

Answer all the questions.

Each question is followed by four options lettered A to D. Find out the correct option for each question and 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 elements reacts with water?

- A. Carbon
- B. Iodine
- C. Sodium
- D. Sulphur

The correct answer is Sodium, which is lettered C and therefore answer space C would be shaded.

[ A ]                      [ B ]                      ☒ [ C ]                      [ D ]

Think carefully before you shade the answer spaces; erase completely any answer you wish to change.

Do all rough work on this question paper.

Now answer the following questions.

- The shape of  $\text{CH}_4$  is
  - A. linear.
  - B. planar.
  - C. pyramidal.
  - D. tetrahedral.
- The crystal layers in graphite are held together by
  - A. covalent bond.
  - B. electrostatic forces.
  - C. ionic bond.
  - D. van der Waal's forces.
- Hydrogen bonds are formed between molecules containing a hydrogen atom bonded to a
  - A. strongly electronegative atom.
  - B. non-polar species.
  - C. diatomic element.
  - D. complex ion.
- The two elements,  $_{11}\text{X}$  and  $_{19}\text{Y}$  are in the same group because they have the same
  - A. valence electrons.
  - B. ionization energy.
  - C. number of shell.
  - D. atomic size.
- Which of the following processes is used in food preservation in an industry?
  - A. Carbon dating
  - B. Irradiation of gamma rays
  - C. Nuclear fission
  - D. Nuclear fusion

6. Which of the following arrangements is in decreasing order of atomic radius?

- A.  $\text{Li} > \text{Be} > \text{C} > \text{B}$
- B.  $\text{Li} > \text{B} > \text{Be} > \text{C}$
- C.  $\text{Li} > \text{Be} > \text{B} > \text{C}$
- D.  $\text{C} > \text{B} > \text{Be} > \text{Li}$

7. The electron configuration of  $_{26}\text{Fe}^{3+}$  is

- A.  $[\text{Ar}] 4s^2 3d^6$ .
- B.  $[\text{Ar}] 4s^2 3d^3$ .
- C.  $[\text{Ar}] 4s^1 3d^4$ .
- D.  $[\text{Ar}] 4s^0 3d^5$ .

8. Which of the following transition metals is **not** attracted to external magnetic field?

- A. Cu
- B. Fe
- C. Ti
- D. Zn

9. An atom W has 17 electrons and 18 neutrons. Which of the following representations of the atom is correct?

- A.  $^{17}_{18}\text{W}$
- B.  $^{18}_{17}\text{W}$
- C.  $^{35}_{17}\text{W}$
- D.  $^{35}_{18}\text{W}$

10. The relative atomic mass of chlorine is **not** a whole number because

- A. it is the weighted average mass of all its various isotopes.
- B. it is the average mass of all the isotopes of the element.
- C. the element has strong oxidizing ability.
- D. the atom contains a higher number of neutrons than protons.

11.  $\text{NH}_4^+$  is formed from  $\text{NH}_3$  and  $\text{H}^+$  by

- A. covalent bonding.
- B. dative bonding.
- C. hydrogen bonding.
- D. ionic bonding.

12. How many lone pair(s) of electrons is present in HF?

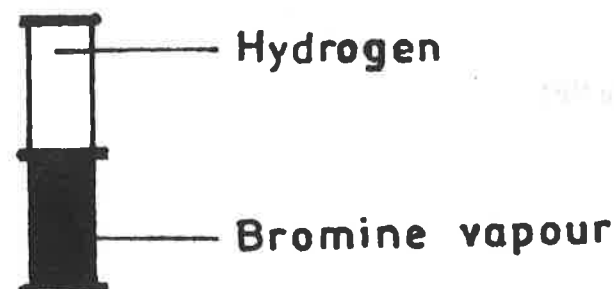
- A. 0
- B. 1
- C. 2
- D. 3

13. An aqueous solution of  $\text{Na}_2\text{CO}_3$  is

- A. acidic.
- B. alkaline.
- C. amphoteric.
- D. neutral.

