Appendices

Appendix A
Validated and Reliability-assessed Pre-test

Class No.

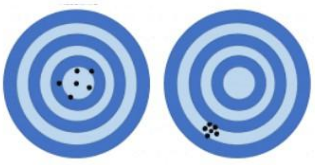
PRE-TEST
agriCHEMture: Interdisciplinary Practical Laboratory Course
A.Y. 2021 – 2022

Direction: Choose the letter of the best answer.

1. Photosynthesis is the plants' ability to convert carbon dioxide and water into glucose and oxygen gas through the presence of chlorophyll and sunlight. Which of the following statements is **TRUE** about photosynthesis?

   A. Photosynthesis changes only the physical properties of substances.
   B. Photosynthesis does not change the composition of initial substances.
   C. **Photosynthesis transforms the chemical properties of substances.**
   D. During photosynthesis, the initial substances and the products formed are the same in composition.

2. Which of the following statements is/are **CORRECT** about the diagrams below?



A **B**

   I. Diagram B shows greater precision than diagram A.
   II. Diagram A shows greater precision than diagram B
   III. Diagram A shows accuracy while diagram B shows precision.
   IV. Diagram B shows accuracy while diagram A shows precision.

   A. I and II
   B. II and III
   C. **I and III**
   D. I, II and III

3. At first, Karla tried to purify the water with soil particles using a simple decantation technique. Her groupmate Marielle suggested using filtration for better results. Karla wholeheartedly accepted Marielle's idea. Which of the following attitude is shown by Karla?

   A. honesty
   B. objectivity
   C. **open-mindedness**
   D. skepticism

4. Carbon dioxide is an important gas needed by plants to perform photosynthesis. Which of the following chemical formula **CORRECTLY** represents carbon dioxide?

   A. CO
   B. **CO_2**
   C. C_2O_2
   D. CaO_2

5. Plants can grow in different soil properties. Which of the following physical properties of soil can be described using sensory observation?

   A. color, texture, reactivity
   B. acidity, basicity and color
   C. alkalinity, hardness and size
   D. **color, texture and appearance**

6. Glucose is an important metabolic product of photosynthesis. It is used for the growth and development of plants. which of the following is **CORRECT** about the chemical formula of glucose?

   A. One glucose molecule contains 12 carbon atoms, 24 hydrogen atoms, and 12 oxygen atoms.
   B. One glucose molecule contains 12 carbon atoms, six hydrogen atoms, and six oxygen atoms.
   C. One glucose molecule contains three carbon atoms, 12 hydrogen atoms, and six oxygen atoms.
   D. **One glucose molecule contains six carbon atoms, 12 hydrogen atoms, and six oxygen atoms.**

7. Which of the following refers to how closely two or more measurements of the same property agree with one another?

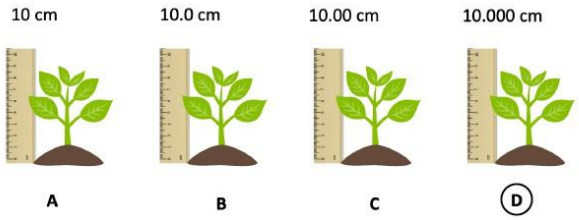
   A. accuracy
   B. measurement
   C. **precision**
   D. significant figures

8. The use of hard water is dangerous for plant growth as it prevents the root from taking nutrients from the soil. In the given chemical equation, which compound causes water hardness and buildup of salts in soil and plants' roots?

$$Ca^{2+}_{(aq)} + 2HCO^{-}_{3(aq)} \rightarrow CaCO_{3(s)} + CO_{2(g)} + H_2O_{(l)}$$

   A. bicarbonate ion
   B. **calcium carbonate**
   C. calcium ion
   D. carbon dioxide

9. Which of the following diagrams shows the most accurate measurement based on the number of significant figures?



10. The table below shows the height of plants measured by each member of Group A. What is the average of week 5 measurements expressed in correct number of significant figures?

