Name: _____ Group: _____ Date: _____

Concept evaluations by chapter **ST**

CHAPTER 2 **ANSWER KEY**

Molecules and solutions

1. Do the following chemical formulas represent atoms or molecules?

a) Ba *Atom*

b) N_2 *Molecule*

c) P_4 *Molecule*

d) $NaNO_3$ *Molecule*

e) HNO_2 *Molecule*

f) Ag *Atom*

g) Hg *Atom*

h) Co *Atom*

[___ /4]

2. How many protons and electrons does each of the following ions have?

a) Cr^{3+} *24 protons and 21 electrons*

b) Si^{4-} *14 protons and 18 electrons*

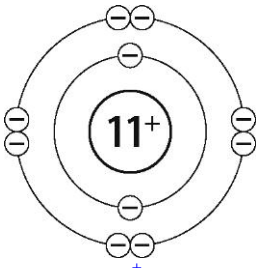
c) Hg^{2+} *80 protons and 78 electrons*

d) Br^{-} *35 protons and 36 electrons*

[___ /4]

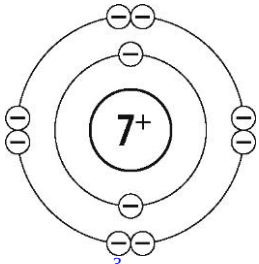
3. Write the chemical symbol and the charge of each of the ions below.

a)



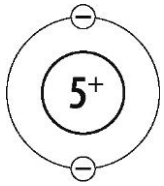
Na^{+}

b)



N^{3-}

c)



B^{3+}

[___ /3]

Name: _____ Group: _____ Date: _____

4. To make sure they understand the concepts they have learned in science class, Jessica and Fiona have made up questions based on information from reliable websites and posted them on their own website.

Jessica found this table on solubility.

Chemical formula	State at 20°C	Solubility in water at 20°C (g/L)
N_2	Gas	0.02
O_2	Gas	0.04
CO_2	Gas	0.16
CO	Gas	0.26
O_3	Gas	0.57
$CaCO_3$	Solid	0.0153
$CaCl_2$	Solid	425

The girls prepared the following questions about this table:

a) We learned from a science program on television that the sea naturally counteracts the greenhouse effect. Can you explain how the sea does this?

CO_2 is relatively soluble compared to the other main components of air. The vast expanse of ocean water is capable of capturing large amounts of CO_2. In addition, calcium ions in the water can react with carbon dioxide, producing the precipitate $CaCO_3$, which is not very soluble.

b) Bottled water is sometimes ozonized. What is the maximum amount of ozone (O_3), expressed in grams, that can be dissolved in an 18-L bottle of water?

$m = C \times V = \frac{0.57\ g}{L} \times 18\ L = 10.26\ g$

The maximum amount of ozone that can be dissolved in an 18-L bottle of water is 10.26 g.

c) Here is the puzzle of the week. Explain the following fact: The sea contains the greater part of all the hydrogen on Earth. However, hydrogen does not figure in this table.

The sea is made up of water (H_2O) and therefore contains an enormous amount of hydrogen, but very little in dissolved form because the solubility of hydrogen gas is very low.

[___ /6]

Name: _____ Group: _____ Date: _____

5. Many commercial products are aqueous solutions.

a) A variety of orange juice contains 26 g of carbohydrates per 250-mL serving. What is the concentration of carbohydrates in % m/V?

$$\frac{26\ g}{250\ mL} = \frac{x\ g}{100\ mL}$$

x = 10.4 g, therefore 10.4% m/V

The carbohydrate concentration is 10.4% m/V.

b) A 500-mL bottle of isopropyl alcohol, better known as *rubbing alcohol*, contains 350 mL of alcohol. What is the alcohol concentration of this solution in % V/V?

$$\frac{350\ mL}{500\ mL} = \frac{x}{100\ mL}$$

x = 70 mL, therefore 70% V/V

The alcohol concentration is 70% V/V.

[___ /4]

6. Other solutions, such as some medicines, are solids. According to the label on a medication for cramps and headaches, for example, each tablet contains 60 mg of caffeine and 340 mg of another substance. What is the caffeine content of each tablet, in % m/m?

