

Name.....Index No...../.....

School.....Adm. No.....

Candidates Signature:..... Date.....

233/2

CHEMISTRY

PAPER TWO

July/August, 2023

Time; 2 ½ hours

MARKING
SCHEME



KABOURA JOINT EXAMINATION

Kenya Certificate of Secondary Education (K.C.S.E)

INSTRUCTIONS TO CANDIDATES

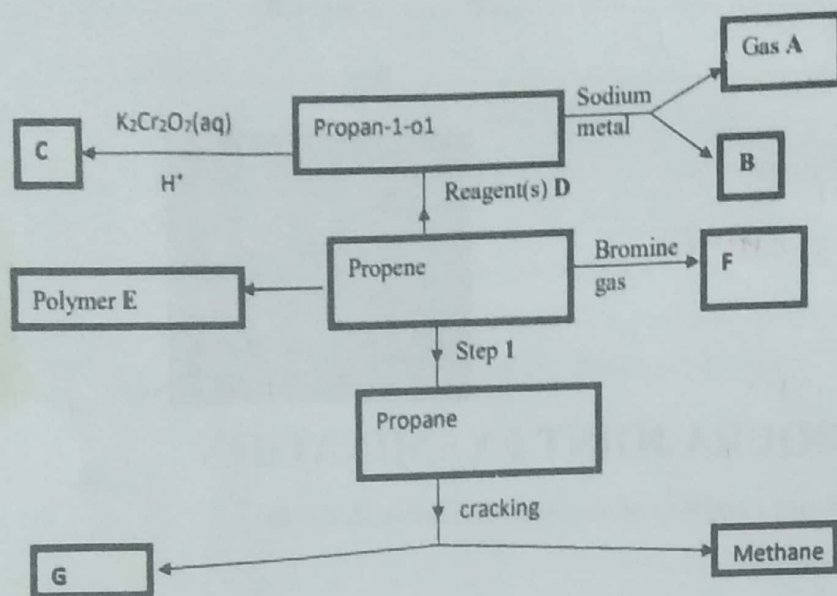
- Write your name, school and index number in the spaces provided above.
- Sign and write date of examination in the spaces provided above.
- Answer **ALL** questions in the spaces provided.
- Mathematical tables and silent electronic calculators may be used.
- All workings **MUST** be clearly shown where necessary.

Questions	Maximum Score	Candidate's Score
1	10	
2	12	
3	13	
4	10	
5	10	
6	13	
7	12	
TOTAL	80	

This paper consists of 13 printed pages

*Candidates should check the question paper to ensure that all the
Papers are printed as indicated and no questions are missing.*

1. The scheme below shows a series of reactions and compounds. Study it and use it to answer the questions that follow.



(a) Identify the following compounds and products

(3marks)

A. Hydrogen gas ✓
 B. Sodium Prop-oxide ✓
 C. Propanoic acid ✓
 D. Poly Propene ✓
 E. 1,2-dibromopropane ✓
 F. Ethene ✓
 G. accept the formula

(b) State 2 conditions for step 1 to occur.

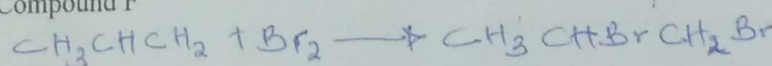
(2 mark)

High Pressure ✓
Nickel / Palladium catalyst ✓

(c) Write an equation for the formation

Compound F

(1 mk)

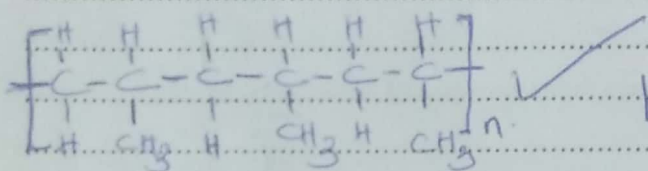


Compound C. (1 mark)
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \xrightarrow{\text{H}^+/\text{K}_2\text{Cr}_2\text{O}_7} \text{CH}_3\text{CH}_2\text{COOH} + \text{H}_2\text{O}$ 01

(d) Identify reagent(s) D. (1 mark)
 concentrated sulphuric(VI) acid H_2SO_4 01
 water

(e) State one industrial use of methane. (1 mark)
 Manufacture of chloromethane 01

(f) Draw the structure of a section of polymer E showing three repeated units. (1 mark).



