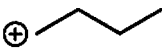
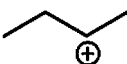
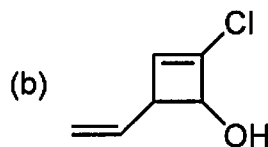
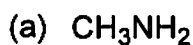


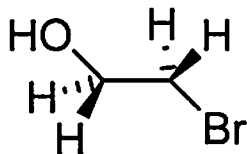
Name _____

*If you do NOT want your graded exam placed in the box outside my office, then please check here _____*1-10 Are True/False (10pts)

- 1) ^{12}C has six protons in its nucleus
- 2) The conjugate base of H_2SO_4 is H^+
- 3)  is more stable than 
- 4) A π bond is formed by the sideways overlap of p orbitals
- 5) Ring strain is comprised of angle strain and torsional strain
- 6) Tin (Sn) has a larger atomic radius than Germanium (Ge)
- 7) A Nucleophile is a two electron donor
- 8) Bond dissociation energy is the energy required to break a covalent bond into ions
- 9) Endothermic reaction steps have late (product like) transition states
- 10) The element Antimony has the symbol Sb
- 11) For each of the molecules below, indicate the number of:
(i) lone pairs of electrons
(ii) sp^2 hybridized atoms. (2+2pts)



12) i) Draw the following molecule using a Newman projection. (2pts)

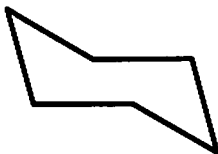


ii) The above conformation is called ANTI. Name one other higher energy conformation that can be achieved through rotation of the C-C bond. (1pt)

13) Using “fish hook” arrows (which represent the movement of ONE electron), draw the *mechanism* for this free radical halogenation reaction. (3pts)

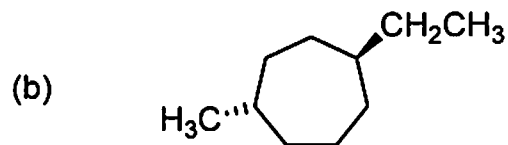
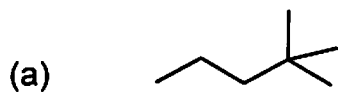


14) (3pts) On this cyclohexane:



- draw in (and label) any one of the *axial* C-H bonds.
- draw in (and label) any one of the *equatorial* C-H bonds.
- What name is given to this conformation of the ring?

15) Name the following compounds in IUPAC form. (3+4pts)

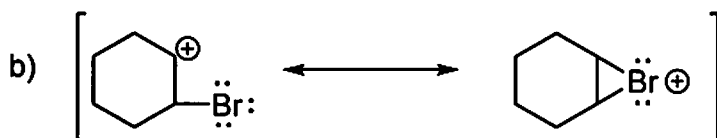


16) Draw 1,1-dimethylcyclopentane using a line angle formula (stick figure). (3pts)

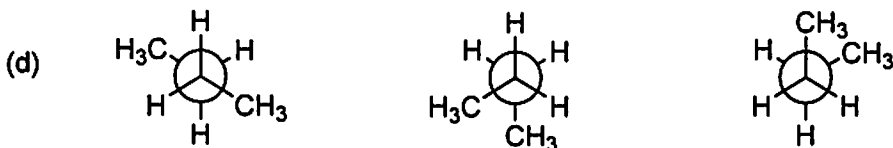
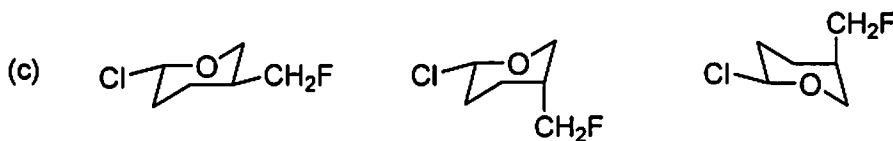
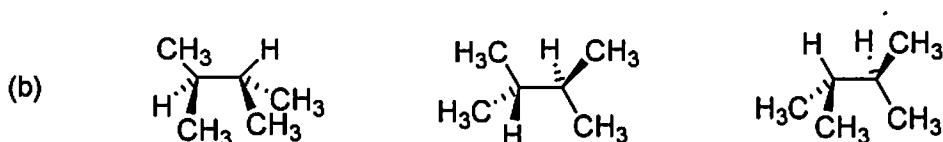
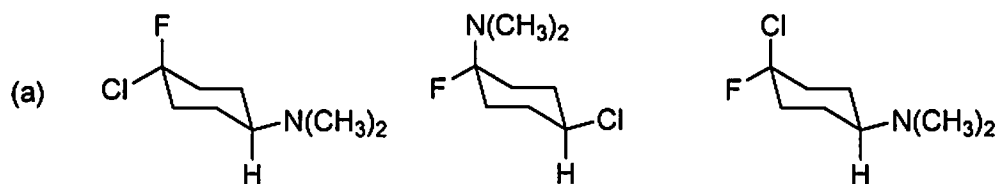
17) (1+1+4pts) i) Who invented *lewis structures* as a way to represent bonding between atoms of a molecule?

