Thebes El Maadi International School Science Department Chemistry 2020/2021 Quarter 2 Exams- Revision Sheet- Paper 4- Ions in aqueous solutions

Chapter 13/ Ions in Aqueous Solutions

Q1) Multiple Choice

Identify the choice that best completes the statement or answers the question.

<u>a</u>1. Which of the following is a spectator ion in the following equation?

 $Na^{+}_{(aq)} + \mathbf{C}\mathbf{\Gamma}_{(\mathbf{aq})} + \mathbf{A}\mathbf{g}^{+}_{(\mathbf{aq})} + NO_{3}^{-}_{(aq)} \textcircled{2} N^{\dagger}a_{(aq)} + NO_{3}^{-}_{(aq)} + \mathbf{A}\mathbf{g}\mathbf{C}\mathbf{l}_{(\mathbf{ppt})}$ a. Na^{+} b. Ag^{+} c. CI^{-} d. None of the above

<u>d</u> 2. Which ions <u>do not</u> appear in the net ionic equation for the precipitation of $CaCO_3$ when the solutions of $CaCl_2$ and K_2CO_3 are mixed?

a.	K^{+} and CO_{3}^{2}	c. Ca^{2+} and Cl^{-}
b.	$Cl^{-} and CO_{3}^{2}$	d. K^+ and Cl^-

_c__3. How many moles of ions are produced by the dissociation of 1.0 mol of Na₂SO₄?

a.	0.5	с.	3
b.	1.0	d.	2.0

<u>b</u> 4. Which of the following reactions is described by the net ionic equation

$$Ag+(aq) + Cl(aq) \rightarrow AgCl(s)$$

- a. only the reaction between AgNO₃ and KCl
- b. any reaction in which a precipitate of AgCl is formed
- c. only the reaction between AgNO₃ and NaCl
- d. None of the above

<u>b</u> 5. A solute whose water solution conducts electricity is called a(n)

- a. nonconductor c. nonelectrolyte
- b. electrolyte d. aqueous solution

<u>a</u> 6. Which of the following is an ionic compound that dissociates in water?

a.	NaCl	с.	CCl_4
b.	C1 ₂	d.	C_6H_6

____d___7. Which of the following is a spectator ion in the following equation?

 $Cu²⁺ (aq) + Zn²⁺ (aq) + 2S²⁻(aq) \longrightarrow CuS(s) + ZnS(s)$ a. S²⁻ b. Cu²⁺ d. None of the above

- <u>a</u> 8. How many moles of Cl⁻ are produced by the dissociation of 0.5 mol of NaCl?
 - a. 0.5 c. 1.5 b. 1.0 d. 2.0

Use the following table to answer questions 9 and 10.

Solubility Rules for Some Common Ionic Compounds

Compounds containing these ions are soluble in water:
Alkali metals (Group 1), except LiF
Ammonium, NH ₄ *
Bromides, Br ⁻ , except those of Ag ⁺ , Pb ² , and Hg ₂ ²⁺
Chlorides, Cl ⁻ , except those of Ag^+ , Pb^2 , and Hg_2^{2+}
Nitrates, NO ₃
Sulfates, SO_3^{2+} , except those of Ca^{2+} , Sr^{2+} , Ba^{2+} , Pb^{2+} , and Hg_2^{2+}
Compounds containing these ions are insoluble in water:
Carbonates, $\rm CO_3^{2-}$, except those of Group 1 and $\rm NH_4^+$
Hydroxides, OH ⁻ , except those of Group 1
Oxides, O ²⁻ , except those of Group 1, Ca ²⁺ , Sr ²⁺ , and Ba ²⁺ (which form hydroxides)
Phosphates, PO_4^{3-} , except those of Group 1 and NH_4^*
Sulfides, S ²⁻ , except those of Group 1, Mg ²⁺ , Ca ²⁺ , Ba ²⁺ , and $\rm NH_4^+$

_b____9. Which of the following compounds is soluble in water?

