Chem. 112
Final Exam Practice

Part 4

1) The decomposition of hydrogen iodide follows the equation $2HI\ (g) \rightarrow H_2\ (g) + I_2\ (g)$ and it is second order with a rate constant of 1.6×10^{-3} L/mol sec at 700^{o} C. If the initial concentration of HI in the container is 3.4×10^{-2} M, how many seconds will it take for the concentration to be reduced to 8.0×10^{-4} M?

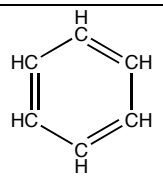
2) Show the nuclear equation for the positron emission of N-14

3) Show the nuclear equation for the alpha emission of Thorium-230

4) Show the equation for the hydrolysis of propyl pentanoate. Draw the full structure of the reactant and the main product. Name the product.

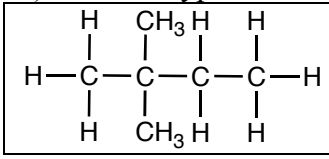
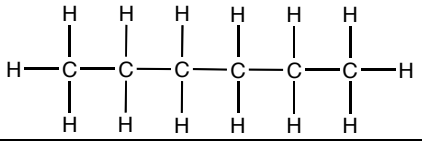
5) Show the addition reaction of bromine to 2-pentene. Draw the full structure of the reactant and the main product. Name the product.

6) Complete the following table

Name	**Structure**	**Class of Compound**
		

3-methyloctane		

7) State the type of isomers

8) For the following mechanism:

Br_2 (g) ←→ 2 Br (g)
Br (g) + H_2 (g) → HBr (g) + H (g)
H (g) + Br_2 (g) → HBr (g) + Br (g)

What is the overall reaction?

What is the rate law? (no intermediates in rate law)_____

What are the intermediate(s) if none write none_____

Draw and correctly label the reaction diagram:

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Part 3

9) For the following complex ion draw the valence bond theory diagram and the crystal field theory diagram. Label the diagrams as shown in lecture. Label all orbitals.

$[Cr(CN)_6]^{4-}$

a. Valence bond diagram:

b. Crystal Field diagram

c. Is the species high spin or low spin	
d. Is the species paramagnetic or diamagnetic	
e. State the hybridization	
f. State the shape	
g. Which is greater crystal field splitting energy or pairing energy?	
h. Is(are) the ligand(s) weak field or strong field	
i. Coordination number	
j. Name the species	

10) A complex ion produces a splitting energy of 195 KJ/mol.

What color is absorbed?_____

What color is seen?_____

Is this a relatively large or small splitting energy?_____

Can you tell if the compound is high spin or low spin?_____

Is this likely a strong field ligand or weak field ligand?_____

What causes this split?

11) $[Cr(H_2O)_6]^{2+}$ is violet. Another chromium complex is green. Would that compound most likely be $[Cr(CN)_6]^{4-}$ or $[Cr(Cl)_6]^{4-}$

Answer_____

Give a three sentence explanation:

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Part 2

12) State the 7 types of hybridization and the shape that corresponds
State the kind of hybridization for the following shapes

Shape	**Hybridization**

13) Draw the VSEPR structures labeling angles correctly. Correctly show wedges and hash marks. VSEPR structure must be correct to receive credit. State the molecular geometry.

Formula	VSEPR Drawing	Molecular geometry
$TeBr_6$		
GeF_4^{2-}		

14. For the following molecules or ions draw the box diagrams as shown in class. Label all orbitals showing relative energy of each. State the type of hybridization. Draw the contour diagram for each labeling correctly all angles and orbitals. Contour diagram must be drawn correctly to receive credit. Draw it large. Show all electrons. State the **shape** of the molecule or ion.

A. $XeBr_2I_2$

Box Diagram

Contour Diagram

15) For the following molecules or ions draw the box diagrams as shown in class. Label all orbitals showing relative energy of each. State the type of hybridization. Draw the contour diagram for each labeling correctly all angles and orbitals. Contour diagram must be drawn correctly to receive credit. Draw it large. Show all electrons. State the **shape** of the molecule or ion.

B. C_2Br_4
Box Diagram

Contour Diagram

Part 1

16) List a possible set of four quantum numbers (n,ℓ,$m\ell$,ms) in order, for the highest energy electron in iron, Fe . Refer to the periodic table as necessary. **Enter four numbers separated by commas (e.g., 3,0,-1,1/2). Also give the electron configuration for Fe ($1S^1$ etc.)**

Quantum #s:

Electron configuration:

17. Draw the orbital diagram (boxes and arrows) that represents the ground state of P

18. For the following reaction calculate Gibbs free energy and state if the reaction is spontaneous at 25 ^{0} C.

$2Ca\ (s) + O_2\ (g) \rightarrow CaO\ (s)\ \Delta H_{rxn} = -1269.8\ kJ\ \ \Delta S = -364.6\ J/K$

Answer_____

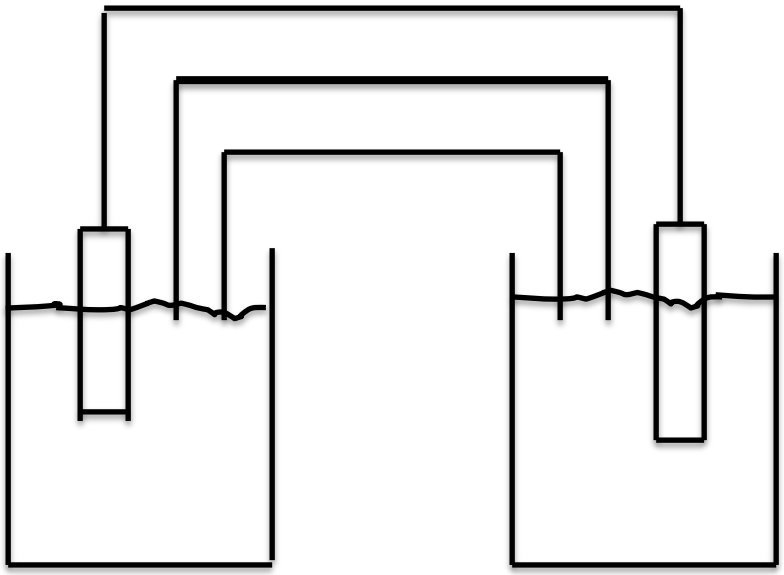
Spontaneous?_____ Reason_____

19. For the following cell reaction at 25^0 C:

$Pb^0 \mid Pb^{2+}$ 0.40M $\mid\mid Au^{3+} \mid Au^0$ 0.025M

Label the diagram:

a) Show the location of each species
b) Label all parts of the cell (salt bridge, cathode, anode, + electrode, - electrode etc.)
c) Show the flow of electrons
d) Write the half reaction under each beaker
e) Label oxidation and reduction reactions



f) Calculate E^0 for the cell:

Answer_____

g) Calculate the EMF (E) for this cell under the given conditions

Answer_____

Calculate **Δ** G:

Answer_____
Is this reaction spontaneous_____ Reason:_____

$I^- < Cl^- < F^- < OH^- < H_2O < SCN^- NH_3 <$ en , $NO_2^- < CN^- < CO$

Weaker field----------> Stronger Field

Color	Wavelength
Violet	400-430
blue	430-480
green	480-560
yellow	560-590
orange	590-630
red	630-750

Plank's Constant $=6.626 \times 10^{-34}$ J (sec)