

- 1 (a) (i) *element*
cannot be broken into anything simpler [1]
by chemical means [1]
OR made up of one type of atom only [2]
- (ii) *compound*
two **or** more different elements [1]
chemically bonded together [1]
- (iii) *mixture*
two **or** more substances not chemically joined together [1]
- (b) (i) mixture [1]
- (ii) compound [1]
- (iii) element [1]
- (c) conductivity (of heat or electricity) [1]
- [Total: 9]

- 2 (a) (i) positive **and** negative ions [1]
regular pattern / opposite charges closer than the same charge [1]
- (ii) so that charges cancel / ions may not have the same charge [1]
- (iii) Any **three** of:
high melting point or boiling point
hard
brittle
soluble in water / insoluble in organic solvents
conduct (electricity) in liquid state **or** in aqueous solution / non-conductors or
poor conductor (when solid) [3]
- (b) correct formula [1]
correct charges [1]
6x and 2o around oxygen [1]

[Total: 9]

- 3 (a) weak forces between layers or between (hexagonal) rings / weak bonds between layers or between (hexagonal) rings / Van der Waals forces between layers or between (hexagonal) rings; [1]
(layers/rings) slip/slide (over each other) / move over each other [1]
- (b) strong bonds (between atoms) / covalent bonds (between atoms); [1]
all bonds are covalent/strong / each atom covalently bonded / carbon (atoms) is bonded to four others / bonds are directional / (atoms are arranged) tetrahedrally; [1]
accept: carbon has four bonds
- (c) graphite has delocalised / mobile / free electrons; [1]
diamond (outer shell) electrons used / fixed / localised in bonding / no delocalised electrons / no mobile electrons / no free electrons; [1]

- 4 (a) (i) melting point is below 25°C; [1]
boiling point above 25°C; [1]
accept: argument based on actual values
note: 25°C is between mp and bp = [2]
- (ii) strontium loses 2e; [1]
sulfur gains 2e; [1]
- (iii) hydrogen chloride / hydrochloric acid; [1]
accept: sulfurous acid or sulfur dioxide
- (iv) molten strontium chloride has ions / ionic compound; [1]
which can move; [1]
sulfur chloride has no ions / only molecules / molecular / covalent;
- (b) strontium carbonate does not dissolve / no effervescence; [1]
note: not just reaction is complete
- (ii) to remove excess / unreacted / undissolved strontium carbonate; [1]
- (iii) water of crystallisation needed / 6H₂O in crystals / would get anhydrous salt /
would not get hydrated salt / crystals dehydrate; [1]
not: just to obtain crystals
- (c) number of moles of HCl used = 0.05 × 2 = 0.1 [1]
number of moles of SrCl₂.6 H₂O which could be formed. = 0.05 [1]
mass of one mole of SrCl₂.6H₂O is 267 g
theoretical yield of SrCl₂.6H₂O = 0.05 × 267 = 13.35 g [1]
percentage yield = 6.4 / 13.35 × 100 = 47.9% [1]
accept: 48%
allow: ecf

[Total: 15]

- 5 (a) (i) Sb;
- (ii) Xe / B;
- (iii) Sr / Te / A / D;
- (iv) Sn and I / E and F;
- (v) Sr / A; [5]

(b) any two from:
physical
niobium is
harder; stronger; higher mp/bp; higher density [2]
note: there has to be a comparison

any two from:
chemical
niobium is less reactive; forms coloured compounds; forms complex ions; its
compounds have catalytic properties; has more than one oxidation state; has more
than one valency electron; [2]
note: the response has to refer to or compare properties of both elements

[Total: 9]

- 6 (a) (i) $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ [2]
not balanced = [1]
- (ii) 3 bps and 1 nbp around As; [1]
1 bp each hydrogen atom; [1]
- (b) (97.4/75 =) 1.3 **and** (2.6/1 =) 2.6; [1]
empirical formula AsH_2 ; [1]
note: correct formula with no working = [1]
- (ii) As_2H_4 ; [1]
- (iii) $\text{H}_2\text{As}-\text{AsH}_2 / \text{AsH}_2-\text{AsH}_2$; [1]
- (c) (amide / peptide; [1]
- (ii) named strong acid / alkali; [1]
allow: HCl / enzymes
- (iii) amino acid; [1]
allow: peptides
- (d) (Cu and As have more than one oxidation state / valency; [1]
- (ii) $3\text{Cu}^{2+} + 2\text{AsO}_4^{3-} \rightarrow \text{Cu}_3(\text{AsO}_4)_2$ [2]
either side correct = [1]

[Total: 14]

7 (a) $C + O_2 \rightarrow CO_2$ [1]

(b) (i) CO_2 already formed (from C burning or from $CaCO_3$); then carbon reacts with carbon dioxide; [1]

or

$C + CO_2 \rightarrow 2CO$ = [2] If equation not balanced = [1]

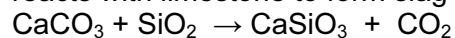
(ii) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ [2]

not balanced = [1]

not: reduction by carbon

(c) to remove / neutralise silica / silicon dioxide / silicon(IV) oxide / sand; [1]

reacts with limestone to form slag / calcium silicate; [1]



or $CaO + SiO_2 \rightarrow CaSiO_3$

or $CaCO_3 \rightarrow CaO + CO_2$

(d) galvanising / galvanisation / sacrificial protection; [1]

(ii) sacrificial protection / zinc is sacrificed;

zinc corrodes rather than iron;

zinc is oxidised in preference to iron;

zinc reacts with oxygen and / water in preference to iron;

zinc more reactive / electropositive than iron;

zinc loses electrons more readily than iron;

electrons move on to iron

any **three**

[3]

[Total: 12]