The total mass of a tablet is 340 mg + 60 mg = 400 mg

$$\frac{60\ mg}{400\ mg} = \frac{x}{100\ mg}$$

x = 15 g, therefore 15% m/m

The caffeine concentration is 15% m/m.

[___ /2]

Name: _____ Group: _____ Date: _____

7. Janine has a sheepdog with big droopy ears. The veterinarian advised her to clean her dog's ears regularly. She noticed that the solution she uses contains 0.15% m/V salicylic acid, which is one of the main ingredients in aspirin. What is the equivalent concentration in ppm?

0.15% (m/V) means $\frac{0.15\ g}{100\ mL} = \frac{0.15\ g}{0.1\ L}$

$\frac{0.15\ g}{0.1\ L} = \frac{x}{1\ L} = \frac{1.5\ g}{1\ L} = \frac{1500\ mg}{1\ L}$

1 ppm = 1mg/L, therefore 1500 mg/L = 1500 ppm

The salicylic acid concentration is 1500 ppm.

[___ /2]

8. A prospecting geologist has literally struck gold. He has discovered a river whose waters contain 0.1 ppm of gold. He believes that a worker could process 700 L of water a day to extract the gold it contains. The current market price of gold is $850 an ounce (one ounce equals 28 g). What is the market value of one day's worth of extracted gold?

1 ppm $= \frac{1\ mg}{1L}$ *, therefore 0.1 ppm* $= \frac{0.1\ mg}{1L}$

A person can process 700 L of water a day, so the mass collected is:

$\frac{0.1\ mg}{1L} \times 700\ L = 70\ mg$

28 g of gold is worth $850

$\frac{\$850}{28\ g} \times 0.070\ g = \$2.12$

The value of one day's worth of extracted gold is approximately $2.12.

[___ /2]

Name: _____ Group: _____ Date: _____

9. During a lab experiment, you are asked to prepare 200 mL of a 12% m/V saltwater solution.

a) Perform the necessary calculations to prepare the solution.

A 12% m/V solution contains $\frac{12\ g}{100\ mL}$

$\frac{12\ g}{100\ mL} = \frac{x}{200\ mL}$

I need 24 g of salt.

b) Describe the main steps in your procedure. Remember to identify the materials clearly.

1. Measure exactly 24 g of salt with a scale.

2. Pour the salt into a graduated cylinder or 200-mL volumetric flask containing approximately 100 mL of water.

3. Stir the mixture with a stirring rod until the salt is completely dissolved.

4. Add water to the cylinder or flask to obtain a total volume of 200 mL.

5. Stir again.

[___ /6]

10. An apple has a pH of 3, while a carrot has a pH of 5.

a) Which of these two foods is more acidic?

The apple is more acidic.

b) How many times more acidic is it?

It is 100 times more acidic.

[___ /2]

11. What colour does neutral litmus paper turn if it is dipped in . . .

a) soapy water?

The litmus paper will turn blue.

b) rainwater?

The litmus paper will turn red.

c) distilled water?

The litmus paper will remain purple.

[___ /3]

Name: _____ Group: _____ Date: _____

12. John drew the table below to help himself memorize essential information about electrolytes. As you can see, he wrote only the first letters of the words in certain columns. Complete John's table.

Type of electrolyte	Taste	pH	Colour of litmus paper	Reaction to metal	Example
A*cids*	S*our*	<7	R*ed*	Yes	Lemon
B*ases*	B*itter*	>7	B*lue*	No	Detergent
S*alts*	S*alty*	=7	P*urple*	No	Table salt

[___ /6]

13. Classify the following substances by type of electrolyte (acid, base or salt).

KOH	*Base*	$Ba(NO_3)_2$	*Salt*	KF	*Salt*
H_2SO_3	*Acid*	HNO_3	*Acid*	Na_2CO_3	*Salt*
$Mg(OH)_2$	*Base*	NH_4OH	*Base*	$Fe(OH)_3$	*Base*

[___ /9]

[___/53]