

Model Exam

Course Title: Analytical Chemistry

Course Code: 1112

Term : Second

Marks: 30
Total pages: 4

Time Allowed :
45 minutes

Choose ONE best answer and mark it in the answer sheet in the first page (30 points)

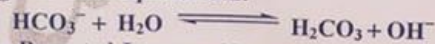
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1- A solution of accurately known concentration is the definition of a.....

- a- Buffer solution.
- b- Neutral solution.
- c- Standard solution.
- d- Saturated solution.

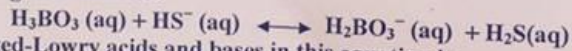
2- Consider the following acid-base equilibrium:



In the reaction above, the Brønsted-Lowry acids are.....

- a- H_2O and OH^-
- b- H_2O and H_2CO_3
- c- HCO_3^- and OH^-
- d- HCO_3^- and H_2CO_3

3- Consider the following reaction.....



The order of Brønsted-Lowry acids and bases in this equation is

- a- Acid, base, base, acid
- b- Acid, base, acid, base
- c- Base, acid, acid, base
- d- Base, acid, base, acid
- e- None of the above.

4- RNH_2 is a basic compound according to

- a- Arrhenius Ionization Theory.
- b- Brønsted-Lowry Theory.
- c- Lewis Concept (Theory)
- d- a & b
- e- b & c

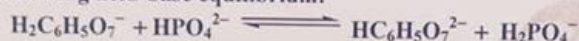
5- Consider the following:

I.	PO_4^{3-}
II.	HPO_4^{2-}
III.	H_2PO_4^-
IV.	H_3PO_4

The term amphoteric can be used to describe:

- a- I only.
- b- II and III only.
- c- I, II and III only.
- d- II, III and IV only.

6- Consider the following acid-base equilibrium:



In the equilibrium above,

- a- Reactants are favored because $\text{H}_2\text{C}_6\text{H}_5\text{O}_7^-$ is the weaker acid.
- b- Reactants are favored because HPO_4^{2-} is the weaker acid.
- c- Products are favored because $\text{HC}_6\text{H}_5\text{O}_7^{2-}$ is the weaker acid.
- d- Products are favored because H_2PO_4^- is the weaker acid.

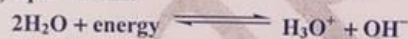
N.B.

$$\begin{aligned} \text{Ka of } \text{H}_2\text{C}_6\text{H}_5\text{O}_7^- &= 1.8 \times 10^{-5} \\ \text{Ka of } \text{H}_2\text{PO}_4^- &= 6.3 \times 10^{-8} \end{aligned}$$

7- As the $[\text{H}_3\text{O}^+]$ in a solution decreases, the $[\text{OH}^-]$:

- a- Increases and the pH increases.
- b- Increases and the pH decreases.
- c- Decreases and the pH increases.
- d- Decreases and the pH decreases.

8- Consider the following equilibrium:



In pure water at a temperature of 50°C ,

- a- $K_w = 1.0 \times 10^{-14}$
- b- $\text{pH} + \text{pOH} = 14$
- c- $\text{pH} < 7$
- d- $[\text{OH}^-] < 1.0 \times 10^{-7}$

9- What is the pH of a 0.10M NaOH solution?

- a- 0.70
- b- 1.00
- c- 10.00
- d- 13.00

10- What does a buffer do?

- a- Keeps the salt concentration of a solution constant.
- b- Keeps the pH of solution constant
- c- Keeps the cation concentration constant.
- d- Keeps the anion concentration constant.

11- What substances are present in a buffer?

- a- A weak base or acid only.
- b- A hydrolyzing salt only
- c- A weak base or acid and its salt
- d- A salt only.

12- Which of the following could be added to a solution of **sodium acetate** to prepare a buffer? acetic acid hydrochloric acid ammonium acetate sodium chloride

- a- Acetic acid only
- b- Hydrochloric acid only
- c- Ammonium acetate only
- d- Sodium chloride or ammonium acetate
- e- Acetic acid or hydrochloric acid



13- Of the following solutions, which has the greatest buffer capacity?

- a- 0.100 M NH₃ and 0.455 M NH₄Cl
- b- 0.543 M NH₃ and 0.555 M NH₄Cl
- c- 0.087 M NH₃ and 0.088 M NH₄Cl
- d- 0.100 M NH₃ and 0.455 M NH₄Cl

14- Which of the following reactions shows what happens when nitric acid is added to an ammonium ion ammonia buffer?

