

**3.20 ELECTRICITY (448)**

**3.20.1 Electricity Paper 1 (448/1)**

**SECTION A (48 marks)**

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

- 1 (a) State the name of the institution into which each of the following was upgraded:
- (i) Kenya Polytechnic;
  - (ii) Mombasa Polytechnic. (1 mark)
- (b) State the main duty of class A2 Electrical License holder. (1 mark)
- 2 (a) Name the materials used to make the parts of an AC machine in **table 1** and in each case state **one** reason why the material is used.

**Table 1**

PART	MATERIAL	REASON
Brushes	.....	.....
Slip rings	.....	.....

(3 marks)

- (b) State the **three** factors to consider when choosing a motor for a particular installation. (3 marks)
- 3 Draw a ring final circuit diagram with four socket outlets and a spur. (5 marks)
- 4 (a) State **two** factors that determine the resistance of a conductor. (2 marks)
- (b) Determine the colour code of a 1500  $\Omega \pm 5\%$  carbon resistor. (3 marks)
- 5 (a) (i) **Figure 1** shows a pair of current - carrying conductors. Draw the magnetic flux around the conductors. (2 marks)



**Figure 1**

- (ii) Name the type of force that exists between the conductors in a(i) above.

(b) With the aid of a labelled diagram show how each of the following permanent magnets are stored to preserve their magnetism: (2 marks)

- (i) horse shoe;
- (ii) bar.

6 (a) Name **four** faults that occur in electric circuits. (2 marks)

(b) State **two** ways of increasing the magnetic field strength of a moving coil instrument. (2 marks)

7 **Figure 2** shows a resistive circuit.

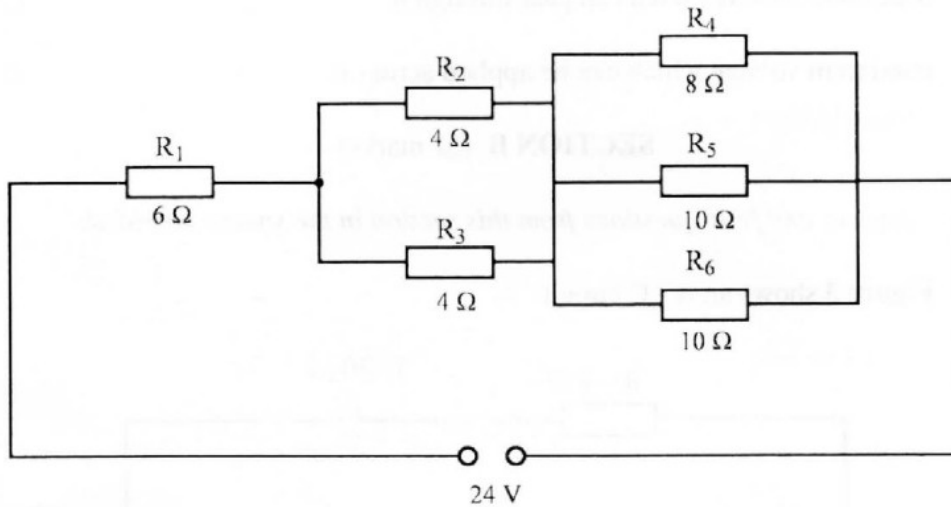


Fig. 2

Calculate:

(a) total resistance of the circuit; (3  $\frac{1}{2}$  marks)

(b) current through R<sub>6</sub>. (2  $\frac{1}{2}$  marks)

8 (a) State **two** safety precautions to be observed when using each of the following:

- (i) arc welding machine;
- (ii) microwave oven. (4 marks)

(b) Name **four** non-ferrous metals used in manufacturing electrical components. (2 marks)

- 9 (a) State **four** qualities of successful entrepreneurs. (2 marks)
- (b) Sketch the correct symbol for each of the following electronic components: (3 marks)
- (i) cored inductor;
  - (ii) LED;
  - (iii) electrolytic capacitor.
- 10 A  $47\text{ k}\Omega$  carbon resistor has a power rating of  $\frac{1}{4}\text{ W}$ . Determine the:
- (a) maximum current which can pass through it. (2  $\frac{1}{2}$  marks)
  - (b) maximum voltage which can be applied across it. (2  $\frac{1}{2}$  marks)

**SECTION B (52 marks)**

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

- 11 (a) **Figure 3** shows an R - C circuit.

