This is, in large part, a sample final exam from a colleague of mine.

The Chemistry Data sheet will be identical to the one we had for the MidTerm Exam.

This sample is for orientation only; the actual exam might be substantially different; it probably will have more concept questions, rather than calculation problems.

This is a **closed book exam**.

You may use a non-programmed calculator and the provided Chemistry Data Sheet.

1 a)	Write the chemical formula for aluminum sulfite.
(1 mark)	
1 b)	Write the chemical formula for nitrous acid.
(1 mark)	
1 c)	Write the chemical formula for iron (III) oxide.
(1 mark)	
1 d)	Give the correct name for AuCl ₃ .
(1 mark)	
1 e)	Give the correct name for $K_2Cr_2O_7$.
(1 mark)	
1 f)	Give the correct name for NaHCO ₃
(1 mark)	

Adipic acid contains 49.32% of carbon, 43.84% of oxygen and 6.85% of hydrogen, (all percentages being by mass). A different experiment showed that the molar mass of adipic acid is between 130 and 160 g/mol. Find the empirical and molecular formulas of adipic acid?

(5 marks)

3a) What is the maximum number of electrons in an atom that can have n = 3 and $m_{\ell} = \pm 1$? (4 marks)

3b) Draw the $d_{x^2-v^2}$ orbital. Make sure to label the axes properly.

(4 marks)

4) Using MO theory, draw the MO energy diagram for O_2 labeling all orbitals (you can omit lower MO that cancel out) and rank the following species in terms of stability: O_2 , O_2^- , O_2^+ .

Briefly explain your answer.

(7 marks)

5a) Draw the correct Lewis dot structure for C_3H_4 . To receive full marks, indicate the

number of valence electrons, the number of unshared electrons and formal charges for

each atom. If necessary, draw resonance structures. Indicate the geometries around all central atoms of all structures.

(6 marks)

5b) How would it be possible to distinguish between possible structures in 5a).

(2 marks)

6a) Draw the correct Lewis dot structure for XeO₃F₂. To receive full marks, indicate the number of valence electrons, the number of unshared electrons and formal charges foreach atom.

(5 marks)

6b) What is the name for the geometry of the above structure and do you expect it to be polar or non polar? (3 marks)

7a) Write the electronic configuration for lead. Do not use the abbreviated notation !

(2 marks)

7b) Explain why the second ionization energy of nitrogen is smaller than that of oxygen but the first ionization energy of nitrogen is larger than that of oxygen!

(3 marks)

8) A sample of potassium chlorate, KClO₃, is impure, being mixed with sodium sulfate. When the sample is heated, the KClO₃ decomposes completely to give oxygen gas and potassium chloride, and the sodium sulfate is not changed. 2.38 g of the sample were heated and produced 537 mL of oxygen gas collected over water at 25°C and total pressure of 697 torr.

a. How many moles of oxygen gas were produced?

(5 marks)

b. What was the mass percent of KClO₃ in the sample?

(2 marks)

9) a. List 3 assumptions made in the kinetic molecular theory of ideal gases

(3 marks)

b. The vapor pressure of bromine is larger than that of mercury (both liquids at room temperature).Which liquid has a higher boiling point? Explain briefly.

(3 marks)

10) Identify the main intermolecular forces in the following molecules and rank them in order of strength:

(To avoid confusion, list them in order and clearly indicate the strongest).

Briefly explain your answer.

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CH<sub>3</sub>COH, iodobenzene C<sub>6</sub>H<sub>5</sub>I and NH<sub>4</sub>NO<sub>3</sub>.
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(4 marks)

11) Tungsten has a body-centered cubic crystal structure. Using a metallic radius of 139pm for the W atom, calculate the density of tungsten.

(8 marks)