- a- $H^+ + Cl^- \rightarrow HCl$
- b- $H^+ + NH_4^+ \rightarrow NH_5$
- c- $Cl^- + NH_3 \rightarrow NH_3Cl$
- d- $H^+ + NH_3 \rightarrow NH_4^+$

15- Increasing the temperature will greatly affect the pH of the buffer in the former question

- a- True
- b- False

16- Consider a buffer solution containing 0.1 N acetic acid & 0.1N sodium acetate, The pH of this solution is (the pKa of acetic acid is 4.74):

- a- 3.55
- b- 4.74
- c- 10.45
- d- 9.26

17- The pH of the solution produced by adding 10.0 ml of 1N HCl to the buffer in the former question is

- a- 3.55
- b- 4.74
- c- 3.65
- d- 4.65

18- During an acid-base titration, the point at which the indicator color is changed is known as, while the is point at which stoichiometric amounts of acid and base have been combined

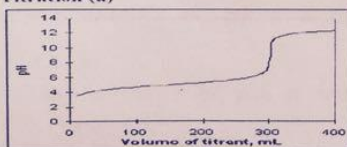
- a- End point, Transition point.
- b- End point, Equivalence point.
- c- Equivalence point, End point.
- d- Equivalence point, Transition point.
- e- None of the above.

19- Pure potassium hydrogen phthalate is used to standardize a solution of NaOH for use in an acid-base titration. What term is used to describe the potassium hydrogen phthalate?

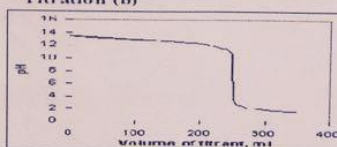
- a- Titrant base.
- b- Standard buffer.
- c- Equivalent base.
- d- Primary standard.

Examine the following titration curves (T.C) to answer questions 20 to 24 :

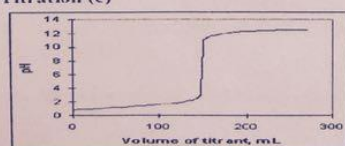
Titration (a)



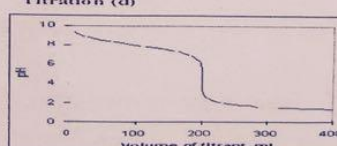
Titration (b)



Titration (c)



Titration (d)



- 20- Which one of the titration curves corresponds to the titration of strong acid (in flask) With strong base (in burette)?
a- T.C.(a) b- T.C. (b)
c- T.C (c) d- T.C. (d)
- 21- The pH at the equivalence point in the former titration equals.
a- 0.00 b-7
c- 6.5 d- 8.5
- 22- Titration curve (d) corresponds to titration of
a- Strong base with strong acid. b- Weak base with strong acid.
c- Strong base with weak acid . d- Weak base with weak acid .
- 23- Which indicator would be best for the titration (d) ?
a- Phenolphthalein (pKa = 9.1). b- Thymol blue (pKa = 1.7).
c- Methyl red (pKa = 5). d- Phenol red (pKa = 7.4).
- 24- In the titration of weak acid against strong base, at the half equivalence point
a- pH = 1/2 pKa. b- pH = pKb
c- pH = 2 pKa. d- pH = pKa.
- 25- What volume (mL) of 0.5M HNO₃ is necessary to titrate 25 mL of 0.05M KOH solution to the endpoint?
a- 2.5 b- 5.0 c- 10 d- 25 e- 50
- 26- A 30.0 mL sample of 0.44M hydrazoic acid, (HN₃ ; K_a = 2.6 x 10⁻⁵) is titrated with a 0.22M KOH solution.
What is the pH of the solution at 60% of titration ?
a- 8.87 b- 7.0 c- 5.94 d- 4.77 e- 4.59
- 27- Titration of a mixture of formic acid (K_a = 1.8 x 10⁻⁴) & acetic acid (K_a = 1.8 x 10⁻⁵), will give two end points .
a- True b- False
- 28- H₃BO₃ (K_a = 10 x 10⁻¹⁰) can be titrated with NaOH after addition of
a- Dextrin. b- Nitrobenzene
c- Glycerol d- Neutral formalin
- 29- In the Titration of Na₂CO₃ / NaOH mixture , total alkalinity can be determined by using standard HCl as a titrant & M.O indicator
a- True . b- False
- 30- Among the reasons for back or residual acid-base titration:
a- Volatile substances
b- Insoluble substances
c- Substances which require heating with standard reagent.
d- Substances which require excess reagent for quantitative reaction to proceeds rapidly.
e- All of the above.
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Good Luck