# Candidate’s Name: ……………………………………………….............

**Signature: ………………………………… combination…………………………….**

# P525/1 CHEMISTRY

**Paper 1 PRIDE SECONDARY SCHOOL-MITYANA**

2 ¾ hours

**END OF TERM II EXAMINATIONS-2022**

# Uganda Advanced Certificate of Education S.5 CHEMISTRY

**Paper 1**

# 2 hours 45 minutes

***INSTRUCTIONS TO STUDENTS:***

***Answer all questions in section A and six questions in section B***

***All questions must be answered in the spaces provided***

***The Periodic Table, with relative atomic masses, is supplied.***

***Mathematical tables(3 – figure tables) are adequate or non-programmable scientific electronic calculators may be used***

***Illustrate your answers with equations where applicable. Where necessary, use the following:***

***Molar gas constant R = 8.31 JK-1 mol-1 Molar volume of a gas at s.t.p is 22.4 litres. Standard temperature = 273 K***

***Standard pressure = 101325 N m-2***

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| **For Examiner’s Use Only** | | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | Total |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

# Turn Over

**SECTION A (46 MARKS)**

1. a) Methylamine is a weak base
   1. What is **weak base**? *(1 mark)*

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* 1. Write the equation for the ionization of methylamine. *(1 mark)*

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* 1. Write the expression for the ionization constant of methylamine.

*(1 mark)*

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b) i) Calculate the hydrogen ion concentration in a 0.02M solution of methylamine. (*Kb = 4.4 × 10-4; Kw = 1 x 10-14 at 25oC*).

*(3 marks)*

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ii) Calculate the pH of the solution. *(1 mark)*

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1. Name the reagent that you would use to distinguish between the following pairs of compounds. In each case state what you would observe when the reagent is treated with each member of the pair.
2. CH3CH2Cl and Chlorobenzene *(2 marks)*

## Reagent:

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## Observations:

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1. CH3CH2OH and CH3OH *(2 marks)*

## Reagent:

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## Observations:

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1. CH3CHO and CH3CH2CHO *(2 marks)*

## Reagent:

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## Observations:

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1. Write the ionic equation for the reaction between sodium hydroxide and
2. Silicon(IV) oxide *(1 ½ marks)*

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1. Aluminum *(1 ½ marks)*

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1. Beryllium oxide *(1 ½ marks)*

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1. a) i) Define a ‘**complex ion**’. *(2 marks)*

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ii) Explain why transition metals form complexes. *(2 marks)*

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(b) Complete the following table about complexes of chromium and cobalt.

*(2 marks)*

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| **Complex** | **Oxidation state of metal ion** | **Co-ordination number** |
| [Cr(NH3)6]3+ |  |  |
| [CO(NH3)4(H2O)2]C*l*2 |  |  |

1. State what you would observe and write an ionic equation for the reaction between aqueous copper(II) sulphate solution and:
2. Excess concentrated hydrochloric acid *(2 ½ marks)*

## Observation

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## Equation

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1. Aqueous potassium iodide solution. *(2 ½ marks)*

## Observation

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## Equation

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1. Excess magnesium was added to 100 cm3 of 0.2 M copper(II) sulphate solution. The temperature rose by 16.9 oC.

a) Write an equation for the reaction. *(1½ marks)*

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(b) Calculate the enthalpy of the reaction. *(Density of the solution is*

*1.0 g/cm3. Specific heat capacity of the solution is 4.2 J/g/oC).*

*(2½ marks)*

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1. a) Define:
   1. **Bond energy**. *(02 marks)*

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* 1. **Heat of formation**. *(02 marks)*

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1. a) An alkyne X has molecular formula C4H6. Write the names and structural formulae of all possible isomers of X. *(2 marks)*

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1. **X** reacts with an ammoniacal solution of silver nitrate.
   1. State what is observed. *(½ mark)*

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* 1. Write the equation for the reaction that takes place. *(1 mark)*

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c) Write equations to show how **X** can be synthesized from ethene.

(*4 marks)*

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1. Explain the law of mass action. Illustrate your answer

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# SECTION B: (54 MARKS)

*Answer* **six** *questions from this section.*

*Additional questions answered will* **not** *be marked.*

1. Write equations to show how the following compounds can be synthesized. Indicate the reagents and conditions.

a) (CH3)2C = NOH from propane – 2 – ol. *(2 marks)*

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b) CH3CH(OH)CH3 from CH3CH2CH2Cl (3 marks)

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1. CH3CH2C ≡ CCH2CH2CH3 from But-l-ene. *(2 marks)*

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1. CH3COCH3 from CH3CHClCH2Cl *(2 marks)*

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1. (a) Write the formula and name of **one** ore of aluminium. *(1 mark)*

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1. In the extraction of aluminium, the ore is first digested with sodium hydroxide solution. Describe what happens and write equation(s) for the reaction (s ) that take place. *(3 marks)*

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1. Name the steps that are carried out after digesting the ore with sodium hydroxide. *(3 marks)*

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(c) Describe how pure aluminium is obtained from the purified ore. Write the equation for the reaction. *(2 marks)*

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1. a) Define
   1. **Electrolytic conductivity**. *(1 mark)*

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* 1. **Molar conductivity** *(1 mark)*

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1. The electrolytic conductivity of a 0.1 M ethanoic acid at 20o C is

1.96 x 10-2 Sm-1. Its molar conductivity at infinite dilution is

3.52 x 10-2 S m2 mol-1. Calculate:

1. The molar conductivity of ethanoic acid at 20oC. *(2 marks)*

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1. The degree of ionization of the acid at 20oC. *(1 mark)*

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1. The pH of the acid *(2 marks)*

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1. State **two** other factors other than concentration that can affect the pH of the acid. *(2 marks)*

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1. a) State **three** properties exhibited by chromium as a transition metal.

