

MARK SCHEME

GCSE

CHEMISTRY

AQA - COMBINED SCIENCE

C2 - TEST 4

BONDING, STRUCTURE AND PROPERTIES OF MATTER

Intermediate

Mark schemes

1.

(a) 2.8.3 on diagram as Xs / dots

or e

accept paired or unpaired

1

(b) any **two** from:

- electrons in highest energy level **or** electrons in outer shell
- electrons are delocalised **or** sea of electrons
- electrons are free **or** electrons move around / flow
- electrons carry charge / current

ignore carry electricity

2

[3]

2.

(a) magnesium loses electrons

there are four ideas here that need to be linked in two pairs.

1

two electrons

1

chlorine gains electrons

magnesium loses electrons and chlorine gains electrons scores 2 marks.

1

two atoms of chlorine

magnesium loses two electrons and two chlorines each gain one electron will score full marks.

1

(b) 95

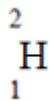
*correct answer with or without working gains 2 marks
if answer incorrect, allow $24 + 35.5 + 35.5$ for 1 mark*

2

[6]

3.

(a)



2 and 1 must be on the left

2 must be above half-way on the H and the 1 below half-way

accept diagram with 2 different particles in centre and 1 particle on circle

1

(b) (i) 18

ignore working

ignore units

1

(ii) forces (of attraction) between molecules **or**
bonding between molecules **or**
intermolecular forces /intermolecular bonds

1

*are weak **or** not much energy needed to break them **or** easily overcome*

must be linked to first mark

if no other mark awarded allow small molecules / small M_r for 1 mark

allow forces / bonds are weak for 1 mark

*do **not** allow covalent bonding is weak*

1

(c) *any reference to more protons = 0 marks*

H-2 atoms have 1 proton and 1 neutron

allow H-2 has more neutrons / particles for 1 mark

1

H-1 atoms have one proton

allow H-2 has two particles and H-1 has one particle for 1 mark

or

H-2 atom has one neutron (1)

allow H-2 atom has one more neutron for 2 marks

H-1 atom has no neutrons (1)

NB *heavy water (molecule) has 2 more neutrons = 2 marks*

heavy water (molecule) has more neutrons / particles = 1 mark

if no other mark awarded then heavy water molecule has M_r of 20 = 1 mark

ignore reference to electrons

1

[6]

4.	(a) (i) 7 / seven	1
	(ii) 1	
	<i>do not accept -1</i>	1
	Electron	1
	(iii) isotopes	1
	(b) (i) (sodium +) fluorine → sodium fluoride	1
	(ii) compounds	1
	(iii) mole	1
	(iv) sodium (atom) loses	1
	fluorine (atom) gains	1
	one electron	1
	ions formed	1
	<i>allow sodium forms positive (ion) or fluorine forms negative (ion)</i>	
	<i>allow form ionic bond</i>	
	<i>allow to gain a full outer shell of electrons</i>	
	<i>allow forms noble gas structure</i>	
	max 3 if reference to incorrect particle / bonding	
	(v) Dissolve in water	1
	High melting point	1
		[13]
5.	(a) 2,4 (drawn as crosses) on shells	
	<i>accept dots / e / - etc.</i>	1
	(b) (i) hard	
	<i>allow rigid / high melting point</i>	
	<i>do not allow references to bonding</i>	
	<i>ignore strong</i>	
	<i>ignore unreactive</i>	
	<i>ignore structure</i>	1

(ii) any **three** from

*max 2 if ionic / metallic / molecule / intermolecular bonds or
incorrect number of bonds*

- giant structure / lattice / macromolecular
allow many bonds
- covalent (bonds)
- (covalent) bonds are strong
accept needs lots of energy to break bonds (owtte)
- (each) carbon / atom forms four bonds

or

(each) carbon / atom bonded to four other atoms

3

- (c) any **three** from:
max 2 if ionic / ions / metallic / molecule
'it' needs to be qualified

graphite

- has delocalised / free electrons
*do **not** accept the electrons move unless qualified (around structure etc)*

or

electrons that can move through / around the structure

- each carbon is joined to three other carbon atoms
allow graphite has three bonds

or

one electron from each atom is free / delocalised

diamond

- has no free / delocalised electrons
*do **not** accept the electrons do not move*

or

no electrons that move around the structure

- all the electrons are used for bonding
allow diamond has 4 bonds

or

each carbon joined to four other carbon atoms

3

[8]

6.

- (a) • made of layers / rows (atoms / ions / particles)
ignore free / delocalised electrons

1

- which can slide / slip (over each other)
*reference to incorrect particles / covalency / intermolecular forces =
max 1*

or

particles / ions / atoms can slide over each other
ignore malleable / ductile / weak bonds

1

(b) (i) sulfuric
accept sulphuric
ignore formula
ignore hydrogen sulfate

1

(ii) any **two** from:
list principle applies for incorrect observations

- (hydrogen) gas produced (or any indication of a gas such as bubbles etc.)
ignore just hydrogen produced
ignore cloudiness / colour changes
- magnesium / solid disappears / goes into solution
accept magnesium / magnesium sulfate / solid / it dissolves
accept forms a liquid / solution
- gets hot
allow exothermic
ignore floats

2

(iii) crystallisation
accept detailed answers such as: evaporate to half volume and then allow the solution to crystallise.

or

evaporation / heating / boiling / cooling
ignore any references to filter

1

[6]

7.

(a) (i) 65
correct answer with or without working = 2 marks
if answer incorrect
evidence of (81 - 16) for 1 mark
ignore units

2

(ii) zinc
accept error carried forward from (a)(i)
allow correct symbol
answer given should be element / metal closest to their answer
*do **not** allow compounds*

1

- (b) (i) • it loses electrons
sharing / covalency = max 1 mark 1
- three electrons 1
- (ii) 8 electrons shown in second shell.
*accept dots / crosses / mixture of dots and crosses / e
 electrons do not need to be paired
 do **not** allow extra electrons in first shell* 1

[6]

8.

- (a) (i) covalent
two different answers indicated gains 0 marks 1
- (ii) carbon
two different answers indicated gains 0 marks 1
- (iii) 3
two different answers indicated gains 0 marks 1
- (b) layers can slide / slip 1
- because there are no bonds between layers
accept because weak forces / bonds between layers
- or** so (pieces of) graphite rubs / breaks off
- or** graphite left on the paper 1

[5]

9.

- (a) 4 electrons shared 1
- each atom has 4 unshared electrons outside the bond 1
- (b) carbon dioxide 1
- water 1

- (c) giant structure of atoms 1
- delocalised electrons 1
- (delocalised electrons) are free to move 1
- through the whole structure 1

[8]

10.

- (a) carbon 1
- allow C*

- (b) (i) (atoms are in) layers (that) can slide over each other 1

because between the layers there are only weak forces
accept because there are no (covalent) bonds between the layers
accept Van der Waals forces between the layers
*do **not** allow intermolecular bonds between the layers*
if no other marks are awarded allow weak intermolecular forces for
1 mark

1

- (ii) because each atom forms four (covalent) bonds **or** (diamond is a) giant (covalent) structure **or** lattice **or** macromolecular 1
- any reference to ionic / metallic bonding or intermolecular forces scores a maximum of 1 mark*
accept carbon forms a tetrahedral shape

1

(and) covalent bonds are strong 1

accept covalent bonds need a lot of energy / difficult to break

1

- (iii) because graphite has delocalised electrons 1
- allow sea of electrons*
allow each carbon atom has one free electron

1

which can move through the whole structure (and carry the current / charge / electricity) 1

1

[7]