Name_____   Date _____

Mark: ____ /65 = ____ %

PRETEST ON CHAPTER 2
"MOLECULES AND SOLUTIONS"

Part 1 – MULTIPLE CHOICES
Answer all the questions on the multiple choice sheet provided

1) Jamie is a very curious student. She has just learned about the electrical conductivity of aqueous solutions and wants to study the process. She takes a beaker that contains distilled water and dissolves a substance in it. Then, she connects 2 electrodes to an electrical battery and inserts the electrodes in the water. The water starts conducting electricity.

Electrolytes are substances which enable electrical conductivity when dissolved in water, because they release positive and negative ions.
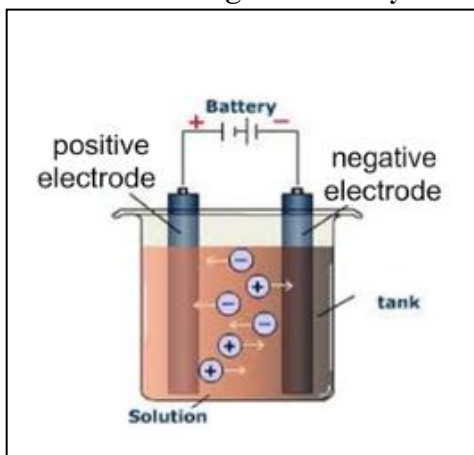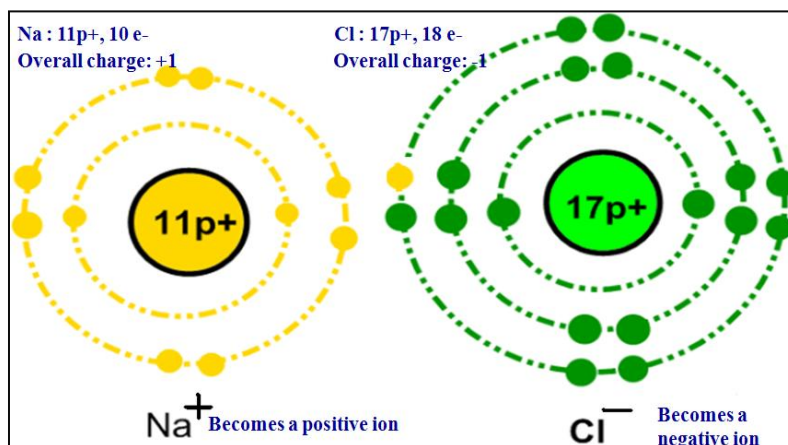

This solution contains positive (+) and negative (-) ions and therefore will conduct electricity.

Which of the following statements could explain this process?

A) The dissolved substance was sugar.
B) The positive ions released protons in the solution.
C) The solution conducts electricity because it contains positive and negative ions.
D) The positive and negative ions were released by a nuclear reaction.

2) Which one of the following statements is TRUE?

A) Positive ions are atoms that have gained protons.

B) Negative ions are atoms that have gained protons.

C) Positive ions are atoms that have lost electrons.

D) Negative ions are atoms that have lost electrons.

Na : 11p+, 10 e-
Overall charge: +1

11p+

Na⁺ Becomes a positive ion

Cl : 17p+, 18 e-
Overall charge: -1

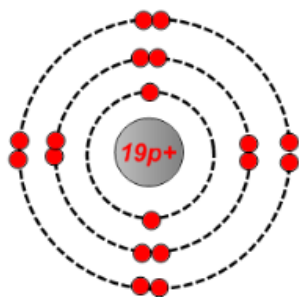17p+

Cl⁻ Becomes a negative ion

Ions are atoms that lost or gained one or more electrons.
- *An atom that loses electrons will have extra positive charges in its nucleus and become a positive ion.*
- *An atom that receives electrons will have extra negative charges and become a negative ion.*

Protons are very tightly bound to their nuclei and therefore cannot be transferred in chemical reactions.

3) What does the diagram below represent?

19p+

In neutral state, any atom has as many positive charges in its nucleus as electrons on its electron orbits.

