WASHINGTON LATIN PUBLIC CHARTER SCHOOL
CHEMISTRY 2019-20

UNIT 5A – CHEMICAL REACTIONS I – ACIDS AND BASES
PRACTICE TEST

SECTION A – OPEN RESPONSE

1. Neutralization reactions are reactions between acids and bases to produce salts. They have a variety of uses, including making different salts.

Complete the following table to show the names and formulas of different acids, bases and salts:

Name	formula	acid, base or salt?
calcium oxide	CaO	Base
hydrochloric acid	HCl	acid
calcium chloride	$CaCl_2$	salt
copper sulfate	$CuSO_4$	salt
sulfuric acid	H_2SO_4	acid
copper carbonate	$CuCO_3$	Base

5

(a) Complete the following symbol equations for neutralization reactions:

(i) $CaO + 2HCl \rightarrow CaCl_2 + H_2O$

(ii) $CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + CO_2 + H_2O$

4

(b) State a useful application of reaction (a) (i)

Farmers use CaO to reduce soil acidity

1

(c) You carried out a very similar reaction to (a) (ii) in the lab. After mixing the acid and the base together, what two steps did you take to get pure solid sample of the salt?

Step 1	Filtered (to remove the base)
Step 2	Heated (to remove the water)

2

TOTAL 12

2. The acidity or alkalinity of a solution can be captured in a simple number called the pH.

The acidity of alkalinity of a solution can also be determined by using acid-base indicators. Two common indicators are methyl orange and phenolphthalein. The colors and end-point pH ranges of these indicators are shown in the table below:

Indicator	Color 1	End-point pH range	Color 2
methyl orange	pink	2.9 – 4.6	yellow
phenolphthalein	colorless	8.3 – 10.0	purple

A sample of rainwater was analysed and found to have a pH of 5.
A sample of bathroom cleaner was analysed and found to have a pH of 13.
A sample of pure water was also analysed.

Complete the following table:

Sample	pH	acid, neutral or alkaline?	Color it turns methyl orange	Color it turns phenolphthalein
Bathroom cleaner	5	acid	yellow	colorless
Rainwater	13	alkaline	yellow	purple
Pure water	7	neutral	yellow	colorless

TOTAL 5

3. Nitric acid, HNO_3, is a strong acid. Nitrous acid, HNO_2, is a weak acid.

Both acids are neutralized by calcium oxide according to the following equations:
Nitric acid: $2HNO_3 + CaO \rightarrow Ca(NO_3)_2 + H_2O$
Nitrous acid: $2HNO_2 + CaO \rightarrow Ca(NO_2)_2 + H_2O$

(a)	What is the difference between a strong acid and a weak acid?			
	Strong acid fully dissociates in water to give H^+ ions Weak acid slightly dissociates in water to give H^+ ions			2
(b)	Write ionic equations to show what happens to nitric acid and nitrous acid in water: (you might need this symbol ⇄)			
	(i)	nitric acid	$HNO_3 \rightarrow H^+ + NO_3^-$	
	(ii)	nitrous acid	$HNO_2 \rightleftarrows H^+ + NO_2^-$	3
(c)	Marcus poured 50 mL of 1 mol/L nitric acid into a boiling tube. He then added CaO powder gradually to the boiling tube until the acid had been completely neutralized. He then repeated the experiment with 50 mL of 1 mol/L nitrous acid.			
	(ii)	State one similarity Marcus would observe when repeating the experiment using the nitrous acid solution.		
		Both acids will dissolve the same amount of CaO		
	(iii)	State one difference Marcus would observe when repeating the experiment using the nitrous acid solution.		
		The strong acid (HNO_3) will dissolve the CaO much faster		2
			TOTAL	7

SECTION B – MULTIPLE CHOICE

Do not answer these questions on this document. Click on the answer sheet provided at the end of the questions.

4.	When iron carbonate reacts with nitric acid, the name of the salt produced is	
	A	carbonic acid
	B	sodium chloride
	C	nitric carbonate
	D	iron nitrate
(iron carbonate + nitric acid → iron nitrate + carbon dioxide + water) 1		

5.	A solution of washing soda has a pH of 9. It could be described as:	
	A	strongly acidic (pH 0-3)
	B	weakly acidic (pH 4-6)
	C	Neutral (pH 7)
	D	weakly alkaline (pH 8-10)
	E	strongly alkaline (pH 11 – 14)
1		

6.	Which of the following solutions has the lowest pH?	
	A	1 mol/L sodium hydroxide (14)
	B	Vinegar (3)
	C	pure water (7)
	D	1 mol/L hydrochloric acid (0)
	E	orange juice (4-5)
1		

Questions 7 – 9

25 mL of a standard solution of sodium carbonate (0.5 mol/L) was placed in a conical flask. Two drops of methyl orange indicator were added and a solution of sulfuric acid (of unknown concentration) was gradually added from a burette. When 18.3 mL of the sulfuric acid had been added, the indicator changed color.

7.	The formula of the salt produced in this reaction is:	
	A	K_2CO_3
	B	Na_2SO_4 ($Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + CO_2 + H_2O$)
	C	H_2SO_4
	D	Na_2CO_3
	E	K_2SO_4
		1

8.	(Use the table in question 2 to help you with this question) At the equivalence point of this titration, the indicator will change from	
	A	orange to yellow
	B	pink to yellow
	C	yellow to orange
	D	yellow to pink (it is alkaline at the start and acidic at the end)
	E	orange to pink
		1

9.	Use the formula $C_2 = \frac{C_1V_1}{V_2}$ to answer this question. The molarity of the sulfuric acid used in this titration is	
	A	0.34 mol/L
	B	0.37 mol/L
	C	0.68 mol/L $C_2 = 0.5 \times 25/18.3 = 0.68$ mol/L
	D	1.37 mol/L
	E	3.4 mol/L
		2

Go to the answer sheet