Conjugate Acids and Bases

CλeMis+ry: http://genest.weebly.com

Stop in for help every day at lunch and Tues,&Thurs after school!

ANN SIRS

Name_____

Period_____

DRAFT

1. Give the formula of the conjugate acid of each: NO_3^-, H_2O, HSO_4^-

HNO_3 H_3O^+ H_2SO_4

Identify the acid, base, conjugate acid and conjugate base for each of the following.

2. $HClO_4(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + ClO_4^-(aq)$

BASE ACID

ACID BASE

3. $H_2SO_3(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + HSO_3^-(aq)$

BASE ACID

ACID BASE

4. $HC_2H_3O_2(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + C_2H_3O_2^-(aq)$

BASE ACID

ACID BASE

5. $H_2S(g) + H_2O(l) \rightleftharpoons H_3O^+(aq) + HS^-(aq)$

BASE ACID

ACID BASE

6. These are all either acids or bases. **Draw a slash** through the molecule to show the half that would fall off. How many pieces will this fall apart into if made into an aqueous solution? (circle your choice)

$NaOH_{(aq)}$	1? 2? 3? 4? 5?	HBr	1? 2? 3? 4? 5?
$HNO_{3(aq)}$	1? 2? 3? 4? 5?	KOH	1? 2? 3? 4? 5?
H_2CO_3	1? 2? 3? 4? 5?	$HCH_3COO)_2$	1? 2? 3? 4? 5?

Don't worry much. Not on test

7. Circle the CATION element in each.

Circle any element that is a metal	This substance is…	When one of these dissolves, how many aqueous ions form?
$H_2SO_{4(aq)}$	acid / base / neither	
$Mg(OH)_{2(aq)}$	acid / base / neither	

Circle any element that is a metal	This substance is…	When one of these dissolves, how many aqueous ions form?
$NaOH_{(aq)}$	acid / base / neither	
$HNO_{3(aq)}$	acid / base / neither	

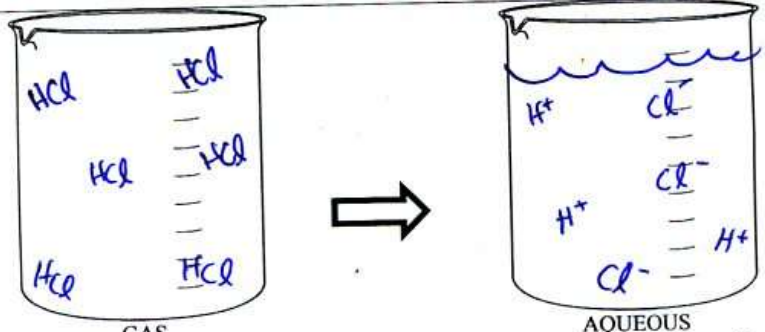
8. Give the formula for the conjugate acid of CH_3NH_2

$CH_3NH_3^+$

9. Give the conjugate base of each: HCl, HBr, HI,

(Cl^-) (Br^-) (I^-)

10. Draw gas in the left beaker and aqueous, per the following instructions:



GAS
In gas phase draw a half dozen molecules of the only substance in HCl(g)

AQUEOUS
In gas phase draw three particles of all three substances present in HCl(aq)

11. Write a balanced equation that shows $HClO_4$, losing a H+ to form its conjugate base.

$HClO_4 \longrightarrow H^+ + ClO_4^-$

12. Write a balanced equation that shows HNO_3, losing a H+ to form its conjugate base.

$HNO_3 \longrightarrow H^+ + NO_3^-$

13. What happens to hydroxide concentration in water when base is added?
(it rises / it falls / it doesn't change)

14. What happens to the hydronium concentration in water when base is added?
(it rises / it falls / it doesn't change)

15. The following substances act as Bronsted acids in water. Write a chemical equation for each that illustrates its reaction with water.

ammonium ion, NH_4^+	$NH_4^+ + H_2O \rightarrow NH_3 + H_3O^+$
H_3PO_4	$H_3PO_4 + H_2O \rightarrow H_2PO_4^- + H_3O^+$
HBr	$HBr + H_2O \rightarrow Br^- + H_3O^+$

writing H_2O is okay but not as convenient

16. The following substances act as Bronsted bases in water. Write a chemical equation for each that illustrates its reaction with water.

$CHOO^-$	$CHOO^- + HOH \rightarrow HCHOO + OH^-$
hydride ion: H-	$H^- + HOH \rightarrow H_2 + OH^-$
ammonia NH_3	$NH_3 + HOH \rightarrow NH_4^+ + OH^-$

17. What is the conjugate acid of HSO4- ? H_2SO_4

18. What is the conjugate base of HSO4-? SO_4^{2-}

Identify the acid, base, conjugate acid and conjugate base for each of the following.