2. The grid below shows part of the periodic table. Use it to answer the questions that follow. The letters do not represent actual symbols. 10

					S	U	V	
P	R				T	X	W	
Q								

(a) Which of the elements has the largest atomic radius? Explain. (2 marks)

Q has four (more) energy levels 02

(b) Identify the highest Oxidizing agent. Explain. (2 marks)

U ✓ readily gains one electrons to be stable. (02)

(c) Compare the atomic radius of P and R.

(2 marks)

Atomic radius of P is larger than that of R. ✓
R has more protons than P hence stronger force of attraction. ✓ (02)

(d) Give the formula of one stable ion with an electron arrangement of 2.8 which is:

(i) A Negatively charged divalent ion.

(1 mark)

S^{2-} ✓ (01)

(ii) A Positively charged monovalent

(1 mark)

R^{2+} ✓ (01)

(e) Given that the mass number of W is 40. Write down the composition of its nucleus. (2 marks)

18 protons ✓
22 neutrons ✓ (02)

(f) Write the

formula of the compounds formed when Element R and X react.

(1 mark)

RX_2 ✓ (01)

(ii) Give one

property of the structure formed when R and X bond.

(1 mark)

- Conducts electricity in molten & aqueous state ✓ (01)
- Has relatively high melting point.
- Soluble in water. Any one.

3.a). Study the standard electrode potentials below and answer the questions that follow. The letters do not represent the actual symbols of the elements.

E° volts		
$E^{2+}(aq) + 2e^-$	$E(s)$	-0.44
$A^+(aq) + e^-$	$A(s)$	-2.92
$\frac{1}{2}D_2(s) + e^-$	$D(aq)$	+1.36
$C^+(aq) + e^-$	$\frac{1}{2}C_2(g)$	0.00
$B^+(aq) + e^-$	$B(s)$	+0.52

i). Identify the strongest reducing agent. Give a reason.

(1 mark)

$\text{D}_{2\text{O}}$ has a more positive $E^\ominus$ value. (1)

(ii) Which element is likely to be hydrogen? Give a reason

(2 marks)

Cu^{2+} reference half cell with $E^\ominus$ value of 0.00 V. (2)

(iv) Explain whether the reaction represented below can take place.

(2 marks)



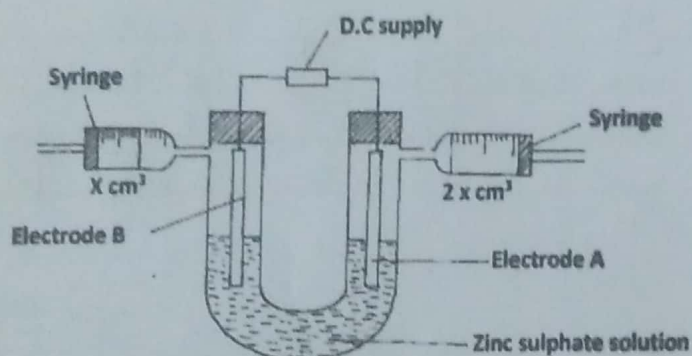
$E^\ominus_{\text{cell}} = E^\ominus_{\text{reduction}} - E^\ominus_{\text{oxidation}}$

$$+0.44 - (-2.42) = +2.86 \text{ V}$$

Reaction will take place since

the $E^\ominus$ of the cell is positive.

(b) An aqueous solution of zinc sulphate is electrolyzed using platinum electrodes as shown in the set up below.



a) (i) Write a half equation for the reaction taking place at electrode A.

(1 mark)

$2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$ (1)

(ii) Identify electrodes A

(1 mark)

Cathode ✓

01

(iii) State and explain the observation at electrode B if copper plate was used instead of platinum electrode.

