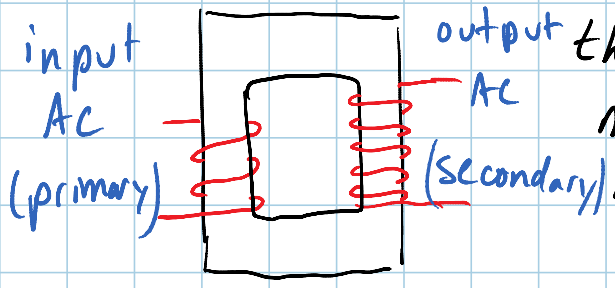
Transformers

Thursday, June 06, 2013
9:40 AM



the A.C. current produces alternating magnetic fields which produce an A.C current

1) step up $V_s > V_p$ $N_s > N_p$ from generating station to transmission lines

2) step down $V_s < V_p$ $N_s < N_p$ transmission lines to house adapter for charging phone

If a transformer is 100% efficient $P_{in} = P_{out}$

$$P_p = P_s$$
$$V_p I_p = V_s I_s$$

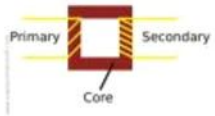
$$\frac{V_s}{V_p} = \frac{I_p}{I_s} = \frac{N_s}{N_p}$$

Transformers

Inserted from: <file://D:\My Documents\My Files\Physics 12\10 Magnetism\Transformers.doc>

PHYSICS 12

NAME: _____



Transformers

1. A transformer has 280 turns in the primary and 110 in the secondary. What kind of transformer is this and, assuming 100 % efficiency, by what factor does the voltage change? **Step down, 2.54 times**

2. An ideal transformer has 150 turns in the primary coil and 1 800 turns in the secondary coil. If the primary coil is connected to 120 V ac and draws 7.5 A of current, what is the current in the secondary coil? **0.625 A**

3. Which one of the following **best** describes a step-up transformer? [primary circuit: p; secondary circuit: s] **C**

	VOLTAGE	CURRENT
A.	$V_p > V_s$	$I_p > I_s$
B.	$V_p > V_s$	$I_p < I_s$
C.	$V_p < V_s$ ✓	$I_p > I_s$ ✓
D.	$V_p < V_s$ ✓	$I_p < I_s$

4. A transformer has four times as many turns on the secondary as on the primary. If the primary voltage is 120 V ac, which of the following describes the transformer? **D**

$\frac{V_s}{V_p} = \frac{N_s}{N_p}$, $\frac{V_s}{120} = \frac{4}{1}$

	SECONDARY VOLTAGE	TYPE
A.	30 V ac	step down
B.	30 V ac	step up
C.	480 V ac ✓	step down
D.	480 V ac ✓	step up ✓

5. A transformer connected to a 120 V ac source has an output of 24 V ac. If the primary coil has 330 turns, how many turns of wire are there in the secondary coil? **B**
   A. 24 turns
   B. 66 turns
   C. 330 turns
   D. 1 650 turns

6. For what type of input current will the output current in a transformer be zero? **A**
   A. dc
   B. ac
   C. increasing dc
   D. decreasing dc

7. Neon signs require 12kV for their operation. To operate from a 220-V line, what must be the ratio of the secondary to primary turns of the transformer? What would the voltage output be if the transformer were connected backwards? **60:1.1, 4.0 V**

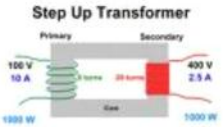
8. If 30 MW of power at 45 kV arrives at a town from a generator via 4.0 Ω transmission lines, calculate
   a) the Emf at the generator end of the lines and **47.7 kV**

   b) the fraction of power generated that is lost in the lines. **6%**

9. If 50 kW is to be transmitted over two 0.100-Ω lines, estimate how much power is saved if the voltage is stepped up from 120 V to 1200 V and then down again, rather than simply transmitting at 120 V. Assume the transformers are each 100% efficient. **17.2 kW**

10. A transformer has 250 turns on its primary coil and 25 000 turns on its secondary. If the input voltage is 120 V AC, what is the output voltage? **12 000 V**

11. A spark plug for a car needs about 20, 000 V for the spark to jump the gap. A transformer is used to step up the voltage from the 12 V car battery. If the primary coil of the transformer has 200 turns of wire, how many turns must the secondary coil have? **3.33×10^5 turns**



12. Doorbells and buzzers usually are designed for 12 V ac and they are powered by small transformers that step down 110 V ac to 12 V ac. Suppose that such a transformer has a primary winding with 1500 turns.
   a) How many turns are there on the secondary winding? **164**

   b) If the current in the bell is 500 mA what was the current in the primary windings? **0.0545 A**

13. The primary coil of a transformer has 5000 turns and the voltage across it is 120 V. The secondary coil has 50 turns.
   a) What is the secondary voltage? **1.2 V**

   b) What is the primary coil current if the current in the secondary coil is 10.0 A? **0.10 A**