a.	PbBr ₂	с.	$BaSO_4$
b.	MgCl ₂	d.	CaCO ₃

___d_10. Which of the following compounds is insoluble in water?

a.	$(NH_4)_2S$	с.	LiOH
b.	Na ₂ O	d.	Al_2O_3

<u> c_11 </u>. What is the ionic equation for the precipitation reaction between BaCl₂ and Na₂SO₄? $\mathbb{D}_{2^{+}(\pi\pi)} \times \mathbb{SO}^{2^{-}}(\pi\pi) \rightarrow \mathbb{B}_{2^{+}(\pi\pi)}(s)$

a. $\operatorname{Ba}^{-1}(aq) + \operatorname{SO}_{4}^{-1}(aq) \to \operatorname{BaSO}_{4}^{-1}$	$_4(s)$
b. $Na^+(aq) + Cl^-(aq) \rightarrow NaCl(s)$)
c. $Ba^{2+}(aq) + 2Cl^{-}(aq) + 2Na^{+}(aq)$	$(aq) + \mathrm{SO}_4^{2-}(aq) \rightarrow$
	$BaSO_4(s) + 2Cl^-(aq) + 2Na^+(aq)$
d. $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow B$	$aSO_4(s) + 2NaCl(aq)$
a hydronium ion forms when hydrogen i	ons?

<u>___d</u>12. The hydronium ion forms when hydrogen ions?

a.	dissociate	c. combine with HCl
b.	ionize	d. combine with H_2O .

d. combine with H_2O .

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- c 13. How many moles of ions are produced when 2 mol of Na₂CO₃ dissociate?
 - a. 2 c. 6 b. 3

d. 7

- __d_14. What happens when acetic acid, (covalent compound), a weak electrolyte, dissolves in water?
 - a. Hydronium ions form
 - b. The resulting solution will conduct electricity.
 - c. Most of the acid remains as nonionized molecules in equilibrium with ions.
 - d. All of the above
- <u>a</u>15. Which solution contains the strongest electrolyte?

a.	1.50 M NaCl	c. 5.7 M NH ₃
b.	$2.0 \text{ M C}_{6}\text{H}_{12}\text{O}_{6}$	d. 0.80 M CH ₃ COOH

_c___16. If the following equation were written as a net ionic equation, which ion(s) is (are) the spectator ion(s)?

 $Zn(s) + CuSO_4(aq) \longrightarrow Cu(s) + ZnSO_4(aq)$

a.	$Cu^{2+}(aq)$	c. SO ²⁻ (aq)
b.	$\operatorname{Zn}^{2+}(\operatorname{aq})$	d. None of the above

b 17. Why is freezing-point depression a colligative property?

- a. It is not related to the number of particles in a solution.
- b. It is directly proportional to the number of particles in a solution.
- c. It depends on the identity of an electrolyte in a solvent.
- d. None of the above.

a 18. Compared with a 1.00 m NaI solution, a $1.00 \text{ m Na}_2\text{SO}_4$ solution has . a. the same boiling-point elevation.

- b. about twice the boiling-point elevation.
- c. a boiling-point elevation about two-thirds as high.
- d. a boiling-point elevation about 1.5 times as high.
- b 19. When a nonvolatile solutes dissolve in a solvent, the vapor pressure of the solvent
 - a. increases. c. stays the same.
 - b. decreases. d. changes depending on the solvent used.

<u>c</u> 20. Which of the following compounds would be most effective in lowering the freezing point of ice on roads?

