MEGA LECTURE

TOPIC 6 TEST MS

M1.(a) (i) $3CuS(s) + \mathbf{8}HNO_3(aq) \longrightarrow \mathbf{3}CuSO_4(aq) + \mathbf{8}NO(g) + \mathbf{4}H_2O(l)$

1

(ii) **(+) 5**
(+) 2

2

(iii) $\mathbf{4}H^+ + NO_3^- + \mathbf{3}e^- \longrightarrow \mathbf{2}H_2O + NO$

Ignore state symbols.
*Credit multiples of **this equation only**.*
Ignore absence of charge on the electron.

1

(iv) $S^{2-} + \mathbf{4}H_2O \longrightarrow SO_4^{2-} + \mathbf{8}e^- + \mathbf{8}H^+$

Ignore state symbols.
*Credit multiples of **this equation only**.*
Ignore absence of charge on the electron.

1

→ **[5]**

2. (i) $Cu^- \quad Cu^{2+} + 2e^-$

1

(ii) $NO_3^- + 4H^+ 3e^- \rightarrow NO_2 H_2O$

1

(iii) $3Cu + 2NO_3^- + 8H^+ \rightarrow 3Cu^{2+} + 2NO + 4H_2O$

1

[3]

3. (a) (i) $SrCl_2(aq) + Na_2SO_4(aq) \rightarrow SrSO_4(s) + 2NaCl(aq)$

Allow multiples, including fractions.

Allow ionic equations.

Lose this mark if any of the state symbols are missing or incorrect.

1

(ii) Add nitric acid to the mixture (until in excess)

Do not allow any suggestion that the solution is an emetic.

1

Filter (to isolate strontium sulfate)

1

(b) Insoluble barium sulfate is formed

Allow 'removes barium ions as a precipitate'.

1

(c) Add silver nitrate, then dilute ammonia (solution) **M1**

Do not allow answers which imply silver nitrate and ammonia are added at the same time.

Allow 'add silver nitrate, then concentrated ammonia (solution)'.

*Can score **M1** in the answer for **M3***

1

Cream precipitate **M2**

Allow 'off white precipitate'.

1

No visible change or precipitate dissolves slightly in dilute ammonia **M3**

Allow 'soluble / colourless solution / precipitate dissolves in concentrated ammonia'.

Allow 3 marks for:

*Add dilute ammonia (solution), then silver nitrate **M1***

*No visible change **M2***

*Cream / off white precipitate with silver nitrate **M3***

1

[7]

4. (a) **M1 (could be scored by a correct mathematical expression**

*Correct answer to the calculation gains all of **M1**, **M2** and **M3***

M1 $\Delta H = \Sigma \Delta H_f$ (**products**) $\Sigma \Delta H_f$ (**reactants**)

Credit 1 mark for 101 (kJ mol^{-1})

OR a correct cycle of balanced equations

M2 = 1669 3(590)
= 1669 + 1770
(This also scores M1)

M3 = **+ 101** (kJ mol^{-1})

Award 1 mark ONLY for 101

For other incorrect or incomplete answers, proceed as follows

- *check for an arithmetic error (AE), which is either a transposition error or an incorrect multiplication; this would score 2 marks (**M1** and **M2**)*
- *If no AE, check for a correct method; this requires either a correct cycle with 3Sr and 2Al OR a clear statement of **M1** which could be in words and scores **only M1***

M4 - Using powders
Any **one** from

- To increase collision frequency / collisions in a given time / rate of collisions
- To increase the surface contact / contact between the solids / contact between (exposed) particles

Ignore dividing final answer by 3

*Penalise **M4** for reference to molecules.*

5

M5 Major reason for expense of extraction
Any **one** from

- Aluminium is extracted by electrolysis ***OR*** aluminium extraction uses (large amounts of) electricity
- Reaction / process / It / the mixture requires heat

- It is endothermic

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

Ignore general Group 2 statements.

Correct reference to size of cations / proximity of electrons
M1 (For Ca) delocalised electrons closer to cations / positive ions / atoms / nucleus
OR cations / positive ions / atoms are smaller
OR cation / positive ion / atom or it has fewer (electron) shells / levels

*Penalise **M1** if either of Ca or Sr is said to have more or less delocalised electrons OR the same nuclear charge.*

Ignore reference to shielding.

Relative strength of metallic bonding
M2 (Ca) has stronger attraction between the cations / positive ions / atoms / nucleus and the delocalised electrons
OR
stronger metallic bonding

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

***CE= 0** for reference to molecules or Van der Waals forces or intermolecular forces or covalent bonds.*

2

(c) **M1** $\mathbf{2}Mg + O_2 \rightarrow \mathbf{2}MgO$

M2 $Mg + \mathbf{2}H_2O \rightarrow Mg(OH)_2 + H_2$

Credit multiples of the equations.

M3 Magnesium hydroxide is used as an antacid / relieve indigestion (heartburn) / neutralise (stomach) acidity / laxative

*Not simply "milk of magnesia" in **M3***

3

[10]

5. Mg^{2+} and Cl^-

Do not allow names.

[1]

6. (a) sulfuric acid / H_2SO_4

1

(b) hydriodic acid / HI **OR** hydrobromic acid / HBr

1

(c) add **dilute** ammonia solution

Notes
** do not allow 'concentrated ammonia' or 'ammonia'*

1

precipitate / ppt disappears / dissolves **OR** colourless solution forms

1

(d) would react with the acid / no gas evolved in tests

1

[5]

7. (a) decreases;

1

increase in shielding ;

1

(or atomic radius)
less attraction for bonding *(or shared)* electrons;

1

(b) brown solution;
→

1

(or black solid)
$Cl_2 + 2KI \quad 2KCl + I_2$;

(or ionic equation)

1

(c) SO_2;

1

$SO_4^{2-} + 4H^+ 2e^- \rightarrow SO_2 + 2H_2O$
;

1

S (also H_2S);

1

$SO_4^{2-} + 8H^+ 6e^- \rightarrow S + 4H_2O$ (or $SO_4^{2-} + 10H^+ + 6e^- \rightarrow H_2S + 4H_2O$
→)

1

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

1

sodium chloride;

1

–1;

1

sodium chlorate(I) (or bleach etc);

1

+1;

1

[14]

8. C

[1]

9. A

[1]

10. C **[1]**

11. D **[1]**

12. C **[1]**