LANJET F4 JOINT EXAMINATION – 2020
Kenya Certificate of Secondary Education
233/1
CHEMISTRY
PAPER 1
DECEMBER, 2020
TIME: 2 HOURS
PAPER 1 MARKING

1. State the observations made when a piece of sodium metal is dropped into a beaker
    containing water. (2mks)
    > **Sodium melts into a silvery ball**
    > **Hissing sound produced**
    > **The piece of sodium darts on surface of water**
    >
    > **All three correct-2mks**
    > **Two correct-1mk**
    > **Only one-no mark**

2. During a class experiment, students passed gas X over heated copper metal, the metal
    changed its colour to black.

    (a)Identify gas X. (1mk)

    > **Oxygen**

    (b)Name the black substance formed. (1mk)

    > **Copper (II) Oxide**

3. Aluminium is extracted from its ore by electrolysis.

    (a)Name the main ore of Aluminium . (1mk)
    Bauxite
    (b)The Aluminium ore in (a) above has a very high melting
    point.(2015^0C),though it is electrolyzed at a lower temperature of about 900^0 C.
    Explain how the low temperature is achieved. (1mk)
    By addition of cryolite as an impurity which lower the melting point.

(c)In the above process, graphite electrodes are used. What is the disadvantage of using these kind of electrodes (1mk)

At high temperatures oxygen gas produced at the anode reacts with graphite electrode to form Carbon (IV) Oxide and hence the electrode is depleted with time.

4. A student added 50cm^3 of 1.0M aqueous Sulphuric (VI) acid to 50cm^3 of 2.0M Potassium Hydroxide and the temperature of the resulting solution rose by 4^0 C.

   (a) Define the term Molar heat of neutralization. (1mk)

    Is the heat change that occurs when one mole of H$^+$ ions (from an acid) reacts with one mole of OH$^-$ (from an alkali) to form one mole of water.

    (b) Calculate the molar heat of neutralization
       (C=4.2KJKg^{-1} K^{-1} ,Density of solution=1g/cm^3)

5. Use the table below to answer the question that follow:

Element	Atomic number
A	11
B	13
C	14
D	17
E	19

    (a) Write an equation for the reaction between element A and water. (1mk)
       2A$_{(s)}$ +2H2$_{(l)}$ ⟶ 2AOH$_{(aq)}$+H2$_{(g)}$
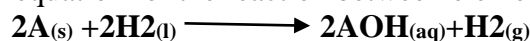
    (c) Explain the trend of atomic radii between elements A and D. (2mks)

    **Atomic radii decrease from A to D.
    This is because protons are added into the nucleus resulting in higher nuclear charge between the positive nucleus and outermost electrons hence atomic radii decrease across a period.**

6. In terms of structure and bonding, explain why graphite is used as a lubricant. (2mks)

Graphite structure has layers that are held together by weak Van der Waals forces; the layers slide over each other.

7. (a) State the Boyles Law. (1mk)
    The volume of a given mass of gas is inversely proportional to its pressure at a constant temperature.

    (b) A given mass of the gas occupies $20cm^3$ at 25^0 C and 670mmHg pressure. Find the volume it will occupy at 10^0 C and 335mmHg. (2mks)

