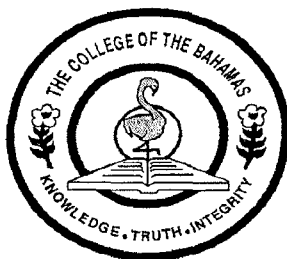


THE COLLEGE OF THE BAHAMAS



EXAMINATION

SEMESTER 04-2002

FACULTY OF PURE AND APPLIED SCIENCES
SCHOOL OF NATURAL SCIENCES AND ENVIRONMENTAL STUDIES

X NASSAU
FREEPORT
EXUMA
ELEUTHERA

DATE AND TIME OF EXAMINATION: Thursday, December 5, 2002 at 7 p.m.
DURATION: 3 HOURS

COURSE NUMBER: CHEM 230

COURSE TITLE: ORGANIC CHEMISTRY

STUDENT NAME:

STUDENT NUMBER:

LECTURER'S NAME:

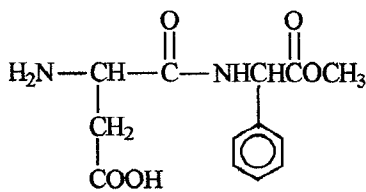
INSTRUCTIONS TO CANDIDATES: This paper has 7 pages and 14 questions. Answer ALL questions in the spaces provided on the examination paper. The use of calculators are allowed during this examination.

PERIODIC TABLE OF THE ELEMENTS

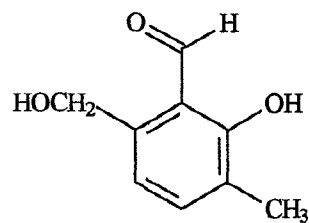
I	II										III	IV	V	VI	VII	0		
1 H 1-0																	2 He 4-0	
3 Li 6-9	4 Be 9-0											5 B 10-8	6 C 12-0	7 N 14-0	8 O 16-0	9 F 19-0	10 Ne 20-2	
11 Na 23-0	12 Mg 24-3											13 Al 27-0	14 Si 28-1	15 P 31-0	16 S 32-1	17 Cl 35-5	18 Ar 39-9	
19 K 39-1	20 Ca 40-1	21 Sc scandium 45-0	22 Ti titanium 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 galium 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 rubidium 85-5	38 Sr strontium 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. Circle and name all of the functional groups in the following molecules. It is not necessary to circle alkane groups.

[5 marks]

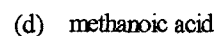
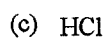
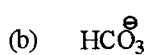
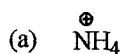


Aspartame or Equal



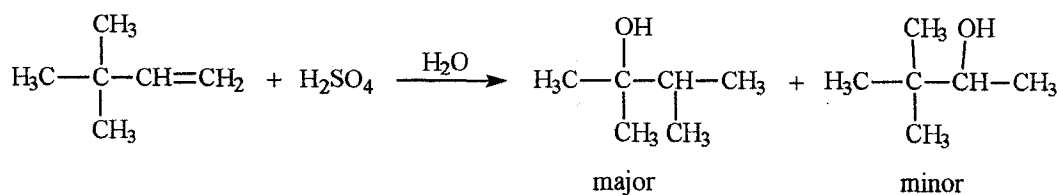
2. Draw the complete Lewis structure for the following molecules showing all non-bonding electrons.

[4 marks]



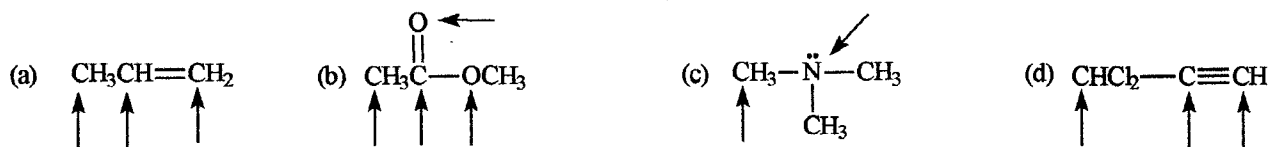
3. Explain (using curved arrow mechanisms) the product ratio given. Remember to account for the formation of the minor product as well as the major product.

[6 marks]



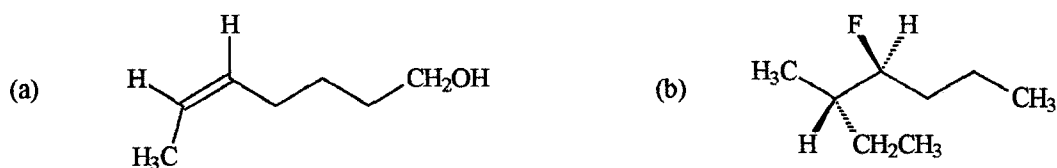
4. Clearly indicate the hybridization of the carbon, oxygen and nitrogen atoms highlighted in the following molecules.