ii) Why (or when) do we use *resonance structures*?

iii) For the below resonance structures, draw the electron movement (i.e. curly arrows) that converts the left hand side structure into the other.



18) Circle the lowest energy member of each threesome. (4pts)

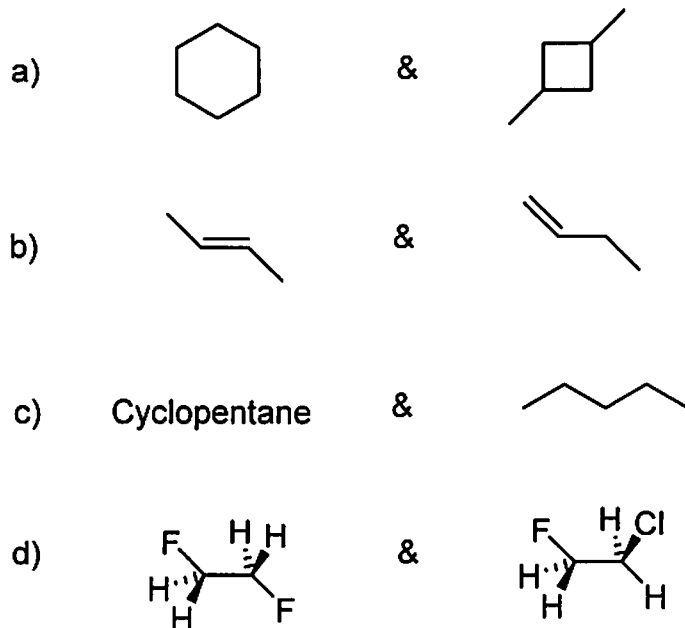


19) (1+1+1pts) a) What is meant by the term *thermodynamics*?

b) State one parameter that influences (or controls) the rate of a chemical reaction.

c) From an energy level (reaction profile) diagram of a multistep process, how can you identify the *rate determining step*?

20) Label each pair of structures as one of *structural isomers*, *stereoisomers*, *conformers*, or *not isomers*. (1+1+1+1pts)



**** Up to two BONUS POINTS****

Draw the two different products resulting from the monobromination of 1,1,3,3-tetramethylcyclobutane.

