UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
SCHOOL OF EDUCATIONAL DEVELOPMENT AND OUTREACH
INSTITUTE OF EDUCATION

COLLEGES OF EDUCATION
FOUR-YEAR BACHELOR OF EDUCATION (B. ED)
FIRST YEAR, END-OF-SECOND SEMESTER EXAMINATION, JULY 2019

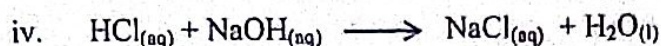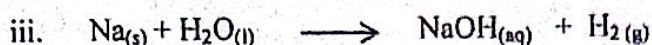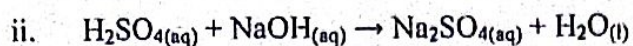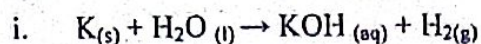JULY 19, 2019   GENERAL CHEMISTRY   2:40 PM – 4:00 PM

SECTION B
Answer any TWO questions from this Section in the answer booklet provided.

1. (a) i. State any four physical properties each of ionic and covalent compounds.   [8 Marks]

    ii. Describe the type of bonding in chlorine gas.   [4 Marks]

(b) What are isotopes?   [3 Marks]

(c) Copy and complete the table below.   [11 Marks]

Element	Atomic number	Mass number	Proton number	Electron number	Neutron number
Fluorine		19		9	10
Magnesium	12		12		12
Phosphorus		31	15		16
Potassium	19	39		19	
Argon		40		18	

(d) How many NO_3^- ions are contained in 0.10 mol dm^{-3} $Ca(NO_3)_2$ solution?
    [L=6.02x 10^{23} mol^{-1}]   [5 Marks]

2. (a) Write the chemical formula for the following compounds:
       i.   Copper (II) tetraoxosulphate (VI)   [1 Mark]
       ii.   Iron (III) oxide   [1 Mark]
       iii. Potassium chloride   [1 Mark]
       iv.   Potassium hydroxide   [1 Mark]
       v.   Water   [1 Mark]

(b) Balance the chemical equations below:

i. $K_{(s)} + H_2O_{(l)} \rightarrow KOH_{(aq)} + H_{2(g)}$ [2 Marks]

ii. $H_2SO_{4(aq)} + NaOH_{(aq)} \rightarrow Na_2SO_{4(aq)} + H_2O_{(l)}$ [2 Marks]

iii. $Na_{(s)} + H_2O_{(l)} \longrightarrow NaOH_{(aq)} + H_{2(g)}$ [2 Marks]

iv. $HCl_{(aq)} + NaOH_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$ [2 Marks]

(c) i. In a chemical reaction, carbon monoxide gas reacts with oxygen gas to produce carbon dioxide gas. Write a balanced chemical equation for the reaction. [3 Marks]

ii. Hydrogen peroxide decomposes to produce water and oxygen gas. Write a balanced chemical equation for the reaction [3 Marks]

iii. What will be the chemical formular for an ionic compound containing Na^+ and SO_4^{2-}? [2 Marks]

iv. What gas is produced when hydrochloric acid reacts with zinc? Write a balanced chemical equation for this reaction. [5 Marks]

(d) A solution is prepared by dissolving 2.1g of NaOH in 250 cm^3 of solution. What is the concentration of solution in mol dm^{-3} [Na=23, O=16, H=1]. [5 Marks]

3. (a) i. Define an acid and a base according to the Bronsted-Lowry concept. [4 Marks]

ii. Give two examples each of a Lewis acid and a Lewis base. [4 Marks]

iii. State any four physical properties of acids. [4 Marks]

(b) Complete the table below with the colours observed when the given indicators are each added to alkaline solution and an acidic solution. [4 Marks]

Indicator	Colour in acid	Colour in base
Phenolphthalein		
Methyl orange	Red	
Blue litmus	Red	

(c) In a tabular form, classify the following as acids, bases or salts.

    i.   KOH   [1 Mark]
    ii. CaCO$_3$ [1 Mark]
    iii. CaO   [1 Mark]
    iv. HNO$_3$ [1 Mark]
    v.   MgCl$_2$ [1 Mark]
    vi. HCl   [1 Mark]
    vii. NaCl   [1 Mark]
    viii. KCl   [1 Mark]
    ix. H$_2$SO$_4$ [1 Mark]

(d) What mass of H$_2$SO$_4$ is contained 400cm^3 of 0.50M solution?
    [H=1.0, O=16.0, S=32.1]   [5 Marks]

4. (a). i. What is a pure substance?   [2 Marks]
    ii. Explain **four** importance of purifying an impure substance.   [8 Marks]
    iii. Differentiate between fractional distillation and simple distillation.   [4 Marks]