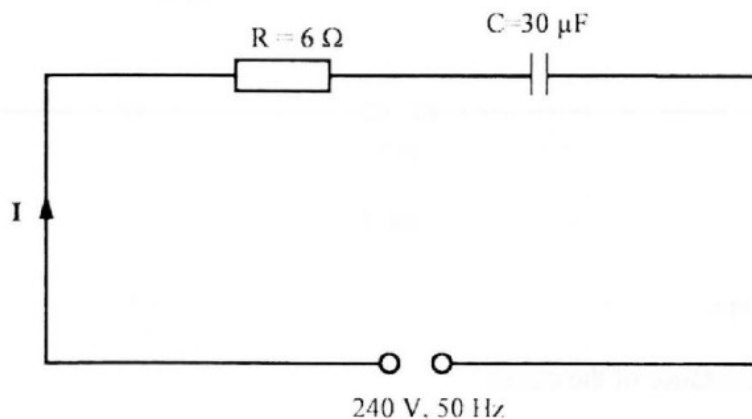


Fig. 3

Calculate the:

- (i) impedance; (2 marks)
  - (ii) current I; (2 marks)
  - (iii) phase angle. (2 marks)
- (b) Draw a labelled diagram of a continuous ringing bell. (7 marks)

12 Figure 4 shows a block drawn in isometric projection.

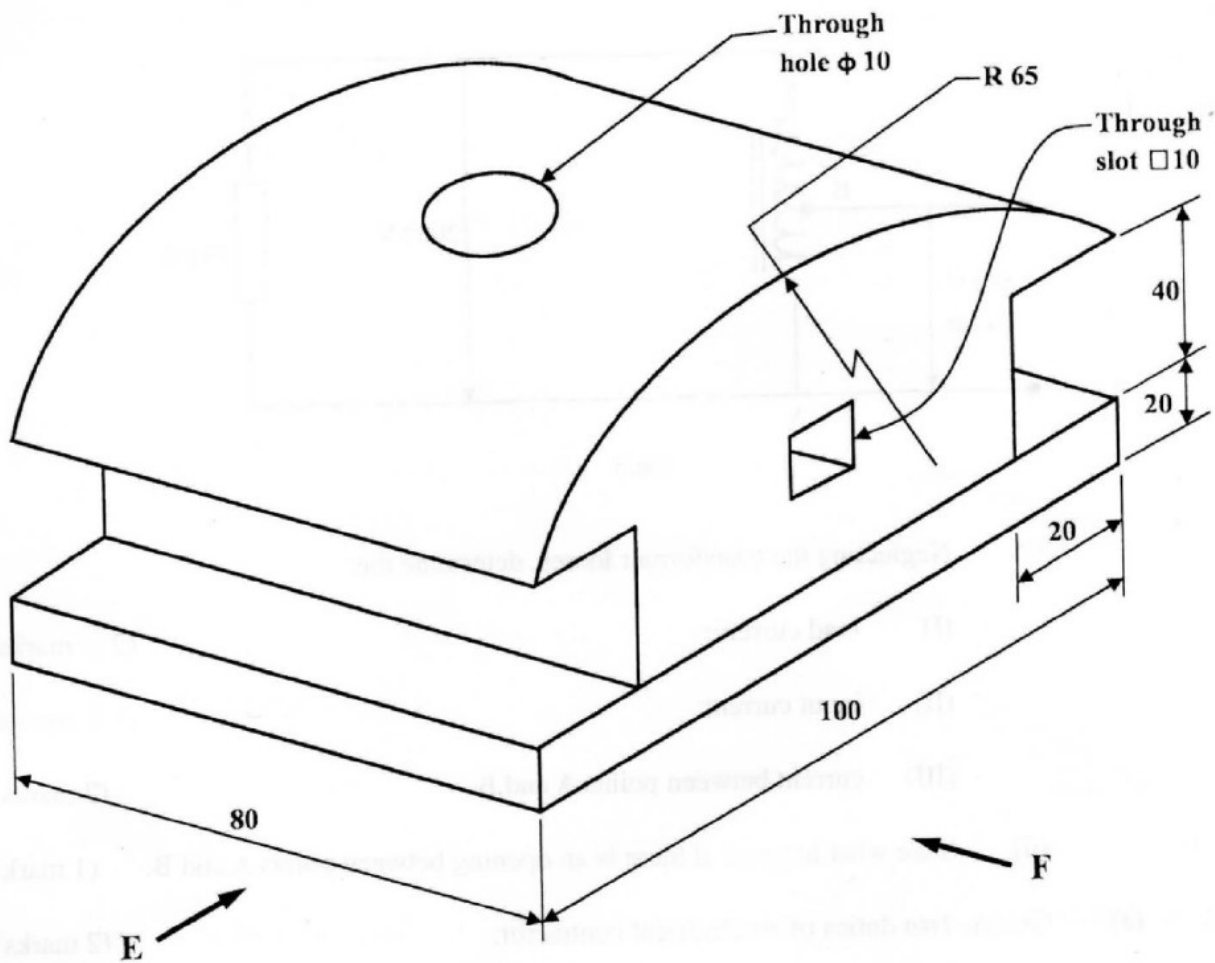


Fig. 4

Using first angle projection draw the following views full size:

- front elevation in the direction of arrow F;
- end elevation in the direction of arrow E;
- plan.

(13 marks)

(Use A<sub>3</sub> paper provided)

- 13
- State **three** reasons why autotransformers are more efficient than double wound transformers of the same rating. (3 marks)
  - Outline **three** functions of oil in a transformer. (3 marks)

