The University of Jordan
Chemistry Department
General Chemistry lab 109
Midterm Exam
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13/14

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Answer each of the following questions and put X on the correct choice in case of multiple answer questions and write down your answer in the indicated place in other questions.

Laboratory safety rules:

1. Which of the following actions is allowed in the laboratory?

a) Drinking and eating b) Smoking tobacco c) visitors coming into the lab

(d) Wearing glasses e) All of the above

Techniques and measurement

2. Which of the following volume measuring devices can't be used for precise determination of the volume of a liquid?

a) Erlenmeyer Flask b) Volumetric flask c) A dispenser d) A pipet

e) Buret

3. Given the following set of data for the determination of liquid density:

Mass of empty beaker = 25.25 g

Mass of beaker + liquid = 27.53 g

Volume liquid = 10.52 mL

Then the density of liquid in g/mL is

(Write the answer to correct number of significant figures)

Answer: 2.16 x 10^{-1} g/mL

$m = 27.53 - 25.25 = 2.28$

$V = 10.52$

$d = \frac{m}{V} = \frac{2.28}{10.52} = 0.216$

$= 2.16 \times 10^{-1}$

4. Which of the following statements is false?

a) Specific gravity is a dimensionless quantity.

b) Specific gravity is defined as the ratio of the density of water to the density of the substance

c) Specific gravity is defined as the ratio of the density of the substance to the density of water.

d) Density changes with changing temperature.

e) The density of a substance is expressed in g / mL.

5. In an experiment to determine the density of a solid object, the value you obtained was 3.52 g/mL. But you noticed air bubbles were formed when you put the solid object in water, then

a) The determined density will not be affected by the formation of these bubbles.

b) The determined density will be lower than the actual density.

c) The determined density will be higher than the actual density.

d) Density variations depend on the nature of the solid.

e) None of the above is correct.

Formula of a Hydrate Experiment

6. The following set of data was obtained in an experiment to determine water content of the hydrate, $MSO_4 . x H_2O$:

Mass of empty crucible = 17.50 g

Mass of empty crucible + hydrate = 19.20 g

Mass of empty crucible + anhydrous salt = 18.24 g

Molar mass of anhydrous salt, MSO_4 = 154.76 g/mol

Molar mass of H_2O = 18.0 g/mol.

Calculate the value of "x" in the hydrate.

Answer: x = ...11.....

anhydrous | H_2O

$m = 0.74$ | $m = 0.96$

$n = 4.8 \times 10^{-3}$. $n = 0.053$

$x = \frac{0.053}{4.8 \times 10^{-3}}$

$= 11.$

7. Which of the following statements is **correct** concerning the formula of a hydrate?

$CuSO_4.5H_2O$ is an example of alum.

a) Incomplete dehydration will cause the calculated value of "x" to be higher than the actual value.

b) The calculated value of x will be lower than the actual value if the mass of empty crucible was more than true value.

c) Heating the hydrated salt too strongly at the beginning, will lead to a decrease in calculated value of x.

d) If the mass of H_2O and hydrate are 0.60 and 1.50 g, respectively, then the mass % of water of crystallization is 40. %.

Formula of an Oxide Experiment:

8. In the empirical formula of an oxide experiment, the value of x in Mg_xO was found to be 1.21. Calculate the mass (in grams) of Mg_xO if the mass of magnesium used was 0.590 g. (Molar masses (g/mol): Mg = 24.3, O = 16.0)

Answer: 0.903 ..... g

9. Which of the following statements is correct? (molar masses (g/mol):Mg = 24.3, O = 16.0 , N = 14.0)?

a) For magnesium oxide empirical formula experiment the student burned a weighed sample of Mg in air and then added water to convert $Mg(OH)_2$ produced MgO.

b) The crucible with magnesium metal must be heated with its cover completely closed to ensure forming a mixture of two different magnesium compounds.

c) The metal should glow with a flame to ensure producing one product.

d) The empty crucible was heated to redness and weighed two times to ensure completeness of the reaction of Mg with air.

e) The mass percent of Mg in magnesium nitride (Mg_3N_2) is 72.2 %.

