PHYSICS - X-PART-9 CLASS 23

Examine the Table and answer the following questions.

	Primary			Secondary		
Transformer	Total voltage Vp	No. of turns Np	Voltage in one turn (ε) Vp/Np	Total voltage Vs	No. of turns Ns	Voltage in one turn (ε) Vs/Ns
T1	500 V	100	5 V	50 V	10	5 V
T2	20 V	10	2 V	200 V	100	2 V
T	N p × ε	Np	ε	N s × ε	Ns	ε

1. *What kind of transformers are T1 and T2 ?*
   - ➔ *T1 – Step down transformer*
   - ➔ *T2 – Step up transformer*

2. *What is the voltage in one turn when 500 V is given as input in T1 primary?*
   - ➔ *5 V*

3. *Is there a change in one turn voltage of the same transformer when the output voltage decreases to 50 V?*
   - ➔ *No change*

4. *Is there a voltage change in each one turn of the primary and secondary in the step up transformer T2?*
   - ➔ *No change*

5. *How the ratio of voltages to the number of turns in each of the transformers, primary and secondary is related? Write this ratio in mathematical form.*
   - ➔ *The voltage is directly proportional to the number of turns*

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

6. What could be the reason for using thicker wire windings in the primary of a step up transformer and the secondary of a step down transformer?

➔ ***The primary and secondary power of a transformer will be equal. Therefore the current in the primary of the step up transformer and the secondary of the step down transformer will be higher. So thicker wires will be used to prevent the coil from overheating. Thicker wires have less resistance.***

**** In a transformer without any loss in power, there are 5000 turns in the primary and 250 turns in the secondary. The primary voltage is 120 V and the primary current is 0.1 A. Find the voltage and current in the secondary.***

Primary voltage ***Vp = 120 V***
No. of turns in the primary ***Np = 5000 turns***
No. of turns in the secondary ***Ns = 250 turns***
Primary current ***Ip = 0.1 A***
Secondary voltage ***Vs = ?***
Secondary current ***Is = ?***

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

Secondary voltage ***Vs = (Ns x Vp)/Np***
= (250 x 120)/5000
= 6 V

Vp x Ip = Vs x Is

Secondary current ***Is = (Vp x Ip)/Vs***
= (120 x 0.1)/6
= 2 A

Worksheet

1. Categorise the following relations appropriately as step up or step down transformers.

- $V_s > V_p$
- $V_s < V_p$
- $I_s < I_p$
- $I_s > I_p$
- $\frac{N_s}{N_p} < 1$
- $\frac{N_s}{N_p} > 1$

2. Differentiate the statements given below, suitable to the step up and step down transformer.

a) Number of turns in the primary coil is lesser than Secondary coil.

b) Number of turns in the primary coil is greater than Secondary coil.

c) Input voltage is greater than output voltage.

d) Output voltage is greater than input voltage.

e) Thickness of primary coil is greater than secondary.

f) Thickness of secondary coil is greater than primary.

g) Input current is greater than output current.

h) Output current is greater than input current.