The provided diagram depicts and atom that has 19 positive charges and only 18 electrons and it therefore represents an ion.

A) an atom

B) a molecule

C) an ion

D) a nucleus

4) Below are the observations from two tests done on four different solutions:

Solution	Reaction to litmus	Test for conductivity
a	red to blue	yes
b	blue to red	yes
c	no change	yes
d	no change	no

Which of the above solutions above could be glucose ($C_6H_{12}O_6$)?

Answer: D
Electrolytes are substances that conduct electricity when dissolved in water. The only known electrolytes are acids, bases and salts. Glucose is not an acid, a base or a salt, therefore will not conduct electricity in aqueous solutions.
The only substance that does not conduct electricity is d).

5) Anna often uses a white powder when cleaning the house. She is curious and wonders if this powder is an electrolyte. *What must she do FIRST to find out?*

A) put a piece of blue litmus paper on the solid
B) put a piece of red litmus paper on the solid
C) check to see if the solid conducts electricity
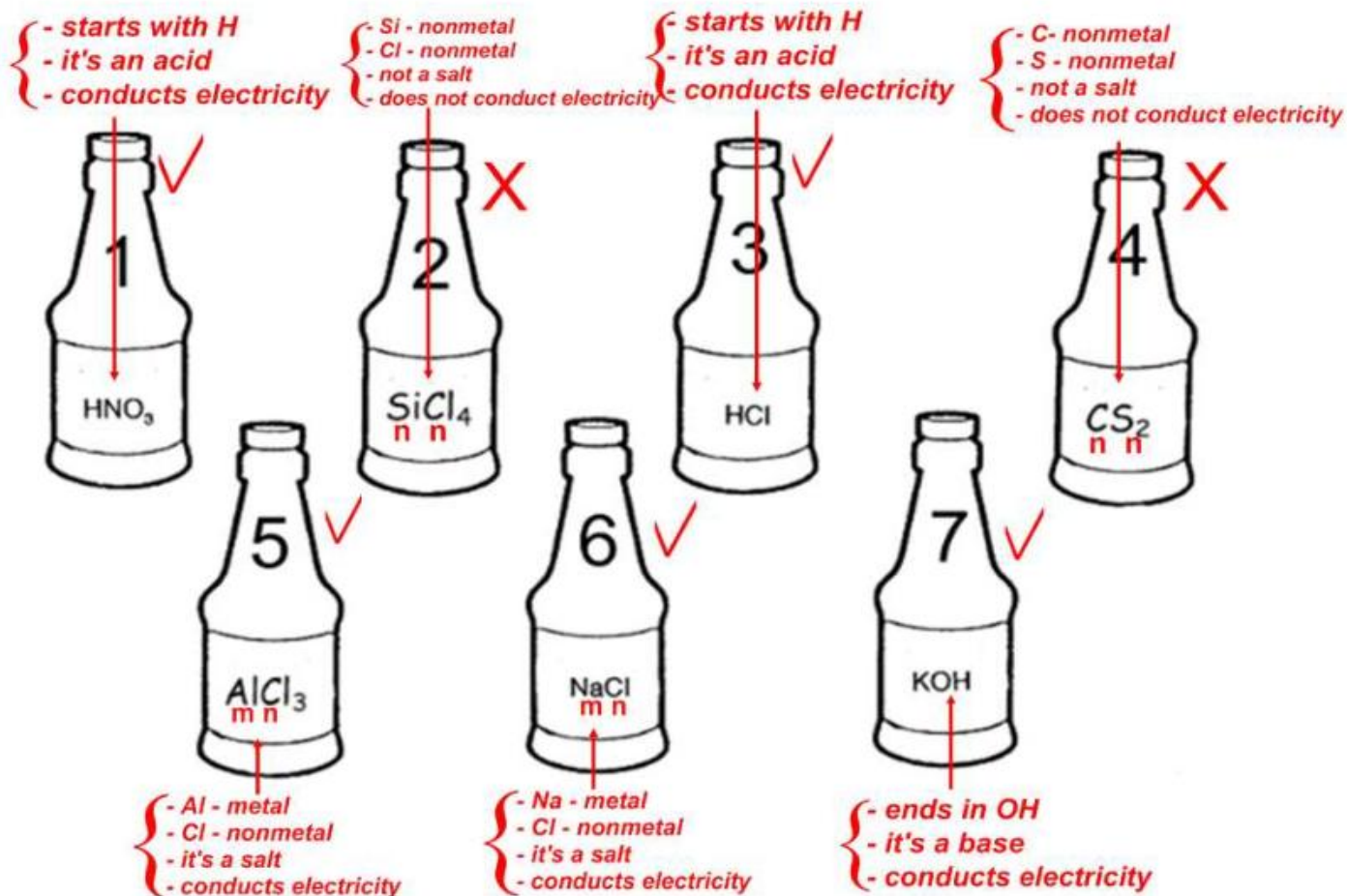*D) dissolve a small amount of the solid in water*