(b) i. Write down the names of two methods used in separating an insoluble solid
       from a liquid which does **not** require heating during the process.   [2 Marks]
    ii. What are separation techniques?   [2 Marks]

(c) Which separation techniques will you apply for the separation of the following
    mixtures?
    i.   Sodium chloride from its solution in water.   [1 Mark]
    ii. Ammonium chloride from a mixture containing sodium chloride and
         ammonium chloride.   [1 Mark]
    iii. Small pieces of metal in the engine oil of a car.   [1 Mark]
    iv. Different pigments from an extract of flower petals.   [1 Mark]
    v.   Oil from water.   [1 Mark]
    vi. Tea leaves from tea.   [1 Mark]
    vii. Wheat grains from husk.   [1 Mark]
    viii. Fine mud particles suspended in water.   [1 Mark]

(d) Calculate the moles of NaOH in 25 cm^3 of 0.5 moldm^{-3} of a solution.   [5 Marks]

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JULY 19, 2019   GENERAL CHEMISTRY   2:00 PM – 2:40 PM

This paper consists of two sections, A and B. Answer all the questions in section A and TWO questions from Sections B. Section A will be collected after the <u>first 40 minutes.</u>

SECTION A
Answer ALL the questions in this Section.

For items 1 to 40, each stem is followed by four options lettered A to D. Read each statement carefully and circle the letter of the correct or best option.

1. A positively charged atom has ....
   A. equal number of protons and electrons.
   B. less number of electrons than protons.
   C. less number of neutrons than protons.
   D. more number of neutrons than protons.

2. The mass number of an atom is the total number of ....in a nucleus.
   A. electrons and neutrons.
   B. neutrons and nucleons.
   C. protons and neutrons.
   D. protons and electrons.

3. The electronic configuration of potassium is ....
   A. 2,8,8,2
   B. 2,8,8,3
   C. 2,8,8,0
   D. 2,8,8,1

4. For electrically neutral atoms, the proton number is equal to the ....
   A. atomic number.
   B. electron number.
   C. mass number.
   D. neutron number.

5. Which one of the following compounds has the least relative molecular mass?
   [H=1, O=16, C=12, S=32]
   A. H_2CO_3
   B. H_2SO_3
   C. H_2CO_3
   (D) HCOOH

6. The maximum number of electrons a shell can contain is given by the formula ....
   A. $2n$
   (B) $2n^2$
   C. n^2
   D. $3n^2$

7. Find the molar mass of carbon dioxide. [C=12, O=16]
   A. 28g/mol
   B. 40g/mol
   (C) 44g/mol
   D. 46g/mol

8. The number of electrons in the Mg^{2+} ion is [Mg = 12]
   A. 12
   (B) 10
   C. 14
   D. 2

9. Which of the following nuclides contains the same number of neutrons and protons
   (A) $_{10}^{20}X$
   B. $_{20}^{20}X$
   C. $_{10}^{20}X^{2+}$
   D. $_{10}^{10}X$

10. Which one of the following set of numbers best describes the electronic arrangement in $_{16}S^{2-}$?
    A. 2, 8, 6
    (B) 2, 8, 8
    C. 2, 8, 4
    D. 2, 8, 2

11. Which of following pairs are isoelectronic species?
    (A) $_{13}Al^{3+}$ and $_{10}Ne$
    B. $_{13}Al^{3+}$ and $_{13}Al$
    C. ^8O and $_{10}Ne$
    D. $_8O^{2-}$ and $_8O$

12. Which of the following compounds has the highest relative molecular mass? [H=1, O=16, C=12, S=32]
    A. H_2CO_3
    B. H_2SO_4
    C. H_2CO_3
    D. HCOOH

13. Which of these set of elements will form covalent bonding/bond?
    A. Cl and Na
    B. C and O
    C. Li and Cl
    D. O and Al

14. In the formation of ionic bond between sodium and chlorine, the.................
    A. chlorine accepts an electron from sodium.
    B. chlorine loses two electron to sodium.
    C. sodium accepts an electron from chlorine.
    D. sodium loses two electron to chlorine.

15. Which of the following is **not** a characteristic of ionic compound?
    A. They are made up of molecules.
    B. They consist of ions.
    C. They conduct electricity in their molten state.
    D. They conduct electricity in their aqueous state.

16. The valence electrons that are not used in bonding is known as ....
    A. bonding pair electrons.
    B. outermost electrons.
    C. innermost electrons.
    D. lone pair electrons.

17. How many molecules are there in 6g of H_2S gas? [H = 1, S =32, L = 6.02 $\times 10^{23}$]
    A. 1.06×10^{22} molecules.
    B. 2.06×10^{23} molecules.
    C. 1.06×10^{23} molecules.
    D. 1.06×10^{21} molecules.

18. How many atoms are there in 0.4mols of hydrogen molecules? [L = 6.02 $\times 10^{23}$]
    A. 1.50×10^{23} atoms.
    B. 2.41×10^{23} atoms.
    C. 3.01×10^{23} atoms.
    D. 4.82×10^{23} atoms.

19. What is the total number of oxygen atoms contained in two molecules of Iron (III) oxide(Fe_2O_3)?
    A. 2
    B. 3
    C. 4
    D. 6

20. Select the alkali among the following compounds.
    A. Lead(II)hydroxide.
    B. Magnesium hydroxide.
    C. Sodium hydroxide.
    D. Zinc hydroxide.

21. A substance that ionizes completely in an aqueous medium into hydronium ions is known as a
    ....
    A. strong acid.
    B. strong base.
    C. weak acid.
    D. weak base.

22. Which one of the following would have a pH of less than 7?
    A. Ammonia solution.
    B. Lemon juice.
    C. Pure water.
    D. Sodium chloride solution.

23. What is the pOH of a solution whose pH is 5?
    A. 9
    B. 7
    C. 5
    D. 2

24. Two elements, X and Y, have the electronic configuration 2, 3 and 2, 8, 7 respectively. What is the chemical formula of the compound formed between X and Y?
    A. XY
    B. X_3Y
    C. XY_3
    D. XY_4

25. What gas is produced when hydrochloric acid reacts with zinc metal?
    A. H_2
    B. NO_2
    C. NO
    D. N_2O
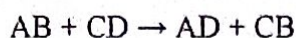
26. Which one of the following is the formula for iron (III) bromide?
    A. FeBr
    B. Fe□Br
    C. Fe□Br□
    D. FeBr□

27. Which of the following chemical equations is balanced?
    A. $Al_{(s)} + O_{2(g)} \rightarrow Al_2O_{3(s)}$
    B. $Zn_{(s)} + HCl_{(aq)} \rightarrow ZnCl_{2(aq)} + H_{2(g)}$
    C. $N_2O_{4(g)} \rightarrow 2NO_{2(g)}$
    D. $H_2O_{(l)} \rightarrow H_{2(g)} + O_{2(g)}$

28. What type of reaction is represented by the general equation below?

    $AB + CD \rightarrow AD + CB$

    A. Combination reaction
    B. Combustion reaction
    C. Decomposition reaction
    D. Double-decomposition reaction

29. Iron filings can be separated from powdered charcoal by a process called ....
    A. chromatography.
    B. distillation.
    C. evaporation.
    D. magnetization.

30. Which method of separation can be used to separate liquids with very close boiling points?
    A. fractional distillation.
    B. paper chromatography.
    C. repeated evaporation.
    D. simple distillation.

31. The separation technique that involves heating a solution until the liquid changes into a gas, leaving behind a solid is known as ....
    A. centrifugation.
    B. chromatography.
    C. crystallization.
    D. evaporation.

32. A mixture of ink in a green pen can be separated by....................
    A. chromatography.
    B. filtration.
    C. magnetization.
    D. sublimation.

33. The best method of separating crude oil into its constituents is...............
    A. chromatography.
    B. evaporation.
    C. fractional distillation.
    D. simple distillation.

34. What is the empirical formula for the compound $CH_3CH_2CH_2COOH$?
    A. $C_4H_8O_2$
    B. C_2H_4O
    C. C_2H_3O
    D. CHO

35. The ratio of carbon atoms to hydrogen atoms in a hydrocarbon is 1:2. If the molecular mass of the hydrocarbon is 56, determine its molecular formula.
    A. C_4H_8
    B. C_2H_4
    C. CH_2
    D. C_3H_6

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Bonus

37. Which of the following is the general molecular formula for alkynes?
    A. C_nH_{2n}
    B. C_nH_{2n-2}
    C. C_nH_{2n+2}
    D. C_nH_{2n+1}

38. Which of the following is an unsaturated hydrocarbon?
    A. $CH_3CH_2CH_3$
    B. CH_2CH_2
    C. CH_3CH_3
    D. $CH_2CH_2CH_2CH_3$

39. What is the name of the compound, $CH_3(CH_2)_3CH_3$?
    A. Butane.
    B. Hexane.
    C. Pentane.
    D. Propane.

40. The IUPAC name for the compound $CH_3C(CH_3)_2CH_3$ is ....
    A. propane.
    B. pentane.
    C. 2-methylpentane.
    D. 2,2-dimethylpropane.