$$\frac{P1V1}{T1} = \frac{P2V2}{T2}$$

But P₁=670mmHg

V₁=20cm3

T₁=(25+273)=298K

P₂=335mmHg
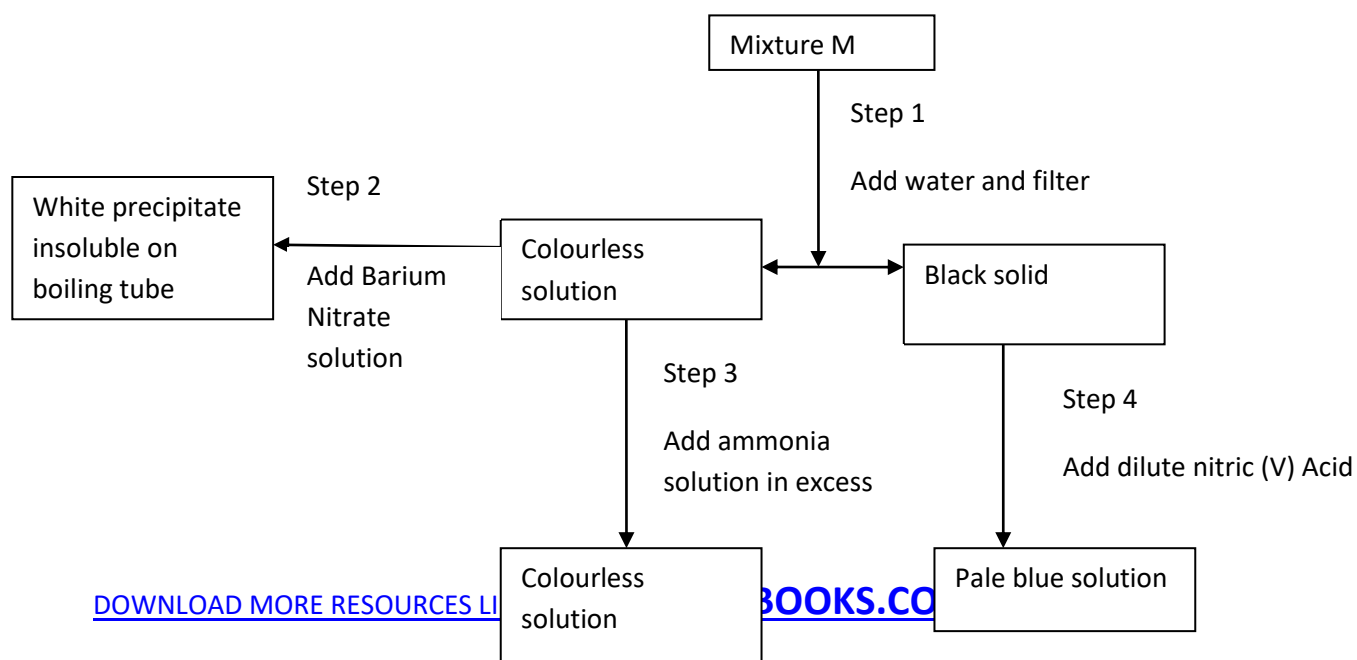**V2=?**
T₂=(10+273)=283K

$$V_2 = \frac{670 \times 20 \times 283}{335 \times 298}$$

= 38cm³

8. Study the flow chart below and answer the questions that follow.

(a)   Name

(i) Cations present in mixture M.   (1mk)

Cu^{2+} ½ mk and Zn^{2+} √ ½ mk

(ii) Anion present in the solution.
(1mk)

$SO_4{}^{2-}$

(c) Write an equation to show how the white precipitate in step 3 dissolves. (1mk)

$Zn(OH)_2$ (s) +$4NH_3$(aq) $\longrightarrow$ $\left[Zn(NH_3)_4 \right]^{2+}$(aq) +$2OH^-$(aq)

(d) Name the process outlined in step 4 above.   (1mk)

Neutralization

9.The solubility of potassium nitrate is 85g/100g of water at $50\,^0$ C and 32g/100g of water at $25\,^0$ C.

(a) Define the term solubility.   (1mk)
The amount of a substance that can dissolve in 100g of water at a certain temperature.

(c) Calculate the mass of the crystals formed if a saturation of potassium nitrate in 50g of water at $50\,^0$ C is cooled to $25\,^0$ C.   (2mks)

$$\frac{85 \times 50}{185} = 22.9g \; in \; 50g \; of \; water.$$

$$\frac{32 \times 50}{132} = 12.1g \; in \; 50g \; of \; water$$

22.9-12.1=10.8g KNO$_3$

10. Magnesium Chloride dissolves in water to form a neutral solution while iron (III) chloride forms an acidic solution. Explain. (2mks)

Magnesium chloride does not hydrolyze in water √ ;Iron (III) Chloride hydrolyse in water producing hydrogen ions.

11. The diagram below is a set up to prepare a certain gas X. Study it and use it to answer the questions that follow.

(a)Identify gas X. (1mk)

Hydrogen

(b)Why is the gas collected over water? (1mk)

It is slightly soluble in water.

(c)Why are Copper (II) Sulphate crystals added to the flask where the reaction takes place?

Copper (II) Sulphate act as a catalyst to speed up the reaction.