hydrogen 1 H 1.0079	beryllium 4 Be 9.0122	scandium 21 Sc 44.956	yttrium 39 Y 88.906	lanthanum 57 La 138.91	actinium 89 Ac 227.04	helium 2 He 4.0026	neon 10 Ne 20.180
lithium 3 Li 6.941	sodium 11 Na 22.990	titanium 22 Ti 47.867	zirconium 40 Zr 91.224	cerium 58 Ce 140.12	thorium 90 Th 232.04	boron 5 B 10.811	argon 18 Ar 39.948
beryllium 4 Be 9.0122	magnesium 12 Mg 24.305	vanadium 23 V 50.942	niobium 41 Nb 92.906	praseodymium 59 Pr 140.91	protactinium 91 Pa 231.04	carbon 6 C 12.011	krypton 36 Kr 83.80
lithium 3 Li 6.941	calcium 20 Ca 40.078	chromium 24 Cr 51.996	molybdenum 42 Mo 95.94	neodymium 60 Nd 144.24	uranium 92 U 238.03	nitrogen 7 N 14.007	rubidium 87 Rb 85.468
beryllium 4 Be 9.0122	strontium 38 Sr 87.62	manganese 25 Mn 54.938	technetium 43 Tc 98	promethium 61 Pm 144.9	neptunium 93 Np 237	oxygen 8 O 15.999	cesium 55 Cs 132.91
beryllium 4 Be 9.0122	barium 56 Ba 137.33	iron 26 Fe 55.845	ruthenium 44 Ru 101.07	samarium 62 Sm 150.36	plutonium 94 Pu 244	fluorine 9 F 18.998	barium 56 Ba 137.33
beryllium 4 Be 9.0122	radium 88 Ra 226	cobalt 27 Co 58.933	rhodium 45 Rh 102.91	europium 63 Eu 151.96	americium 95 Am 243	neon 10 Ne 20.180	strontium 38 Sr 87.62
beryllium 4 Be 9.0122	radium 88 Ra 226	nickel 28 Ni 58.693	paladium 46 Pd 106.42	gadolinium 64 Gd 157.25	curium 96 Cm 247	helium 2 He 4.0026	calcium 20 Ca 40.078
beryllium 4 Be 9.0122	radium 88 Ra 226	copper 29 Cu 63.546	silver 47 Ag 107.87	terbium 65 Tb 158.93	berkelium 97 Bk 247	lithium 3 Li 6.941	strontium 38 Sr 87.62
beryllium 4 Be 9.0122	radium 88 Ra 226	zinc 30 Zn 65.38	cadmium 48 Cd 112.41	dysprosium 66 Dy 162.50	californium 98 Cf 251	beryllium 4 Be 9.0122	calcium 20 Ca 40.078
beryllium 4 Be 9.0122	radium 88 Ra 226	gallium 31 Ga 69.723	indium 49 In 114.82	holmium 67 Ho 164.93	essenetium 99 Es 257	beryllium 4 Be 9.0122	calcium 20 Ca 40.078
beryllium 4 Be 9.0122	radium 88 Ra 226	germanium 32 Ge 72.61	tin 50 Sn 118.71	erbium 68 Er 167.26	fermium 100 Fm 257	beryllium 4 Be 9.0122	calcium 20 Ca 40.078
beryllium 4 Be 9.0122	radium 88 Ra 226	arsenic 33 As 74.922	antimony 51 Sb 121.76	thulium 69 Tm 168.93	radium 88 Ra 226	beryllium 4 Be 9.0122	calcium 20 Ca 40.078
beryllium 4 Be 9.0122	radium 88 Ra 226	selenium 34 Se 78.96	tellurium 52 Te 127.60	ytterbium 70 Yb 173.04	radium 88 Ra 226	beryllium 4 Be 9.0122	calcium 20 Ca 40.078
beryllium 4 Be 9.0122	radium 88 Ra 226	bromine 35 Br 79.904	iodine 53 I 126.90	radium 88 Ra 226	radium 88 Ra 226	beryllium 4 Be 9.0122	calcium 20 Ca 40.078
beryllium 4 Be 9.0122	radium 88 Ra 226	krypton 36 Kr 83.80	xenon 54 Xe 131.29	radium 88 Ra 226	radium 88 Ra 226	beryllium 4 Be 9.0122	calcium 20 Ca 40.078
beryllium 4 Be 9.0122	radium 88 Ra 226	radon 86 Rn 222	radon 86 Rn 222	radium 88 Ra 226	radium 88 Ra 226	beryllium 4 Be 9.0122	calcium 20 Ca 40.078
beryllium 4 Be 9.0122	radium 88 Ra 226	radon 86 Rn 222	radon 86 Rn 222	radium 88 Ra 226	radium 88 Ra 226	beryllium 4 Be 9.0122	calcium 20 Ca 40.078

* Lanthanide series

** Actinide series


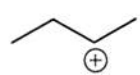
lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm 144.9	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
actinium 89 Ac 227.04	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np 237	plutonium 94 Pu 244	americium 95 Am 243	curium 96 Cm 247	berkelium 97 Bk 247	californium 98 Cf 251	essenetium 99 Es 257	fermium 100 Fm 257	radium 88 Ra 226	radium 88 Ra 226

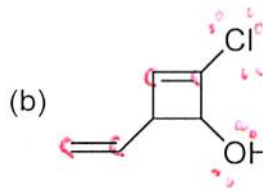
Name

Ψ OF RELIEF

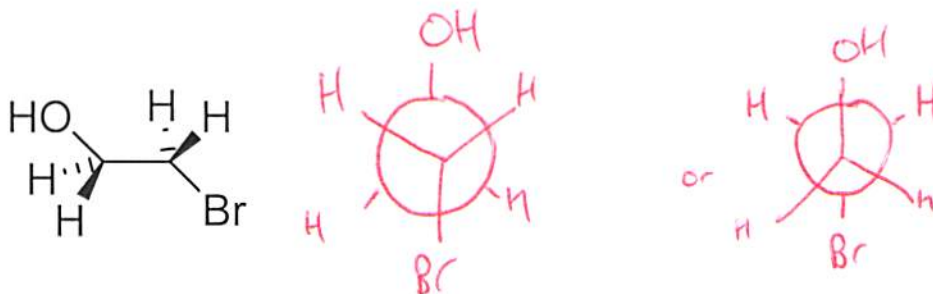
If you do NOT want your graded exam placed in the box outside my office, then please check here _____