(2 marks)

A colourless gas
Bubbles of a colourless gas are liberated
 OH^- ions are preferentially discharged giving out oxygen gas.

02

(b) 0.22g of metal Q is deposited by electrolysis when a current of 0.06A flows for 99 minutes. (RAM of Q = 184, 1F = 96500C) (i) Find the number of moles of Q deposited.

(1 mark)

~~Q = 0.06 \times 99 \times 60~~

$$\text{No. of moles} = \frac{0.22}{184} \times \frac{1}{2}$$

$$= 0.001196 \text{ mole} \times \frac{1}{2}$$

01

(ii) Determine the value of n in the metallic ion Q^{n+}

(3 marks)

$$Q = 0.06 \times 99 \times 60 \times \frac{1}{2}$$

$$= 356.4 \text{ C} \times \frac{1}{2}$$

$$0.001196 \times 184 = 356.4 \text{ C}$$

$$\frac{356.4}{184} = ?$$

$$1F = 96500 \text{ C}$$

$$? = 298080 \text{ C}$$

$$\frac{298080}{96500} = 3.089 \text{ F}$$

$$\frac{298080}{96500} \approx 3 \text{ F}$$

$$n = 3$$

$$\frac{184 \times 356.4}{0.22} = 298,080 \text{ C}$$

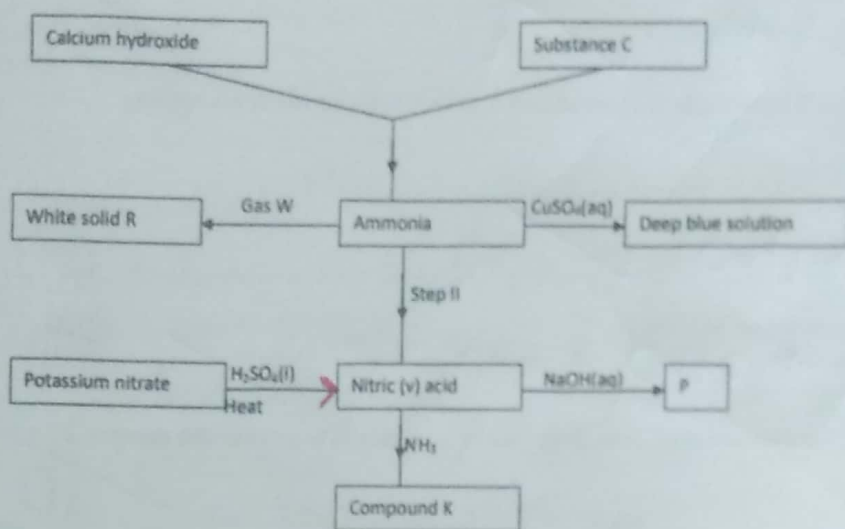
$$\frac{0.001196}{0.22}$$

03

13

4.

I. Use the flow chart drawn to answer the questions that follow:



a) Identify:

i. Compound C

Ammonium chloride ✓

(1mk)

01

ii. Compound K

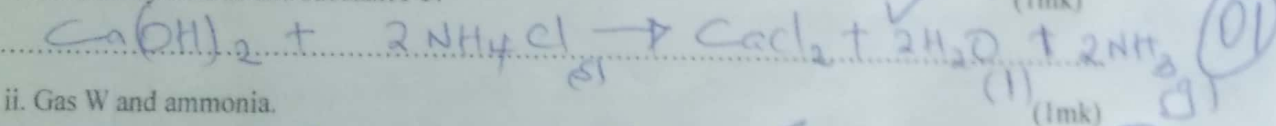
Ammonium Nitrate ✓

(1mk)

01

b) Write the equation for the following:

i. Calcium hydroxide and substance C.



(1mk)

01

(1)

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

(1mk)

01

e) State the type of reaction that produces P.

(1mk)

Neutralisation ✓

01

f) State one use of compound K.

