HOLA SECONDARY SCHOOL

CHEMISTRY FORM THREE PAPER ONE 233/1

TIME: 2 HOURS

NAME…………………………………………………………ADM NO………………CLASS………………………

**Instructions to Candidates**

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

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

*(d) Mathematical tables and electronic calculators may be used.*

*(e) All working must be shown clearly where necessary.*

### For examiner’s use only

|  |  |  |
| --- | --- | --- |
| **Questions** | **Maximum score** | **Candidates score** |
| **1 – 29** | **80** |  |

1. You are provided with water and usual laboratory apparatus. Describe how you would fully separate solid lead (II) carbonate from a mixture of lead II carbonate, iron fillings and sodium carbonate. (3 marks)

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

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

2. Explain how a sample of solid lead (II) chloride can be prepared using the following reagents: dilute nitric (V) acid, hydrochloric acid and lead (II) carbonate. (2 marks)

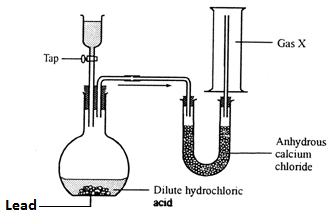
………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

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

3. Name another gas which is used together with oxygen in welding. (1mark)

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

4. In an attempt to prepare dry hydrogen gas, a class set up the experiment below:



(a). Identify **one** mistake in the set up. (1mark)

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

(b). Write a chemical equation for the reaction that occurs in the conical flask. (1mark)

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

(c). State **two** observations made during the experiment. (2marks)

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

5. Nitrogen gas diffuses through a porous plug at the rate of 10 cm-3 min-1 and gas A diffuses at a rate of 5.9 cm-3 min-1. Calculate the molar mass of gas A. (N = 14.0) (2 marks)

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

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

6. During welding of fractured railway lines by thermite reaction 12g of oxide of iron is reduced by aluminium to 8.4g of iron. Determine the empirical formula of the oxide. (Fe = 56, O =16).

(3 marks)

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

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

7. Determine the relative atomic mass of the element whose isotopic mixture occur in the given proportions. (2 marks)



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

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

8. Explain why very little carbon (IV) oxide gas is evolved when dilute sulphuric (VI) acid is added to lead (II) carbonate. (1mark)

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

9. An electric current was passed through a solution of molten potassium fluoride using inert electrodes.

(a). Name the products at:

(i). Anode (1 mark)

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

(ii). Cathode. (1 mark)

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

(b). Write an equation for the reaction at the anode. (2marks)

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

10. (a). Both sodium and aluminium are metals in period 3, yet sodium has a much lower melting point than aluminium. Explain (2 marks)

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

(b). Explain why electrical conductivity of metals decreases with increase in temperature.

(2 mks)

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

11.Phosgene is a compound of chlorine, carbon and oxygen, used to make polyurethane and dyes. Its simplest formula is Cl2CO. Draw a Lewis dot (**.**) and cross (**x**) diagram to represent a molecule of phosgene. (2 marks)

12. The diagram below shows how carbon (II) oxide gas can be prepared starting with carbon (IV) oxide and solid W. Study it and answer the questions that follow.



(a). With reasons state a suitable location where such an experiment should be rightly conducted.

(1mark)

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

(b). what is the purpose of concentrated potassium hydroxide? (1mark)

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

(c). Identify solid **W.** (1 mark)

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

(d). Complete the diagram to show how dry carbon (II) oxide can be collected. (2 marks)

13. The atomic and ionic radii of two elements M and N were given as in the table below. M and N belong to the same period

|  |  |  |
| --- | --- | --- |
| **Element** | **Atomic radii (nm)** | **Ionic radii (nm)** |
| M  N | 0.136  0.099 | 0.065  0.181 |

(a) Identify the element, which is found to the left of the other in the periodic table and explain your answer. (1mark)

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

(b) Compare the atomic and ionic radii of the element N and suggest a reason for the difference.

(2 marks)

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

14. A wooden splint was slipped through a region of a particular flame in the laboratory and was burnt as shown in the diagram below.



(i). Name the type of flame the splint was slipped through. (1mark)

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

(ii). Stating the region explain why the splint was burnt the way it is shown in the diagram.

(2 marks)

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

(iii). State **one** disadvantage of using the above type of flame in the laboratory. (1mark)

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

15. The diagram below shows a set up arranged by a student for an experimental investigation. Study it and answer the questions that follow.



