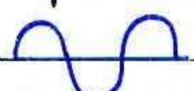
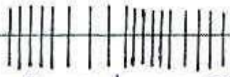
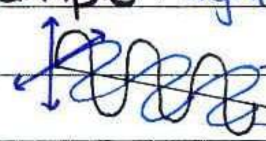
(Section B)

Q. No. 2 Part (i)

Mechanical Waves	**Electromagnetic Wave**
1. These waves require medium for their propagation.	1. These waves donot require medium for propagation.
2. Mechanical waves can't travel through **vaccum.**	2. Electromagnetic waves can travel through **vaccum** as well as other media.
3. Mechanical waves can be either transverse or Longitudinal.	3. They are only transverse in nature.
4. They travel by **vibrations of medium.**	4. They travel in the form of **electric and magnetic fields.**
Example : Sound, water waves etc.	**Example :** light, heat waves etc.
 water waves  Sound waves	 electric field, magnetic field

Q. No. 2 Part (ii)

Intensity: The sound energy passing persecond through a unit area held **perpendicular** to the direction of propagation of waves is called intensity.

Unit = Wm^{-2}

Intensity Level: The difference between the Loudness L of an **unknown sound** and the Loudness Lo of the least audible sound is called intensity level.

$$\text{Intensity level} = L - L_o$$
$$= 10 \log\left(\frac{I}{I_o}\right) \text{dB}$$

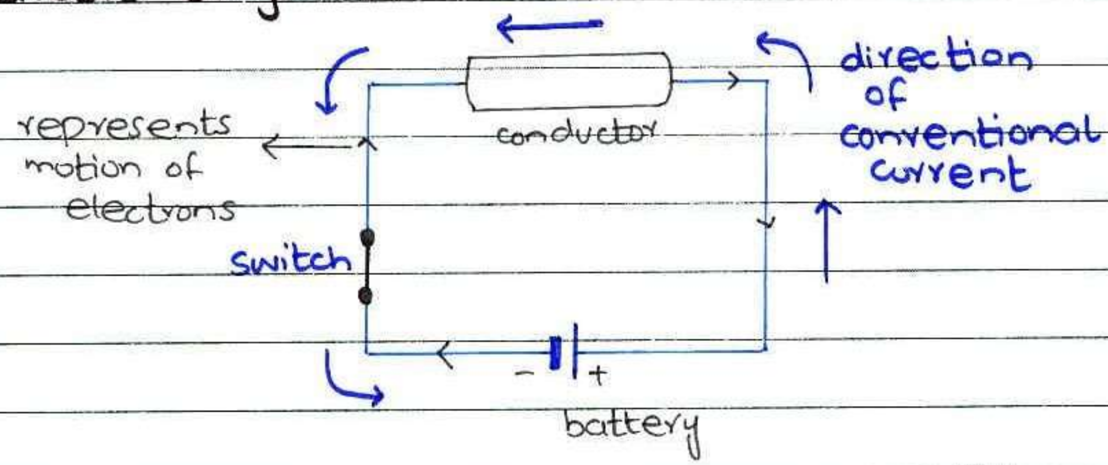
Units = Bel is the SI unit but smaller units **dB** (deciBel) are also used.

(Section B)

Q. No. 2 Part (iii) **Conventional Current:**

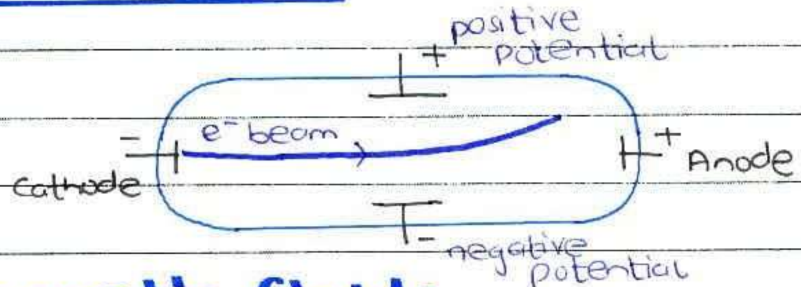
a. **Definition:** The current passing from positive to negative terminal of the battery due to flow of "positive charges" is called conventional current.

