F321: Atoms, Bonds and Groups
Structure & Bonding – Mark Scheme

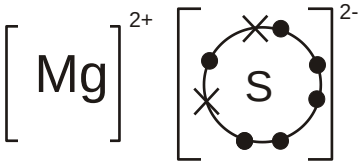
1. (i) (Electrostatic) **attraction** between oppositely charged **ions**. ✓

IGNORE *force*
IGNORE *references to transfer of electrons*
MUST *be ions, not particles*

1

(ii) Mg shown with either 8 of 0 electrons
AND
S shown with 8 electrons **with** 2 crosses and 6 dots (or vice versa) ✓

Correct charges on both ions ✓



Mark charges on ions and electrons independently
For first mark*, if 8 electrons are shown around the Mg then 'extra electrons' around S must match the symbol chosen for electrons around Mg*

Shell circles not required

IGNORE *inner shell electrons*

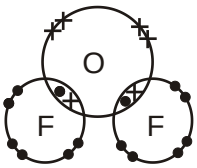
Brackets are not required

2

[3]

2. (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

www.accesstuition.com

(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]

3. (i) (At least) two **NH_3** molecules with correct dipole shown with at least one H with δ^+ and one N with δ^- ✓

DO NOT ALLOW *first mark for ammonia molecules with incorrect lone pairs*

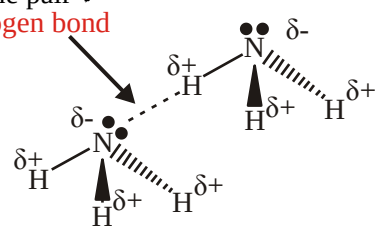
DO NOT ALLOW *first mark if H_2O, NH_2 or NH is shown*

(Only) one hydrogen bond from N atom on one molecule to a H atom on another molecule ✓

ALLOW *hydrogen bond need not be labelled as long as it clear the bond type is different from the covalent N–H bond*

ALLOW *a line (i.e. looks like a covalent bond) as long as it is labelled 'hydrogen bond)*

Lone pair shown on the N atom and hydrogen bond must hit the lone pair ✓



ALLOW *2-D diagrams*

ALLOW *two marks if water molecules are used. One awarded for a correct hydrogen bond and one for the involvement of lone pair*

3

www.accesstuition.com

(ii) Liquid H_2O is denser than solid ✓
In solid state H_2O molecules are held apart by hydrogen bonds
OR ice has an open lattice ✓

ORA

***ALLOW** ice floats for first mark*

OR
H_2O has a relatively high boiling point **OR** melting point ✓

***ALLOW** higher melting **OR** boiling point than expected*
***DO NOT ALLOW** H_2O has a high melting / boiling point*

(relatively strong) hydrogen bonds need to be broken
OR a lot of energy is needed to overcome hydrogen bonds
OR hydrogen bonds are strong ✓

***ALLOW** other properties caused by hydrogen bonding not mentioned within the specification*
E.g. high surface tension – strong hydrogen bonds on the surface

2

[5]

4. Mg has a **giant** structure ✓

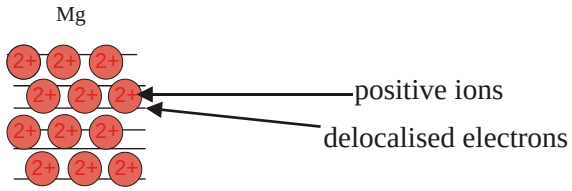
Metallic OR delocalised** seen spelt correctly at least **ONCE

Mg has **metallic** bonding OR description of metallic bonding as positive ions and **delocalised** electrons ✓

(There is electrostatic attraction between) positive ions and electrons ✓

***DO NOT ALLOW** as label nuclei **OR** protons for positive ions*

***ALLOW labelled** diagram of metallic bonding for second and third marks*



Lattice must have at least two rows of positive ions. If a Mg ion is shown it must correct charge

