**Name: ……………………………………………………… Index No: …………….….……..………..……**

School: …………………………………………………….. Candidate’s Signature………….………………

Date: ……………….…………………………..

233/1

**CHEMISTRY**

**PAPER 1 (THEORY)**

**July/August 2019**

**Time: 2 Hours**

**SCHOOL BASED FORM 4 EXMINATION 2019**

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

**CHEMISTRY**

Paper 1

**Time: 2 Hours**

**INSTRUCTIONS TO CANDIDATES:**

* Write your **name** and **index number** in the spaces provided above.
* Sign and write the date of examination in the spaces provided above
* Answer **all** the questions in the spaces provided.
* All workings **must** be clearly shown where necessary
* Candidates must answer all the questions in English
* This paper consists of 15 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.

**For Examiner’s Use only:**

|  |  |  |
| --- | --- | --- |
| **QUESTION** | **MAXIMUM SCORE** | **CANDIDATE’S SCORE** |
| 1 – 28 | **80** |  |

1. a) Differentiate between exothermic and endothermic reaction. (1 mark)

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b) The table below gives bond energies of some covalent compounds.

|  |  |
| --- | --- |
| Bond | Bond energy kJ/Mole |
| C – H | 413 |
| O = O | 497 |
| C = O | 804 |
| H – O | 464 |

Calculate the enthalpy change for the combustion of methane in excess oxygen. (2 marks)

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1. A student added very dilute Sulphuric (VI) acid to three substances and recorded the observations shown in the table below.

|  |  |  |
| --- | --- | --- |
| Test | Substance | Gas given off |
| I | Carbon | Yes |
| II | Copper | No |
| III | Iron | No |

From which tests are the observations wrong? Explain. (3 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Describe how a pure sample of Lead (II) carbonate can be prepared starting with lead (II) oxide. (3 marks)

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1. In preparation of hydrogen sulphide, hydrochloric acid is reacted with metal sulphudes.
2. Name the metal sulphide used in preparing the gas. (1/2 mark)

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1. Write the equation for the reaction in (a) above. 1 mark)

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1. Give one physical test for hydrogen sulphide gas. (1/2 mark)

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1. 20cm3 of Potassium hydroxide solution containing 7.0g/dm3 were required for neutralization 0,18g of H2X acid. Calculate the relative formula mass of the acid.

(K = 39, O = 16, H = 1) (3 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. The table below shows some elements and their atomic numbers. The letters do not represent the actual symbols of the elements.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Element | E | F | G | H | I | K | L |
| Atomic Number | 11 | 10 | 20 | 14 | 13 | 4 | 8 |

1. From the letters given select two elements with the same chemical properties. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Write the formula of a compound formed when element H reacts with element L. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Identify the most stable element. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

Cr2O72- (aq) + 2OH- (aq) 2CrO72- (aq) + H2O(l)

Orange Yellow

State and explain the observation made if a few drops of sodium hydroxide are added to the equilibrium mixture. (2 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. A Sample of compound T containing sulphur and oxygen requires 28 seconds to diffuse through a hole. A similar volume of oxygen gas pass through the same hole in 20 seconds. Determine the molecular mass of J. (S = 32, O = 16) (2 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Use the reaction scheme below to answer the questions that follow.

H 2(g)

Process P

Alkanol N Propene Compound M

Ni

Conc. H2SO4

1. Draw the structure of alkanol N. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Name the (i) Process P. (1/2 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) Compound M (1/2 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. An oxide of potassium has molar mass of 110. If 2.75g of the oxide contains 1.95g of potassium, calculate the formula of oxide. (K = 39, O = 16.0). (3 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. The table below gives information about elements Q, R, S and W.

|  |  |  |  |
| --- | --- | --- | --- |
| Element | Atomic Number | Atomic radius (nm) | Ionic radius (nm) |
| Q | 3 | 0.134 | 0.074 |
| R | 5 | 0.090 | 0.012 |
| S | 13 | 0.143 | 0.050 |
| W | 17 | 0.099 | 0.181 |

1. In which period of the periodic table is element S? Give a reason. (2 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

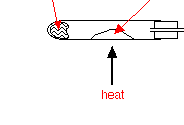
1. Explain why the atomic radius of Q is greater than that of R. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. When Magnesium is reacted in steam it forms a white solid and hydrogen gas.

Magnesium ribbon

Wet cotton wool



Heat

Heat

Complete the diagram to show how dry hydrogen gas can be collected. (3 marks)

1. The diagram below shows a set up that was used to determine the molar heat of combustion of methanol.



Metallic can

Lamp

Methanol

Tripod stnad

400cm3 of water

Thermometer

During the experiment the data given below was recorded.

Initial temperature of water = 250C

Final temperature of water = 340C

Mass of methanol + Lamp before heating = 125.0g

Mass of methanol + Lamp after heating = 124.5g

Calculate the

1. Heat evolved during the experiment.

(Density of water = 1g/cm3, Specific heat capacity = 4.2Jg-1k-1) (1 mark)

1. Molar heat of combustion of methanol. (C = 12, H = 1, O = 16) (2 marks)
2. The table below gives three experiments on the reaction of excess sulphuric (VI) acid and 0.5g of zinc done under different conditions. In each the volume of gas was recorded at different time internals

|  |  |  |
| --- | --- | --- |
| Experiment | Form of Zinc | Sulphuric (VI) acid solution |
| I | Powder | 0.8M |
| II | Powder | 1.0M |
| III | Granules | 0.8M |

On the axis below draw and label three curves that could be obtained from such results. (3 marks)

Volume of H2 (cm3)

Time Sec

1. Excess marble chips (Calcium carbonate) was pour in a beaker containing 1.5M dilute hydrochloric acid. The mixture was then filtered and the filtrate in the beaker was evaporated to dryness.