Turn over

14. A gaseous mixture contains 0.256 g of hydrogen and 2.00 g of oxygen. The mole ratio of hydrogen to oxygen in the mixture is  
[ H = 1.00; O = 16.0 ]
- A. 1 : 1.  
B. 2 : 1.  
C. 1 : 4.  
D. 8 : 1.
15. If  $0.20 \text{ mol dm}^{-3}$  NaOH<sub>(aq)</sub> was evaporated to yield 5.0 g of solid NaOH, calculate the volume of NaOH<sub>(aq)</sub> used.  
[ Na = 23.0, O = 16.0; H = 1.00 ]
- A.  $600 \text{ cm}^3$   
B.  $625 \text{ cm}^3$   
C.  $1000 \text{ cm}^3$   
D.  $1600 \text{ cm}^3$
16. The oxidation number of sulphur in Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> is
- A. +2.  
B. +3.  
C. +4.  
D. +6.
17. The mass of  $800 \text{ cm}^3$  of a gas Q at s.t.p. is 1.0 g. What is the molar mass of Q?  
[ Avogadro's constant =  $22.4 \text{ dm}^3 \text{ mol}^{-1}$  ]
- A.  $18.0 \text{ g mol}^{-1}$   
B.  $22.4 \text{ g mol}^{-1}$   
C.  $28.0 \text{ g mol}^{-1}$   
D.  $36.0 \text{ g mol}^{-1}$
18. A compound U melts at 82°C and boils at 113°C. If U was found to be insoluble in water, a mixture of U in water could best be separated by
- A. chromatography.  
B. sublimation.  
C. filtration.  
D. the use of separating funnel.
19. The following set-up can be used to demonstrate



- A. diffusion.  
B. dissolution.  
C. evaporation.  
D. sublimation.

**DO NOT TURN OVER THIS PAGE 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.**

PAPER 1  
OBJECTIVE TEST  
[50 marks]

1 hour

- Use HB pencil throughout.
- If you have got a blank answer sheet, complete the top section as follows.
  - In the space marked *Name*, write in capital letters your **surname** followed by your **other names**.
  - In the spaces marked *Examination*, *Year*, *Subject* and *Paper*, write 'WASSCE', '2014 JUNE', 'CHEMISTRY' and '1' respectively.
  - In the box marked *Index Number*, write your **index number** vertically in the spaces on the left-hand side. There are numbered spaces in line with each digit. Shade carefully the space with the same number as each digit.
  - In the box marked *Paper Code*, write the digits **505213** in the spaces on the left-hand side. Shade the corresponding numbered spaces in the same way as for your index number.
  - In the box marked *Sex*, shade the space marked **M** if you are **male**, or **F** if you are **female**.
- If you have got a pre-printed answer sheet, check that the details are correctly printed, as described in 2 above. In the boxes marked *Index Number*, *Paper Code* and *Sex*, **reshade** each of the shaded spaces.
- An example is given below. This is for a **male** candidate, whose **name** is **Chukwuma Adekunle CIROMA**, whose **index number** is **4251102068** and who is offering **Chemistry 1**.

## THE WEST AFRICAN EXAMINATIONS COUNCIL

PRINT IN BLOCK LETTERS

Name: CIROMA CHUKWUMA ADEKUNLE Examination: WASSCE Year: 2014 JUNE  
Surname Other Names

Subject: CHEMISTRY Paper: 1

INDEX NUMBER		PAPER CODE		SEX
4	0	5	0	Indicate your sex by shading the space marked M (for Male) or F (for Female) in this box: M <input type="checkbox"/> F <input type="checkbox"/>
2	0	0	0	
5	0	5	0	
1	0	5	0	
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2	0	3	0	
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6	0			<b>INSTRUCTIONS TO CANDIDATES</b> 1. Use grade HB pencil throughout. 2. Answer each question by choosing one letter and shading it like this: [A] [B] [C] [D] 3. Erase completely any answers you wish to change. 4. Leave extra spaces blank if the answer spaces provided are more than you need. 5. Do not make any markings across the heavy black marks at the right-hand edge of your answer sheet.
8	0			

For Supervisors only.  
If candidate is absent shade this space: ☐

- (c) A chemistry student was provided with **four** samples of organic compounds, **A, B, C and D**.

Samples **A** and **B** each decolourized bromine in tetrachloromethane but only sample **B** reacted with a solution of ammoniacal silver trioxonitrate (V) to give a white precipitate.

Sample **D** reacted with sodium trioxocarbonate (IV) to liberate carbon(IV)oxide. When heat was applied to the mixture of samples **C** and **D** in a test tube and drops of concentrated tetraoxosulphate (VI) acid added, a product with a fruity odour was formed.