- (c) **Figure 5** shows a step-up transformer supplying a load of 75 kW at unity power factor.

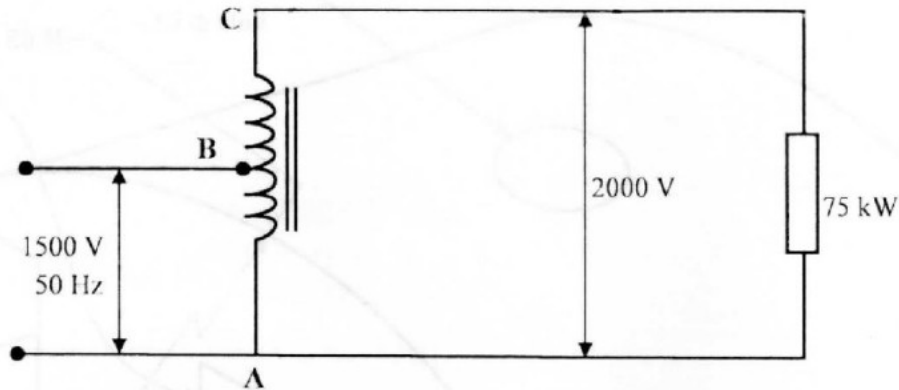


Fig.5

- (i) Neglecting the transformer losses, determine the:
- (I) load current; (2  $\frac{1}{2}$  marks)
  - (II) input current; (1  $\frac{1}{2}$  marks)
  - (III) current between points A and B. (2 marks)
- (ii) State what happens if there is an opening between points A and B. (1 mark)
- 14** (a) Outline **two** duties of an electrical contractor. (2 marks)
- (b) State **two** reasons for carrying out installation resistance test in an installation. (2 marks)
- (c) (i) Draw and label a filament lamp. (6 marks)
- (ii) A fluorescent lamp flickers in an effort to start. State **three** possible causes for this action. (3 marks)



15 (a) **Figure 6** shows a NAND gate in a circuit.