1-10 Are True/False (10pts)

- 1) ^{12}C has six protons in its nucleus *True*
- 2) The conjugate base of H_2SO_4 is H^+ *F*
- 3)  is more stable than  *F*
- 4) A π bond is formed by the sideways overlap of p orbitals *True*
- 5) Ring strain is comprised of angle strain and torsional strain *True*
- 6) Tin (Sn) has a larger atomic radius than Germanium (Ge) *True*
- 7) A Nucleophile is a two electron donor *True*
- 8) Bond dissociation energy is the energy required to break a covalent bond into ions *F*
- 9) Endothermic reaction steps have late (product like) transition states *True*
- 10) The element Antimony has the symbol Sb *True*
- 11) For each of the molecules below, indicate the number of:
 (i) lone pairs of electrons
 (ii) sp^2 hybridized atoms. (2+2pts)

*1 lone pair
zero sp^2 atoms**5 lone pairs
4 sp^2 atoms*

12) i) Draw the following molecule using a Newman projection. (2pts)



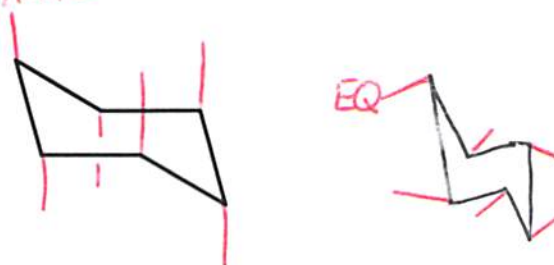
ii) The above conformation is called ANTI. Name one other higher energy conformation that can be achieved through rotation of the C-C bond. (1pt)

staggered, gauche, eclipsed, totally eclipsed, skew.

13) Using “fish hook” arrows (which represent the movement of ONE electron), draw the *mechanism* for this free radical halogenation reaction. (3pts)



14) (3pts) On this cyclohexane: *AXIAL*



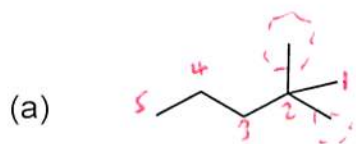
a) draw in (and label) any one of the *axial* C-H bonds.

b) draw in (and label) any one of the *equatorial* C-H bonds.

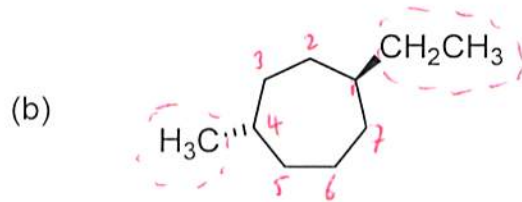
c) What name is given to this conformation of the ring?

CHAIR

15) Name the following compounds in IUPAC form. (3+4pts)

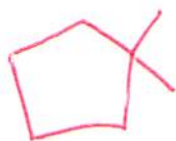


2,2-DIMETHYLPENTANE



TRANS-1-ETHYL-4-METHYL CYCLOHEPTANE

16) Draw 1,1-dimethylcyclopentane using a line angle formula (stick figure). (3pts)



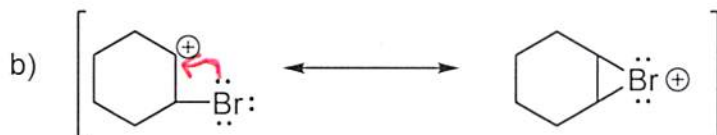
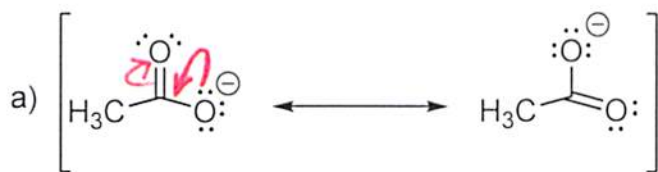
17) (1+1+4pts) i) Who invented *lewis structures* as a way to represent bonding between atoms of a molecule?