- Name the family of organic compounds to which samples **A, B, C**, and **D** belong.
  - State why samples **A** and **B** reacted with bromine in tetrachloromethane.
  - State the reason why sample **B** gave a white precipitate with the solution of ammoniacal silver trioxonitrate (V).
  - Give the name of the reactions between samples **C** and **D**.
  - State the **two** roles of the concentrated tetraoxosulphate (VI) acid in the reaction in 5(a)(iv).
- (d) (i) Describe **briefly** the production of biogas using a biogas generator.
- (ii) State **two** uses of biogas.

[ 10 marks ]

[ 5 marks ]



20. Which of the following statements about a chemical system in equilibrium is **correct**? The
- reaction is irreversible.
  - reaction goes to completion.
  - equilibrium is re-established when a stress is applied.
  - equilibrium position is affected by catalyst.
21. Which of the following relationships **correctly** expresses the Boyle's law?
- $P \propto V$  at constant  $T$
  - $V \propto T$  at constant  $P$
  - $P \propto \frac{1}{V}$  at constant  $T$
  - $V \propto \frac{1}{T}$  at constant  $P$
22. The vapour pressure of a given volume of liquid increases when the
- liquid becomes saturated with a salt.
  - volume of the liquid increases.
  - temperature of the liquid falls.
  - temperature of the liquid rises.
23. Which of the following statements about volatile liquids is **correct**? They have
- high vapour pressure and low boiling point.
  - high vapour pressure and high boiling point.
  - low vapour pressure and low boiling point.
  - low vapour pressure and high boiling point.
24. The type of energy changes that accompany the mixing of a strong acid to a strong base is
- electrical.
  - heat.
  - light.
  - sound.
25. Zinc oxide is said to be amphoteric because it
- forms an acid salt.
  - is an insoluble base.
  - forms a double salt.
  - reacts with a base or an acid.
26. Which of the following substances with the corresponding  $pH$  value is an alkali?

Substance	$pH$
A. Lime	2.4
B. Banana	4.6
C. Distilled water	7.0
D. Milk of magnesia	10.5

Turn over

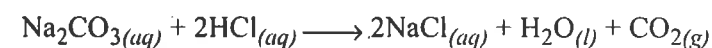
27. The gases produced when  $\text{Cu}(\text{NO}_3)_2(s)$  was heated are

- A.  $\text{NO}$  and  $\text{NO}_2$ .
- B.  $\text{O}_2$  and  $\text{NO}_2$ .
- C.  $\text{O}_2$  and  $\text{NO}$ .
- D.  $\text{NO}_2$  and  $\text{N}_2\text{O}_4$ .

28. Which of the following salts on hydrolysis would give an alkaline solution?

- A.  $\text{NH}_4\text{Cl}(s)$
- B.  $\text{AlCl}_3(s)$
- C.  $\text{CH}_3\text{COONa}(s)$
- D.  $\text{NH}_4\text{NO}_3(s)$

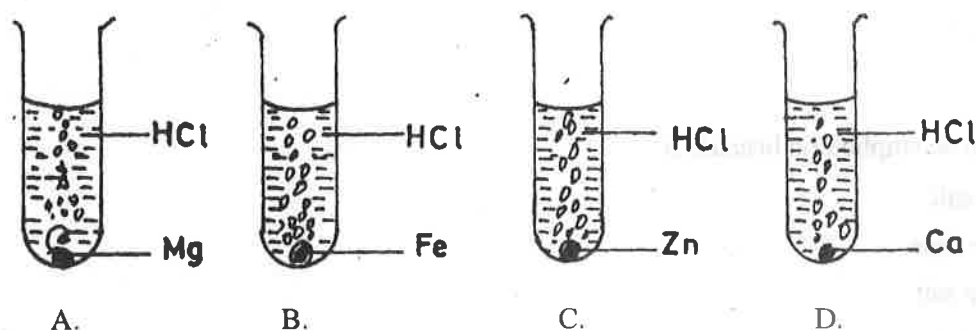
29. Consider the reaction represented by the following equation:



What volume of  $0.02 \text{ mol dm}^{-3}$   $\text{Na}_2\text{CO}_3(aq)$  would be required to completely neutralize  $40 \text{ cm}^3$  of  $0.10 \text{ mol dm}^{-3}$   $\text{HCl}(aq)$ ?