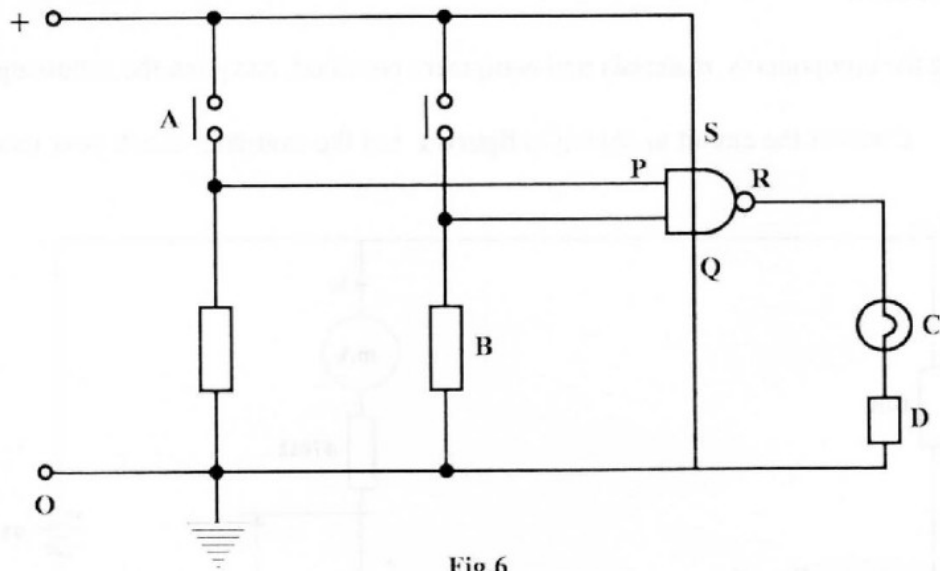


Fig.6

(i) Names the parts labelled P, Q, R and S. (4 marks)

(ii) State the functions of components A, B, C and D. (4 marks)

(b) **Figure 7** shows a capacitor discharge circuit.

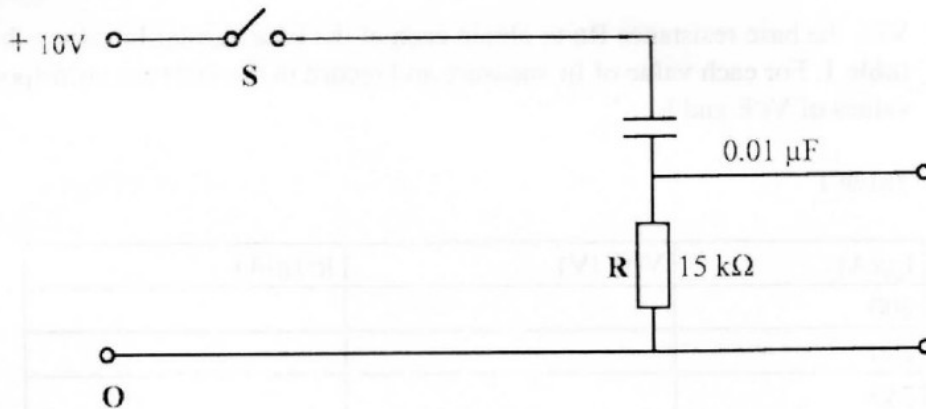


Fig.7

(i) Sketch the output voltage - time waveform when switch S is closed. (2 marks)

(ii) Determine the duration taken to fully discharge the capacitor. (3 marks)

3.20.2 Electricity Paper 2 (448/2)

1 STATION 1

Using the components, materials and equipment provided, carry out the following tasks:

- (a) Connect the circuit as shown in **figure 1**. Let the examiner check your work. (7 marks)

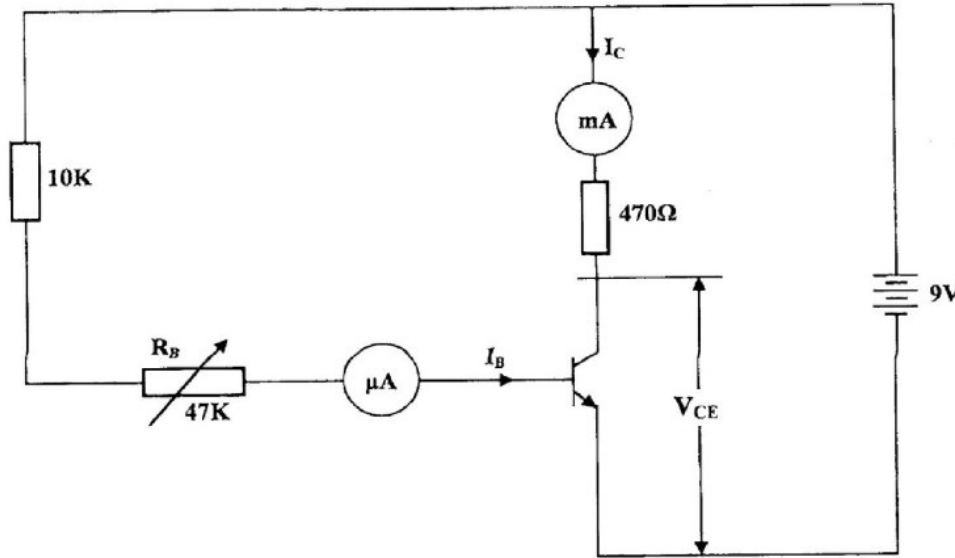


Figure 1

- (b) Vary the base resistance  $R_B$  to obtain each of the base current  $I_B$  values shown in **table 1**. For each value of  $I_B$ , measure and record in the table the corresponding values of  $V_{CE}$  and  $I_C$ . (6 marks)

