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MARANDA HIGH SCHOOL

Kenya Certificate of Secondary Education

MOCK EXAMINATIONS 2022

Handwritten: Maranda Joshi

233/1

Chemistry (Theory)

September, 2022

Paper 1

Time: 2 Hours

Name:

Handwritten: M/S

Adm No:

Class:

Candidate's Signature:

Date: 6th September, 2022

Time: 10:45AM-12.45 PM

Instructions to candidates

- (a) Write your name, admission number, stream in the spaces provided above.
- (b) Answer ALL the questions in the spaces provided and calculations **MUST** be clearly shown
- (c) This paper consists of 15 printed pages, please check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-27	80	80

~~XXXXXXXXXX~~

ELIJAH

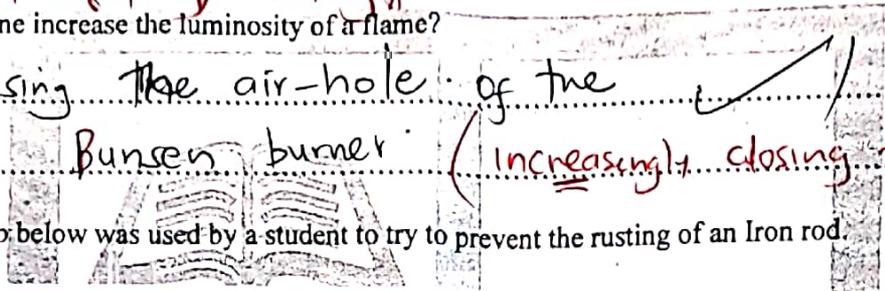
2

1a). State two reasons why most laboratory apparatus are made of glass (2marks)

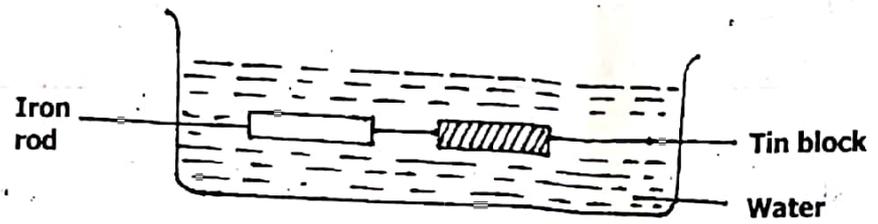
✓ - Glass does not corrode with most chemicals.....
✓ - Glass is transparent, enables visibility of rxns taking place.

b) How can one increase the luminosity of a flame? (1marks)

by increasingly closing the air-hole of the Bunsen burner (increasingly closing the air-hole)



2. The set-up below was used by a student to try to prevent the rusting of an Iron rod.



a) Did the student succeed in preventing the rusting of Iron using the set-up above?

Explain

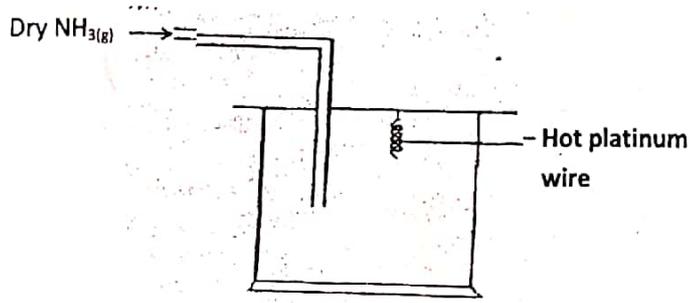
NO ✓

Tin is less reactive than iron, hence it cannot sacrificially protect iron. ✓ // Tin is a weaker reducing agent hence.....

b) Which method of rust prevention was the student investigating?

Sacrificial protection ✓ // Cathodic protection.

3. The apparatus below was set up to show the catalytic oxidation of ammonia. Study the diagram and answer the questions that follow

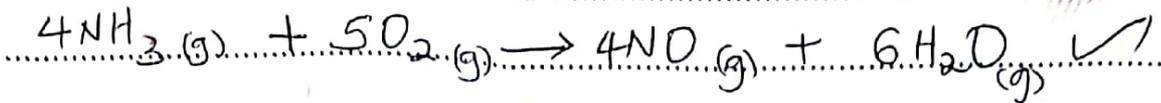


06

~~XXXXXXXXXX~~
KRA

i) Write an equation for the reaction that takes place in the gas jar

(1mark)



ii) What is the role of hot platinum wire?

