1. Choose the correct answer

1. Choose the correct answer and explain your answer A. In kitchen applications a piezoelectric crystal is used for _____

a) Skimming milk

b) Lighting a gas stove

c) Grinding

d) Mixing B.

2. A piezoelectric transducer is used as an ignition source for a cigarette.

 a) True

b) False

3. A quartz crystal is _____

 a) A chemical transducer

b) A photoelectric transducer

c) Not a self-generating transducer

d) A self-generating transducer

2. Imagine that you are going to build an innovative prototype idea based on the Piezoelectricity /pyroelectric phenomenon. What would be your idea and how are you going to develop it?

3. Explain in details three applications of your choice that use Ferroelectric materials?

4. Compare between the supercapacitors and the batteries?

Consider the parallel plate capacitor equation

$$C = \frac{\varepsilon_o \varepsilon_r xy}{z}$$

where ε_r is the relative permittivity (or ε_r'), x and y are the side lengths of the dielectric so that xy is the area A, and z is the thickness of the dielectric. The quantities ε_r, x, y and z change with temperature. By differentiating this equation with respect to temperature, show that the temperature coefficient of capacitance (TCC) is

$$\text{TCC} = \frac{1}{C}\frac{dC}{dT} = \frac{1}{\varepsilon_r}\frac{d\varepsilon_r}{dT} + \lambda \qquad \textit{Temperature coefficient of capacitance}$$

where λ is the linear expansion coefficient defined by

$$\lambda = \frac{1}{L}\frac{dL}{dT}$$

where L stands for any length of the material (x, y or z).