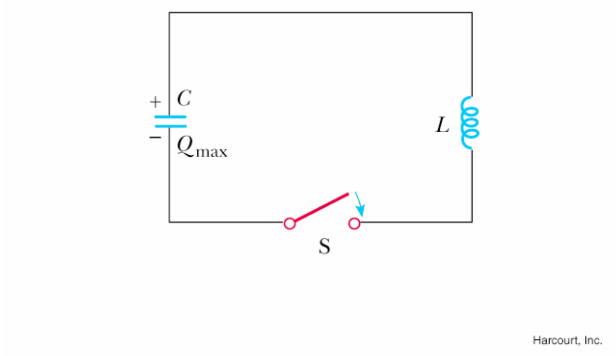
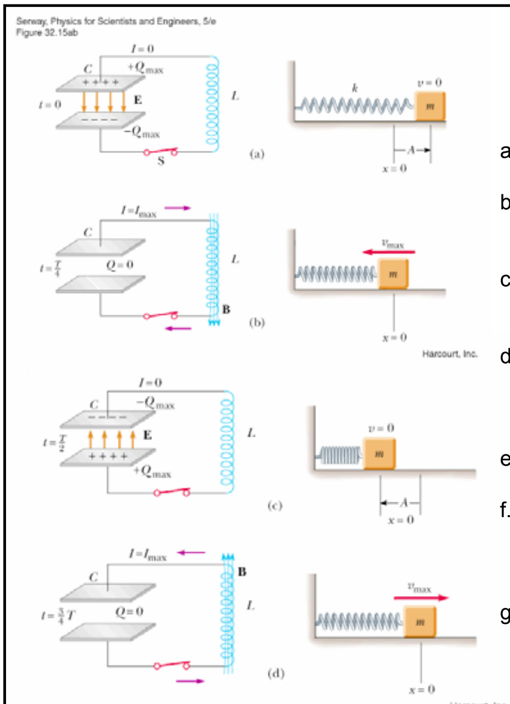
LC Circuits





a. When the capacitor is fully charged: energy in the **E** field is ***$Q^2_{max}/2C$***
b. When the capacitor is discharging, the current through the solenoid generates a **B** field with energy: ***$LI^2/2$***
c. When the capacitor is fully discharged all the energy is in the **B** field, and the current is maximum.
d. At this time the induced ***emf*** of the solenoid keeps the current going so that the capacitor is charged in the opposite direction.
e. And this keeps going and going and ….

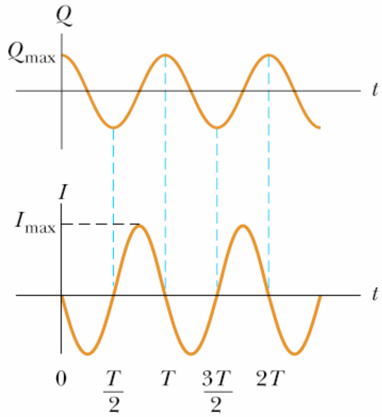
f. Total energy of the system at any time:

$$U = Q^2/2c+LI^2/2$$

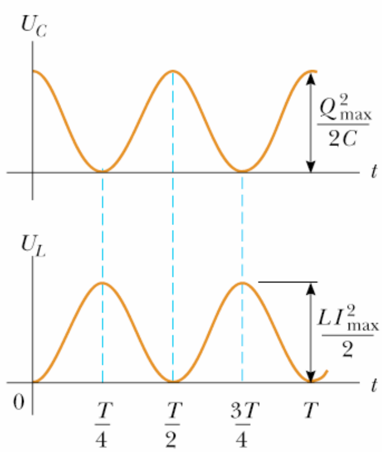
g. Just like a spring-mass system

$$U = kx^2/2 + mv^2/2$$

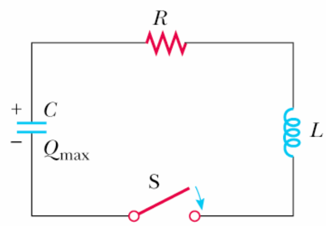
Serway, Physics for Scientists and Engineers, 5/e
Figure 32.16

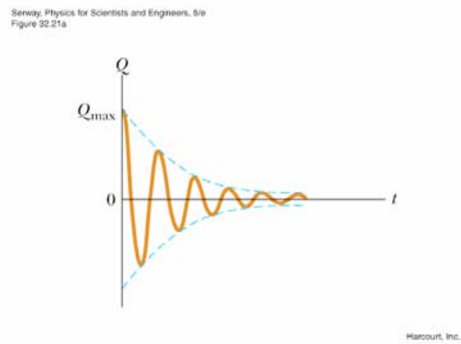


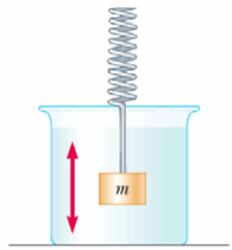
Serway, Physics for Scientists and Engineers, 5/e
Figure 32.17