*(3 marks)*

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1. An aqueous solution of iron(II) salt was added to an acidified solution of chromium in the oxidation state of +6.
   1. State what was observed. *(1 mark)*

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* 1. Write half equations and the overall equation for the reaction that took place *(3 ½ marks)*

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1. i) State **one** application of chromium in the oxidation state of +6 in organic synthesis. *(½ mark)*

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ii) Write the equation to illustrate your answer. *(1 mark)*

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1. Hydrogen iodide decomposes according to the equation.

2 HI(g) → H2(g) + I2(g) ΔH = +11.3 kJ/mol.

a) Write an expression for the equilibrium constant (Kc) of the reaction.

*(½ mark)*

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1. 2.56 g of hydrogen iodide was heated in a 1000 cm3 bulb at 500 oC. At equilibrium the bulb was rapidly cooled to room temperature and broken under potassium iodide solution. The iodine liberated required 33.5 cm3 of 0.2 M sodium thiosulphate for complete reaction. Calculate
   1. The number of moles of hydrogen iodide that were heated.

*(1 mark)*

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* 1. The number of moles of iodine that were formed from the decomposition. *(2½ marks)*

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* 1. The value of Kc for the reaction at 500 oC. *(3½ marks)*

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1. i) State what would happen to the value of Kc if the temperature changed from 500 oC to 200 oC *(½ mark)*

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ii) Explain your answer. *(1 mark)*

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1. a) What is meant by “**hydrolysis of a salt**”? *(1 mark)*

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1. A solution was made by dissolving 2.675 g of ammonium chloride in water to make 1 litre of solution.
   1. Write the equation for the hydrolysis of ammonium chloride.

*(1½ marks)*

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* 1. Calculate the hydrogen ion concentration and hence the pH of the solution in (b) above *(5 marks)*

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ii) The degree of hydrolysis.

*(Kw = 1 x 10-14 at 25oC, Kh =1.75 x 10-5 ) (1½ marks)*

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1. Complete the equation and write an acceptable mechanism
2. CH3CHO+2,4-dinitrophenylhydrazine in acidic medium (5.5 marks)

(b)CH3CH2COCH3 +NaHSO3 (aq) …………………………………………………………………………… …………………………………………

***(3.5 marks)***

17. A compound Y contains 52.2% carbon, 13.0% hydrogen and the rest oxygen.

a) Determine the empirical formula of Y. ***(04marks)***

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b) When vapourised 0.1g of Y occupied 78.8cm3 at 107°C and 654mmHg.

(i) Calculate the formula mass of Y. ***(2 ½ marks)***

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(ii) Determine the molecular formula of Y. ***(01mark)***

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(iii) Write the structural formulae of all possible isomers of Y. ***(01mark)***

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(iv) Y does not react with sodium. Identify Y. ***( ½ mark)***

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PERIODIC TABLE

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 |  | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 |  | | | | | | | | | | | | | | | 1 | 2 |
| H | H | He |
| 1.0 | 1.0 | 4.0 |
| 3 | 4 |  | | | | | | | | | | 5 | 6 | 7 | 8 | 9 | 10 |
| Li | Be | B | C | N | O | F | Ne |
| 6.9 | 9.0 | 10.8 | 12.0 | 14.0 | 16.0 | 19.0 | 20.2 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Na | Mg | Al | Si | P | S | Cl | Ar |
| 23.0 | 24.3 | 27.0 | 28.1 | 31.0 | 32.1 | 35.4 | 40.0 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| 39.1 | 40.1 | 45.0 | 47.9 | 50.9 | 52.0 | 54.9 | 55.8 | 58.9 | 58.7 | 63.5 | 65. | 69.7 | 72.6 | 74.9 | 79.0 | 79.9 | 83.8 |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| 85.5 | 87.6 | 88.9 | 91.2 | 92.9 | 95.9 | 98.9 | 101 | 103 | 103 | 108 | 112 | 115 | 119 | 122 | 128 | 127 | 131 |
| 55 | 56 | 57 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Ti | Pb | Bi | Po | At | Rn |
| 133 | 137 | 139 | 178 | 181 | 184 | 186 | 190 | 192 | 195 | 197 | 201 | 204 | 207 | 209 | (209) | (210) | (222) |
| 87 | 88 | 89 |  | | | | | | | | | | | | | | |
| Fr | Ra | Ac |
| (223) | (226) | (227) |
|  | | | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 |
| La | Ce | Fr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu |
| 139 | 140 | 141 | 144 | (145) | 150 | 152 | 157 | 159 | 162 | 165 | 167 | 169 | 173 | 175 |
| 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 |
| Ac | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Ea | Fm | Mv | No | Lw |
| (227) | 232 | 231 | 238 | 237 | (244) | (243) | (247) | (247) | 251 | (254) | (257) | (256) | (254) | 260 |

**1**

# H – indicates Atomic number

1. **H – indicates relative Atomic mass 1.0**

# END