b. Circuit diagram:



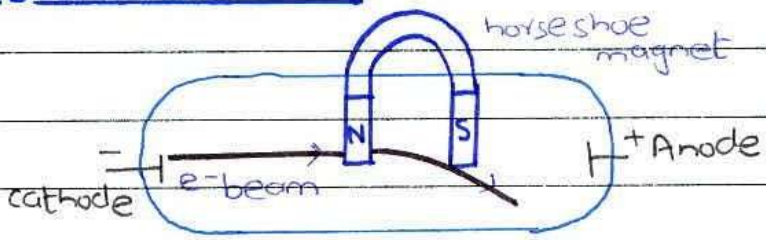
Q. No. 2 Part (iv) **Path of electron beam:**

a. Electric field:



The e^- beam is attracted towords positive.

b. Magnetic field:



The e^- beam is deflected downword.

(Section B)

Q. No. 2 Part (v) **Radioactivity:**

A: A represents the 2^{nd} half life So, $A = \frac{1}{2}\left(\frac{1}{2}N\right) = \frac{1}{4}N$

B: B shows 3^{rd} half life $B = \frac{1}{2}\left(\frac{1}{4}N\right) = \frac{1}{8}N$

C: C is time for 3^{rd} half life. $T_{1/2} = 1620$ yeass.

$C = T = T_{1/2} \times t = 1620 \times 3 =$ **4860 years.**

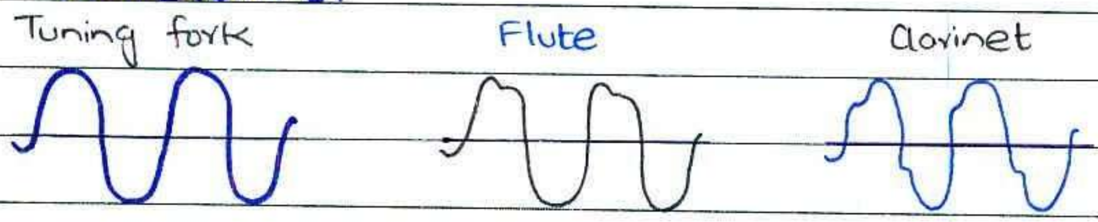
Q. No. 2 Part (vi) **Quality of Sound:**

"The characteristic of a sound by which we can differentiate between two sounds of same frequency and amplitude **(pitch and loudness)** is called quality of sound."

By this we assign a sound to its respective source.

Example:

We can differentiate the sounds of flute, tuning fork and clarinet of same f and Amplitude due to difference in **"waveforms"**.



(Section B)

Q. No. 2 Part (vii) **Numerical:**

Given:

n for water $= n_i = 1.33$

n for air $= n_r = 1$

To Find:

$\angle C = ?$

Solution:

As light enters from water (denser) to air (rarer) so,

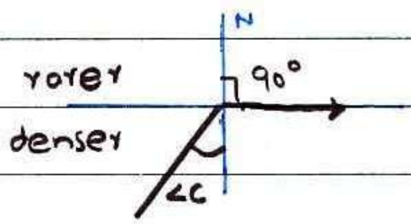
$$\frac{\sin i}{\sin r} = \frac{n_r}{n_i}$$

