MEGA LECTURE

TOPIC 6 HW MS

1. (a) Gain of electrons **1**

(b) (i) (+)5 or V or N^{5+} **1**

(+)4 or IV or N^{4+} **1**

(+)2 or II or N^{2+} **1**

(ii) Reduction → **1**

$4H^+ + NO_3^- + 3e^{(-)} \rightarrow NO + 2H_2O$ **1**

(iii) $2H^+ + NO_3^- + e^{(-)} \rightarrow NO_2 + H_2O$ **1**

(iv) $Cu + 4H^+ + 2\ NO_3^- \rightarrow Cu^{2+} + 2H_2O + 2NO_2$

species **1**

balanced
If electrons included **mark CE if these are not balanced** **1**

[9]

2. (a) A reducing agent gives electrons **(1)**
Not electron pairs **1**

(b) Zero **(1)** **1**

(c) (i) -3 or +3 **(1)**

(ii) –3 **(1)**

(iii) –1 **(1)**
Allow answers in roman **3**

(d) (i) $PbO_2 + 4H^+ + 2e^- \rightarrow Pb_{2^+} + 2H_2O$ **(1)**

(ii) $2Cl^- \rightarrow Cl_2 + 2e^-$ **(1)**

(iii) $PbO_2 + 4H^+ + 2Cl^- \rightarrow Pb^{2+} + Cl_2 + 2H_2O$ **(1)**

Or molecular

3

[8]

3. (a) **M1** Used in a barium meal / barium swallow / barium enema

OR (used to absorb) X-rays

*Credit a correct reference to **M1** written in the explanation in **M2** unless contradictory.*

M2 $BaSO_4$ / barium sulfate / it is insoluble

*For **M2** penalise obvious reference to barium or to barium ions being insoluble.*

2

(b) $Mg(OH)_2 + \mathbf{2}HCl \rightarrow MgCl_2 + 2H_2O$

Or multiples.

Ignore state symbols.

1

(c) It / magnesium hydroxide is insoluble / insufficiently soluble / sparingly soluble / less soluble than barium hydroxide / forms low concentration solutions

Weak alkali alone is insufficient.

Formation of a precipitate needs explanation.

1

(d) $TiCl_4 + \mathbf{2}Mg \rightarrow \mathbf{2}MgCl_2 + Ti$

Or multiples.

Ignore state symbols.

1

(e) **M1** Hydrogen / H_2 produced

OR an equation to produce hydrogen / H_2

(eg $Mg + \mathbf{2}H_2O \rightarrow Mg(OH)_2 + H_2$)

(eg $Mg + H_2O \rightarrow MgO + H_2$)

*For **M1***

Do not penalise an incorrect equation; the mark is for H_2 or hydrogen.

*Award one mark only for 'exothermic reaction with steam / H_2O' for a student who has not scored **M1***

M2 requires correct **M1**

risk of explosion

OR forms explosive mixture (with air)

OR (highly) flammable

Ignore 'violent' reaction.

2

[7]

4. (a) (i) Increases

1

(ii) Decreases

1

(iii) Increases

1

(b) Calcium has a higher melting point than strontium, because

CE = 0 for reference to molecules or intermolecular forces or covalent bonds

Correct reference to size of cations/proximity of electrons

M1 (For Ca) delocalised electron(s) closer to cations / positive ions / nucleus

Ignore "Van der Waals forces (between atoms)" but penalise if between "molecules"

OR cations / positive ions / atoms are smaller

OR cation / positive ion / atom or it has fewer (electron) shells / levels

Ignore general Group 2 statements

Answers must be specific

Relative strength of metallic bonding

M2 (For Ca) has stronger attraction between the cations / positive

ions / nucleus
and the delocalised electron(s)

Penalise M1 if Ca or Sr is said to have more or less delocalised electrons

OR

stronger metallic bonding

(assume argument refers to Ca but accept converse argument for Sr)

Ignore reference to shielding

2

(c) (i) Sulfuric acid / it contains sulfate ions / SO_4^{2-}

OR

Do not penalise an additional but incorrect formula for sulfate ion.

