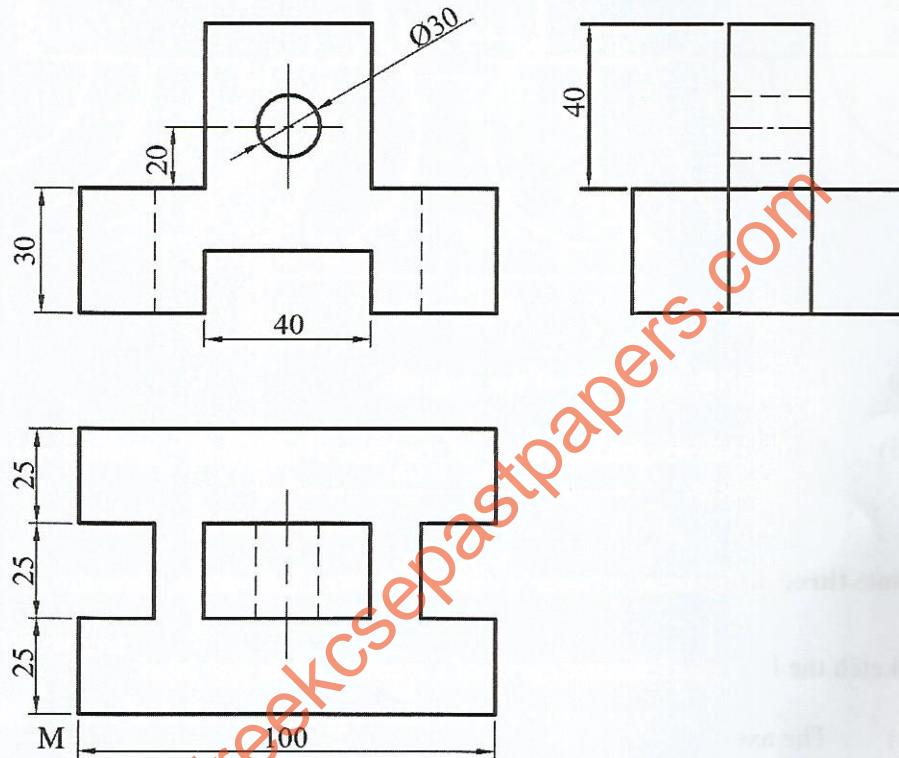


Figure 8

## 4.6.2 Electricity Paper 2 (448/2)

## EXERCISE 1

1. Figure 1 shows an electronic circuit.

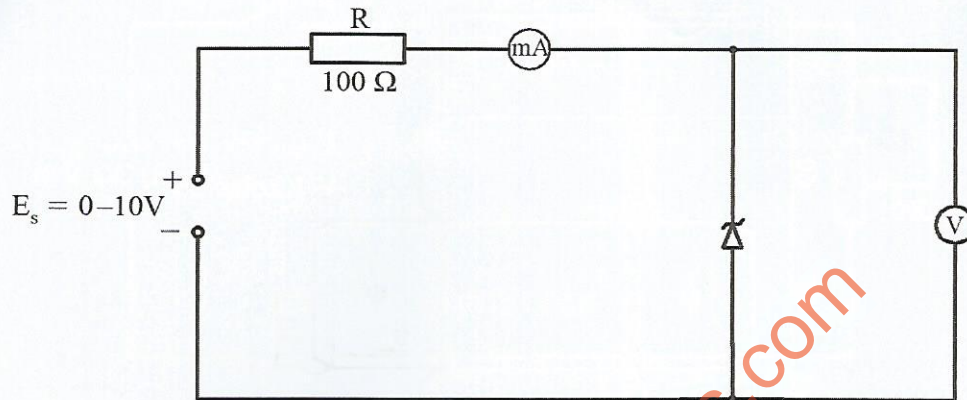


Figure 1

- (a) Using the breadboard and items provided, connect the circuit as shown.

Let the examiner check your work.

(5 marks)

- (b) Adjust the power supply to obtain the values shown in Table 1, and for each voltage value, measure and record the corresponding value of voltage (V) and current (mA).

(10 marks)

Table 1

SUPPLY VOLTAGE, $E_s$ (V)	VOLTAGE (V)	CURRENT (mA)
1.5		
3.0		
4.5		
6.0		
7.5		
9.0		

- (c) Using the values in Table 1, plot a graph of current (mA) against voltage (V).