[6 marks]



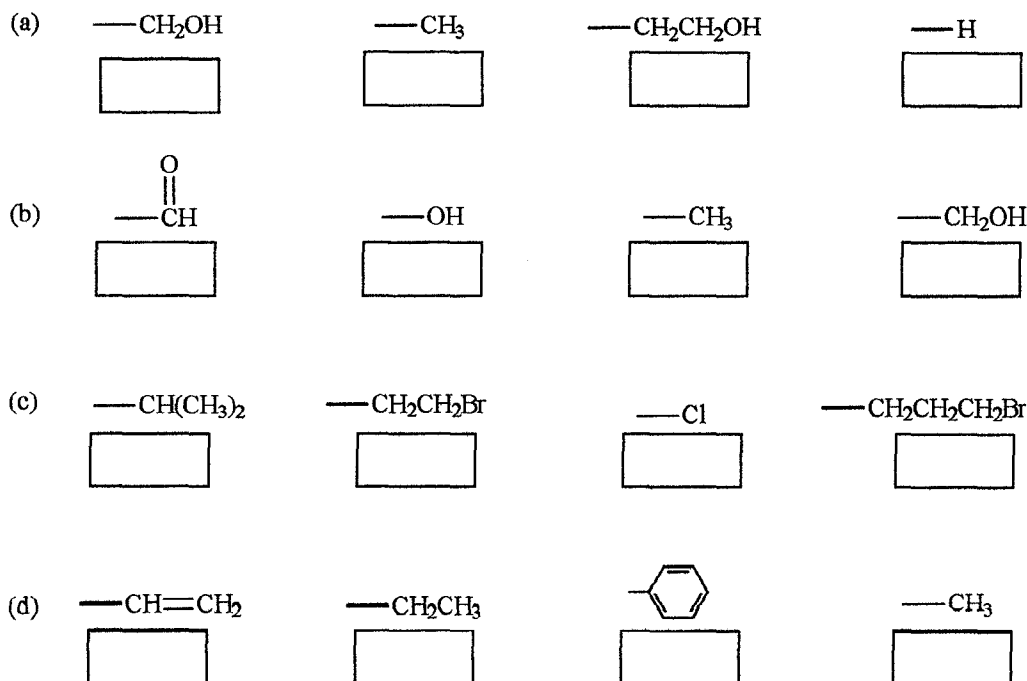
5. Give systematic names including stereochemical designations (*R*, *S*, *cis* or *trans*) when required for the following molecules:

[4 marks]



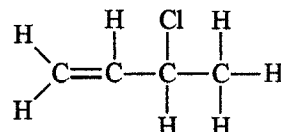
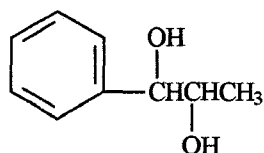
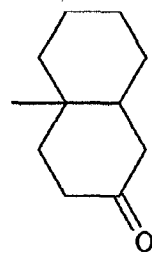
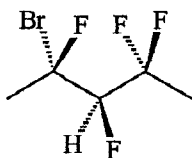
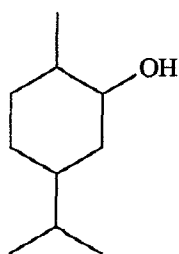
6. Assign priority numbers to the following groups. Let the number 4 represent the group of lowest priority and the number 1 represent the group of highest priority.

[4 marks]



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

[9 marks]



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

[5 marks]

(a) (*3R*)-3-bromopentanamide(b) (*2R,3R*)-2-ethyl-3-fluoroheptanal(c) *cis*-2-octene

(d) 2,4,6-trinitrotoluene

(e) 3,3-dimethylcyclopentene



9. The specific rotation of pure (*R*)-(+)-glyceraldehyde is $+8.7^\circ$. The observed specific rotation of a mixture of (*R*)-glyceraldehyde and (*S*)-glyceraldehyde is $+3.40^\circ$.