(a). State the observations made during the experiment. (1mark)

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

(c). Explain the observations in (a) above. (2 marks)

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

16. Helium, He, is the second element in the Periodic Table. Tritium is the isotope of hydrogen 3H.

What is the same in an atom of 4He and an atom of 3H? (1mark)

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

17. X, Y and Z represent different halogens. The table shows the results of nine experiments in which aqueous solutions of X2, Y2 and Z2 were separately added to separate aqueous solutions containing X–, Y– and Z– ions.

|  |  |  |  |
| --- | --- | --- | --- |
|  | X-(aq) | Y-(aq) | Z-(aq) |
| X2(aq) | No reaction | No reaction | No reaction |
| Y2(aq) | X2 formed | No reaction | Z2 formed |
| Z2(aq) | X2 formed | No reaction | No reaction |

Arrange the ions X–, Y– and Z– in order of their decreasing strength as reducing agents? (1mark)

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

18. Which factor helps to explain why the first ionization energies of the Group I elements decrease from lithium to sodium to potassium to rubidium? (1mark)

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

19. Tanzanite is used as a gemstone for jewellery. It is a hydrated calcium aluminium silicate mineral with a chemical formula Ca2Al xSiyO12(OH).6½H2O. Tanzanite has RFM of 571.5.

Its chemical composition is 14.04 % calcium, 14.17 % aluminium, 14.75 % silicon, 54.59 % oxygen and 2.45 % hydrogen. What are the values of x and y? (H = 1.0, O = 16.0, Al = 27.0, Si = 28.1, Ca = 40.1) (3 marks)

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

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

20.(a). Name the type of bonding that exists between water molecules. (1 mark)

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

(b) Draw a diagram to show this bonding. Use displayed formulae of two water molecules. Clearly mark and label the bond angle **between** the water molecules. (2 marks)

21. A glass bulb of capacity 350 cm3 contains some hydrogen gas at s.t.p. The gas was then carefully transferred to another glass bulb of capacity 300 cm3 at a temperature of 50oC. Calculate the new pressure of the hydrogen gas. (2 marks)

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

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

22. a) State **Boyles law** ( 1 mk )

b) Sketch a graph that represents Charles’ law ( 2 mks )

c) A gas occupied a volume of 250cm3 at -23ºC and 1 atmosphere. Determine its volume

At 127ºC when pressure is kept constant. (2 mks )

23. How many chloride ions are present in 1.7g of magnesium chloride crystals?

(Avogadro’s constant = 6.0 x 1023, Mg = 24, Cl = 35.5) (2 mks )

24. When hydrogen is burnt and the product cooled, the following results are obtained as shown

in the diagram below:

Dry hydrogen

Liquid **Y**

Burning hydrogen

Ice cold water

Clamp

Clamp

(a) Write the equation for the formation of liquid **Y** (2mks)

(b) Give a chemical test for liquid **Y** ( 2 mks )

25. Below is a list of oxides.

MgO, N2O, K2O, CaO and Al2O3

Select:-

a) A neutral oxide. (1 Mk)

b) A highly water soluble basic oxide. ( 1 mk )

c) An oxide which can react with both sodium hydroxide solution and dilute hydrochloric acid.( 1 mk )

26.Analysis of a compound showed that it had the following composition: 69.42% carbon, 4.13% hydrogen and the rest oxygen.

1. Determine the empirical formula of the compound. (C = 12.0, H = 1.0, O = 16.0)

(2 marks)

1. If the mass of one mole of the compound is 242, determine its molecular formula (2marks )

27. The grid below shows part of a periodic table. The letters do not represent the actual

Symbols of the elements

F

H

I

G

1. Select the:
   1. element which has the largest atomic radius ( 1mk )
   2. Most reactive non-metal ( 1 mk )
2. Show on the grid the position of the element J which forms J2 ions with electronic configuration 2, 8, 8. ( 1 mk )

28. The table below shows the PHvalues of solutions I, II, III and IV.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Solution | I | II | III | IV |
| PH | 2 | 7 | 11 | 14 |

A) Which solution is likely to be that of calcium hydroxide? (1mk)

B) Select the solution in which a sample of aluminium oxide is likely to dissolve. Give reason for your answer (1mk)

29. 15.0cm3 of ethanoic acid (CH3COOH) was dissolved in water to make 500cm3 of solution.

Calculate the concentration of the solution in moles per litre

[C=12, H = 1, O = 16, density of ethanoic acid is 1.05g/cm3] (3mks)