12. (a)Give the systematic names of the following organic compounds. (2mks)

(i) $CH_3CH_2CH_2CH_2OH$

Butanol /Butan-1-ol

(ii) $CH_3CH_2COOCH_2CH_3$

Ethyl propanoate.

(b)Explain why an organic compound with the formula C_4H_6 burns with a more sooty flame than C_4H_{10}. (2mks)

C_4H_8 is unsaturated hydrocarbon whose double bond requires excess oxygen for complete combination whereas C_4H_{10} is a saturated hydrocarbon which burns completely.

13. When solid Zinc Carbonate was added to a solution of Hydrogen Chloride in methylbenzene there was no observable change. On addition of some water to the mixture there was effervescence. Explain the observation. (2mks)
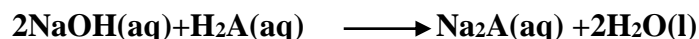
> **HCL in methylbenzene exists in a molecular form and has no H^+ ions hence no effect on $ZnCO_3$. On addition of water, HCL ionizes to give H^+ ions which react with $ZnCO_3$, producing Carbon (IV) oxide.**

14. In titration experiment,25.0 cm^3 of sodium hydroxide containing 8.0 g per litre was required for complete neutralization of0.245 g of a diabasic acid. Calculate the relative molecular mass of the acid. (3mks)

> **Molarity of NaoH = $\dfrac{\text{g/litre}}{RFM}$**
>
> **$= \dfrac{8.0}{40} = 0.2M$**
>
> **Moles of NaOH that reacted$= \dfrac{vol}{1000} \times M$**
>
> **$= 0.005$mole**
>
> **$2NaOH(aq) + H_2A(aq) \longrightarrow Na_2A(aq) + 2H_2O(l)$**
>
> **From the equation**
>
> **Moles of H2A that reacted= ½ (0.005)**
>
> **=0.0025mole**
>
> **RFM of $H_2A = \dfrac{mass}{moles} = \dfrac{0.245}{0.0025}$**
>
> **=98**

15. (a)100g of a radioactive isotope was reduced to 12.5g after 81 days. Calculate the half life of the radioisotope. (2mks)
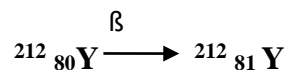
$$100g \xrightarrow{\text{t ½}} 50g \xrightarrow{\text{t ½}} 25g \xrightarrow{\text{t ½}} 12.5g$$
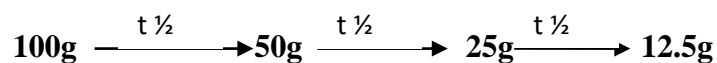
3 half lifes   take   81 days

1 half life   ?

$$t½ = \frac{81}{3} = 27 \text{ days}$$

(b) $^{212}_{80}Y$ decays by beta emission. What is the mass number and the atomic number of the product after decay?

$$^{212}_{80}Y \xrightarrow{\text{ß}} {}^{212}_{81}Y$$

Mass number is 212 √½

Atomic number is 81√ ½

16.(a) Distinguish between ionization energy and electron affinity.   `   (2mks)

Ionization energy is the energy required by an atom to lose one electron in gaseous state ,while electron affinity is the amount of energy released when an electron is added to a neutral atom in gaseous sate to form a negative ion.

17.The diagram below represents a paper chromatography for three brands of juice suspected to contain unwanted food additives.

From the results, it was found that unwanted additives are present in Y and Z only.

On the chromatogram;

   (a)Circle the spots which show unwanted food additives.

   (b)Name the solvent commonly used in paper chromatography.   (1mk)

Propanone.

   (c)State two applications of chromatography.   (2mks)

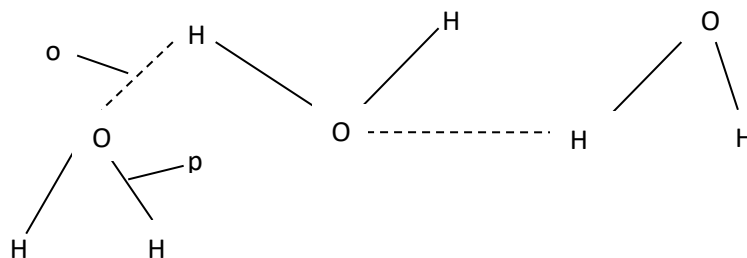**Testing purity of drugs in pharmaceutical industry.**

Identifying banned substances in sports

In food industry to identify contaminants in food and drinks.

