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Chemistry Department | Chem. 109 | 2nd Semester 2012

Midterm | 70 min. | 8/4/2012

Name(in Arabic): [redacted]

Section, Instructor

Registration Number: [redacted]

Answer each of the following questions and put "X" on the correct choice in answer sheet below.

Answer Sheet

1.	a	b	c	d	e	11.	a	b	c	d	e
2.	a	b	c	d	e	12.	a	b	c	d	e
3.	a	b	c	d	e	13.	a	b	c	d	e
4.	a	b	c	d	e	14.	a	b	c	d	e
5.	a	b	c	d	e	15.	a	b	c	d	e
6.	a	b	c	d	e	16.	a	b	c	d	e
7.	a	b	c	d	e	17.	a	b	c	d	e
8.	a	b	c	d	e	18.	a	b	c	d	e
9.	a	b	c	d	e	19.	a	b	c	d	e
10.	a	b	c	d	e	20.	a	b	c	d	e

Techniques and Measurement and safety rules.

1. Which of the following are used for precise measurement of liquid volume?

   a) beaker and burret
   b) pipet and burret
   c) beaker and graduated cylinder
   d) Erlenmeyer flask and pipet
   e) beaker and pipet

2. A student obtained the following set of data:
   Volume of a liquid = 10.00 mL
   Mass of empty beaker = 42.60 g
   Mass of beaker with the liquid = 52.10 g → mass of liquid =
   Calculate the density of the liquid (in g/mL).
   Record the value to the correct number of significant figures.

   density = mass / volume = 9.50 / 10.00

   a) 0.9500
   b) 0.95
   c) 0.9
   d) 0.950
   d) 0.95000

3. Which of the following statements is **incorrect**?

   a) Food, drinks and gum are not allowed in the labs at any time.
   b) All injures should be reported to your laboratory instructor.
   c) Dispose excess chemical by returning it into the original reagent bottle
   d) Safety goggles must be worn at all times when working with chemicals or near others doing so.
   e) Whenever your hands come into contact with chemicals in laboratory, wash them quickly with soap and water.

Formula of a Hydrate

4. Given the following set of data:
   Mass of empty crucible = 19.72 g
   Mass of crucible with the hydrate ($KFe(SO_4)_2 . xH_2O$) = 21.34 g
   Mass of the crucible with anhydrous salt ($KFe(SO_4)_2$) = 20.58 g.
   Molar masses: $KFe(SO_4)_2$ = 287g/mol; H_2O = 18.0 g/mol.
   Calculate the value of "x" in ($KFe(SO_4)_2 . xH_2O$).

   mass of hydrate = 1.62
   mass of anhydrate = .86
   mass of water = .76

   a) 12
   b) 10
   c) 13
   d) 14
   e) 11

hydrous → anhydrous → water.

↑ H_2O Gained = x
↓ anhydrous Gained

5. A student determined value of 'x' in the formula of alum $KAl(SO_4)_2 . xH_2O$ greater than should be. A possible reason for that could be:
   a) Incomplete dehydration of alum.
   b) Some of the alum was lost during heating.
   c) The mass recorded for the crucible with anhydrous salt was higher than actual value.
   d) Answers a and b.
   e) Answers a and c.

$KAl(SO_4)_2$ $Na_2(SO_4)$

Formula of an Oxide

6. A sample of metal, M, was burned in air to produce a metal oxide
   Given the following set of data:

Mass of empty crucible	=	20.18 g
Mass of crucible with metal	=	20.54 g
Mass of crucible with metal oxide	=	20.81 g

→ mass of metal = .36.
" - oxide = .63
" - O = .27

   Molar mass of metal = 24.0 g/mol and of oxygen =16.0 g/mol)
   Determine the value x in the formula(MO_x).
   Report x to two significant figures.

x = 1 1.1

x O
.36 .27
.16

   a) 1.0 b) 1.4 c) 1.3 d) 1.2 e) 1.1

7. A student heated 2.75 g of sodium sulfate hydrate, $Na_2SO_4 .x H_2O$ in a crucible to get 1.56 g of anhydrous salt. What is the value of "x"? (Formula weight of Na_2SO_4 = 142).

   a) 4 b) 6 c) 7 d) 8 e) 5

hydrate = 2.75.
anhydrate = 1.56 → .11
water = 1.19 → .77 and

8. In "the empirical formula of an oxide" experiment, after burning magnesium in air and allowing the crucible to cool, 10 drops of water were added to:

a) Convert magnesium nitride into magnesium hydroxide.
b) Convert magnesium oxide into magnesium nitride.
c) Convert unreacted magnesium into magnesium oxide.
d) Convert magnesium nitride into magnesium oxide.
e) Convert magnesium oxide into magnesium hydroxide.