$$\frac{\sin C}{\sin 90^\circ} = \frac{1}{1.33}$$

$$\sin C = \frac{1}{1.33} \times 1$$

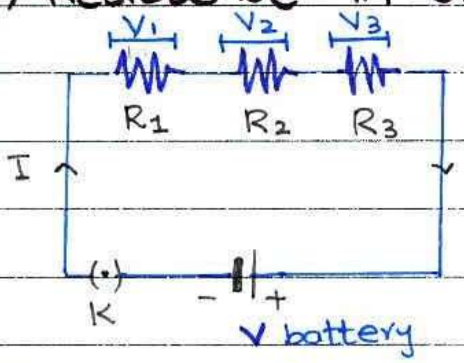
$$C = \sin^{-1}(1/1.33)$$

critical angle $= 48.75^\circ$

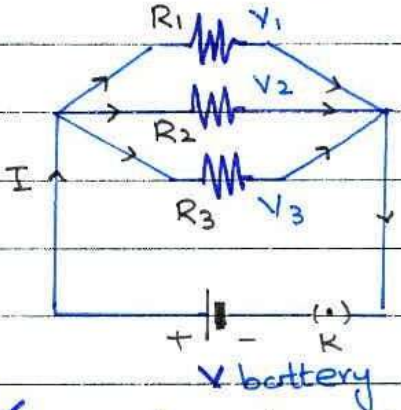


Q. No. 2 Part (viii) **Circuit Diagrams:**

(a) Resistence in Series (b) In parallel



$R_{eq} = R_1 + R_2 + R_3$



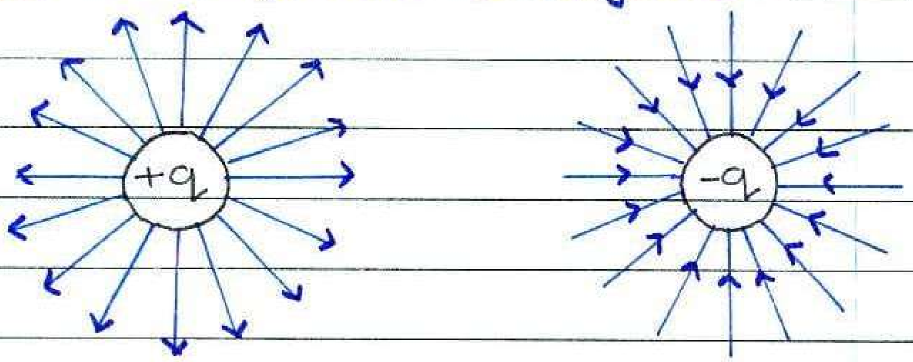
$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

The equivolent Resistence in case of parallel is less then the smallest Resistence.

(Section B)

Q. No. 2 Part (ix) **Electric field lines:**

Definition: Electric field lines are the imaginary lines that represent the motion of a charge ~~when~~ **(test charge)** when placed in an electric field. OR These lines represent the direction of electric field intensity. They never cross eachother and are directed from **positive to negative.**



positive charge negative charge

Q. No. 2 Part (x) **Induced emf :**

The emf that appears as a result of change of magnetic flux is called **induced emf**. It is affected by following factors:

1. **Speed** : The greater the speed of relative motion of magnet and coil, greater emf.
2. **Turns of Coil** : Increasing turns of coil increases emf.
3. **Strength of magnet** : greater strength, more emf.
4. Also depends on angle.

By Faradays law :

$$\text{Magnitude of emf} = -\frac{NBA(\cos\theta)}{\Delta t}$$

Q. No. 2 Part (xi) **Numerical:**

Given:

$V = 220V$

$I = 20A$

$t = 1h = 60 \times 60 = 3600s$

To Find:

Electrical Energy = W = ?

Solution:

$$Energy = ItV$$

$$W = 20A \times 3600s \times 220V$$

$$= 15840000\ J$$

$$= 1.584 \times 10^{7}\ J \quad OR$$

$$= 15.84\ MJ$$

Use for rough work

Q. No. 3 (Page 1) **Electric Potential:**

1. Definition:

"Electric potential at a point in electric field is equal to the amount of work done in bringing a **unit positive charge** from infinity to that point."

2. Mathematical Form:

$$\text{Electric Potential} = \frac{\text{Work done}}{\text{Charge}}$$

$$V = \frac{W}{q}$$

3. Type of Quantity:

It is a **scalar quantity** because the values involved that are work and charge, both are **scalar** quantities. Potential Involves no direction determination.

