**402 S. H. S. C. E.**
**May 2010**
**CHEMISTRY 1 & 2**
**Objective and Essay Tests**
2½hours

**Name**.....

**Indentification Number**.....

# THE WEST AFRICAN EXAMINATIONS COUNCIL

## Senior High School Certificate Examination

## CHEMISTRY

May 2010 2½ hours

*Do* **not** *open this booklet until you are told to do so. While you are waiting, read and observe the following instructions carefully. Write your* **name** *and* **identification number** *in the spaces provided above.*

*This paper consists of* **two** *parts: Paper* 1 *and* 2. *Answer Paper* 1 *on your Objective Test answer sheet and Paper* 2 *in your Answer booklet. Paper* 1 *will last* ***1 hour*** *after which the answer sheet will be collected. Do* **not** *start Paper* 2 *until you are told to do so. Paper* 2 *will last* ***1½ hours****.*

## PAPER 1

OBJECTIVE TEST

[40 marks] 1hour

1. Use **2HB** pencil throughout
2. On the objective answer sheet supplied, provide the following details **correctly**.
   (*a*) Supply the information required in the spaces marked *CENTER NAME, CENTER No., SCHOOL NAME* and *SCHOOL No.*
   (*b*) In the space marked *STUDENT'S NAME*, write your **surname** followed by your **other names**. Write your *IDENTIFICATION NUMBER* in the space marked *STUDENT No.*
   (*c*) In the spaces marked *SUBJECT* and *GRADE*, write *CHEMISTRY* and 12TH in that order.
   (*d*) In the box marked *IDENTIFICATION NUMBER*, provide your **identification number** vertically in the spaces on the left-hand side, and shade each numbered space in line with each digit. This identification number must be the same as the one indicated on your Admission Slip. Repeat the process with the correct information for the box marked *YEAR OF FIRST ENTRY.*
   (*e*) In the box marked *Subject Code*, write the digits 402 vertically in the spaces on the left-hand side. **Shade** the corresponding numbered spaces as you did for your identification number.
3. An example is given below. This is for a male candidate whose *name* is Joseph Kerkula TOKPAH. His *identification number* is 101011379, his first entry is in 2010 and he is offering *Chemistry.*

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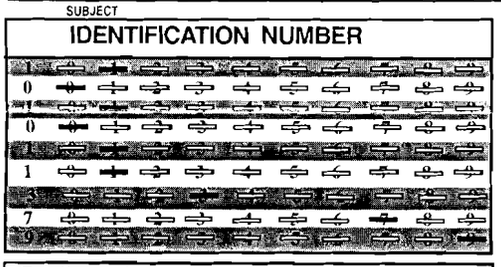
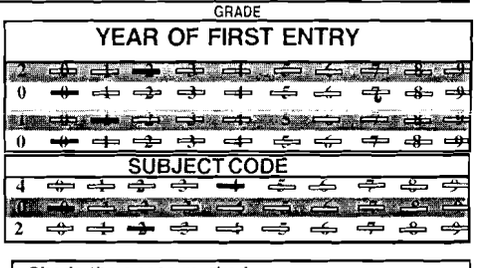
|---|---|
| ST.BROWNE HIGH SCHOOL | 891001 |
| CENTER NAME | CENTER No. |
| SWEN S. TOE ACADEMY | 101011 |
| SCHOOL NAME | SCHOOL No |
| TOKPAH JOSEPH KERKULA | 003 |
| STUDENT NAME | STUDENT No |
| CHEMISTRY | 12TH |
| SUBJECT | GRADE |




For Supervisors only
If a candidate is absent shade this space.

Shade the space marked
M (for Male) or F (for Female)
In this box

M F

*Answer all the questions* **Time: 1 hour**

*Paper 1 consists of* ***sixty*** *questions. Each question is followed by* ***four*** *options lettered* **A to D**. *Find out the correct option for each question and then shade in* ***pencil*** *on your answer sheet, the answer space which bears the same letter as the option you have chosen. Give only* ***one*** *answer to each question.*
*An example is given below.*

*Which of the following formulas is the formula of the compound ammonia?*

*A.* *Am*
*B.* $NH_3$
*C.* $Nh^3$
*D.* *Amm*

*The correct answer is $NH_3$ which is lettered B and therefore answer space B would be shaded.*

[A] [■] [C] [D]

**1.** The **correct** systematic name for $Fe_2S_3$ is
A. Iron (III) sulfate.
B. Iron (II) trisulfide.
C. Iron (III) sulfide.
D. Iron (III) sulfite.