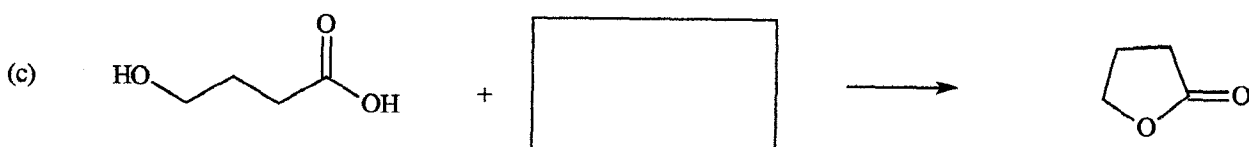
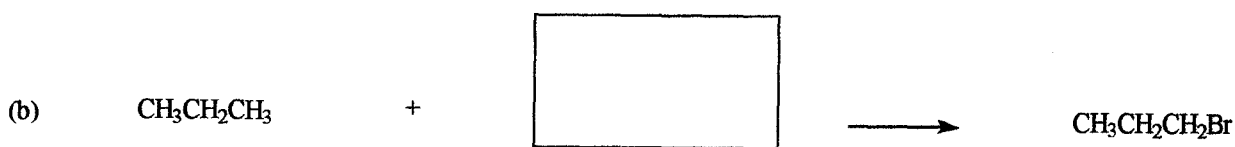
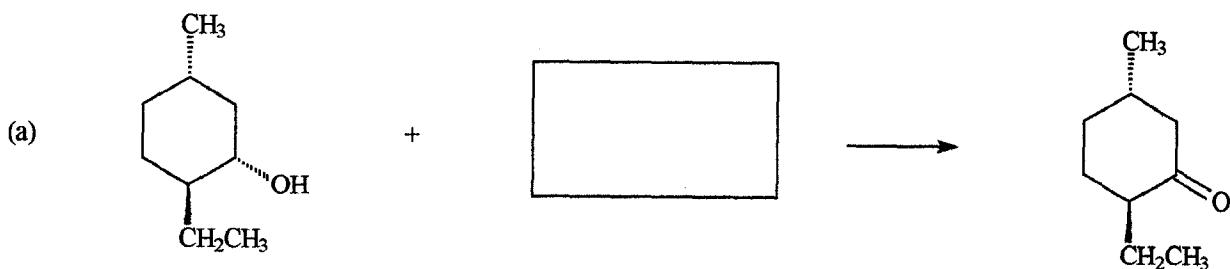
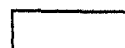
[5 marks]

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

(b) What percent of (*R*)-(+)-glyceraldehyde is present in the mixture?

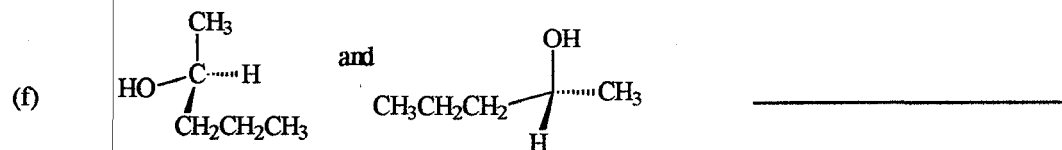
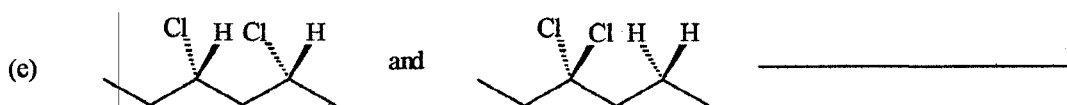
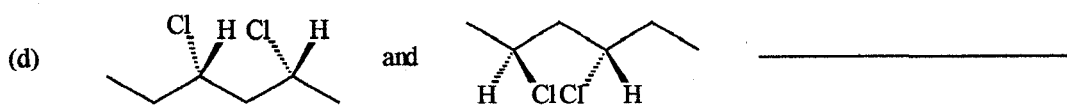
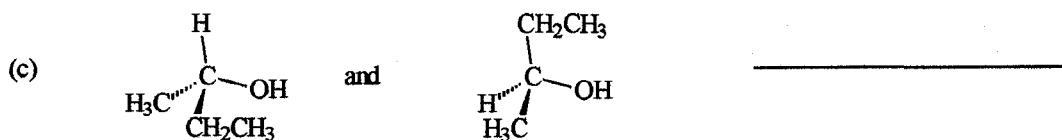
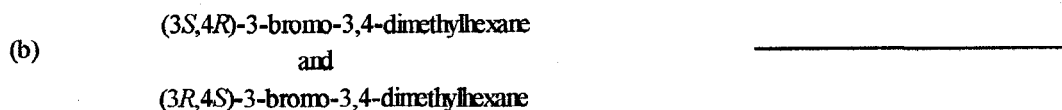
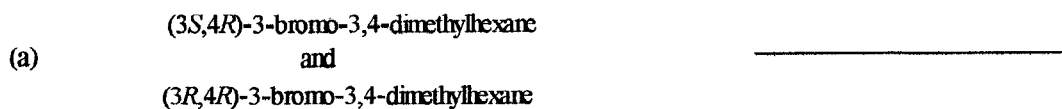
10. Insert all necessary reagents and conditions in the boxes to complete the following transformations. Mechanisms of the reactions and names of the structures are NOT required.