Answer: D
Electrolytes are substances that conduct electricity WHEN DISSOLVED IN WATER. To check the electrical conductivity of a substance, first you need to dissolve the substance in water, in order to be able to use the electrical conductivity tester.

6) The lab technician asks you to help out by putting your knowledge of chemistry to work. She shows you some bottles in which she keeps different chemicals and asks you to select the ones that *conduct electricity*.

The only known electrolytes are acids, bases and salts. To identify the nature of these chemicals we need to check the chemical formulae:
- *acids generally start with H;*
- *bases end in OH;*
- *salts are generally made of a metal and a non metal.*

- starts with H
- it's an acid
- conducts electricity

✓

1

HNO₃

- Si - nonmetal
- Cl - nonmetal
- not a salt
- does not conduct electricity

✗

2

SiCl₄
n n

- starts with H
- it's an acid
- conducts electricity

✓

3

HCl

- C- nonmetal
- S - nonmetal
- not a salt
- does not conduct electricity

✗

4

CS₂
n n

5 ✓

AlCl₃
m n

- Al - metal
- Cl - nonmetal
- it's a salt
- conducts electricity

6 ✓

NaCl
m n

- Na - metal
- Cl - nonmetal
- it's a salt
- conducts electricity

7 ✓

KOH

- ends in OH
- it's a base
- conducts electricity

REMEMBER:
- *metals are situated on the left side of the jagged line o the periodic table;*
- *non metals are situated on the right side of the jagged line of the periodic table;*

Which of the above solutions would you chose?

A) 1, 3, 4, 6 and 7
B) 2, 3, 4, 5 and 6
C) 3, 4, 5, 6 and 7
D) 1, 3, 5, 6 and 7

7) The following represents a list of substances and their pH:

a) pH 2   b) pH 11   c) pH 4   d) pH 7   e) pH 10   f) pH 9

**Which of the sentences describing the above solutions is FALSE?**

A) Solution f) is 100 times more acidic that solution b). *TRUE; AN INCREMENT OF 2 TOWARDS THE LEFT MEANS THAT THE SUBSTANCE IS 10X10=100 TIMES MORE ACIDIC.*
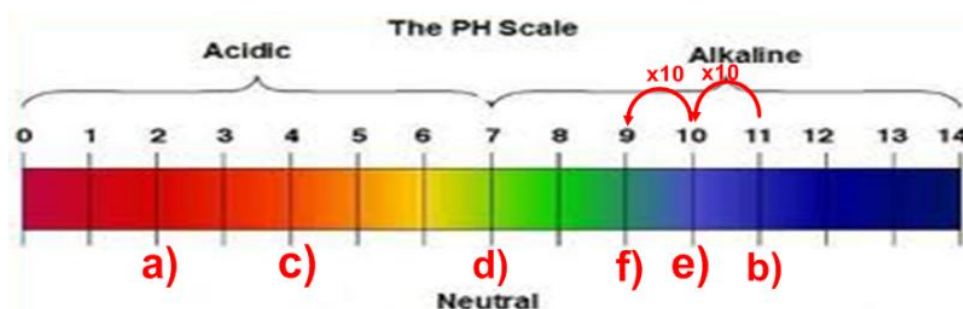
B) Red litmus paper will turn blue in solution e). *TRUE; SOLUTION e) IS A BASE. RED LITMUS PAPER TURNS BLUE IN A BASE.*
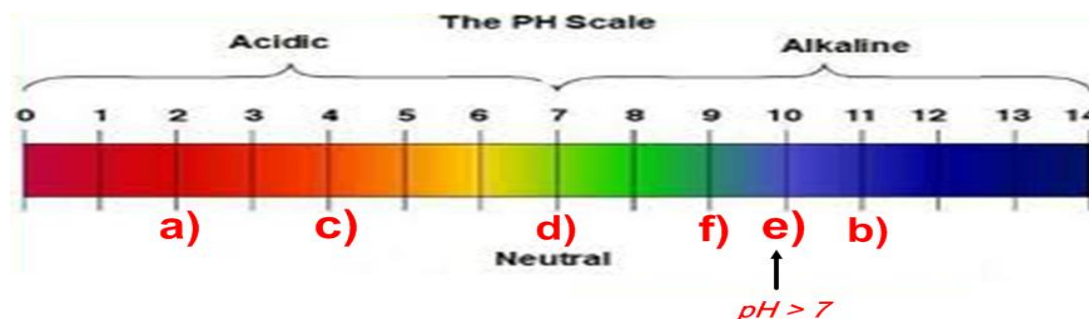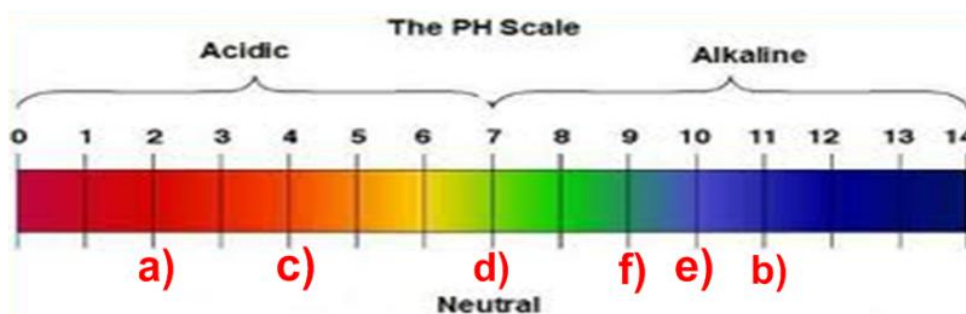

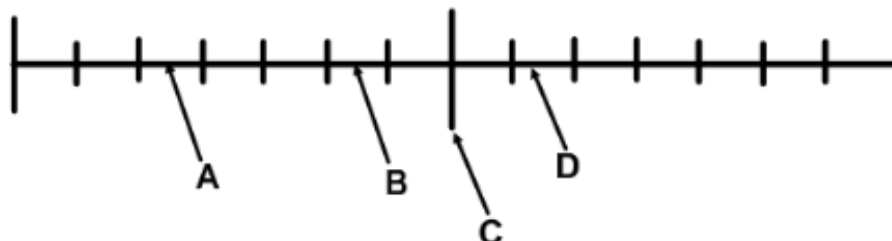C) Solution d) could be distilled water. *TRUE; DISTILLED WATER IS A NEUTRAL SUBSTANCE (pH 7);*
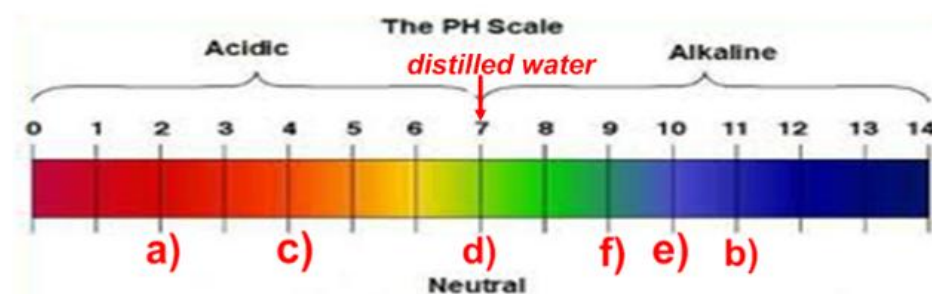
D) *Solution c) could be used for cleaning purposes. FALSE; SOLUTION C) IS AN ACID; ACIDS ARE NOT USED FOR CLEANING PURPOSES; BASES ARE USED FOR CLEANING PURPOSES BECAUSE THEY DISSOLVE FATS*

ANSWER:D

The PH Scale

8) Which of the following arrows shows the pH of rainwater?