**2.** The oxidation number of hydrogen in $CaH_2$ is
A. + 2.
B. - 2.
C. - 1.
D. +1.

**3.** Ethanol and water mixture can **best** be separated by
A. decantation.
B. separating funnel.
C. evaporation.
D. fractional distillation.

**4.** The cation in the compound, $NH_4Cl$ is
A. nitrogen ion.
B. hydrogen ion.
C. chloride ion.
D. ammonium ion.

**5.** An alkene with ten hydrogen atoms is called
A. butone .
B. decane.
C. pentene.
D. butene.

**6.** To which block does an element with 19 as its atomic number belong?
A. s-block
B. f- block
C. d -block
D. p-block

**7.** Substances that absorb water from the atmosphere but **do not** produce solutions are said to be
A. efflorescent.
B. hydroscopic.
C. deliquescent.
D. effervescent.

**8.** The general formula for Ethers is
A. ROH.
B. ROR.
C. RCOOR.
D. RX.

**9.** Which of the following scientists discovered the negatively charged subatomic particle?
A. Rutherford
B. Chaderlick
C. Thomson
D. Priestly

**10.** What volume will 4.0 moles of helium gas occupy at 2.94 atmospheric pressure and $60^0$C? [ R = 0.0821 L. atm/mol. K]
A. 30.7L
B. 3.72L
C. 37L
D. 39L

**11.** If a given volume of methane diffuses in 20sec, how long will it take the same volume of sulphur (IV) oxide to diffuse under the same conditions? [$CH_4$ = 16, SO2 = 64]
A. 5sec
B. 80sec
C. 40sec
D. 60sec

**12.** Chemical reaction can be made to proceed **faster** by the following processes **except**
A. grinding a solid reactant.
B. stirring the mixture.
C. changing the vessel.
D. using a suitable catalyst.

**13.** A radioactive substance has an original mass of 80.0g. After 4 half-life, what is the mass of the radioactive substance?
A. 5.00g
B. 10.0g
C. 20.0g
D. 40.0g

**14.** A nucleus is bombarded by a small particle. The product has 2 more protons and 2 more neutrons than the original nucleus. The small particle is a/an
A. proton.
B. neutron.
C. alpha.
D. beta particle.

**15.** Which of the following atoms has 36 neutrons?
A. $^{63}_{29}Cu$
B. $^{65}_{29}Cu$
C. $^{67}_{30}Zn$
D. $^{69}_{31}Ga$

**16.** Which isotope below contains the **most** neutrons?
A. $^{60}_{28}Ni$
B. $^{60}_{27}Co$
C. $^{60}_{29}Cu$
D. $^{60}_{30}Zn$

**17.** When the rate of a chemical reaction is decreased, which explanation is possible?
A. More reactant was added.
B. A catalyst was added.
C. The temperature decreased.
D. The temperature increased.

**18.** Consider the following redox equation $A_{(s)} + B^{2+}_{(aq)} \rightarrow A^{2+}_{(aq)} + B_{(s)}$ . The half equation for the reduction reaction is
A. $B^{2+}_{(aq)} \rightarrow B_{(s)} + 2e^-$.
B. $A_{(s)} \rightarrow A^{2+}_{(aq)} + 2e^-$.
C. $B^{2+}_{(aq)} + 2e^- \rightarrow B_{(s)}$ .
D. $A_{(s)} + 2e^- \rightarrow A^{2+}_{(aq)}$

**19.** What is the oxidation number of phosphorus in $P_4O_{10}$?
A. +20
B. +4
C. +5
D. -3

**20.** For any period, in which family is the element with the **highest** ionization energy ?
A. Alkali metal
B. Alkaline earth metal
C. Halogen
D. Noble gas

