



Chemistry 11
Department of Physical Sciences
Kingsborough Community College
City University of New York

NAME _____

Exam 1: Chapters 1-3 50 points

1. How many protons, electrons, and neutrons are in one atom of the following isotopes (6 points)?

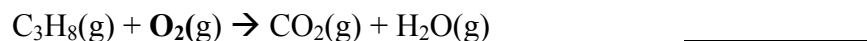
Fluorine-19 p= _____ e= _____ n= _____

^{53}Cr p= _____ e= _____ n= _____

2. Which of the following elements would you expect to conduct heat the best? (circle the best choice. Only one is correct) (2 points)

H He N Rn Ni

3. When the equation is balanced, what is the coefficient in front of the material in **BOLD** (2 points)?



4 Which of the following compounds is a hydrocarbon? (more than one may be correct) (2 points)

CH₃OH C₂H₆ H₂O C₆₀(s) H₂O₂ CO₂

5. Name the following compounds (8 points):

Na₂O _____

P₅O₁₀ _____

FeCl₃ _____

Ti(OH)₃ _____

6. How many centimeters are in 0.00125 meters? _____ (1 cm = 10⁻² m) (2 points)

7. How many centimeters are in 2.45 feet? _____ (2.54 cm/inch, 12 inches/foot) (2 points)

8. Report the answer to the following equation using the correct number of significant figures and units (3 points):

$$\frac{(6.626 \times 10^{-34} \text{ kg}\cdot\text{m}^2/\text{s})(2.9979 \times 10^8 \text{ m/s})}{(640 \times 10^{-9} \text{ m})} \quad \underline{\hspace{2cm}}$$

9. Identify each of the following materials as a pure substance, a homogeneous mixture, or a heterogeneous mixture. (3 points)

copper(II) sulfate _____

mineral water _____

gasoline _____

10. How many atoms of each element are in one molecule of $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$? (4 points)

Co _____ Cl _____ H _____ O _____

11. Write the chemical formula for the following compounds (6 points):

dinitrogen pentoxide _____

lithium nitrate _____

scandium (III) phosphate _____

12. Which element is most likely to gain one electron when forming a compound with another element? (circle the best choice) (2 points)

Na Li O S Cl

13. Which element is most likely to lose two electrons when forming a compound with another element? (circle the best choice) (2 points)

Na Ba O S Cl

14. How many electrons do the following chemical species possess? (3 points)

Ca _____

Ca⁺² _____

CaCl₂ _____

15. What are the primary differences between molecular substances and ionic substances? In your answer write the formula for an example of each(3 points)

End Exam



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Exam 2: Chapters 4-6 47 points

Be sure to show all work to receive credit.

You may not share calculators.

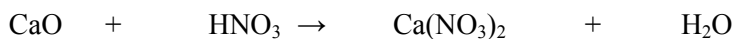
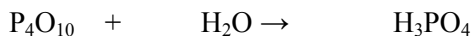
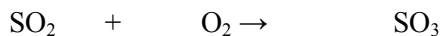
Report all numerical answers to the correct number of significant figures and with the appropriate units.

Be sure to circle your final answers

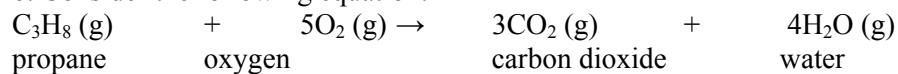
$$N_A = 6.022142 \times 10^{23}/\text{mol}$$

1. How many moles of carbon are in a sample of 5.5×10^{15} atoms? 2 points
2. How many moles of hydrogen are in 4.25×10^{26} molecules of glucose, $C_6H_{12}O_6$? 2 points
3. What is the mass (in grams) of 2.4 mol of Cu_2O ? 2 points
4. Calculate the percentage mass of each element in dodecanoic acid, $C_{12}H_{24}O_2$. 4 points

5. Balance the equations with the smallest whole numbers (3 points):



6. Consider the following equation:



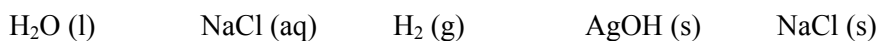
If 3 molecules of propane are consumed in the equation, how many molecules of water are produced? 2 points

If 2.5 moles of carbon dioxide are produced in the above equation, how many moles of water are produced? 2 points

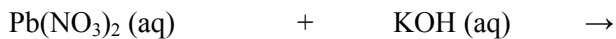
If 2.5 grams of propane are added to excess oxygen, how many grams of water are produced? 3 points

