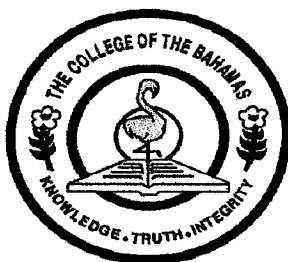


THE COLLEGE OF THE BAHAMAS



EXAMINATION

SEMESTER 04-2005

FACULTY OF PURE AND APPLIED SCIENCES
SCHOOL OF SCIENCES AND TECHNOLOGY

- NASSAU
 FREEPORT
 EXUMA
 ELEUTHERA

DATE AND TIME OF EXAMINATION: Monday, December 5, 2005 at 7:00 p.m.
DURATION: 3 HOURS

COURSE NUMBER: Chemistry 230

COURSE TITLE: Organic Chemistry I

STUDENT NAME:

STUDENT NUMBER:

LECTURER'S NAME: Dr. D. Davis

INSTRUCTIONS TO CANDIDATES:

This examination paper consists of 17 questions on 9 pages (excluding this instruction page). Answer ALL questions in the spaces provided on the examination paper.

Only handheld calculators are allowed during this examination. The use of any other electronic device, e.g., cellular phone or PDA, is strictly prohibited for the duration of this examination.

PERIODIC TABLE OF THE ELEMENTS

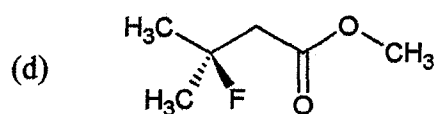
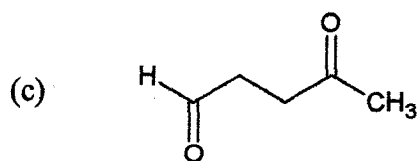
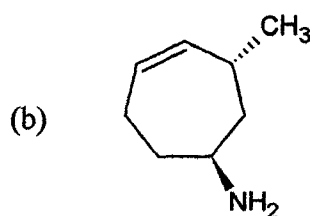
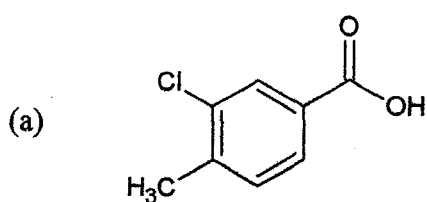
I	II										III	IV	V	VI	VII	0		
1 H 1·0																	2 He 4·0	
3 Li 6·9	4 Be 9·0											5 B 10·8	6 C 12·0	7 N 14·0	8 O 16·0	9 F 19·0	10 Ne 20·2	
11 Na 23·0	12 Mg 24·3											13 Al 27·0	14 Si 28·1	15 P 31·0	16 S 32·1	17 Cl 35·5	18 Ar 39·9	
19 K 39·1	20 Ca 40·1	21 Sc scandium 45·0	22 Ti titanium 47·9	23 V vanadium 50·9	24 Cr chromium 52·0	25 Mn manganese 54·9	26 Fe iron 55·8	27 Co cobalt 58·9	28 Ni nickel 58·7	29 Cu copper 63·5	30 Zn zinc 65·4	31 Ga gallium 69·7	32 Ge germanium 72·6	33 As arsenic 74·9	34 Se selenium 79·0	35 Br bromine 79·9	36 Kr krypton 83·8	
37 Rb 85·5	38 Sr 87·6	39 Y yttrium 88·9	40 Zr zirconium 91·2	41 Nb niobium 92·9	42 Mo molybdenum 95·9	43 Tc technetium 98·9	44 Ru ruthenium 101·1	45 Rh rhodium 102·9	46 Pd palladium 106·4	47 Ag silver 107·9	48 Cd cadmium 112·4	49 In indium 114·8	50 Sn tin 118·7	51 Sb antimony 121·8	52 Te tellurium 127·6	53 I iodine 126·9	54 Xe xenon 131·3	
55 Cs cesium 132·9	56 Ba barium 137·3	57 La lanthanum 138·9	72 Hf hafnium 178·5	73 Ta tantalum 180·9	74 W tungsten 183·85	75 Re rhenium 186·2	76 Os osmium 190·2	77 Ir iridium 192·2	78 Pt platinum 195·1	79 Au gold 197·0	80 Hg mercury 200·6	81 Tl thallium 204·4	82 Pb lead 207·2	83 Bi bismuth 209·0	84 Po polonium	85 At astatine	86 Rn radon	
87 Fr francium	88 Ra radium	89 Ac actinium																
	58 Ce cerium	59 Pr praseodymium	60 Nd neodymium	61 Pm promethium	62 Sm samarium	63 Eu europium	64 Gd gadolinium	65 Tb terbium	66 Dy dysprosium	67 Ho holmium	68 Er erbium	69 Tm thulium	70 Yb ytterbium	71 Lu lutetium				
	90 Th thorium	91 Pa protoactinium	92 U uranium	93 Np neptunium	94 Pu plutonium	95 Am americium	96 Cm curium	97 Bk berkelium	98 Cf californium	99 Es einsteinium	100 Fm fermium	101 Md mendelevium	102 No nobelium	103 Lr lawrencium				

