AQA Chemistry Paper 1 – Topics 1-5

Higher

Separate Science

Predicted Paper A

Name……..

Date……..

1 hour 45 minutes allowed

Similar to your real exam each question in this gets harder towards the end of each question, so if you find you can do the last part of a certain question, try the next question, they all start off easier then get harder.

You will need a chemistry data sheet (periodic table)

Grade boundaries

These are VERY rough guesses! Getting an 8 or 9 on here does not guarantee you the same mark in the exam

- 9 75
- 8 65
- 7 55
- 6 45
- 5 35

Exam Analysis

Question	Marks available	Marks gained	Topic	What do you need to do to improve …	Bits to help if you don't understand …
1	9		Atomic Structure		Topic summary; https://youtu.be/sYlmoNKypoY
2	10		Quantitative chemistry and experiments		Explanation; https://youtu.be/yzTJybCnrzo
3	12		Required practical 1		Experiment; https://youtu.be/ttsAmaNu4ao Exam questions' https://youtu.be/BmaXoGTAmeA
4	16		Structure and bonding		Topic summary flashcards; https://youtu.be/LwZD3-5rLV8
5	7		pH		Explanation; https://youtu.be/CvmhbNYroeo
6	13		Electrolysis		Experiment and explanation; https://youtu.be/r0kbEj2PDEg
7	23		Energy Changes		Calculations; https://youtu.be/B3hs4GEgJQc
8	10		Nanotechnology		The strange new world of Nanoscience, narrated by Stephen Fry http://bit.ly/2wseIVH
Total	100				

Question 1

a) What are the two sub-atomic particles that are in the nucleus of an atom? [2 marks]

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b) Draw the arrangement of electrons in an atom of carbon. [2 marks]

c) What is the difference between an atom and an ion? [1 mark]

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d) What is the difference between an atom of oxygen and an atom of sulfur? [4 marks]

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Question 2

New fertiliser technology is being developed that would help oil producing plants grow faster; these are being trialled all over the country. A scientist collected the results and looked at the amount of oil produced after these plants have been growing.

a) Ammonium sulfate, $(NH_4)_2SO_4$, is commonly used in fertilizers to aid the growth of plants. What is the relative formula mass of ammonium sulfate (M_r)?

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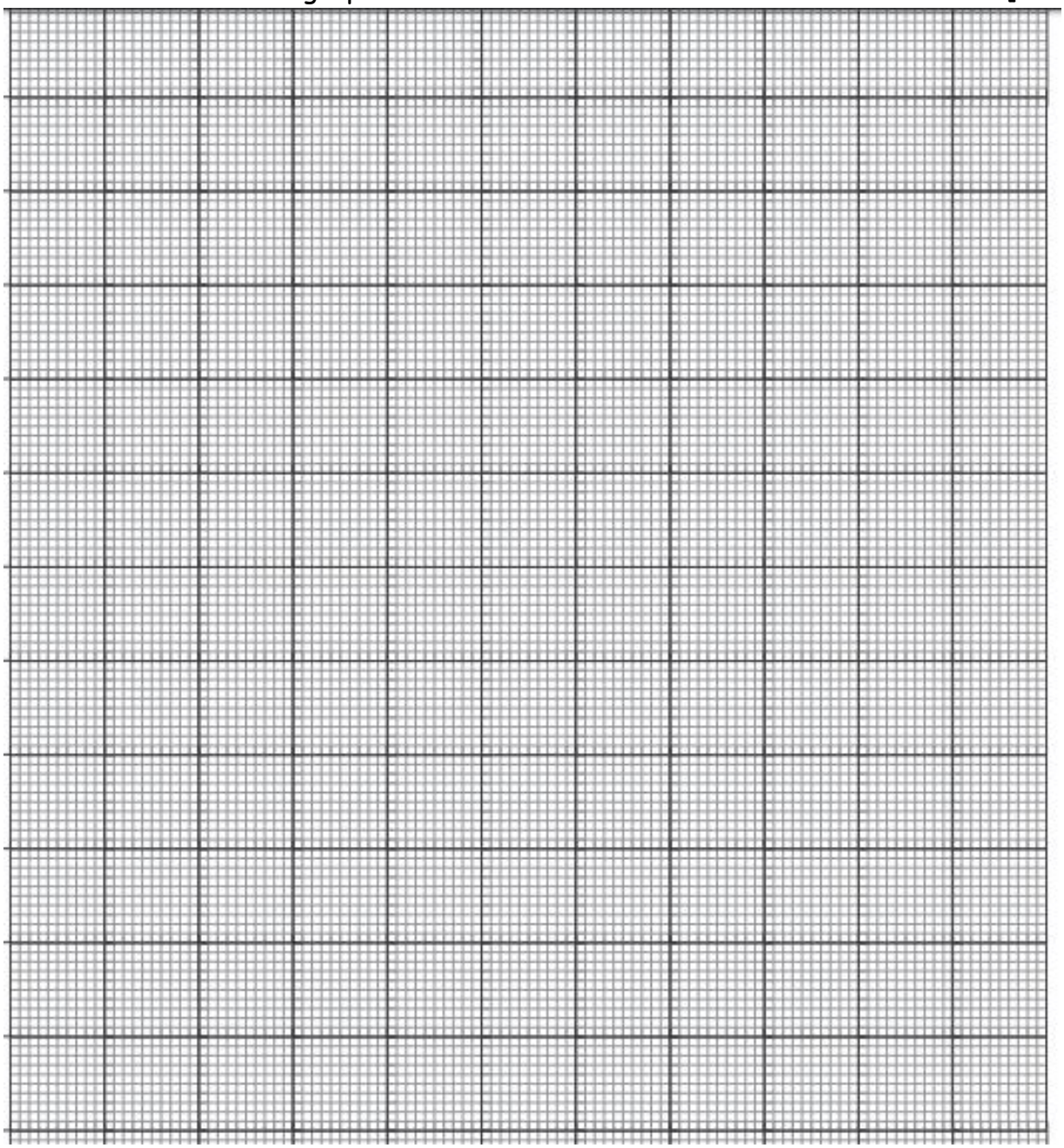
[2 marks]