(1mk)

used as a fertilizer ✓

01

II. When compound N is heated, a brown gas is evolved and a yellow residue is left on cooling.

a) Name:

i). The yellow residue.

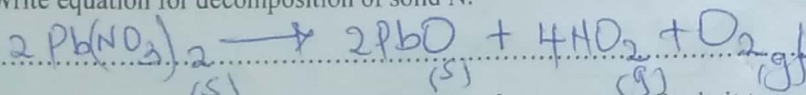
(1mk)

Lead (II) oxide (PbO) ✓

01

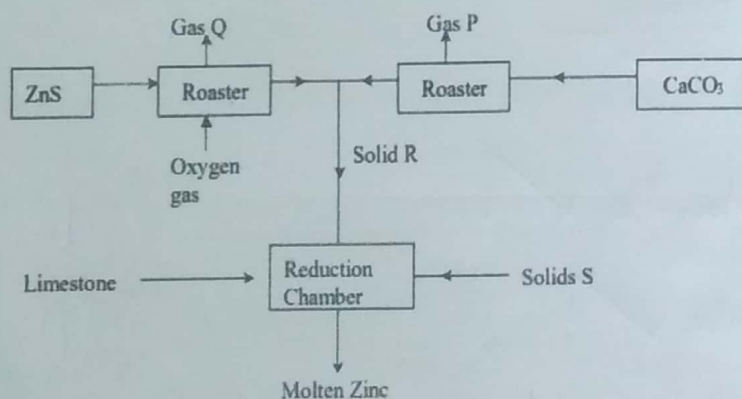
ii. Write equation for decomposition of solid N.

(1mk)



01

5. The flow chart below shows the extraction of Zinc from two ores. Study it to answer the questions that follow.



i) Give the common names of the following ores:

(1mark)

ZnS

zinc blende ✓

$CaCO_3$

~~Marble~~ limestone ✓

ii) Name the gases P and Q

(1mark)

P

Sulphur (IV) oxide ✓

Q

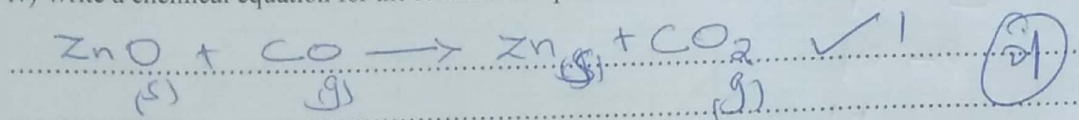
carbon (IV) oxide ✓

iii). Name the solids R and S.

R. zinc oxide ✓ (1 mark)

S. coke ✓ (1 mark)

iv) Write a chemical equation for the reaction that produces Zinc metal. (1 mark)



v) What is the purpose of adding limestone in the reduction chamber? (1 mark)

To produce CaO which is used to remove impurities.
To give out CO used for reduction of ZnO.

vi) Give two uses of Zinc metal (2 marks)

- Galvanizing iron (metals) ✓
- Making outer casing in dry batteries ✓
- To make brass ✓

vii) Name two other industries that can be established alongside the zinc extraction plant. (2 marks)

6. (a) Define the term solubility. (1 mark)

- is the maximum mass of solute required to saturate 100g of water at a particular temperature. ✓

