**NAME …………………… …………………………………ADM NO ………………………….…….**

**SCHOOL.……………………………………………………CANDIDATE’S SIGN……...……………**

 **DATE……………………………………..**

**233/1**

**CHEMISTRY**

**PAPER 1**

**(THEORY)**

**Nov-Dec-2021**

**TIME: 2 HOURS**

**CEKENAS END OF TERM 2 EXAMINATION-2021**

**FORM FOUR EXAMINATIO**

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

**233/1**

**CHEMISTRY**

**PAPER 1**

**(THEORY)**

**Nov-Dec-2021**

**TIME: 2 HOURS**

**INSTRUCTION TO CANDIDATES**

1. Write your name and Adm number in the spaces provided above

2. Sign and write the date of the examination in the spaces provided

3. Answer all the questions in the spaces provided

4. All working must be clearly shown where necessary.

**5. This paper consists of 12 printed pages**

**6. Candidates should check to ascertain that each page s printed as indicated and that no question is/are missing.**

**FOR EXAMINAER’S USE ONLY**

|  |  |  |
| --- | --- | --- |
| **Question** | **Maximum score** | **Candidate’s score** |
| **TOTAL** | **80** |  |

1. Ethanol and pentane are miscible liquids. Explain how water can be used to separate a mixture of ethanol and pentane. (2mks)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

2. Solutions can be classified as acids, bases or neutral. The table below shows solutions and their pH values.

|  |  |
| --- | --- |
| Solution  | pH values  |
| KLM | 1.57.014.0 |

 (a) Select any pair that would react to form a solution of pH 7. (1 mk)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (b) Identify two solutions that would react with aluminum hydroxide. Explain. (2mks)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

3. Using crosses (x) and dots (.) show bonding in,

 (a) NH4+ (1 mk)

 (b) Na2S (1mk)

4. Starting with 50cm3 of 0.5M H2SO4 describe how you can prepare a sample of Na2SO4 crystals.

 (3mks)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

5. (a) State Gay-Lussac’s law of combining volumes. (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (b) When 100cm3 of gaseous hydrocarbon (CxHy) burns in 300cm3 of oxygen. 200cm3 of carbon (IV) oxide and 200cm3 of steam are formed. Deduce the formula of the hydrocarbon. (2mks)

6. Study the set up below for electrolysis of copper (II) sulphate using copper eletrodes.

 Write Ionic equations for reactions that took place at.

 (i) Anode (1 mk)

 ……………………………………………………………………………………………………… (ii) Cathode (1 mk)

 ………………………………………………………………………………………………………

 (b) State the flow chart below to answer the questions that follow.



 Identify

 Gas P (½mk)

 ……………………………………………………………………………………………………… Solid R (½mk)

 ………………………………………………………………………………………………………

 Solid T (½mk)

 ………………………………………………………………………………………………………

 Liquid S. ………………………………………………………………………………………………………

8. Explain the following observations

 (a) Chlorine has a higher melting point than argon (2mks)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (b) Elements P,Q and S have atomic number 11, 12 and 13 respectively which element has the highest melting point. (2 mks)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

9. The basic raw material for extraction of aluminium is from bauxite. (1 mk)

 (a) Name the method that is used to extract aluminiunm from bauxite. (1 mk)

 ……………………………………………………………………………………………………… (b) Cryolite is used in the extraction of aluminium from bauxite. State its role. (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (c) Aluminium is a reactive metal yet utensils made of aliminium do not corrode easily. Explain this observation. (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

10. A student set-up the experiment to study the effect of heat on lead (II) nitrate.

 (a) Identify liquid x. (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (b) Describe the test for gas Y. (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (c) Write a balanced chemical equation for the reaction in flask A. (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

11. Below is part of the Thorium decay series.

 

 (a) Write an overall equation for the conversation of  (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (b) Radioactivity has several applications. State two applications of radioactivity in relation to medicine. (2mks)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

12. Hydrogen iodide is a product formed when hydrogen reacts with Iodine according to the equations.

 H2(g) + I2(g)  2HI(g) ΔH = +52.0Kj/mole

 (a) What is meant by the term dynamic equilibrium. (1mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (b) Explain how the following would affect the yield of hydrogen iodide

 (i) Increase the temperature. (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (ii) A decrease in pressure of the system (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

13. An element T has a relative atomic mass of 88 when a current of 0.5 amperes was passed through the fused chloride of T for 32 minutes and 10 seconds, 0.44g of T were deposited at the cathode. Determine the charge on an ion of T. (1 Farady = 96000C) (3mks)

14. (a) Complete the table below to show the observation made when concentrated sulphuric (VI) acid is added to the substances shown. (2mks)

|  |  |
| --- | --- |
| Substance | observations |
| Iron fillings |  |
| Crystals of white sugar |  |

 (b) Suggest a reason why BaSo4 a pigment from sulphuric (VI) acid would be suitable in making paint for cars. (1mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

15. 20cm3 of unknown gas Q takes 12-6 seconds to pass through small orifice 10cm3 of oxygen gas takes 11.2 seconds to diffuse through the same orifice under the same conditions of temperature and pressure. Calculate the molecular mass of unknown gas Q. (0=16) (3mks)

