**P.P.6.1** $v = \dfrac{q}{C} = \dfrac{120x10^{-6}}{4.5x10^{-6}} =$ **26.67 V**

$w = \dfrac{1}{2}Cv^2 = \dfrac{1}{2}x4.5x10^{-6}x711.1 =$ **1.6 mJ**.

**P.P.6.2** $i(t) = C\dfrac{dv}{dt} = 10x10^{-6}\dfrac{d}{dt}(75\sin(2000t))$

= **1.5cos(2,000t) A**.

**P.P.6.3** $v = \dfrac{1}{C}\int_0^t idt = \dfrac{10^{-3}}{0.1x10^{-3}}\int_0^t 50\sin 120\pi t \, dt \text{ V}$

$= -\dfrac{500}{120\pi}\cos 120\pi t\Big|_0^t = \dfrac{50}{12\pi}(1 - \cos 120\pi t)\text{V}$

$v(t = 1\text{ms}) = \dfrac{50}{12\pi}(1 - \cos 0.12\pi) =$ **93.14 mV**

$v(t = 5\text{ms}) = \dfrac{50}{12\pi}(1 - \cos 0.6\pi) =$ **1.736 V**

**P.P.6.4** $i(t) = \begin{cases} 50t, & 0 < t < 2 \\ 100, & 2 < t < 6 \end{cases}$

$v = \dfrac{1}{C}\int idt = \dfrac{1}{10^{-3}}\int idt \cdot 10^{-3} = \int idt$

For 0< t <2, $v = \dfrac{1}{C}\int_0^t 50t \, dt = 25t^2 \text{ x } 10^3$

For 2< t <6, $v = \dfrac{1}{C}\int_2^t 100dt + v(2) = (100t - 0.2 + 0.1)$

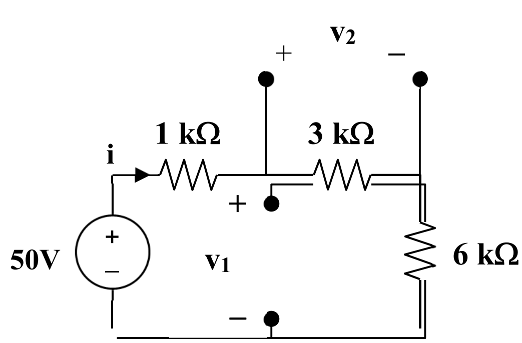
= (100t - 0.1)V

At t = 2ms, v = **100 mV**

At t = 5ms, v = (500 - 100)mV

= **400 mV**

**P.P.6.5** Under dc conditions, the capacitors act like open-circuits as shown below:



$$i = \frac{50}{1+3+6} = 5\text{mA}$$

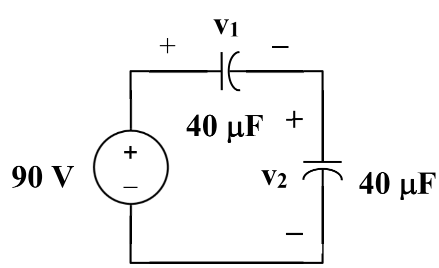
$$v_1 = (3k + 6k)i = 45\text{V}$$
$$v_2 = (3k)i = 15\text{V}$$
$$w_1 = \frac{1}{2}C_1 v_1^2 = \frac{1}{2}\left(20x10^{-6}\right)(45)^2 = \mathbf{20.25\ mJ}$$
$$w_2 = \frac{1}{2}C_2 v_2^2 = \frac{1}{2}\left(30x10^{-6}\right)(15)^2 = \mathbf{3.375\ mJ}.$$

**P.P.6.6** Combining 60 and 120μF in series = $\frac{60x120}{180}$ = 40μF

40μF in parallel with 20μF = 40 + 20 = 60μF
50μF in parallel with 70μF = 50 + 70 = 120μF
60μF in series with 120μF = $\frac{60x120}{180}$ = **40μF**

**P.P.6.7** Before we solve this, we need to assume that the initial charge on each capacitor is equal to zero.

60μF in series with 30μF = $\frac{60x30}{90}$ = 20μF
20μF in parallel with 20μF = 40μF




From the Figure, $v_1 = v_2 = 90/2 =$ **45 V**; $q_1 = 45x40x10^{-6} = 1.8$ mC; $q_2 = 45x20x10^{-6} = 0.9$ mC $= q_3 = q_4$ leading to $v_3 = 0.0009/(60x10^{-6}) =$ **15 V** and
$v_4 = 0.0009/(30x10^{-6}) =$ **30 V**.

