



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
(A Centre of Excellence)

Faculty of Applied & Health Sciences

DEPARTMENT OF MEDICAL SCIENCES

DIPLOMA IN PHARMACEUTICAL TECHNOLOGY
(DPT 12M)

ACH 2114: PHYSICAL CHEMISTRY

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- Answer Booklet

Attempt **ALL** questions in section **A** by choosing the correct answer

Attempt **ALL** question on section **B** and any **TWO** question on section **C**

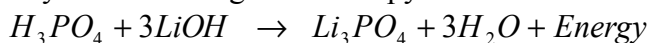
This paper consists of **EIGHT** printed pages

SECTION A (COMPULSORY)

1. Which of the following statement is not consistent:

- b) Gas molecules are a apart
- c) Gas molecules have K.E
- d) Total translation energies is independent of collision
- e) Diffusion is movement of gas molecules

2. Identify nature and sign of Enthalpy for reaction



- a) Endothermic, Negative
- b) Endothermic, Positive
- c) Exothermic, Negative
- d) Exothermic, Positive

3. Calculate quantity of heat required to flow into 1.5g of water to change temperature of water by 53°C (Specific heat of water = 4.184Ug.°C)

- a) 326
- b) 327
- c) 326.8
- d) 330

4. One mole of CH₃COONa dissolves to release -17.3kg of heat. Calculate ΔH_s for 3 moles.

- a) 17.3
- b) -34.6k
- c) -51.9
- d) None of above

5. Give an equilibrium constant expression for $A_{(s)} \rightleftharpoons 2C_{(g)} + B_{(g)} + D_{(g)}$

- a) $K_c = [D] [C] [B]$
- b) $K_c = [C] [B] [D]/[A]$
- c) $K_c = [C]^2 [B] [D]$
- d) $K_c = [C]^2 [B] [D]/[A]$

Use the following value of Equilibrium constant to answer question 6, 7, 8 and 9

- a) $K_c = 1 \times 10^2$
- b) $K_c = 1 \times 10^{-8}$
- c) $K_c = 1 \times 10^8$
- d) $K_c = 1$

6. Which value of KC indicates that reaction is towards completion?

7. Which value of K_C indicates that reaction is at Equilibrium balance?
8. Which value of K_C indicates that reaction is far from completion?
9. Which value of K_C indicates that reaction proceeds to a small extent?
10. For reaction $2\text{NH}_3 \rightleftharpoons 3\text{H}_{2(g)} + \text{N}_{2(g)}$ $\Delta H = -90\text{kJ}$ the number of moles of H_2 can be decreased by:
- Increasing container size
 - Adding NH_3
 - Increasing Temperature
 - Removing N_2
11. Which factor will not affect the value of equilibrium constant K_C ?
- Volume
 - Pressure
 - Catalyst
 - Temperature
12. Which pair of variables are inversely proportional to each other?
- P, T
 - P, V
 - V, T
 - P, n
13. If solute present is less than maximum amount, solution is said to be:
- Saturated
 - Supersaturated
 - Unsaturated
 - Concentrated
14. In a solution equilibrium.
- No dissolution occurs
 - Rate of dissolution is less than rate of crystallization
 - Rate of dissolution greater than rate of crystallization
 - None of the above
15. The solubility of solute depends on:
- Nature of solute only
 - Temperature of solvent
 - Nature of solute and temperature
 - Nature of solvent and temperature
16. Viscosity is proportional to:
- Temperature
 - Molecular weight
 - Pressure
 - Nature of molecules
17. Which of the following is not an empirical gas law?

- a) Charles
- b) Boyles
- c) Dalton
- d) Avogadro's

18. What is the sign of Enthalpy of formation?

- a) ΔH_f^+
- b) ΔH_f^0
- c) ΔF
- d) ΔH_f

19. Which unit of composition varies with temperature?

- a) Molality
- b) Molarity
- c) Mole fraction
- d) Mass percent

20. Calculate molarity of a solution that contains 0.20 mol of KCl in 7.98L solution

- a) 0.0132
- b) 0.0253
- c) 0.459
- d) 1.363

21. Colligative properties depends on:

- a) Identify of solute molecules
- b) Concentration of solute
- c) Nature of solute
- d) Physical properties

22. Which of the following is NOT a colligative properties.

- a) Elevation of Boiling Point
- b) Depression of Boiling Point
- c) Depression of Freezing Point
- d) Osmotic Pressure

23. Gases have:

- a) Maximum intermolecular space
- b) Maximum intermolecular attraction
- c) High compressibility factor
- d) Maximum Repulsion

24. Choose basic salt from the following:

- a) NaCl

- b) Na_2CO_3
- c) NaHSO_4
- d) NaNO_3

25. Which of the following is a double salt?

- a) K CaPO_4
- b) NaCl
- c) NaSO_4

26. Non-colligative properties depends on:

- a) Nature of solute
- b) Amount of solute
- c) Nature of solvent
- d) Amount of solvent

27. Which of the following is NOT a theory of osmosis

- a) Sieve theory
- b) Solution
- c) Elevation of vapour pressure
- d) Vapour pressure theory

28. Which law relates pressure and volume

- a) Charles
- b) Boyles
- c) Dalton
- d) Avogadro's

29. Which pair of variable are directly proportional to one another in ideal gas equation

- a) P,T
- b) P,V
- c) n,T
- d) R,n

30. If solute is present in small size less than one nanometer the mixture will be called.

- a) Solution
- b) Suspension
- c) Emulsion
- d) Mixture

31. Which is not a characteristic of chemical equilibrium:

- a) Rate of forward equal rate of reverse
- b) Concentration of Reactant and products are constant with time
- c) Pressure of both reactant and products are equal
- d) Reaction moves to forward and reverse at the same rate

32. Consider reaction $3\text{A}_{(s)} + \text{B}_{(s)} \rightleftharpoons 2\text{C}$ if 2 mol of A, 3.0 mols of B and 2.0 moles of C were present in 1 L vessels. Calculate the value of KC.