Member	Height (inch)				
	Week 1	Week 2	Week 3	Week 4	Week 5
Mary	5.2	7.4	8.5	9.51	10.12
John	5.7	7.5	8.6	9.7	10.9
Michael	4.31	5.57	7.21	8.44	9.21
Rose	6.3	8.4	9.5	9.87	11.5

A. 10 inches
B. **10.4 inches**
C. 10.425 inches
D. 10.43 inches

11. The table below shows the measurements obtained by Maria in performing the urban gardening laboratory activities. Which of the following statement/s is/are **TRUE** about her data?

	Set-up	Height (cm)				
		Week 1	Week 2	Week 3	Week 4	Week 5
	A	3	4.0	6.0	10	15
I.	B	0.50	2.5	4.05	5	8.0
II.	C	2.00	5	15	8.40	10.0
III.	D	0.90	2.50	5.02	8.00	12.01

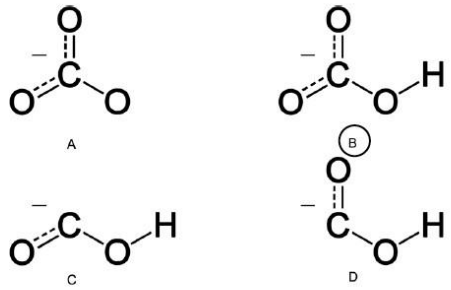
I. Set-up A has more measurements with significant zeros than B.
II. Set-up B has more measurements with placeholder zeros than A.
III. Set-up C has more measurements with placeholder zeros than D.
IV. Set-up D has more measurements with significant zeros than C.

A. I & II
B. II & III
C. **IV only**
D. III only

12. Susan found out that her plants did not grow as much as her classmates even though she tried her best to follow all the necessary steps in taking good care of plants. Nevertheless, she still reported the actual data to her groupmates and teacher. Is this attitude of Susan correct?

    A. Yes, Fe shows determination.
    B. Yes, Fe shows acceptance of the results.
    C. No, Fe must repeat all the laboratory activities to obtain good results.
    D. No, Fe must change her data before reporting the results to her teacher.

13. Most plants survive in slightly acidic soil. However, too many bicarbonates in the soil increase the soil's pH over time. Which of the following is the correct structural formula of bicarbonate?



14. Plants absorb nutrients from the soil. One of most important primary macronutrients for plants is nitrogen which is commonly absorbed in the form of nitrates or nitrites. Which of the following is correctly paired?

    A. nitrate: NO_2^-
    B. **nitrate: NO_3^-**
    C. nitrite: NO_3^-
    D. nitrite: NO_4^-

15. Water hardness refers to the number of dissolved salts and bicarbonates in the water. Which of the following are the common cations that make the water hard?

    A. K and P
    B. Ca^{1+} and Mg^{3+}
    C. **Ca^{2+} and Mg^{2+}**
    D. boron and iron

16. Ammonium nitrate plays a role in plant nutrition. It is commonly used as a fertilizer. Which of the following is the correct chemical formula of ammonium nitrate?

    A. NH_2NO_2
    B. NH_3NO_3
    C. NH_3NO_4
    D. **NH_4NO_3**

17. Which metabolic product of photosynthesis is being released in the environment in the form of a gas?

A. H_2, hydrogen gas
B. N_2, nitrogen gas
C. **O_2, oxygen gas**
D. O_3, ozone

18. The chemical equation below shows the cellular respiration process. Which of the following are the necessary substances needed by plants to do the process of cellular respiration?