Table 1

$I_B (\mu A)$	$V_{CE} (V)$	$I_C (mA)$
200		
220		
240		
260		
280		
300		

- (c) Using the values in table 1:
- (i) determine the current gain  $\beta$  when  $I_B = 240 \mu A$ . (2 marks)
  - (ii) plot a graph of  $I_C$  against  $V_{CE}$ . (5 marks)

2 STATION 2

Using the tools, equipment and materials provided, fabricate the saddle bracket shown in figure 2. (20 marks)

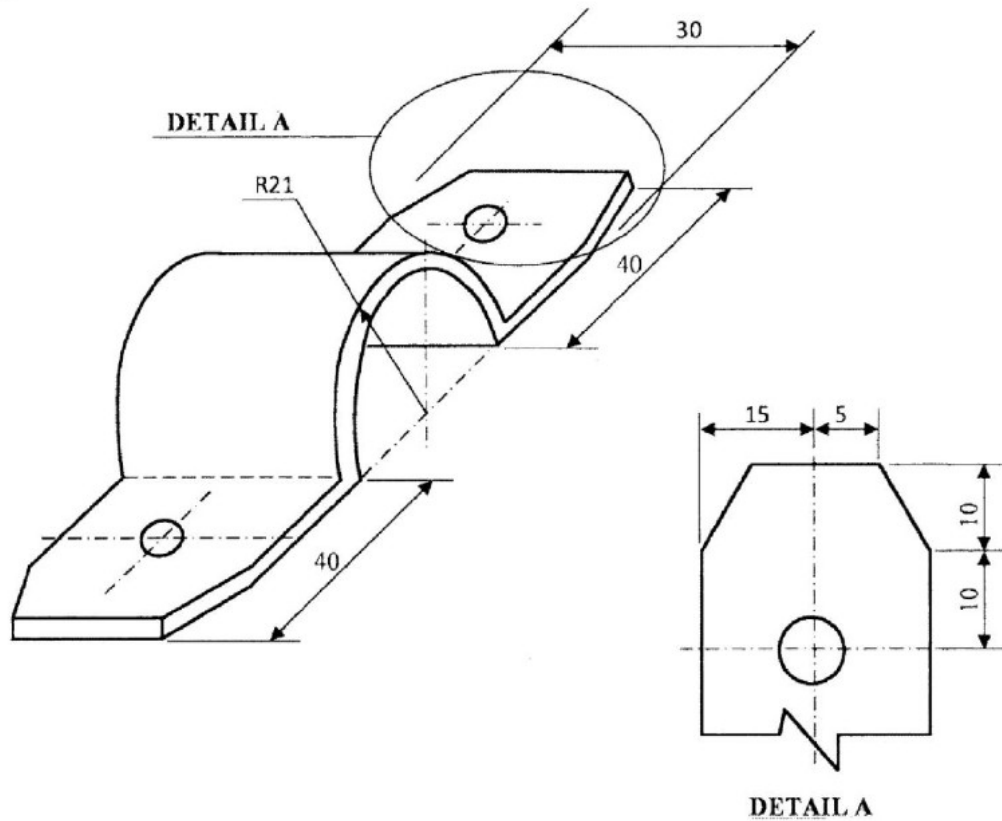


Figure 2

3 STATION 3

Using materials, components and equipment provided, perform the following tasks:

- (a) Connect the circuit shown in figure 3. Let the examiner check your work. (5 marks)

