

Chemistry 234-101

Exam 1 – Version B

Summer 2019

Dr. J. Osbourn

Instructions: Answer the first 16 questions of this exam using the bubble sheet attached to the end of this exam booklet. You may detach this sheet if you wish. Answer the remaining questions directly on this exam. Show all work and provide complete explanations.

The Periodic Table

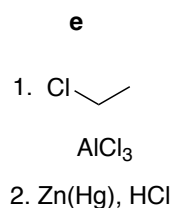
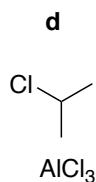
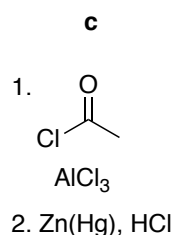
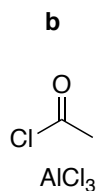
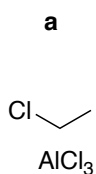
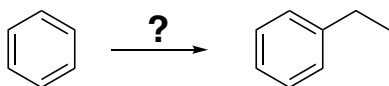
IA	1	2											13	14	15	16	17	VIII A	2
	H																		He
	1.01																		4.00
	3	4											5	6	7	8	9	10	
	Li	Be											B	C	N	O	F	Ne	
	6.94	9.01											10.81	12.01	14.01	16.00	19.00	20.18	
	11	12	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	Na	Mg											Al	Si	P	S	Cl	Ar	
	22.99	24.31											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								
	Fr	Ra	Ac^	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg								
	(223)	(226)	(227)	(261)	(262)	(263)	(264)	(265)	(268)	(271)	(272)								

	58	59	60	61	62	63	64	65	66	67	68	69	70	71
*	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
	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)

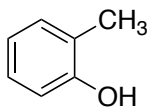
Multiple-Choice

Choose the best answer for each of the following questions. Record each answer on the attached bubble sheet. **Ensure you completely bubble in your answers.** (2 points each)

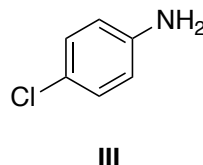
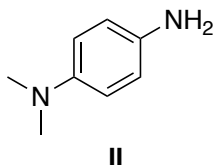
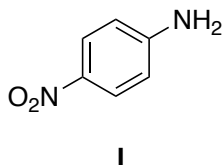
1. Choose the best reagent (or reagent set) to accomplish the following transformation.



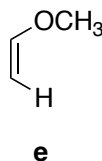
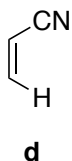
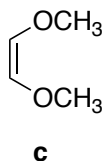
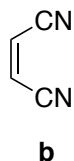
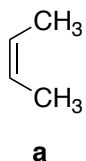
2. The common name for methyl phenol is cresol. What is the best name for the following compound?



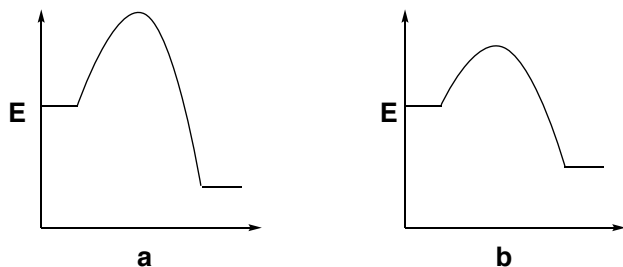
- a. *para*-cresol
b. *meta*-cresol
c. *ortho*-cresol
3. Rank the following aniline derivatives from least basic to most basic.



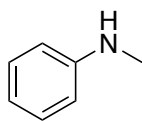
- a. I < II < III
b. III < II < I
c. III < I < II
d. II < I < III
e. I < III < II
4. Which one of the following would be the worst dienophile for a normal Diels-Alder reaction?



5. Which reaction coordinate represents formation of a thermodynamic reaction product?

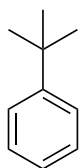


6. What is the predominate effect that following substituent has on the aromatic ring?

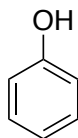


- a. Inductive Donation
- b. Inductive Withdraw
- c. Resonance Donation
- d. Resonance Withdraw

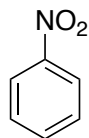
7. Which of the following can undergo a successful Friedel-Crafts alkylation? *Bubble in the letter for all that apply.*



