

4.10. Figure 4.30 shows a resistance welding system that uses the electrical discharge of energy stored in an inductive circuit to create a transient high-current flow between two pieces of metal. The localized heat generated forms a weld. A constant voltage source  $V_s$  is connected through a switch to a high-inductance coil of wire and the two pieces to be welded. When a high current is established in the coil the switch is opened. Because the current in the coil cannot change instantaneously, a high current is forced through the workpieces generating the heat necessary for welding.

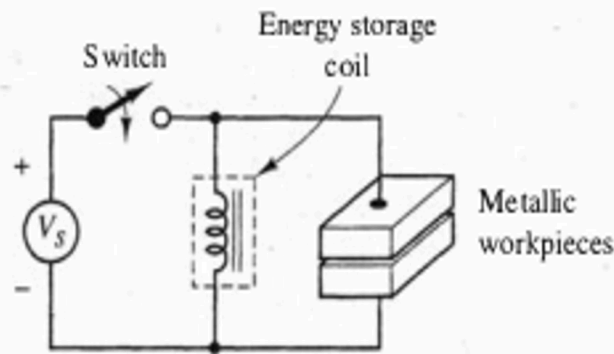
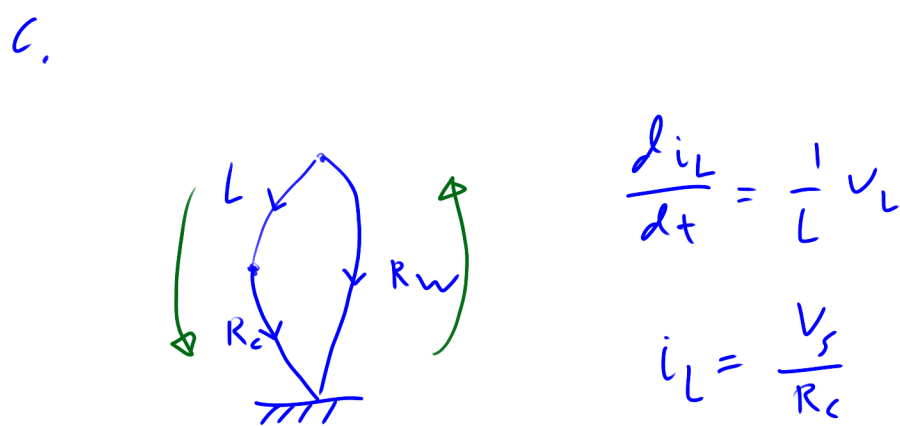
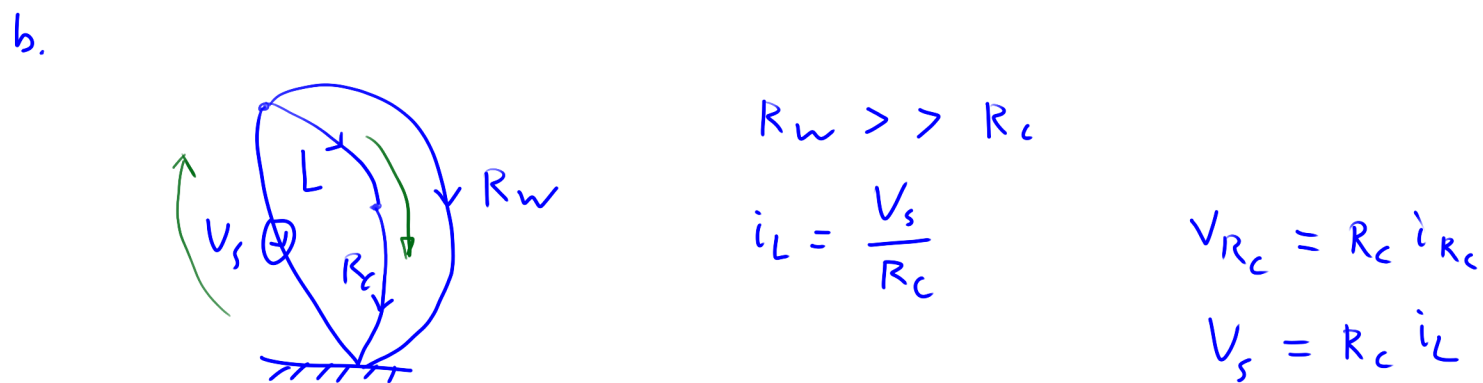
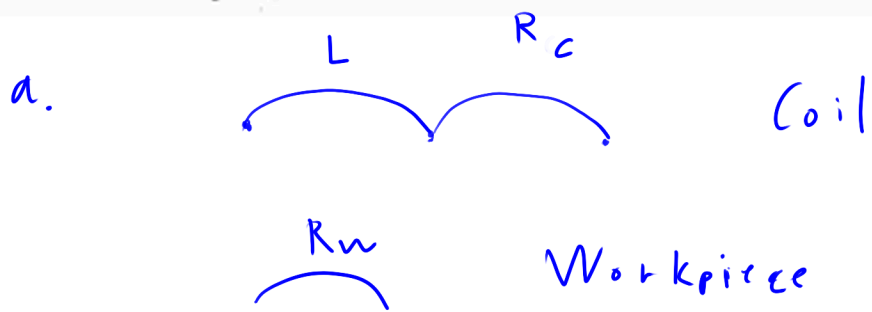


Figure 4.30: An electric welding system.

- (a) How would you represent the energy storage coil using lumped elements? What element would be used to represent the metal workpieces?
- (b) Construct a linear graph representing the system when the switch is closed. What will determine the current flowing in the coil and the resistive workpieces after any transients have decayed to zero?
- (c) Construct a linear graph representing the system after the switch is opened. At the instant after the switch is opened, how much current flows through the workpieces?
- (d) What is the direction of current flow (i) just before the switch is opened and (ii) just after the switch is opened?



d.

$$i_{R_w} \ll i_{R_c}$$