(4 marks)

- (d) From the graph, obtain the zener potential voltage.

$V_z = \dots\dots\dots$  volts.

(1 mark)



## EXERCISE 2

2. Figure 2 shows the development and pictorial view of a casing of a switchgear.

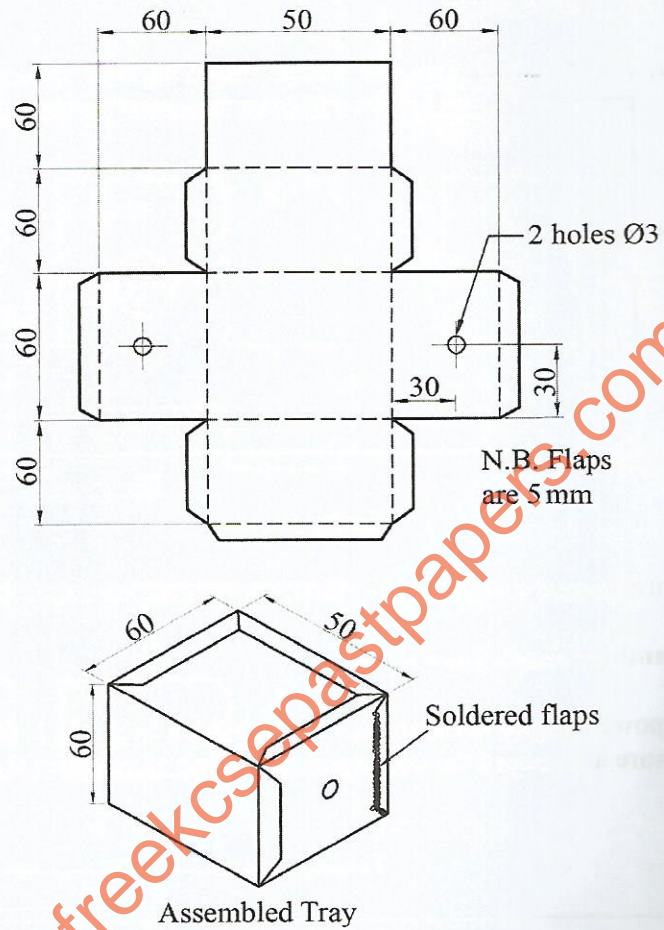


Figure 2

Using the tools, equipment and materials provided:

- (i) fabricate the casing
- (ii) solder the flaps

(20 marks)

## EXERCISE 3

3. Figure 3 shows an electric circuit.

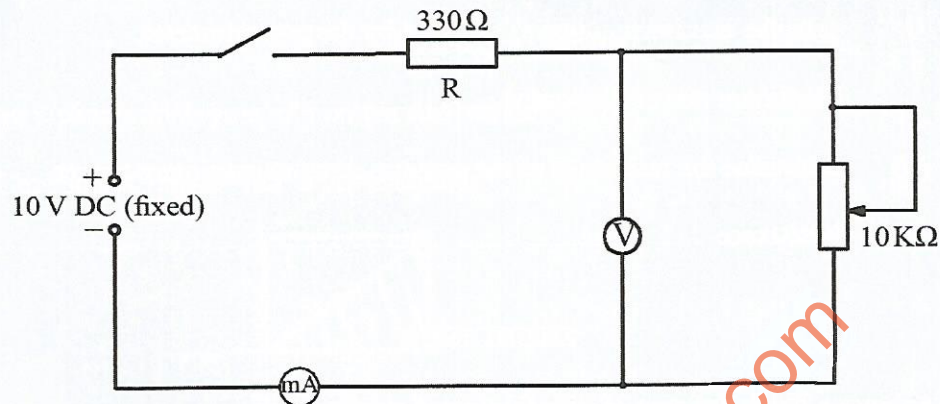


Figure 3

- (a) Connect the circuit as shown in the Figure. (6 marks)

Let the examiner check your work.