ANSWER: B) RAIN WATER HAS A pH OF ABOUT 5.5 – 5.6

9) Which one of the statements below is TRUE?

A) The human body does not contain acids or bases. *FALSE; HUMAN BODIES CONTAIN MANY ACIDIC AND ALKALINE SUBSTANCES*

B) PURE WATER HAS A pH OF 7; TRUE

C) A pH of 2 is 30 times more acidic than a pH of 5. *FALSE; AN INCREMENT OF 3 TOWARDS THE LEFT MEANS THAT THE SUBSTANCE IS 10x10x10=1000 TIMES MORE ACIDIC.*
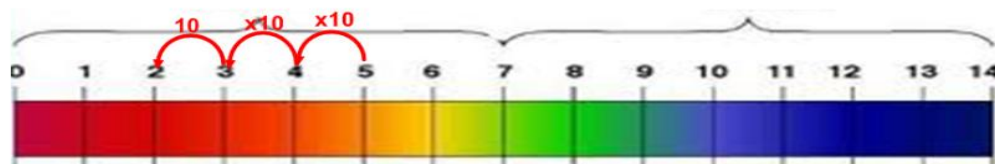
D) As the pH increases, the solutions become more acidic. *FALSE: THE SMALLER THE pH, THE MORE ACIDIC SUBSTANCES BECOME*
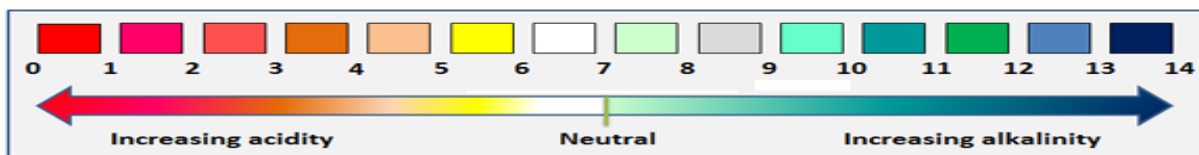
10) Which of the following substances could be used to clean the grease accumulated in your kitchen oven?

A) NaCl

B) HCl

C) NaOH**; ENDS IN OH; IT IS A BASE; BASSES DISSOLVE FATS**

D) CH_4

11) "The concentration in g/l of an aqueous solution" represents:

A) the quantity of solute, in grams, dissolved in one litre of solvent.

B) the quantity of solvent, in grams, dissolved in one litre of solution.

C) the quantity of solvent, in grams, dissolved in one litre of solute.

D) the quantity of solute, in grams, dissolved in one litre of solution.(BY DEFINITION)

CONCENTRATION IN %m/V REPRESENTS THE QUANTITY OF SOLUTE, IN GRAMS, DISSOLVED IN 100 mL OF SOLUTION

CONCENTRATION IN ppm REPRESENTS THE QUANTITY OF SOLUTE, IN MILIGRAMS, DISSOLVED IN ONE LITRE OF SOLUTION

12) What is the best concentration unit to use when measuring the amount of sugar in 100 mL of fruit juice?

