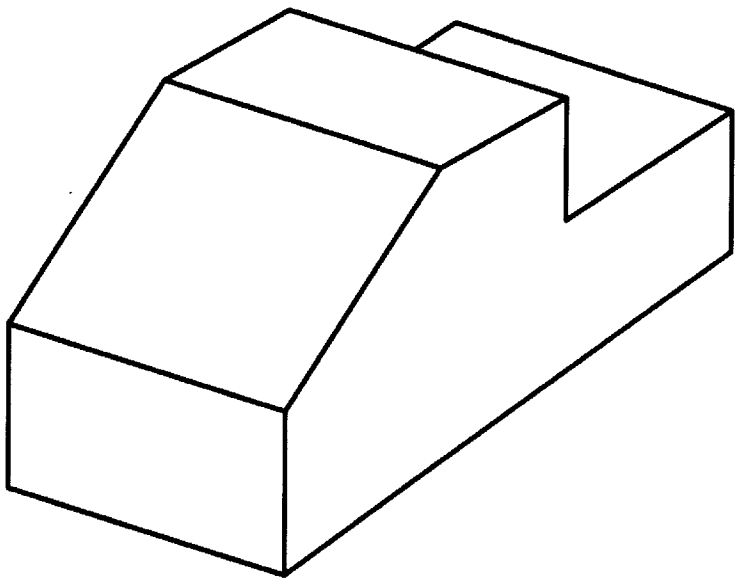
4.20 ELECTRICITY (448)

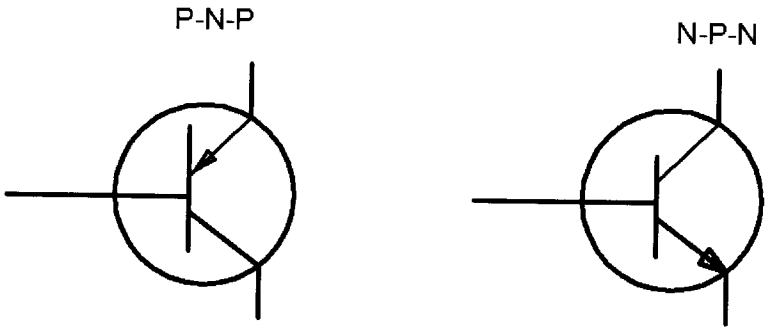
4.20.1 Electricity Paper 1 (448/1)

1. (a)	**Insulating materials** – Rubber – Plastic – Paper – Magnesium – Porcellein **Any 4 x ½ = 2**	**(2 marks)**
(b)	**Advantages** - Can withstand high temperatures - Its impervious to moisture - Resists action of most chemicals - Has high current rating **Any 4 x 1 = 2**	**(2 marks)**
2. (a)	**Lenz's law** - The direction of induced Emf is always such that it tends to set up a current opposing the motion or change of flux responsible for inducing that Emf **Any 2 x 1 = 2**	**(2 marks)**
(b)	Applications of electromagnets - Magnetic relays - Dynamos - Motors - Electric bells **Any 2 x 1 = 2**	**(2 marks)**
3. (a)	**National polytechnics** - Kabete National Polytechnic - KTTC - Gusii National Polytechnic - Sigalagala - Nyeri National Polytechnic - Rift Valley - Meru National Polytechnic - Kitale - Mombasa National Polytechnic - Coast - Kisumu National Polytechnic **Any 4 x ½ = 2**	**(2 marks)**
(b)	Business opportunities – Electrical and electronics shop – Repair and maintenance of electrical equipment – Electrical installation – Electrical consultant Accept any other correct **Any 2 x ½**	**(1 mark)**
4. (a)	Disposal of waste (i) Fluorescent tubes: Crushing and burying (ii) Damaged computer: Recycling of electronic component **2 x ½**	**1 mark**

