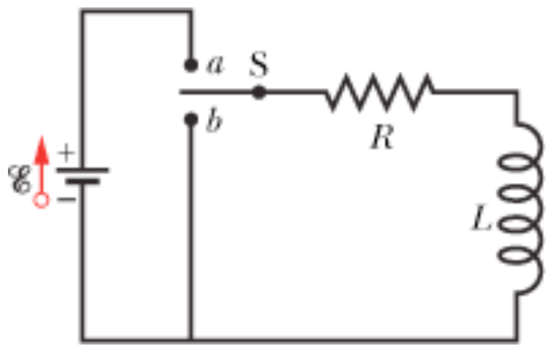
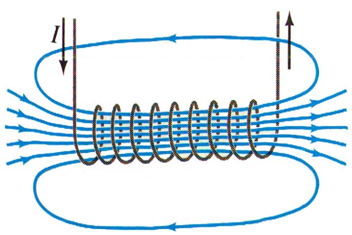
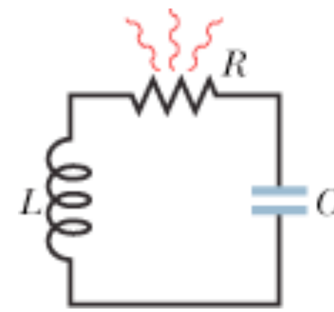


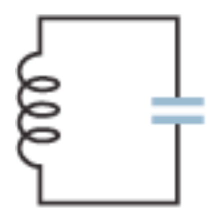
Physics 2102



Exam review

Inductors, EM oscillations

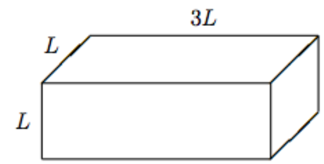


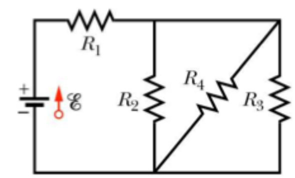


(a)

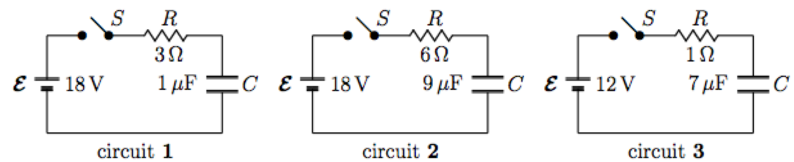
Exam review

Q1: 75.7

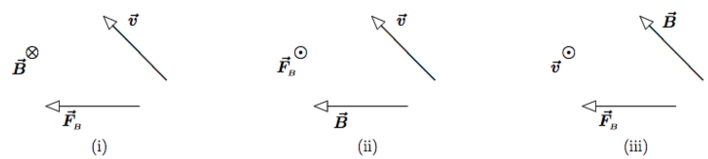


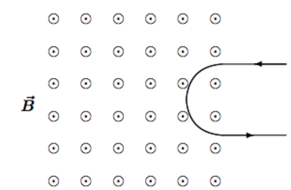


P1: 61.6

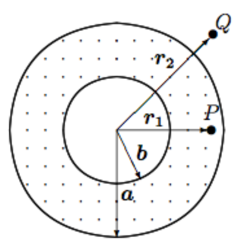


Q2: 67.2

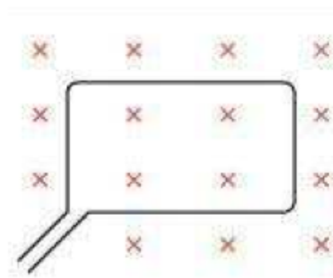




Q3: 79.2



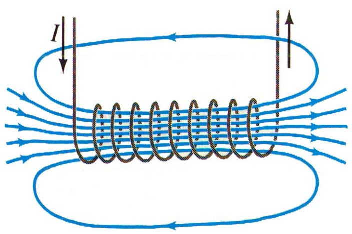
P2: 58.2

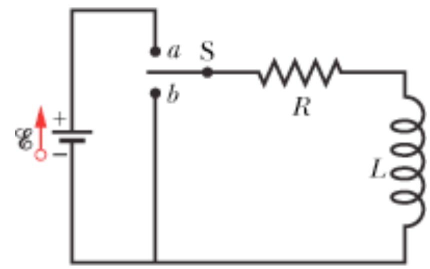


$$B = 0.64 - 4.0\, t^2,$$

P3:52.2

Inductors





- Inductance definition: $L=N\Phi_B/I$
- Solenoid inductance: $L=\mu_0 n^2 A l$
- Induced emf (voltage) across an inductor is $E=-L\,di/dt$
- In an RL circuit, we can "charge" the inductor with a battery until there is a constant current, or "discharge" the inductor through the resistor. Time constant is L/R.

$$i=\frac{\mathcal{E}}{R}\left(1-e^{-t/\tau_L}\right) \quad \text{(rise of current)}. \qquad i=i_0 e^{-t/\tau_L} \quad \text{(decay of current)}.$$

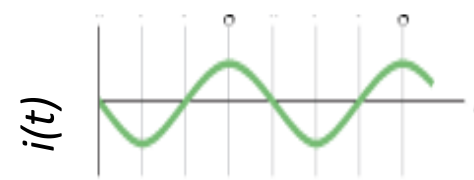
- An inductor stores magnetic potential energy: $U_B=Li^2/2$
- Energy density stored in a magnetic field is $u_B=B^2/2\mu_0$

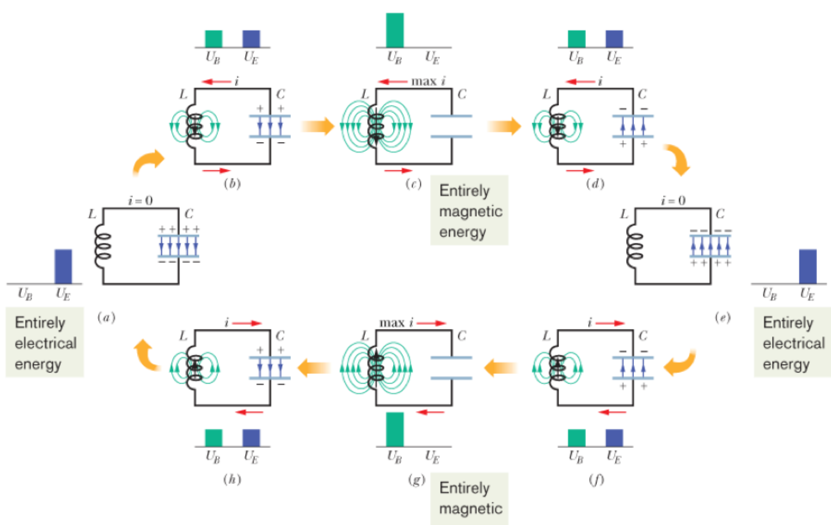
EM oscillations

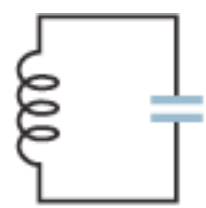
- An LC combination produces an electrical oscillator, the natural frequency of oscillator is $\omega=1/\sqrt{LC}$
- Total energy in circuit is conserved: switches between energy stored in capacitor (electric energy) and in inductor (magnetic energy).
- If a resistor is included in the circuit, the total energy decays (is dissipated by R).

$$q = Q\cos(\omega t + \phi) \quad \text{(charge)},$$

$$i = -\omega Q \sin(\omega t + \phi) \quad \text{(current)},$$







(a)