- A.  $200 \text{ cm}^3$
- B.  $100 \text{ cm}^3$
- C.  $40 \text{ cm}^3$
- D.  $20 \text{ cm}^3$

30. In which of the following experimental set-ups would the rate of evolution of hydrogen gas be **fastest**?



31. Which of the following factors would affect the equilibrium constant?

- A. Concentration
- B. Temperature
- C. Pressure
- D. Volume

(b) Consider the reaction represented by the following equation:

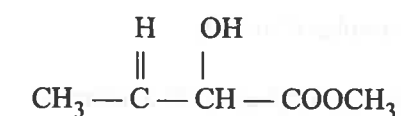


- (i) Explain **briefly** why this reaction is redox.
- (ii) Write balanced half equations for the reaction.
- (iii) Write the over-all balanced reaction equation. [ 8 marks ]

(c) During the electrolysis of molten  $\text{Al}_2\text{O}_3$ , a current of  $6\text{A}$  was passed through the electrolyte for 1 hr. 30 mins. Calculate the mass of aluminium deposited at the cathode. [ 6 marks ]

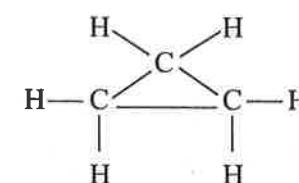
5. (a) (i) Define the term *functional group*.

(ii) Name the functional groups present in the following compound:



[ 5 marks ]

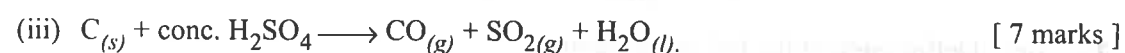
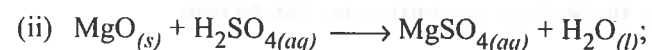
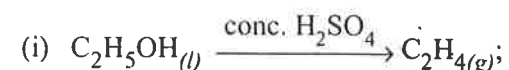
(b) Consider the following structure of an organic compound, **Q**.



- (i) Name compound **Q**.
- (ii) Write the balanced equation for the complete combustion of compound **Q**.
- (iii) What type of reaction will compound **Q** undergo with chlorine?
- (vi) Draw the structure of the alkene that is an isomer of compound **Q**. [ 5 marks ]

3. (a) (i) Outline the steps involved in the purification of water for town supply.
- (ii) Give **two** cations that can cause hardness in water.
- (iii) State **two** disadvantages of hardness of water.
- (iv) List **two** sources of water pollution. [ 13 marks ]

- (b) (i) Explain **briefly** why water is a good solvent for sodium chloride but **not** for oil.
- (ii) State the function of  $\text{H}_2\text{SO}_4$  in **each** of the following reaction equations:



- (c) (i) Give the **two** products formed when chlorine water is exposed to sunlight.

- (ii) Consider the following compounds:  $\text{Na}_2\text{CO}_3$  and  $\text{NaOH}$ .

I. Which of the compounds is suitable for the preparation of standard alkaline solution?

II. Give a reason for your answer in 3(c)(ii)I. [ 5 marks ]

4. (a) (i) Explain **briefly each** of the following terms.

I. *anode*;

II. *cathode*.

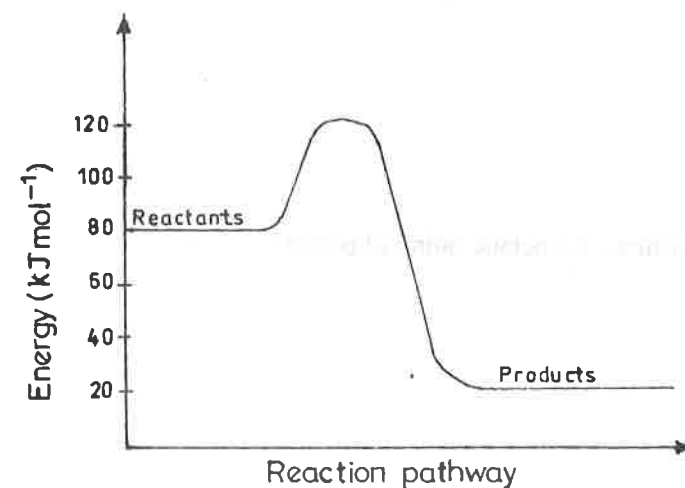
- (ii) Sodium and aluminium are extracted by the electrolysis of molten sodium chloride and alumina respectively. Write balanced equations for the reactions at the anode and cathode during the extraction of:

I. sodium;

II. aluminium.

- (iii) Explain **briefly** why extraction of aluminium is considered environmentally friendly while that of sodium is **not**. [ 11 marks ]

32. Consider the following energy profile diagram of exothermic reaction:



The enthalpy change,  $\Delta H$  is

- A.  $120 \text{ kJ mol}^{-1}$ .  
 B.  $80 \text{ kJ mol}^{-1}$ .  
 C.  $60 \text{ kJ mol}^{-1}$ .  
 D.  $40 \text{ kJ mol}^{-1}$ .