Limiting reactant Experiment

10. Given the following data for the determination of % composition of a mixture of $Na_3PO_4.12H_2O$ and $BaCl_2.2H_2O$.

Mass of salt mixture = 3.731g

Mass of precipitate formed 0.481 g

Molar mass of $Na_3PO_4.12H_2O$ = 380 g/mole

Molar mass of $BaCl_2.2H_2O$ = 244 g/mole

Molar mass of $Ba_3(PO_4)_2$ = 601g/mole

If when a drop of Na_3PO_4 solution was added to the filtrate no precipitate was formed, but when a drop of $BaCl_2$ solution was added ,a white precipitate was formed.

Calculate the mass % of the limiting reactant in the salt mixture

Answer:.....15.7..... %

$m = 3.731$

$2\,Na_3PO_{4(aq)} + 3BaCl_{2(aq)} \longrightarrow Ba_3(PO_4)_2 + 6\,NaCl$

$M_M = 380$ $\quad M_M = 244$ $\quad m = 0.481$ $\quad M_M = 601$

L.R

$3 \rightarrow 1$

$x \rightarrow 8.00 \times 10^{-4}$

$x = 2.40 \times 10^{-3}$

$m = 0.586\ g$

$\% = \frac{0.586}{3.731} \times 100 = 15.71\ \%$

Acetic acid in vinegar

11. How many grams of acetic acid are there in a 20.0-mL vinegar solution that neutralized 30.0 mL of solution made by dissolving 1.00 g of sodium hydroxide in 100.0 mL of aqueous solution? (Molar mass, NaOH = 40.0, acetic acid = 60.0 g / mole)

Answer: .....1.5..... g

vinegar: $V = 20 \times 10^{-3}$ $\quad m = ??$

NaOH: $V = 30 \times 10^{-3}$ $\quad M = 1$ $\quad V = 100 \times 10^{-3}$

Vinegar: $n = \frac{m}{M_M}$ $\quad m = (M)(MM)$ $\quad m = (0.025)(60)$

$m.v = n$ $\quad = 0.025$ $\quad (20) \times 10^{-3} = (30) \times 10^{-3}$

$n = \frac{1}{40} = 0.025$ $\quad M = \frac{n}{v} = \frac{1}{100}$

$1.5 \rightarrow 100$

$x \rightarrow 30$

$x = 0.45$

$M\,(2^{-1}) = (30)$

0.018

12. The name of the indicator used in the determination of acetic acid in vinegar experiment is

a) Sodium hydroxide b) acetic acid c) HCl (d) phenolphthalein

e) Bromothymol blue

Antacid Tablet Experiment

13. Which of the following statements is incorrect?

a)The active ingredient in most commercial antacid tablets is NaOH.

b) phenolphthalein blue solution was used as an indicator.

(c) The purpose of boiling the acidified antacid tablet solution is to get rid of CO_2.

d)An antacid tablet is dissolved in water first then titrated with standard HCl solution.

e) The HCl solution added to the antacid must be less than is necessary to completely neutralize the antacid

14. A 0.2512 g of antacid it was dissolved in 35.25 mL of 0.1008 M HCl and then the excess HCl was titrated to the equivalence point with 10.25 mL of 0.1212 M NaOH. Calculate the acid-neutralizing capacity of the antacid tablet in mol HCl/g.

Answer: 9.199×10^{-3} mol HCl/g

$M = 0.2512$ $V_{HCl} = 35.25 \times 10^{-3}$, $M_{HCl} = 0.1008$

$V_{NaOH} = 10.25 \times 10^{-3}$ $M = 0.1212$

$n_s = n_A - n_B$

$n_s = 2.311 \times 10^{-3}$

$n.c = \frac{n_s}{m_s} = \frac{2.311 \times 10^{-3}}{0.2512} = 9.199 \times 10^{-3}$

18 + 22