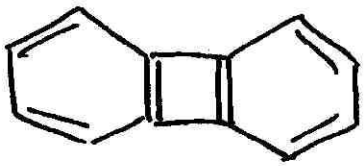
Problem Set # 10

1. Draw an MO diagram for the molecule:

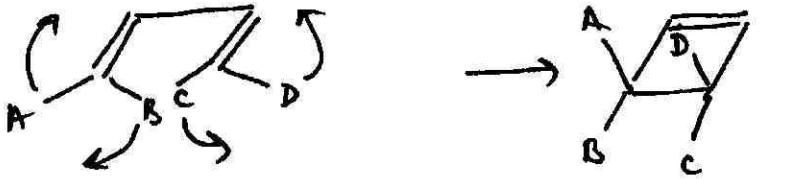


Where would EAS occur on this molecule?

2. Draw a Walsh-diagram for the reaction

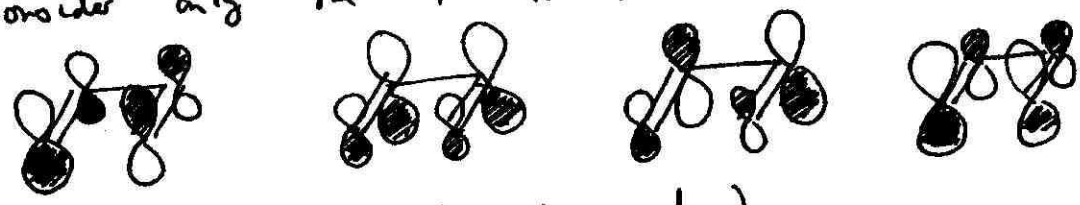
A, B, C, D are labelled so one gets all H's but are the motion involved.

conrotatory



disrotatory.

Consider only the 4 π-MO's.



(not in order)

Which mechanism is favored: conrotatory or disrotatory?

Part of an old prelim (not for handing in)

Chem 216

Please do not open this examination until the TA's say you may do so. Please check that there are 5 questions in your exam each on a separate page. The TA's have been told not to answer any questions during the examination period. If you finish the examination at least 15 minutes before the end of the exam you may turn the exam in. Otherwise please wait at your desk for your exam to be picked up by a TA. Please note this is a Chem 216 exam.

Name:_____

Day of the week your lab meets:_____

Question 1: _____

Question 2: _____

Question 3: _____

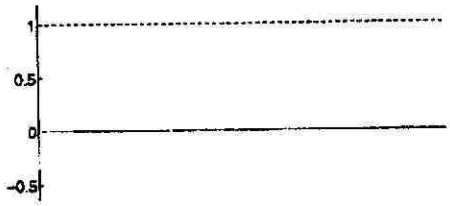
Question 4: _____

Question 5: _____

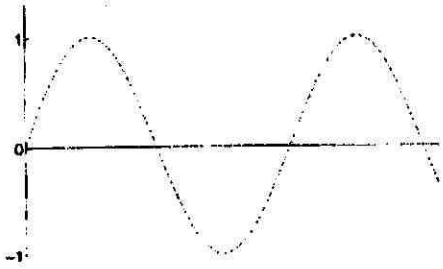
TOTAL: _____

1 (20 pt) Consider the five wavefunctions (A–E) drawn below as dotted lines. Rank their kinetic energy from highest to lowest in the answer box provided. ***If two wavefunctions have equal kinetic energy please indicate this in your answer.***