(1marks)

Speeds up the oxidation of NH_3 ✓
(N.T.T.E) // is a catalyst

iii) Write the formula of the complex ion formed when excess ammonia gas is passed through a solution containing Zn^{2+} ions

(1mark)



4. The atomic number of sulphur is 16. By calculating the of oxidation number of sulphur, state the electron configuration of sulphur in the sulphate ion (SO_4^{2-})

(2marks)

let S be x ✓
 $x + (4 \times -2) = -2$ ✓
 $x - 8 = -2$ ✓
 $x = +6$ ✓
S 6+ means S 10e- ✓
electrons ✓
E.C = 2.8 ✓
2018 ✓

5. Explain the following trends

i) Atomic ^{radii} radius of alkaline earth metals increase down the group

(1mark)

Due to increase in number of occupied energy levels ✓

06

Alago - Cr, R, B, G, Y

Rose - R, W, O, M, V

ii) Melting and boiling points of halogens increase down the group VII

(1 mark)

Due to increase in ^{strength} intermolecular forces of attraction, ^{or Van der Waals' forces of attraction} as the size of the molecules increase ✓

iii) Aluminium metal is a better conductor than sodium metal

(1 mark)

Aluminium has three delocalised electrons while Na has one delocalised electron, // Al has more delocalised electrons than Na ✓

6 a) State Le Chatelier's Principle

(1 mark)

When a change in condition is applied to a system at equilibrium, the system moves/shif so as to oppose the change ✓

b) A dynamic equilibrium between dichromate and chromate ions is established as shown in the equation below.



Orange

Yellow

State and explain the observation made if a few drops of sodium hydroxide are added to the equilibrium mixture. or ~~Orange~~ color (more of yellow is observed) ✓

(2 marks)

Yellow colour of the mixture intensifies ✓

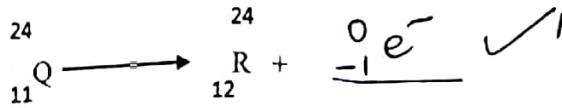
Expl: Equilibr Forward reaction will be favored so as to eliminate or consume the OH⁻ ions added. ✓

PETER

5

7 a) Complete the nuclear equation below.

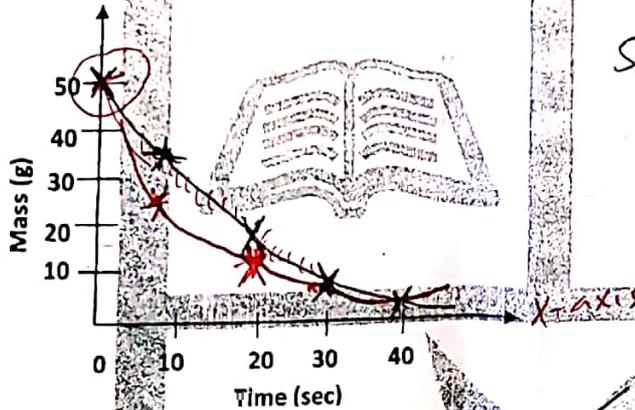
(1mark)



rej beta particle.
β-particle.

b) A radioactive element of mass 50g has a half-life of 10 seconds. Sketch a graph of mass against time to show how the element mass varies with time

(2mark)