[4 marks]

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

[6 marks]



12. Compound X ($C_8H_{18}O$) gave a negative result, *i.e.*, the solution remained orange-red, when treated with a CrO_3/H_2SO_4 solution. When X reacted with H_3PO_4 product Y was isolated. Y gave a positive test with $KMnO_4$, *i.e.*, the solution changed colour from purple to brown to colourless. Reaction of Y with H_2/Pt gave Z that had two stereogenic carbons. When Y was treated with ozone, 2-butanol was the only product identified. Draw the chemical structures for X, Y and Z. There are 2 possible structures for Y based on the above information, you are only required to give one of the possible structures.

[6 marks]

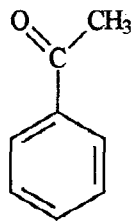
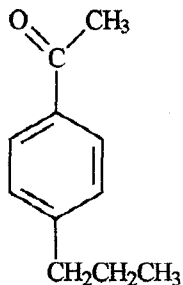
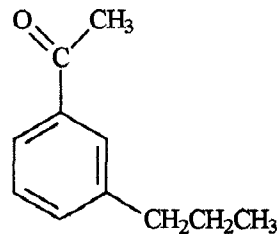
X

Y

Z



13. A chemistry student (who obviously did not take Chemistry 230) attempted to make *p*-propylacetophenone (compound **V**) by reacting acetophenone (compound **U**) with 1-chloropropane under Friedel-Crafts alkylation conditions. The only product isolated was *m*-propylacetophenone (compound **W**).

**U****V****W**

- (a) How can you account for fact that the student did not produce any of the desired *p*-propylacetophenone (**V**) but instead made *m*-propylacetophenone (**W**)? Curved arrow mechanisms combined with a few sentences may be your best approach to providing a complete answer to this question.

[8 marks]

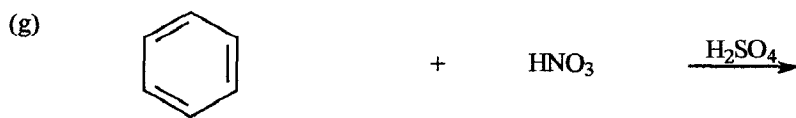
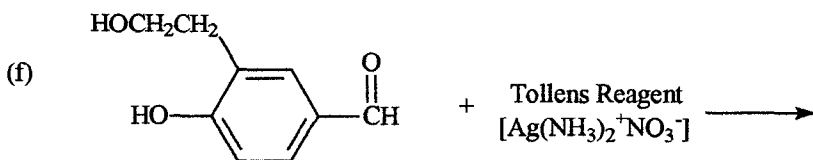
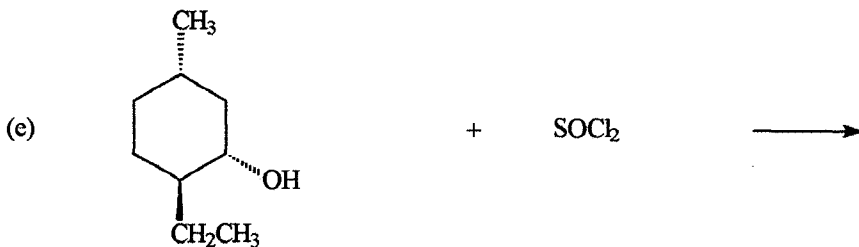
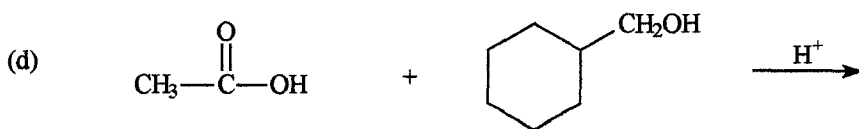
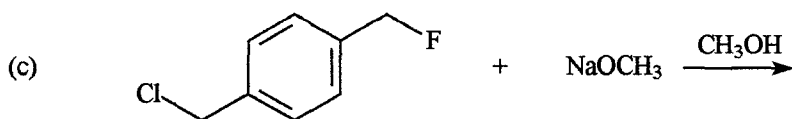
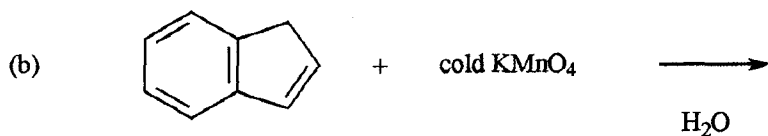
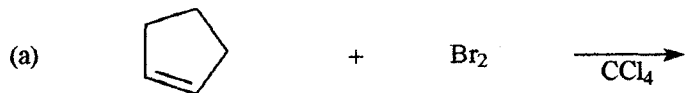
- (b) Using any reagents you desire how can you prepare a sample of *p*-ethylacetophenone (product **U**) starting from benzene? You are NOT required to show mechanisms for this part of the question.

[4 marks]



14. Draw structures, showing stereochemistry when relevant, for the products for the following reactions. Mechanisms of the reactions and names of the structures are NOT required.

[10 marks]



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

