

## GCSE Chemistry A (Gateway Science) J248/04 Chemistry A C4-C6 and C7 (Higher Tier)

**Question Set 4** 

1 This question is about properties of materials.

Police bullet-resistant vests could be made from steel or Kevlar<sup>®</sup>.



The table shows some information about steel and Kevlar®.

	Steel	Kevlar®
Density (g/cm <sup>3</sup> )	7.85	1.44
Relative strength	1	5
Flexibility	low	high
Resistance to corrosion	low	high

(a) Describe and explain **two** reasons why bullet-resistant vests are made from Kevlar<sup>®</sup> instead of steel.

2

(b) Look at the structure of Kevlar<sup>®</sup>.



What type of molecule is Kevlar®?

[1]

[4]

(c) Nanoparticles are being used to make a material that is better than Kevlar<sup>®</sup> at resisting bullets.

Nanoparticles are often made of silicon dioxide.

A silicon dioxide nanoparticle has a diameter of 18 nm. The diameter of a silicon atom is 0.22 nm.

(i) Estimate how many times larger the silicon dioxide nanoparticle is, compared to a silicon atom.

Give your answer to **1** significant figure.

(ii) Silicon dioxide is used as a **catalyst**.

Suggest why 1g of silicon dioxide is **more effective** as a catalyst when used as nanoparticles rather than as a powder. [3]

## **Total Marks for Question Set 4: 11**

## **Resource Materials**

(0)	18 He He 4.0	10 Neon 20.2	18 <b>Ar</b> 39.9	36 Kr krypton 83.8	54 Xe <sup>xenon</sup> 131.3	86 Rn <sup>radon</sup>	
(2)	1	9 19.0	17 C1 chlorine 35.5	35 Br <sup>bromine</sup> 79.9	53 I lodine 126.9	85 At <sub>astatine</sub>	
(9)	16	8 0 0 16.0	16 <b>S</b> 32.1	34 Se selenium 79.0	52 Te tellurium 127.6	84 Po Polonium	116 Lv livermorium
(5)		7 N nitrogen 14.0	15 Phosphorus 31.0	33 As arsenic 74.9	51 Sb <sup>antmony</sup> 121.8	83 Bi <sup>bismuth</sup> 209.0	
(4)	14	6 C carbon 12.0	14 Si 28.1	32 Ge germanium 72.6	50 Sn <sup>tin</sup> 118.7	82 <b>Pb</b> lead 207.2	114 F1 fierovium
(3)	13	5 Baron 10.8	13 A1 aluminium 27.0	31 <b>Ga</b> <sup>gallium</sup> 69.7	49 In <sup>indium</sup> 114.8	81 <b>T1</b> thallium 204.4	
			12	30 Zn <sup>zinc</sup> 65.4	48 Cd cadmium 112.4	80 <b>Hg</b> <sup>mercury</sup> 200.6	112 Cn copernicium
			5	29 Cu 63.5	47 <b>Ag</b> silver 107.9	79 <b>Au</b> <sup>gold</sup> 197.0	111 Rg roentgenium
			10	28 Ni 58.7	46 Pd <sup>palladum</sup> 106.4	78 Pt platinum 195.1	110 DS <sup>darmsta dijum</sup>
თ				27 <b>Co</b> cobalt 58.9	45 Rh <sup>thodium</sup> 102.9	77 Ir <sup>iidum</sup> 192.2	109 Mt <sup>meitnerium</sup>
œ				26 Fe Iron 55.8	44 Ru ruthenium 101.1	76 <b>Os</b> <sup>osmium</sup> 190.2	108 Hs <sup>hassium</sup>
		_	7	25 Mn <sup>manganese</sup> 54.9	43 Tc technetium	75 Re <sup>rhenium</sup> 186.2	107 Bh <sup>bohrium</sup>
	ber mass		9	24 Cr chronium 52.0	42 <b>Mo</b> <sup>molybdenum</sup> 95.9	74 W tungsten 183.8	106 Sg <sup>seaborgium</sup>
Key minic numb Symbol name e atomic r			ъ	23 V vanadlum 50.9	41 Nb <sup>niobium</sup> 92.9	73 Ta tantalum 180.9	105 Db <sup>dubnium</sup>
	atc relativ		4	22 Ti ttanium 47.9	40 Zr ≊rconium 91.2	72 Hf hathium 178.5	104 Rf rutherfordium
			ы	21 Sc scandium 45.0	39 yttrium 88.9	57-71 lanthanoids	89—1 03 actinolds
(2)	~	Be beryllum 9.0	12 Mg 24.3	20 Ca calclum 40.1	38 Sr 87.6	56 Ba barium 137.3	88 Ra <sup>rađium</sup>
(1)	hydrogen 1.0	3 Li Bithium 6.9	11 Na <sup>sodium</sup> 23.0	19 K potassium 39.1	37 Rb <sup>rubidium</sup> 85.5	55 Cs caesium 132.9	87 Fr francium

The Periodic Table of the Elements



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