NAME: _____

Topic 11.2 – Power generation and transmission – AHL

THIS IS A PRACTICE ASSESSMENT. Show formulas, substitutions, answers (in spaces provided) and units!

A rectangular coil of wire having dimensions 4.5 cm by 6.8 cm has 135 turns. It is rotating at a frequency of 60 Hz in a magnetic field having a strength of 2.5 T.

1. What is its peak voltage ε_0? 1. _____

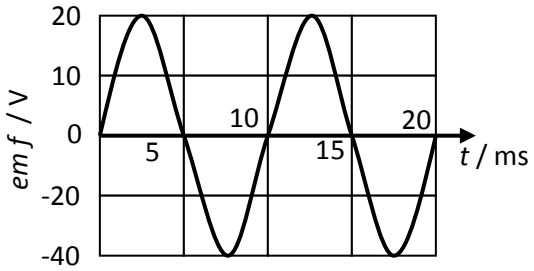
2. Write the equation of the time dependence of its emf. 2. _____

3. If the frequency is decreased to 40 Hz, what is this generator's peak voltage?

3. _____

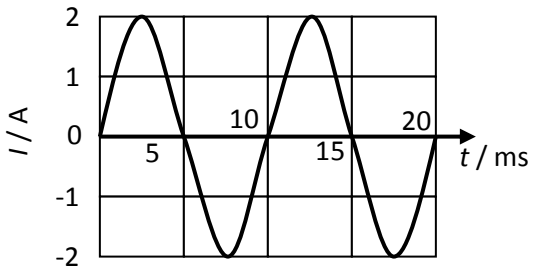
The graphs of voltage and current for an ac circuit containing a resistor are shown.

4. Find the *rms* voltage corresponding to the induced emf whose graph is shown.
   4. _____



5. Find the peak voltage. 5. _____

6. Find the angular frequency of the coil that is producing this emf. 6. _____



7. Find the maximum flux linkage of the coil that is producing this emf. 7. _____

8. Find the *rms* current from the graph. 8. _____

9. Find the peak current. 9. _____

10. Write the equation which shows the time variation of the current. 10. _____
    (hint…use ohm's law and your answer to #2)

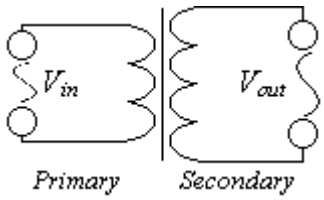
11. Find the resistance of the circuit. 11. _____

12. What is the average power dissipated by the circuit? 12. _____

A transformer having 145 turns in its primary winding has a 60 Hz input voltage of V_{in} = 75 VAC. It is desired that V_{out} should be 120 VAC.

13. How many turns should the secondary winding have?

13. _____



14. If the current in the primary winding is 1.25 A, what will the current in the secondary winding be?

14. _____

The following questions are about power transmission and the power grid.

15. Explain the use of high-voltage step-up and step-down transformers in the transmission of electrical power.

_____

_____

16. A power plant produces a 60 Hz alternating voltage having V_{rms} = 125 V. A step-up transformer is needed to raise the plant's voltage to 765 kV. Find the ratio of N_s / N_p needed in the transformer.

16. _____

A power transmission cable having a diameter of 4.75 cm is made of aluminum which has a resistivity of $5.18\times10^{-8}\ \Omega m$.

17. Find the cross-sectional area of the cable in m^2. 17. _____

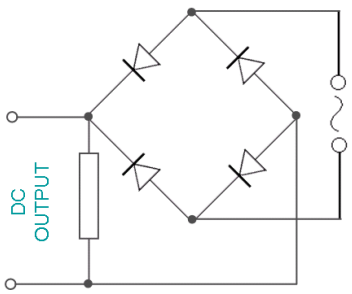
18. Find the resistance of this cable if it provides electricity to a township 375 km away from a power plant. 18. _____

19. Suppose this cable is used to supply a township with 285 MW of energy at a transmission voltage of 765 kV. What is its current? What is its heat loss. What percentage of the overall energy transmission is this? 19. _____

_____

_____

A circuit that consists of four diodes and a resistor is shown.



20. Label the top AC power supply terminal with a (+), and with a red pencil trace the positive current through the circuit all the way to the load resistor and the correct DC output terminal.
20. ___See figure___

21. Label the bottom AC power supply terminal with a (–), and with a green pencil trace the negative current through the circuit all the way to the load resistor and the correct DC output terminal.
21. ___See figure___

22. If the AC power supply now reverses its polarity, determine which output terminal is (+) and which is (–).
22. TOP is_____

BOTTOM is_____