1. Draw the complete Lewis structure for the following molecules. Remember to show all non-bonding electrons.

(a) water (b) methanoic acid (c) nitromethane (d) O₃ (non-cyclic molecule)

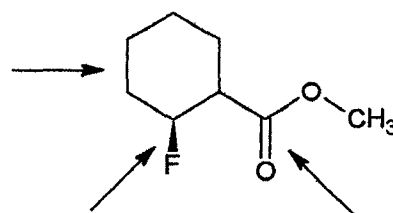
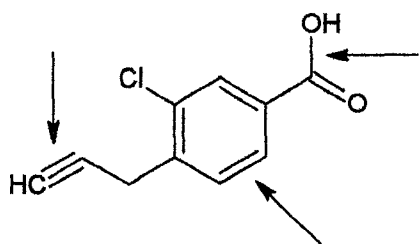
[4 marks]

2. Give systemic names including stereochemical designations (*R*, *S*, *cis* or *trans*) when required for the following molecules:

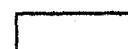


[4 marks]

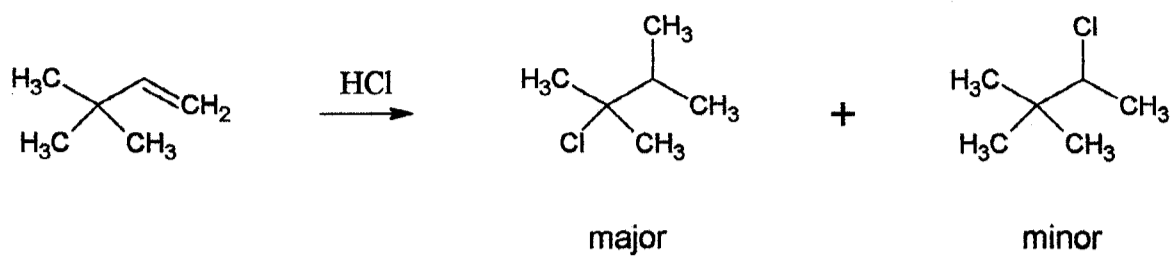
3. Clearly indicate the orbitals AND the type of bonding involved in the formation of the highlighted bonds in the following molecules.



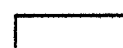
[5 marks]



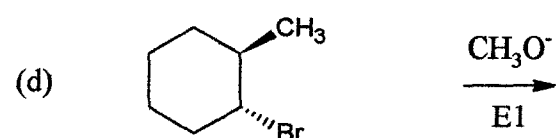
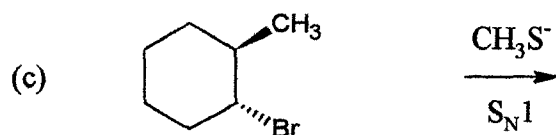
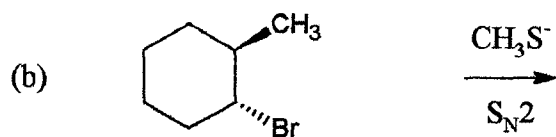
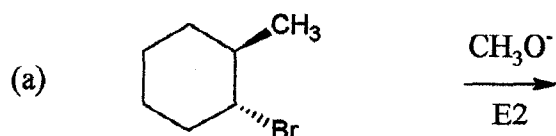
4. Draw a step by step curved arrow mechanism that accounts for the major and minor product shown in reaction below.



