

MARK SCHEME

GCSE

CHEMISTRY

AQA - TRIPLE SCIENCE

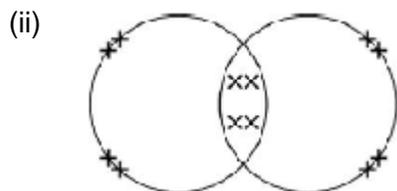
C2 - TEST 5

BONDING

Advanced

Mark schemes

- 1.** (a) (i) giant lattice
allow each carbon atom is joined to three others 1
- atoms in graphene are covalently bonded
max. 2 marks if any reference to wrong type of bonding 1
- and covalent bonds are strong **or** need a lot of energy to be broken
allow difficult to break 1
- (ii) because graphene has delocalised electrons
allow each carbon atom has one free electron 1
- which can move throughout the structure
*do **not** accept just electrons can move.* 1
- (b) because there are weak forces between molecules
allow no bonds between the layers 1
- so layers / molecules can slip / slide. 1
- [7]
- 2.** (a) *weaker bonds*
allow (other substances) react with the silicon dioxide
- or**
- fewer bonds*
ignore weaker / fewer forces
- or**
- disruption to lattice*
*do **not** accept reference to intermolecular forces / bonds* 1
- (b) (i) Na_2O
*do **not** accept brackets or charges in the formula* 1



electrons can be shown as dots, crosses, e or any combination

2 bonding pairs

accept 4 electrons within the overlap

1

2 lone pairs on each oxygen

accept 4 non-bonding electrons on each oxygen

1

(c) *lattice / regular pattern / layers / giant structure / close-packed arrangement*

1

(of) positive ions **or** (of) atoms

1

(with) delocalised / free electrons

*reference to incorrect particles **or** incorrect bonding **or** incorrect structure = max 2*

1

[7]

3.

(a) has delocalised electrons

accept free (moving) electrons

1

(so electrons) can move through the structure/metal

accept (so electrons) can carry charge through the structure/metal

accept (so electrons) can form a current

1

*reference to incorrect particles **or** incorrect bonding **or** incorrect structure = max 1*

(b) giant structure

accept lattice

accept each atom forms four bonds (with other carbon atoms)

ignore macromolecular

1

strong bonds

accept covalent

*do **not** accept ionic*

1

*reference to intermolecular forces/bonds **or** incorrect particles = max 1*

- (c) thermosetting polymers do not melt (when heated)
accept thermosetting polymers do not change shape (when heated)
accept thermosetting polymers have high(er) melting points
ignore thermosetting polymers do not soften (when heated)

1

due to cross-links (between chains)
accept due to bonds between chains

1

*reference to smart polymers = **max 1***
accept converse argument

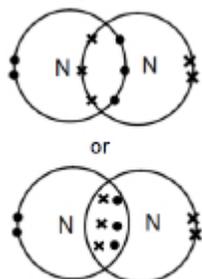
[6]

4.

- (a) six electrons in the overlap
allow dots, crosses or e^{-} for electrons

1

2 non-bonding electrons on each nitrogen atom
2 marks for an answer of:



1

- (b) weak forces

1

between molecules
or
 intermolecular

do not allow references to covalent bonding between molecules

1

(which) need little energy to overcome

1

- (c) each (carbon) atom forms three covalent bonds

1

forming layers (of hexagonal rings)

1

(soft)

(because) layers can slide over each other

1

(conducts electricity)

(because of) delocalised electrons

1

- (d) molecules are spherical 1
 (so molecules) will roll 1
- (e) surface area ($= 20 \times 20 \times 6 = 2400 \text{ (nm}^2\text{)}$) 1
 volume ($= 20^3 = 8000 \text{ (nm}^3\text{)}$) 1
 ratio = $0.3 \text{ (nm}^3\text{)} : 1 \text{ (nm}^3\text{)}$
 ratio = $0.3 \text{ (nm}^3\text{)} : 1 \text{ (nm}^3\text{)}$
or
 $1 \text{ (nm}^3\text{)} : 3.33 \text{ (nm}^3\text{)}$ 1
- (f) (nanoparticles) have a larger surface area to volume ratio 1
 so less can be used for the same effect 1

[16]

- 5.** (a) nanotubes can slide (over each other) 1
allow nanotubes can roll (over each other)
- because no (covalent) bonds between the nanotubes
accept weak forces between the nanotubes or weak intermolecular forces
allow layers for nanotubes throughout 1
- (b) delocalised electrons 1
accept free electrons
- so (delocalised) electrons can move through the graphite
accept so (delocalised) electrons can carry charge through the graphite 1

[4]

- 6.** (i) can be from diagram chlorine (2.8).7. 1
accept chlorine needs one more electron

can be from diagram shares a pair of electrons

1

shared pair of electrons is a covalent bond

do not accept ionic bond

1

- (ii) can be from diagram and appropriately annotated sodium (2.8). 1.
and chlorine (2.8).7

1

sodium loses one electron and chlorine gains one electron

1

Na⁺ and Cl⁻ formed

1

bond formed between oppositely charged ions **or** ionic bond is formed

do not accept covalent bond

1

[7]

7.

- (a) 8 marks Particularly well structured answer with most points mentioned.

7-6 marks Well structured answer. The two metals will have been compared rather than simply listing advantages/disadvantages. Most of the advantages and disadvantages of each metal have been mentioned.

5-3 marks Some structure to the answer. An attempt to compare the metals by giving some advantages and disadvantages.

2-1 marks Little structure or attempt to compare. Marks gained by listing a few advantages or disadvantages.

Advantages of Nickel:

Relatively low cost which makes the sparking plugs cheaper to produce.
Quite high melting point which is needed because the temperature in the engine is very high.

Good conductor of electricity needed to carry electricity into combustion chamber to produce spark.

Disadvantages of Nickel:

Subject to corrosion in engine which means they only last a short time
because nickel is higher in reactivity than platinum.

Idea that this leads to reduced efficiency, unburnt petrol and air pollution.

Advantages of Platinum:

Less susceptible to corrosion (not corroded) because platinum is very low in reactivity.

Idea that this improves efficiency and reduces pollution.-

Higher melting point than nickel to withstand the high temperatures in the combustion chamber.

Last a lot longer than nickel electrodes due to low reactivity.

(Sensible extension here could be longer service intervals etc.)-

Good conductor of electricity as for nickel.

Extension here could be linked to the idea that the conductivity does not deteriorate as quickly as nickel.)

Disadvantages of Platinum:

Cost *which will make the sparking plug more expensive.*

A good candidate might justify cost by longer life, better fuel consumption and less pollution.

8

- (b) (i) giant structure/lattice/regular arrangements of atoms
any for 1 mark

of atoms/of ions (provided free electrons mentioned)
either for 1 mark

delocalised or free electrons
for 1 mark

3

- (ii) electrons free/can move
for 1 mark each

2

[13]

8.

- (a) covalent/description of covalent
for 1 mark

1

- (b) forces/bonds between the molecules/particles (not atoms) are weak
for 1 mark each

2

- (c) non-flammable so it will not burn etc.
extremely unreactive so it will not react with materials in the transformer,
does not conduct electricity so it can insulate the transformer
gas so it has freedom to move and insulate whole area
for 1 mark each

3

[6]