b) Complete the mean averages in the table below [3 marks]

Months of growth	Volume of oil per 10kg of plant (cm^3)			
	Test 1	Test 2	Test 3	Average
2	25	28	24	
4	39	42	37	
6	32	35	31	
8	51	21	49	
10	57	61	62	

c) Plot the results on the graph [4 marks]



d) Give one independent variable from the experiment [1 mark]

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Question 3

a) How many atoms are there in sulfuric acid? [1 mark]

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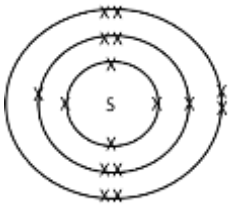
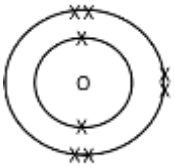
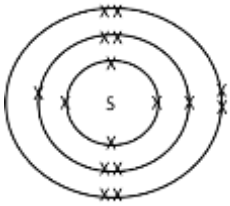
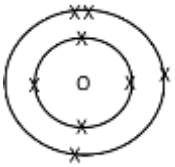
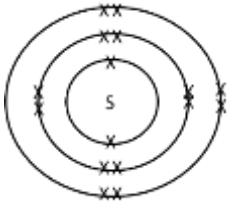
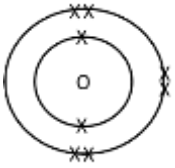
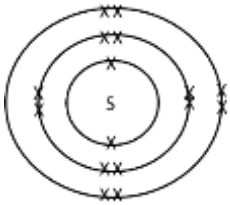
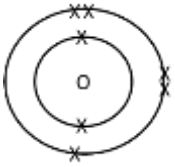
b) Which of the following represents the accurate electronic configurations for sulfur and oxygen?

[1 mark]

Circle **one** answer only

	Sulfur	Oxygen
A		
B		
C		
D		

c) Describe the process of making dry copper sulfate crystals from sulfuric acid and copper oxide, name the equipment used and the separation processes involved. [6 marks]

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d) Write the balanced symbol equation for the reaction between copper oxide and sulfuric acid [2 marks]

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e) What is the atom economy of the reaction? [2 marks]

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Question 4

a) Which of the following are the correct set of properties?

[1 mark]

Circle **one** answer only.