(b)	Fire extinguishers i. Carbon dioxide – oil, chemical and electrical fires ii. Water – used for burning wood, paper and grass	 1 1
5. (a)	Brown – 1 Black – 0 Red = 10^2 Gold = $\pm 5\%$ $= 1000\Omega \pm 5\%$	**(2 marks)**
(b)	Factors that determine the resistance of a material – Type of material – Length of conductor – Cross-sectional area – Temperature of the material **Any 3 x 1 = 3**	**(3 marks)**
6. (a)	Equivalent resistance of R_2 and B $\frac{1}{R_2}+\frac{1}{B}=\frac{1}{12}+\frac{1}{B}\Rightarrow\frac{12B}{B+12}$ Total circuit resistance $20=10+\frac{12B}{B+12}$ $10=\frac{12B}{B+12}\Rightarrow 10(B+12)=12B$ $\Rightarrow 10B+120=12B$ 2B=120 $B=60\Omega$	**(1 mark)** **(1 mark)** **(1 mark)** **(1 mark)**
(b)	Total circuit current $I=\frac{V}{R}=\frac{20}{20}$ = 1A Accept any other suitable approach	**(1 mark)** **(1 mark)**

7. (a)	Parts of a fluorescent lamp – Starter – Choke – Tube – capacitor **Any 4 x ½**	**(2 marks)**
(b)	**Marking out tools** – Steel rule – Scriber – Dot punch – Pair of divider – Engineers square **Any 4 x ½**	**(2 marks)**
8. (a)		**(3 marks)**
(b)	Troubleshooting a faults TV set – Visual inspection – Circuit analysis – Use of service manuals – Testing using meters **Any 2 x 1**	**(2 marks)**

9. (a)



1½@ x 2 **(3 marks)**

(b) Applications of semi-conductor diodes

- Rectifiers
- Switches
- Lighting devices
- Voltage regulators
- Surge protectors

Accept any other correct answer

Any 4 x ½ **(2 marks)**

(a) **Advantages of digital instruments**

- Easy readability
- High accuracy
- Better resolution
- Automatic polarity and zeroing

Accept any correct answer

Any 3 x 1 **(3 marks)**

(b) **(i)**

$$\frac{N_S}{N_P} = \frac{V_{OUT}}{V_{IN}}$$ **(1 mark)**

$$= \frac{12V}{240V}$$ **(1 mark)**

$$= \frac{1}{20}$$ **(1 mark)**

(ii)

$$P_{IN} = P_{OUT}$$ **(1 mark)**

$$240V \times I_{IN} = 120W$$ **(1 mark)**

$$I_{IN} = 0.5A$$ **(1 mark)**

SECTION B

10. (a) (i) Convert 23_{10} to binary

$23 \div 2 = 11\ rem\ 1$

$10 \div 2 = 5\ rem\ 1$

$5 \div 2 = 2\ rem\ 1$

$2 \div 2 = 1\ rem\ 1$

$1 \div 2 = 0\ rem\ 1$

$hence\ 2_{10} = 10101$ **(2 marks)**

(ii) 11011_2 to decimal

$11011 = 1\times2^4 + 1\times2^3 + 0\times2^2 + 1\times2^1 + 1\times2^0$

$= 16+8+0+2+1$

$= 27$ **(2 marks)**

(b) Truth table

(i) NOR gate

Inputs		output
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

4 x 1 **(4 marks)**

(ii) NAND Gate

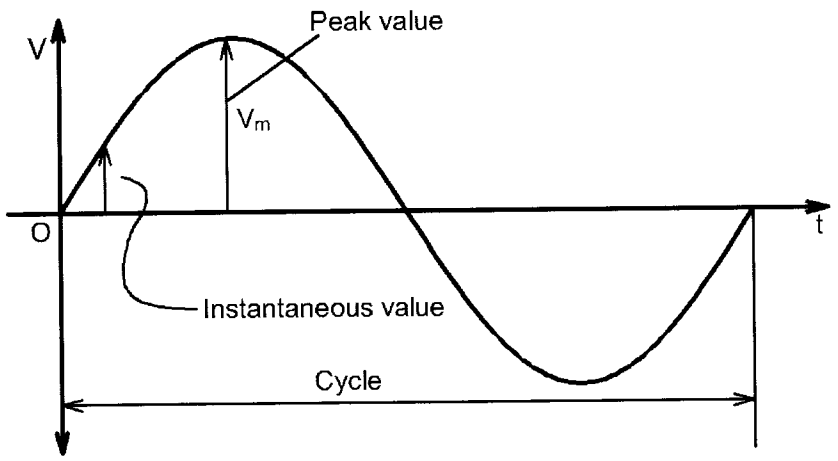
Input		output
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

4 x 1 **4 marks**

(c)
- Counters
- Registers
- Timers

Any 2 x ½ **(1 mark)**

11. (a)



