BONDING, STRUCTURE AND PERIODICITY TEST MS

1. (i) $4\ Na + O_2 \rightarrow 2\ Na_2O$

OR $2\ Na + ½\ O_2 \rightarrow Na_2O$ ✓

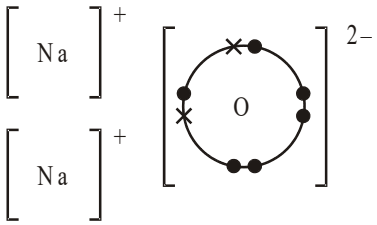
ALLOW *correct multiples including fractions*
IGNORE *state symbols*

1

(ii) (electrostatic) attraction between oppositely charged ions✓

1

(iii)



Na shown with either 8 or 0 electrons
AND
O shown with 8 electrons **with** 6 crosses and 2 dots (or vice versa) ✓
Correct charges on both ions ✓

For 1st mark*, if 8 electrons shown around cation then 'extra' electron(s) around anion must match symbol chosen for electrons in cation*
Shell circles not required
IGNORE *inner shell electrons*
ALLOW*:* $2[Na^+]\ 2[Na]^+\ [Na^+]_2$ *(brackets not required)*
DO NOT ALLOW $[Na_2]^{2+}$ / $[Na_2]^+$ / $[2Na]^{2+}$
DO NOT ALLOW: $[Na_2]^{2+}\ [Na_2]^+\ [2Na]^{2+}\ [Na]_2^+$

2

[4]

2. (i) $2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$ ✓✓
1st mark for equation
2nd mark for state symbols
2

(ii) Giant ionic (lattice) or 3D ✓
with alternating Na^+ and Cl^- ✓
2

[4]

3.



regular arrangement of **labelled** + ions with some attempt to show electrons ✓

scattering of labelled electrons **between** other species
OR
a statement anywhere of **delocalised** electrons (can be in text below) ✓

metallic bond as (electrostatic) **attraction** between the electrons and the positive ions ✓

Lattice must have at least 2 rows of positive ions

If a metal ion is shown (e.g. Na^+), it must have the correct charge

***ALLOW** for labels: + ions, positive ions, cations*
If '+' is unlabelled in diagram, award the label for '+' from a statement of 'positive ions' in text below

***DO NOT ALLOW** as label or text positive atom **OR** protons **OR** nuclei*

***ALLOW** e^- **OR** e as label for electron*
***DO NOT ALLOW** '–' as label for electron*

[3]

4. shared pair ✓ of electrons ✓
i.e. 'shared electrons' is worth 1 mark. pair of electrons for second mark

[2]

5. H_2O: all correct including lone pairs around O ✓

CO_2: correct covalent bonds around carbon ✓
lone pairs added around oxygen atoms ✓
(must be 'dot AND cross' or electron source clearly shown
(different coloured for source is OK)

[3]

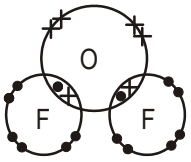
6. (i) dative covalent, bonded pair comes from same atom/ electron pair is donated from one atom/ both electrons are from the same atom ✓ 1

(ii) $Ca(NO_3)_2$ ✓ → $CaO + 2NO_2 + ½O_2$ ✓
or double equation with 2/2/4/1 1

[2]

7. (i) Electron pairs in covalent bonds shown correctly using dots and crosses in a molecule of the F_2O ✓

Lone pairs correct on O and both F atoms ✓



Must be 'dot-and-cross'
*circles for outer shells **NOT** needed*
***IGNORE** inner shells*
Non-bonding electrons of O do not need to be shown as pairs
Non-bonding electrons of F do not need to be shown as pairs

2

(ii) Predicted bond angle 104 – 105°. ✓

***ALLOW** 103 – 105° (103° is the actual bond angle)*

There are 2 bonded pairs and 2 lone pairs ✓
Lone pairs repel more than bonded pairs ✓

***ALLOW** responses equivalent to second marking point. e.g. There are 4 pairs of electrons and 2 of these are lone pairs*
***ALLOW** 'bonds' for 'bonded pairs'*
***DO NOT ALLOW** 'atoms repel'*
***DO NOT ALLOW** electrons repel*
***ALLOW** LP for 'lone pair'*
***ALLOW** BP for bonded pair*
***ALLOW** LP repel more if bonded pairs have already been mentioned*

3

[5]

8. (i) mark vertically:

H_2O	NH_3	
2	3	
2	1	2
✓	✓	

3D Diagram required or diagram with name

(ii) labelled bond angle required

NH_3	pyramidal molecule shown ✓	107 °✓ (106-108°)	
SO_2	non-linear molecule shown ✓	110 – 130 ° ✓	4

[6]

9. (i) Attraction of electrons ✓ in a bond ✓ towards an atom 2

(ii) CO_2 is symmetrical/H_2O is not symmetrical ✓
In CO_2, dipoles cancel/in H_2O, the dipoles don't cancel ✓ 2

[4]

10. H_2O

H bonding from O of 1 molecule to H of another ✓
dipoles shown or described ✓ 3
with lone pair of O involved in the bond ✓

CH_4

van der Waals' forces from oscillating dipoles/ temporary dipoles/ transient dipoles/ instantaneous dipoles ✓

leading to induced dipoles ✓
caused by uneven distribution of electrons ✓ 3

[6]

11. ice is less dense than water✓

hydrogen bonds hold H_2O molecules apart in ice /
hydrogen bonds cause an open lattice structure✓ 2

[2]

12. High boiling point **or** difficult to break linked to strong bonds in the right context within Li **or** C ✓ 1

Li conducts by delocalised/free/mobile electrons ✓ structure: giant ✓metallic ✓ 3

or '+ ions with a sea of electrons' for giant mark

C conducts by delocalised/free/mobile electrons ✓ structure: giant ✓covalent with layers ✓ 4

N No mobile charge carriers/electrons/ions to conduct electricity ✓

simple molecular structure/made of N_2 molecules✓

low boiling point **or** easily broken due to intermolecular forces/ van der Waals' forces ✓ 3

QWC: At least 2 complete sentences in which the meaning is clear. ✓ 1

[12]

13. (i) S **(1)** 1

(ii) A*l* **(1)** 1

(iii) B **(1)** 1

(iv) Ca **(1)** 1

(v) K **(1)** 1

(vi) K **(1)** 1

[6]