If 2.5 moles of propane are added to 2.5 moles of oxygen how many moles of water are produced? 3 points

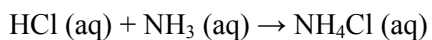
7. Which compound is most likely to conduct electricity? Assume that compounds are pure. Circle the correct answer. 2 points



8. Complete the equations. Include states of matter. There is no need to balance the equations. 6 points



9. Write the complete and then net ionic equation for (2 points):



Complete ionic:

Net ionic:

10. Name the following compounds (2 points):

HCl (aq) _____

H₂SO₄ (aq) _____

HNO₃ (aq) _____

NH₃ (aq) _____

11. Calculate the concentration (molarity) of a solution of sodium chloride when 1.5 mol of NaCl is added to water to make a solution that has a volume of 0.75 L. 2 points

12. If 4.551 g of NaOH is added to water to make a solution with a volume of 450 mL what is the molarity of the solution? 1 L = 1000 mL 3 points

13. Assign oxidation numbers to each element (2 points):

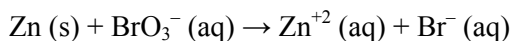
N₂O₅ _____

Cr₂O₇²⁻ _____

14. A reduction–oxidation reaction involves (Circle the best answer) (2 points):

- a loss of electrons a transfer of electrons a loss of a proton
a transfer of a proton a loss of a water molecule a transfer of a water molecule

15. Balance the equation using the half-reaction method (5 points):



Solubilities of Salts in Water

- Most salts of the acetate ion ($\text{C}_2\text{H}_3\text{O}_2^-$), the nitrate ion (NO_3^-), the chlorate ion (ClO_3^-), and the perchlorate ion (ClO_4^-) are soluble.
- Most salts of the group I alkali metals (Li^+ , Na^+ , K^+ , Rb^+ , Cs^+) are soluble.
- Most salts of the ammonium ion (NH_4^+) are soluble.
- Most salts of the chloride (Cl^-), bromide (Br^-), and iodide (I^-) ions are soluble except those of Ag^+ , Pb^{+2} , Hg_2^{+2} , and Cu^+ .
- Most salts of the sulfate ion (SO_4^{2-}) are soluble except those of Ca^{+2} , Ba^{+2} , Sr^{+2} , Pb^{+2} , and Hg^{+2} .
- Most salts of the sulfide ion (S^{2-}) are insoluble except those of the alkali metal ions and the ammonium ion.
- Most salts of the hydroxide ion (OH^-) are insoluble except those of the alkali metal ions, the ammonium ion, Ba^{+2} ion, Sr^{+2} ion, and Ca^{+2} ion.

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Exam 3: Chapters 7-9

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Be sure to circle your final answers

$$N_A = 6.022142 \times 10^{23}/\text{mol}$$

$$q = mC\Delta T$$

$$E = h\nu$$

$$c = \nu\lambda$$

$$c = 3.0 \times 10^8 \text{ m/s}$$

$$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$$

Metric prefixes

atto	a	10^{-18}
femto	f	10^{-15}
pico	p	10^{-12}
nano	n	10^{-9}
micro	μ	10^{-6}
milli	m	10^{-3}
kilo	k	10^3
mega	M	10^6
giga	G	10^9
tera	T	10^{12}

Specific heat capacities (J/g \cdot °C)

carbon	0.711
copper	0.387
ethyl alcohol	2.45
gold	0.129
granite	0.803
iron	0.500
lead	0.128
olive oil	2.0
silver	0.235
liquid water	4.18

Standard enthalpies of formation (kJ/mol)

AgBr (s)	-100.4
AgCl (s)	-127.0
Al ₂ O ₃ (s)	-1667
CO (g)	-110.5
CO ₂ (g)	-393.5
Fe ₂ O ₃ (s)	-822.2
Fe ₃ O ₄ (s)	-1118
H ₂ O (g)	-241.8
H ₂ O (l)	-285.9
H ₂ O ₂ (l)	-187.6
HNO ₃ (l)	-173.2

Quantum numbers

$$n = 1, 2, 3, \dots$$

$$l = 0, 1, 2, \dots, n-1$$

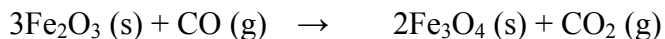
$$m_l = -l, \dots, 0, \dots, +l$$

$$m_s = \pm 1/2$$

1. If a 12.5 g sample of copper is heated from 15.0°C to 34.0°C how much energy was added?

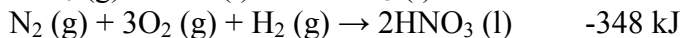
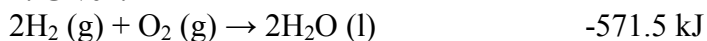
2. Suppose that a 500. g sample of gold, initially at 20.0°C, is heated by adding 15.0 kJ. What temperature will the sample of gold be at after it is heated?