A) g/L

B) ppm

C) mg/100 mL

D) %m/V

%m/V MEANS A CERTAIN NUMBER OF GRAMS OF SOLUTE DISSOLVED IN 100 mL OF SOLUTION

13) *What is the volume of a 10 g/L solution that contains 500 mg of salt?*

Given:

$m = 500\ mg = 0.5\ g$

$(500\ mg \div 1000 = 0.5g)$

$C = 10\ \dfrac{g}{L}$

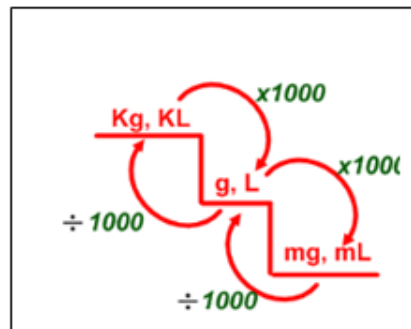*Required: V?*

Solution:

$$V = \dfrac{m}{C} = \dfrac{0.5g}{10\frac{g}{L}} = 0.05L$$

$(0.05L \times 1000 = 50\ mL)$

$V = 50\ mL$

A)	50 mL	C)	250 mL
B)	5000 mL	D)	25 mL

14) The lab technician used 0.003 kg of lead nitrate to produce 6 L of solution. *Which of the following represents the correct concentration value of her solution?*

Given:

$m = 0.003\ Kg = 3\ g$ $(0.003Kg \times 1000 = 3g)$

$V = 6\ L$

Required: C?

SOLUTION:

$$C = \dfrac{m}{V} = \dfrac{3g}{6L} = 0.5g/L$$

$C = 0.5g/L$ - *not a match*
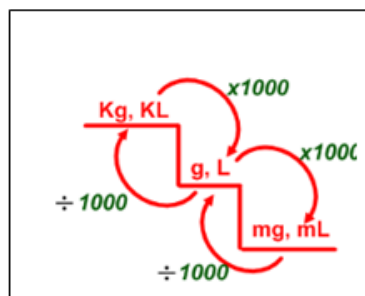
NONE OF THE ABOVE VALUES ARE A MATCH; TRANSFORM THE CONCENTRATION IN DIFFERENT UNITS:

1) Turn the concentration in %m/V:

$$C = \frac{0.5g}{1L} = \frac{0.5g \div 10}{1000mL \div 10} = \frac{0.05g}{100mL}$$

$C = 0.05\ \%m/V$- not a match

2) Turn the concentration in ppm:

$(0.5g \times 1000 = 500mg)$

$$C = \frac{0.5g}{1L} = \frac{500mg}{1L} = 500\ ppm$$

$C = 500\ ppm$

A) 2 g/L   C) 5g/L
B) 500 ppm   D) 0.5%m/V

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15) How much solute there is in 2 L of a 15%m/V concentration solution?

Given:
$C = 15\%m/V$
$V = 2\ L$
Required: m = ?
Solution:

1) Turn the concentration in %m/V:

$$C = 15\% \frac{m}{V} = \frac{15g}{100mL} = \frac{15g}{0.1\ L} = \frac{150g}{L} \qquad (100mL \div 1000 = 0.1L)$$

2) Find mass:

$$m = C \times V = 150\ g/L \times 2L = 300\ g$$

ANSWER: B
A) 150 g
B) 300 g
C) 7.5 g
D) 30 g

Part 2 – EXTENDED ANSWERS
Answer all the questions in the space provided below. Show all your work

1) Draw a Rutherford-Bohr Diagram for the following atom and ion. Also indicate the electronic charge of each.
(___/4)

Magnesium Atom	***Magnesium Ion***
Model (1.5 p) : 	Model (1.5 p) :
Overall electrical charge (0.5 p) : ***12p$^+$*** ***12e$^-$*** ***OVERALL CHARGE: 0***	Overall electrical charge (0.5 p) : ***12p$^+$*** ***10e$^-$*** ***OVERALL CHARGE: +2***

