GCSE Chemistry A (Gateway Science)

J248/03 C1-C3 and C7 Higher (Higher Tier)

Question Set 5

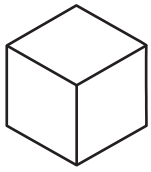
1 A new sun cream has been developed using zinc oxide nanoparticles.

The small particles provide better protection from the sun and they do not leave white marks on the skin.

(a) Explain **one** possible risk of using nanoparticles in sun cream. **[1]**

Inhaling or ingesting nanoparticles could cause damage to GI tract.

(b) A cube-shaped nanoparticle has sides of length 50 nm.



50 nm

Calculate the surface area to volume ratio for this nanoparticle.

Use the equation: ratio = surface area ÷ volume

SA: $50^2 \times 6 = 15000$ V: $50^3 = 125000$

Surface area to volume ratio = ... 0.12 ..... **[4]**

$\text{ratio} = \frac{15\,000}{125\,000} = 0.12$

(c) **(i)** Scientists compare the size of nanoparticles to the sizes of other small objects.

Look at the table.

Object	Diameter (nm)
Gold atom	0.14
Water molecule	0.27
DNA strand	2.5
Zinc oxide nanoparticle	32
Red blood cell	7000
Human hair	100 000

The diameter of a DNA strand is 2.5 nm.

Explain why DNA is a nanoparticle but a water molecule is **not** a nanoparticle. **[2]**

Because nanoparticle size ranges between 1–100nm and DNA strand's diameter is within that range whilst water molecule is smaller than 1nm (outside the range)

(ii) Calculate how many zinc oxide nanoparticles would fit across a human hair.

Give your answer to **2** significant figures.

32 nm ⟶ 100 000nm $\frac{100\,000}{32}$ = 3125 times

Number of nanoparticles = 3125

[2]

Total Marks for Question Set 5: 9

The Periodic Table of the Elements

(1)	(2)											(3)	(4)	(5)	(6)	(7)	(0)
1																	18
1 **H** hydrogen 1.0	2											13	14	15	16	17	2 **He** helium 4.0
3 **Li** lithium 6.9	4 **Be** beryllium 9.0											5 **B** boron 10.8	6 **C** carbon 12.0	7 **N** nitrogen 14.0	8 **O** oxygen 16.0	9 **F** fluorine 19.0	10 **Ne** neon 20.2
11 **Na** sodium 23.0	12 **Mg** magnesium 24.3	3	4	5	6	7	8	9	10	11	12	13 **Al** aluminium 27.0	14 **Si** silicon 28.1	15 **P** phosphorus 31.0	16 **S** sulfur 32.1	17 **Cl** chlorine 35.5	18 **Ar** argon 39.9
19 **K** potassium 39.1	20 **Ca** calcium 40.1	21 **Sc** scandium 45.0	22 **Ti** titanium 47.9	23 **V** vanadium 50.9	24 **Cr** chromium 52.0	25 **Mn** manganese 54.9	26 **Fe** iron 55.8	27 **Co** cobalt 58.9	28 **Ni** nickel 58.7	29 **Cu** copper 63.5	30 **Zn** zinc 65.4	31 **Ga** gallium 69.7	32 **Ge** germanium 72.6	33 **As** arsenic 74.9	34 **Se** selenium 79.0	35 **Br** bromine 79.9	36 **Kr** krypton 83.8
37 **Rb** rubidium 85.5	38 **Sr** strontium 87.6	39 **Y** yttrium 88.9	40 **Zr** zirconium 91.2	41 **Nb** niobium 92.9	42 **Mo** molybdenum 95.9	43 **Tc** technetium	44 **Ru** ruthenium 101.1	45 **Rh** rhodium 102.9	46 **Pd** palladium 106.4	47 **Ag** silver 107.9	48 **Cd** cadmium 112.4	49 **In** indium 114.8	50 **Sn** tin 118.7	51 **Sb** antimony 121.8	52 **Te** tellurium 127.6	53 **I** iodine 126.9	54 **Xe** xenon 131.3
55 **Cs** caesium 132.9	56 **Ba** barium 137.3	● 57–71 lanthanoids	72 **Hf** hafnium 178.5	73 **Ta** tantalum 180.9	74 **W** tungsten 183.8	75 **Re** rhenium 186.2	76 **Os** osmium 190.2	77 **Ir** iridium 192.2	78 **Pt** platinum 195.1	79 **Au** gold 197.0	80 **Hg** mercury 200.6	81 **Tl** thallium 204.4	82 **Pb** lead 207.2	83 **Bi** bismuth 209.0	84 **Po** polonium	85 **At** astatine	86 **Rn** radon
87 **Fr** francium	88 **Ra** radium	● 89–103 actinoids	104 **Rf** rutherfordium	105 **Db** dubnium	106 **Sg** seaborgium	107 **Bh** bohrium	108 **Hs** hassium	109 **Mt** meitnerium	110 **Ds** darmstadtium	111 **Rg** roentgenium	112 **Cn** copernicium		114 **Fl** flerovium		116 **Lv** livermorium		

Key
atomic number
Symbol
name
relative atomic mass