1.

i) $i_t = 1, q_o = -4C, q_t = 5C, t = ?$

$q_t = q_0 + \int_0^t i_t dt$

plug in

$5 = -4 + \int_0^t 1 dt$

move around

$9 = \int_0^t 1 dt$

integrate

$9 = t|_0^t$

$t = 9$

ii)$i_t = 2t, q_o = -4C, q_t = 5C, t = ?$

$q_t = q_0 + \int_0^t i_t dt$

plug in

$5 = -4 + \int_0^t 2t dt$

move around

$9 = \int_0^t 2t dt$

integrate

$9 = t^2|_0^t$

$t = 3$

iii)

$V = \frac{J}{C}$

$i_t = 1, q_o = -4C, q_t = 5C, V = 2, t = ?$

$q_t = q_0 + \int_0^t i_t dt$

$J = VC$

plug in

$5 = -4 + \int_0^t 1 dt$

move around

$9 = \int_0^t 1 dt$

integrate

$9 = t|_0^t$

$t = 9$

$t * \Delta V = J$

$9 * 2 = 18J$

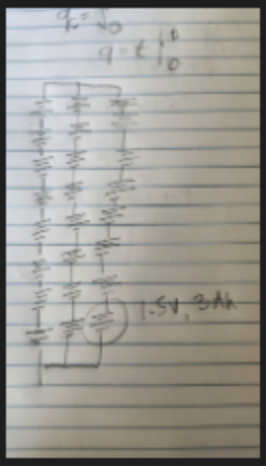
2.

i)

$V = 12$, each battery is $1.5V, 3Ah$ 24 total batteries

$12/1.5 = 8$

3 sets of 8 batteries in parallel



ii)

$3 * 3Ah * 12V = 108Wh$

$24Ah/.1A = h$

$.1A * 12V = 1.2W$

$108Wh * .9 = 97.2Wh$

$97.2Wh/1.2W = 81h$

iii)

$97.2Wh$

$3V * 1A = 3W$

$97.2Wh/3W = 32.4h$