	Solid	Liquid	Gas
A	Can't flow	Can't flow	Can flow
B	Fixed volume	Fixed volume	Not fixed volume
C	Can't be compressed	Can be compressed	Can be compressed
D	Particles in a fixed position	Particles in a fixed position	Particles free to move

b) Describe the bonding between magnesium and oxygen. Give the formula in your answer, you may use a diagram to help. [6 marks]

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c) Diamond and graphite are both made from the same element.

a) Which element is this? [1 mark}

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b) How many bonds does each element make in diamond? [1 mark}

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c) Which one can conduct electricity? [1 mark}

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d) Which gas will be produced when they are burnt in an excess of oxygen? [1 mark}

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d) A student had two unknown compounds A and B both were white solids at room temperature and both dissolved in water. Compound A was able to conduct electricity when dissolved but compound B was not.

For each compound give the type of structure and explain why you have come to this conclusion.

[5 marks]

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Question 5

a) A drink (sample A) is tested and found to be pH 9, what does this tell us about the solution?

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b) Which ion is responsible for the solution being pH 11??

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[1 mark]

c) An acidic and an alkaline solution can be mixed together and a neutral solution produced, what is the ionic equation for this?

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[2 marks]

d) Describe the difference between weak and strong acids

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[3 marks]

Question 6

a) The electrolysis of sodium chloride solution (brine) produces a number of useful products; give the formula for these products and a possible use for each of them.

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[3 marks]

b) Which electrode does hydrogen go to and why?

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[2 marks]

c) Complete the equation for the reaction of chloride ions.

……$Cl^- \rightarrow Cl_2$ + …….. [2 marks]

d) What type of reaction is happening to chlorine?

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[1 mark]

e) How do you test for chlorine gas?

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[1 mark]

f) How do you test for hydrogen gas?

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[1 mark]

g) Copper metal is a product of copper chloride electrolysis, why is sodium metal not a product of sodium chloride electrolysis?

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[3 marks]

Question 7

Methanol (CH_4O) burns in oxygen to produce carbon dioxide and water

a) Draw the dot and cross diagram for the bonding in oxygen gas

[3 marks]

b) Write the balanced equation for the burning of methanol (CH_4O) in oxygen.

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[4 marks]

c) Draw an energy level diagram for this reaction [2 marks]

d) Calculate the energy change when the reaction happens.

Bond	Bond energy in kJ per mole
O = O	495
O – H	467
C – H	413
C – O	358
C = O	745
C - C	347

[4 marks]

e) New fuels, such as hydrogen are being developed in place of traditional fuels like alcohols.

i. Write the half equations for the reactions that take place inside a hydrogen fuel cell, include locations and state symbols [4 marks]

ii. Evaluate the use of hydrogen as a fuel

[6 marks]

Question 8

Hip replacements are generally done using a new titanium hip, this last for about 10 years before needing replacement. A new hip made from an alloy of titanium and gold has shown to make a better replacement

a) Why would a titanium alloy be a better replacement hip than a pure titanium one?

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[1 mark]

b) Describe the differences in structure between the pure metal and the alloy

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[4 marks]

c) Nanotechnology is driving revolution in medicine. How big are nanoparticles?

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[1 mark]

d) Some people are wary about nanotechnology, why might this be?

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[2 mark]

e) Which question cannot be answered by scientist?

Tick **one** answer only.

What are the effects of nanotechnology on the human body?	
How much does nanotechnology cost?	
Should we use nanotechnology?	

[1 mark]

f) Explain your answer to part e)

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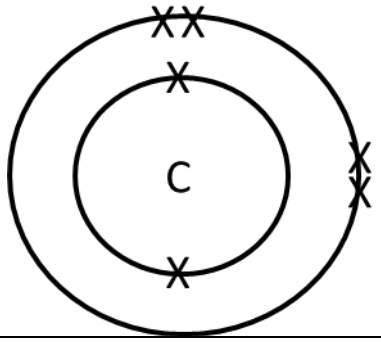
[1 mark]

Answers

<table>
<tr><th>Question</th><th>Answer</th><th>Guidance</th></tr>
<tr><td>1a</td><td>Proton
Neutron</td><td>1 mark for each</td></tr>
<tr><td>1b</td><td> 
</td><td>1 mark for inner shell
1 mark for outer shell</td></tr>
<tr><td>1c</td><td>An ion is an atom that has lost or gained electrons</td><td>1 mark</td></tr>
<tr><td>1d</td><td>-oxygen has 8 protons
OR
-sulfur has 16 protons
AND
-this is more/less then oxygen/sulfur

