Name: _	Answer	Key		
_	ast	0	First	MI

Chemistry 234-001 Exam 1

Fall 2017 Dr. J. Osbourn

<u>Instructions:</u> The first 18 questions of this exam should be answered on the provided Scantron. You must use a pencil for filling in the Scantron sheet. Ensure all erasures are complete. Any questions left blank will be marked incorrect. Answer the remaining questions on the exam itself. Show all work and provide complete explanations.

Please write your name on:

- The first page (Exam Cover Page)
- The second page (Grading Page)
- The Scantron Sheet Circle your Last Name

Please bubble in your WVU Student ID Number on your Scantron sheet.

The Periodic Table

1 [A																,	18 VIIIA
1 H	2											13	14	15	16	17	He l
1.01	ΠA											IIIA	IVA	VA	VIA	VIIA	4.00
3	4	ı										5	6	7	8	9	10
Li	Be	1										В	C	N	0	F	Ne
6.94	9.01	l										10.81	12.01	14.01	16.00	19.00	20,18
11	12											13	14	15	16	17	18
Na	Mg	3	4	5	6	7	8	9	10	11	12	Al	Si	P	S	Cl	Ar
22.99	24.31	IIIB	IVB	VB	VIB	VIIB		VIIIB		1B	IIB	26.98	28.09	30.97	32.07	35.45	39.95
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	Ca	Sc	Ti	v	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
39.1	40.08	44.96	47.88	50.94	52.00	54.94	55.85	58.93	58.69	63.55	65.39	69.72	72.61	74.92	78.96	79.90	83.80
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
85.47	87.62	88.91	91.22	92.91	95.94	(98)	101.07	102.91	106.42	107.87	112.41	114.82	118.71	121,76	127.6	126.9	131.29
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba	La*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
132.9	137.3	138.9	178.5	180.9	183.9	186.2	190.2	192.2	195.1	197.0	200.6	204.4	207.2	209	(209)	(210)	(222)
87	88	89	104	105	106	107	108	109	110	111	l						
Fr	Ra	Ac^	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	İ						
(223)	(226)	(227)	(261)	(262)	(263)	(264)	(265)	(268)	(271)	(272)	l						
			58	59	60	61	62	63	64	65	66	67	68	69	70	71	1
		*	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	1
			140.1	140.9	144.2	(145)	150.4	152.0	157.3	158.9	162.5	164.9	167.3	168.9	173.0	175.0	
			90	91	92	93	94	95	96	97	98	99	100	101	102	103	
		^	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	
			232.0	(231)	238.0	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(260)	

Exams will be returned by placing them alphabetically on the table at the front of BUE 459. Your grade will not be visible as it is on the second page. If, however, you have a privacy concern, check the box below and your exams will be held back so that you can pick them up privately.

	Hold	Back	My	Exams
--	------	------	----	-------

Name:	x (45)		
• • • • • • • • • • • • • • • • • • • •	Last	First	MI

Grading Page (Exam 1):

Page	Points Possible	Points Earned
Multiple Choice (3-6)	36	
7	27	
8	37	
TOTAL	100	

Multiple-Choice

Choose the one best answer for each of the following questions. Record this answer on your Scantron sheet. Additionally, circle your answer on this exam. (2 points each)

1. Arrange the following in order of increasing stability.

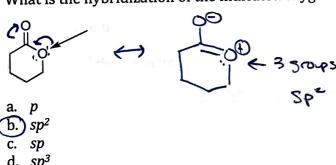
BLDCCKA

- b. A < B < C < D
- c. D < C < B < A
- (d.) B < D < C < A
- e. B < A < C < D
- slowest.

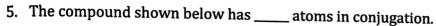
- a. I, II
- b. I, III
- c. II, V
- (d.) III, I
- e. IV, V

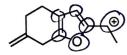
S

3. What is the hybridization of the indicated oxygen atom in the structure below?

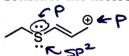


4. In the molecule shown below, which double bond will react the most rapidly with HBr?





6. Consider the molecule shown below and determine the orbital location for each indicated species.



	3							
	Carbocation [⊕]	S – lone pair 1	S – lone pair 2					
a.	sp ² orbital	sp ² orbital	sp ³ orbital					
b.	p orbital	p orbital	p orbital					
Ç.	p orbital	sp ³ orbital	sp ² orbital					
d.	p orbital	sp ² orbital	sp ² orbital					
(e.)	p orbital	sp ² orbital	p orbital					

7. The compound shown below is non-aromatic because:



a. it is not planar
b. it is not completely conjugated (i.e. the N lone pair is in an sp³ orbital)

Triponal Planar

- it has 6π electrons.
- d. a, b, and c
- (e.) both a and b

8. Which one of the following dienes will react the fastest in a normal Diels-Alder reaction?



- b
- C

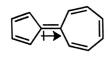
9. Which reaction shown below would you expect to occur at the fastest rate?



