

**THE OPEN UNIVERSITY OF SRI LANKA**  
**CERTIFICATE IN LABORATORY TECHNOLOGY 2015/2016**  
**PSC 1222-BASIC CHEMISTRY FOR LABORATORY PRACTICE**  
**CONTINUOUS ASSESSMENT TEST**



**Date:** 30<sup>th</sup> October 2015  
**Time:** 4.00 - 5.30 p.m  
**Duration:** One and half hours

Question no	Marks
1	
2	
3	
4	

**Instructions to candidates**

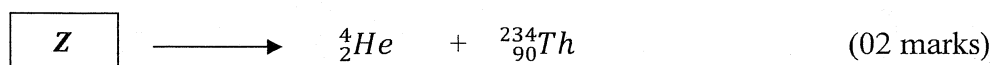
**This question paper consists of four structured type questions. Answer all the questions.**

Registration number: .....

- (1) (a) (i) Define the term isotope. (03 marks)  
 (ii) The relative atomic mass of chlorine is quoted as 35.5. A sample of chlorine is made in the laboratory is a mixture of  $^{35}_{17}\text{Cl}$  and  $^{37}_{17}\text{Cl}$ . What are the percentages of the two isotopes in chlorine. (05 marks)
- (b) (i) What is a standard solution? (02 marks)  
 (ii) Can we use sodium hydroxide (NaOH) pellets to make a standard solution of sodium hydroxide? Explain your answer. (03 marks)  
 (iii) Calculate the mass of sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) must be dissolved in  $1 \text{ dm}^3$  of solution to give a sodium carbonate solution of concentration  $1.5 \text{ mol dm}^{-3}$ . (Atomic mass of Na = 23; C = 12 and O = 16  $\text{g mol}^{-1}$ ) (05 marks)
- (c)  $100 \text{ cm}^3$  of a solution of hydrochloric acid (HCl) were exactly neutralized by 0.12 g of magnesium (Mg) ribbon. (Atomic mass of Mg = 24; H = 1 and Cl = 35.5  $\text{g mol}^{-1}$ )  
 (i) Write down the balanced equation for the above reaction. (02 marks)  
 (ii) What is the concentration of the acid? (05 marks)
- (2) (a) Name acidic and basic compounds/ solutions (two each) that you use commonly in household. (04 marks)  
 (b) Equilibrium is established in the reaction
- $$\text{A}_{(\text{aq})} + \text{B}_{(\text{aq})} \rightleftharpoons 2\text{C}_{(\text{aq})}$$
- (i) Write an equation for the equilibrium constant ( $K_c$ ) of the above reaction. (03 marks)  
 (ii) If equilibrium concentrations are  $[\text{A}] = 0.25$ ,  $[\text{B}] = 0.40$ ,  $[\text{C}] = 0.50 \text{ mol dm}^{-3}$ , calculate the value of  $K_c$ ? (06 marks)

- (c) (i) Write down an expression to indicate pH of a solution. (03 marks)  
 (ii) What is the pH of a solution of hydrochloric acid of concentration  $0.1 \text{ mol dm}^{-3}$  (04 marks)  
 (iii) Comment on the following statement;  
 "Acid rain has made the natural water resources acidic" (05 marks)

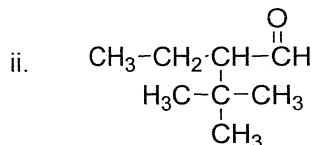
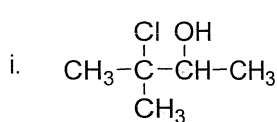
- (3) (a) Write a balance equation for the decay of  ${}^{234}_{90}\text{Th}$  by electron emission. The symbol of the element resulted is Q. (05 marks)  
 (b) Complete the following reaction.



(Z is a hypothetical symbol)

- (c) Write gamma, beta and alpha particles in the increasing order of penetration power. (03 marks)  
 (d) What is nuclear fusion?  
 Give two advantages of nuclear fusion compound to nuclear fission. (06 marks)  
 (e)  ${}^{90}_{38}\text{Sr}$  is a radioisotope having a half life of 29 years. The current weight is 0.800 g. What will be the weight remaining after 87 years? (09 marks)
- (4) (a) A compound has a molecular formula  $\text{C}_5\text{H}_{10}\text{O}$ . Draw three possible structures for this molecular formula. (09 marks)

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



(06 marks)

- (c) Give reasons for the following observations.  
 i. Table salt is soluble in water but insoluble in kerosene oil.  
 ii. Lacquer applied on wood dries quickly.

(06 marks)

- (d) A reaction was performed in the laboratory at room temperature. Give four possible signs to tell that a chemical reaction has occurred.

(04 marks)