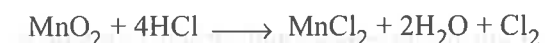
33. Consider the reaction represented by the following equation:



Which of the following conditions would increase the yield of  $\text{NH}_3$ ?

- A. Addition of iron catalyst  
 B. Increase in the temperature of the system  
 C. Increase in the volume occupied by reactants  
 D. Increase in the total pressure of the system

34. What is the function of manganese (IV) oxide in the reaction represented by the following equation?



- A. Catalyst  
 B. Dehydrating agent  
 C. Oxidizing agent  
 D. Reducing agent

35. The reaction that occurs at the anode when  $\text{CuSO}_{4(aq)}$  is electrolyzed using carbon electrodes is

- A.  $2\text{H}^+_{(aq)} + 2\text{e}^- \longrightarrow \text{H}_{2(g)}$ .  
 B.  $\text{Cu}^{2+}_{(aq)} + 2\text{e}^- \longrightarrow \text{Cu}_{(s)}$ .  
 C.  $4\text{OH}^-_{(aq)} - 4\text{e}^- \longrightarrow 2\text{H}_2\text{O}_{(l)} + \text{O}_{2(g)}$ .  
 D.  $\text{SO}_4^{2-}_{(aq)} - 2\text{e}^- \longrightarrow \text{SO}_{2(g)} + \text{O}_{2(g)}$ .

36. *Reduction* is the process of

- A. loss of electron.  
 B. loss of hydrogen.  
 C. loss of oxygen.  
 D. addition of electronegative elements.

Turn over

37. Ethene molecules can be added to one another to form a long chain compound called a
- dimer.
  - monomer.
  - polymer.
  - trimer.
38. Which of the following compounds determines the octane rating of petrol?
- 1, 2, 3 - trimethyl pentane
  - 2, 3, 5 - trimethyl octane
  - 2, 3, 5 - trimethyl pentane
  - 2, 2, 4 - trimethyl pentane
39. Which type of reaction is illustrated by the following equation?
- $$\text{C}_{12}\text{H}_{26} \longrightarrow 5\text{C}_2\text{H}_4 + \text{C}_2\text{H}_6$$
- Addition
  - Cracking
  - Hydrogenation
  - Polymerization
40. The IUPAC name of the following organic compound is
- $$\text{HOOC} - \text{COOH}$$
- ethan-1, 2-dioic acid.
  - ethanoic acid.
  - oxalic acid.
  - propan-1, 2-dioic acid.
41. The enzyme that catalyses the conversion of glucose to ethanol and carbon(IV)oxide is
- diastase.
  - maltase.
  - ptyalin.
  - zymase.
42. A colourless hydrocarbon with a sweet smell undergoes substitution reaction. The hydrocarbon is likely to be
- alkanol.
  - benzene.
  - ester.
  - methane.

- (i) State **one** use of **each** of the following processes in the chemical industry:

(i) hydrogenation of vegetable oil;

(ii) cracking;

(iii) esterification.

[ 3 marks ]

- (j) Calculate the amount of silver deposited in moles when 10920 coulombs of electricity is passed through a solution of a silver salt.

[ Faraday constant =  $96500 \text{ C mol}^{-1}$  ]

[ 3 marks ]

### SECTION B

Answer **three** questions **only** from this section.

2. (a) Define **each** of the following terms:

(i) ion;

(ii) isotopes.

[ 4 marks ]

- (b) (i) Consider the elements  $_{12}\text{Mg}$  and  $_{13}\text{Al}$ .

I. Write the electron configuration of **each** element.

II. Explain **briefly** why the first ionization energy of  $_{12}\text{Mg}$  is greater than that of  $_{13}\text{Al}$ .

- (ii) Write the formulae of **three** different oxides of period 3 elements that react with water.

[ 8 marks ]

- (c) (i) What are *allotropes*?

(ii) Name the **two** crystalline allotropes of carbon.

(iii) Give **one** industrial use of **each** allotrope named in 2(c)(ii).

[ 6 marks ]

- (d) On warming crystals of sodium chloride with concentrated tetraoxosulphate (VI) acid, a gas was evolved.

(i) List **two** physical properties of the gas produced.

(ii) Write a balanced equation for the reaction.

[ 4 marks ]

- (e) A certain chip **W** used in a circuit of a microcomputer has a mass of 5.68 mg.

Calculate the amount of **W** in the microcomputer.

[  $\text{W} = 28 \text{ g mol}^{-1}$  ]

[ 3 marks ]

Turn over

Answer **four** questions in all. Question 1 in Section A and three questions from Section B.

All questions carry equal marks.

Credit will be given for clarity of expression and orderly presentation of material.

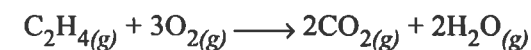
## SECTION A

FOR ALL CANDIDATES

Answer **all** the questions from this Section.

1. (a) (i) Define *ionic bond*.  
 (ii) What type of bond(s) exist(s) in:  
 I. magnesium oxide;  
 II. ammonium ion? [ 4 marks ]
- (b) Determine the oxidation number of sulphur in  $\text{Na}_2\text{S}_2\text{O}_3$ . [ 3 marks ]
- (c) State *Faraday's first law*. [ 2 marks ]
- (d) Give **one** example **each** of:  
 (i) acid salt;  
 (ii) base salt. [ 2 marks ]
- (e) Name the type of energy change that occurs in **each** of the following processes:  
 (i)  $\text{I}_{2(s)} \longrightarrow \text{I}_{2(g)}$ ;  
 (ii)  $\text{Cl}_{(g)} + \text{e}^- \longrightarrow \text{Cl}_{(g)}^-$ . [ 2 marks ]
- (f) State the effect of **each** of the following aqueous solutions on litmus paper:  
 (i)  $\text{Na}_2\text{SO}_{4(aq)}$ ;  
 (ii)  $\text{AlCl}_{3(aq)}$ . [ 2 marks ]
- (g) Define the term *efflorescence*. [ 2 marks ]
- (h) Give **two** uses of activated charcoal. [ 2 marks ]

43. Consider the reaction represented by the following equation:



How many moles of ethene would be burnt to produce 0.1 mole of water?

- A. 0.05 mole  
 B. 0.10 mole  
 C. 0.20 mole  
 D. 2.00 moles
44. The liquid hydrocarbon likely to be found in the fraction of crude oil used for domestic cooking is  
 A.  $\text{C}_3\text{H}_8$ .  
 B.  $\text{C}_5\text{H}_{12}$ .  
 C.  $\text{C}_{13}\text{H}_{28}$ .  
 D.  $\text{C}_{20}\text{H}_{42}$ .
45. Which of the following organic compounds could be represented by the empirical formula  $\text{CH}_2\text{O}$ ?  
 A. Ethanal  
 B. Ethane  
 C. Ethanol  
 D. Ethanoic acid
46. The production of biogas from the fermentation of waste materials is an example of  
 A. combustion.  
 B. incineration.  
 C. refining.  
 D. recycling.
47. The purity of a solid sample can **best** be determined by its  
 A. boiling point.  
 B. melting point.  
 C. conductivity.  
 D. solubility.
48. Which of the following gases is used to retard the vapourization of the filament in a light bulb?  
 A. Argon  
 B. Helium  
 C. Hydrogen  
 D. Oxygen
49. The **most** common process in the extraction of metals from their ore is  
 A. catalysis.  
 B. electrolysis.  
 C. oxidation.  
 D. reduction.
50. The oxide from electric power station is  
 A. carbon (IV) oxide.  
 B. copper (II) oxide.  
 C. nitrogen (IV) oxide.  
 D. sulphur (IV) oxide.

S5052 & 1 June  
WASSCE 2014  
CHEMISTRY 2 & 1  
Essay & Objective  
3 hours

2 & 1

Name: .....

Index Number: .....

THE WEST AFRICAN EXAMINATIONS COUNCIL  
West African Senior School Certificate Examination

June 2014

CHEMISTRY 2 & 1

3 hours

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

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