



THE OPEN UNIVERSITY OF SRI LANKA
 CERTIFICATE IN LABORATORY TECHNOLOGY

FINAL EXAMINATION-THEORY- 2016 / 2017

PSC1222 — BASIC CHEMISTRY FOR LABORATORY PRACTICES

Date: 06/01/2017 (Friday)

Time: 10.00 am - 12.00 noon

Duration: Two hours

Instructions to students

This question paper consists of six questions and six pages. Answer any four questions.

(1). (a). Potassium atom reacts with chlorine atom to form potassium chloride. [Atomic number: Potassium = 19 ; Chlorine = 17].

- i. Describe the formation of potassium chloride compound.
- ii. Give **three** physical properties of compounds which have similar bond type as potassium chloride.

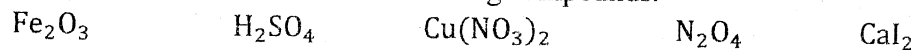
(20 marks)

(b). Define the following terms

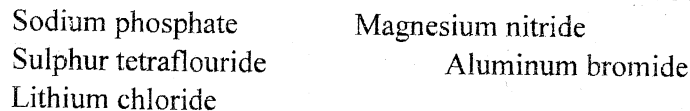
- i. Isotope of an atom
- ii. Atomic mass unit
- iii. The natural abundance for boron isotopes is 19.9% ^{10}B (10.013 amu) and 80.1% ^{11}B (11.009 amu). Calculate the average atomic mass of boron.

(20 marks)

(c). i. Give the name for each of the following compounds.

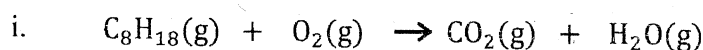


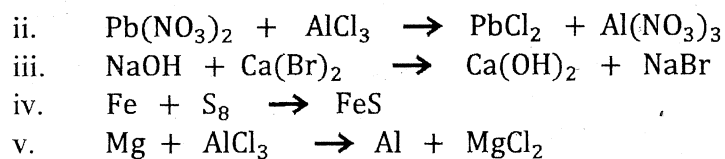
ii. Write down the chemical formula for each of the following compounds.



(20 marks)

(d). Balance each of the following reactions and also classify each of them as combination reaction, single replacement, double replacement and decomposition.





(30 marks)

(e). Determine the empirical formula of a compound with the following composition by mass; C= 24%; H=4%; Cl=72.0%.

[Relative atomic mass; C=12; H=1 Cl=35.5]

(10 marks)

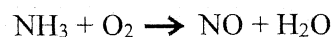
(2).(a). What do you understand by each of the following the terms?

- i. Molarity (M) of a solution
- ii. Percentage yield
- iii. Limiting reagent
- iv. 5.95 g of potassium bromide was dissolved in 400 cm³ water. Calculate its molarity.

[Relative atomic mass: K = 39; Br = 80]

(30 marks)

(b). Consider the following reaction:



In an experiment, 3.25 g of NH₃ are allowed to react with 3.50 g of O₂.

- i. Which reactant is the limiting reagent?
- ii. How many grams of NO are formed?
- iii. How much of the excess reactant remains after the reaction?

(30 marks)

(c). A 12 g sugar (molecular formula C₁₂H₂₂O₁₁) was dissolved in 350 ml hot water (at 80° C). The density of water at 80° C is 0.975 ml. Calculate the mass percentage of this solution?

(15 marks)

(d). i. Define the term "molality" (m) of a solution.

ii. The concentration of conc. HCl solution is 12.0 M. The density of HCl solution is given as 1.18 g/ml. What is the molality of this solution?

(25 marks)

(3). (A)(a) (i) What is meant by the term “Flammable liquids”.

(ii) What is the flash point of a liquid which can be considered as a flammable liquids?

(iii) Identify the danger/risk(s) associated, with the following substances.

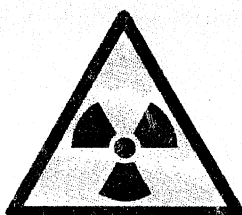
- (A) Hydrogen peroxide.....
(B) Sulphuric acid.....
(C) Thorium 228.....

(30 marks)

(b) (i) “Crude oil contains a mixture of different compounds with different boiling points, it can be separated into individual components”. **Name** the process which can be used to achieve the above statement.

(ii) Explain how would you store a chemical which is air sensitive/ react with oxygen?

(c) Identify the following symbols (i) and (ii).



(i)



(ii)

(20 marks)

(B) (a) 0.48 g of Mg will react with excess Conc HCl solution. The liberated H₂ gas was collected at pressure of 660 mmHg at 57 °C. If the volume of H₂ gas was 1.52 L, What would be the volume of gas if it were measured at STP.

(b) 2 g of NaOH was dissolved in 250 ml of pure water and prepare a solution.

Calculate

- (i) Molality of the solution
(ii) Concentration of the solution in Parts per million (ppm)

(20 marks)

(C) Waste water of 10,000 L collected to a tank was suspected to have Ca²⁺, Na⁺, NH₄⁺ and Ba²⁺ as cations.

(i) How do you take a random sample of the waste water in the tank?

(10 marks)

(ii) When 10.0 mL of 0.1 M H₂SO₄ was added to the random sample of the waste water a white precipitate was resulted. Write the equation of one possible reaction resulting this precipitate. Label the precipitate.

(12 marks)

- (iii) When the same amount of H_2SO_4 was added to another random sample of the same waste water after heating the white precipitate was not formed. What may be the reason for that? (08 marks)

(4). Three solutions of each having 100 mL are in three beakers placed on the laboratory table.

One is 0.10 M NaOH and the other two was 0.10 M HCl and 0.20 M CH_3COOH .

- (i) Giving reasons comment on the dissociation constants of the three solutions. (12 marks)
- (ii) Suggest a suitable method with expected observations to identify the three solutions separately. (20 marks)
- (iii) Calculate the pH of the NaOH solution. (10 marks)
- (iv) A 25.0 mL of 0.02 M CH_3COOH was titrated with 0.10 M NaOH using phenolphthalein as the indicator. Calculate the end point. (20 marks)
- (v) What is the colour change at the end point? (08 marks)
- (vi) Comment on the following statements.
- (a) NaOH should not be stored in glass bottles.
 - (b) The concentration of HCl decreases if the solution bottle is kept open.
 - (c) Distilled water becomes acidic if exposed to air for some time.
- (3 x 10 marks)

(5). (a) (i) Write the equations for the following nuclear reactions.

(a) ${}_{92}^{238}\text{U}$ decays by emitting alpha particles.

(b) ${}_{6}^{14}\text{C}$ decays by emitting beta particles.

(20 marks)

(ii) State two differences of the radiations emitted in the above two reactions in (i).

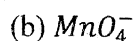
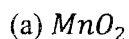
(08 marks)

(iii) (a) Of a radioactive element only 12.5 % was remaining after 27 days. Calculate the half- life of it.

(b) What will be the weight remaining of 0.3000 g of the same compound after 18 days? (16 marks)

(iv) What are the advantages of nuclear energy sources compared to other types of energy sources? (06 marks)

(b) (i) Determine the oxidation number of "Mn" in the following compounds.

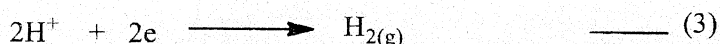
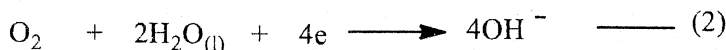
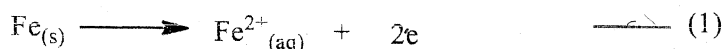


(10 marks)

(ii) "When a strip of Zn is dipped in a $CuSO_4$ solution, we observed solid Cu particles deposit on the Zn metal and Zn strip gradually disappears forming zinc ions". By **writing relevant half reactions** write down the **overall redox reaction** for the above cell.

(15 marks)

(iii) Following are some of the redox reactions takes place when corrosion process occur on iron surface,



Identify oxidation and reduction reaction/s from above reactions (1) to (3) by calculating the oxidation numbers of Fe/O/H atoms. (15 marks)

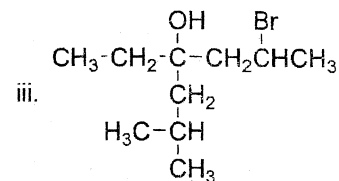
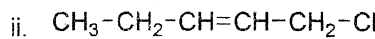
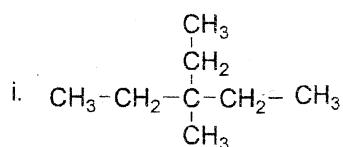
(iv) Write down the balanced half reaction for the reduction of $Cr_2O_7^{2-}_{(aq)} \rightarrow Cr^{3+}_{(aq)}$ in acidic medium. (10 marks)

(6). (a) A compound has a molecular formula C_5H_8O .

- Draw two possible structures with linear carbon chains (branched or unbranched) for this compound.
- Draw one possible cyclic structure for this compound.

(30 marks)

(b) Name the following compounds according to the IUPAC nomenclature systematically.



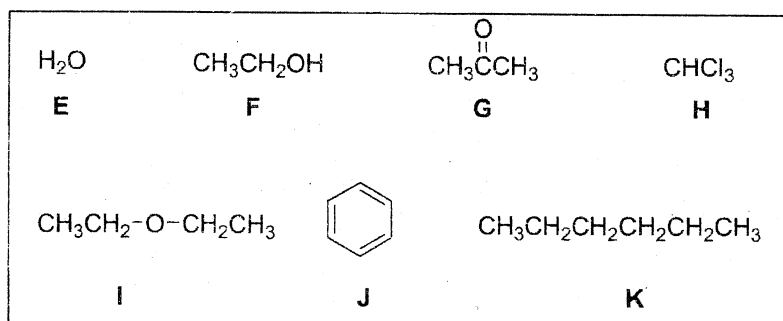
(21 marks)

(c) Draw structures of the following compounds.

- Cyclohexanol
- 2-bromo-3-butenic acid

(14 marks)

(d) Given below in the box are some solvents labeled E- K. Select the most suitable solvent which matches with each of the descriptions given below.



- A solvent used in perfumery
- A highly volatile solvent in the laboratory
- A solvent used to remove ball pen ink
- A solvent used to dissolve nail varnish
- Most polar solvent out of all given in the box

(25 marks)

(e) Name the four basic types of organic reactions you can observe in the laboratory.

(10 marks)