Drawing axes 2 x ½=1
Curve - 1
Labelling - 3

(5 marks)

(b) **(i) inductive resistance**

$Y_L = 2\pi fL$ **1**

$= 2 \times 3.14 \times 50 \times 0.15 = 47.1\Omega$ **1**

(ii). Capacitive resistance **1**

$Y_c = \dfrac{1}{2\pi fc}$ **1**

$= \dfrac{1 \times 10^6}{2\pi \times 50 \times 100} = 31.85\Omega$ **1**

(iii) $Z = \sqrt{R^2 + (Y_L - Y_i)^2}$ **1**

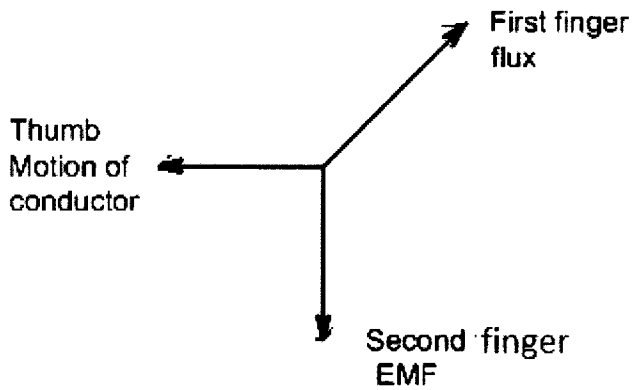
$= \sqrt{12^2 + (47.1 - 31.85)^2}$

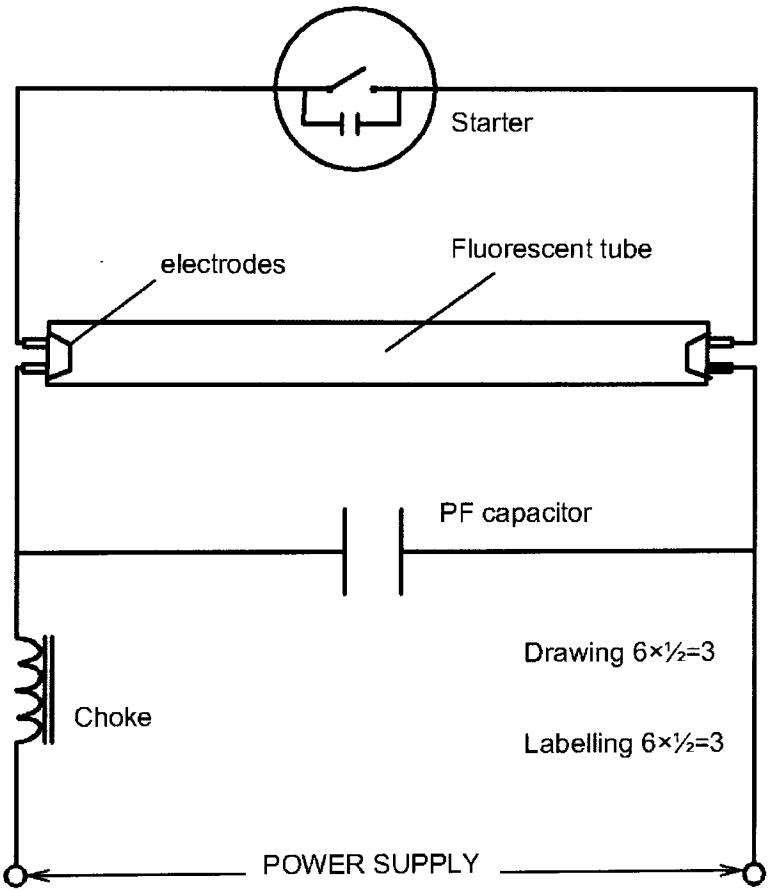
$= \sqrt{144 + (47.1 - 31.85)^2} = 19.4\Omega$