***ALLOW** for labels: + ions, positive ions, cations*

***DO NOT ALLOW** as label nuclei **OR** protons for positive ions*

***ALLOW** e^- or e as label for electron*

***DO NOT ALLOW** '–' without label for electron*

Cl has a simple molecular **OR** simple covalent (lattice) ✓

Covalent OR molecule OR molecular** seen spelt correctly at least **ONCE

ALLOW** Cl is a (covalent) **molecule

www.accesstuition.com

Cl has van der Waals' forces (between molecules)
OR
Cl has instantaneous dipole–induced dipoles
OR
temporary dipole–temporary dipole ✓

IGNORE *Cl has intermolecular bonding*

van der Waals' forces are weak **and** metallic bonds are strong
OR
van der Waals' forces are weak**er** than metallic bonds
OR
Less energy is needed to overcome van der Waals' than metallic bonds ✓

ALLOW *ECF from incorrect descriptions of giant structure with strong bonds; e.g. Mg has giant ionic structure*
ALLOW *ECF from any incorrect intermolecular forces e.g. permanent dipole–dipole from marking point 5*

ALLOW *vdW easi**er** to break*
ORA

[6]

5. giant covalent (lattice) ✓

layers ✓

Each of the three properties below must be linked to explanation
good conductor – because it has mobile electrons **OR** delocalised electrons **OR** electrons can move ✓

high melting / boiling point – because strong **OR** covalent bonds have to be broken ✓

soft – because there are van der Waals' forces **OR** intermolecular forces **OR** weak bonds **OR** weak forces between the layers

OR
soft – because layers can slide ✓

Use annotations with ticks, crosses etc. for this part.

All five marking points are independent

ALLOW *giant atomic **OR** giant molecular **OR** macromolecular*

ALLOW *planes **OR** sheets*
Allow diagram showing at least two layers

Electron(s) must be spelt correctly ONCE

DO NOT ALLOW *'strong ionic bonds' **OR** strong metallic bonds.*

[5]

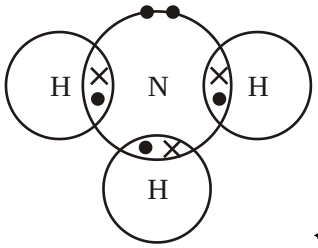
www.accesstuition.com

6. (i) a shared pair of electrons ✓

ALLOW *any response that communicates electron pair*
ALLOW *shared pairs*

1

(ii)



✓

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

1

(iii) Shape: pyramidal **OR** (trigonal) pyramid ✓

Explanation:
There are 3 bonded pairs and 1 lone pair ✓
Lone pairs repel more than bonded 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*

3

[5]

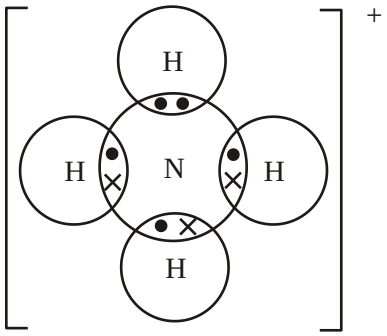
7. (i) $1s^2 2s^2 2p^6 3s^2 3p^6$ ✓

ALLOW *subscripts*

1

www.accesstuition.com

(ii)



'Dot-and-cross' diagram to show four shared pairs of electrons one of which is a dative covalent bond (which must consist of the same symbols) ✓

***IGNORE** inner shells*
***IGNORE** '+' sign **BUT DO NOT ALLOW** a '−' sign.*
Brackets and circles not required

1

(iii) tetrahedral ✓

109.5° ✓

***ALLOW** 109 – 110°*

2

(iv) ions **OR** electrons cannot move in a solid ✓

ions can move **OR** are mobile in solution ✓

***ALLOW** ions can move in liquid*
***DO NOT ALLOW** ions can move when molten*

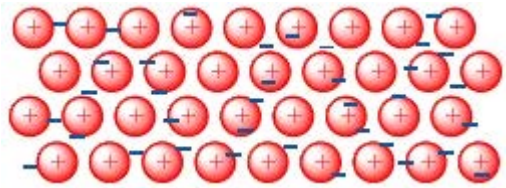
ALLOW 1 mark for:
'Ions can only move in solution'

2

[6]

www.accesstuition.com

8.