shape - smooth curve ✓

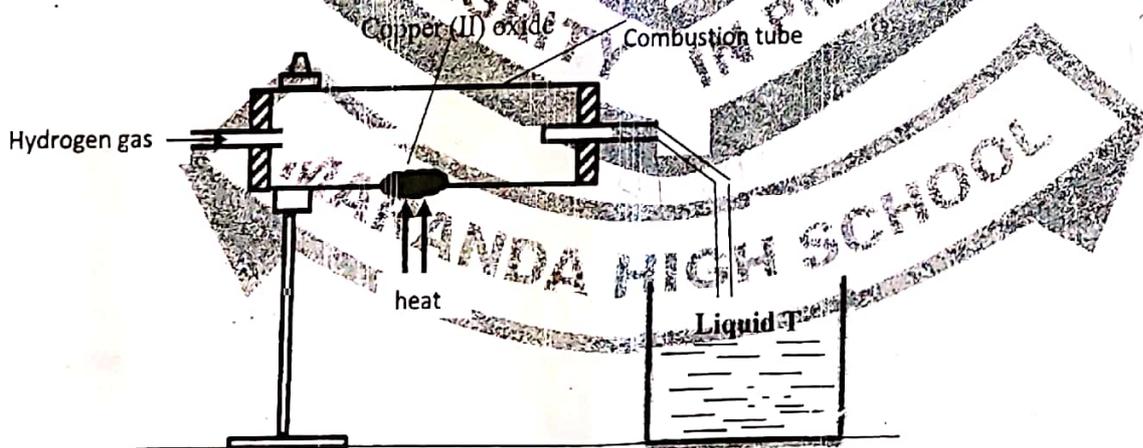
i) starting at 50 (plotting) ✓
ii) curve ✓

c) Give one use of radioactive isotopes in medicine

(1mark)

- 1) sterilization of surgical instruments using gamma rays ✓ (1st pt)
- Radioactive I-131 is used on patients with defective thyroids to follow the path of iodine intake
- Destruction of cancerous tissues, with exposure to correct dose of radiation

8. The set-up below was used to investigate reaction between copper (II) oxide and hydrogen gas



a) Identify liquid T

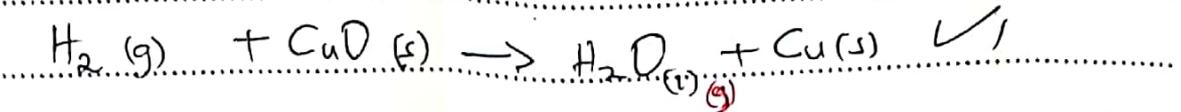
(1mark)

Water ✓
(H₂O)

Jesse

b) Write an equation for the reaction that took place in the combustion tube. (1mark)

Rules apply.



c) State an observation made in the combustion tube. (1mark)

- colorless liquid on the cooler parts of the tube

Black CuO changes to brown copper metal (brown solid)
(Black solid changes to brown solid)

9. The table below shows PH values of some solutions

Solution	A	B	C	D
PH values	13	7	1	6.5

a) Which solution reacts vigorously with Magnesium metal? (1mark)

C ✓

b) Which solution is likely to be that of Lemon juice? (1mark)

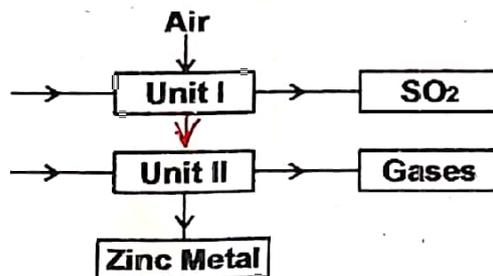
D ✓

c) Select any two solutions that are likely to react with aluminium hydroxide (1mark)

A, C/D ✓

A, C/D

10. The flow chart below shows some processes involved in the industrial extraction of zinc metal.



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DDUNDO

a) Name one ore from which zinc is extracted.

(1 mark)

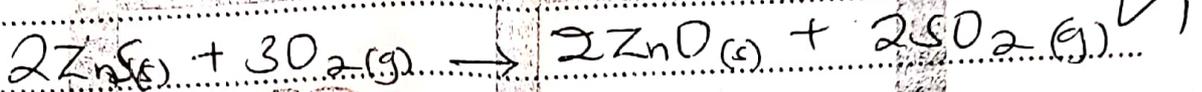
Zinc blende ✓

Common names only

~~Galvanisation~~ Calamine

b) Write the equation for the reaction taking place in unit I.

(1 mark)

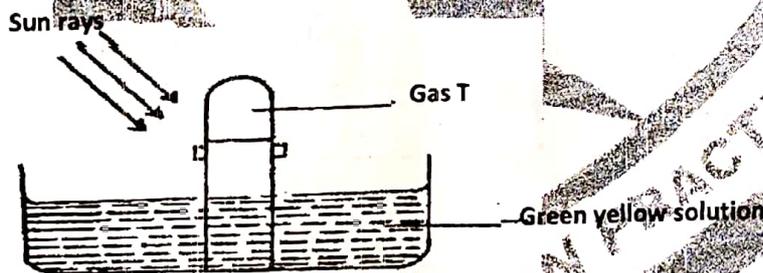


c) State any one use of zinc metal.