(iv) Circuit current **1**

$= \dfrac{V}{Z}$ **1**

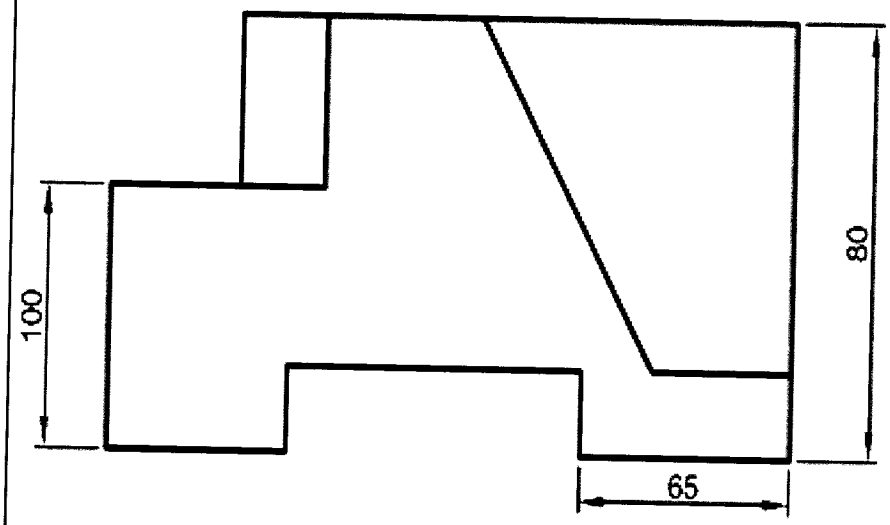
$= 200/19.4 = 10.31A$

12. (a)	i. Advantages – Linear scale – High sensitivity – Wall shielded from stray magnetic fields – Lower power consumption **Any 2 x 1**	**2 marks**
	ii. Deflecting device – whereby a mechanical force is produced by the electric current. Controlling device -whereby the value of deflection is dependent upon the magnitude of quantity being measured Damping device to prevent oscillation of the moving system and enable the latter to settle quickly	**1** **1**
(b)	 If the first finger of the right hand be pointed in the direction of magnetic flux. If the thumb be pointed in the direction of motion Then the second finger held at right angles to both the thumb and first finger, the second finger represents the direction of EMF	**3** **1** **1** **1**
c.	Let the capacitors be C_1 and C_2 In a series circuit $V = V_1 + V_2$ Since $V = \frac{Q}{C}$ then $\frac{Q}{C} = \frac{Q}{C_1} + \frac{Q}{C_2}$ Hence $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{C_1 + C_2}{C_1 \times C_2}$ $C_T = \frac{C_1 \times C_2}{C_1 + C_2}$	**1** **1** **1**

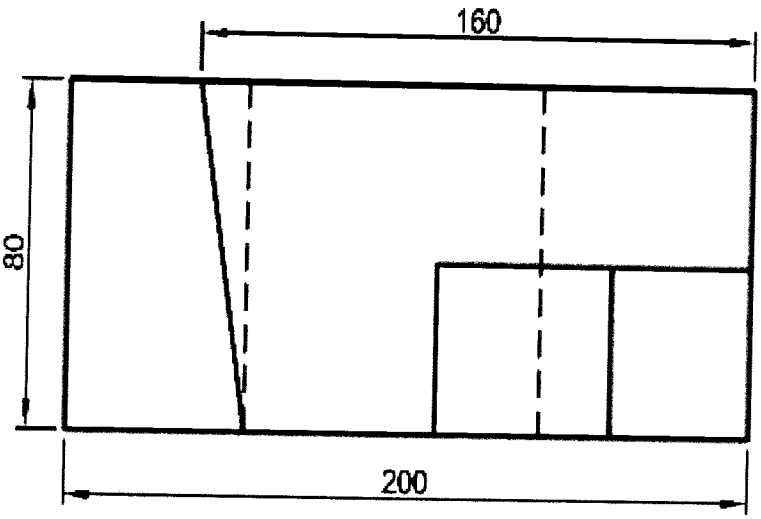
13. (a)	(i) Advantages of trunking – Easy to install – Carry more cables than conduits – Easy to inspect and maintain **Any 2 x 1**	**(2 marks)**
	(ii) Advantages of MCBs – Faulty circuits can be easily identified – Supply can be quickly and easily restored when fault has been cleared – The overload tripping characteristics are set by the manufacturer **Any 2 x 1**	**(2 marks)**
(b)		
(c)	- Continuity test - Installation resistance test - Earth continuity test - Performance test **Any 3 x 1**	**3 marks**

15.

(a)



(b)



(c) Dimensions as indicated in the drawings

13 marks