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 32\ ATP\ (energy)$$

A. water and glucose
B. carbon dioxide and ATP
C. **glucose and oxygen gas**
D. glucose and carbon dioxide

19. Which of the following set of coefficients will balance the chemical equation below?

$$\_CO_2 + \_H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} \_C_6H_{12}O_6 + \_O_2$$

A. 1,6,1,6
B. 12,12,2,3
C. 1,1,1,6
D. **6,6,1,6**

20. Which chemical equation **BEST** represent the description of the reaction below?

The heated hard water allows calcium ions to react with bicarbonate ions to form insoluble calcium carbonate, carbon dioxide gas and water.

A. $Ca^{2+}_{(aq)} + 2HCO^-_{3(aq)} \rightarrow CaCO_{3(s)} + CO_{2(g)} + H_2O_{(l)}$
B. $Ca^{+}_{(aq)} + 3HCO^-_{3(aq)} \rightarrow H_2O_{(l)} + CaCO_{3(s)} + CO_{2(g)}$
C. $Ca^{+}_{(aq)} + 3HCO^-_{3(aq)} \rightarrow CaCO_{3(s)} + CO_{2(g)} + H_2O_{(l)}$
D. $Ca^{2+}_{(aq)} + HCO^-_{3(aq)} \rightarrow H_2O_{(l)} + CaCO_{3(s)} + CO_{(g)}$

21. Why is there a need to have a balanced chemical equation?

A. to determine the spectators in the reactions
B. **to satisfy the law of conservation of mass**
C. to identify the reactants and products properly
D. none of the above

22. Plants produce their own food through the process called photosynthesis. Glucose, the main product of photosynthesis, is the basic unit of which biomolecule?

    A. **carbohydrates**
    B. lipids
    C. nucleic acids
    D. proteins

23. Biosynthesis is composed of chemical reactions responsible for producing biomolecules needed by plants to grow, replace, and repair cells. Which of the following is an indication that plants do biosynthesis?

    A. increase in height
    B. enlargement of roots
    C. increase in number of leaves
    D. all of the above

24. What conclusion can you make by analyzing the data below?

Set-up	Height (cm)		
	Week 1	Week 2	Week 3
Plant A (With fertilizer)	5.0	8.5	12.5
Plant B (Without fertilizer)	3.0	5.5	8.3

    A. The fertilizer keeps plants alive.
    B. The fertilizer causes harm to plants.
    C. **The fertilizer helps plants to grow better.**
    D. The fertilizer does not affect plants growth.

25. Which of the following biomolecules is needed by plants in order to produce ATP?

    A. amino acids
    B. cholesterol
    C. **glucose**
    D. nitrogenous bases

26. The chemical equation below shows the formation of insoluble precipitate:

$$\boldsymbol{Ca^{2+}_{(aq)} + 2HCO^{-}_{3(aq)} \rightarrow CaCO_{3(s)} + CO_{2(g)} + H_2O_{(l)}}$$

    Which species is considered as the Bronsted acid?

    A. $Ca^{2+}_{(aq)}$
    B. $\mathbf{HCO^{-}_{3(aq)}}$
    C. $CaCO_{3(s)}$
    D. $CO_{2(g)}$

27. Why is it important to determine the soil pH before performing urban gardening?

    A. The soil pH directly affects photosynthesis.
    B. The soil pH helps the roots become bigger.
    C. The soil pH is important in the reproduction of plants.
    D. **The soil pH affects the nutrition absorption capability of plants.**

28. Most plants can grow in slightly acidic soil. What is the range of soil pH appropriate for plant growth?

    A. **5.5-7.0**
    B. 2.5-5.5
    C. 9.0-12.0
    D. 7.0-8.0

29. After performing the acidity test for water, you found out that the paper-turmeric strip turned into bright yellow. What does it indicate?

    A. The water is basic.
    B. The water is alkaline.
    C. **The water is acidic.**
    D. The water is neutral.

30. Hard water has higher dissolved minerals as compared to soft water. How do dissolved minerals affect the pH of water?

