*ATAR Chemistry – Unit 1 & 2, TA Fisher 2018*

 **ATAR Chemistry 11** **Research Assignment**

**Task 6: Nanoparticle Research – Validation SOLUTIONs**

Name:

Score: /40

1. A set of detailed notes submitted, including references ( 4 marks notes (zero if copy/paste), 2 marks refs): [6]
2. What is a nanoparticle? [1]

*A small particle of size 1 – 100nm; less than 100nm also acceptable*

1. Describe the role of nanoparticles in each of the following contexts:
2. **Domestic use**
   * 1. **Sun screen**
     2. State the type of nanoparticles used: [1]

*titanium dioxide and zinc oxide nanoparticles.*

* + 1. How are the nanoparticles manufactured (made) ? [1]

*Eg. Crude titanium dioxide (rutile ) converted to titanium tetrachloride and re-oxidised to give pure TiO2.*

*Other methods are also possible*

* + 1. Explain how the nanoparticles improve the sunscreen compared to a sunscreen without nanoparticles? Include an explanation as to why this is advantageous? [4]

*less sticky sunscreen, transparent, reflects more UV light, increased surface area*

*Higher sunscreen protection*

* + 1. Discuss whether there are any disadvantages of nanoparticles in a sunscreen? Consider environmental or health effects. [1]

*Adverse effects may occur if TiO2 and ZnO absorbed by viable skin cells and blood stream (endocrine disruption, cancer). Current research suggests nanoparticles stay on surface on nonviable skin cells but long term effects not clear.*

1. **Medical**
   * 1. State the application: *(Many possibilities)* [1]

*Targeted Drug delivery, eg cancer, Other applications, improved absorption of drugs through small intestine*

* + 1. State the type of nanoparticles used in the application: [1]

*Gold nanoparticles attached to a molecule of a tumor-killing agent called tumor necrosis factor alpha (TNF) as well as a molecule of Thiol-derivatized polyethylene glycol (PEG-THIOL)*

* + 1. Explain how the nanoparticles improve the application compared to the application without nanoparticles? Include an explanation as to why this is advantageous? (If it is a brand new application explain why it is useful and its advantages) [4]

*Hides the TNF bearing nanoparticle from the immune system.*

*The nanoparticle is designed to be too big to exit most healthy blood vessels, however some blood vessels located at the site of tumors are leaky, allowing the nanoparticle to exit the blood vessel at the tumor site. The second technique involves the TNF molecules binding to the tumor.*

*Advantages: Targets the tumour without affecting healthy parts of the body*

* + 1. Discuss whether there are any disadvantages of nanoparticles in the application? Consider environmental or health effects. [1]

*Still in trial stage*

1. **Technology**
   * 1. State the application: [1]

*Transistors , Flexible electronics etc*

* + 1. State the type of nanoparticles used in the application: [1]

*carbon nanotubes*

* + 1. Explain how the nanoparticles are manufactured (made) ? [4]

*Grew transistors with carbon nanotubes of 0.7nm to 1.1nm., Direct deposition, atomic layer by layer, various techniques*

* + 1. Explain how the nanoparticles improve the application compared to the application without nanoparticles? Include an explanation as to why this is advantageous? (If it is a brand new application explain why it is useful and its advantages) [4]

Carbon nanotubes carry electrical current virtually without friction

1000 times more current than standard Si transistors. Even smaller transistor dimensions, without generating heat

* + 1. Discuss whether there are any disadvantages of nanoparticles in the application? [1]

Still working on making tubes straight

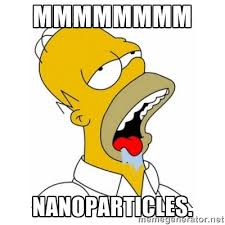
1. Your position on Nanoparticles:
   1. Do you think nanoparticles should be used for some, all or none of the above applications?

*(You are entitled to your opinion but you must be able to give three valid reasons, based on your research, why you have this opinion. Don’t just quote the three applications and say they are useful)*

* 1. Give three reasons for your opinion: [6]



* 1. Discuss the direction you think nanoparticle research should take in the future? *(Give a direction and justify this )* [2]

END OF QUIZ