In the cosmetics industry to identify harmful substances.

18.(a)Show bonding in Aluminium Oxide.   (1mk)

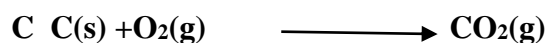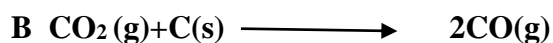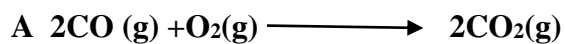(b)Identify the type of bonds represented by p and q in the substances below.

p-Covalent bond √ ½ mk   (½ mk)
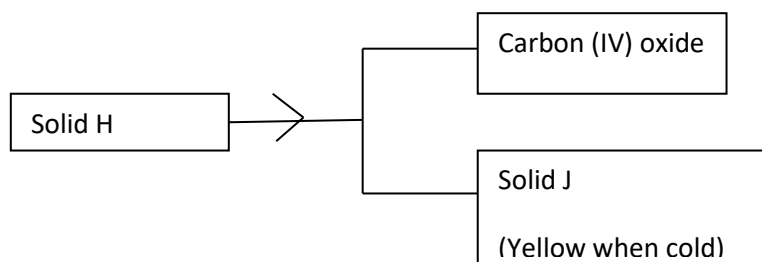
q-Hydrogen bond√ ½ mk   (½ mk)

19.The following diagram represents a charcoal burner. Study it and answer the questions that follow:

Write the equations for the reactions at A,B and C regions.   (3mks)

A $2CO_{(g)} + O_{2(g)} \longrightarrow 2CO_{2(g)}$

B $CO_{2(g)} + C_{(s)} \longrightarrow 2CO_{(g)}$

C $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$

20. Use the scheme below to answer the question that follow.

```
                          ┌─────────────────────┐
                          │  Carbon (IV) oxide  │
                          └─────────────────────┘
 ┌──────────┐     ⟹    ─┤
 │ Solid H  │──────       ─┤
 └──────────┘              ┌─────────────────────┐
                           │  Solid J            │
                           │                     │
                           │  (Yellow when cold) │
                           └─────────────────────┘
```

(a)Identify process N.   (1mk)

Decomposition/Thermal decomposition

(b)Identify the solids

H. Lead (II) nitrate(½ mk)

J. Lead (II) Oxide   (½ mk)

21.Ammonia gas is prepared by Harber process according to the equation below:

$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g) + Heat$

State and explain the effect on equilibrium when the following conditions are applied.

(a)Pressure increased.   (1mk)

Equilibrium shift to the right. This is because there are few number of moles of gas molecules on the right than on the left hand side.

(b)Temperature increased.   (1mk)

Equilibrium shift to the left; heat is absorbed or reaction is endothermic in the backward reaction.

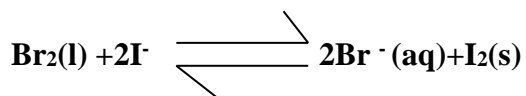(c)State Le Chatelier's principle.   (1mk)

It states that when a change in conditions is applied to a system in equilibrium, the system moves as to oppose that change.

22. You are given the following half equations.

$I_2(s) + 2e^- \rightleftharpoons 2I^- (aq)$ $E^\ominus = +0.54V$

$Br_2(l) + 2e^- \rightleftharpoons 2Br^- (aq)$ $E^\ominus = +1.09V$
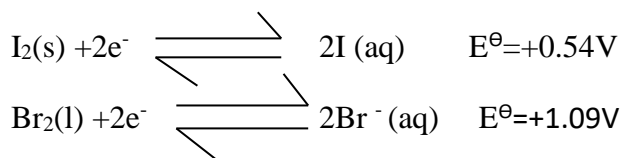
(a)Write an overall equation for the cell reaction.   (1mk)

$Br_2(l) + 2I^- \rightleftharpoons 2Br^- (aq) + I_2(s)$

(b)Calculate the $E^\ominus$ value of the cell.(1mk)

E.M.F = $E^\ominus$(reduction) - $E^\ominus$(oxidation)

1.09 - 0.54

= 0.45V

(c)Name the oxidizing agent. (1mk)

Br$_2$ (l)

23.when a current of 0.8Ampheres was passed for 44 minutes and 20 seconds through fused iodide of metal Z, 0.7167g of Z was deposited. Determine the charge of the ion of metal Z.

