ORGANIC: TEST I

SCHOA_2002-2003

MULTIPLE CHOICE   (5 marks)

1.   A compound contains only carbon, hydrogen and oxygen has the following percentage by mass:

            carbon 60 %   hydrogen 8 %   oxygen 32 %

        What is a possible molecular formula?

        A. $C_5H_8O_2$ B. C_5H_4O C. C_6HO_3 D. C_7HO_4

2.   The following compounds have similar molar masses. Which compound has the highest boiling point?

        A. CH_3COOH B. $C_2H_5OCH_3$ C. CH_3COCH_3 D. C_2H_5Cl

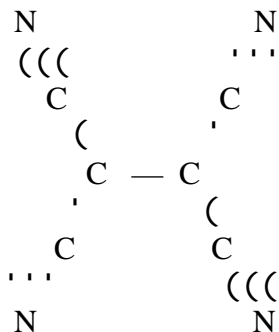3.   What are the states of hybridisation for the first three carbon atoms in hexatriene:

$$H_2C = C = CH - CH = C = CH_2$$
$$1 \quad 2 \quad 3$$
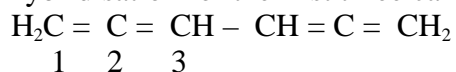
        A. sp^2 sp sp^2 B. sp sp^2 sp^3
        C. sp^2 sp sp^3 D. sp^2 sp^2 sp

4.   A molecule of ethyne, C_2H_2, contains:

        A. 2 s bonds and 1 p bond   B. 2 s bonds and 3 p bond
        C. 3 s bonds and 2 p bond   D. 5 s bonds

5.

Problems

1.   Iodine molecules, I_2 can be dissociated into two iodine atoms by light if the energy of the light is sufficient. Experiments show that the wavelength of light required for the dissociation of I_2 molecules is 499.5 nm.

a. What is the frequency of 499.5 nm light? what part of the electromagnetic spectrum is this light in?
b. Use Planck's equation to calculate the energy of dissociation of iodine. Express your answer in kJ mol^{-1}

2.   A 1.24 g sample of a hydrocarbon, when completely burned in an excess of oxygen gas, yields 4.04 g of CO_2 and 1.24 g of H_2O. Given that the molar mass of the hydrocarbon is twice the mass of the empirical unit, determine the empirical formula, the molecular formula and the possible structure(s) for the hydrocarbon molecule, and name the possible structure (s).

3.   The structure of tetracyanoethene is shown below:

```
   N                    N
   (((                 ' ' '
     C                   C
      (                  '
       C  —  C
        '       (
     C              C
   ' ' '            (((
   N                    N
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From the diagram above answer the following questions:
a. total number of s bonds   =
b. total number of p bonds   =
c. total number of sp^2 hybridised atoms =
d. total number of sp hybridised atoms   =

4.   When cyclopentene reacts with aqueous bromine in a solution of sodium chloride, three products are obtained:
            1,2 dibromocyclopentane
            2-bromocyclopentan-1-ol
            1-bromo - 2- chlorocyclopentane
Write a mechanism that explains the formation of these three products.

4. Describe **one** simple test tube reaction that you could perform in the Colonel By Chem Lab to distinguish between cyclohexane and cyclohexene. (Note: expected observations, reactions with balanced equation!!!)   4

5. Fill in each blank with an appropriate number, (i.e. 1,2,3 4, etc.):   3

sp^2 orbitals are formed by hybridizing _____ s orbitals and _____ p orbitals. Since total _____ orbitals are used in making the hybrid orbitals, the number of sp^2 orbitals obtained is _____ . Therefore, sp^2 orbitals are appropriate when there are _____ "things" (atoms or lone pairs) attached to a central atom. The bond angle that is typical of sp^2 hybridization is _____ degrees.