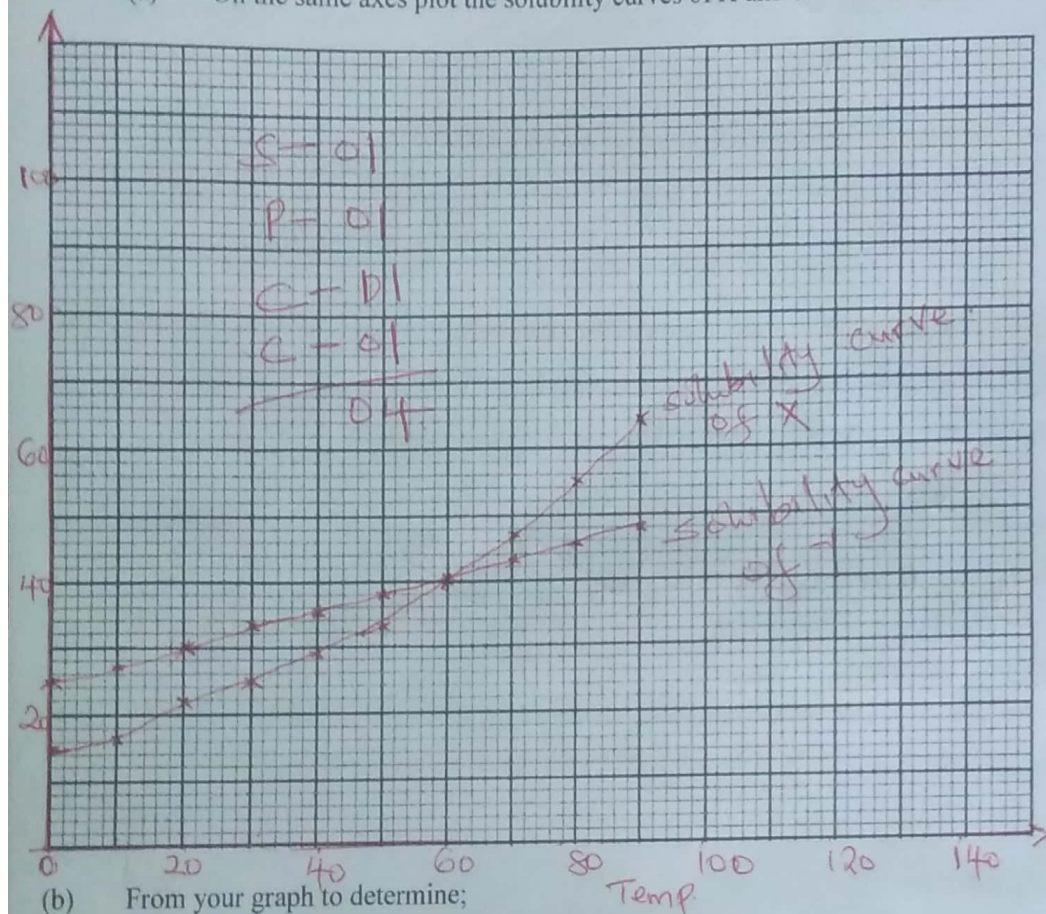
(b) In an experiment to determine the solubilities of two salts X and Y at different temperatures, a candidate recorded her observations as shown below.

Temperature (°C)	0	10	20	30	40	50	60	70	80	90
Solubility of X in g/100 g of H ₂ O	14.3	17.4	20.7	25.0	28.5	33.3	40.0	47.0	55.0	64.0
Solubility of Y in g/100 g of H ₂ O	25.0	27.5	30.0	32.5	35.0	37.6	40.1	42.4	45.0	48.0

Solubility

(a) On the same axes plot the solubility curves of X and Y.

(4marks)



(b) From your graph to determine;

(i) The solubility of X and Y at 47 °C

Solubility of X

32 g / 100 g of H₂O ± 1 g (1 mark) (01)

Solubility of Y

37 g / 100 g of H₂O ± 1 g (1 mark) (01)

(ii) The temperature at which the two salts are soluble in water.

60 °C ± 0.1 °C (1 mark) (01)

(c) If 60g of X is dissolved in 100 g of water and heated to 90°C, calculate the amount of salt that crystallized out if cooled to 20 °C.

