

CHM 138H
INTRODUCTORY ORGANIC CHEMISTRY I

TERM TEST 2

November 19th 2012

TOTAL MARKS: 70

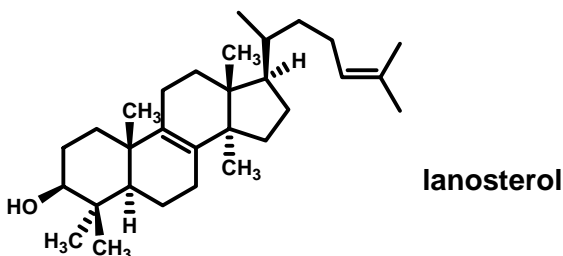
NAME (PRINT): _____ Student #: _____

TUTORIAL GROUP #: **T** _____

- Answer **all** questions in the spaces provided on the accompanying answer sheet. It is attached to the back of the test paper. You may detach the answer sheet. **Nothing written on this question sheet will be marked.**
- PRINT YOUR NAME, STUDENT NUMBER, and TUTORIAL GROUP NUMBER on this test paper and on the answer sheet. *Write all answers in blue or black ink.*
- You may use *unboxed* molecular models. Calculators are not permitted.
- A periodic table is included on page 5 of the test.
- At the end of the test, place the answer sheet inside the test paper and **HAND BOTH IN.**

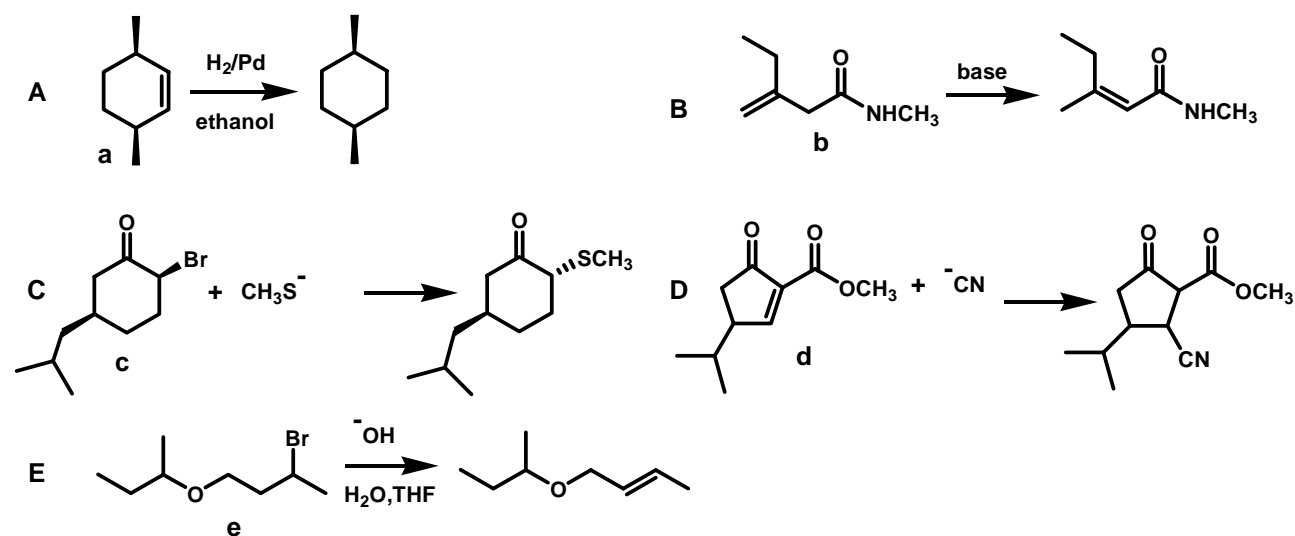
Part I. (20 marks) - Multiple Choice Questions (2 marks each)

Lanosterol is an intermediate in the biosynthesis of cholesterol. Questions 1 and 2 are about this molecule.