- a) 8.0
- b) 1.0
- c) 2.0
- d) 0.50

33. For chemical reactions $\text{PCl}_{3(g)} + \text{Cl}_{2(g)} \rightleftharpoons \text{PCl}_{5(g)}$ $\Delta H = -92.6 \text{ kJ}$ which conditions favours maximum conversion to products.

- a) High pressure and high temperature
- b) High pressure and low temperature
- c) Low pressure and low temperature
- d) Low pressure and low temperature
- e) Low pressure and high pressure

34. 25 grams of Naphthalene was mixed with 75 grams of Benzene. Calculate mass percent of Benzene.

- a) 35
- b) 36
- c) 25
- d) 75

35. Calculate molality of a solution that contains 6.1 mols of KNO_3 and 745 grams of water.

- a) 0.315
- b) 1.02
- c) 0.779
- d) 1.14

36. The pressures of gas will _____ when volume is decreased.

- a) Increases
- b) Decreases
- c) Do not change
- d) Non of above

37. If both volume and pressure are double what would happen to temperature.

- a) Double
- b) Reduce by half
- c) Decreases
- d) Increases

38. If a solute exist in equilibrium with the solvent, the solution is defined as:

- a) Saturated
- b) Unsaturated
- c) Dilute
- d) Concentrated

39. The weakest antiparticle attraction exist between particles of

- a) Liquid
- b) Gas-liquid
- c) Gas-gas
- d) Solid-solid

40. Boyles Law requires that:

- I. $P_1 V_1 = P_2 V_2$
- II. $PV = \text{Constant}$
- III. $P_1/P_2 = V_2/V_1$

- a) I only
- b) II and I
- c) III only
- d) II and III

SECTION B (ATTEMPT ALL QUESTIONS – 40 MARKS)

41. 10g of Nitrogen gas and 10g of Neon were mixed in 15L contained at 25°C. Calculate total pressure of mixture and partial pressure of Nitrogen gas. **(4 marks)**

42. With the aid of equations state:

- a) Charles Law
- b) Boyles Law **(4 marks)**

43. Define:

- a) Partial pressure of a gas
- b) Vapour pressure of a liquid **(4 marks)**

44. A solution was prepared by dissolving 35.0gramms of Haemoglobin (Hb) in water and making solution up to one litre. If osmotic pressure of solution at 25°C was 10mmHg, calculate molar mass of Haemoglobin $LR = 0.0821 \text{ L.atm/Kelvin mol}$ **(4 marks)**

45. 0.55grams of Nitrobenzene in 22grams of ethanoic acid depressed the freezing point of the latter by 0.78°C. Calculate R.M.M of Nitrobenzene given cryoscopic constant as 3.90°Cm^{-1} **(4 marks)**

46. Differentiate between:

- a) Isotonic and hypotonic solution
- b) Reverse osmosis and osmosis **(4 marks)**

47. State the postulates made in kinetic theory of gases. **(4 marks)**

48. Calculate molar gas constant R at S.T.P for one mole of a gas given pressure as 760mmHg. **(4 marks)**

49. Calculate heat of combustion of liquid Benzene per mole given enthalpy of formation of CO_2 , H_2O and C_6H_6 as -393.55 , -285.85 and -49.04 Kibjoules respectively. **(4 marks)**
50. (a) State equilibrium Law **(2 marks)**
 (b) Explain why gases deviate at high pressure. **(2 marks)**

SECTION C (ATTEMPT ANY TWO QUESTIONS)

51. (a) 0.6 grams of Vinyl Methyl ether $\text{C}_3\text{H}_6\text{O}$ was dissolved in 460 grams of water and volume of solution was made to 120ML. Calculate:
 i) Molarity of solution
 ii) Molality of solution
 iii) Mole fraction of Methyl ether
 iv) Boiling point of solution given ebulliscope constant of water as 0.52°C kg/m
 v) Vapour pressure of solution given vapour pressure of water as 23.48mmHg **(10 marks)**
- (b) Define the following terms:
 i) Boiling point
 ii) Osmotic pressure
 iii) Enthalpy of combustion
 iv) Hydration energy **(8 marks)**
- (c) State Lechateliers Principle. **(2 marks)**
52. (a) With help of a diagram, explain the working of Berkely Hertley Apparatus. **(6 marks)**
- (b) State (i) Characteristic of Reversible Reaction
 (ii) Characteristic of Dynamic Equilibrium **(5 marks)**
- (c) Explain briefly theories of semi-permeable membrane. **(9 marks)**
53. (a) Define the following terms:
 i) Order of reaction
 ii) Molecularity
 iii) Rate Constant **(6 marks)**
- (b) State:
 i) Rate Law
 ii) Ohmic Law
 iii) Characteristic of First Order Reaction. **(6 marks)**
- (c) Derive first order rate equation and use it to calculate concentration of a reaction after 30 minutes if the initial concentration was 0.02m with rate constant of $1.8 \times 10^2 \text{ min}^{-1}$ **(8 marks)**