**21.** What charge do halogens have when they form ions?
A. -1
B. -2
C. +1
D. +2

Turn over

**22.** A certain mass of water cools from 52.5°C to 31.2°C. If 5,956 Joules of heat is released, what is the mass of the water?
[ $H_20C_p = 4.18$ J/g°C]
A. 66.9g
B. 45.7g
C. 27.1g
D. 3.64g

**23.** 12.5g of $Al_2(SO_4)_3$ is dissolved in 150.0g of water. What is the mass percent of the solution?
A. 7.69%
B. 8.33%
C. 9.09%
D. 12.5%

**24.** Which of the following is a physical change?
A. Paper burning
B. Glass shattering
C. Iron rusting
D. Food digesting

**25.** What is the shape of the p-suborbital?
A. Spherical shape
B. Box shape
C. Dumbbell shape
D. Triangular shape

**26.** What is the name of the compound $PCl_3$?
A. Phosphate chloride
B. Phosphorus tetrachloride
C. Phosphorus trichloride
D. Phosphorus chloride (III)

**27.** Isotopes have the same number of protons, but differ in
A. atomic number.
B. number of neutrons.
C. quantum.
D. Avogadro's number.

**28.** If the pressure on a gas at -23°C is doubled but its volume is held constant, what will its final temperature be in degrees Celsius?
A. -227°C
B. -46°C
C. +46°C
D. +227°C

**29.** KOH reacts with $H_2SO_4$. What volume of 0.75M $H_2SO_4$ is required to completely neutralize 58.5 mL of 50.0M KOH ?
A. 0.0195 $cm^3$
B. 0.0195 mL
C. 195.0 $cm^3$
D. 19.5 mL

**30.** Copper has two natural isotopes, $^{63}_{29}Cu$ and $^{65}_{29}Cu$. What is the percentage by mass of the heavier isotope if the relative atomic mass of copper is 63.54?
A. 73%
B. 27%
C. 65%
D. 86%

**31.** What are the spectator ions in the reaction given below
$KCl_{(aq)} + AgNO_{3(aq)} \rightarrow KNO_{3(aq)} + AgCl_{(aq)}$?
A. $K^+$ and $NO_3^-$
B. $Ag^+$ and $Cl^-$
C. $K^+$ and $Cl^-$
D. $K^+$, $NO_3^-$ and $Cl^-$

**32.** Non-polar covalent bond results from
A. losing of electrons.
B. gaining of electrons.
C. equal sharing of electrons.
D. unequal sharing of electrons.

**33.** Aluminum is a group 13 element. How many valence electrons does it have?
A. 3
B. 5
C. 8
D. 13

**34.** Non-metal oxides are
A. acid anhydrides.
B. basic anhydrides.
C. salt anhydrides.
D. amphoteric oxides.

**35.** The **highest** state of an atom is known as
A. ground state.
B. solid state.
C. liquid state.
D. excited state.

36. The reaction between Group VIIA elements and an unsaturated hydrocarbon is called
A. chlorination.
B. hydrogenation.
C. esterification.
D. halogenation.

37. Hydrocarbons with the general formula, $C_nH_{2n-2}$ belong to
A. acetylene series.
B. paraffin series.
C. olefin series.
D. lyman series.

38. A metal oxide in which oxygen has the oxidation number of -½ is a/an
A. peroxide.
B. super oxide.
C. oxide.
D. acid oxide.

39. Dry ice is the solid form of ?
A. $H_2O$.
B. $NO_2$ .
C. CO .
D. $CO_2$.

40. At what temperature will 0.2 moles of oxygen occupy 5.0Liter at 1.5 atm? [R = 0.0825(atm)(L)(mol)(4)]
A. $182^0C$
B. $82.1^0C$
C. $28.1^0C$
D. $812^0C$

41. Which of the following statements is **true** about reduction reaction?
A. Losing of electrons
B. Reaction going in the positive direction
C. Gaining of electrons
D. Neither gaining nor losing of electrons

42. An electrolytic cell converts
A. chemical energy to electrical energy.
B. electric energy to electrical energy.
C. chemical energy to kinetic energy.
D. electrical energy to mechanical energy.