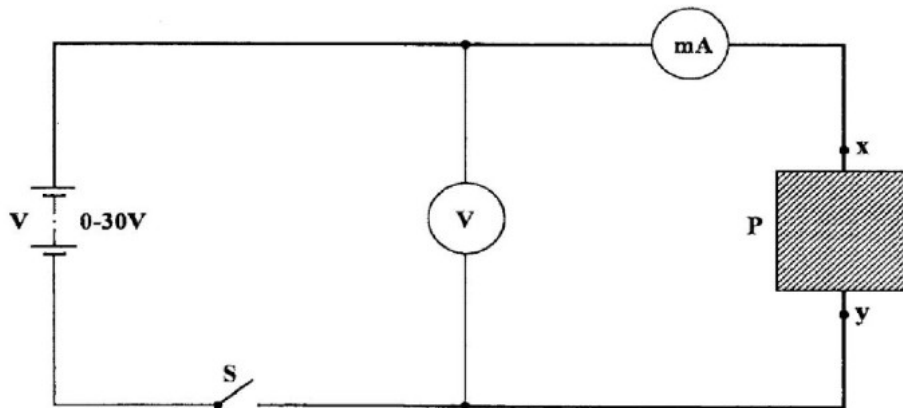


Figure 3



In each case, measure and record in table 3 the corresponding values of Load Voltage  $V_L$  and load current  $I_L$ .

**Table 3**

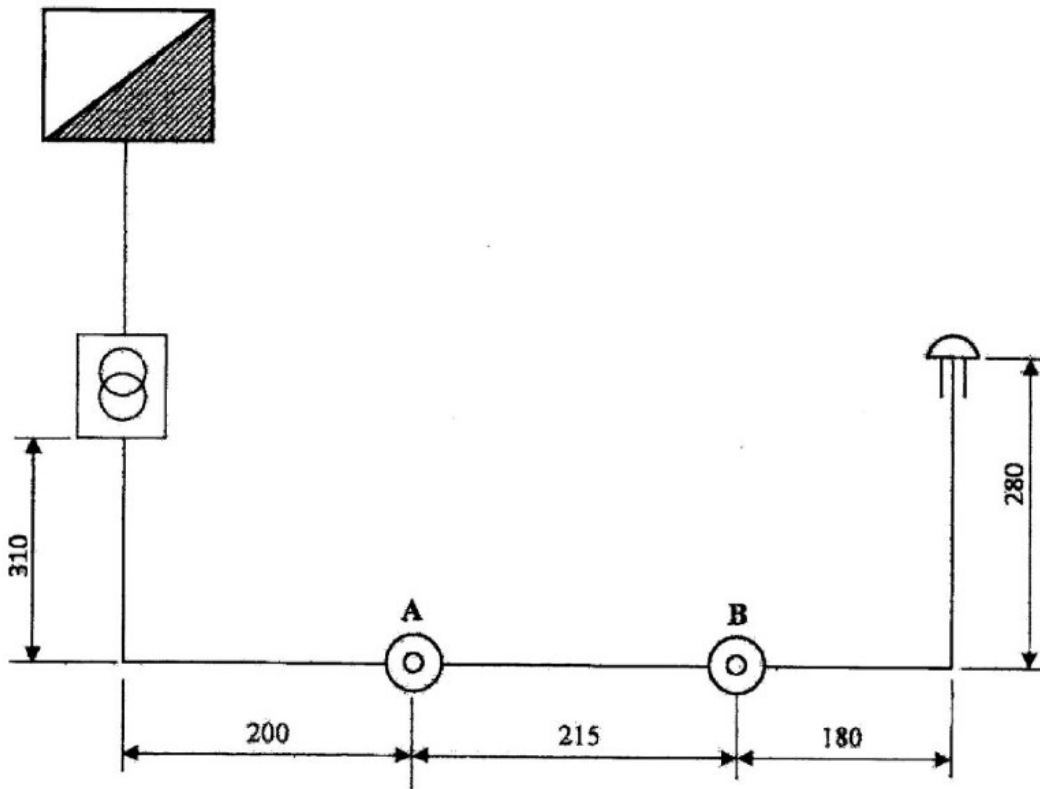
ES	$V_{LOAD}$	$I_{LOAD}$
1		
3		
6		
7		
10		
12		

(9 marks)

- (c) Plot a graph of load voltage  $V_L$  against power source voltage  $E_s$ . (5 marks)
- (d) State **one** application of the circuit P and give the reason for your answer. (2 marks)

**5 STATION 5**

Using PVC sheathed wiring, complete the installation shown in **figure 5**, such that the bell is operated from either A or B. (20 marks)



**Figure 5**