

**M1.(a)** Macromolecular / giant covalent / giant molecule  
*Not giant atomic*

1

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

1

(c)  $\text{SiO}_2 + 6\text{HF} \longrightarrow \text{H}_2\text{SiF}_6 + 2\text{H}_2\text{O}$   
*Accept multiples*

1

[3]

**M2.(a)** M1  $550 \times \frac{100}{95} = 579 \text{ g}$  would be 100% mass  
*Allow alternative methods.*  
*There are 4 process marks:*

1

M2 So  $\frac{579}{65} = 8.91$  moles  $\text{NaN}_3$

or

M1  $\frac{550}{65} = 8.46$  moles  $\text{NaN}_3$  (this is 95%)

M2 So 100% would be  $8.46 \times \frac{100}{95} = 8.91$  moles  $\text{NaN}_3$

1: *mass*  $\div 65$

2: *mass or moles*  $\times 100 / 95$  or  $\times 1.05$

3: *moles*  $\text{NaN}_3 \times 2$

4: *moles*  $\text{NaNH}_2 \times 39$

1

Then M3 Moles  $\text{NaNH}_2 = 8.91 \times 2 = (17.8(2))$  moles)

1

M4 mass  $\text{NaNH}_2 = 17.8(2) \times 39$  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  $\text{N}_2$   
*Allow only this answer but allow to more than 3 sig figs* 1

M4 Moles  $\text{NaN}_3 = 4.395 \times \frac{2}{3}$  (= 2.93)  
*M4 is for M3  $\times \frac{2}{3}$*  1

M5 Mass  $\text{NaN}_3 = (2.93) \times 65$   
*M5 is for moles M4  $\times 65$*  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  $\text{NaN}_3$  or 2.31 moles nitrous acid 1

Conc = 2.31  $\times \frac{1000}{500}$

*M2 is for M1  $\times 1000 / 500$*  1

4.6(1) or 4.6(2) ( $\text{mol dm}^{-3}$ )  
*Only this answer* 1

(ii)  $3\text{HNO}_2 \longrightarrow \text{HNO}_3 + 2\text{NO} + \text{H}_2\text{O}$   
*Can allow multiples* 1

(d) Ionic

*If not ionic then CE = 0 / 3*

1

Oppositely charged ions /  $\text{Na}^+$  and  $\text{N}_3^-$  ions

*Penalise incorrect ions here but can allow M3*

1

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

*M3 dependent on M2*

1

(e) (i)  $\text{N} \equiv \text{N} \rightarrow \text{N}^-$

*Only*

1

(ii)  $\text{CO}_2$  /  $\text{N}_2\text{O}$  /  $\text{BeF}_2$  /  $\text{HN}_3$

*Allow other correct molecules*

1

(iii)  $\text{MgN}_6$

*Only*

1

[21]

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

*Ignore punctuation.*

1

$\text{C}_n\text{H}_{2n+1}\text{Br}$  or  $\text{C}_n\text{H}_{2n+1}\text{X}$  or  $\text{C}_x\text{H}_{2x+1}\text{Br}$

*Any order.*

1

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

*QoL*

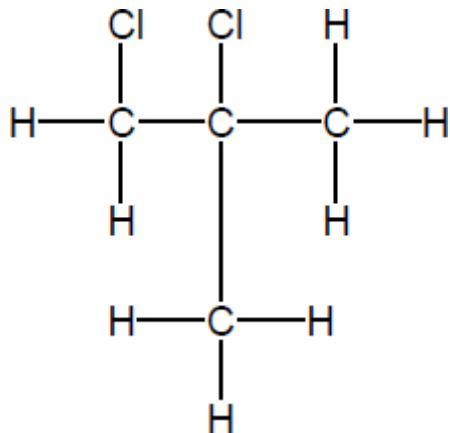
*Allow converse arguments for Z*

*Not just more IMF.*

*Ignore size of molecule.*

1

(b)



1



*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 delocalised / mobile / free / sea of electrons

*Ignore atoms.*

1

Strong attraction between them or strong metallic bonds

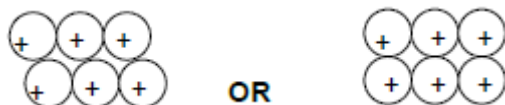
*Allow 'needs a lot of energy to break / overcome' instead of 'strong'.*

*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)  $\text{NiCl}_2 \cdot 6\text{H}_2\text{O} + 6 \text{SOCl}_2 \longrightarrow \text{NiCl}_2 + 6 \text{SO}_2 + 12 \text{HCl}$   
*Allow multiples.*

1

$\text{NaOH} / \text{NH}_3 / \text{CaCO}_3 / \text{CaO}$

*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

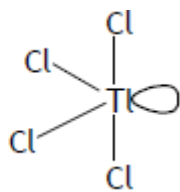
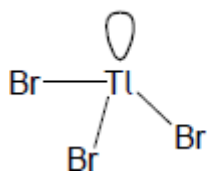
- (d) CH

*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 /  $\text{TI}^+$  and  $\text{Br}^-$  ions

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

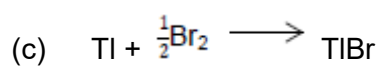
1

M3 Strong attraction between ions

*M3 dependent on M2.*

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

1



*Allow multiples.*

*Ignore state symbols even if incorrect.*

1

**[8]**