In the following problems, write "I" for increase, "D" for decrease, or "S" for "stays the same."

What happens to the current, I, in Fig. 1 when:

1. R is increased _____  
2. L is increased _____  
3. f is doubled _____  
4. V, R, and L are all doubled _____  
5. f and R are doubled ___  
6. f is doubled, L is halved ___  
7. R and L are physically interchanged _____  
8. f is increased _____  
9. R is decreased _____  
10. L is decreased _____  
11. V is increased _____  

_______________________________________________________________________________

12. As f approaches 0 Hz (DC), $V_A$ approaches a value of _______.

13. As f becomes very high, $V_A$ approaches a value of _______.

_______________________________________________________________________________

If $V = 12.6$ VAC, $f = 60$ Hz, $L = 2.7$ H, and $R = 1000$ Ω in Fig. 1, find:

14. the current, $I = \underline{\quad}$  
15. the AC voltage measured across the coil, $V_L = \underline{\quad}$.

16. the AC voltage measured across R, $V_R = \underline{\quad}$.

17. $V_L + V_R = \underline{\quad}$ (= 12.6 V ?)

18. the phase angle by which the current lags the applied 12.6 V voltage = _______.

19. Solve the equation $Z^2 = R^2 + X_L^2$ for R. $R = \underline{\quad}$
20. To get a current of 4 mA, you should change the 1000-Ω resistor to ________ Ω.

21. EXTRA CREDIT (1 quiz point) To get a phase angle of 35°, you should change the 1000-Ω resistor to ________.

In following problems, write "I," "D," or "S" as before. For the circuit of Fig. 2, what happens to:

22. $I_L$ when $f$ is increased ______ 23. $I_T$ when $V$ is increased ______

24. $I_R$ when $f$ is decreased ______ 25. $V_R$ when $f$ is decreased ______

26. $V_L$ when $f$ is increased ______ 27. $I_T$ when $R$ is doubled ______

28. $I_T$ when $V$, $R$, and $f$ are doubled ______ 29. $I_T$ when $V$, $L$, and $R$ are all tripled ______

30. $I_L$ when $R$ is decreased ______

31. As $f$ gets very large in the circuit of Fig. 2, $I_T$ approaches a value of ________.

32. As $R$ gets very large, $I_T$ approaches a value of ________.

In the circuit of Fig. 2, suppose $I_L$ measures 3 mA, and $I_R$ 4 mA.

33. $I_T$ = ________ 34. If $V$ and $f$ are halved, $I_T$ = ________

35. If $f$, $V$, and $R$ are doubled, $I_T$ = ________ 36. If $f$ is doubled and $L$ halved, $I_T$ = ________

Suppose further that $V = 12$ VAC.

37. $R$ = ________ 38. $X_L$ = ________ 39. Solve $I_T^2 = I_L^2 + I_R^2$ for $I_R$ = ______________
40. To get an $I_T$ of 10 mA, you should change $R$ to _________ $\Omega$.

For the waveforms in Fig. 3,

41. does the current lag or lead the voltage? ________

42. If $f = 50$ Hz, what is the phase delay, $t$, in ms? ________

43. What would the delay have to be for a phase angle of 75°? ________

44. ....for a phase angle of 90°? ________

45. John Kluge is trying to measure his unknown inductor by applying 6.3 VAC, 60 Hz to it. He measures a current of 2.00 mA of current, then disconnects power and measures a DC resistance of 200 $\Omega$. What was the value of his unknown inductor?

46. Suppose you want to simultaneously display the waveforms of the line voltage across and the current through a series RL AC circuit, as has been done, for example, in Fig. 3. The black lead of your AC generator connects to earth ground, as do the black leads of your dual-trace oscilloscope
probes. Show below how to connect the oscilloscope to the circuit so that the line voltage waveform will appear on channel 1, and the current waveform on channel 2.

Using the oscilloscope screen shown in Fig. 4,

47. sketch sine wave A, which has an RMS amplitude of 2.828 mA, a period of 0.8 ms, and starts (\(v = 0\) mA) at \(t = 0\);

48. sketch sine wave B, which has an RMS amplitude of 4.242 mA, a period of 0.8 ms, and lags sine wave A by 90 degrees;

49. sketch a third sine wave, C, equal to the instantaneous algebraic total of A and B.

50. By approximately how many degrees does C lag behind A? ________

51. What is C's period? ________  52. What is C's amplitude? ________
Fig. 4