19. $HSO_3^-(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + SO_3^{2-}(aq)$
ACID BASE ACID Base

20. $NH_3(g) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$
BASE ACID ACID BASE

21. $HF(aq) + HSO_3^-(aq) \rightleftharpoons F^-(aq) + H_2SO_3(aq)$
acid Base Base ACID

22. $HNO_2(aq) + HS^-(aq) \rightleftharpoons NO_2^-(aq) + H_2S(aq)$
ACID Base Base ACID

23. What is the formula for the conjugate acid of water? H_3O^+

24. What is the formula for the conjugate base of water? OH^-

notice the charges

Atomic Radius Trends.

25. In each pair, circle the element that has a greater radius.

a) Neon or Helium

b) Hydrogen or Helium

c) Magnesium or Potassium

hydrogen is larger! Why? radius grows as you go left in a period

26. Write a balanced equation for neutral fluorine atom gaining one electron:

$F + e^- \rightarrow F^-$

27. Write a balanced equation for S^{2-} anion losing two electrons:

$S^{2-} \rightarrow S + 2e^-$

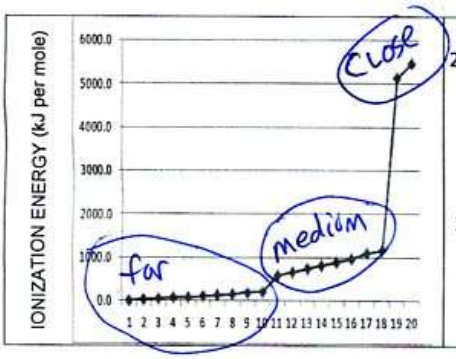
Electronegativity Trends.

28. In each pair, circle the element that has a greater electronegativity.

a) phosphorous or chlorine

b) phosphorous or antimony

c) fluorine or iodine



29. One this graph, next to all twenty dots write words similar to CLOSE or FAR or OTHER WORDS to describe where you think the electron is compared to the nucleus.

30. Write the number-number-number style of electron orbits for this atom based on the graph shown here.

2-8-10

31. Draw a stable Lewis Dot structure for each molecule:

H_2S	N_2
H : S : H	:N ::: N:

32. Draw a stable Lewis Dot structure for each molecule:

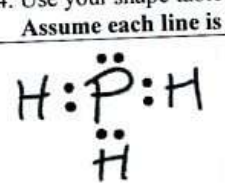
HCl	F_2
H:Cl:	:F:F:

33. for a NEUTRAL atom with the following electron configuration:

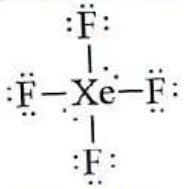
$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 5s^2 4d^{10} 5p^1$

Write a 'number-number-number' diagram for this atom	Write a Lewis dot diagram (Letter and dots) for this atom	This atom has 3 e- valence therefore it is (stable / unstable)
2-8-18-12-3	:Tc·	

34. Use your shape table to write the name of the geometric shape based on each molecule's central atom.
Assume each line is a connection between two atoms.



trigonal pyramidal



square planer

trigonal bipyramidal

linear

35. Fill in the missing numbers for these two test tube:

Test Tube	OH- concentration	H+ concentration	pH
A	3.16×10^{-12}	3.16×10^{-3}	2.50
B	8.04×10^{-5} M	1.24×10^{-10}	9.91

Review #2

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Review #1 was the Camouflage Sheet

Name ERS

Per

1. For an atom with atomic number =9, charge of zero, and 10 neutrons...
   a. mass number 19
   b. number of protons? 9
   c. number of electrons 9
   d. symbol of the element, with highLow numbers $^{19}_{9}F$

2. For this atom,
   a. how many **total** electrons ? 17e⁻
   b. how many protons? 17p
   c. how many **valence** electrons? 7

3. Which of the following elements has the greatest ionization energy?
   a. Lithium
   b. Calcium
   c. Neon
   d. Silicon

4. What is the high-low symbol of a neutral atom that has a mass of 44 and has 24 neutrons?

   $^{44}_{20}Ca$

5. What is the charge of an atom with p = 5, n = 5, e = 8?

   charge = p − e
   charge = 5 − 8
   charge = −3

6. for a NEUTRAL atom with the following electron configuration:

   $1s^2 2s^2 2p^6 3s^2 3p^6$

Write a 'number-number-number' diagram for this atom	Write a Lewis dot diagram (Letter and dots) for this atom	This atom has 8 valence e⁻
2-8-8	:Ar:	therefore it is (stable / unstable)

7. For an atom with 14 protons and 15 neutrons and 18 electrons
   a. mass number 29
   b. atomic number 14
   c. number of electrons 18
   d. symbol of the element Si
   e. charge of the atom 4−
   f. symbol of the element, with highLow numbers $^{29}_{14}Si^{-4}$

How many valence electrons are in each of the following?