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]

9. (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*

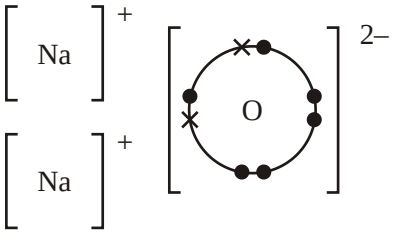
1

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

1

www.accesstuition.com

(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]

10. sodium is a (good) conductor because it has mobile electrons **OR** delocalised electrons
OR electrons can move ✓

sodium oxide does not conduct as a solid ✓

sodium oxide conducts when it is a liquid ✓

ions cannot move in a solid ✓

ions can move **OR** are mobile when liquid ✓

Throughout this question, 'conducts' and 'carries charge' are treated as equivalent terms.

***DO NOT ALLOW** 'free electrons' for mobile electrons*

***ALLOW** poor conductor **OR** bad conductor*
'Sodium oxide only conducts when liquid' is insufficient to award 'solid conductivity' mark

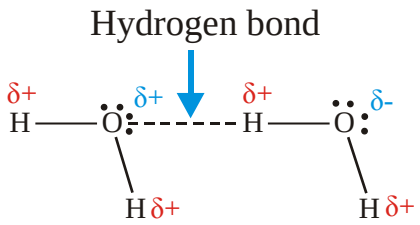
***ALLOW** ions are fixed in place*
***IGNORE** electrons*
***IGNORE** charge carriers*

***IGNORE** 'delocalised ions' or 'free ions' for mobile ions*
*Any mention of electrons moving is a **CON***

[5]

11. (i)

www.accesstuition.com



Shape of water with at least one H with δ+ and at least one O with δ– ✓

H-bond between H in one water molecule and a lone pair of an O in another water molecule ✓

hydrogen bond labelled
OR H_2O has hydrogen bonding ✓

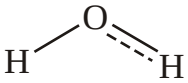
all marks can be awarded from a labelled diagram

*If HO_2 shown then **DO NOT ALLOW** 1st mark*

*Dipole could be described in words so it does **not** need to be part of diagram.*

*At least one hydrogen bond **must** clearly hit a lone pair*
*Lone pair interaction could be described in words so it does **not** need to be part of diagram.*

***DO NOT ALLOW** hydrogen bonding if described in context of intramolecular bonding, ie*



3

(ii) no hydrogen bonding
OR
weaker intermolecular forces ✓

***DO NOT ALLOW** 'weaker'/ 'weak' hydrogen bonding*

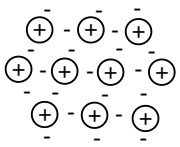
***ALLOW** weaker van der Waals' forces*
***ALLOW** weaker dipole-dipole interactions*
***DO NOT ALLOW** 'weak intermolecular forces'*
(ie comparison essential here)
***DO NOT ALLOW** 'no intermolecular forces'*

1

[4]

www.accesstuition.com

12. (i)



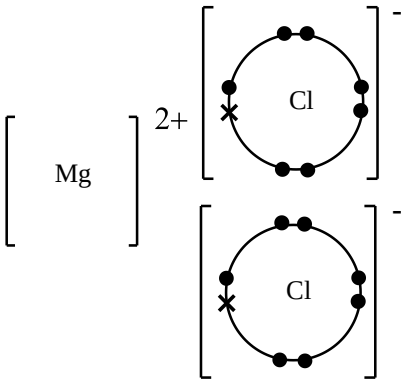
positive ions **(1)** electrons **(1)** (must be labelled) 2

(ii) the electrons move **(1)** 1

[3]

13. (i) attraction between oppositely charged ions 1

(ii)



Mg and C*l* both with 8 electrons in outer shell, (accept 0 electrons for Mg)
C*l* must have one dot to seven crosses or vice versa **(1)**
correct charges on each ion **(1)** 2

(iii) $MgCl_2$ does not conduct when solid because ions are fixed in lattice **(1)**
H_2O does not conduct as there are no free charge carriers/water molecules are uncharged **(1)**
$MgCl_2$ conducts when aqueous because ions are free to move **(1)** 3