43. The d-block elements are known as
A. alkali metals.
B. alkaline metals.
C. transitional metals.
D. metalloids.

44. The bonds formed between sodium (Group IA) and halogen (group VIIA) elements are
A. covalent.
B. ionic.
C. polar covalent.
D. nonpolar covalent

45. In an electrolytic cell, positive ions migrate to the
A. cathode.
B. cation.
C. anode.
D. anion.

46. The introduction of a suitable catalyst in a chemical reaction leads to
A increase in formation of activation complex.
B decrease in formation of activation complex.
C increase in reaction rate.
D no change in reaction rate.

47. Aluminium is extracted by the
A. Habor process.
B. Hall process.
C. Solvay process.
D. Frasch process.

48. The process in which a very heavy nucleus splits into medium-mass nuclei is referred to as
A. fission reaction.
B. fusion reaction.
C. composition reaction.
D. decomposition reaction.

**49.** Which quantum number determines the distance of an electron from the nucleus of an atom?
A. Orbital
B. Principle
C. Spin
D. Magnetic

**50.** A lone pair donor is
A. Bronsted-Lowry acid.
B. Arrhenius-acid.
C. Lewis-base.
D. Lewis-acid.

**51.** The IUPAC name for the compound, $CH_3-CH=CH-C(CH_3)_2-CH_3$ is
A. methyl – 2 – pentene.
B. 2, -dimethyl1-3-pentene.
C. 3,-dimethyl-2-pentene.
D. 3,-dimethyl-2-pentyne.

**52.** Given the equation, $H_2 + O_2 \longrightarrow H_2O$, what volume of water, is produced at STP from 2 moles of hydrogen gas?
A. 4.8L
B. 2.4L
C. 3.6L
D. 12L

**53.** The treatment of rubber with heat and sulfur to improve the rubber quality is termed as
A. polymerization.
B. vulcanization.
C. dimerization.
D. sulfation.

**54.** The concentration of a solution made by dissolving 10.0 Kg of sodium hydroxide in 2 Liters of solution is (Na =23, 0 = 16, H =1)
A. 10M
B. 1.0M
C. 0.1M
D. 100M

**55.** The combined enthalpy-entropy function of a system is called
A. kinetic energy.
B. potential energy.
C. solar energy.
D. free energy.

**56.** Hess's Law states that the total enthalpy change for a reaction
A. is independent of the route taken
B. is dependent on the route taken
C. changes when the conditions of the reactants change
D. changes with the volume of the reaction vessel.

**57.** A helium-filled balloon has volumes of 100.0L at $50^0$C and 1.09 atm. What volume will be required to occupy at 650 mm Hg and $10^0$C?
[ 1 atm = 760 mmHg]
A. 145.5L
B. 415.5L
C. 154.5L
D. 545.1L

**58.** A salt with a denotable hydrogen ion is a/an
A. basic salt.
B. acidic salt.
C. neutral salt.
D. table salt.

**59.** Unlike salt, sugar dissolved in water will **not** supply electric current. Sugar is therefore a/an
A. electrolyte.
B. nonelectrolyte.
C. conductor.
D. catalyst.

**60.** Given that: $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H$ = 350.4 kJ and $2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$ $\Delta H$ = -467.2 kJ
From the following thermochemical equation, the heat of reaction for $2C_{(s)} + O_{2(g)} \rightarrow 2CO_{2(g)}$ is

A. + 115.8 kJ
B. - 115.8 kJ
C. - 224.6 kJ
D. + 224.6 kJ

END OF THE OBJECTIVE TEST

**DO NOT TURN THIS PAPER OVER UNTIL YOU ARE TOLD TO DO SO.**

**YOU WILL BE PENALIZED SEVERELY IF YOU ARE FOUND LOOKING AT THE NEXT PAGE BEFORE YOU ARE TOLD TO DO SO.**

## PART II

$1\frac{1}{2}$ hours

## ESSAY

**[60 marks]**

Paper 2 consists of **nine** essay questions divided into **three** sections: **I, II, III.** You are required to answer **seven** questions in all: **four** questions from Section I, **two** questions from Section II and **one** question from Section III.