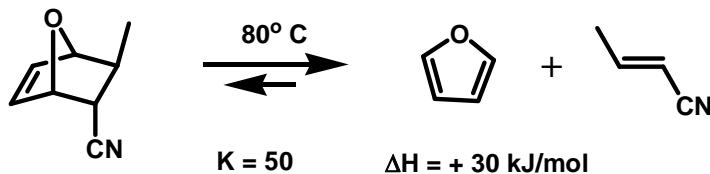
- The degree of unsaturation of lanosterol is
 (a) 5 (b) 6 (c) 7 (d) 8 (e) 9
- The number of chiral centres (stereocentres) in lanosterol is
 (a) 5 (b) 6 (c) 7 (d) 8 (e) 9

Questions 3 – 6 are about the five reactions (A, B, C, D and E) shown below; questions 7 – 9 are about the starting materials (a, b, c, d and e) in these reactions.



- Which of the five reactions shown above is an addition reaction?
 (a) A and B (b) D and E (c) A and D (d) C only (e) A only
- Which of the five reactions shown above is a rearrangement reaction?
 (a) B only (b) E only (c) B and C (d) C only (e) B and E
- Which of the five reactions shown above creates an additional chiral centre (stereocentre) in the product?
 (a) A and B (b) A and D (c) D only (d) C only (e) E only
- Which of the five reactions shown above is an elimination reaction?
 (a) A and B (b) A and D (c) D only (d) C only (e) E only
- Which of the five reactants shown above contains a *sec*-butyl group?
 (a) a (b) b (c) c (d) d (e) e

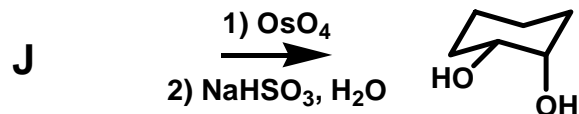
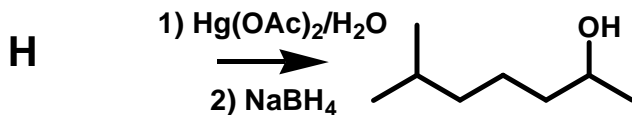
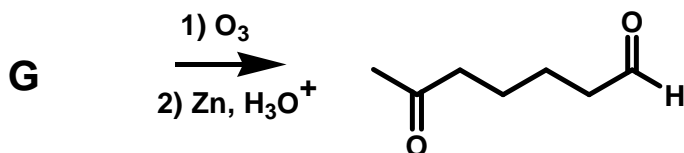
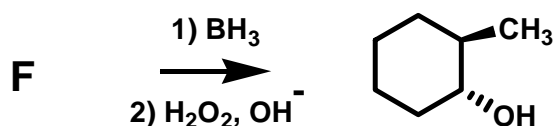
8. Which of the five reactants shown above contains an amide functional group?
 (a) a (b) b (c) c (d) d (e) e
9. Which of the following terms best describes the relationship between the two carbonyl groups in d (reaction D)?
 (a) *trans* (b) *anti* (c) *cis* (d) *gauche* (e) coplanar