a. CaCl ₂	c. K ₃ PO ₄
b. NaCl	d. K_2SO_4

Thebes El Maadi International School Science Department Chemistry 2020/2021 Quarter 2 Exams- Revision Sheet- Paper 4- Ions in aqueous solutions c 21. A water-based solution is also known as an (a) a. orange solution. c. aqueous solution. b. plot solution. d. non aqueous solution. c 22. The separation of ions that occurs when an ionic compound dissolves is a. ionization. c. dissociation. b. electronegativity. d. speciation. b 23. Solutes which loose ions that carry charges are called a. Powerade. c. aqueous solutes. b. electrolytes. d. non aqueous solutes. _____electrolytes dissolve completely and conduct electricity very well. 24. a. strong. c. weak. b. acid. d. base. b 25. Solutes that don't conduct electricity at all in a solution are called . a. electrolytes. c. both a and b. b. nonelectrolytes. d. none of the above. d 26. Select the correctly balanced net ionic equation for this reaction. $Ca^{2+}(aq) + OH^{-}(aq) + H^{+}(aq) + PO_{4}^{3-}(aq) -> Ca^{2+}(aq) + PO_{4}^{3-}(aq) + H_{2}O(1)$ a. $OH^{-}(aq) + H^{+}(aq) + -> Ga^{2+}(aq) + H_2O(1)$. b. $OH^{-}(aq) + H^{+}(aq) + PO^{-}(aq) -> PO^{-}(aq) + H_2O(1)$. c. $Ca^{2+}(aq) + PO^{3-}(aq) -> Ca^{2+}(aq) + PO^{3-}(aq)$. d. $OH(aq) + H(aq) -> H_2O(1)$. <u>c</u>27. Select the correctly balanced net ionic equation for this reaction. $Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaNO_3(aq)$ $\begin{array}{l} a. \ 2Na^{+}(aq) + 2NO^{3\text{-}}(aq) & --> 2NaNO_{3}(aq) \\ b. \ Ba^{2+}_{2+}(aq) + NO^{3\text{-}}_{2-}(aq) & --> BaSO_{4}(s) + NO^{3\text{-}}(aq) \\ c. \ Ba^{+}(aq) + SO^{4\text{-}}(aq) & --> BaSO_{4}(s) + NO^{3\text{-}}(aq) \\ d. \ Na^{+}(aq) + SO_{4}^{4\text{-}}(aq) & --> BaSO_{4}(s) + Na^{+}(aq). \end{array}$ b 28. What are the spectator ions in this reaction? $CuCl_2(aq) + NaOH(aq) \rightarrow Cu(OH)_2(s) + NaCl(aq)$ a. Cu^{2+} and OH. c. Na^{2+} and Cl^{2-} . d. Na⁺ and OH⁻. b. Na⁺ and Cl⁻. <u>b</u> 29. How many moles of ions are produced when 1 mol of magnesium chlorate

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$Mg(ClO_3)_2$ are dissolved in wate	er?
a. 1 moles of ions.	c. 2 moles of ions
b. 3 moles of ions	d. 4 moles of ions.
c 30. When $CaBr_2$ is dissolved in wa	ater, how many particles will be in solution?
a. 1.	c. 3.
b. 2.	d. 4.
<u>a</u> 31. Colligative properties depend of the solute.	on the of the solute but not the
a. concentration; identity.	c. identity; concentration.
b. reactivity; nature.	d. nature; reactivity.
<u></u> 32. The freezing point of a solution	n isthe freezing point of the pure solvent.
a. the same as.	c. lower than.
b. higher than.	d. no relation to.
<u>b</u> 33. Δ Tb= Kb × molality	
What concentration of ethylene	glycol is needed to raise the boiling point of
water by 5 °C? (Kb= 0.51 °C/m)).
a. 1.5 m.	c. 2.5 m.
b. 9.8 m.	d. 205 m.
<u> </u>	
What is the boiling-point elevation $0.514^{\circ}C/m$).	ion of a 2.0 m glucose solution in water? (Kb =
a. 0.26°C.	c. 1.02°C.
b. 0.51°C.	d. 98.9°C.
<u></u> 35. When an ionic solid dissolve in	water, which of the following does not occur?
a. The compound dissociates.	
b. Hydration occurs.	
c. The compound ionizes.	
d. Polar ends of water molecules a	pproach the ions, releasing energy
<u>a</u> 36. Colligative properties depend o	n the
a. number of solute particles prese	nt.
b. size of solute particles present.	
c. mass of solute particles present.	
d. charge on solute particles preser	nt.
<u> </u>	
a. depresses both the freezing poin	t and the boiling point
b. elevates both the freezing point	and the boiling point.
c. depresses the freezing point and	elevates the boiling point.
d. elevates the freezing point and c	lepresses the boiling point.