Explain what happens if the beaker and its contents were left in the open overnight. (2 marks)

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1. The table below shows the tests carried out on separate samples of water drawn from a river and the results obtained.

|  |  |
| --- | --- |
| Test | Results |
| 1. Addition of excess sodium hydroxide solution | White ppt formed dissolves in excess |
| 1. Addition of few drops of sodium carbonate | No effervescence/no bubbles/no white ppt |
| 1. Addition of dilute nitric (V) acid followed by a few drops of silver nitrate | White ppt |

1. Identify the cation and anion present in the water. (1 mark)

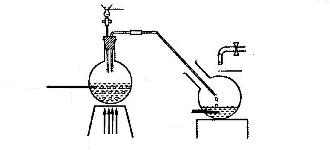
Cation - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Anion - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Write an ionic equation for the reaction which takes place in test (iii) above. (1 mark)

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1. A scientist can determine the age of a fossil by measuring the proportion of carbon – 14 present in a fossil. If the half life of carbon – 14 is approximately 5600 years, calculate the age of a piece of wood found to contain as much carbon – 14 as in a living material. (3 marks)
2. The set up below was used to prepare nitric (V) acid.



Heat

Solid T

Tap

Nitric (V) acid

Cold water

Flask P

Conc. H2SO4 acid

1. Give the name of solid T. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Write the equation for the reaction which took place in the flask P. (1 mark)

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1. Explain why nitric (V) acid is stored in dark bottles. (1 mark)

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1. Classify the following processes a either permanent or temporary. (3 marks)

|  |  |
| --- | --- |
| Process | Type of change |
| 1. Heating of Lead (II) oxide |  |
| 1. Obtaining Petrol from Crude oil |  |
| 1. Souring of milk |  |

**20.** Study the flow chart below and answer the questions that follow.

Gas that forms

a white precipitate

with lime water

Solid heat heat No effect

U

Solid

V

Dilute Gas that forms

HCl a white precipitate

with lime water

1. Write down the formula of solids.

U\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1/2 mark)

V \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1/2 mark)

1. Write down a balanced chemical equation between solid V and dilute hydrochloric acid.(1 mark)

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**21.** Study the information in the table below and answer the questions that follow.

|  |  |
| --- | --- |
| Salt | Solubility (g/100g water) at  400C 800C |
| CuSO4 | 27 37 |
| AgNO3 | 78 97 |

A mixture containing 36g of CuSO4 and 78g of AgNO3 in 100g of water at 800C was cooled to 400C.

1. Which salt was crystallised out? (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Calculate the mass of the salt that crystallised. (1 mark)
2. Name the process used to separate mixture. (1 mark)

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**22.**  Given the following half cells

L 2+ (aq) / L(s) E0 = -0.13V

Q 2+ (aq) / Q(s) E0 = +0.34V

1. Write the ionic equation for the half cell that undergoes (2 marks)
2. Oxidation

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ii) Reducation

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Calculate the e.m.f. of the resulting electro-chemical cell. (1 mark)

**23.**  Study the information given below and use it to answer the questions that follows.

|  |  |  |
| --- | --- | --- |
| Substance | Reaction with acids | Melting point (0C) |
| P | No reaction | -30 |
| S | Reacts explosively | 1190 |
| t | No reaction | 1728 |
| r | Reacts readily | 3075 |

Select

1. An oxide with giant atomic structure . (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. An oxide which dissolves in water to form an acidic solution. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**24.** 5.34 g of a salt of formula N2SO4 was dissolved in water. The sulphate was precipitated by adding excess Barium chloride solution. The mass of precipitate formed was 4.66g.

(Ba = 56, S = 32, O = 16) (3 marks)

1. Determine the moles of sulphate ion present. (1 mark)
2. Calculate the relative atomic mass of N in N2SO4. (2 marks)

**25.**  The following is an organic compound represented as CH3CH2COOCH3.

1. Name the alkanoic acid and alkanol used in making the compound above. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Name the class of organic compound to which the compound above belongs. (1 mark)

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1. Write an equation for reaction that takes place when the alkanol in (i) above is reacted with potassium . (1 mark)

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**26.**  The set-up below was used to electrolyse aqueous copper (II) sulphate.

Bulb

Platinum electrodes

Copper (II) sulphate

1. Explain why the bulb light brightly at the beginning of the experiment and becomes dim after sometime. (2 marks)

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1. Write the ionic equation of the reaction that took place at the cathode. (1 mark)

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**27.**  a) An element Z has a relative atomic mass of 44. When 0.5 A was passed through the molten

chloride of Z for 18 minutes and 5 seconds, 0.22g of Z were deposited at the cathode.

Determine the charge on an ion of Z. (1F = 96500C) (3 marks)

**28.**  Name the process which takes place when :-

1. Iodine changes directly from solid to gas. (1 mark)

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1. Fe2+ (aq) changes directly to F 3+ (aq) . (1 mark)

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

(1 mark)

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