KIT - INTERNATIONAL DEPARTMENT GMBH

Pre-Semester Physics - Exercises Summer 2010

Stefan Kremer	Sheet 10
stefan.kremer@ensicaen.fr	24.9.2010

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1. Exercise:

A coil with self inductance $\mathcal{L} = 5.0 \,\mathrm{H}$ is placed across the terminals of a battery labeled $U = 12 \,\mathrm{V}$ with inner resistance $R = 15 \,\Omega$.

- (a) What is the final current I_f ?
- (b) State the time constant τ .
- (c) When has the current reached 75% of its maximum value?
- (d) How large would be the maximum current \hat{I} if the battery was replaced by an AC-source with frequency $\omega = 50 \text{ s}^{-1}$ and maximum strength $\hat{U} = U$?

2. Exercise:

A capacitor with $C = 4.0 \,\mu\text{F}$ is charged to $U = 24 \,\text{V}$ and then connected across two serially connected resistors with $R = 100 \,\Omega$.

- (a) Find the initial charge Q_0 on the capacitor.
- (b) Determine the initial current I_0 through the resistor.
- (c) What is the time constant τ ?
- (d) How much charge Q is on the capacitor after $t = 4 \,\mu s$?
- (e) Sketch the time dependence of the current $I_1(t)$ through one of the resistors and mark where I_0 and τ can be found in the diagram.

3. Exercise:

A capacitor with $C = 2.0 \,\mu\text{F}$ is charged to $U = 20 \,\text{V}$ and is then connected across an inductor with $\mathcal{L} = 6.0 \,\mu\text{H}$.

- (a) What is the frequency f of the oscillation?
- (b) Find the maximum value of the charge on the capacitor Q_0 .
- (c) Determine the maximum value of the current I_0 .