    A. The dissolved minerals stabilize the pH of the water.
    B. The dissolved minerals decrease the pH of the water.
    C. The dissolved minerals do not affect the pH of the water.
    D. **The dissolved minerals increase the pH of the water.**

Appendix B
Validated and Reliability-assessed Post-test

Class No.

POST-TEST
agriCHEMture: Interdisciplinary Practical Laboratory Course
A.Y. 2021 – 2022

Direction: Choose the letter of the best answer.

1. Cellular respiration converts glucose and oxygen into carbon dioxide, water and ATP molecules. Which of the following statements is **NOT TRUE** about cellular respiration?

   A. Substances undergo chemical change during cellular respiration.
   B. Cellular respiration changes the chemical properties of the reactants.
   C. **Cellular respiration does not change the composition of substances.**
   D. Cellular respiration transforms the chemical properties of substances.

2. Which of the following statements is/are **INCORRECT** about the diagrams below?

A **B**

   I. Diagram B shows greater precision than diagram A.
   II. Diagram A shows greater precision than diagram B
   III. Diagram A shows accuracy while diagram B shows precision.
   IV. Diagram B shows accuracy while diagram A shows precision.

   A. I and II
   B. II and III
   C. **II and IV**
   D. I, II and III

3. Skepticism helps every researcher to be objective in their experiments by examining the information very well to establish facts. Which of the following shows skepticism?

   A. **Iggy asks questions about the findings of his groupmate.**
   B. Carol immediately follows her mother's advice to use rainwater for her plants.
   C. Maria uses the products she saw in a TV commercial for her tomato plants.
   D. Kevin falsely claims that plants' grow better by watering them three times a day.

4. Oxygen gas is an important molecule needed by plants to perform cellular respiration. Which of the following chemical formula **CORRECTLY** represents oxygen gas?

   A. O_4
   B. $\mathbf{O_2}$
   C. O
   D. O_3

5. Plants can grow in different soil properties. Which of the following are the chemical properties of soil?

   A. color, texture, reactivity
   B. alkalinity, hardness and size
   C. color, texture and appearance
   D. **acidity, basicity and alkalinity**

6. Glucose is an important metabolic product of photosynthesis. It is used for the growth and development of plants. which of the following is **INCORRECT** about the chemical formula of glucose?

   A. The chemical formula of glucose is $C_6H_{12}O_6$.
   B. There are 12 hydrogen atoms, six oxygen atoms and six carbon atoms in a glucose molecule.
   C. One glucose molecule contains six carbon atoms, 12 hydrogen atoms, and six oxygen atoms.
   D. **One glucose molecule contains 12 carbon atoms, six hydrogen atoms, and six oxygen atoms.**

7. Which of the following refers to the closeness of measurements to the true value?

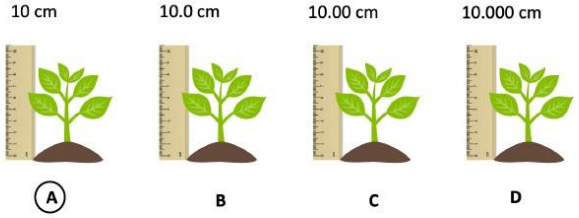
   A. **accuracy**
   B. measurement
   C. precision
   D. significant figures

8. The use of hard water is dangerous for plant growth as it prevents the root from taking nutrients from the soil. In the given chemical equation, which compound causes water hardness and buildup of salts in soil and plants' roots?

$$Ca^{2+}_{(aq)} + 2HCO^{-}_{3(aq)} \rightarrow CaCO_{3(s)} + CO_{2(g)} + H_2O_{(l)}$$

   A. bicarbonate ion
   B. **calcium carbonate**
   C. calcium ion
   D. carbon dioxide

9. Which of the following diagrams shows the **LEAST** accurate measurement based on the number of significant figures?



10. The table below shows the height of plants measured by each member of Group A. What is the average of week 3 measurements expressed in correct number of significant figures?