**P.P.6.8** $v = L\frac{di}{dt} = 10^{-3}\frac{d}{dt}(60\cos(100t))\cdot 10^{-3}$

= **–6sin(100*t*) mV**

$$w = \frac{1}{2}Li^2 = \frac{1}{2}x10^{-3}\left(3600\cos^2(100t)\right)\cdot 10^{-6}$$

= **1.8cos $^2$(100*t*) μJ**.

**P.P.6.9** $i = \frac{1}{L}\int_{t_0}^{t} v(t)dt + i(t_0) = \frac{1}{2}\int_{0}^{t} 10(1-t)dt + 2$

$$= 5\left(t - \frac{t^2}{2}\right) + 2$$

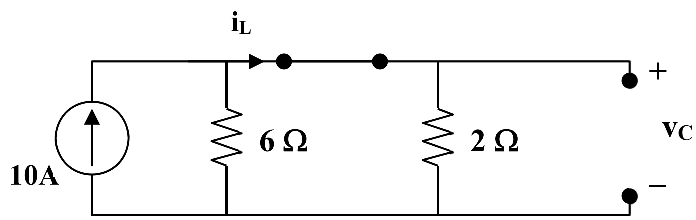
At t = 4, i = 5(4 - 8) + 2 = **–18 A**

$p = vi = 10(1 - t)\left[5t - \frac{5}{2}t^2 + 2\right]$

$= 20 + 30t - 75t^2 + 25t^3$

$w(4) = (1/2)Li(4)^2 = 0.5 \times 2 \times (-18)^2 =$ **324 J.**

**P.P.6.10** Under dc conditions, the circuit is equivalent to that shown below




$$i_L = \frac{3}{1+3}(10) = \mathbf{7.5\ A}$$

$$v_C = 2i_C = \mathbf{15\ V}$$

$$w_C = \frac{1}{2}Cv_C^2 = \frac{1}{2}(4)(15)^2 = \mathbf{450\ J}$$

$$w_L = \frac{1}{2}Li_L^2 = \frac{1}{2}(6)(7.5)^2 = \mathbf{168.75\ J}.$$

**P.P.6.11** 40mH in series with 20mH = 40 + 20 = 60mH
60mH in parallel with 30mH = 30 x 60/(90) = 20mH
20mH in series with 100mH = 120mH
120mH in parallel with 40mH = 40 x 120/(160) = 30mH
30mH in series with 20mH = 50mH
50mH in parallel with 50mH = 25mH
$L_{eq}$ = **25mH**

**P.P.6.12** (a) $i_2 = i - i_1 \longrightarrow i_2(0) = i(0) - i_1(0) = 1.4 - 0.6 =$ **800 mA**

(b) $v_1 = 6\dfrac{di_1}{dt} = 6(0.6)(-2)e^{-2t} = -7.2e^{-2t}$

$$i_2 = \frac{1}{3}\int_0^t v_1 dt + i_2(0) = \frac{1}{3}\frac{(-7.2)}{(-2)}e^{-2t}\Big|_0^t + 0.8$$

$= \mathbf{(-0.4 + 1.2e^{-2t})\ A}$

$i = i_1 + i_2 = \mathbf{(-0.4 + 1.8e^{-2t})\ A}$

(c) From (b),

$v_1 = \mathbf{-7.2e^{-2t}V}$

$v_2 = 8\dfrac{di}{dt} = 8(-2)(1.8)e^{-2t} = \mathbf{-28.8e^{-2t}V}$

$v = v_1 + v_2 = \mathbf{-36e^{-2t}V}$