-oxygen has 8 neutrons
OR
-sulfur has 16 neutrons
AND
-this is more/less then oxygen/sulfur

-oxygen has 8 electrons
-sulfur has 16 electrons
-oxygen has 2 electrons shells
-sulfur has 3 electrons shells

Not mark for mentioning the number of electrons in the outer shell as this is the same for both</td><td>1 mark for each bullet point

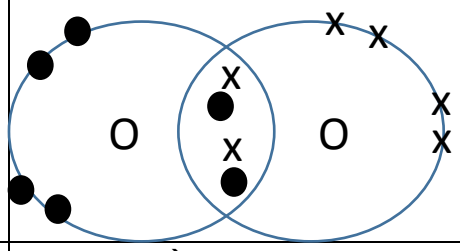
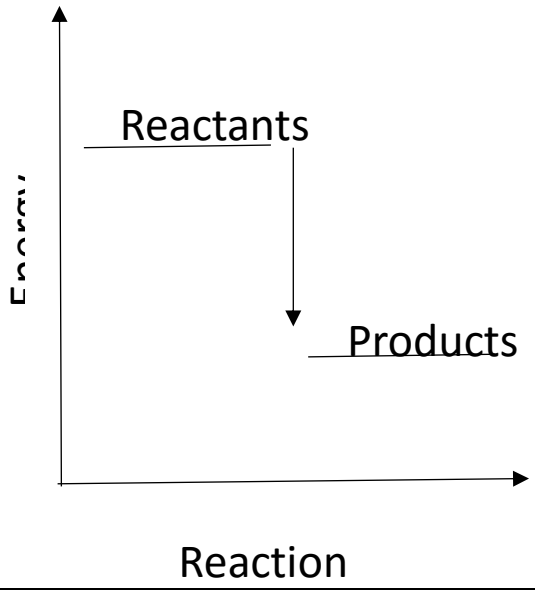
If only electrons mentioned then max 2 marks

To gain full marks each of the subatomic particles must be mentioned</td></tr>
<tr><td>2a</td><td>132</td><td>2 marks</td></tr>
<tr><td>2b</td><td>
<table>
<tr><th rowspan="2">Months of growth</th><th colspan="4">Volume of oil per 10kg of plant (cm^3)</th></tr>
<tr><th>Test 1</th><th>Test 2</th><th>Test 3</th><th>Average</th></tr>
<tr><td>2</td><td>25</td><td>28</td><td>24</td><td>25.7</td></tr>
<tr><td>4</td><td>39</td><td>42</td><td>37</td><td>39.3</td></tr>
<tr><td>6</td><td>32</td><td>35</td><td>31</td><td>32.7</td></tr>
<tr><td>8</td><td>51</td><td>21</td><td>49</td><td>50</td></tr>
</table>
</td><td>-3 marks if all correct
-2 if 3 answers correct
-1 if 1 answer correct

-25.6 or 32.7 do not gain a mark as student have not rounded correctly, penalise this only once.</td></tr>
</table>

		10	57	61	62	**60**
2c	-x axis correct (label, units, scale) -y axis correct (label, units, scale) -point plotted correctly -line of best fit drawn					1 mark for each point
2d	Months of growth Location around the country					
3a	7					1 mark
3b	C					1 mark
3c	Simple statements might include; -crystallisation -filtering -evaporation Simple Explanations (clear explanations in brackets) might include; -Heating sulfuric acid and mixing the copper oxide in (until the black copper oxide cannot dissolve in the sulfuric acid any more) -filtering the solution (to remove the left over solid) -heating the blue solution (to evaporate off the water leaving about half the solution) -leaving the solution to crystallise (copper sulfate crustal made)					**Level 1 (1-2 marks)** -simple statements made **Level 2 (3-4 marks)** -statement with simple explanations **Level 3 (5-6 marks)** -statements with clear explanations
3d	$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$					1 mark for each side of the equation
3e	-Mr reactants = (Mr CuO=79.5 + Mr H_2SO_4 = 98) =177.5 -159.5/177.5=90%					1 mark for each bullet point
4a	B					1 mark
4b	-magnesium loses 2 of electrons … -…and becomes a 2+ positive ion -oxygen gains 2 of electrons … …becoming a -2 negative ion -They now both have full outer shells -MgO					1 mark for each bullet point, marks may be gain from a diagram
4ci	carbon					
4cii	4					

4ciii	graphite	
4civ	Carbon dioxide	
4d	Points for compound A -is ionic -solid at room temperature so has a high melting point -conducts when dissolve -ions free to move Points for compound B -giant covalent -does not conduct when dissolved	The first point for each compound is needed to gain the rest of the marks. Correct identification of A as ionic and B as giant covalent (simple covalent is incorrect and gains no marks, covalent alone is insufficient information and gains no marks) After that 1 mark for each bullet point up to 5
5a	Alkali	1 mark
5b	Hydroxide or OH^-	1 mark Allow error carried forward if 1a is answered acid and 1b is answered H^+
5c	$H^+ + OH^- \rightarrow H_2O$	1 mark for left hand side 1 mark for right hand side Reversible reaction sign preferred
5d	-strong acid fully dissociates -weak acid partially dissociates -any correct example give	1 mark for each bullet point
6a	-Cl_2 (disinfectant, production of HCl) -H_2 (fuel, production of HCl) -NaOH (bleach, paper making)	Product and use must be given to gain mark 1 mark for each bullet point
6b	-negative -because its positive and opposites attract	1 mark for each bullet point
6c	$2Cl^- \rightarrow Cl_2 + 2e^-$	1 mark for LHS 1 mark for RHS
6d	Reduction	1 mark
6e	Damp litmus paper turns pink	Test and result must be present for 1 mark
6f	Squeaky pop with lit flame	Test and result must be present for 1 mark
6g	-sodium is higher up then hydrogen on the reactivity series -hydrogen gas will be formed	1 mark for each point

	-the sodium ions react with hydroxide ions from water	
7a		1 mark for correct placement of electrons 1 mark for correct number of electrons 1 mark for double bond
7b	$2CH_4O + 3O_2 \rightarrow 2CO_2 + 4H_2O$	1 mark for all formula correct 1 mark for LHS 1 mark for RHS
7c		

7d

Reactants				**Products**			
Methanol				**Carbon Dioxide**			
Bond	Energy	Number of bonds	Total energy	Bond	Energy	Number of bonds	Total energy
C-H	413	3	1239	C = O	745	2	1490

C-C	347	0	0	Total for each carbon dioxide			1490
C-O	358	1	358				
O-H	467	1	467	Number of carbon dioxides			2
Total for each methanol			2064				
Number of methanols			2	**Overall for carbon dioxide**			2980
Overall for methanol			4128				
Oxygen				**Water**			
O=O	495	1	495	O - H	467	2	934
Total for each oxygen			495	Total for each water			934
Number of oxygens			3	Number of waters			4
Overall for oxygen			1485	**Overall for water**			3736
Overall for reactants			5613	**Overall for products**			6716

Total for REACTANTS – Total for PRODUCTS = 5613-6716= -1103kJ/Mol

EXOTHERMIC (-ve)

1 mark for LHS, 1 mark for RHS, one mark for correct answer, 1 mark for correct sign

7ei	At the cathode (negative electrode): $H_2(g) - 2e^- \rightarrow 2H^+(aq)$ At the anode (positive electrode): $4H^+(aq) + O_2(g) + 4e^- \rightarrow 2H_2O(g)$	1 mark for correctly associated locations 1 mark for all state symbols present and correct 1 mark for each correct equation
7eii	To gain full marks- this must give a balance of advantages and disadvantages, followed by a justified option. **Advantages of using hydrogen:** -combustion only produces water	**Level 1 (1-2 marks)** -simple statements made **Level 2 (3-4 marks)** -statement with simple explanations **Level 3 (5-6 marks)**

	-combustion of hydrogen does not produce carbon dioxide -does not contribute to climate change **Disadvantages of using hydrogen:** -hydrogen gas needs to be stored at high pressure -there is a risk of explosion -much less energy produced from hydrogen	-statements with clear explanations-t
8a	Stronger/harder	1 mark
8b	Pure metal -atoms arranged in layers -these layer can slide (making it soft) Alloy -different sized atoms disrupting the layers -no sliding can take place (making it hard)	1 mark for each bullet point
8c	Very small	1 mark
8d	-they are unsure of the long term effects -don't like new things	1 mark for each bullet point
8e	Should we use nanotechnology?	1 mark
8f	It is based on people opinions and scientist can't tell people what to think	1 mark