The Lagrangian is usually defined as a function of generalized coordinate $q_i$ and their time derivatives $\dot{q}_i$. However, it sometimes can depend explicitly on the time $t$, so we have

$$ L = L(q_i, \dot{q}_i, t) $$

In this case, its time derivative is

$$ \frac{dL}{dt} = \frac{\partial L}{\partial q_i} \dot{q}_i + \frac{\partial L}{\partial \dot{q}_i} \ddot{q}_i + \frac{\partial L}{\partial t} $$

We can use the Euler-Lagrange equations

$$ \frac{\partial L}{\partial q_i} - \frac{d}{dt} \frac{\partial L}{\partial \dot{q}_i} = 0 $$

To convert into

$$ \frac{dL}{dt} = \frac{d}{dt} \left( \frac{\partial L}{\partial \dot{q}_i} \right) \dot{q}_i + \frac{\partial L}{\partial q_i} \ddot{q}_i + \frac{\partial L}{\partial t} $$

With the canonical momentum defined as

$$ p_i \equiv \frac{\partial L}{\partial \dot{q}_i} $$

this is

$$ \frac{dL}{dt} = \frac{d}{dt} (p_i \dot{q}_i) + \frac{\partial L}{\partial t} $$

or

$$ \frac{d}{dt} (p_i \dot{q}_i - L) = -\frac{\partial L}{\partial t} $$

With the usual definition of the Hamiltonian
\[ H = p_i \dot{q}_i - L \]  
we see that a time-dependent Lagrangian gives the relation

\[ \frac{dH}{dt} = -\frac{\partial L}{\partial t} \]  

(9)  
(10)