Reading for understanding

Education in Chemistry
July 2017
rsc.li/EiC417-medical-plastics

These questions accompany the above article 'Body, heal thyself'.

Read the whole article first. The questions appear in approximately the order in which the answers can be found in the text. You should answer in full sentences and you might find it useful to organise your work in bullet points to ensure you answer all parts of each question.

1. Explain why the scientists believe polymers are a logical choice for building medical implants.
    - Much of the body is made up of polymers.
2. Explain why in theory it is possible to design a polymer to behave exactly as you wish.
    - The ability to vary the structure of the monomers and also the length of the monomer chains means the number of different polymers that could potentially be made is almost infinite. As tweaking the design of a polymer changes its properties, it should be possible to design a polymer to behave exactly as you want it to.
3. Give three reasons why using metals for implants in the body is not ideal.
    - Patients need a second operation to remove them once the bones have healed.
    - Leaving metal in the body long term is not desirable because it can react with body tissues.
    - Metals are much stiffer than bone and carry all the body's load as the bone is healing. This can result in the bone healing poorly because it doesn't sense any need to take weight while it heals.
4. Describe two roles of nano-hydroxyapatite in the implants being designed by Davide's team.
    - Reinforcing the polymer
    - Releasing minerals the bones need to regrow
5. State one similarity and one difference between the polymer implants being developed by Davide and by Julian
    - Similarity: both use forms of calcium phosphate
    - Difference: Davide's use polylactic acids as the polymer; Julian's uses poly(caprolactone)
6. Give two limitations of the current plastic spacer treatment for worn out cartilage
    - It requires a major operation with significant recovery time.
    - The plastic spacer doesn't mimic the mechanical properties of natural cartilage, especially stiffness.
7. State what is meant by the term hybrid material and explain why Julian is researching this type of material for cartilage replacement.
    - A hybrid material contains two or more components that are intimately mixed together throughout its structure (on a finer scale than in composites).
    - The hybrid can be designed to have the required mechanical properties. The proportion of bioglass and polymer in the hybrid can also be tweaked to suit different applications.