(1 mark)

- Galvanisation of iron to prevent it from rusting ✓
- making brass, an alloy of Cu & Zn.
- making the outer casing in dry cells // -ve electrodes ✓

11. Chlorine gas was bubbled through water for some time. The pale yellow solution formed was poured into a long glass tube and placed in the sun as shown in the diagram below.



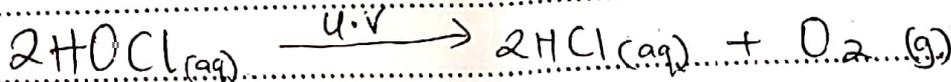
a) Give the chemical composition in the pale yellow solution?

(1 mark)

- i) hydrochloric acid (HCl) ✓
- ii) Chloric (I) acid (HOCl) ✓ // HClO *rej. common name*

b) Write an equation to show how gas T is formed

(1 mark)



05

OBONYO

c) Give one use of chlorine

(1mark)

1st pt

- Large scale manufacture of HCl ✓
- manufacture of bleaching agent like NaOCl, CaOCl₂
- Treatment of drinking water.

12. The solubility of potassium nitrate in water at 70°C is 155g/100g H₂O while at 20°C, the solubility is 31g/100g water. 50g of a saturated solution of potassium nitrate at 70°C was cooled to 20°C, calculate the mass that crystallized out.

At 70°C; 155g of KNO₃ → 155g of KNO₃
 ∴ 50g → ?
 $\frac{50 \times 155}{255} = 30.39g$

at 20°C; 31g of KNO₃ in 100g water → 31g of KNO₃ (3marks)
 ∴ 50g → ?
 $\frac{50 \times 31}{131} = 11.83g$

Mass crystallised = 30.39 - 11.83 ✓
 = 18.56g of KNO₃ ✓

13. Substance L, M, N and P have the following properties

Substance	M.P.	Solubility in water	Electrical conductivity	
			Solid state	Liquid state
L	Low	Soluble	Does not	Does not
M	High	Soluble	Does not	Conducts
N	High	Soluble	Conducts	Conducts
P	High	Insoluble	Does not	Does not

a) Select the letter which represents a substance which is suitable for making kettle handles. (1mark)

P ✓

b) Which letter represents a substance which is likely to be sodium chloride? (1mark)

M ✓

TIM

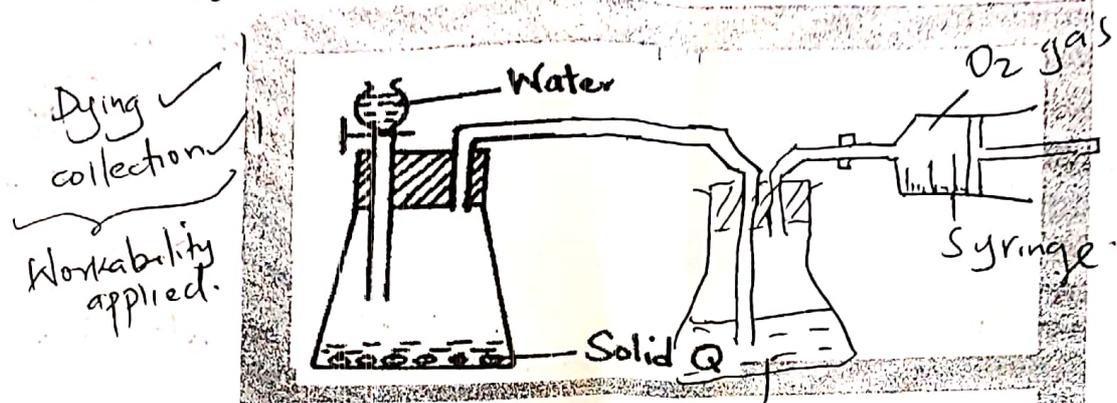
9

c) Name the bond structure and bond type likely to be in L. (1 mark)

i) Bond structure... Simple molecular ✓₂

ii) Bond type... covalent ✓₂

14. The diagram below represents a set-up used to prepare oxygen gas.



a) Name substance Q. (1 mark)