3. What is the heat of reaction for the following process?



Is the reaction endothermic, exothermic, or nonthermic? _____

4. Given:



Find ΔH° for $2\text{N}_2 (\text{g}) + 5\text{O}_2 (\text{g}) \rightarrow 2\text{N}_2\text{O}_5 (\text{g})$

5. What is the frequency of a photon with a wavelength of 285 nm?

6. What is the energy of 1.0 mol of photons with a wavelength of 650 nm in the units of kJ/mol?

7. Explain what is wrong with each of the sets of quantum numbers.

n	l	m_l	m_s	problem
1	1	0	+1/2	_____
2	1	2	-1/2	_____
3	1	0	0	_____

8. a. Write the electron configuration (spdf) for each element:

Cl _____

Ni _____

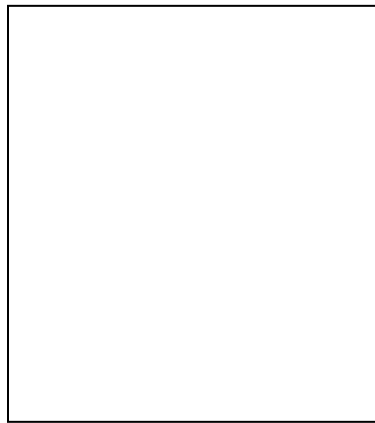
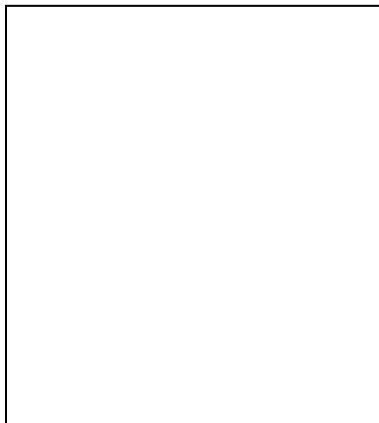
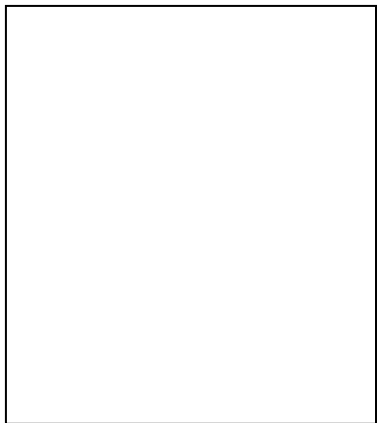
b. How many unpaired electrons are in each of the above elements?

Cl _____

Ni _____

c. How many valence electrons are there in the Chlorine atom? _____

9. Draw the best Lewis structure for each species. Formal charges can be used to determine the best form for each species. However, it is not a requirement that you show the formal charge calculations.





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Exam 4: Chapters 10-12 50 points

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Be sure to circle your final answers

1. Predict the shapes of

H₂O _____

CO₃²⁻ _____

NH₂⁻ _____

SiO₄⁴⁻ _____

the choices are linear, trigonal planar, tetrahedral, trigonal pyramidal, bent, square planar, trigonal bipyramidal, octahedral.

2. Explain why CH₃F is polar but CF₄ is not.

3. Explain the hybridization of the carbon atom for each of the molecules.

CH₃Cl _____

H₂**C**=CH₂ (answer for the carbon in **BOLD**)

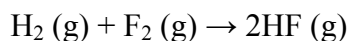
N≡CH _____

4. How many pi bonds are in each of the molecules? How many sigma bonds?

5. A 2.50 liter container at 25°C is filled with 0.500 mol of helium. What is the pressure of the helium in the container?

6. A sample of helium at a pressure of 400 torr and in a volume of 2.54 L is cooled from 16.5°C to 2.45°C. The volume decreases to 2.15 L. What is the final pressure of the helium?

7. a. How many moles of HF will be produced if 2.15 moles of H₂ reacts with excess F₂?



b. If the system is at STP (0°C and 1 atm) what volume of HF is produced?

8. Draw a graph that shows the velocity distribution of a one mole sample of helium atoms at 100°C . On the same graph show the velocity distribution if the temperature is raised to 500°C . Be sure to label the axes of the graph and clearly indicate which curve represents each temperature.