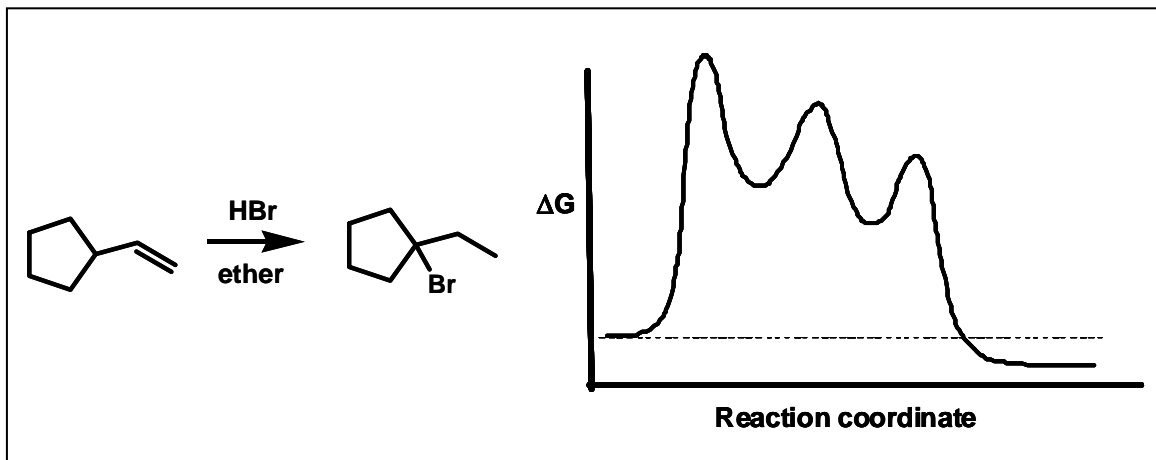
10. Consider the “reverse Diels-Alder” reaction shown above. Based on the provided thermodynamic information, which of the following two terms best describes this reaction?
 (a) exothermic and exergonic
 (b) exothermic and endergonic
 (c) endothermic and exergonic
 (d) endothermic and endergonic
 (e) none of the above

Part II. Short Answer Questions

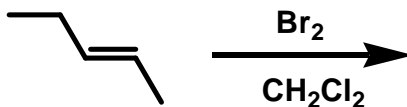
1. (20 marks, 5 marks each) On the answer sheet, draw the **skeletal structure** of the alkene reactants **F – J** that would yield the compounds indicated as the only isolated products. Under the structure of each alkene that you have drawn, write “*regio*” if the reaction as shown is regioselective. Write “*syn*” or “*anti*” if the reaction is stereospecific and exhibits *syn* or *anti* addition respectively. **Note that each of F – J contains one alkene functional group only.**



2. (12 marks) When vinyl cyclopentane reacts with HBr in ether, the only product isolated is 1-bromo-1-ethylcyclopentane. This reaction and the energy diagram corresponding to the mechanism of this reaction are shown below.



- (a). On the energy diagram presented on the answer sheet, label the transition states as “T” and the intermediates as “I”. Circle the letter “T” representing the transition state for the rate limiting step. Indicate the change in free energy for the overall reaction, and also indicate the activation energy for the rate limiting step.
- (b). In the boxes on the answer sheet, draw **skeletal structures** for the intermediates formed in the reaction (**note that there may be more boxes than intermediates**). Label the structures “I1” for the first intermediate, “I2” for the second intermediate etc.
3. (18 marks) (a). In box A on the answer sheet, complete the template to draw a **stereoisomer** of the product formed in the reaction of *trans*-2-pentene with Br₂ using dichloromethane (CH₂Cl₂) as the solvent. **The stereoisomer must have an “R” configuration at carbon 2.** Clearly label the chiral centre (stereocentre) at carbon 3 as either “R” or “S”.
- (b). In box B, redraw the **same** stereoisomer in a Newman projection looking **from** carbon 2 **to** carbon 3.
- (c). In box C, draw the **same** stereoisomer in a Fischer projection.
- (d). In box D, draw a mechanism (using curved arrows to indicate electron flow) to show formation of the bromonium ion intermediate in this reaction.



----- END OF TEST -----

Periodic Table For Term Test #2

1 H 1.00794																	1 H 1.00794	2 He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	6 C 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797	
11 Na 22.989770	12 Mg 24.3050											13 Al 26.981538	14 Si 28.0855	15 P 30.973761	16 S 32.066	17 Cl 35.4527	18 Ar 39.948	
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.904	36 Kr 83.80	
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29	
55 Cs 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.96655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.98038	84 Po (209)	85 At (210)	86 Rn (222)	
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (277)		114 (289) (287)		116 (289)		118 (293)	

58 Ce 140.116	59 Pr 140.90765	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.92534	66 Dy 162.50	67 Ho 164.93032	68 Er 167.26	69 Tm 168.93421	70 Yb 173.04	71 Lu 174.967
90 Th 232.0381	91 Pa 231.03588	92 U 238.0289	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)