Sodium peroxide ✓
conc. H₂SO₄ or anhy. CaCl₂ in a tube or CaO in u-tube.

b) Complete the set-up given, to show how DRY oxygen gas is collected. (2 marks)

15. Explain why a reaction between sodium carbonate powder with hydrogen chloride solution in water produces effervescence while the same reaction with hydrogen chloride solution in methylbenzene does not produce effervescence. (2 marks)

HCl sln in water ionise/dissociates to yield H⁺ ions for the reaction ✓₂
While HCl sln in methylbenzene does not ionise or dissociate, hence no H⁺ ions available for the reaction ✓₂

27
6

06

JOSHUA

16. A hydrocarbon S contains 3.6g carbon by mass and 0.8g hydrogen. Given that 3dm³ of the compound at s.t.p has a mass of 5.89g. Calculate the molecular formula (Molar gas volume at s.t.p = 22.4dm³)

C=12, H=1		
Elements	Carbon	Hydrogen
mass (g)	3.6	0.8
Moles	$\frac{3.6}{12} = 0.3$	$\frac{0.8}{1} = 0.8$
Simplest mole ratio	$\frac{0.3}{0.3} = 1$	$\frac{0.8}{0.3} \approx 2.7 \approx 3$

$E.F = CH_3$ (3mark)
 Molecular mass = $\frac{22.4 \times 5.89}{22.4} = 5.89$
 $n = \frac{44}{15} = 2.93 \approx 3$
 $M.F = (CH_3)_3 = C_3H_9$
 $M.F = C_3H_9$

17. Name the following processes.

a) When anhydrous calcium chloride is left in an open beaker overnight a solution was formed (1mark)

Deliquescence

b) White sugar changes to black solid when mixed with excess concentrated sulphuric (VI) acid. (1mark)

Dehydration

100 x 607
60.700

c) Sodium deca-hydrate crystals change to anhydrous sodium carbonate (powder) (1mark)

Efflorescence

18. Chlorine has two isotopes with mass number 35 and 37. If the relative atomic mass of chlorine is 35.5 Determine the percentage abundance of each isotope of chlorine. (3marks)

let Cl-35 be x

Cl-37 = 100 - x

$$35.5 = \frac{35x + 37(100-x)}{100}$$

$$3550 = 35x + 3700 - 37x$$

$$3550 - 3700 = 35x - 37x$$

$$-150 = -2x$$

$$x = 75\%$$

Cl-35 = 75% ✓

Cl-37 = 25% ✓

09.

19 a) Explain why water containing some traces of common salt is considered to be hard water (1mark)

Common salt contains traces of $MgCl_2$ which supplies Mg^{2+} ions responsible for water hardness

b) i) State one method used to remove permanent hardness (1mark)

1st Ion exchange ✓

- Distillation

- Addition of Na_2CO_3

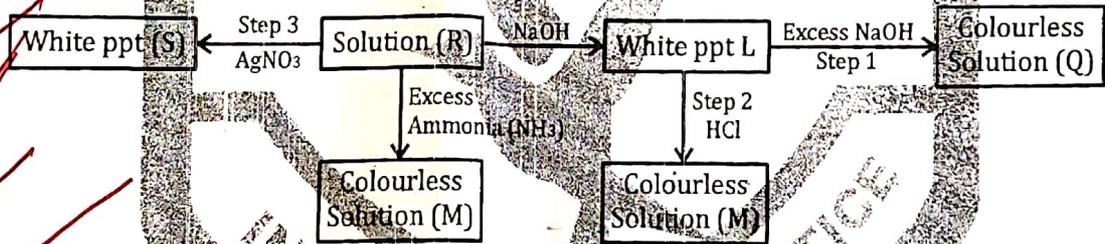
Refer accordingly

Soda-ash

ii) Give one advantage of using hard water for domestic purpose. (1mark)

Has Ca^{2+} responsible for formation of strong teeth and bones
 - Has less Nations, reducing the risk of high blood pres
 - Has a better taste than water that's not hard.
 - Scale formation minimises pollution in water.

