UNIVERSITY OF GHANA

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SECOND SEMESTER EXAMINATIONS: 2014/2015
LEVEL 300: BACHELOR OF SCIENCE IN ENGINEERING
BMEN 304:   SOLUTION AND COLLOID CHEMISTRY   (3 Credits)

TIME ALLOWED: 2½ HOURS

Answer ALL Questions

1. Differentiate between the strength of a base and concentration of a base.   **[4 marks]**

2. NH_4Cl is an acidic salt. Explain.   **[4 marks]**

3. The salt produced by the reaction of an equal number of moles of KOH and HNO_3 will react with water to give a solution which is neutral.

    i. Write a balanced equation to represent the reaction.   **[2 marks]**

    ii. Explain why the solution is neutral.   **[2 marks]**

4. Explain why aqueous solutions of NH_3 and H_2CO_3 are weak electrolytes but a mixture of the two forms a strong electrolyte.   **[6 marks]**

5. What is the relationship between the value of pKa and the strength of a weak acid?

    [4 marks]

6. List the factors that influence solution formation.   **[4 marks]**

7. Solubility of gases in water increases with increasing mass. Explain.   **[4 marks]**

8. Calculate the amount of water (in grams) that must be added to 5.00 g of glucose in the preparation of a 32.4 percent by mass of a solution.   **[5 marks]**

9. Differentiate between 1 Molar solution and 1 Molal solution.   **[4 marks]**

10. A 25.0 mL sample of a 30.0% HF solution has a density of 1.101 g/mL. The sample is diluted to a volume of 0.500 L. What is the **molarity** of the final solution?
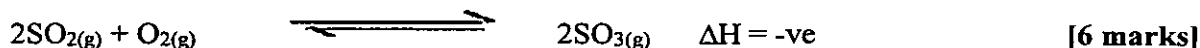
    (H = 1.008, F = 19.00).   **[5 marks]**

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11. Differentiate among **solution**, **colloid** and **suspension**. Give an example for each.

[6 marks]

12. Using thermodynamic principles, deduce the most suitable conditions for an economic yield of SO_3 in the reaction below:

$$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad \Delta H = -ve$$

[6 marks]

13. In an industrial process to produce ammonia (NH_3); nitrogen, N_2, reacts with hydrogen, H_2, the enthalpy change (ΔH) is -46 kJ/mol.

i. Write a correctly balanced equation for this reaction. [4 marks]

ii. Would this reaction absorb heat or give out heat to the environment? [2 marks]

14. State the Raoult's Law. If a solution shows a negative deviation from Raoult's law, would you expect it to have a higher or lower boiling point than if it was ideal? Explain your answer. [6 marks]

15. The presence of a non volatile solute in solution reduces the tendency of the solvent molecule from escaping. Explain. [5 marks]

16. Explain why the following reaction is a **REDOX** reaction:

$$Mn^{2+} + H_2O_2 \rightarrow MnO_2 + H_2O$$
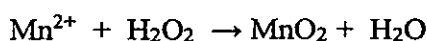
(α) List the species that is reduced and the one that is oxidised. [2 marks]

(δ) State the initial and final oxidation numbers of the species you have listed. [2 marks]

(γ). Separate the reaction into two half-reactions and balance each of them. [6 marks]

17. Using intermolecular forces differentiate between an ideal solution and non ideal solution.

[4 marks]

18. Differentiate between a galvanic cell and an electrolytic cell. [4 marks]

19. State the Beer-Lambert's Law. [4 marks]

20. If a solution of Cr^{+3} has an absorbance of 0.660, and the molar absorptivity of Cr^{+3} is 2.31×10^5 A/M/cm, and the length of the light path is 2.2 cm, what is the concentration of Cr^{+3}?

[5 marks]

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