Member	Height (inch)				
	Week 1	Week 2	Week 3	Week 4	Week 5
Mary	5.2	7.4	8.5	9.51	10.12
John	5.7	7.5	8.6	9.7	10.9
Michael	4.31	5.57	7.21	8.44	9.21
Rose	6.3	8.4	9.5	9.87	11.5

A. 8 inches
B. **8.5 inches**
C. 8.45 inches
D. 8.425 inches

11. The table below shows the measurements obtained by Allan in performing the urban gardening laboratory activities. Which of the following statement/s is/are **INCORRECT** about her data?

	Set-up	Height (cm)				
		Week 1	Week 2	Week 3	Week 4	Week 5
	A	3	4.0	6.0	10	15
I.	B	0.50	2.5	4.05	5	8.0
II.	C	2.00	5	15	8.40	10.0
III.	D	0.90	2.50	5.02	8.00	12.01

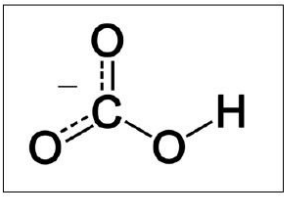
I. Set-up A has more measurements with significant zeros than B.
II. Set-up B has more measurements with placeholder zeros than A.
III. Set-up C has more measurements with placeholder zeros than D.
IV. Set-up D has more measurements with significant zeros than C.

A. I & II
B. **I, II & III**
C. II & IV only
D. I & III only

12. Cristina found out that her plants did not grow as much as her classmates' even though she tried her best to follow all the necessary steps in taking good care of plants. Nevertheless, she still reported the actual data to her groupmates and teacher. Is this attitude of Cristina correct? Why or why not?

A. Yes, Cristina shows determination.
B. Yes, Cristina shows acceptance of the results.
C. No, Cristina must repeat all the laboratory activities to obtain good results.
D. No, Cristina must change her data before reporting the results to her teacher.

13. Most plants survive in slightly acidic soil. However, the substance presented in the image below contributes in increasing soil pH. What is it called?



A. carbon ion
B. carbonate ion
C. **bicarbonate ion**
D. calcium bicarbonate

14. Curcumin is the active component of turmeric responsible for its acid-base reaction. It is the principal curcuminoid of turmeric which also has an anti-inflammatory property. Which of the following is the **CORRECT** chemical formula of curcumin?

A. $C_{20}H_{21}O_6$
B. **$C_{21}H_{20}O_6$**
C. $C_{20}H_{21}O_5$
D. $C_{21}H_5O_{20}$

15. Water hardness refers to the number of dissolved salts and bicarbonates in the water. Which of the following is **NOT** a common cation that contributes to water hardness?

A. Ca^{2+}
B. Mg^{2+}
C. **Fe^{2+}**
D. all of the above

16. Plants absorb nutrients from the soil. One of most important primary macronutrients for plants is nitrogen which is commonly absorbed in the form of nitrates or nitrites. Which of the following is correctly paired?

A. nitrate: NO_2^-
B. **nitrate: NO_3^-**
C. nitrite: NO_3^-
D. nitrite: NO_4^-

17. Which metabolic product of photosynthesis is being released in the environment in the form of a gas?

A. H_2, hydrogen gas
B. N_2, nitrogen gas
C. **O_2, oxygen gas**
D. O_3, ozone

18. The chemical equation below shows the cellular respiration process. Which of the following are the metabolic products of cellular respiration?