<u>d</u> 38. Which of these is a spectator ion in the following equation?

 $Cu^{2+}(aq) + Zn^{2+}(aq) + 2S^{2-}(aq) \rightarrow CuS(s) + ZnS(s)$ c. S²⁻ a. Cu^{2+} d. None of the above

b. Zn^{2+}

c 39. What happens when a weak electrolyte dissolves in water?

- a. The boiling point decreases.
- b. The solution does not conduct electricity.
- c. Few ions form.
- d. 100% of the molecules ionize.

b 40. Δ Tb=Kb × molality

What concentration of ethylene glycol is needed to raise the boiling point of water to 105 °C? (Kb= $0.51 \circ C/m$).

a. 1.5 m. c. 2.5 m. b. 9.8 m. d. 205 m.

d___41. Electrolytes have a greater effect on colligative properties than nonelectrolytes do

because electrolytes

- a. are volatile.
- b. have higher boiling points.
- c. produce fewer moles of solute particles per mole of solvent.
- d. produce more moles of solute particles per mole of solvent.
- d 42. A 2 m solution contains
 - a. 2 mol of solute dissolved in 1 L of solvent.
 - b. 1 mol of solute dissolved in 2 L of solvent.
 - c. 2 mol of solute dissolved in 1 mol of solvent.
 - d. 2 mol of solute dissolved in 1 kg of solvent.

d___43. The hydronium ion forms when hydrogen ions

- a. dissociate. c. combine with HCl. b. ionize. d. combine with H₂O.
- d 44. Which of the following is not a colligative property?
 - a. boiling-point elevation. c. freezing-point depression.
 - b. lowering vapor pressure. d. conducting electricity

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Q2) Completion

1. An ion that does not take part in a chemical reaction is called a(n) spectator ion	·
2. The number of moles of ions produced by the dissociation of 1 mol of $MgCl_2$ is	3

3. The symbol for the hydronium ion is H_3O^+ .

4. The ions Ca^{2+} (aq) and NO^{3-} (aq) are produced by the dissociation of the compound whose formula is ______Ca(NO_3)_2_____.

5. The right-hand side of the equation for the dissolving of K_2S is ____2K⁺ (aq) + S²⁻ (aq) .

6. When a solid is formed from the combination of two solutions of ionic compounds, it is called _______.

7. Any substance whose water solution conducts electricity is a(n) <u>electrolyte</u>.

8. The vapor pressure of pure water is greater than the vapor pressure for an aqueous solution.

Q3) Short Answer

1. Explain how ionization and dissociation differ.

Dissociation is the separation of ions that occurs when an ionic compounds dissolve. The ions, already present, separate from one another. Ionization is the process of forming ions from the solute molecules by the action of the solvent. When a molecular compound dissolves and ionizes in a polar solvent, ions are formed.

2. Distinguish between the dissolution of a strong electrolyte and that of a weak electrolyte.

In a strong electrolyte, all or almost all of the dissolved compound exists as ions in aqueous solution. In a weak electrolyte, little of the dissolved compound exists as ions in aqueous solution

3. Why is the hydronium ion used to represent the hydrogen ion in a solution?

When a compound containing hydrogen dissolves in water to form a hydrogen ion, H^+ , the H^+ ion attracts other molecules or ions so strongly that it rarely exists alone. In water, the H^+ ion immediately bonds to a water molecule, forming a hydronium ion, H_3O^+ .

4. Explain why salt is frequently poured on icy roads in the winter.

Dissolved salt will lower the freezing point of water. Therefore, adding salt to icy roads will help melt the ice and prevent further freezing of any water on the road's surface. It will also prevent the refreezing of water as it melts.
