OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA
DEPARTMENT OF CHEMISTRY
B.Sc. Degree Examination Part II
CHM 205: EXPERIMENTAL PHYSICAL/INORGANIC CHEMISTRY

Harmattan Semester Examination (2022/2023 Session)

TYPE 3 **TIME ALLOWED: 1hr**

1. Which of the following statement is NOT true about the experiment to determine the rate constant for the hydrolysis of methyl acetate?
   (a) The reaction takes place in the presence of acid
   (b) Methyl orange indicator is most suitable for the titration of the hydrolysis product with sodium hydroxide
   (c) The amount of acid formed increases with increase in reaction time
   (d) Phenolphthalein indicator is suitable for the titration of the hydrolysis product with sodium hydroxide

2. In the determination of rate constant for hydrolysis of methyl acetate in the presence of excess water, the reaction is (a) first order (b) second order (c) third order (d) zero order

3. Which of the following salts will NOT hydrolyse? (a) ferric chloride (b) sodium acetate (c) sodium carbonate (d) sodium chloride

4. If an indicator shows its acid colour in water, it means its pK is (a) equal to 7 (b) less than 7 (c) greater than 7 (d) at infinity

5. Which of the following is NOT true about experimental errors (a) they are avoidable mistakes (b) they can occur due to poor personal judgement (c) limits of errors can be estimated (d) They are inevitable

6. Which of the following describes the line of best fit in an experimental graph?
   (a) The line for which the sum of the squares of the deviation of the experimental points from the line is maximum
   (b) The line passing through some experimental points which seems collinear
   (c) The line for which the sum of the squares of the deviation of the experimental points from the line is minimum
   (d) The line with a positive slope

7. Which of these are the products obtained from the hydrolysis of methyl acetate (CH_3COOCH_3)?
   (a) CH_3OOH and CH_3CHO (b) CH_3COCH_3 and CH_3OH (c) CH_2COOH and CH_2OH (d) CH_3COOH and CH_3OH

8. Error due to parallax is categorized as
   (a) Random errors (b) Basic errors (c) Standard errors (d) Systematic errors

9. Which of the following shows precision in an experiment (a) Nearness of measurement to the accepted value (b) Reproducibility and repeatability of results (c) Absence of error (d) High value of average deviation

10. The pK of an indicator is the pH at which the indicator displays its (a) acid colour (b) basic colour (c) neutral colour (d) secondary colour

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11. What is the pH of a buffer prepared by adding equimolar of 13.5 mL acetic and 10 mL NaOH? (k_a for acetic acid = 1.8×10^{-5}) (a) 6.3 (b) 6.9 (c) 4.8 (d) 4.6

12. Which of the following is true for centroid method?
(a) Experimental points are divided into three groups as nearly equal as possible, with the odd in the middle
(b) Experimental points are divided into two groups of equal numbers
(c) Experimental points are used indiscriminately
(d) Experimental points are divided into three unequal groups

The Table below shows a set of experimental data used by a student to plot a best-fitting line using centroid method. Use this information to answer questions 13-16

X	0.06	0.14	0.18	0.28	0.36	0.40	0.42	0.50
Y	0.10	0.22	0.34	0.32	0.46	0.60	0.74	0.88

13. Calculate the value of the slope (a) 1.66 (b) 1.56 (c) 0.64 (d) 16.6

14. If the range of the vertical scatter of points (ω) is 0.22 and the range on the x coordinate is 0.44, calculate the standard error of the slope
(a) 0.45 (b) 0.335 (c) 0.35 (d) 0.25

15. What is the value of the intercept? (a) 0.08 (b) -0.0276 (c) -0.08 (d) 0.0276

16. Calculate the standard error in $\bar{y}$ (a) 0.293 (b) 0.113 (c) 0.335 (d) 0.0275

17. Which of the following statements is NOT true about indicators?
(a) They are weakly acid or basic (b) Their unionized forms have different colour from the ionized forms (c) They catalyse the reaction in which they are placed (d) Their colours in acid and base are different

18. Which of the following is true for pH of a buffer solution?
(a) It changes upon addition of small amount of acid or alkali (b) It does not change upon addition of large amount of concentrated acid or alkali (c) it does not change upon addition of small amount of acid and alkali (d) it is always acidic

19. The correct choice of an indicator for acid-base titration depends on the (a) salt solution formed at equivalent point (b) titre value (c) concentration of the acid (d) concentration of the base

20. A accurate measurement of pH can be achieved by using (a) methods involving comparison of colours of indicator in buffer solution with that of the unknown (b) pH meter (c) universal indicator paper (d) litmus paper

21. A buffer has a pH of 4.8. What is the concentration of hydrogen ions (mol/dm^3) in the buffer?
(a) 0.68 (b) 1.58×10^{-5} (c) 6.31×10^4 (d) 1.58

22. What is the role of hydrochloric acid in the hydrolysis of methyl acetate?
(a) reducing agent (b) oxidation agent (c) catalyst (d) decomposition agent

Given the equation $log\ (V_\infty - V_t) = -\frac{kt}{2.303} + log\ V_\infty$ for the hydrolysis of methyl acetate. **Use this information to answer question 22-23**

23. The V_∞ is (a) volume of acid that neutralize the base produced upon completion of hydrolysis (b) volume of base that neutralize the acid after six hours of reaction (c) volume of acid that neutralize the base after six hours of reaction (d) volume of base that neutralize the acid upon completion of hydrolysis

24 Calculate the value of the rate constant k if the slope is – 0.1667
(a) 0.0218 (b) – 0.384 (c) 0.384 (d) -0.0218

25. What quantity of acetic acid should be added to 10 mL of 1M NaOH to give a buffer solution of pH 5.6? (k_a for acetic acid = 1.8×10^{-5}) (a) 1.4 mL (b) 2.8 mL (c) 11.4 mL (d) 12.8 mL

26. Which acid/base pairs will produce sodium acetate and ammonium chloride respectively?
(a) acetic acid/sodium hydroxide and hydrochloric acid/sodium carbonate
(b) acetic acid/sodium chloride and hydrochloric acid/ aqueous ammonia
(c) acetic acid/sodium hydroxide and hydrochloric acid/ aqueous ammonia
(d) methanoic acid/ sodium hydroxide and hydrochloric acid/ aqueous ammonia

27. In which of the following acid-base titration can any indicator be used? (a) acetic acid/sodium hydroxide (b) sulphuric acid/sodium carbonate (c) hydrochloric acid/ aqueous ammonia (d) hydrochloric acid/ sodium hydroxide

28. Which of the following salts will form a weakly alkaline solution? (a) Potassium chloride (b) sodium carbonate (c) sodium nitrate (d) ammonium chloride

29. A buffer is best described as a mixture of (a) salt of weak acid and strong base (b) salt of strong acid and weak base (d) salt of strong base and strong acid (d) salt of weak acid and weak acid

30. Methyl orange has a pH range 2.8-3.8, in which of the following titrations would you recommend its use as indicator? (a) acetic acid vs sodium hydroxide (b) hydrochloric acid vs sodium carbonate (c) formic acid vs sodium carbonate (d) acetic acid vs ammonia solution

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5.6 = 4.745 + log[ ]/[acid]   n = CV   10 =

CH3COOH + NaOH → CH3COONa + H2O

10mL 1M   n = m

n = CV
n = 10