Homework 4: Smart materials

# 1. Which one of the following smart materials does not react to electricity? [1]

⬨ Shape memory alloy

⬨ Quantum tunnelling compound

⬨ Thermochromic pigment

⬨ Piezoelectric material

# 2. Which smart material can be both a conductor and an insulator? [1]

# 3. Explain one disadvantage of using photochromic particles with self-darkening glasses. [2]



# 4. Describe how self-healing polymers could be useful in the construction of plastic frames for glasses and sunglasses. [2]

# 5. Use the following key words to create a short paragraph that explains the process that self-healing concrete undergoes when activated. [3]

**Water** – **bacteria** – **stress** – **calcium carbonate** – **spheres** – **food** – **cracks**

# 6. The following question is about the shape memory alloy, nitinol.

(a) Nitinol is an alloy of nickel and which other metal? [1]

(b) How is a shape ‘set’ in to the memory of nitinol? [2]

(c) A piece of Nitinol has a shape ‘set’ in its memory.

Explain what stimulus is required to return the material to its ‘set’ shape,   
once deformed. [1]

(d) Name and briefly describe **one** commercial use of nitinol. [2]

Total 15 marks