University of Canterbury

End-of-year Examinations 2008

Prescription Number(s):	CHEM 241
Paper Title:	Inorganic Chemistry

Time Allowed: Two hours

Number of pages: Five

Answer **THREE** questions out of FOUR.

TURN OVER

1. Answer (a) and **either** (b) **or** (c).

(a) Zinc is a special case in the first transition series.

(i) What makes zinc chemistry, and hence zinc complexes, different?

(ii) Where is zinc used in biology?

either

(b) Name one zinc-containing metalloprotein in which the zinc has a catalytic role. Discuss, briefly, the role of this protein in a biological system and comment on the significance of the zinc in the function of the protein.

or

(b) Name one zinc-containing metalloprotein in which the role of the zinc is purely structural. Discuss, briefly, the role of this protein in a biological system and comment on the significance of the zinc in the function of the protein.

2. (a) (i) What properties of transition metals make them suitable for use in electron-transfer proteins? Which metals are used and why?

(ii) What kinds of ligands are available to these metals in biological systems?

(iii) How does the variation of these ligands affect the chemistry of the transition-metal ions?

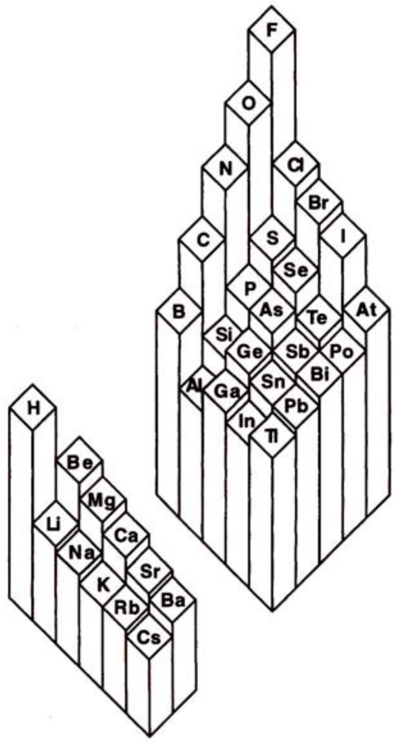
(b) Cytochrome C oxidase is an example of a metalloprotein involved in redox processes. Briefly describe the role of cytochrome C oxidase in a biological system.

(c) In many metalloproteins, amino acid sequences of the metal binding site are **highly conserved** across different species. What does the term "highly conserved' mean and why would this be expected?

3. ”Oxygen is Killing You!”

Comment on this statement. With particular reference to superoxide dismutase discuss ways in which your body is protected against the ravages of oxygen. Include a description, with diagrams, of the essential features of the active site structure of Cu_2Zn_2 superoxide dismutase and the so-called “ping-pong’” mechanism of this enzyme.

4. (a) Describe the concept of **electronegativity** and explain why the electronegativities of the *s*- and *p*-block elements are found to vary periodically as shown within the figure below.



Question 4 continued on following page

Question 4 continued

(b) Approximate bond energies (kJ mol^{-1}) for *s*- and *p*-block element fluorides (heteronuclear single bonds) are given below.

H-F 565							
Li-F 573	Be-F 632		B-F 613	C-F 485	N-F 283	O-F 190	F-F 155
Na-F 477	Mg-F 513		Al-F 583	Si-F 565	P-F 490	S-F 284	Cl-F 142
K-F 490	Ca-F 550		Ga-F 469	Ge-F 452	As-F 406	Se-F 285	Br-F 187
Rb-F 490	Sr-F 553		In-F 444	Sn-F 414	Sb-F 402	Te-F 329	I-F 231
Cs-F 502	Ba-F 578		Tl-F 439	Pb-F 331	Bi-F 297	Po-F -	At-F -

Where appropriate, make reference to the table when addressing the following questions.

(i) Why are heteronuclear bonds generally stronger than homonuclear ones?

(ii) Why are the bond energies for the *s*-block so high?

(iii) The bond energies of the Group 13 fluorides show a general *decrease* as the group is descended. Is this consistent with expectations on electronegativity grounds?

(iv) Why is the N-F bond *much weaker* than the P-F bond?

(v) How can you account for marked variation in element-F bond energy on moving across the periodic table?

END OF PAPER