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 32\,ATP\,(energy)$$

A. water and glucose
B. carbon dioxide and ATP
C. glucose and oxygen gas
D. **carbon dioxide, water and ATP**

19. Which of the following set of coefficients will balance the chemical equation below?

$$\_CO_2 + \_H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} \_C_6H_{12}O_6 + \_O_2$$

A. 1,6,1,6
B. 12,12,2,3
C. 1,1,16
D. **6,6,1,6**

20. Which description **BEST** represent the chemical reaction below?

$$Ca^{2+}_{(aq)} + 2HCO^{-}_{3(aq)} \rightarrow CaCO_{3(s)} + CO_{2(g)} + H_2O_{(l)}$$

A. The heated hard water allows calcium ions to react with carbonate ions to form insoluble calcium carbonate, carbon dioxide gas and water.
B. The heated hard water allows carbon ions to react with bicarbonate ions to form insoluble calcium carbonate, carbon dioxide gas and water.
C. The heated hard water allows calcium ions to react with bicarbonate ions to form insoluble carbon carbonate, carbon dioxide gas and water.
D. **The heated hard water allows calcium ions to react with bicarbonate ions to form insoluble calcium carbonate, carbon dioxide gas and water.**

21. In order to satisfy the conservation of mass, there must be a _____ chemical equation.

A. **balanced**
B. accurate
C. well-defined
D. meaningful

22. Plants produce their own food through the process called photosynthesis. Which of the following is the basic unit of carbohydrates which is also considered the main product of photosynthesis?

A. amino acid
B. **glucose**
C. glycerol
D. nucleic acid

23. Biosynthesis is composed of chemical reactions responsible for producing biomolecules needed by plants to grow, replace, and repair cells. Which of the following is an indication that plants do biosynthesis?

A. increase in height
B. enlargement of roots
C. increase in number of leaves
D. all of the above

24. What conclusion can you make by analyzing the data below?

Set-up	Height (cm)		
	Week 1	Week 2	Week 3
Plant A (With presence of sunlight)	3.0	5.6	7.4
Plant B (Without sunlight)	2.3	3.2	4.2

A. sunlight keeps plants alive
B. sunlight causes harm to plants
C. **sunlight helps plants to grow better**
D. sunlight does not affect plants growth

25. Which of the following biomolecules is primarily needed by plants in order to produce ATP?

A. **glucose**
B. cholesterol
C. amino acids
D. nitrogenous bases

26. The chemical equation below shows the formation of insoluble precipitate:

$$\boldsymbol{Ca^{2+}_{(aq)} + 2HCO^{-}_{3(aq)} \rightarrow CaCO_{3(s)} + CO_{2(g)} + H_2O_{(l)}}$$

Which species is considered as the Bronsted acid?

A. $\mathrm{Ca^{2+}_{(aq)}}$
B. $\mathbf{HCO^{-}_{3(aq)}}$
C. $\mathrm{CaCO_{3(s)}}$
D. $\mathrm{CO_{2(g)}}$

27. Why is it important to determine the soil pH before performing urban gardening?

A. The soil pH directly affects photosynthesis.
B. The soil pH helps the roots become bigger.
C. The soil pH is important in the reproduction of plants.
D. **The soil pH affects the nutrition absorption capability of plants.**

28. Most plants can grow in soil pH of 5.5-7.0. This pH range is considered _____.

    A. **slightly acidic**
    B. highly acidic
    C. slightly basic
    D. highly basic

29. After performing the acidity test for water, you found out that the paper-turmeric strip turned into dark brown/red. What does it indicate?

    A. The water is acidic.
    B. The water is neutral.
    C. **The water is basic.**
    D. The water is slightly acidic.

30. Dissolved minerals affect water hardness. What will happen if the water has many dissolved minerals?

    A. The water will become soft.
    B. The water will become acidic.
    C. **The water will become hard.**
    D. The water will have lower pH value.