[6]

14. To boil Cl_2, van der Waals' forces/intermolecular forces are broken (with van der Waals/intermolecular spelt correctly) **(1)**
To boil C, covalent bonds are broken **(1)**
covalent bonds are stronger than van der Waals' forces **(1)**

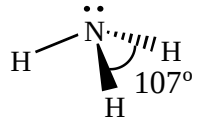
[3]

15. (i)

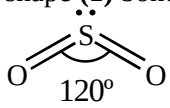
H_2O	NH_3	
2	3	**(1)**
2	1	**(1)**

2

www.accesstuition.com

(ii) 

shape **(1)** bond angle labelled on diagram as 107° **(1)**



shape **(1)** bond angle labelled on diagram as 110–120° **(1)** 4

[6]

16. H bonding from lone pair on O of 1 H_2O molecule to H of another **(1)**
dipoles shown **(1)**

Two properties:
Ice is lighter than water/ max density at 4°C **(1)**
explanation: H bonds hold H_2O molecules apart
/ open lattice in ice
/ H-bonds are longer **(1)**

Higher melting/boiling point than expected **(1)**
explanation: strength of H bonds that need to be broken **(1)**
must imply that intermolecular bonds are broken

High surface tension/viscosity **(1)**
explanation: strength of H bonds across surface **(1)**

[6]

17. (i) $1s^2 2s^2 2p^6 3s^2 3p^6$ ✓ 1

(ii) 3 ✓ 1

(iii) 10 ✓ 1

(iv) 'dot-and-cross' of Ca^{2+} with either 8 electrons or no electrons. ✓
'dot-and-cross' of $2OH^-$ correct ✓ 2
N.B. H electron and Ca electrons can look the same.

[5]

Lattice must have at least two rows of positive ions. If a Mg ion is shown it must correct charge
ALLOW *for labels: + ions, positive ions, cations*
DO NOT ALLOW *as label nuclei* ***OR*** *protons for positive ions*
ALLOW e^- *or e as label for electron*
DO NOT ALLOW *'–' without label for electron*

Cl has a simple molecular **OR** simple covalent (lattice) ✓✓✓**18.** (i)
attraction between oppositely charges ions ✓ 1

www.accesstuition.com

(ii) shared pair of electrons ✓✓ 2

'shared electrons' scores 1 mark only

[3]

19. (i) attraction of an **atom/element** for electrons ✓
in a (covalent) bond/bonded pair ✓ 2

(ii) one element attracts bonded pair more
/is more electronegative than other ✓

→ δ– on more electronegative atom and δ+ on less 2

electronegative element in example ✓

May need to look for these marks below if not given here.

[4]

20. H–bond shown between H of one molecule and O, N or F of another ✓
H-bond shown going to a lone pair ✓

[2]

21. (a) 3

element	structure	bonding	
Mg	giant	metallic	✓
Si	giant	covalent	✓
S	simple	covalent	✓

1 mark for each correct row

(b) Si has strong forces between atoms/
covalent bonds are broken ✓
P has weak forces between molecules/
intermolecular forces/van der Waals' forces are broken ✓ 2

www.accesstuition.com

(c) From Na → Al, no of **delocalised** electrons increases ✓
charge on positive ion increases/
ionic size decreases/
charge density increases ✓
attraction between + ions and electrons increases/
metallic bonding gets stronger ✓ 2

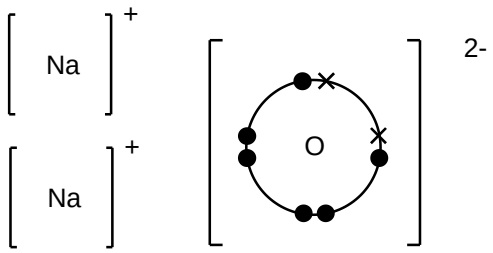
[7]

22. (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]

23.