9. A student burned 0.310 g of white phosphorus in air and obtained 0.710 g of phosphorous oxide. What is the empirical formula of the oxide produced ?(atomic weights: P = 31.0 , O = 16.0)

a) PO_3 b) P_2O_3 c) P_2O_5 d) PO e) PO_2

Limiting Reactant

10. Given the following set of data for the determination of % composition of a mixture of Na_3PO_4. 12 H_2O and $BaCl_2$. 2H_2O.
Mass of salt mixture = 1.20 g.
Mass of precipitate formed = 0.360 g
Molar mass of $BaCl_2$. 2H_2O = 244 g/mol
Molar mass of Na_3PO_4. 12H_2O= 380 g/mol
Molar mass of $Ba_3(PO_4)_2$ = 601 g/mol
When a drop of $BaCl_2$ solution was added to the filtrate a white precipitate was formed.
Calculate the mass % of **the limiting reactant** in the salt mixture.

a) 36.5 b) 32.5 c) 28.4 d) 24.4 e) 20.4

11. Calculate the mass of $Ba_3(PO_4)_2$ produced from the reaction of 0.84 g of Na_3PO_4. 12H_2O with excess $BaCl_2$. 2H_2O.

a) 0.51 b) 0.43 c) 0.59 d) 0.73 e) 0.66

12. A mixture of 0.35 g of $BaCl_2.2H_2O$ and 0.69 g of $Na_3PO_4.12H_2O$ was dissolved in water and heated at 80-90 °C for 20 minutes. Calculate the mass of the precipitate.(Molar masses from question 10 above).

a) 0.38 g b) 0.34 g c) 0.31 g d) 0.29 g e) 0.26 g

Determination of Acetic Acid in Vinegar

13. A solution of NaOH of unknown concentration was standardized using potassium hydrogen phthalate (KHP).
Given the following set of data:
Mass of (KHP) = 0.32 g
Initial reading of burret (NaOH) = 12.40 mL
Final reading of burret (NaOH) = 22.40 mL
Molar mass of KHP = 204.6 g/mol.
Calculate the molar concentration of NaOH

a) 0.20 b) 0.30 c) 0.16 d) 0.11 e) 0.13

14. A sample of 10.00 mL of vinegar was titrated 0.15 M NaOH solution using phenolphthalein as an indicator.
Given the following set of data:
Initial reading of burret (NaOH) = 12.60 mL
Final reading of burret (NaOH) = 28.60 mL
Calculate the molar concentration of acetic acid in vinegar solution.
Record the value to the correct number of significant figures.

a) 0. 240 b) 0.24 c) 0.2400 d) 0.2 e) all wrong

15. If concentration of acetic acid, CH_3COOH, in a vinegar solution is 0.40 M. Calculate the mass percent of acetic acid in this solution.
Given: Density of solution is 1.05 g/mL and molar mass of acetic acid is 60.0 g/mol.

a) 1.7 b) 1.1 c) 2.7 d) 1.4 e) 2.3

The Neutralization Capacity of Antacid Tablets

16. A 0.16 g sample of an antacid was dissolved in 25.00 mL of 0.15 M HCl solution. The excess acid was back titrated with 0.10 M NaOH solution.
Given the data:
Initial reading of burret (NaOH) = 12.60 mL
Final reading of burret (NaOH) = 20.60 mL
Calculate the number of moles of HCl neutralized by one gram antacid.

a) 0.018 b) 0.016 c) 0.012 d) 0.010 e) 0.014

17. Given:
The antacid capacity of a substance is 0.0200 mol HCl / g antacid.
The stomach acid is 0.100 M HCl.
Calculate the volume of stomach acid that can be neutralized by 0.80 g antacid tablet.

a) 100. mL b) 120. mL c) 140. mL d) 160. mL e) 180. mL

18. Calculate the volume of 0.160 M HCl needed to react 3.36 g $NaHCO_3$. (Atomic weights: Na = 23.0; H = 1.0; C = 12.0; O =16.0).

a) 200. mL b) 125 mL c) 250. mL d) 400 mL e) 450. mL

Bleach Analysis

19- Given the following set of data;
Volume of 0.010 M $K_2Cr_2O_7$ = 25.0 mL
Mass of KI = 1.0 g
Volume of HCl solution = 5.0 mL
Volume of $Na_2S_2O_3$ needed to titrate the librated iodine = 30.0 mL.
Calculate the molar concentration of $Na_2S_2O_3$ solution
The balanced equations is:

$$Cr_2O_7^{2-} + 6S_2O_3^{2-} + 14H^+ \rightarrow 2Cr^{3+} + 3S_4O_6^{2-} + 7H_2O$$

a) 0.10 b) 0.12 c) 0.075 d) 0.060 e) 0.050

20. Which of the following statements is **correct** concerning bleach analysis?

a) I_3^- oxidizes $Na_2S_2O_3$ to $Na_2S_4O_6$.
b) $Na_2S_2O_3$ solution cannot be oxidized by oxygen or bacterial action.
c) Sodium thiosulfate, $Na_2S_2O_3$, oxidizes I_3^- to I^-.
d) Sodium thiosulfate can readily be prepared from solid $Na_2S_2O_3$ as
e) Potassium dichromate, $K_2Cr_2O_7$, cannot be used as a primary standard solution.