(1 Faraday=96500C,RAM of Z=65) (2mks)

Q=It

=(44×60 +20=26605(convert time into seconds)

2660×0.8

2128Coulombs √ ½ mk

0.7167g of Z   =   2128C

65g(RAM) of Z   ?

$$\frac{65 \times 2128}{0.7167}$$

=192995.6C√ ½ mk

96500C =   1F
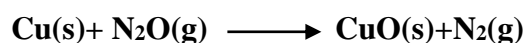
192995.6C   ?

$$= \frac{192995.6 \times 1}{96500}$$

1.99995F

~2.0F√ ½

2F discharges 2 electrons hence ,change of metal Z ion is Z^{2+} √ ½

24.The set up below shows how small pieces of copper are heated in nitrogen (I) Oxide.

(a)Write an equation for the reaction which occurs in the glass jar. (1mk)

$Cu(s)+ N_2O(g) \longrightarrow CuO(s)+N_2(g)$

(b)Give one use of the Nitrogen (I) Oxide. (1mk)

Used as an anaesthesia for minor surgery and dental surgery.

25.State what would be observed if concentrated Sulphuric (VI) Acid is added to:

(a)Sugar crystals. (1mk)

A black mass will be seen.

(b)Hydrated Copper (II) Sulphate crystals. (1mk)

Turn from blue to white.

(c)What type of reaction has taken place above. (1mk)

Dehydration.

26.Explain why commercial indicators are preferred to flower extracts as acid base indicators.
(2mks)

The composition of commercial indicators remains constant hence gives consistent results.

The composition of flower extracts changes with time giving inconsistent results.

27.(a)Magnesium reacts with hydrochloric acid according to the following equation.

$Mg(s) +2HCl(aq) \longrightarrow MgCl_2(aq) +H_2(g)$
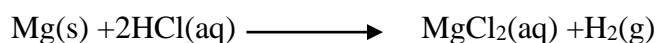
Identify the reducing agent. Give a reason for your answer. (2mks)

Mg/Magnesium; Oxidation number of magnesium increased.

(b)Iron sheets are dipped in molten Zinc to prevent rusting .Name this process.   (1mk)

Galvanisation

28.Explain why a balloon filled with helium gas deflates faster than a balloon of the same size filled with argon gas.   (2mks)

Helium is less dense that argon; hence it diffuses out faster than argon

(Rej deflates for diffuses)

29.Complete the table below.   (2mks)

Solution	PH	Nature of Solution
H	1.0	**Strong acid**
I	**7.0**	Neutral
J	**4.0-6.9**	Weak acid
K	13.0	**Strong base**

30.A farmer intended to plant cabbages in his farm. he first tested the PH of the soil and found it to be 3.0.If cabbages do well in alkaline soils, explain the advice that would be given to the farmer in order to realize a high yield.   (2mks)

Add calcium oxide /lime to raise the soil PH. Calcium Oxide is a basic oxide hence dissolve in water in the soil to form alkaline solution that reacts with acidic soil to raise soil PH.

31.Name an appropriate apparatus:

(a)That is used to prepare standard solutions in the laboratory.   (1mk)

Volumetric flask

(b) That is used in heating solid substances strongly.   (1mk)

Crucible

(c)That can be used to separate two immiscible liquids.   (1mk)

Separating funnel

32.Some plants have seeds that contain vegetable oil.

(a)State the reagent and apparatus used to extract the oil from the seeds.   (1mk)

Reagent-acetone/ethanol ½ √

Apparatus-motar and pestle ½ √

(*mortar and pestle must both be mentioned for the mark)

(b)Explain how it could be confirmed that the liquid obtained from the seeds is oil?   (1mk)

The liquid left after evaporation is placed on a piece of paper. It leaves a translucent mark, which proves it is oil.

(c)State an application of the method of extracting oil above.   (1mk)

Used in extraction of oil from corn seeds e.g Elianto oil

Extraction of natural dyes from plants.

In dry cleaning to remove dirt.