[5 marks]

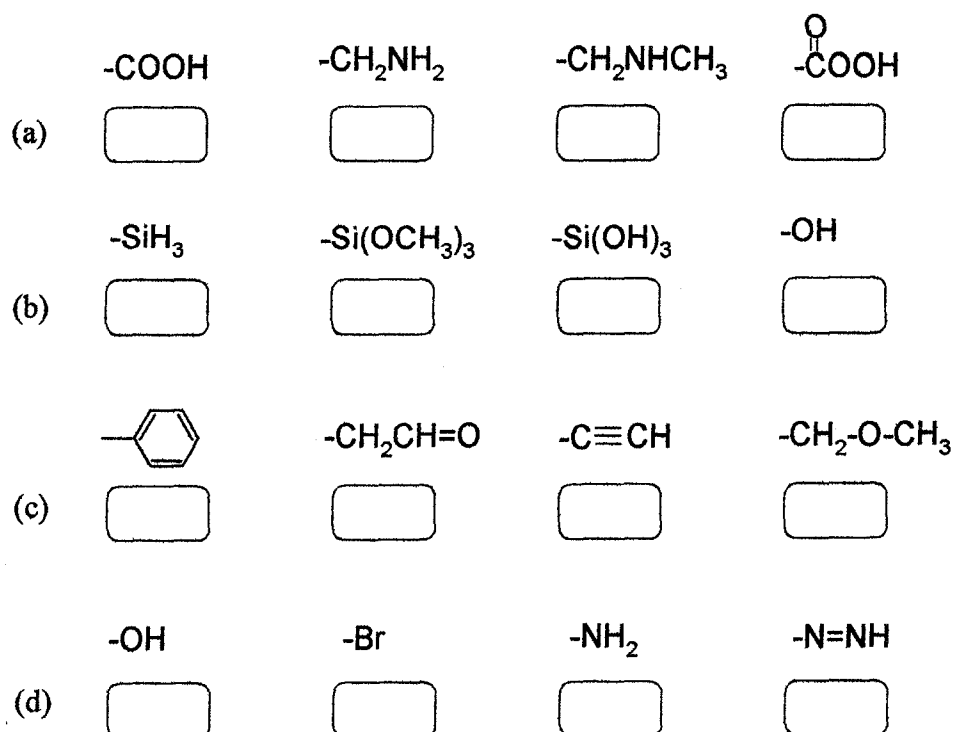


5. Draw the structure of the major product(s) arising from each of the following reactions. Indicate stereochemistry where applicable.

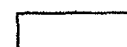


[5 marks]

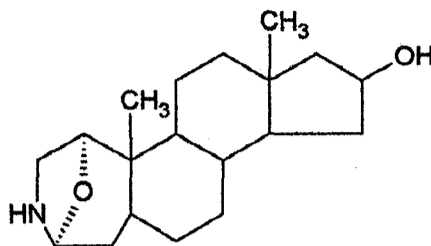
6. Assign priority numbers to the following groups. Let the number 4 represent the group of lowest priority and the number 1 represent the group of highest priority.



[4 marks]



7. (a) Mark each stereocenter (chirality center) in the following molecule with an asterisk. Ensure that your asterisks are not ambiguously placed. You will lose 0.25 marks for each incorrectly labeled carbon.



- (b) What is the maximum theoretical number of stereoisomers for this molecule?

[5 marks]

8. Draw the chemical structure showing stereochemical designations (*R*, *S*, *cis* or *trans*) where required for the following:

(a) *cis*-1,5,7,7-tetrachloro-3-octene

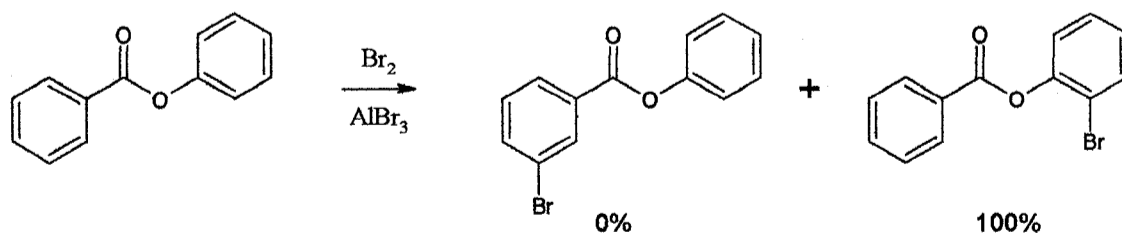
(b) (4*R*,5*R*)-4-hexyl-5-nitrocyclohexene

(c) 2-(1-hydroxypropyl)benzoic acid

(d) (3*R*,4*S*)-3-floro-4-aminopentanal

[4 marks]

9. A student, who obviously did not pass Chem 230, attempted to prepare 2-bromophenylbenzoate by reacting phenylbenzoate with bromine in the presence of AlBr_3 . To the student's surprise the only product isolated was phenyl 3-bromobenzoate. Explain why the desired product was not formed.

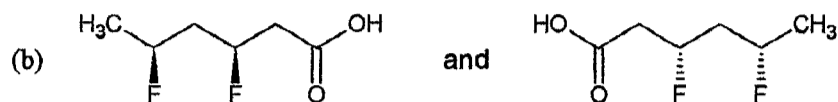


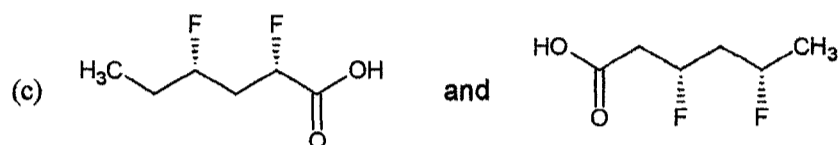
[3 marks]

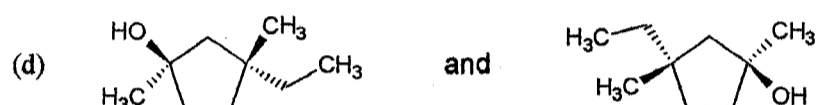


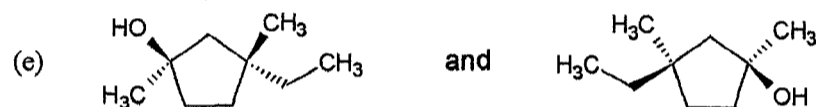
10. Assign one designation of "identical", "enantiomers", "diastereomers" or "constitutional isomers" to each pair of molecules below.

(a) (2*S*,3*S*)-threonine and 2*R*,3*S*-threonine









[5 marks]

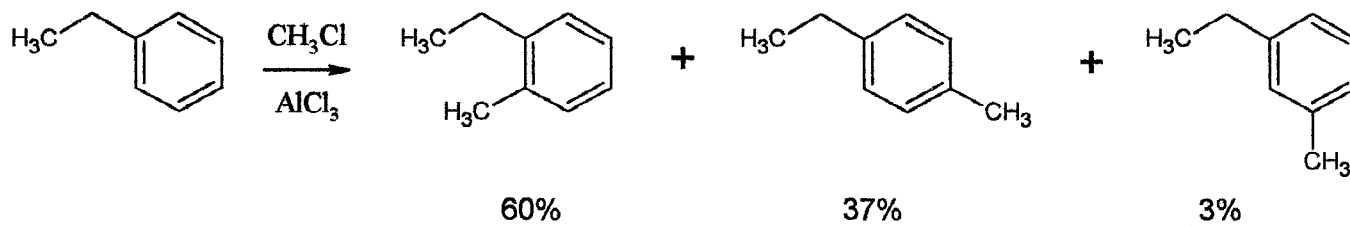
11. The specific rotation of cholesterol is -39.0° . The observed specific rotation of a mixture of cholesterol and its enantiomer was determined to be $+29.4^\circ$.

a. What is the enantiomeric excess (%ee) of the mixture?

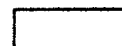
b. What percentage of the mixture is cholesterol?

[4 marks]

12. Explain (using curved arrow mechanisms and a few sentences) the product ratio given below. Remember to account for the formation of the minor products as well as the major product.