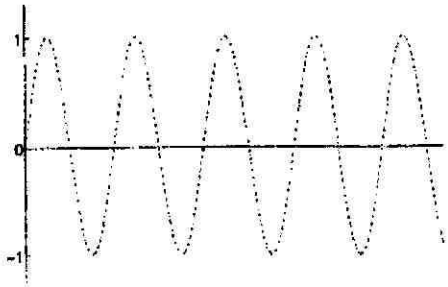
A



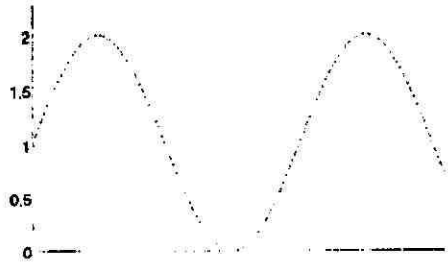
B



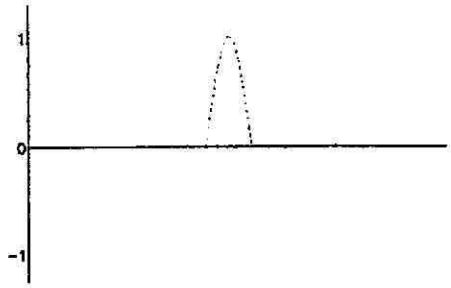
D



C



E

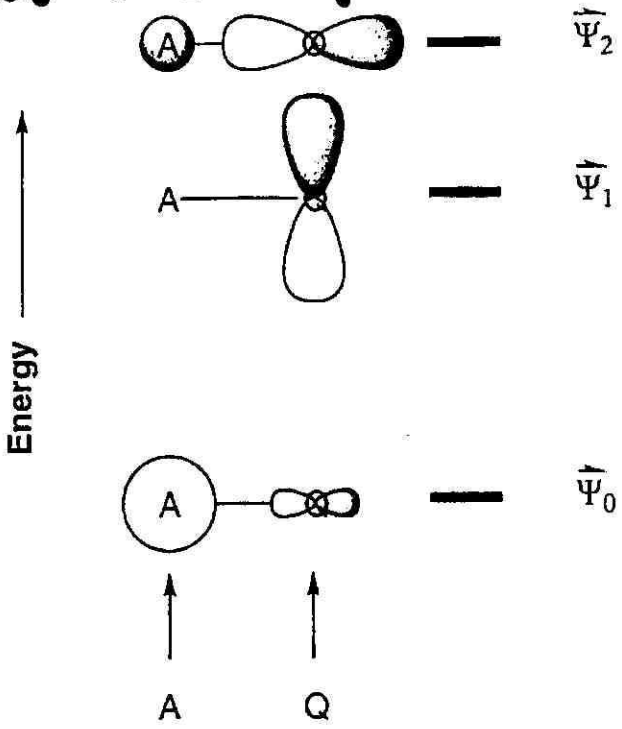


Answer Box:

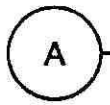
HIGHEST KINETIC ENERGY ***LOWEST KINETIC ENERGY***

2a. (15 pts) Two unspecified elements A and Q form a diatomic molecule. Their MO diagram is given below. Indicate in the space provided the initial energy of the corresponding atomic orbitals for both atom A and atom Q. **Please use the same energy scale as that used in the MO diagram.**

This problem wasn't graded correctly in this version of the exam



ANSWER:

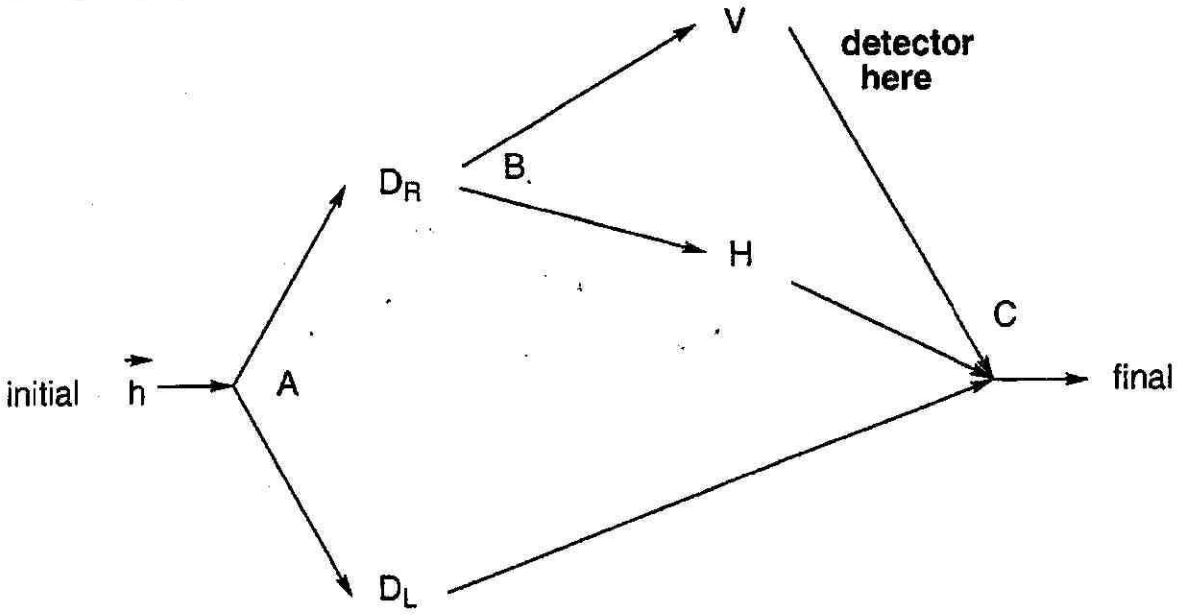
2b. (7 pts) An electron starts off in the orbital, 

. If one measures the energy what is the relative probability it is found to be in the Ψ_2 state vs. the Ψ_1 state?

