6 **(a)** The current in a filament lamp decreases.

State and explain how the resistance of the lamp changes.

.....

..... [1]

(b) A cylindrical wire has length L and resistance R. The **total** number of free electrons (charge carriers) contained in the volume of the wire is N. Each free electron has charge e. The potential difference between the ends of the wire is V.

Determine expressions, in terms of some or all of the symbols e, L, N, R and V for:

(i) the current in the wire

current = ... [1]

(ii) the average drift speed of the free electrons

average drift speed = ... [2]

(iii) the average time taken for a free electron to move along the full length of the wire.

time taken = ... [1]

[Total: 5]