Gilbert N. LEWIS

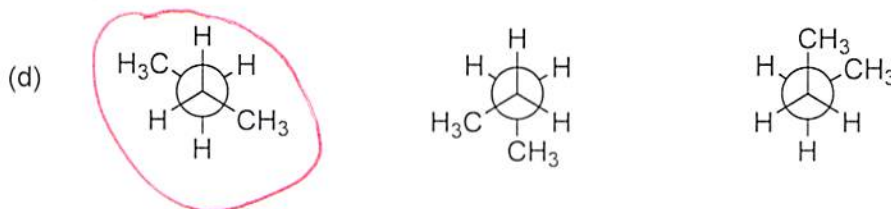
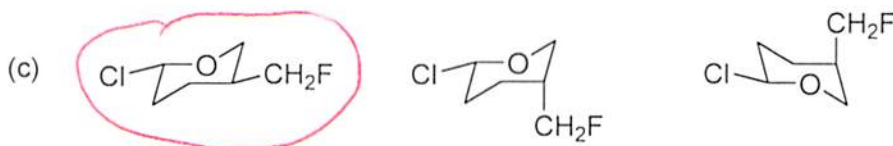
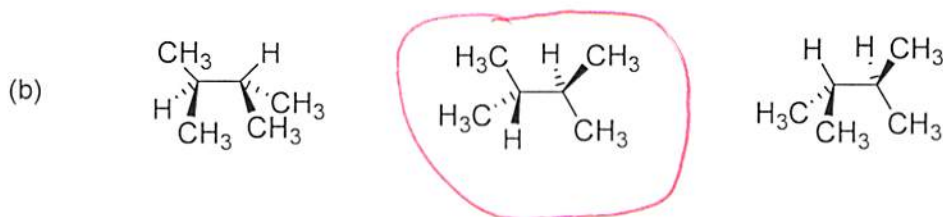
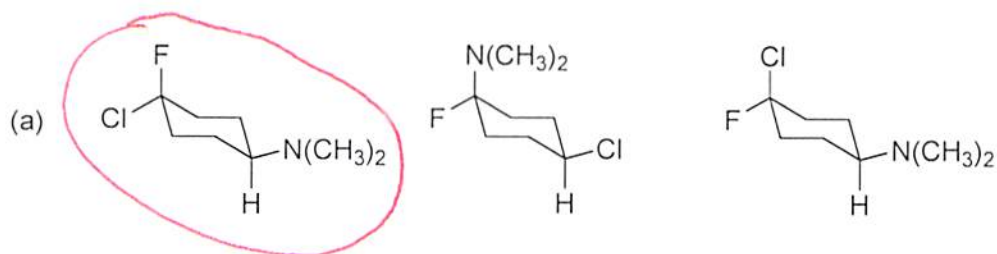
ii) Why (or when) do we use *resonance structures*?

For non-classical (delocalized/hybrid) structures that cannot be accurately described by a single Lewis structure.

iii) For the below resonance structures, draw the electron movement (i.e. curly arrows) that converts the left hand side structure into the other.



18) Circle the lowest energy member of each threesome. (4pts)



19) (1+1+1pts) a) What is meant by the term *thermodynamics*?

The study of Energy changes (during a chemical reaction).

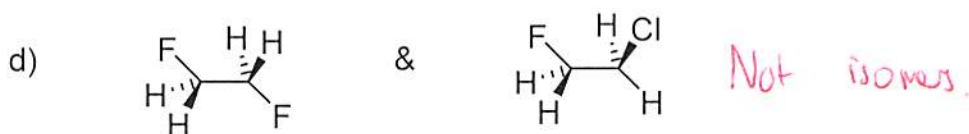
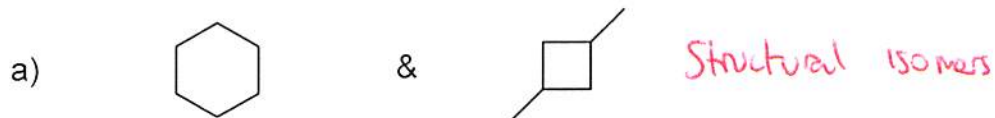
b) State one parameter that influences (or controls) the rate of a chemical reaction.

rate constant, concentrations, temperature, activation energy.

c) From an energy level (reaction profile) diagram of a multistep process, how can you identify the *rate determining step*?

The step with the highest Transition State energy.

20) Label each pair of structures as one of *structural isomers*, *stereoisomers*, *conformers*, or *not isomers*. (1+1+1+1pts)



**** Up to two BONUS POINTS****

Draw the two different products resulting from the monobromination of 1,1,3,3-tetramethylcyclobutane.