[6 marks]



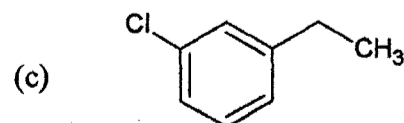
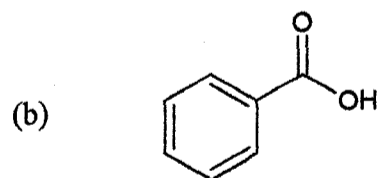
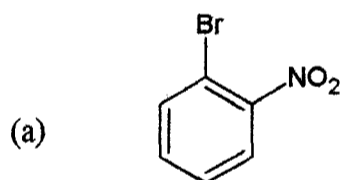
13. A typical carbon-carbon triple bond is 1.20\AA in length while the carbon-carbon double bond is only 1.33\AA long. Explain.

[3 marks]

14. Borane (BH_3) and ammonia (NH_3) have similar chemical structures but different shapes. Predict and explain the shapes of these two molecules.

[3 marks]

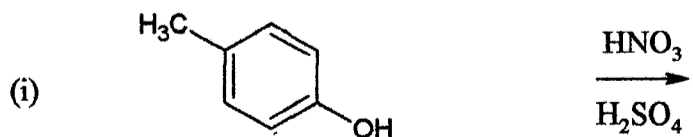
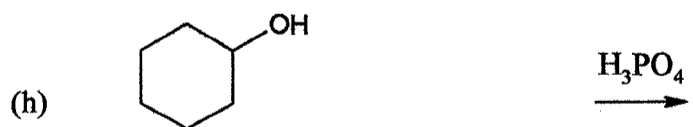
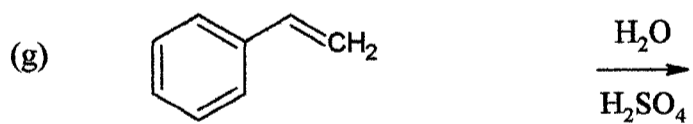
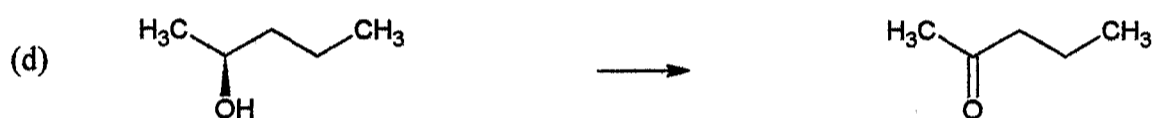
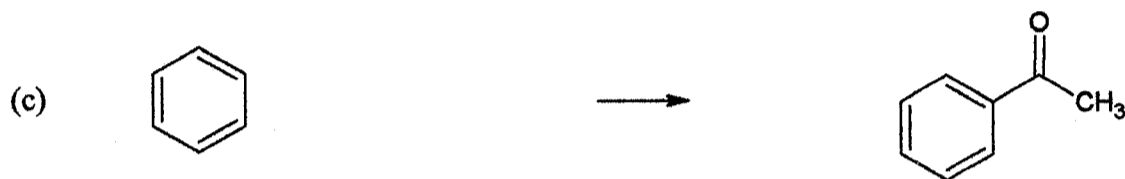
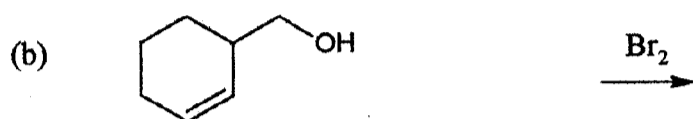
15. Provide a reaction scheme to show the preparation of the following reagents from benzene. Mechanisms are NOT required.



[7 marks]



16. Draw structures, showing stereochemistry when relevant, for the reactant(s)/major product to complete the following reactions. Mechanisms of the reactions and names of the structures are NOT required.



[9 marks]



17. The reaction of HBr with 3-bromocyclohexene yields *trans*-1,2-dibromocyclohexane as the sole product. Draw a curved arrow mechanism to show the formation of *trans*-1,2-dibromocyclohexane from the reaction of HBr with 3-bromocyclohexene.

[4 marks]

***** End of Examination *****