Also accept Na with full shell as long as it contains 'x's
(as in example above)

Ignore any inner shells

correct dot and cross ✓
correct charges ✓

[2]

24. (i) $2Na + O_2 \rightarrow Na_2O_2$ ✓ 1

(ii) $Na_2O_2 + 2H_2O \rightarrow H_2O_2 + 2NaOH$ ✓ 1

correct covalent bonds shown ✓
(iii) electron count (14) for rest of molecule correct ✓ 2

[4]

www.accesstuition.com

25. (i) (trigonal) pyramidal✓ 1

(ii) electron pairs repel/bonds repel
/electron pairs get as far apart as possible ✓

lone pairs repel more/forces 'them' closer ✓

4 electron pairs surround central atom or N
/diagram with 3 bonds and a lone pair ✓ 3

[4]

26. Original solution contains ions/there are mobile ions ✓
Charge carriers removed as reaction takes place
/as solid forms/ as $BaSO_4$ forms/as water forms ✓ 2

[2]

27. **general**
NaC*l*: ionic/has ionic bonds ✓
Beware of contradictions for this mark, especially reference to intermolecular forces.
Ignore 'atoms'. 2

graphite: covalent/giant molecular/macromolecular ✓
Ignore van der Waals', intermolecular, molecules

---

www.accesstuition.com

conductivity

NaC*l*: ions cannot move/
no free ions (or electrons) /
mobile ions only in solution or when molten ✓

graphite: 2

delocalised electrons/
free electrons (between layers)/
electrons conduct ✓

Ignore lone pair

melting point

both graphite and NaC*l*:
bonds are strong/
bonds difficult to break / 1
large amount of energy is needed to break bonds

✓

solubility

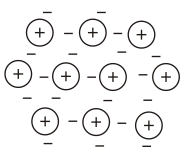
NaC*l*: Water is polar/water has a dipole/
ions interacts with water molecules ✓

Graphite: no interaction with water/
no intermolecular forces with water/ 2
graphite is non-polar ✓

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

[8]

28. (i)



positive ions ✓ electrons ✓ (must be labelled)
If Mg^{2+} shown then must be correct: Mg^{+} not worthy 2

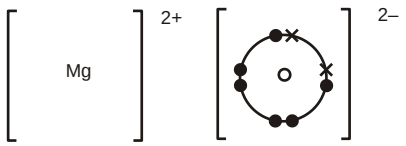
(ii) electrons move ✓ 1

[3]

www.accesstuition.com

29. (i) Oxidation state goes from 0 in O_2 ✓
→ –2 in MgO ✓ 2

(ii)



or with Mg full shell.
correct dot and cross✓; correct charges✓ 2

[4]

30. (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]

31. (i) oxygen/ nitrogen is more electronegative/
molecule has atoms with different electronegativities
/oxygen/more electronegative atom … attracts bonded
electron pair more ✓ 1

(ii) H bonding from N of 1 NH_3 molecule to H of another NH_3
molecule with a $H^{\delta+}$ shown and a $N^{\delta-}$ shown✓
with lone pair involved in bond✓
2nd mark is available from water molecule(s) 2

[3]

32. ice is less dense than water✓

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

[2]

www.accesstuition.com

33. (i) 107° ✓ (accept any angle in the range 108° ✓→ 91°) 1

(ii) electron pairs repel electron pairs/bonds go as far apart as possible✓

lone pairs repel more ✓ 2

[3]

34. attraction between oppositely charged ions/

oppositely charged atoms ✓ 1

For CaO: correct dot and cross ✓; correct charges ✓

For CO_2: correct dot and cross ✓ 3

$1s^2 2s^2 2p^6 3s^2 3p^6$ ✓ 1

[5]

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

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

[2]

36. 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 3
intermolecular forces/
van der Waals' forces ✓

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

[12]

37. CO_2: correct covalent bonds around carbon ✓

www.accesstuition.com

outer shell electrons correct ✓
(must be 'dot AND cross' or electron source clearly shown
(different coloured for source?)