16. Study the flow chart below and answer the questions that follwos.



 Identify

 i) Solid V (1 mk)

 ………………………………………………………………………………………………………

 ii) Solution R (1 mk) ………………………………………………………………………………………………………

 iii) Solution Q (1 mk) ………………………………………………………………………………………………………

17. A student lowered burning magnesium in a gas jar of sulphur (IV) oxide

 (a) Explain the observation made in the gas jar (2 mks)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (b) Write the equation of the reaction that takes place in the gas jar. (2mks)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… (c0 Write the equation of the reaction that takes place in the gas jar. (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

18. State two differences between physical and chemical changes. (2mks)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… (b) Ammonium chloride and copper (II) nitrate are affected by heat as shown

 I NH4Cl(s) 🡺 NH3(g) + HCl(g)

 II 2Cu(NO3)2(s) 🡺 2CuO(s) +4NO2(g) + O2(g)

Classify each of the processes in terms of type of change.

 Process I (1 mk)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… Process II (1mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

19. 30cm3 of 0.5M hydrochloric acid was used to neutralize 25cm3 of sodium hydroxide solution. Determine the concentration of Sodium hydroxide in grams per litre. (H=1, O=16, Na=23)(3mks)

20. (a) The define the term isotopes (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (b) The peaks below shows the mass spectrum of element x

 Calculate relative atomic mass of X. (2 mks)

21. In an experiment a student put equal volumes of mixture of ethanoic acid in methylbenzene in two separate test tubes as shown below. In each test tube, equal amounts of solid sodium hydrogen carbonate were added.

 (a) State the observation which was made in each test tube. (2mks)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (b) Explain the observation in (a) above. (2 mks)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

22. 16g of ethanol (C2H5OH) were completely burnt in air. The heat evolved caused the temperature of 600cm3 of water to change from 200C to 850C. Calculate the molar enthalpy of combustion of ethanol (H=1, C=12, O=16) (Specific heat capacity of water 4.2KJKg-1K-1 (3mks)

23. (a) Give the structural formula of 3.3-dimethylpent-1-yne. (1 mk)

 (b) (i) CH3CH2CH2OOCCH3

 (ii) CH3CH2CHC=CH2 (1 mk)

 | |

 Br CH3

24. (a) What is meant by solubility? (1mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (b) In an experiment to determine the solubility of solid x in water at 300C the following results were obtained.

 Mass of evaporating dish = 26.2g

 Mass of evaporating dish + saturated solution = 42.4g

 Mass of evaporating dish + dry solid x=30.4g

 Using the information, determine the solubility of solid x at 300C in g/100g water. (2mks)

25. The apparatus below was a set-up to show the catalytic oxidation of ammonia. Study the diagram and answer the question that follow.

 (i) Write an equation for the reaction that takes place in the gas jar. (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (ii) Why is it necessary to have a hot nichrome wire in the gas jar. (1 mk)

 ……………………………………………………………………………………………………… ……………………………………………………………………………………………………… (ii) Write the formula of the complex ion formed when excess ammonia gas is passed through a solution containing Zn (II) ions. (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

26. The lattice and hydration energies of lithium chloride are given as,

 Lattice energy 891Kj/Mol and hydration energy is 884Kj/Mol.

 (a) Draw an energy cycle diagram to show the relationship between lattice energy hydration energy and heat of solution. (2mks)

 (b) Calculate the enthalpy of solution of lithium chloride (1mk)

27. The graph below is the cooling curve of a substance from gaseous state to solid state.

 Give the name of the

 (a) Process taking place between t0 and t1 . (1 mk)

 ……………………………………………………………………………………………………… ………………………………………………………………………………………………………

 (b) Energy change that occurs between t3 and t4 (1 mk)

**CEKENAS**

**FORM FOUR EXAMINATIO**

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

**233/1**

**CHEMISTRY**

**PAPER 1**

**(THEORY)**

**Nov-Dec-2021**

**MARKING SCHEME**

1. Add water ½ to the mixture. Water mixes with ethanol and forms a lower layer while the upper layer is pentane ½. Use separating funnel½ to separate pentane and use fractional distillation to obtain ethanol from water.

2. (a) K and M 1 (for both)

 (b) K½ and M½

 This is because K is acidic and M is base and aluminum hydroxide being amphoteric would react with both 1

3. (a) NH4

 (b)

4. Add 100cm3  of 0.5M1 NaoH/50cm3 of 1M NaoH t 50cm3 of 0.5 H2SO4 in a beaker and shake, evaporate to saturation ½ and allow it to cool ½ for crystals to form, filter ½ and dry the crystals between filter papers ½

5. (a) When gases react, they do so in volumes that bear a simple ratio to one another and to the volumes of products if a gaseous, temperature and pressure remains constant.

