

Cool Chemistry Show: End-of-Chapter Assessment

Multiple Choice:

- Identify which one of the following is classified as a chemical change.
a) Evaporation of water b) Burning of gasoline
c) Shredding paper d) Crushing solid coal
- When no more sugar will dissolve in a given volume of water, we say that the solution is:
a) viscous b) liquefied c) saturated d) exothermic
- When equal volumes of two different solutions are mixed together and a precipitate forms, we conclude that:
a) A physical reaction has taken place.
b) A chemical reaction has taken place.
c) Solids form when excess volumes are added together.
d) When common ions combine, they will solidify.
- The correct formula for potassium bromide is:
a) KBr_2 b) K_2Br c) K_7Br d) KBr
- The correct formula for aluminum nitrate is:
a) $\text{Al}(\text{NO}_3)_3$ b) AlNO_3 c) Al_3NO_3 d) $\text{Al}_3(\text{NO}_3)_3$
- Total number of atoms contained in iron (II) ammonium sulfate, $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2$, is:
a) 5 b) 11 c) 19 d) 21
- The correct formula for ammonium hydrogen carbonate is
a) NH_4CO_3 b) $(\text{NH}_4)_2\text{HCO}_3$ c) NH_4HCO_3 d) $\text{NH}_4(\text{CO}_3)_2$
- What are the correct coefficients needed in order to balance the following equation? $_ \text{Zn}(\text{s}) + _ \text{HCl}(\text{aq}) \rightarrow _ \text{H}_2(\text{g}) + _ \text{ZnCl}_2(\text{aq})$
a) 1, 1, 1, 1 b) 1, 1, 2, 1 c) 1, 2, 1, 1 d) 1, 1, 1, 2
- The complete combustion of carbon is:
 $_ \text{C}(\text{s}) + _ \text{O}_2(\text{s}) \rightarrow _ (\quad)$
The sum of the coefficients of the balanced equation is:
a) 1 b) 2 c) 3 d) 4
- Which one of the following reactions is an exothermic reaction?
a) $\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{O}(\text{g})$ b) $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\text{g})$
c) $\text{H}_2(\text{s}) \rightarrow \text{H}_2\text{O}(\text{l})$ d) $\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{O}(\text{s})$

11. Which factor should not have any effect on the rate of the reaction?
a) Temperature b) Density c) Concentration d) Catalyst
12. When carbon dioxide is dissolved in water, the pH of the solution will:
a) Become more basic. b) Become neutral.
c) Become greater than the pH of water. d) Become acidic.
13. When hydrochloric acid is added to zinc metal, what gas is released?
a) H₂ b) Cl₂ c) HCl d) ZnCl₂
14. Red litmus will turn blue when the solution being tested is:
a) acidic b) neutral c) basic d) saturated
15. When an acid is dissolved in water, it releases:
a) H⁺ b) OH⁻ c) HOH d) M
16. If you were to titrate 10 mL of 0.1 M HCl with 10 mL of 0.1 M NaOH, the solution's pH would be:
a) 0 b) 5 c) 7 d) 9
17. If the pH of a solution is 1 and the solution is then diluted to a pH of 2, the hydrogen ion concentration of the diluted solution becomes:
a) 2 times greater than the original hydrogen ion concentration.
b) 2 times weaker than the original hydrogen ion concentration.
c) 10 times weaker than the original hydrogen ion concentration.
d) 10 times greater than the original hydrogen ion concentration.

(For questions 18-20)

Given the net ionic equation: $? \text{Zn}_{(s)} + ? \text{Cu}^{+2}_{(aq)} \rightarrow ? \text{Zn}^{+2}_{(aq)} + ? \text{Cu}_{(s)}$

18. When the equation is balanced, the correct coefficients are:
a) 1, 1, 1, 2 b) 1, 1, 2, 1 c) 1, 2, 1, 1 d) 1, 1, 1, 1
19. In this reaction, we can say that the zinc metal:
a) Gained two electrons. b) Loses two electrons.
c) Gained two protons. d) Loses two neutrons.
20. In this reaction, we can say that copper was:
a) reduced b) oxidized c) acidified d) neutralized

Written Expression:

- Copper (II) sulfate can exist in either the anhydrous copper (II) sulfate (CuSO_4) or copper (II) sulfate pentahydrate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$). Explain how you would accomplish a change from one form to the other, and also explain what type of change this would be.
- Complete the following table:

Name	Formula	Cation	Anion
Sodium chloride	NaCl	Na^+	Cl^-
Sodium nitrate		Na^+	NO_3^-
	$\text{Al}(\text{NO}_3)_3$	Al^{+3}	NO_3^-
Potassium bromide	KBr	K^+	
Ammonium hydrogen carbonate	NH_4HCO_3		HCO_3^-
Barium hydroxide		Ba^{+2}	OH^-
	MgSO_4	Mg^{+2}	SO_4^{-2}
Sodium phosphate		Na^+	PO_4^{-3}
	MgBr_2	Mg^{+2}	Br^-
Magnesium phosphate		Mg^{+2}	PO_4^{-3}
Barium carbonate	BaCO_3	Ba^{+2}	
	NaCH_3CO_2	Na^+	CH_3CO_2^-
Aluminum acetate		Al^{+3}	CH_3CO_2^-

- When the clear colorless solutions of barium nitrate and sodium sulfate are mixed together, a white precipitate forms. Write a balanced equation and explain how you know what combination formed the precipitate.
- Certain factors usually affect reaction rates. Discuss how each of the following factors can affect the reaction rate:
 - State of solid reactant particles.
 - Increase of temperature.
 - Increase of the concentration of the reactants.
- A block of dry ice [$\text{CO}_2(\text{s})$] is placed on the lab table. You observe that carbon dioxide gas is released by sublimation (solid vaporizes to a gas). Is this an endothermic or exothermic reaction? Explain your answer.
- How many milliliters of 0.1 M of NaOH must you add to 10 mL of 0.1M HCl in order to neutralize the acid? What pH would the neutral solution have? Explain.
- If a strip of zinc metal is placed in a test tube that contains a blue solution of copper nitrate and allowed to stand, the copper will plate out on the zinc strip and the solution will lose its blue color. Explain what occurs in this reaction and why the solution loses its blue color.

Answer Key

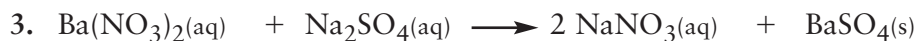
Multiple Choice:

- 1) b 2) c 3) b 4) d 5) a
 6) d 7) c 8) c 9) c 10) d
 11) b 12) d 13) a 14) c 15) a
 16) c 17) c 18) d 19) b 20) a

Written Expression:

- Students should discuss the following:
 - to change the pentahydrate form to the anhydrous form they will need to dehydrate the compound.
 - Students will probably classify this as a physical process. The student may state that since both compounds are solids and only the formula has been changed, then it should be classified as a chemical reaction. A good defense should receive credit.
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Name	Formula	Cation	Anion
Sodium chloride	NaCl	Na ⁺	Cl ⁻
Sodium nitrate	NaNO ₃	Na ⁺	NO ₃ ⁻
Aluminum nitrate	Al(NO ₃) ₃	Al ⁺³	NO ₃ ⁻
Potassium bromide	KBr	K ⁺	Br ⁻
Ammonium hydrogen carbonate	NH ₄ HCO ₃	NH ₄ ⁺	HCO ₃ ⁻
Barium hydroxide	Ba(OH) ₂	Ba ⁺²	OH ⁻
Magnesium sulfate	MgSO ₄	Mg ⁺²	SO ₄ ⁻²
Sodium phosphate	Na ₃ PO ₄	Na ⁺	PO ₄ ⁻³
Magnesium bromide	MgBr ₂	Mg ⁺²	Br ⁻
Magnesium phosphate	Mg ₃ (PO ₄) ₂	Mg ⁺²	PO ₄ ⁻³
Barium carbonate	BaCO ₃	Ba ⁺²	CO ₃ ⁻²
Sodium acetate	NaCH ₃ CO ₂	Na ⁺	CH ₃ CO ₂ ⁻
Aluminum acetate	Al(CH ₃ CO ₂) ₃	Al ⁺³	CH ₃ CO ₂ ⁻



Barium sulfate forms a precipitate because it is insoluble in water. Alkali metal compounds are soluble, and it also known that nitrate compounds are soluble in water.

4.
 - a) State of solid reactant particles. As the nature of the solid is broken up, it allows for more surface area to be able to react favorably.
 - b) Increase of temperature. The kinetic energy of the system increases the chance for the reaction to increase.
 - c) Increase of the concentration of the reactants. If the concentrations of the reactants are increased it will increase the chance for a successful reaction.
5. The system (solid CO_2) absorbs energy in order to sublime. This is an endothermic reaction. The students may use an example like the process of changing ice to a liquid or liquid to a gas as endothermic processes.
6. 10 mL of 0.1 M NaOH will neutralize the 10 mL of 0.1 M HCl. The pH will be 7, since a strong base is being added to a strong acid.
7. The overall equation is: $\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \longrightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu(s)}$. It is noted that the copper has been reduced and as the copper ion concentration decreases, the blue solution will fade. The blue color is due to the concentration of the copper ions present.