M1.(a) Macromolecular / giant covalent / giant molecule

Not giant atomic

1

(b) No delocalised electrons / no free ions / no free charged particles

1

(c) $SiO_2 + 6HF \longrightarrow H_2SiF_6 + 2H_2O$

Accept multiples

1

[3]

M2.(a) M1 $550 \times \frac{100}{95}$ = 579 g would be 100% mass

Allow alternative methods.

There are 4 process marks:

1

M2 So $\frac{579}{65}$ = 8.91 moles NaN_3

or

M1 $\frac{550}{65}$ = 8.46 moles NaN_3 (this is 95%)

M2 So 100% would be $8.46 \times \frac{100}{95}$ = 8.91 moles NaN_3

1: mass ÷ 65

2: mass or moles × 100 / 95 or × 1.05

3: moles NaN_3 × 2

4: moles $NaNH_2$ × 39

1

Then M3 Moles $NaNH_2$ = 8.91 × 2 = (17.8(2) moles)

1

M4 mass $NaNH_2$ = 17.8(2) × 39

1

M5 693 or 694 or 695 (g)

If 693, 694 or 695 seen to 3 sig figs award 5 marks

1

(b) M1 308 K and 150 000 Pa

1

M2 $n = \frac{PV}{RT}$ or $\frac{150\ 000 \times 7.5 \times 10^{-2}}{8.31 \times 308}$

1

M3 = 4.4(0) or 4.395 moles N_2

Allow only this answer but allow to more than 3 sig figs

1

M4 Moles NaN_3 = 4.395 × $\frac{2}{3}$ (= 2.93)

M4 is for M3 × $\frac{2}{3}$

1

M5 Mass NaN_3 = (2.93) × 65

M5 is for moles M4 × 65

1

M6 = 191 g

Allow 190 to 191 g allow answers to 2 sig figs or more

1

(c) (i) 150 / 65 = 2.31 moles NaN_3 or 2.31 moles nitrous acid

1

Conc = 2.31 × $\frac{1000}{500}$

M2 is for M1 × 1000 / 500

1

4.6(1) or 4.6(2) (mol dm^{-3})

Only this answer

1

(ii) $3HNO_2 \longrightarrow HNO_3 + 2NO + H_2O$

Can allow multiples

1

(d) Ionic

If not ionic then CE = 0 / 3

1

Oppositely charged <u>ions</u> / Na^+ and N_3^- ions

Penalise incorrect ions here but can allow M3

1

Strong <u>attraction</u> between (oppositely charged) ions / lots of energy needed to overcome (strong) <u>attractions</u> (between ions)

M3 dependent on M2

1

(e) (i) $N \equiv N \longrightarrow N^-$

Only

1

(ii) CO_2 / N_2O / BeF_2 / HN_3

Allow other correct molecules

1

(iii) MgN_6

Only

1

[21]

M3.(a) 2-bromo-2,3-dimethylbutane

Ignore punctuation.

1

$C_nH_{2n+1}Br$ or $C_nH_{2n+1}X$ or $C_xH_{2x+1}Br$

Any order.

1

Stronger / more <u>vdw</u> (forces) <u>between molecules</u> (of 1-bromohexane)

QoL

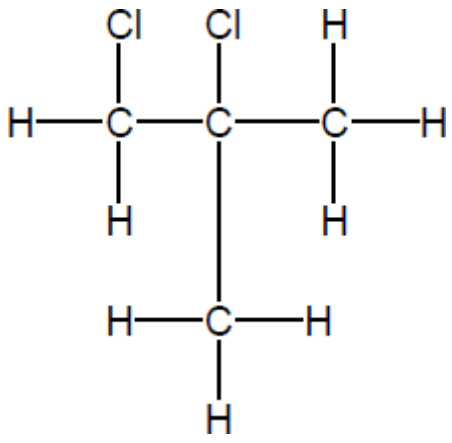
Allow converse arguments for Z

Not just more IMF.

Ignore size of molecule.

1

(b)



1

C_2H_4Cl

Any order

1

[5]

M4.(a) (i) d (block) **OR** D (block)

Ignore transition metals / series.

Do not allow any numbers in the answer.

1

(ii) Contains positive (metal) ions or protons or nuclei and <u>delocalised / mobile / free / sea of</u> electrons

Ignore atoms.

1

<u>Strong attraction</u> between them or <u>strong metallic</u> bonds

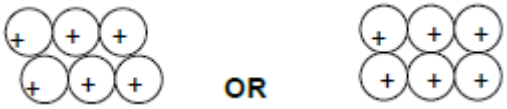
Allow 'needs a lot of energy to break / overcome' instead of 'strong'.

If strong attraction between incorrect particles, then CE = 0 / 2.

If molecules / intermolecular forces / covalent bonding / ionic bonding mentioned then CE=0.

1

(iii)



M1 is for regular arrangement of atoms / ions (min 6 metal particles).

M2 for + sign in each metal atom / ion.

Allow 2^+ sign.

2

(iv) Layers / planes / sheets of atoms or ions can slide over one another *QoL.*

1

(b) (i) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^8\ (4s^0)$

Only.

1

(ii) $NiCl_2.6H_2O$ + **6** $SOCl_2$ $\longrightarrow$ $NiCl_2$ + **6** SO_2 + **12** HCl

Allow multiples.

1

NaOH / NH_3 / $CaCO_3$ / CaO

Allow any name or formula of alkali or base.

Allow water.

1

[9]

M5.(a) Giant covalent / giant molecular / macromolecular

Not giant alone.

Not covalent alone.

1

(b) Shared pair of electrons / one electron from each C atom

1

(c) No delocalised / free / mobile electrons

Allow all (outer) electrons involved in (covalent) bonds.

Ignore ions.

1

(d) CH

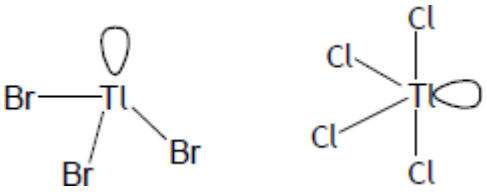
Allow HC

C and H must be capital letters.

1

[4]

M6.(a)



Mark is for correct number of bonds and lone pair in each case.

Ignore charges if shown.

2

Pyramidal / trigonal pyramid

Allow tetrahedral.

1

107°

Allow 107 to 107.5°.

1

(b) M1 Ionic

CE = 0 / 3 if not ionic.

1

M2 Oppositely charged ions / Tl^+ and Br^- ions

If molecules / intermolecular forces / metallic bonding, CE=0.

1

M3 <u>Strong attraction</u> between ions

M3 dependent on M2.

Allow 'needs a lot of energy to break / overcome' instead of 'strong'.

1

(c) $Tl + \frac{1}{2}Br_2 \longrightarrow TlBr$

Allow multiples.

Ignore state symbols even if incorrect.

1

[8]