Appendix C
Table of Specification for Pre-test

Table of Specification
agriCHEMture: Interdisciplinary Practical Laboratory Course Pre-Test

Content Standard	Objectives/Learning Competencies	No. of Items	Percentage of Items	Domain	Level of Behavior, Item Placement & Item Format					
					Remembering	*Understanding*	*Applying*	*Analyzing*	*Evaluating*	*Creating*
Matter and its Properties	Use properties of matter to identify substances and to separate them	3	10%	Knowledge		#1, MC				
				Skills	#5, MC					
				Attitudes			#3, MC			
	Recognize the formulas of common chemical substances	3	10%	Knowledge	#4, MC			#8, MC		
				Skills				#6, MC		
				Attitudes						
Measurements	Differentiate precision from accuracy	2	6.67%	Knowledge	#7, MC					
				Skills		#2, MC				
				Attitudes						
	Apply significant figures in making measurements	4	13.33%	Knowledge					#11, MC	
				Skills				#9, MC	#10, MC	
				Attitudes		#12, MC				
Atoms, Molecules and Ions	Represent compounds using chemical formulas, structural formulas and models	3	10%	Knowledge		#14 #15 MC		#13, MC		
				Skills						
				Attitudes						
		3	10%	Knowledge		#16, #18, MC				
	Name compounds given their formula and write formula given the name of the compound			Skills			#17, MC			
				Attitudes						
Chemical Reactions and Equations	Write and balanced chemical equations	3	10%	Knowledge	#21, MC		#20, MC			
				Skills		#19, MC				
				Attitudes						
Biomolecules	Describe the structure of proteins, nucleic acids, lipids, and carbohydrates, and relate them to their function	4	13.33%	Knowledge	#25, MC	#22, MC				
				Skills		#23, MC	#24 MC			
				Attitudes						
Acid-Base	Define Bronsted acids and bases	3	10%	Knowledge	#26, MC	#28, MC				
				Skills		#27, MC				
				Attitudes						
	Discuss the acid-base property of water	2	6.67%	Knowledge		#29, MC				
				Skills						
				Attitudes		#30, MC				
TOTAL:		30	100%							

Appendix D
Table of Specification for Post-test

Table of Specification
agriCHEMture: Interdisciplinary Practical Laboratory Course Post-Test

Content Standard	Objectives/Learning Competencies	No. of Items	Percentage of Items	Domain	Level of Behavior, Item Placement & Item Format					
					Remembering	*Understanding*	*Applying*	*Analyzing*	*Evaluating*	*Creating*
Matter and its Properties	Use properties of matter to identify substances and to separate them	**3**	**10%**	Knowledge		#1, MC				
				Skills	#5, MC					
				Attitudes			#3, MC			
	Recognize the formulas of common chemical substances	**3**	**10%**	Knowledge	#4, MC			#8, MC		
				Skills				#6, MC		
				Attitudes						
Measurements	Differentiate precision from accuracy	**2**	**6.67%**	Knowledge	#7, MC					
				Skills		#2, MC				
				Attitudes						
	Apply significant figures in making measurements	**4**	**13.33%**	Knowledge					#11, MC	
				Skills				#9, MC	#10, MC	
				Attitudes		#12, MC				
Atoms, Molecules and Ions	Represent compounds using chemical formulas, structural formulas and models	**3**	**10%**	Knowledge		#14 #15 MC		#13, MC		
				Skills						
				Attitudes						
		3	**10%**	Knowledge		#16, #18, MC				
	Name compounds given their formula and write formula given the name of the compound			Skills			#17, MC			
				Attitudes						
Chemical Reactions and Equations	Write and balanced chemical equations	**3**	**10%**	Knowledge	#21, MC		#20, MC			
				Skills		#19, MC				
				Attitudes						
Biomolecules	Describe the structure of proteins, nucleic acids, lipids, and carbohydrates, and relate them to their function	**4**	**13.33%**	Knowledge	#25, MC	#22, MC				
				Skills		#23, MC	#24 MC			
				Attitudes						
Acid-Base	Define Bronsted acids and bases	**3**	**10%**	Knowledge	#26, MC	#28, MC				
				Skills		#27, MC				
				Attitudes						
	Discuss the acid-base property of water	**2**	**6.67%**	Knowledge		#29, MC				
				Skills						
				Attitudes		#30, MC				
TOTAL:		**30**	**100%**							