2) Mr. Woody is mixing solutions in the lab (because that's what he does for fun on the weekends). He decides to mix 7 grams of Sodium Hydroxide NaOH (pH 14) into lemon juice (pH 2) just for kicks. The resulting solution had a volume of 1570 mL and a pH of 6.
(___/9)

    a. ***Is Sodium Hydroxide and acid, base, salt or neither? (give two reasons) (2 p)***
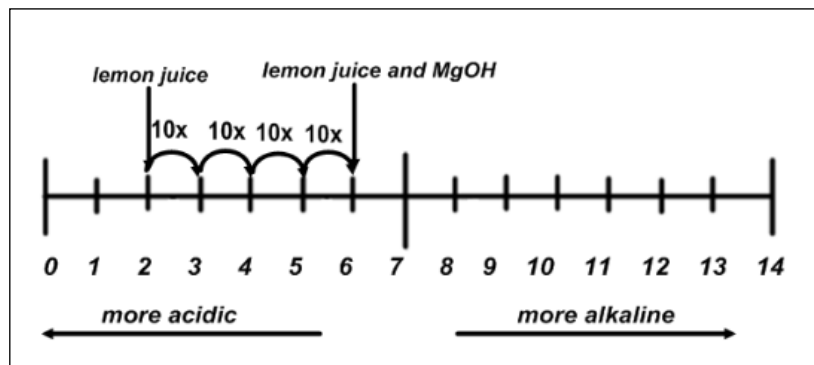   ***SODIUM HYDROXIDE IS A BASE BECAUSE:***
- ***ITS FORMULA ENDS IN OH***
- ***ITS pH >7***
-

    b. ***Will this solution conduct electricity?***

THE FINAL SOLUTION HAS A pH OF 6. IT IS A WEAK ACID. THE SOLUTION WILL CONDUCT ELECTRICITY BECAUSE ACIDS ARE ELECTROLYTES.

c. *After mixing NaOH into the lemon juice how many more times acidic or basic is the new solution compared to the original lemon juice?* (2 p)

THE RESULTING SOLUTION GOES FROM A pH OF 2 TO A pH OF 6 (FOUR STEPS). EACH STEP REPRESENTS AN INCREMENT OF 10 TIMES

THE RESULTING SOLUTION IS 10x10x10x10=10000 TIMES MORE ALKALINE

d. **What is the concentration of NaOH in the resulting solution?**

Given:
$m_{MgOH}=7$ *g*
$V = 1570$ *mL* $= 1.57$ *L*
$(1570mL \div 1000) = 1.57\ L$
Required: $C\ _{(g/L)}$
Solution:

$$C = \frac{m}{V} = \frac{7g}{1.57L} = 4.46\ g/L$$

Answer: $C = 4.46\ g/L$

ii. *In % m/V* (2 p)

$$C = \frac{4.46\ g}{1L} = \frac{4.46\ g \div 10}{1000mL \div 10} = \frac{0.446\ g}{100mL} = 0.446\%\,m/V$$

Answer: $C = 0.446\%\,m/V$

$$C = \frac{4.46\ g}{1L} = \frac{4.46\ g \div 10}{1000mL \div 10} = \frac{0.446\ g}{100mL} = 0.446\%\,m/V$$

Answer: $C = 0.446\%\,m/V$

$$C = \frac{4.46\ g}{1L} =$$

3) The table below shows the salinity of four different bodies of water.

Body of water	Salinity
Baltic Sea	7000 ppm
Black Sea	18 g/L
Dead Sea	27.5% (m/V)
Mediterranean Sea	39 g/L

Compare the given salinities and list the bodies of water in ascending order (from least salty to saltiest)
(___/7)

SINCE 2 OF THE CONCENTRATIONS ARE ALREADY IN g/L, THE EASIEST WAY TO COMPARE SALINITIES IS TRANSFORMING ALL CONCENTRATIONS IN g/L

BALTIC SEA (1.5 p):

$$C = 7000\ ppm = \frac{7000mg}{1L} = \frac{7g}{1L} = 7g/L$$

$(7000\ mg \div 1000 = 7g)$

BLACK SEA (1.5 p) : *18 g/L*

DEAD SEA (1.5p) :

$$C = 27.5\% \frac{m}{V} = \frac{27.5g}{100mL} = \frac{27.5g}{0.1\ L} = 275g/L$$

MEDITERRANEAN SEA (1.5 p): *39 g/L*

Answer: The **increasing** order of salinities is (1 p):
BALTIC SEA< BLACK SEA < MEDITERRANEAN SEA < DEAD SEA