(1 mark)

60 - 20.7 = 39.3 g (51)

- (d) State what would happen if a mixture ^{50g} salt X in 100 g of water and 30 g of Y in 100 g of water were cooled from 90 °C to 70 °C. (3 marks)
- 30g of salt X will crystallise out but no salt Y will
- At 70°C only 47.2g of salt X can dissolve leaving out 2g of the 50g while all the 30g of salt Y will dissolve
- (e) State one application of solubility. (1 mark)
- Fractional crystallization

7. (a) When steam is passed over heated charcoal as shown below, Carbon (II) oxide and hydrogen gas are formed

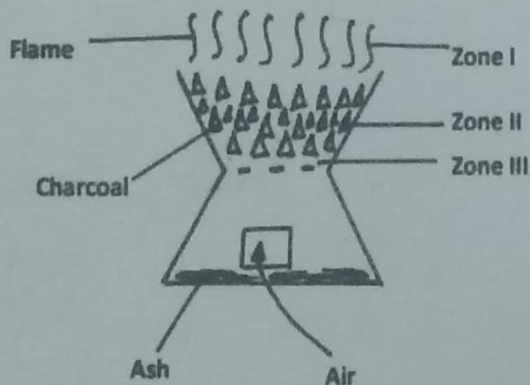
- (i) What name is given to the mixture of gases produced above? (1mk)

Water gas

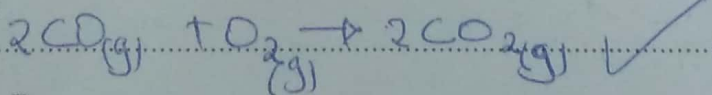
- (ii) Give two uses of Carbon (II) oxide gas which are also uses of hydrogen gas (2mks)

Reducing agent
As fuel

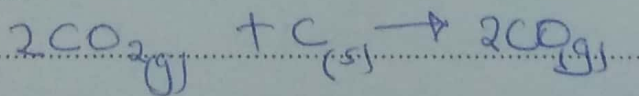
- (b) The diagram below represents a charcoal burner. Study it and answer the questions that follow



- (i) Write equations for the reactions occurring at Zone I



Zone II



(ii) What is the colour of the flame

Blue flame ✓

(1mk)

01

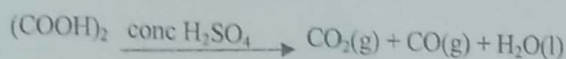
(iii) The ash that collects in the lower compartment was dissolved in water and filtered. Suggest the PH value of the resulting solution

(1mk)

Between 7-10 ✓ (weak base)

01

(c) Carbon (II) oxide gas can be prepared in the laboratory by a process shown below



(i) State the function of the concentration sulphuric (VI) acid in the process above

(1mk)

Dehydrating agent ✓ To remove water molecules

01

(ii) How would you remove Carbon (IV) oxide gas from the mixture of Carbon (II) Oxide and carbon (IV) oxide gas

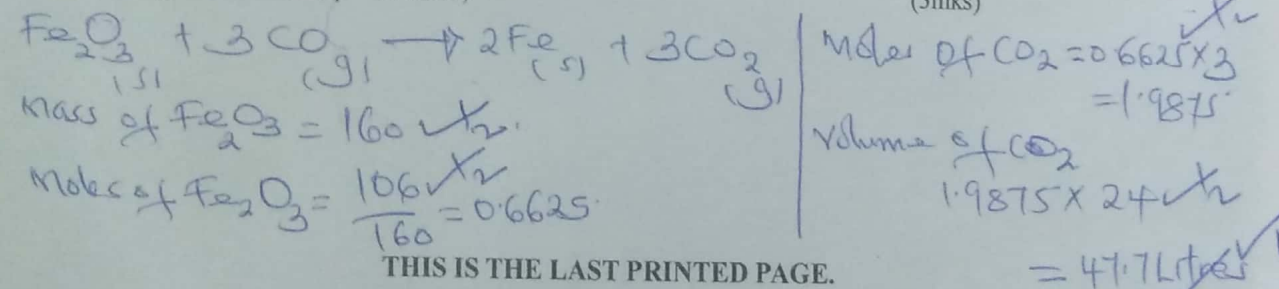
(1mk)

Pass the mixture through concentrated NaOH / KOH / Ca(OH)₂ ✓

01

(d) What volume of Carbon (II) Oxide at r.t.p is needed to reduce 106g Iron (III) Oxide to iron metal? (O=16, Fe=56, Molar gas volume at r.t.p = 24 litres)

(3mks)



THIS IS THE LAST PRINTED PAGE.

03