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 = ________  15. the AC voltage measured across the coil, V_L = ________.
16. the AC voltage measured across R, V_R = ________.
17. V_L + V_R = ________ (= 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 = _______________
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 ( = 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? ________
53. In a series RL circuit,
   A. the current lags behind the applied voltage by 90 degrees.
   B. the current leads the applied voltage.
   C. the voltage across the inductor leads the current by 90 degrees.
   D. the voltage across the resistor is in phase with the current.

54. In a parallel RL circuit,
   A. the voltage across the inductor leads the applied voltage.
   B. the applied voltage leads the inductor’s current by 90 degrees.
   C. the resistor’s current is in phase with the applied voltage.
   D. the inductor’s current leads the total line current.