Statistics: High score, average, and low score will be posted on the course web site after exam grading is complete.

Some questions have more than one answer, even though only one answer may be listed here.

To see the projected course grade cutoffs, consult the grading scale on the Chemistry 14C course web page.

1. (a) Hydrogen atoms: 26
   (b) sp³ carbon atoms that are also stereocenters: 6
   (c) sp² carbon atoms: 7
   (d) Atoms with p orbitals: 10
   (e) Pi electrons: 10
   (f) Total number of stereoisomers (including the structure shown): $2^6 = 64$ No meso compounds in this case.
   (g) Number of enantiomers of the structure shown: 1 A chiral compound always has just one enantiomer.
   (h) Number of diastereomers of the structure shown: 62 64 - the original compound and its enantiomer.
   (i) Number of diastereomers of the structure shown that are also meso compounds: None

2. Alkene, ketone, and alcohol.

3. Absolute configuration = R. Priorities: where 4 = highest priority and 1 = lowest priority.

4. 

5. 11 Coplanar atoms are circled:

6. Prednisone is not aromatic because it lacks a closed loop of p orbitals.
7. Configurational isomers, stereoisomers, and diastereomers. Prednisone and molecule A differ only by the absolute configuration at one stereocenter, the alcohol on the cyclopentane ring.

8. (a) Chiral. Molecule A is not superposable on its mirror image.

(b) Optically active. All chiral molecules are optically active.

(c) Cannot determine from the information given. The direction of rotation of plane-polarized light cannot be determined from just the molecular structure. The rotation must be determined by laboratory measurement, or by knowing the rotation of the corresponding enantiomer.

9. The most likely structure for the prednisone analog produced by carbonyl reduction is molecule C because this molecule retains conjugation, whereas molecule B does not.

10. 

11. Beyond contributor D, the three best contributors are:

Any other contributors violate a greater number of resonance contributor preference rules, and are therefore less significant (and earned less credit).

12. The most significant contributor is D. Regardless of what other contributors you drew contributor D is most significant. All contributors other than D violate at least one resonance contributor preference rule.

13. The one reason why both contributors that I did not circle in question 12 are not the most significant is because these contributors have avoidable formal charges.

14. 

15. O (EN = 3.5) > N (EN = 3.0) > C (EN 2.5) > H (EN 2.1)

16. (Number of conjugated atoms in prednisone oxime) - (number of conjugated atoms in prednisone) = 7 - 6 = 1

17. β-D-glucopyranose

18. Aldohexose

19. Molecule G has 2,000 anomeric carbons and one hemiacetal. Each monosaccharide has exactly one anomic carbon. Only the monosaccharide at the end of the chain has a hemiacetal.

20. Cellulose
21. Molecule G is not easily digestible by humans because the anomeric carbon of the acetal joining adjacent monosaccharides has a $\beta$ configuration.

22. (a) This molecule is not aromatic because it has eight pi electrons and therefore violates Hückel's Rule. Benzocyclobutadiene is anti-aromatic.

(b) This molecule is not aromatic because it lacks a closed loop of $p$ orbitals. The $CH_2$ group next to the carbonyl does not have a $p$ orbital.

(c) This molecule is aromatic. The three tert-butyl groups do cause significant strain, but because three points always define a plane (i.e., the three ring atoms must always be coplanar), the strain cannot force the ring into a conformation in which aromaticity is lost. In this case the tert-butyl groups cause steric strain and angle strain, but not torsional strain.