

Name:

Question 1
(5 points)

1. An ion from a given element has **16** protons and **18** electrons.

What is the charge on the ion? _____

What is the name of the element? _____

What is the symbol for the ion? _____

2. For the element **K**:

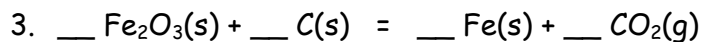
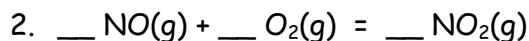
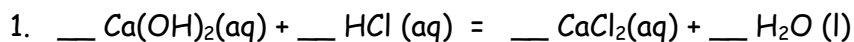
What is the charge on the ion expected to form? _____

How many electrons are present in the ion? _____

Do Not
Write Here

Question 2
(3 points)

When the following molecular equations are balanced using the smallest possible integer coefficients, the values of these coefficients are:



Do Not
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Question 3
(8 points)

1. Name the compound with the formula **Ca(CN)_2** ? _____

2. Name the compound with the formula **NaHCO_3** ? _____

3. What is the formula for **calcium phosphate** ? _____

4. What is the formula for **sulfur tetrafluoride** ? _____

Do Not
Write Here

Question 4
(5 points)

1. A compound is found to contain **10.85 % silicon**, **27.40 % chlorine** and **61.75 % bromine** by weight. Determine the empirical formula for this compound.

Do Not
Write Here

Question 5
(6 points)

Give the **Net Ionic Equation** for the reaction that occurs:

1. when aqueous solutions of **Ni(NO₃)₂** and **Ba(OH)₂** are combined.

2. when aqueous solutions of **sodium sulfide** and **copper(II) nitrate** are combined.

3. When aqueous solutions of **KOH** and **HF** are combined.

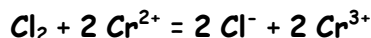
Question 6
(3 points)

What is the oxidation state of:

oxygen in **O₂** _____ **carbon** in **H₂C₂O₄** _____ **oxygen** in **H₂O₂** _____

Question 7
(4 points)

Identify the species oxidized, the species reduced, the oxidizing agent and the reducing agent in the following electron transfer reaction.



1. species oxidized: _____
2. oxidizing agent: _____
3. During the reaction, electrons are transferred from _____ to _____.

Question 8
(4 points)

1. **Valence** electron configuration for the **lithium** atom? _____
2. **Complete** electron configuration for the **aluminum ion**? _____
3. A main group element with the valence electron configuration **2s²2p³** is in periodic group _____. It forms a monatomic ion with a charge of _____.

Do Not
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Do Not
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Do Not
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Name:

Question 9 Consider the following elements:
(4 points)

Se, Ge, As, Br

1. Which would you expect to have the smallest atomic radius? _____
2. Which would you expect to be least metallic? _____
3. Which would you expect to have the largest ionization energy? _____
4. Which would you expect to be most electronegative? _____

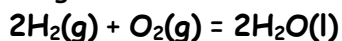
Question 10 Draw Lewis structures for **chlorate ion** and **NO⁺**.
(4 Points)

Chlorate ion	NO ⁺
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Question 11 Draw Lewis structure for **NO₂⁻** and any resonance structures that it may have?
(4 Points)

NO ₂ ⁻

Question 12 Using average bond energies estimate the enthalpy change for the following reaction:
(6 Points)



2. Repeat the above calculation using Heats of Formation. [The Heat of Formation for H₂O(l) = -285.8 kJ.mol⁻¹]
3. Account for the difference in the values obtained.

Question 13
(5 Points)

For each of the following molecules give (where required) the **electron-pair geometry**, the **number of lone pairs** around the central atom, the **molecular geometry** and indicate whether the molecule is **polar or non-polar**.



lone pairs _____

molecular geometry _____

molecular polarity _____



electron-pair geometry _____

molecular polarity _____

Do Not
Write Here

Question 14
(4 Points)

Circle the intermolecular forces that are applicable to the following:

A. The solute-solvent interactions when **potassium fluoride** dissolves in water are primarily of the type:

dipole-induced dipole ion-dipole ion-ion dipole-dipole hydrogen bonding

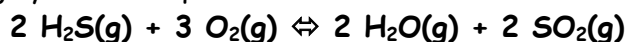
B. The type of intermolecular forces expected between NH_3 molecules:

dipole-induced dipole ion-dipole ion-ion dipole-dipole hydrogen bonding

Do Not
Write Here

Question 15
(4 Points)

Consider the following system at equilibrium:



The production of SO_2 by this reaction would be favored by:

Do Not
Write Here

Question 16
(4 Points)

The $[\text{H}_3\text{O}^+]$ in an aqueous solution is $5.58 \times 10^{-9} \text{ M}$.

1. The $[\text{OH}^-]$ in the solution is _____ M.

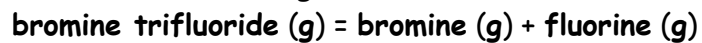
2. The pH of this solution is _____ and the pOH is _____.

3. This solution is _____ . (Acidic or Basic)

Do Not
Write Here

Name:

Question 17 (3 Points) According to the following reaction, how many moles of **bromine trifluoride** are necessary to form **0.387** moles **fluorine gas**?



Do Not
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Question 18 (5 points) How many grams of solid **Ba(OH)₂** are needed to exactly neutralize **21.1** mL of a **0.652** M **HCl** solution ? Assume that the volume remains constant.

Do Not
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Question 19 (5 points) Determine the pH of an aqueous solution of **0.457** M **hydrocyanic acid, HCN** (aq). K_a for HCN = 4×10^{-10} at 298K

Do Not
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Question 20 (5 points) A buffer solution contains **0.367 M KCN** and **0.457 M HCN**. Determine the pH of this buffer solution.

Do Not
Write Here

Question 21 (4 points) A 1.00 liter solution contains **0.457 M HCN** and **0.367 M KCN**. If **0.13** moles of **NaOH** are added to this system, indicate whether the following statements are TRUE or FALSE. (Assume that the volume does not change upon the addition of **NaOH**.)

Do Not
Write Here

- A. The number of moles of **HCN** will **increase**. _____
- B. The number of moles of **CN⁻** will **remain the same**. _____
- C. The equilibrium concentration of **H₃O⁺** will **decrease**. _____
- D. The pH will **increase**. _____

Question 22 (5 points) Classify each of the compounds below with the functional group classification given.

Do Not
Write Here

Alcohol	Carboxylic Acid	Amine	Aldehyde	Ketone	Ether
$C_6H_5CH_2NH_2$	_____		CH_3CH_2CHO	_____	
C_6H_5COOH	_____		CH_3COCH_3	_____	
CH_3OCH_3	_____				

Score:

Do Not
Write Here