4. Unit:

The unit in which electric potential is measured in SI is JC^{-1} which is equal to **Volt(V)**

Volt: If a work of 1 Joule is done in bringing a charge of 1 Coulomb from infinity to that point then, the potential at the point is **1 Volt.**

$$1V = \frac{1J}{1C}$$

Explanation:

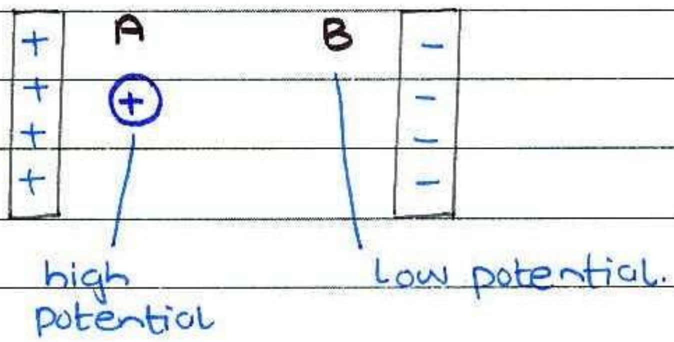
We cannot measure only electric potential potential,

Q. No. 3 (Page 2)

it is measured with respect to some reference point So, simple we can only measure **difference in potential** defined as :

" The energy supplied by a charge as it moves from a point at high potential to low potential **in the direction of field is called potential difference.**"

Example :



Potential difference $= \frac{W_{(A \to B)}}{q}$

If we move charge against field energy will be supplied to it.

Q. No. 4 (Page 1)

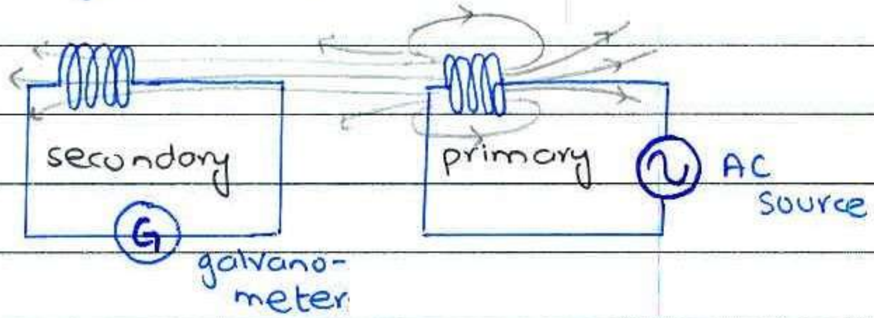
Transformers:

1. Mutual Induction:

"The phenomenon of production of induced current in a circuit due to **change of current** in another (circuit) coil which is neighbouring is called mutual induction."

Explanation:

The 2 coils are not connected to each other and If we consider 1 coil with electrical source as primary coil and the other without source as **secondary**. Then by changing current in primary causes a change in magnetic flux that passes through secondary coil. and this change **induces current in secondary coil.**



2. Numerical:

Given:

$N_s = 20 \qquad V_p = 100$

$N_p = 5$

Solution:

To find V_s:

$$\frac{N_s}{N_p} = \frac{V_s}{V_p}$$

$$\frac{20}{5} = \frac{V_s}{100}$$

Q. No. 4 (Page 2)

$V_s = 4 \times 100$

$V_s = 400V$

To find I_p :

As $P_p = P_s$ (ideal transformer)

$I_pV_p = I_sV_s$

$I_p = \frac{I_sV_s}{V_p}$

$I_p = I_s \times \frac{400\cancel{V}}{100\cancel{V}}$

$I_p = 4I_s$

To Find P_s :

Power = Current x Voltage

$P_s = I_sV_s$

$P_s = I_s(400V)$

OR

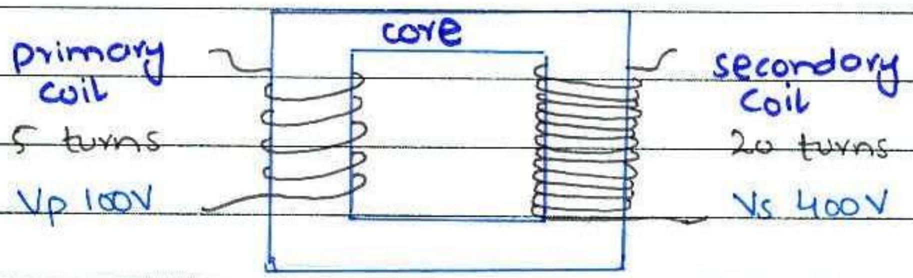
$P_s = \frac{I_p}{4}(400V)$ $[\because I_p = 4I_s$