1.	2.	3.	4.
$1s^2 2s^2 2p^5$	a neutral atom of phosphorous		:Cl·
7	5	1	7

8. Choose one of the three choices. " In neutral atoms…"
   a. # of e > # of p
   b. # of e = # of p
   c. # of e < # of p

9. The Law of Conservation of Charge can help us spot wrongly written equations for ions.
   a. $Ba + 2e^- \longrightarrow Ba^{2+}$ possible / impossible
   b. $F \longrightarrow F^+ + e^-$ possible / impossible
   c. $S \longrightarrow S^{2+} + 2e^-$ possible / impossible
   d. $I \longrightarrow I^+ + e^-$ possible / impossible
   e. $Ag + e^- \longrightarrow Ag^+$ possible / impossible

10. When we speak of ion radius, we speak of their most common ions.
11. The ions for metals are usually (negative / postitive). The common ions for nonmetals are (negative / postitive).

12. When metals form cations, the ion is (smaller / larger) than the neutral version of the same atom.

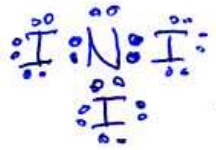
13. When nonmetals form anions, the ion is (smaller / larger) than the neutral version of the same atom.

14. Give the formula of the conjugate acid of each: NO_3^-, H_2O, HSO_4^-

HNO_3, H_3O^+, H_2SO_4

15. Draw a stable Lewis Dot structure for each molecule:

I_2	OF_2
:I:I:	:F:O:F:

CO_2	NI_3
6+6+4=16e⁻ 	

16. for a NEUTRAL atom with the following electron configuration:

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$

Write a 'number-number-number' diagram for this atom	Write a Lewis dot diagram (Letter and dots) for this atom	This atom has 2 e- valence therefore it is (stable / unstable)
2-8-18-2	Ca:	

Write Acid or Base under every substance in each of the following.

17. $HClO_{4(aq)} + H_2O_{(l)} \rightleftarrows H_3O^+_{(aq)} + ClO_4^-{}_{(aq)}$

ACID base acid BASE

18. $NH_{3(aq)}$ TYPO – SKIP ! $H_4^+{}_{(aq)}$

BASE ACID

19. Give the conjugate base of each: HCl, HBr, HI,

20. What is the conjugate acid of H_2O ?

21. What is the conjugate base of H_3O^+?

22. What is the conjugate acid of OH^-?

23. Write ACID or BASE for each of the following solutions:

a. BASE litmus paper turns blue

b. BASE the solution feels slippery --because it turns skin to soap

c. acid the pH = 6

d. acid the pH = 0

e. SKIP the solution conducts electricity but does not react with metal

f. acid the solution has [OH-] < [H+]

g. base bromothymol blue is blue (use the table)

h. ACID methyl orange is red

i. ACID [H+] = 0.000999 → turn into pH

j. ACID [OH-] = 4.4x10-8 → PH=

k. SKIP when mixed with base water and salt usually form

The Law of Conservation of Charge can help us spot wrongly written equations for ions. circle one answer in each of these reactions:

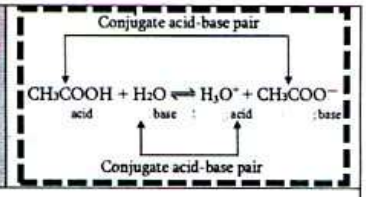
24. $Ba + 2e^- \rightarrow Ba^{2+}$ possible / impossible

25. $F \rightarrow F^+ + e^-$ possible / impossible

26. $S \rightarrow S^{2+} + 2e^-$ possible / impossible

In reversible reactions there is sometimes a conjugated pair of acids and bases.

In the two problems below, connect the conjugate pairs by drawing lines. Identify all four substances in each reaction as either ACID or BASE



27. $F^-(aq) + H_2SO_3(aq) \rightleftharpoons HF(aq) + HSO_3^-(aq)$

BASE ACID ACID BASE

28. $HNO_2(aq) + HS^-(aq) \rightleftharpoons NO_2^-(aq) + H_2S(aq)$

ACID BASE BASE ACID

29. Write a balanced equation for neutral hydrogen atom gaining one electron:

dangerous acids

$H + e^- \rightarrow H^-$

dangerous bases

30. The pH scale looks like this (draw it like a number line, including the neutral point and where dangerous acids and dangerous bases start—see your notes from Tuesday):

31. Water is right in the middle of being Acid or Base so the pH of pure water has a pH of about 7.0

	Acids	Bases
Turns phenolphthalein what color?	colorless	pink
pH	**Acids have pH LESS than** 7	**Bases have pH GREATER than** 7
Taste (if it's food)	sour	bitter