Sulfuric acid would form a (white) precipitate

If only the formula of the sulfate ion is given, it must be correct

1

(ii) $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$ ONLY

Ignore state symbols

No multiples

1

[7]

5. (a) (i) Halides:- Fluoride
Chloride **(1)**

Equation:- $H^+ + F^- \rightarrow HF$ *(or molecular / for a correct halide)* **(1)**

(ii) Halides:- Bromide and iodide **(1)**

Equation:- H_2SO_4 *(or* $2H^+ + SO_4^{2-}$*)* $+ 2H^+ + 2e^- \rightarrow SO_2 + 2H_2O$ **(1)**

$2Br^- \rightarrow Br_2 + 2e^-$ **(1)**

$H_2SO_4 + 2Br^-$ (or 2HBr) $\rightarrow Br_2 + SO_2 + 2H_2O$ **(1)**

Q of L penalise wrong symbol for fluoride or bromide once
Ignore state symbols in equations

(iii) Products Sulphur (or S_8 not S_4) **(1)**

Hydrogen sulphide **(1)**

Equation:- H_2SO_4 *(or* $2H^+ + SO_4^{2-}$*)* $+6H^+ + 6e^- \rightarrow S + 4H_2O$ **(1)**

OR

H_2SO_4 *(or* $2H^+ + SO_4^{2-}$*)* $+ 8H^+ + 8e^- \rightarrow H_2S + 4H_2O$

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Ignore halide if given even if incorrect
Do not allow elements, molecules or atoms in part (a)

(b) Addition of silver nitrate

Chloride gives white precipitate / solid **(1)**
Bromide gives cream precipitate / solid **(1)**
Iodide gives yellow precipitate / solid **(1)**

Addition of ammonia

Chloride precipitate soluble in dilute **(1)**
Bromide precipitate soluble in concentrated **(1)**
Iodide precipitate insoluble **(1)**

Do not allow halogen or sodium halide

6

[15]

6. (a) increases from fluorine to iodine **(1)**

sizes of molecules increase **(1)**
(or molecules have more electrons or mass of molecules increases)

QoL mark

Magnitude of intermolecular forces or vdW forces increase **(1)** (or more vdW forces)

More energy required to separate molecules (or particles) **(1)**
(or more energy to break intermolecular forces)
or intermolecular forces difficult to break

4

(b) with NaCl white ppt **(1)**
soluble in ammonia **(1)**

note, if ppt clearly refers to wrong substance
e.g. NaCl then C.E = 0

with NaBr cream (or off white or biege) ppt **(1)**
partially soluble (or insoluble) in ammonia **(1)**

ignore references to conc ammonia

if obviously added silver nitrate mixed with ammonia allow:
*NaCl: no change **(2)***
*NaBr: cream ppt **(2)***

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(c) oxidising ability decreases from chlorine to iodine (or down the Group) **(1)**

$Cl_2 + 2Br^-$ → $2Cl^- + Br_2$ **(1)**

allow use of NaBr, HBr etc

Br_2 red → brown (or yellow or orange) liquid (or solution but not solid) **(1)**

$Cl_2 + 2I^-$ → $2Cl^- + I_2$ **(1)**

allow use of NaBr etc, penalise HI once only

I_2 brown solution / black solid **(1)**

do not allow any reference to purple

$Br_2 + 2I^-$ → $2Br^- + I_2$ **(1)**

Yellow/orange/red-brown/brown solution goes brown/darker brown solution/black solid **(1)**

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[15]

7. (a) decreases

1

number of shells increases/ shielding increases /atomic size increases

weaker attraction (by nucleus) on bonding electrons / weaker attraction (by nucleus)

1

on electron pair in a covalent bond

1

(b) (i) increases

1

(ii) concentrated sulphuric acid

1

(c) white ppt

1

soluble in ammonia

1

cream ppt

1

partially soluble /insoluble in ammonia

1

(d) $Cl_2 + 2NaOH \quad NaCl + NaOCl + H_2O$

1

bleach

1

disinfectant /steriliser/kills bacteria

1

[12]

8. A **[1]**

9. D **[1]**

10. B **[1]**

11. D **[1]**

12. A **[1]**

13. C **[1]**

14. D **[1]**