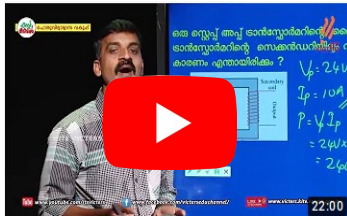


PHYSICS - X-PART-9 CLASS 23



Examine the Table and answer the following questions.

Transformer	Primary			Secondary		
	Total voltage $V_p$	No. of turns $N_p$	Voltage in one turn ( $\epsilon$ ) $V_p/N_p$	Total voltage $V_s$	No. of turns $N_s$	Voltage in one turn ( $\epsilon$ ) $V_s/N_s$
T1	500 V	100	5 V	50 V	10	5 V
T2	20 V	10	2 V	200 V	100	2 V
T	$N_p \times \epsilon$	$N_p$	$\epsilon$	$N_s \times \epsilon$	$N_s$	$\epsilon$

- What kind of transformers are T1 and T2 ?  
 → T1 – Step down transformer  
 → T2 – Step up transformer
- What is the voltage in one turn when 500 V is given as input in T1 primary?  
 → 5 V
- Is there a change in one turn voltage of the same transformer when the output voltage decreases to 50 V?  
 → No change
- Is there a voltage change in each one turn of the primary and secondary in the step up transformer T2?  
 → No change
- 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	$V_p = 120 \text{ V}$
No. of turns in the primary	$N_p = 5000 \text{ turns}$
No. of turns in the secondary	$N_s = 250 \text{ turns}$
Primary current	$I_p = 0.1 \text{ A}$
Secondary voltage	$V_s = ?$
Secondary current	$I_s = ?$

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

Secondary voltage	$V_s = (N_s \times V_p)/N_p$ $= (250 \times 120)/5000$ $= 6 \text{ V}$
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$$V_p \times I_p = V_s \times I_s$$

Secondary current	$I_s = (V_p \times I_p)/V_s$ $= (120 \times 0.1)/6$ $= 2 \text{ A}$
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**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.**