M1. Structure and hardness

M1

Q of L both macromolecular/giant atomic/giant covalent/giant molecular;

1

M2
C atoms in diamond joined to 4 other C atoms / diagram with min 5 C atoms i.e. shows tetrahedral shape / coordination number = 4;

1

M3
C atoms in graphite joined to 3 other C atoms diagram with clear extended hexagonal plane/pattern i.e. shows trigonal planar shape / coordination number = 3;

1

M4
diamond hard / crystal strong;
(not diamond stronger than graphite)

1

M5
because of 3-D structure / rigid structure / not layered;

1

M6
graphite (soft) as layer can slide over each other;

1

M7
Q of L as only (weak) van der Waals' forces between layers;

1

Melting point (for either allotrope)

M8
covalent bonds must be broken / overcome;

1

M9
which are strong / many / hard to break;
(M9 tied to M8)

1

Other difference

M10
diamond is non-conductor of electricity, graphite is conductor
OR appropriate difference in appearance;

1

[9]

M2.A

[1]

M3. (a) (i) positive ions **(1)**
(attract) delocalised electrons **(1)** *(or sea of or free or mobile)* **(1)**

Confusion with - ve ions
or ionic lattice C.E. = 0

(ii) more protons **(1)** (or Mg^{2+} more charge than Na^{+})
attracts <u>delocalised</u> (or bonding) electrons more strongly **(1)**
Delocalised: can be brought forward from (a) (i)

OR more delocalised electrons (1)
Attacks positive ions more (1)
<u>Metallic</u> bonding is stronger scores one mark, only given if no other marks awarded

4

(b) macromolecular **(1)** *(or giant molecule etc)*
covalent **(1)**
<u>strong</u> covalent <u>bonds</u> **(1)**

or bonds require much energy to break

3

(c) delocalised *(OR free or sea of or mobile)* electrons **(1)**

1

(d) Planes **(1)**
weak (bonds) forces between planes **(1)**

2

or v.dw forces between planes

[10]

M4. (a) *Force 1:* Van der Waals' **(1)**

Force 2: dipole - dipole **(1)**

Force 3: hydrogen bonding **(1)**

OR London, Dispersion, temporary dipole

3

(b) (i) covalent between atoms **(1)**

OR within molecule

Van der Waals' between molecules **(1)**

(ii) molecular **(1)**

(iii) Bonds (or forces) between molecules must be broken or loosened **(1)**

OR V.dW forces

OR intermolecular forces

Mention of ions CE=0

4

(c) (i) H-Bonding in HF **(1)**

(dipole-) dipole in HCl **(1)**

OR V.dW

H-bonding is stronger than dipole-dipole or V.dW **(1)**

OR H-bonding is a strongest intermolecular force for 3rd mark

(ii) HI bigger molecule than HCl **(1)**

OR Heavier, more e's, more electron shells, bigger M_r, more polarisable

Therefore the forces between HI molecules are stronger **(1)**

QL mark (Look for unambiguous statements using correct terminology)

5

(d) (i) ionic **(1)**

Strong forces between ions **(1)**
OR lots of energy required to break bonds

(ii) All bonds must be broken **(1)**
mention of molecules etc CE=0

3

(e) macromolecular **(1)**
OR giant molecule / lattice or correct diagram

Strong covalent bonds **(1)**
OR lots of energy required to break bonds

2

[17]

M5. **QoL** Bonding Both covalent
(linked statement)

1

Structure Iodine = molecular /I_2 *(stated or in diagram)*
[treat incorrect diagram as contradiction]

1

Diamond = giant molecular/macromolecular/giant covalent / giant atomic (stated only)
Reference to van der Waals' /dipole-dipole = contradiction

1

QoL Iodine Weak van der Waals' forces / induced dipole-induced dipole

1

Diamond Covalent bonds would need to be broken

1

Many / strong covalent bonds **OR** much energy needed
Tied to M5 *or near miss*
[If ionic/metallic structure suggested then CE for that substance]
[If hydrogen bonding suggested, for I_2 lose M2 & M4; for

diamond lose M3,M5&M6]

1

[6]

M6.C

[1]

M7. (a) Hydrogen bonding *(full name)*

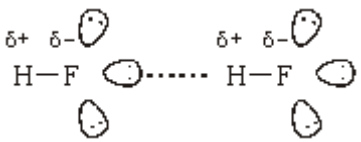
1

Diagram shows at least one $^{\delta+}$H **and** at least one $^{\delta-}$F

(If full charges shown, M2 = 0)

1

3 lone pairs shown on at least one fluorine atom
H-bond indicated, between H and a lone pair on F



(If atoms not identified, zero for diag)

('Fl' for fluorine - mark to Max 2)

*(Max 1 if only one HF molecule shown, **or** HCl shown)*

1

Dipole results from electronegativity difference **or** values quoted

('difference' may be inferred)

(Allow explanation – e.g. F attracts bonding electrons more strongly than H)

1

QoL Fluorine more/very electronegative **or** iodine less electronegative **or** electronegativity difference too small in HI
Comparison required, may be implied.

1

HI dipole weaker or bonding e^- more equally shared - wtte

1

(b) NaCl is ionic (lattice)

(Treat atoms/molecules as a contradiction)

(Accept 'cubic lattice')

1

Diamond is macromolecular/giant covalent/giant atomic/giant molecular

(NOT molecular or tetrahedral)

(Ionic/van der Waals' = CE = 0)

1

(Many) covalent/C-C bonds need to be broken / overcome

(NOT just 'weakened' etc.)

('Covalent' may be inferred from diagram)

(Treat diagram of graphite (without one of diamond) as a contradiction – lose M2 but allow M3/M4])

2

Which takes much energy **or** covalent bonds are strong

(References to van Der Waals' bonds breaking lose M3/M4)

1

[11]