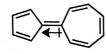


Page 4 of 8

10. Which one of the following best represents the dipole for the molecule shown below?



a





zero net dipole C

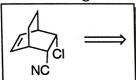
See problem set

Ch 15 #3 for reasoning

11. What is the common name for the compound shown below?

- a. Allyl benzene
- (b.) Styrene
 - c. Xylene
 - d. Benzoethylene
 - e. Toluene

12. What starting materials could be used to prepare the following bicyclic compound?



- 13. Which one of the following is **not** a correct statement regarding the mechanism of electrophilic aromatic substitution of benzene?
 - a. Benzene acts as a nucleophile.
 - b. The intermediate is a resonance stabilized carbocation.
 - c. Aromaticity is regained by loss of H+ (base removal of H+).
 - d. All of the above are correct

14. Which of the following pairs of structures represent resonance structure?

Use the reaction shown below to answer questions (15-18).

- 15. Which of the products are 1,2 products?
 - a. I
 - b. II
 - c. III
 - d. I and II
 - (e.) I and III
- 16. If the reaction were carried out at -78 °C, what would be the major products?
 - a. I and II

4 kinetic = 1,2

- b. II and III
- c. I and III
- 17. If the reaction were carried out at 40 °C, what would be the major product(s)?
 - a. I, II, and III

4 thurmodynamic

- b. I and II
 - c. II and III
 - d. II only
 - e. III only
- 18. Which product (if any) is both a kinetic and a thermodynamic product?
 - (a.) I
 - b. II
 - c. III
 - d. I and II
 - e. None

Completion Section

Answer the questions below in the spaces provided.

(6) 19. Provide the IUPAC name or structure for each compound below. (3 points each)

tert-butyl-1,2-dichlorobenzene 3-iodo-4-propylanisole

(15) 20. For each compound below, determine if it is aromatic, anti-aromatic, or non-aromatic. For aromatic and anti-aromatic compounds, indicate the number of π -electrons. (2 points each)







πе-

non-aromalic

(4) 21. Starting with benzene, show the sequence of reactions that would be required to prepare the molecule shown below. (4 points)

2) Zn(Hg), HCl or NHZ-NHZ10H- (1)

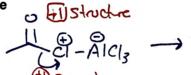


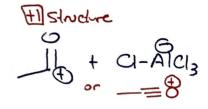
[2/4/if 1) c1 ~ , A1C13

2) NBS or Brz , A

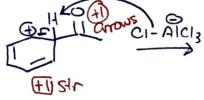
(3) 22. Draw the complete electron pushing mechanism for the reaction shown below. (7 points)

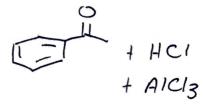
A. Generation of the Active Electrophile





B. Electrophilic Aromatic Substitution Reaction





23. Predict the major product(s) for each reaction shown below. If the reaction does not proceed under the specified conditions, write "No Reaction" *(3 points each)*

- a. HNO_3 H_2SO_4 H_2SO_4 H_2 H_2 H_2 H_3
- b. OH BY

 AICI3

 Na₂Cr₂O₇

 H₂SO₄

 MayC have
- HBr (1 equiv)

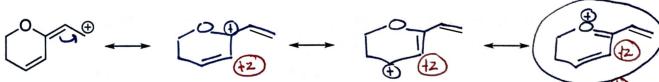
 -78 °C

 HBr be drawn, but okay

 HBr do do 50
- d.

 HBr $\frac{\text{(1 equiv)}}{40 \, ^{\circ}\text{C}}$ HBr $\frac{2}{43}$ Br at 1

 = at 2,3
- e. CO + CO CO Storcochem
- f. | Ph = Ph Ph Z if a double | Ph | Band is missing
- 24. Consider the molecule shown below and answer the following questions.
 - a. Draw three additional resonance structures. (6 points)
 - **b.** Circle the resonance structure that is the major contributor to the resonance hybrid. (1 point)



c. Draw a picture of the molecule showing the location of every p-orbital. (2 pts)

silly mislakes like -lorgelting chowing benzene

- lone pair PD

 do not have to

 the prontitals
- -t if missing one p-orbital
 -2 if missing >1 p-orbital or
 drawing >6 p-orbitals

- d. How many atoms are in conjugation? (1 pt)
- e. What is the hybridization of the oxygen? (1 pt)
 - Sp² (1)
- **f.** What is the hybridization of the carbon bearing the cation in the original structure? (1 pt)

5p2 (1)

g. In what orbital(s) does/do the oxygen lone pairs reside? (1 pt)

IxIp in p-orbital (10,5)

1xIp in 5p2-orbital (10,5)

Page 8 of 8