# THE OPEN UNIVERSITY OF SRI LANKA

## Certificate in Laboratory Technology 2015/2016

### PSC1222 - Basic Chemistry for Laboratory Practice

#### Continuous Assessment Test –Answer Guide

- (1) (a)
- (i) Isotopes are atoms that have the same atomic number but different mass numbers  
or  
Atoms of the same element having different masses are called as isotopes. (03 marks)
- (ii) If  ${}^{35}_{17}\text{Cl} = x\%$  (percentage of  ${}^{35}_{17}\text{Cl}$ ), then  ${}^{37}_{17}\text{Cl} = (100 - x)\%$ .  
 $35.5 = \left(\frac{x}{100} \times 35\right) + \left(\frac{100-x}{100} \times 37\right)$   
 $x = 75\%$   
Therefore,  ${}^{35}_{17}\text{Cl}$  has 75%  
 ${}^{37}_{17}\text{Cl} = (100 - 75)$   
 $= 25\%$  (05 marks)
- (b)
- (i) A standard solution is a solution of known concentration. (02 marks)
- (ii) No. We cannot make a standard solution of sodium hydroxide, As you were weighing it out, it would absorb water vapour from air in atmosphere (Hygroscopic). (03 marks)
- (iii) Amount of  $\text{Na}_2\text{CO}_3 = V \times C$   
 $= 1.00 \text{ dm}^3 \times 1.5 \text{ mol dm}^{-3}$   
 $= 1.5 \text{ mol}$  (02 marks)
- Molar mass of  $\text{Na}_2\text{CO}_3 = (2 \times 23) + 12 + (3 \times 16)$   
 $= 106 \text{ gmol}^{-1}$  (01 marks)
- Mass of  $\text{Na}_2\text{CO}_3 = 1.5 \text{ mol} \times 106 \text{ gmol}^{-1}$   
 $= 159 \text{ g.}$  (02 marks)
- (c)
- (i)  $\text{Mg}_{(s)} + 2 \text{HCl}_{(aq)} \text{-----} \text{MgCl}_{2(aq)} + \text{H}_{2(g)}$  (02 marks)
- (ii) Number of moles of Mg  $= \frac{0.12 \text{ g}}{24 \text{ gmol}^{-1}}$   
 $= 0.005 \text{ mol}$  (02 marks)
- Number of moles of HCl  $= 0.005 \text{ mol} \times 2$   
 $= 0.01 \text{ mol}$  (01 marks)

$$\begin{aligned} \text{Concentration of HCl} &= \frac{0.01 \text{ mol}}{0.1 \text{ cm}^3} \times 1000 \text{ cm}^3 \\ &= 0.1 \text{ moldm}^{-3} \end{aligned} \quad (02 \text{ marks})$$

(2)

- (a) Acidic solution – Vinegar (acetic acid), Lime juice (citric acid)  
 Basic compounds – Milk of magnesia (Mg(OH)<sub>2</sub>), Washing soda (Na<sub>2</sub>CO<sub>3</sub>), Baking soda (NaHCO<sub>3</sub>), Lime (Ca(OH)<sub>2</sub>). (4 × 01 marks)

(b)

(i) 
$$K_C = \frac{[C_{(aq)}]^2}{[A_{(aq)}][B_{(aq)}]} \quad (03 \text{ marks})$$

(ii) 
$$K_C = \frac{[0.50]^2 \text{ mol}^2 \text{ dm}^{-3}}{[0.25] \text{ moldm}^{-3} \times [0.40] \text{ moldm}^{-3}} \quad (04 \text{ marks})$$

$$K_C = \frac{0.25}{0.1}$$

$$K_C = 2.5 \quad (02 \text{ marks})$$

(c)

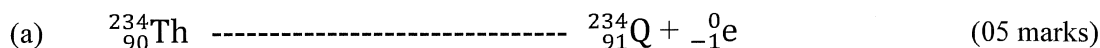
(i)  $\text{pH} = -\log [H^+] \quad (03 \text{ marks})$

(ii)  $\text{pH} = 0.1 = 10^{-1}$

$$\text{pH} = 1 \quad (04 \text{ marks})$$

- (iii) Acid rain has become more acidic, due to the dissolution of many acidic gases such as SO<sub>2</sub>, CO<sub>2</sub>, etc... The gas SO<sub>2</sub> react with the O<sub>2</sub> to produce SO<sub>3</sub> which combines with H<sub>2</sub>O to form sulfuric acid, which is a strong acid. The gas CO<sub>2</sub> react with H<sub>2</sub>O to produce H<sub>2</sub>CO<sub>3</sub>, which makes the rain water slightly acidic. (05 marks)

(3)



(d) Nuclear fusion is combination of small nuclei to form one large nucleus. (02 marks)

Advantages:

Products are stable.

Products are non- reactive, therefore less danger and no storage problem.

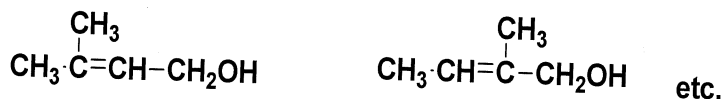
Gives off high energy. (2 × 02 marks)

(e) Number of half lives =  $\frac{87}{29} = 3$  (03 marks)

Fraction left =  $\left(\frac{1}{2}\right)^3 = \frac{1}{8}$  (02 marks)

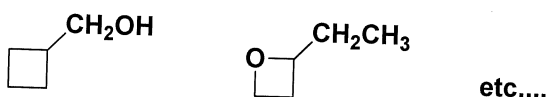
Weight remaining =  $0.8 \times \frac{1}{8} = 0.1$  g (04 marks)

(4) (a)



(even unstable structures acceptable)

(09 marks)



(b) (i) 3-chloro-3-methyl-3-butanol (3-chloro-3-methylbutan-2-ol)

(ii) 2-ethyl-3,3-dimethylbutanal (3×02 marks)

(c)

(i) Table salt is ionic or polar compound. Water is also polar solvent. But kerosene oil is non-polar liquid. Therefore polar or ionic compound is dissolved in only polar solvents. (03 marks)

(ii) Medium to dissolve lacquer is a solvent which is highly volatile. The solvent is evaporates quickly due to the high volatility, due to that reason the lacquer is dried. (03 marks)

(d) Release of temperature (Heat)

Absorbance of temperature (Cooling)

Colour change

Evolution of gases

Solids or precipitate formation

Producing light

Odour formation

(4×01 marks)