MC, Chem1B, Sp 15, Test1 Name_____

Read questions carefully to understand what is being asked. If you have doubt, do ask your instructor. Use the reverse side o your answer paper as scratch. Use attached periodic table and important constants chart. On your scantron, please start from number 11 to answer the multiple choice questions. (Total pts. = 84 + 36 + 12 = 132)

SHORT ANSWER: Be clear in your answer. Show all your calcualtions using appropriate set up and units.

1) Draw the Lewis structure, electronic geometry and then write the hybridization of the central atom next to the following compounds (3x6 = 18 pts): 1) _____

(a) SO_4^{2-}

(b) I_3^-

(c) PCl_5

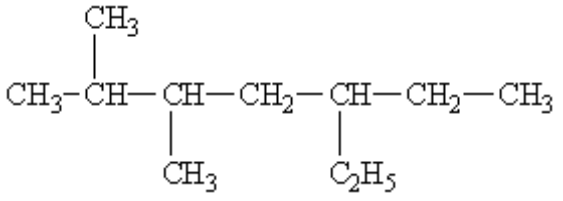
2) Draw skeletal or condensed structures next to the names (2x5 = 10pts.): 2) _____

(a) trans-2,3-dimethyl-3-hexene

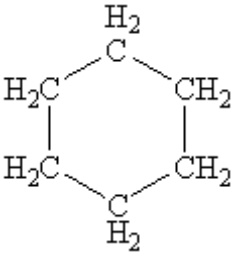
(b) 1,2-Dimethylcyclopentane

3) Write the systematic (IUPAC) name next to the following structures (2x3 = 6pts.). 3) _____

(a)



(b)



4) (a) Show the structure(s) of the product(s) of the following reaction (5 pts) and (b) name what kind of reaction is this (2 pts) : 4) _____

$$n\ ClCO(CH_2)_4COCl + 2n\ H_2N(CH_2)_6NH_2 \text{ -----}>$$

5) Draw the condensed structures of the reactants and product(s) of the reaction between propionic acid and 1-propanol (8 pts.) and name the major product (2 pts.) and the functional group it conatins (2 pts.). 5) _____

6) The following experimental data were obtained at constant temperature for the reaction: 6) _____

$2NO(g) + O_2(g) \text{ -----> } 2\ NO_2(g)$

	Initial Concentrations		Initial Rate
Experiment	[NO]	[O2]	(M s^{-1})
1	0.0010	0.0010	7.0×10^{-6}
2	0.0010	0.0020	1.4×10^{-5}
3	0.0010	0.0030	2.1×10^{-5}
4	0.0020	0.0030	8.4×10^{-5}
5	0.0030	0.0030	1.9×10^{-4}

a. Calculate the order of the reaction with respect to each reactant (6 pts.).

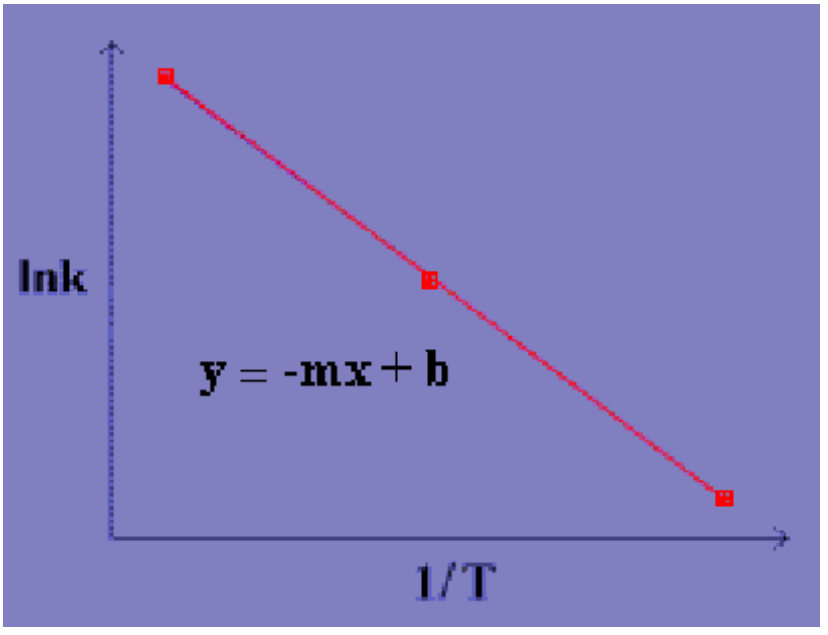
b. Write the rate law for the reaction (3 pts.).