Write your answers in **ink only** (blue and black)

### SECTION I
[Compulsory]
[36 marks]

Answer all **four** questions in this section.

1. Analysis of an organic compound **X** showed that it contained 85.5% carbon and 14.5% hydrogen.

   (a) Find the empirical formula of **X.**

   (b) If the relative vapor density of this compound is 14, determine its molecular mass.

   (c) Write the structural formula of **X.**

   (d) Write a balanced chemical equation for the reaction between **X** and chlorine and name the product(s).

2. (a) Name the ore from which aluminium is obtained.

   (b) With the aid of equations, briefly explain what occurs at the electrodes in the production of aluminium.

3. (a) State Charles' Law.

(b) Sketch a graph to illustrate Charles' Law.

(c) A given sample of gas occupies 40 mL at 25° C. At what temperature will it have to double its volume?

4. Carbon exists in two allotropic forms.

(a) Name the two.

(b) What do you observe if carbon dioxide is passed through limewater for a long time?

(c) Write a balanced chemical equation representing the reactions which take place.

## SECTION II
[16 marks]

There are **three** questions in this section. You are required to answer only **two**.

5. (a) What are colligative properties?

(b) List and discuss any **three** colligative properties

(d) What is the osmotic pressure of a hemoglobin solution, if the molar mass is $6.51 \times 10^4$ g/mol at 25°C?

**Given : $\pi = MRT$, where $\pi$ = osmotic pressure, M = molar mass, R = 0.0821 and T temperature**

6. (a) What is a buffer solution?

(b) Calculate the pH of a buffer solution containing 1.0 M $CH_3COOH$ and 1.0 M $CH_3COONa$.

Given: $Ka = \frac{[H^+][CH_3COO^-]}{[CH_3COOH]} = 1.8 \times 10^{-5}$

7. (a) What is meant by the "enthalpy of a reaction"?

(b) What is the sign for the enthalpy change of

(i) an endothermic reaction?

(ii) an exothermic reaction?

(c) Pentaborane, $B_5H_9$, was once considered as a potential rocket fuel. $B_5H_9$ reacts with excess oxygen according to the below equation:

$\mathbf{B_5H_{9(g)} + O_{2(g)} \rightarrow B_2O_{3(g)} + H_2O_{(l)}}$ at 298K. The enthalpy change for this reaction is -8686,6 kJ/mol

(i) Balance the equation.

(ii) If 0.600 mol of pentaborane is consumed, how many moles of $B_2O_3$ are formed?

(iii) Calculate the enthalpy change when 0.600 mol of pentaborane is consumed?

SECTION III

[8 marks]

There are **two** questions in this section. You are required to do only **one.**

**8. (a)** **For the following gas Laws, identify any quantity that remains constant in the relationship that exists among them and give a mathematical model that expresses the specific Law.**

(i) **Boyle's Law**

(ii) **Charles' Law**

(iii) Avogadro's Law

(iv) Dalton's Law of Partial Pressure

(b) At constant temperature, the pressure and volume of a certain gas are X and Y respectively.
If the pressure is tripled, what will be the new volume?

(c) Calculate the total pressure in a 10.0 L flask that contains 6.0g hydrogen gas, 15.2g nitrogen gas, and 16.8g helium gas at 27°C.
**[H = 1.00, N = 14.00, He = 4.00, R = 8.314Jmol$^{-1}$ K$^{-1}$ or R = 0.0821L atm mol$^{-1}$ K$^{-1}$]**

**9.** Consider the following redox reaction:

$$Cu(s) + HNO_{3\,(aq)} \rightarrow Cu\,(NO_3)_{2(aq)} + NO_{\,(g)} + H_2O_{\,(l)}$$

(a) Balance the above equation as a redox equation.

(b) If 20g of copper was used, how many grams of copper (II) nitrate will be formed?

(c) Write the oxidation half equation and the reduction half equation for reaction.

(d) Which substance is oxidized?

(e) Which substance is the oxidizing agent?

**END OF PAPER**