1 **(a) (i)** macromolecular / giant covalent / giant atomic [1]
all atoms held in position / in tetrahedral structure / to four other carbon atoms / <u>all</u> strong bonds [1]

(ii) jewellery / drilling / cutting / engraving / cutting edges in scalpels [1]
mark first use offered

(iii) layer structure / sheets [1]
molecules / ions in layers = [0]
layers can slide (over each other) [1]

(iv) lubricant / pencils / electrodes [1]
mark first use offered

(b) 4e between carbon and oxygens [1]
2 non-bonding pairs on both oxygens [1]
cond correct coding – only scored if marks 1 and 2 awarded [1]
ignore O_2 in atom

(ii) 4O around each Si [1]
2Si around each O [1]
must refer to diagram **not** valencies **or** electron distributions

(iii) SiO_2 has higher mp or bp
SiO_2 is a solid, CO_2 is a gas (at rtp)
(when both are solids) then SiO_2 is harder
has higher density
SiO_2 insoluble, CO_2 soluble [2]
any **two**, comparison needed

2 **(a** to complete the outer shell (of oxygen) / full outer or valence shell / 8 (electrons) in outer shell / Noble gas structure / to complete outer shell / to complete the octet
ignore reference to hydrogen atoms / reference to accepting / sharing or gaining electrons [1]

(b) loses (one) electron [1]
not loses electron**s**

(c) opposite charges <u>attract</u> / electrostatic <u>attraction</u> / positive <u>attracts</u> negative / + and – <u>attract</u> [1]

(d) in solid ions cannot move / flow / no free ions / ions in a lattice [1]
in solution ions can move / flow / mobile ions / ions free (to move) [1]

[Total: 5]

3 **(a)** **(i)** D [1]

(ii) E [1]

(iii) B or F [1]

(iv) B [1]

(v) A [1]

(b) CF_2 **or** CaI_2 [1]
COND next two marks conditional on correct formula
C^{2+} and F **or** Ca^{2+} and I [1]
7× and 1o round F/I [1]
NOTE covalent = 0
Ignore electrons around Ca
accept arrow notation arrow from electron on calcium atom to iodine

(ii) high melting point **or** boiling point
conducts when molten **or** in solution
soluble in water
brittle
correct chemical properties
hard
Any **TWO** [2]
NOT crystalline solid **NOT** does not conduct as a solid

[Total: 10]

4 **(a** 3Na : 1N correct ratio [1]
correct charges [1]
8e around N [1]

if no symbols then must have correct key
if covalent only mark 1
ignore electrons around sodium
if the response includes both a correct and an incorrect answer
do not select correct one, mark = [0]

(b) (positive ions **or** cations [1]
NOT atoms **or** cores **or** nuclei
layers **or** lattice **or** regular pattern [1]
delocalised **or** free **or** mobile electrons **or** sea [1]

OR positive ions **or** cations [1]
NOT atoms **or** cores **or** nuclei
attraction between ions and electrons [1]
delocalised **or** free **or** mobile electrons **or** sea [1]
the attraction/electrostatic bonding must be between ions and delocalised electrons, between cations and anions does not score
ACCEPT bond if qualified - electrostatic bond, etc.
if molecular **or** molecules then cannot score cation mark

(ii) delocalised/free/mobile electrons
or electrons can move [1]

layers **or** ions **or** atoms **or** particles [1]
NB more flexible than **2(b)(i)**
can slip **or** move past each other **or** bonding non-directional [1]

(c) tetrahedral [1]
1Si : 4O bonded/surrounded, etc. [1]
1O : 2 Si [1]

NOT molecules of oxygen, etc.
NOT intermolecular forces
ONLY tetrahedral can score for either of the above

Despite what the question states, **ACCEPT** a clear accurate diagram which shows the above three points.

(ii) hard
high mp **or** bp
colourless (**NOT** clear) **or** shiny **or** translucent
non/poor conductor (of electricity)
brittle
insoluble
any **TWO** [2]
NOT crystalline **or** strong

[Total: 14]

5 good [1]
named example e.g. sodium chloride [1]
ACCEPT correct formula

silica **or** silicon(IV) oxide **or** sand **or** silicon oxide
named polymer only **TWO** elements [1]

electrons [1] and positive ions [1] [2]
good [1]

[Total: 6]

6 **(a** Correct ratio $MgBr_2$ **or** Mg 2Br [1]
Accept anywhere in space
IF formula suggests covalency then [1] only for $MgBr_2$
or Mg 2Br
correct charges Mg^{2+} and Br [1]
Do not be concerned about location of minus sign
8e around bromine [1]
NOTE do not require correct coding – just 7 and 1 coded differently
NOTE ignore electrons around magnesium

(b) (i) pattern **or** order **or** regular **or** repeat **or** alternate [1]
COND positive and negative ions **or** atoms **or** molecules **or** particles [1]
NOTE Accept a sketch that shows the above, that is particles arranged in a regular way, e.g. any ionic compound such as sodium chloride

(ii) Any reason from the list: [1]
charges must balance
or based on valencies
or group II and group VII
or 2e in outer level and 7e in outer level
or magnesium loses 2 electrons and bromine gains 1 electron (per atom)

(iii) reducing **or** reduction **or** reductant [1]
lost electrons **or** given **or** donated electrons **or** transferred (to bromine) [1]
reduced [1]
gained **or** accepted electrons [1]

[Total: 10]

7 More than required number of answers – [0]

(i) **A**, **B**, **D** [1]
(ii) **D** [1]
(iii) **F** [1]
(iv) **C** and **E** [1]
(v) **A** [1]
(vi) **E** [1]

[TOTAL = 6]

Question 1

(a)(i) lattice **[1]**

(ii) high melting point **or** high fixed points
poor conductor as solid
good conductor as liquid, accept either aqueous or molten
hard
soluble in water
Any **TWO** **[2]**

(b)(i) Mg^{2+} **[1]**

(ii) N^{3} **[1]**

(iii) Mg_3N_2 **[1]**

(iv) opposite charges **[1]**
Do NOT accept "attract" it is in the question
accept <u>electrostatic attraction</u> as a phrase

TOTAL = 7