$I_s = I_p/4]$

$P_s = I_p(100V)$

3. Type of transformer:

It is a **stepup transformer** as Secondary Voltage is greater than primary and there are more turns in secondary coil than primary. **It steps up Voltage.**

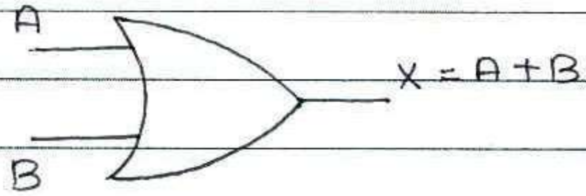


Q. No. 5 (Page 1) **Logic Gates:**

a. OR:

OR Gate: "A gate which gives a high output (1) when either of its inputs are **high (1)** is called OR gate"

Symbol:



Equation:

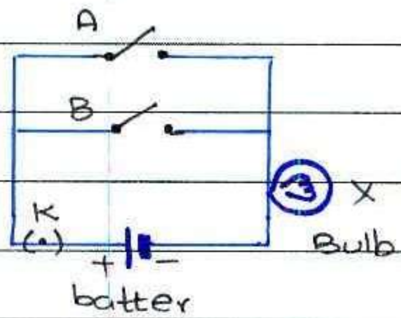
Boolean equation for OR gate:

$$X = A + B$$

read as X equals and OR B.

Truth Table:

A	B	X = A + B
0	0	0
0	1	1
1	0	1
1	1	1

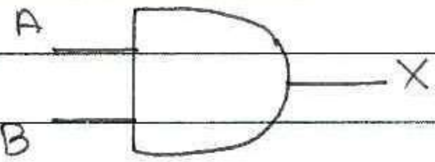


b. AND:

AND Gate: "A gate which gives a high output when **both of its inputs** are high (1) is called and gate"

Q. No. 5 (Page 2)

Symbol:



Equation:

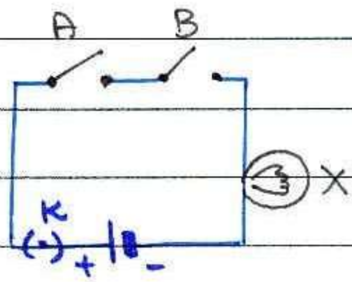
Booleon equation is

$$X = A \cdot B$$

read as X equals A and B

Truth Table:

A	B	$X = A \cdot B$
0	0	0
1	0	0
0	1	0
1	1	1



Both the above gates may have more than 2, any number of inputs but always have **only 1 output**.

Q. No. 6 (Page 1)

Numerical

Given:

$T = 2s$

$g_m = 1.6ms^{-2}$

$g_e = 10ms^{-2}$

To Find:

length on earth = L_e = ?

Length on moon = L_m = ?

Solution:

Using formula :

$$T = 2\pi\sqrt{\frac{L}{g}}$$

Taking squares on b/s

$$T^2 = 2^2\pi^2\frac{(\sqrt{L})^2}{(\sqrt{g})^2}$$

$$T^2 = \frac{4\pi^2 L}{g}$$

$$L = \frac{T^2 \times g}{4\pi^2}$$

L on earth :

$$L_e = \frac{T^2 \times g_e}{4\pi^2}$$

$$= \frac{(2s)^2 \times 10ms^{-2}}{4\pi^2}$$

$$= \frac{40m}{4\pi^2}$$

$$L_e = 1.01m$$

Q. No. 6 (Page 2)

L on moon :

$$L_m = \frac{T^2 \times g_m}{4\pi^2}$$

$$= \frac{(2s)^2 \times 1.6ms^{-2}}{4\pi^2}$$

$$= \frac{6.4m}{4\pi^2}$$

$$L_m = 0.162\ m$$

Space for rough work