- (b) (i) The power supply is pre-set to 10 V DC.  
Vary the potentiometer to obtain each of the voltages shown in **Table 2**. (3 marks)
- (ii) For each values in **Table 2**, calculate and record the power dissipated in the potentiometer. (3 marks)

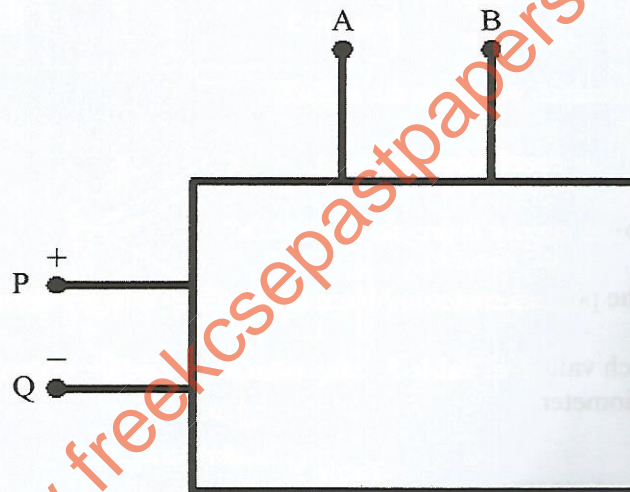
Table 2

<b>Voltage (V)</b>	0	2	4	6	8	10
<b>Current (mA)</b>						
<b>Power dissipated (W)</b>						

- (c) Plot a graph of power against current. (6 marks)
- (d) From the graph:
  - (i) state the maximum power dissipated by the potentiometer.  
Maximum power dissipated ..... (1 mark)
  - (ii) determine the resistance of the potentiometer at maximum power.  
Resistance ..... (1 mark)

**EXERCISE 4**

4. **Figure 4** shows a block diagram of a prefabricated circuit provided.



**Figure 4**

- (a) With the switch open, perform each of the following tasks:
  - (i) Connect the power supply set at 9V DC across points labelled P and Q (1 mark)
  - (ii) Connect the ammeter across terminals marked A and B (1 mark)
- (b) Close the switch, vary the potentiometer from minimum to maximum.
  - (i) State your observation (4 marks)
  - (ii) Measure the values of current at:
    - I. minimum ..... mA (1 mark)
    - II. maximum ..... mA (1 mark)

- (c) Explain the reason for your observation in 4(b). (4 marks)
- (d) Draw a schematic diagram of the circuit. (8 marks)

### EXERCISE 5

5. Figure 5 shows the layout of a power final circuit.

The Consumer Control Unit is pre-installed.

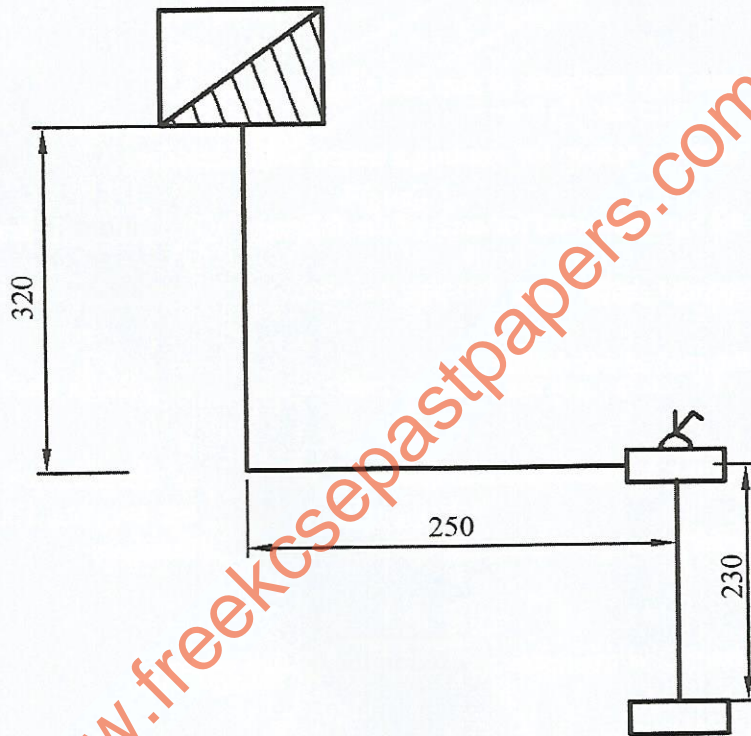


Figure 5

Using PVC sheathed cables, install the circuit.

(20 marks)