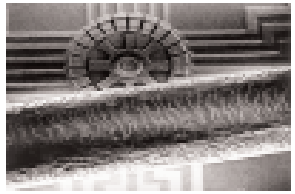
2 - Sensing - Sensors

- A **sensor** is a device designed to produce an electrical signal in response to a change in its surroundings, either caused by a change in a specific physical variable or by the movement of surrounding objects.

- **Sensors** can be made on a scale of millionths of a metre - micrometres.

- A miniature motor next to a human hair. ➔



Keywords
Sensor
Signal
Miniature

2.01

2 - Sensing - Current

- **Electric current** is **charge** flow per unit time:

where I is **electric current** and △Q is the **charge** flow (or charge transferred) in time △t.

Q is measured in Coulombs, C. I is measured in amps, A. t is measured in seconds, s.

$$I = \frac{\Delta Q}{\Delta t}$$

Keywords
Electric current
Charge

2.03

2 - Sensing - Power and energy

- ***Potential difference***, V

$$V = \frac{\Delta E}{\Delta Q}$$

- where △E is the **energy** delivered and △Q is the **charge** passed.

$$P = IV = V^2 / R = I^2 R$$

- **electrical power = current x potential difference**

- where **power** is in watts, W

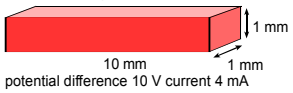
Keywords
Potential difference
Energy
Charge
Power
Watts
Current

2.02

2 - Sensing - Conductance and resistance

Conductance *G*	Resistance *R*
Conductance is the current for a given potential difference:	Resistance is the potential difference needed for a given currrent:
$G = \frac{I}{V}$	$R = \frac{V}{I}$
conductance = $\frac{1}{\text{resistance}}$	resistance = $\frac{1}{\text{conductance}}$

Example: a bar of silicon



potential difference 10 V current 4 mA

G = 0.4 mA per volt	R = 2.5 V per mA
$G = 4 \times 10^{-4}$ siemens	$R = 2.5 \times 10^{3}$ ohm

Keywords
Conductance
Resistance
Conductivity
Resistivity
Ohm

2.04