7) The reaction $2NO(g) + O_2(g) \text{ -----> } 2\ NO_2(g)$ is 2nd order in $[NO_2]$ at 300°C with k = 0.543 $M^{-1}\ s^{-1}$; If in a closed container, the initial concentration of NO_2 = 0.05 M, then calculate the concentration of NO_2 after half an hour at that temperature (6 pts.). [Note: For 2nd order kinetics: $1/[A]_t = k \cdot t + 1/[A]_0$] 7) _____

8) Activation energies of reactions, E_a, are frequently found graphically. The Arrhenius equation: 8) _____

$$\ln (k) = ((- E_a))/RT + \ln(A)$$

is used. Values of k, the rate constant, are measured at various temperatures, then ln k and 1/T are calculated and plotted.



In one particular experiment the, co-ordinates of two points: one at upper left is A(.0013,-3.8) and the other at lower right is B(0.0017, -12.8). Using this information:

(a) Calculate the slope of the st. line (4 pts.)

(b) Calculate the energy of activation of the reaction (Ea) in calories (6 pts.)

9) If a rate law is second order (reactant) , doubling the reactant _____ the reaction rate (4 pts.). 9) _____

10) The minimum energy to initiate a chemical reaction is the _____ (2 pts.). 10) _____

MULTIPLE CHOICE. Start on line 11 of your scantron paper. Select the one alternative that best completes the statement or answers the question (3 pts each).

11) The electron-domain geometry and molecular geometry of iodine trichloride are _____ and _____, respectively. 11) _____

A) T-shaped, trigonal planar
B) tetrahedral, trigonal pyramidal
C) octahedral, trigonal planar
D) trigonal bipyramidal, T-shaped
E) trigonal bipyramidal, trigonal planar

12) The F-B-F bond angle in the BF_3 molecule is _____. 12) _____

A) 109.5° B) 120° C) 180° D) 90° E) 60°

13) According to valence bond theory, which orbitals on bromine atoms overlap in the formation of the bond in Br_2? 13) _____

A) 3s B) 3p C) 4s D) 4p E) 3d

14) The total number of π bonds in the H—C≡C—C≡C—C≡N molecule is _____. 14) _____

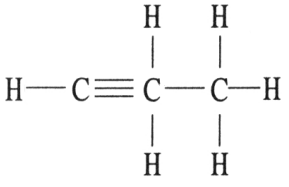
A) 3 B) 4 C) 6 D) 9 E) 12

15) The Lewis structure of carbon monoxide is given below. The hybridizations of the carbon and oxygen atoms in carbon monoxide are _____ and _____, respectively. 15) _____

: C ≡ O :

A) sp, sp^3 B) sp^3, sp^2 C) sp, sp D) sp^2, sp^3 E) sp^2, sp^2

16) The compound below is an _____. 16) _____



A) olefin
B) alkane
C) alkyne
D) alkene
E) aromatic compound

17) Optically active molecules that are mirror images of each other are called _____. 17) _____

A) cofactors
B) chiral compounds
C) allotropes
D) geometrical isomers
E) enantiomers

18) The addition of HBr to 2-butene produces _____. 18) _____

A) no reaction
B) 2-bromobutane
C) 2,3-dibromobutane
D) 1-bromobutane
E) 1,2-dibromobutane

19) Which substance in the reaction below either appears or disappears the fastest? 19) _____

$$4NH_3 + 7O_2 \rightarrow 4NO_2 + 6H_2O$$

A) O_2
B) NH_3
C) H_2O
D) NO_2
E) The rates of appearance/disappearance are the same for all of these.

20) Consider the following reaction: 20) _____

$$A \rightarrow 2C$$

The average rate of appearance of C is given by $\Delta[C]/\Delta t$. Comparing the rate of appearance of C and the rate of disappearance of A, we get $\Delta[C]/\Delta t$ = _____ × $(-\Delta[A]/\Delta t)$.

A) +2 B) +1 C) -1/2 D) -1 E) +1/2

21) If the rate law for the reaction 21) _____

$$2A + 3B \rightarrow \text{products}$$

is first order in A and second order in B, then the rate law is rate = _____.

A) $k[A]^2[B]^3$ B) $k[A][B]^2$ C) $k[A]^2[B]^2$ D) $k[A]^2[B]$ E) $k[A][B]$

22) The half-life of a first-order reaction is 13 min. If the initial concentration of reactant is 0.085 M, it takes _____ min for it to decrease to 0.055 M. 22) _____

A) 8.2 B) 0.048 C) 3.6 D) 11 E) 8.4

TRUE/FALSE. In your scantron, fill up bubble A for true and bubble B for false answers (3 pts./question).

23) Hybridization is the process of mixing atomic orbitals as atoms approach each other to form a bond. 23) _____

24) A carbon with three or more attached groups will be chiral. 24) _____

25) The half-life for a first order rate law depends on the starting concentration. 25) _____

26) Units of the rate constant of a reaction are independent of the overall reaction order. 26) _____