20. Study the flow chart below and use it to answer the questions that follow.

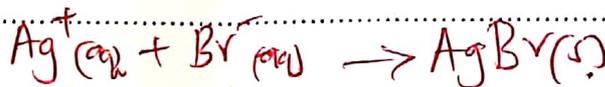
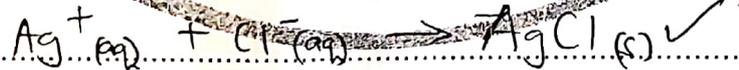


a) Identify the cation and anion in solution (R) (1mark)

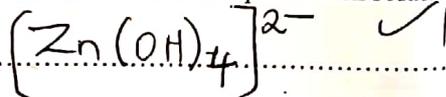
Cation: Zn^{2+} / zinc ions ✓

Anion: Cl^- / chloride ions ✓, Br^- (bromide ions)

b) Write an ionic equation for the formation of compound S (1mark)



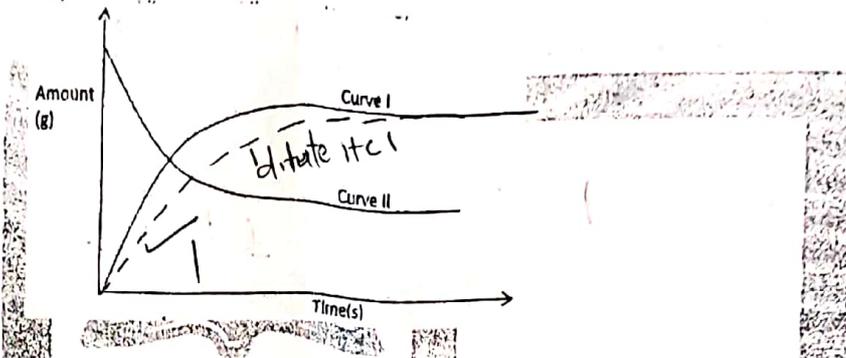
c) Write the formula for complex ion in solution Q. (1mark)



JERRY

12

21. The graph below shows the amount of calcium carbonate and calcium chloride varying with time in the reaction.



a) Which curve shows the amount of calcium chloride formed varying with time? (1mark)

Curve I ✓

b) Explain why the two curves become horizontal after a given period of time. (1mark)

The reaction comes to an end/completion, when either one or both the reactants have been consumed

c) Sketch on the graph, how curve I would appear if the experiment was repeated using a more dilute hydrochloric acid solution. (ON THE CURVE) (1mark)

22 a) State Graham's law of diffusion. (1mark)

Under the same conditions of temperature and pressure, the rate of diffusion of a gas is inversely proportional to the square root of its density

OMENDA

13

b) 60cm³ of oxygen diffused through a porous plate in 20 seconds. How long will it take 120cm³ of carbon (iv) oxide gas to diffuse through the same plate under the same conditions? (C=12, O=16)

$$\frac{R_{O_2}}{R_{CO_2}} = \sqrt{\frac{M_{CO_2}}{M_{O_2}}}$$

$$\frac{60}{20} = \sqrt{\frac{44}{32}}$$

$$\frac{3X}{120} = \sqrt{\frac{44}{32}}$$

$$X = 49.6 \text{ seconds}$$

ALT

Use the approach for equal volumes of O₂ and CO₂ such that

$$\frac{T_{O_2}}{T_{CO_2}} = \sqrt{\frac{M_{O_2}}{M_{CO_2}}}$$

Ans = same / approximate

(2marks)

23. Methane undergoes combustion in oxygen as shown by the equation below.



a) Calculate the heat change for the reaction using bond energies in the table.

