

MARK SCHEME

GCSE

CHEMISTRY

AQA - TRIPLE SCIENCE

C2 - TEST 6

BONDING

Advanced

Mark schemes

1.

(a) **Graphite:**

because the layers (of carbon atoms) in graphite can move / slide

it = graphite

1

this is because there are only weak intermolecular forces **or** weak forces between layers

accept Van der Waals' forces allow no covalent bonds between layers

1

Diamond:

however, in diamond, each carbon atom is (strongly / covalently) bonded to 4 others

allow diamond has three dimensional / tetrahedral structure

1

so no carbon / atoms able to move / slide

*allow so no layers to slide **or** so diamond is rigid*

1

(b) because graphite has delocalised electrons / sea of electrons

allow free / mobile / roaming electrons

1

which can carry charge / current **or** move through the structure

1

however, diamond has no delocalised electrons

accept however, diamond has all (outer) electrons used in bonding

1

[7]

2.

(a) (i) any **two** from:

ignore any conclusion drawn referring to data below 7.5 nm or above 20 nm

- *100% of (type 1 and type 2) bacteria are killed with a particle size of 7.5 to 8.5 nm*

accept nanoparticles in the range of 7.5 to 8.5 nm are most effective at killing (type 1 and type 2) bacteria

- *as the size increases (beyond 8.5 nm), nanoparticles are less effective at killing (type 1 and type 2) bacteria*
- *type 1 shows a linear relationship **or** type 2 is non-linear*
- *type 1 bacteria more susceptible than type 2 (at all sizes of nanoparticles shown on the graph)*

allow type 2 bacteria are harder to kill

2

(ii) (yes) because you *could* confirm the pattern that has been observed

allow would reduce the effect of anomalous points / random errors

allow would give better line of best fit

ignore references to reliability / precision / accuracy / reproducibility / repeatability / validity

or

(no) because trend / *conclusion* is already clear

1

(b) magnesium loses electron(s)

1

oxygen gains electron(s)

1

two electrons (per atom)

1

gives full outer shells (of electrons) **or** *eight electrons in highest energy level*

*reference to incorrect particles **or** incorrect bonding **or** incorrect structure = max 3*

1

or

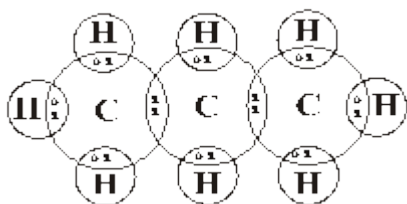
(electrostatic) attraction between ions **or** forms ionic bonds

accept noble gas structure

[7]

3.

(a)



allow all dots

or

all crosses

or

combination

or

all e / e⁻

or –

or other suitable symbols

centre of symbols must be on **or** inside overlapping

areas within reason

1

(b) (i) any **two** from:

- no change initially **or** stays constant at the beginning
- increase
- slowly at first and then more rapidly

accept converse arguments

allow vapour pressure is 0 at any temperature < -100°C for 1 mark

accept positive correlation

accept explanation based on kinetic theory eg particles have more kinetic energy

allow reasonable attempt at using numbers

2

(ii) -44 (using graph) accept -43 to -45

1

(c) • intermolecular forces / bonds **or** forces / bonds between molecules

1

- bonds / forces are weak

covalent bonds are weak = 0 marks

if they do not gain either of the marks on the left then allow simple covalent / molecular / made of small molecules for 1 mark

1

[6]

4.

(a) (i) **Quality of Written Communication**

The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

maximum 2 marks if ideas not expressed well

layers / lattice / giant structure / regular pattern of atoms (diagram)

allow layers / lattice / giant structure / regular pattern of ions

*do **not** accept particles*

1

outer (shell) electrons

accept valence electrons

1

(free to) move (through whole structure)

accept delocalised / mobile / free

1

(ii) the free electrons (allow the metal to conduct electricity)

accept electrons move / mobile / delocalised

1

(iii) atoms / ions / layers can slide / slip / move over each other

1

(b) (i) copper oxide formed **or** Cu reacts with oxygen **or** Cu is oxidised

1

this is a poor conductor **or** gets in the way of free moving electrons **or** fewer mobile electrons

*do **not** accept electricity*

1

or

oxygen atoms / oxygen molecules / oxide ions in metal

do not accept oxygen pockets / bubbles

prevents / disrupts flow of electrons /
current or fewer mobile electrons (1)

*do **not** accept macro explanations*

*do **not** accept electricity*

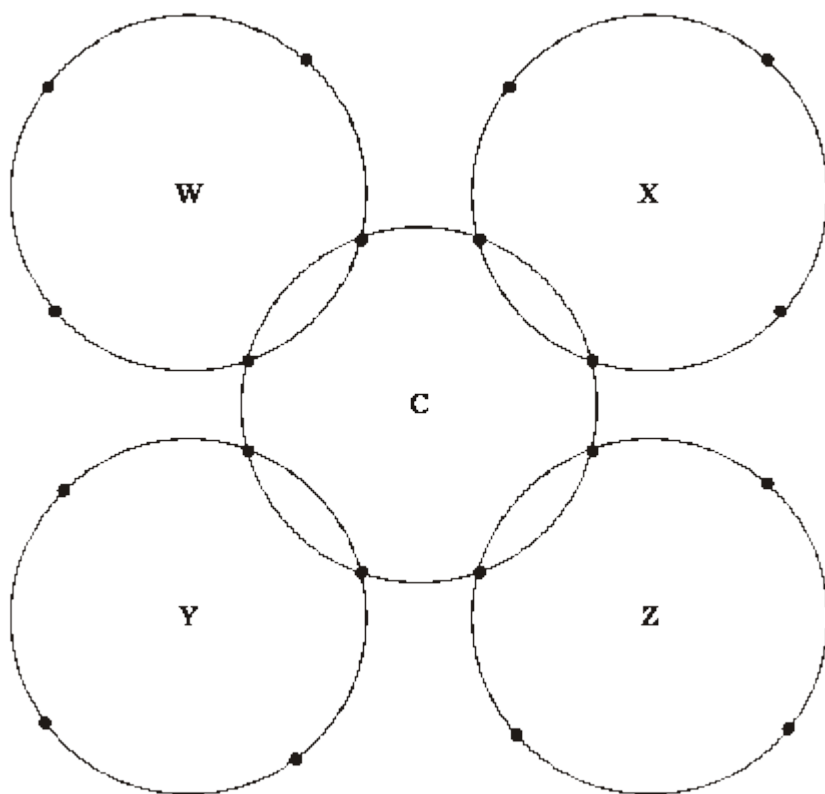
(ii) hydrogen reacts with oxygen or water is formed **or** hydrogen reduces
copper oxide etc.

1

[8]

5.	<p>(a) some electrons from outer shells (some electrons) free to move/mobile through whole structure/between atoms/sea of electrons hold atoms together <i>for 1 mark each</i></p> <p><u>or</u> positive ions in a sea of electrons (owtte) <i>2 marks</i></p> <p>atoms in regular structure/layers giant structure close packed credit diagrams – look for labels <i>for 1 mark each any 4</i></p>	4
	<p>(b) (i) electrons, free to move (reference to electrons) <i>for 1 mark each</i></p>	2
	<p>(ii) layers/atoms can slide over each other <i>for 1 mark</i></p>	1
	<p>(iii) free electrons hold atoms strongly together/strong forces of attraction/bonds (between atoms)/tight packing of atoms <i>for 1 mark</i></p>	1
		[8]
6.	<p>(a) Quality of written communication: All scientific words used correctly (covalent, bonds, atoms)</p> <p>any two from</p> <ul style="list-style-type: none"> • large numbers of covalent bonds <i>allow giant lattice / structure</i> • between <u>atoms</u> <i>do not accept between molecules</i> • (covalent) bonds strong <i>accept need much energy to break</i> 	1
		2

(b)



each carbon has 4 electrons

1

one shared pair

1

four shared pairs

1

[6]

7.

- (a) (i) sodium..... positive **or +**
both required 1
- chloride... negative **or –**
both required
do not credit chlorine 1
- (ii) ions not free (to move) in solid crystal / lattice
ions are free to move when sodium chloride is molten 1
- or** ions are mobile
do not credit when ions are molten
allow 'particles' for ions (1) mark
do not credit electrons etc 1
- (iii) dissolved in water
or in aqueous solution
accept in solution
accept in water
or when a gas/ vapour or solid it will not 1
- (b) (i) 40 1
- (ii) (total) number of protons **and** neutrons (in the nucleus) 1
- (c) (i) $2\text{Ca} + \text{O}_2 \rightarrow 2\text{CaO}$
accept any $2n : n : 2n$ ratio
do not credit if any other change has been made 1
- (ii) any **two** from
electron(s) is / are lost
from the outer shell / orbit / ring
or from the shell furthest the nucleus
or from the 4th shell
two / both (electrons are lost)
accept two electrons are lost for (2)marks
accept both electrons are lost from the atom for (1) mark 2

8.

(a) lattice / giant structure

max 3 if incorrect structure or bonding or particles

1

ionic **or** (contains) ions

1

Na⁺ and Cl⁻

accept in words or dot and cross diagram: must include type and magnitude of charge for each ion

1

electrostatic attraction

allow attraction between opposite charges

1

(b) hydrogen

allow H₂

1

sodium hydroxide

allow NaOH

1

(c) any **one** from, eg:

- people should have the right to choose
- insufficient evidence of effect on individuals
- individuals may need different amounts.

allow too much could be harmful

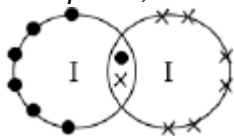
ignore religious reasons

ignore cost

ignore reference to allergies

1

- (d) (i) one bonding pair of electrons
accept dot, cross or e or – or any combination, eg



1

6 unbonded electrons on each atom

1

- (ii) simple molecules
max 2 if incorrect structure or bonding or particles
accept small molecules
accept simple / small molecular structure

1

with intermolecular forces

accept forces between molecules
must be no contradictory particles

1

which are weak **or** which require little energy to overcome – must be linked to second marking point

reference to weak covalent bonds negates second and third marking points

1

- (iii) iodine has no delocalised / free / mobile electrons or ions

1

so cannot carry charge

if no mark awarded iodine molecules have no charge gains 1 mark

1

[14]