[2]

38. correct dot and crosses ✓
correct charges ✓

[2]

39. uneven distribution of electrons ✓
instantaneous /oscillating/changing/temporary/transient/
dipole on one atom ✓
causes an induced/resultant dipole on another
molecule/atom ✓

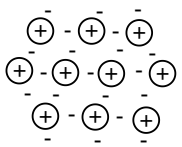
chlorine gas; bromine liquid; iodine solid/
volatility decreases from $Cl_2 \rightarrow Br_2 \rightarrow I_2$/
boiling point increases from $Cl_2 \rightarrow Br_2 \rightarrow I_2$/
stronger forces are broken from $Cl_2 \rightarrow Br_2 \rightarrow I_2$ ✓

number of electrons increases down group ✓

greater/more van der Waals' forces / induced dipole-
dipole interactions / forces between the molecules ✓

[6]

40. (i)



positive ions ✓ electrons ✓ (must be labelled) 2

(ii) electrons move ✓ 1

[3]

41. simple molecular ✓ 2

[2]

www.accesstuition.com

42. (i) $Cl_2 + 2I^- \rightarrow I_2 + 2Cl^-$ ✓✓ 2
1 mark for species.
1 mark for balancing

(ii) C*l* atom is smaller/has less shells ✓
electron to be captured will be attracted more ✓ 2

[4]

°Ø**43.** (i) H bonding from O of 1 H_2O molecule to H of another ✓
dipoles shown ✓ with lone pair involved in bond ✓ 3

(ii) Two properties from:
Ice is lighter than water/ max density at 4°C ✓
explanation: H bonds hold H_2O molecules apart
/ open lattice in ice
/ H-bonds are longer ✓

Higher melting/boiling point than expected ✓
explanation:
strength of H bonds that need to be broken ✓
must imply that intermolecular bonds are broken

High surface tension/viscosity ✓
explanation strength of H bonds across surface ✓ 4

[7]

44. NH_3: 107° ✓ (range 106 – 108°)
electron pairs repel other electron pairs ✓
lone pair has more repulsion ✓
electron pairs get as far apart as possible ✓

[4]

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

[2]

www.accesstuition.com

46. 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]

47. (i) molecule shown as non-linear ✓

angle: 104 - 105°✓

molecule shown as linear ✓ 4

(ii) angle: 180° ✓

shape of H_2O
shape of CO_2

Electron pairs repel/groups (or regions) of electrons 2
repel/electron pairs get as far apart as possible ✓

Oxygen in water surrounded by 4 areas of electron density/2 bonds and 2 lone pairs
AND
Carbon in CO_2 surrounded by 2 regions of electron density/2 double bonds ✓

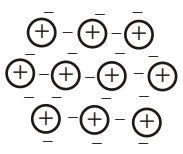
[6]

`(**48.** (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]

49. (i)



positive ions/cations ✓ and negative electrons ✓
Can be described in words only for both marks 2

(ii) contain free/mobile/delocalised electrons ✓ 1

[3]

50. (i) shared **pair of** ✓electrons ✓ 2

www.accesstuition.com

i.e. 'shared electrons' is worth 1 mark. Pair of electrons for second mark

(ii) correct dot-and cross diagram ✓ 1

[3]

51. (i) electrostatic attraction ✓
between oppositely charged ions ✓ 2
(charged or electrostatic for 1st mark)

(ii) correct dot-and cross diagram ✓
correct charges ✓ 2

(iii) $Mg \rightarrow Mg^{2+} + 2e^{-}$ ✓
$F_2 + 2e^{-} \rightarrow 2F^{-}$ ✓ 2
–sign not required with electron

(iv) solid: ions cannot move /in fixed positions in lattice ✓
solution: ions are free to move ✓ 2

[8]

52. 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]

www.accesstuition.com

53. Two properties from:
Ice is less dense/lighter than water/floats on water/ max density at 4°C ✓

explanation: H bonds hold H_2O molecules apart
/ open lattice in ice
/ H-bonds are longer ✓ 2

Higher melting/boiling point than expected ✓
Not just high
Accept: 'unusually high/strangely high/relatively high'
explanation: H bonds need to be broken ✓ 2
must imply that intermolecular bonds are broken

High surface tension ✓
explanation strength of H bonds across surface ✓
mark 2 properties only → 4 max

QoWC over whole question 1
– legible text with accurate spelling, punctuation and grammar ✓

[5]

www.accesstuition.com