LCR Circuits







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Maxwell's Equations

$$\oint \mathbf{E} \cdot d\mathbf{A} = \frac{q_{in}}{\epsilon_0}$$

$$\oint \mathbf{B} \cdot d\mathbf{A} = 0$$

$$\oint \mathbf{B} \cdot d\mathbf{s} = \mu_0 I + \mu_0 \epsilon_0 \frac{d\Phi_E}{dt}$$

$$\oint \mathbf{E} \cdot d\mathbf{s} = -\frac{d\Phi_B}{dt}$$

Electro-Magnetic Waves

- Consider Mawell's eqations in fee space:

$$\oint \mathbf{E} \cdot d\mathbf{A} = 0$$
$$\oint \mathbf{B} \cdot d\mathbf{A} = 0$$
$$\oint \mathbf{B} \cdot d\mathbf{s} = \mu_0 \epsilon_0 \frac{d\Phi_E}{dt}$$
$$\oint \mathbf{E} \cdot d\mathbf{s} = -\frac{d\Phi_B}{dt}$$

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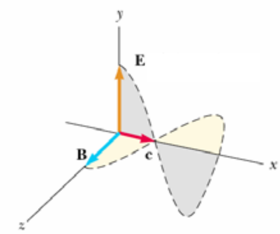
Figure 34.4



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- Assume an Electric field aligned in the y direction and and a Magnetic field aligned in the z direction: Faraday's law and Amphere's law redude to:

$$\frac{\partial^2 E}{\partial x^2} = \mu_0 \epsilon_0 \frac{\partial^2 E}{\partial t^2}$$
$$\frac{\partial^2 B}{\partial x^2} = \mu_0 \epsilon_0 \frac{\partial^2 B}{\partial t^2}$$

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Figure 34.5

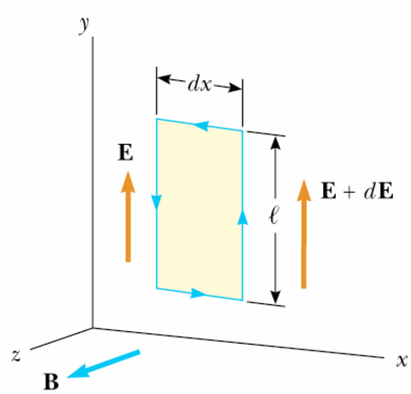

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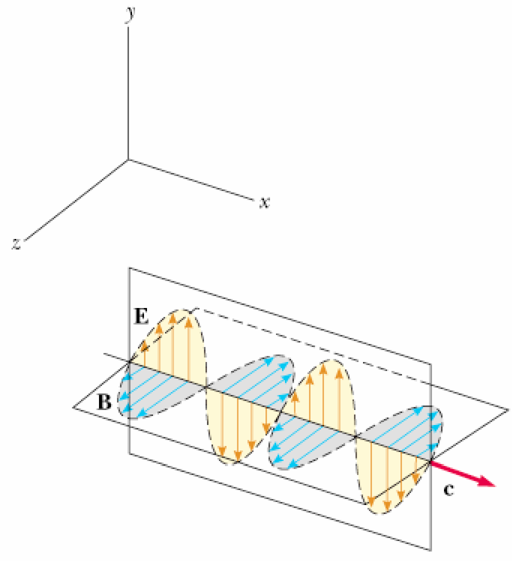
Figure 34.3a



(a)

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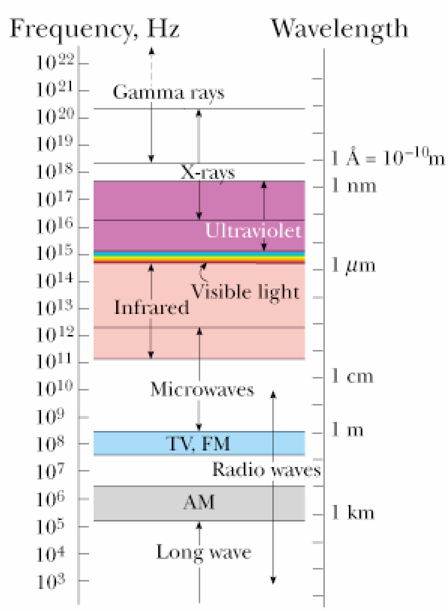
Figure 34.17



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