ANSWER:

$$\frac{\text{Probability in } \Psi_2}{\text{Probability in } \Psi_1} =$$

3a. (12 pts) Consider the following experiment:



At both A and B the light beam is split equally. At C the beams are recombined. Calculate the ratio of the final intensity of light vs. the intitial intensity of light. **Please note the detector placed right after V.**

ANSWER:

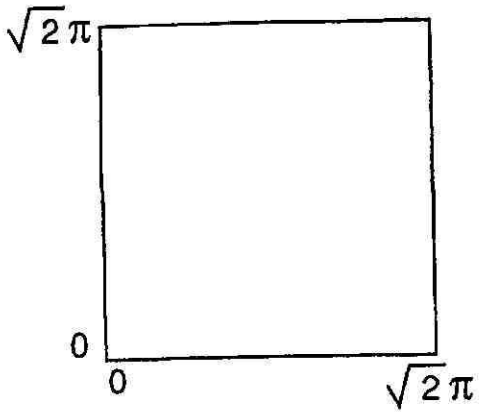
$$\frac{I_{final}}{I_{initial}} =$$

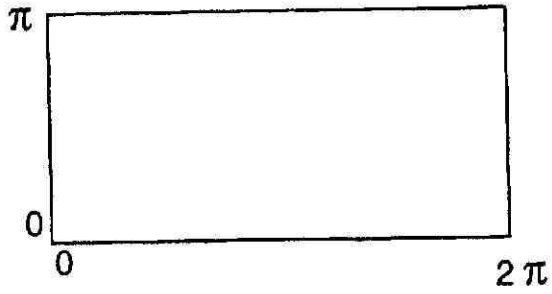
3b. (10 pts) The final state of the light **can not** be described as a single vector. Rather, it **must** be described as two vectors. Write what these two vectors are:

Supplemental problem

not covered in this course

4. (22 pts) Consider the following two boxes:





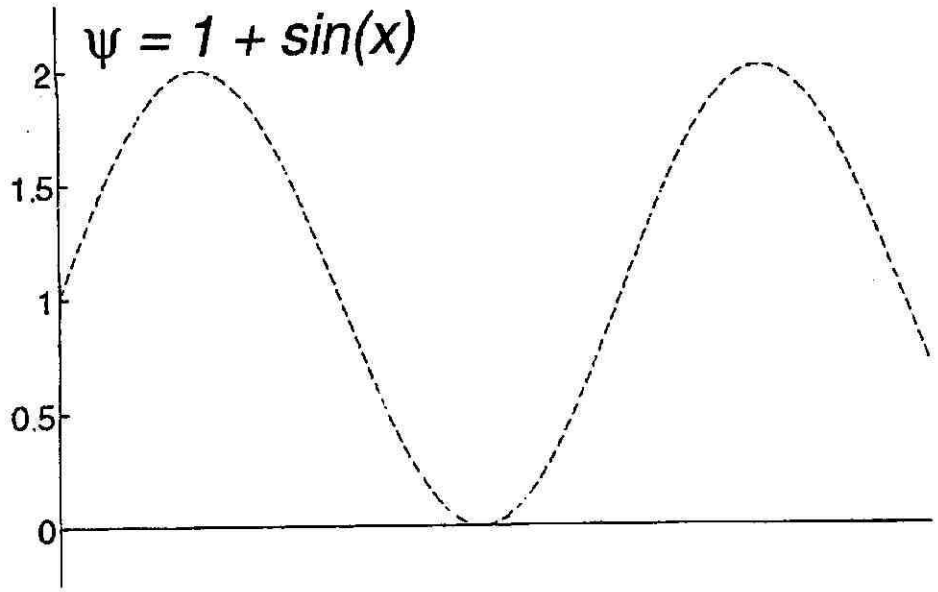
Both boxes have the same area. If one places two electrons in each box, and one places all electrons in the lowest allowable energy wavefunctions, what is the ratio of the energies for the two different boxes? For partial credit , show work on this or another indicated page.

ANSWER:

$$\frac{E_{square}}{E_{rectangle}} =$$

Supplemental problem

5 (20 pt) Consider the wavefunction $\psi = 1 + \sin(x)$ drawn below. If the kinetic energy of this wave function is measured what is (or are) the resultant measured value (or values)? Please write your final answer in the indicated answer box. For partial credit show your work on this or another indicated page.



Answer Box: