**Name: ......................................................................................................................... Class: ..................**

**Candidate’s signature: ......................... Date:.................................... Index No: ............................**

**233/1**

**CHEMISTRY**

**Theory**

**Paper 1**

**Time: 2 Hours**

**KASSUJET JOINT EVALUATION EXAMINATION**

**Kenya Certificate of Secondary Education**

**Chemistry (Paper 1)**

**Instructions to Candidates**

(a) *Write your name and index number in the spaces provided above.*

*(b) Sign and write the date of examination in the spaces provided above.*

*(c) Answer* ***ALL*** *the questions in the spaces provided in the question paper.*

1. *KNEC Mathematical tables and electronic calculators may be used for calculations.*
2. *All working* ***MUST*** *be clearly shown where necessary.*
3. ***This paper consists of 13 printed pages.***
4. ***Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***
5. ***Candidates should answer the questions in English***

**For examiners’ use only.**

|  |  |  |
| --- | --- | --- |
| Questions | Max-score | Candidates score |
| 1-31 | 80 |  |

 ***Turn over***

1. Study the set-up shown below and use it to answer the questions that follow.

Copper oxide

Liquid droplets

Flame

Dry hydrogen gas

 Point(s)

Heat

Anhydrous cobalt II

Chloride

Clamp

1. State the observations made at the end of the experiment on:

(i) The cobalt II chloride papers. **(1 mark)**

 (ii) Copper II oxide powder. **(1 mark)**

1. (i) Why was excess hydrogen ignited? **(1 mark)**

(ii) Write a fully balanced equation for the reaction occurring at the flame

at point(s).  **(1 mark)**

2. A student used the reaction between steam and heated magnesium metal to collect a dry sample of hydrogen gas. Complete the diagram to collect the gas. **(3 marks)**

Glass wool soaked in water

Magnesium ribbon

Heat

Heat

Write the equation for the reaction producing the hydrogen gas in the above reaction. **(1 mark)**

3. The following diagram represents a set-up showing how changes of state from solid to liquid could be investigated.

Q

P

Boiling tube

Beaker

Water

Heat

(a) Identify the apparatus P and Q and state their uses. **(2 marks)**

 P -

 Q -

4. (a) Define the term “Gay Lussac’s law”. **(1 mark)**

 (b) When 100cm3 of gaseous hydrocarbon (Cx Hy) burn in 400cm3 of oxygen,

100cm3 of oxygen is unused, 200cm3 of steam are formed. Deduce the equation for the reaction and the formula of the hydrocarbon.  **(2 marks)**

5. If it takes 30 seconds for 100cm3 of carbon (IV) oxide to diffuse across a porous plate. How long will it take 150cm3 of nitrogen (IV) oxide to diffuse across the same plate under similar conditions? (C = 12.0, N = 14.0, O = 16.0) **(2 marks)**

6. Define Charles’ law. **(1 mark)**

7. The table below shows the solubility of a salt at various temperatures.

|  |  |
| --- | --- |
| Temperature oC | Solubility (g/100g water) |
| 0 | 36 |
| 40 | 30 |
| 80 | 25 |
| 100 | 22 |
| 120 | 20 |

 (a) Define the term fractional crystallization. **(1 mark)**

(b) A saturated solution of the salt at 400C was heated to 1000C. State and

explain the observation made. **(2 marks)**

1. Calculate the mass of salt formed when a saturated solution of the salt at 00C is placed in a water bath maintained at 1000C. **(1 mark)**

8. The structures below are a representation of cleansing agents M and N.

 R $ OSO\_{3}^{-}Na^{+}$ $R- COO^{-}Na^{+}$

M

N

 (i) Identify the agents.  **(1 mark)**

 M -

 N -

(ii) Write an equation for the compound formed when agent N is used with water containing calcium nitrate salt. **(1 mark)**

(iii) A water engineer analyzed water from a borehole and found out that it contained magnesium chloride impurities. State any two methods used to make the water suitable for washing using agent N. **(1 mark)**

9. Calculate the percentage abundance of two other isotopes of element A with three isotopes, (30, 32, 35). Given that the R.A.M is 30.5 and percentage abundance of 35 is 5%.  **(2 marks)**

10. An element Z has ionic configuration of $Z^{+}-2.8. $The element is burned in excess oxygen and the product is then added to water. Write two possible equation for the reactions which took place. **(2 marks)**

11. Phosphorus (III) oxide has a lower melting point than calcium chloride. Explain.

 **(2 marks)**

12. Describe how you would prepare silver carbonate starting with silver. **(3 marks)**

13. Use the table below to determine the enthalpy change for the reaction between hydrogen and chlorine.  **(3 marks)**

 Bond Bond Energy kJ/mole

 H – H 435

 H – Cl 431

 Cl – Cl 244

14. Explain why hydrogen sulphide cannot be used as a fuel, though it can burn to give out useful heat energy. **(1 mark)**

15. (a) Explain why cryolite is added to aluminium oxide before electrolysis.

 **(1 mark)**

(b) During electrolysis 40,000 amperes was passed through a Hall cell for 10 hrs. Calculate the mass of aluminium deposited at the cathode in kg.

 (IF = 96500C, Al = 27) **(3 marks)**

16. (a) Define the term half-life. **(1 mark)**

(b) A certain nuclide has a half-life of 2.5 hours. What percentage of a given mass of the nuclide will be left after 7.5 hrs? **(2 marks)**

17. Explain how increase in temperature affects the rate of a given reaction.

**(2 marks)**

18. Write down the preliminary steps undertaken to concentrate an ore during extraction of metals. **(2 marks)**

19. Write down the formula of the chief ore of Aluminium. **(1 mark)**

20. Dilute sulphuric (VI) acid was added to a compound P of magnesium. The solid reacted with the acid to form a colourless solution Q and a colourless gas R which formed a white precipitate when bubbled through lime water. Identify:

 **(1 ½ marks)**

1. compound P -
2. solution Q -
3. colourless gas R -

21. During an experiment on the reduction of an oxide of copper, the following data was obtained.

 Mass of empty boat = 25.0g

 Mass of empty boat + oxide of copper = 29.0g

 Mass of boat + copper (after reaction) = 28.2g

 Determine the empirical formula. **(3 marks)**

 (Cu = 64, O = 16)

22. Calculate the number of atoms in 26.4g of calcium carbonate.

(Ca = 40, C = 12, O = 16, L = $6.02×10^{23}$)  **(2 marks)**

23. Lead (II) nitrate was heated completely.

 (a) Write an equation for heating lead (II) nitrate. **(1 mark)**

(b) Calculate the mass of the oxide formed given that 0.2 moles of the nitrate was heated. (Pb = 207, O = 16) **(2 marks)**

24. Draw and name two branched isomers of the compound whose chemical

formula is $C\_{5}H\_{12}$. **(2 marks)**

25. (a) Complete the following table based on organic compounds. **(1 mark)**

|  |  |  |
| --- | --- | --- |
|  | Compound | Reagents needed for preparation  |
| (i) | Ethyne |  |
| (ii) | Ethane |  |

 (b) Write chemical equations to represent the reaction in (a) above.

 **(2 marks)**

 (i)

 (ii)

(c) An organic substance (Q) reacted with ethanoic acid to form pleasant smelling compound $CH\_{3}CHOOCH\_{2}CH\_{2}CH\_{3}$.

 (i) What conditions will be required to form the product? **(1 mark)**

(ii) If another compound with a chemical formulas $C\_{3}H\_{6}$ has to be formed from compound Q, what would be the conditions required in this process. **(1 mark)**

26. (a) Give the formula of the Monomer used during the formation of the following

polymer. **(1 mark)**

 H H H H

 C C C C

 Cl H Cl H

 (b) State any use of the polymer in (a) above. **(1 mark)**

(c) Other than using universal indicator explain how one can differentiate between the following chemicals.

 Propanol and propanoic acid. **(1 mark)**

27. The melting points of oxygen and sulphur are -2160C and 1130C respectively yet the two elements belong to group VI in the periodic table. Explain. **(2 marks)**

28. Which type of Sulphur is formed under the following conditions?

|  |  |  |
| --- | --- | --- |
|  | Conditions | Type of Sulphur |
| (i) | Above 960 | **( ½ mark)** |
| (ii) | Pouring boiling Sulphur into cold water | **( ½ mark)** |
| (iii) | Rapidly cooling Sulphur vapour | **( ½ mark)** |
| (iv) | Mixing sodium thiosulphate with dilute hydrochloric acid | **( ½ mark)** |

29. When dry chlorine is passed over heated iron in a combustion tube, a brown solid forms on the cooler parts of the combustion tube.

 (i) Name the brown solid. **(1 mark)**

 (ii) Why does the brown solid form on the cooler parts of the combustion?

 **(1 mark)**

(iii) What will be the pH of the solution formed when the brown solid is dissolved in water? **(1 mark)**

(iv) Chlorine gas is poisonous yet it is used to treat water. Explain. **(1 mark)**

30. The diagrams below show the apparatus used to investigate one of the properties of carbon.

Boiling tube **A**

Boiling tube **B**

Copper II oxide / carbon mixture

 Aluminium oxide / carbon mixture

 Heat

Heat

State and explain the observations made in each boiling tube. **(2 marks)**

31. The diagrams below show the apparatus used to investigate the properties of carbon IV oxide gas.

Deflagrating spoon

 Gas Jar X

 Carbon IV oxide

Burning sulphur

Gas Jar Q

CO2(g)

Burning Mg

 (i) State and explain the observations made in each gas jar. **(2 marks)**

 (ii) State **one** industrial use of carbon (IV) oxide. **(1 mark)**