(3marks)

Bond	Bond energy (KJ/mol)
C-H	413
O=O	497
C=O	740
O-H	463

$\Delta H = H_{\text{reactants}} - H_{\text{products}}$

$$\begin{aligned}
 & \left[(4 \times 413) + (2 \times 497) \right] - \left[(2 \times 740) + (4 \times 463) \right] \\
 & (1652 + 994) - (1480 + 1852) \\
 & = -686 \text{ kJ/mol}
 \end{aligned}$$

KE
GOA

24. Describe how a DRY, PURE sample of Lead (II) chloride can be prepared using the following

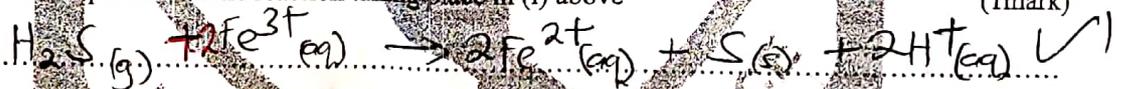
- reagents; dilute nitric (V) acid, dilute hydrochloric acid and lead carbonate (3 marks)
- Add excess $PbCO_3$ to a (given volume) of HNO_3 and stir, until effervescence stops.
 - filter to obtain $Pb(NO_3)_2$ soln. Add dilute HCl to the filtrate to obtain $PbCl_2$. Filter off to obtain unreacted HCl .
 - Wash the residue with distilled H_2O .
 - Dry the residue between filter papers (sand bath).

25. Hydrogen sulphide gas was passed through a solution of iron (III) chloride

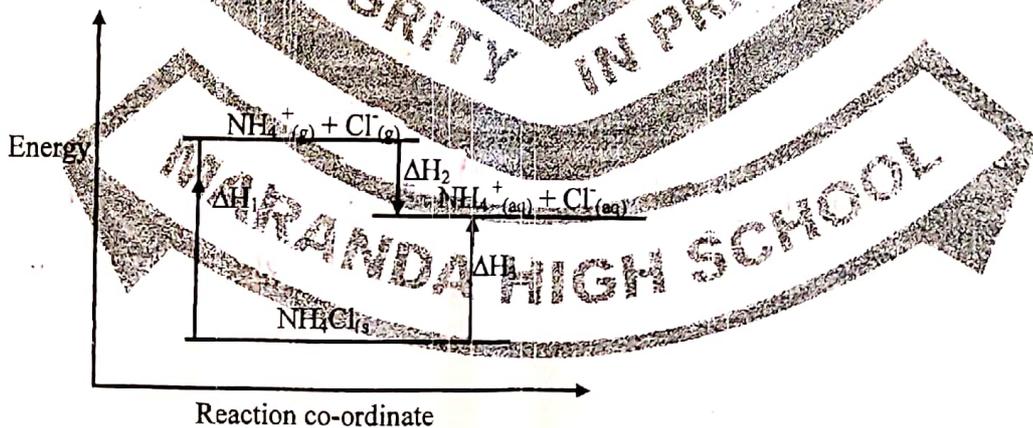
i) State and explain the two observations made (2 marks)

- The soln changes from yellow/brown to pale green because H_2S gas reduces Fe^{3+} ions to Fe^{2+} ions.
- Yellow solid / deposit formation of sulphur.

ii) Write an ionic equation for the reaction taking place in (i) above (1 mark)



26. Study the diagram below and answer the questions that follow.



a) What do ΔH_1 and ΔH_2 represent. (2 marks)

- ΔH_1 Lattice energy ΔH_2 hydration energy

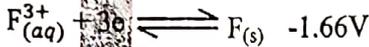
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b) Write an expression to show the relationship between ΔH_1 , ΔH_2 and ΔH_3 .

(1mark)

$$\Delta H_3 = \Delta H_1 + \Delta H_2 \checkmark$$

27. Use the information below and answer the questions that follow. The letters are not the actual symbols of the elements.



a) Calculate the E° value for the electrochemical cell represented below.

(2mark)



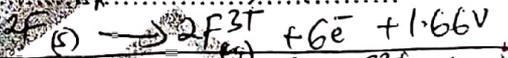
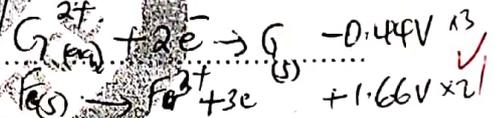
$$E^\circ_{cell} = E_{red} - E_{ox}$$

$$= -0.44 - (-1.66)$$

$$= -0.44 + 1.66$$

$$= +1.22V \checkmark$$

ALT
eqn format



b) Arrange the elements in order of reactivity starting with the least reactive.

(1mark)

G, E, F
least \rightarrow most

67
12

04

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