 (b) CxHy(g) + O2(g) 🡺 CO2(g) + H2O(g) ½

 100 300 200 200

 1mol 3mol 2mol 2mol½

 CxHy(g) +3O2(g) 🡺 2CO2(g) + 2H2O(g) ½

 C4Hy(g) +3O2(g) 🡺 2CO2(g) + 2H2O(g) 

 C2H4

6. (a) i) Cu(s) 🡺 Cu2+(aq) +2e- 1

 ii) CU2+(aq) +2e- 🡺 Cu(s) 1

 (b) Blue colour of CuSO4 remains the same ½ the Cu2+ discharged at cathode were replaced when copper dissolves ½

7. Gas P – Hydrogen ½

 Solid R – Magnesium Oxide ½

 Solid T – Copper metals ½

 Liquids S – Water ½

8. (a) Chlorine is diatomic molecule while argon is monoatomic, therefore chlorine has a larger ½ molecular mass hence stronger/ more van der waal forces than argon.

 (b) S, ½ has smallest ½ radius and highest number of delocalized electrons ½ hence stronger ½ metallic bonding.

9. (a) Electolysis 1

 (b) To lower the m.p of aluminium oxide 1

 (c) Aluminium has thin oxide layer  which prevent it from reacting with oxygen.

10. (i) Dinitrogen tertaoxide/ N2­O4 1

 (ii) Insert a glowing splint inside the gas ½ jar the splint relight½

 (iii) 2Pb (NO3)2(s) 🡺 2PbO(s) + 4NO2(g) + O2(g) 1 (penalize ½ missing/wrong state symbols unbalanced)

11. (a) 

 (b) -Treatment of cancerous tumor through radioactivity.

 -Sterilizing hospital/surgical instrument/equipment by exposing them to gamma radioation

 -For providing power in heart pace setters.

 -Radioactive iodine is used in patience with defective thyroid to enable doctors to follow the path of iodine through the body. (Any two correct answer)

12. (a) A state of balance where the rate of forward reaction equals the rate of backward reaction1

 (b) More of HI forms ½ i.e favour the fowrd½ reaction

 (c) Has no effect ½ , molecules are equal on both sides of the system.

13. Q= 1t

 t= 32× 60+10=1930 seconds ½

 Q = 0.5× 1930 = 956C½

 If 0.44g = 965C

 88 g = ?

 ½ ½

 96500C - 1 mole of electron

 193000C =  + 2 sign must be there to score

14. (a) Bubbles of a colourless gas with pungent smell 1.

 -White crystals are blackened /charred to a mass of black spongy/frothy solid substance1

 (b) It is insoluble in water hence cannot be washed ½easily ½

15. 1

 1

16. (i) Sulphur/ S

 (ii) Sodium chloride/ NaCl

 (iii) Potassium chloride (KCl)/Potassium chlorate (I) / KClO

 Yellow deposit  and white solid ½

17. (a) Magnesium continues ½ to burn with a bright flame/Burning masgesium produce intense heat energy which decomposes ½ SO2 to yellow sulphur with oxygen. Magnesium combine with oxygen to form magnesium oxide.

 (Mark any two correct observations and 2 correct explanation)

 (b) Mg(s) + SO2(g) 🡺 MgO(s) + S(s)

18. (a)

|  |  |
| --- | --- |
| Physical | Chemical |
| * No new substance formed
* No change in mass
* Reversible
* Not accompanied by great heat change
 | * New substance formed
* Change in mass
* Irreversible
* Accompanied by great heat change
 |

 (b) Process I – Physical

 Process II – Chemical

19. NaoH(aq) HCl(aq) 🡺 NaCl(aq) +H2O(l)½

 Ratio 1:1 ½

 Moles of acid 

 Moles of NaoH in 1000cm3 = ½

 Conc = 0.6 × 40 ½ = 24g/l ½ = 24g/l½

20. (a) Atoms of the same element with the same atomic number but different mass number.

 (b)

  1 ½

 =24.263½

21. (a) Test-tube I : Effervescence occurred 1

 Test-tube II : No efferevescence 1

 (b) Ethanoic acid dissolves in water and dissociate partially hence producing hydrogen ½ ion which are responsible for acidic properties of the solution.

 In methylbenzene it only dissolves but does not dissociate ½ therefore no hydrogen ½ ions in the solution.

22. ΔH = MCΔT½

 ½

 Moles of ethanol = 16/46 = 0.3478 moles ½

 0.3478 moles – 163.8kJ ½

 1 mole - ½

23. (a)

 (b) Propylethanoate 1

 (c) 3-Bromo-2-methylpent-1-ene1

24. (a) Maximum mass of solute required to saturate 100g of solvent/water at a given temperature 1

 (b) mass of solid × 30.4-26.2 = 4.2g½

 mass of water = 42.4 – 30.4 =12g½

 12g of water dissolves 4.2g

 100g

 of water.½

25. i) 4NH3(g) + 5O(2)(g) 🡺 4NO(g) + 6H2O(l) NB: unbalanced – zero no or wrong state symbols symbols penalize ½

 ii) To provide activation energy for the reaction

 iii) 

26. (a)

 

 (b) Hsolution= ΔHhydration

 =891 + -884½ = +7kJ/mol ½

27. (a) Cooling1

 (b) Latent heat of fusion 1