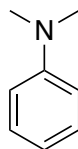
a



b

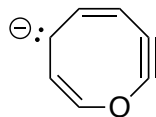


c



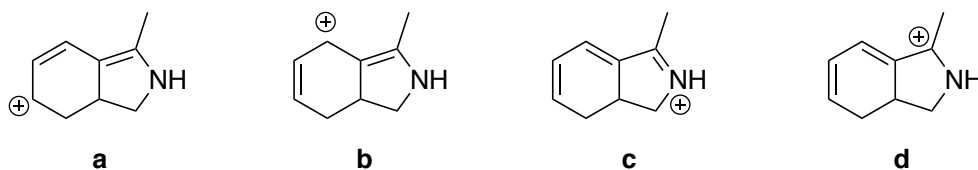
d

8. How many Pi electrons contributing to aromaticity are present in the following ring?

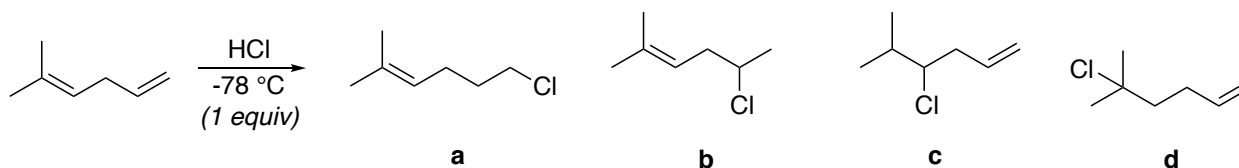


- a. 6
- b. 8
- c. 10
- d. 12
- e. None of the above

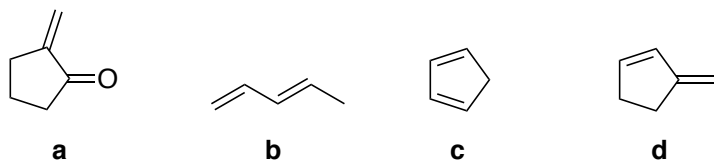
9. Which one of the following is the major resonance contributor?



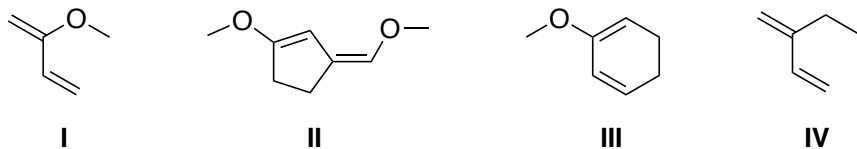
10. What is the major product for the following reaction?



11. Which of the following dienes can successfully be used in a Diels-Alder reaction? *Bubble in the letter for all that apply.*

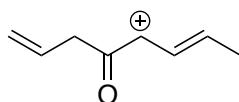


12. Rank the following dienes from least reactive to most reactive in a normal Diels-Alder reaction.



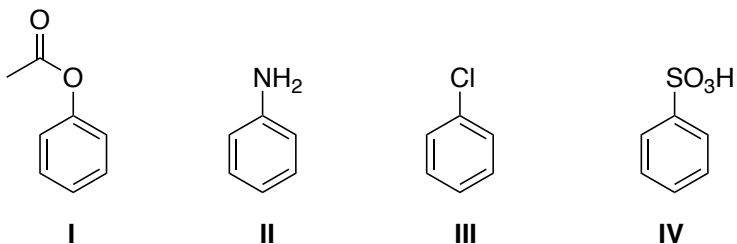
- a. II < IV < I < III
- b. I < III < II < IV
- c. II < III < IV < I
- d. III < II < I < IV
- e. IV < I < II < III

13. How many atoms are in conjugation in the following compound?



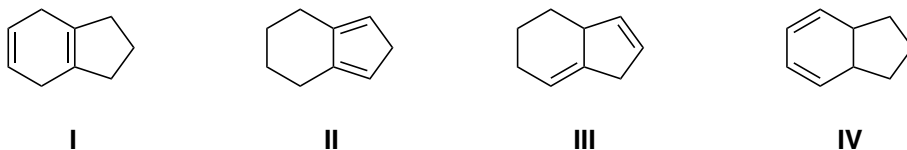
- a. Four
- b. Five
- c. Six
- d. Seven
- e. None of the above

14. Rank the following benzene derivatives from most deactivated to most activated.



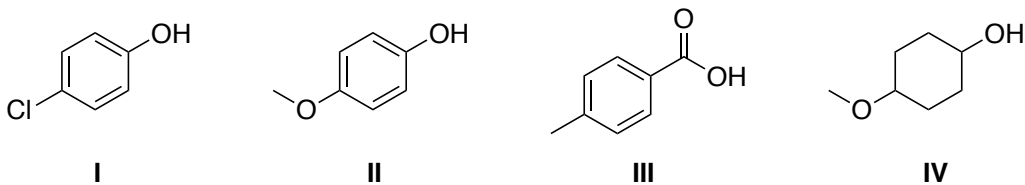
- a. IV < I < III < II
- b. III < I < IV < II
- c. III < IV < II < I
- d. II < IV < III < I
- e. IV < III < I < II

15. In the following series, diene ___ is the least stable and diene ___ is the most stable.



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

16. Rank the following from least acidic to most acidic.

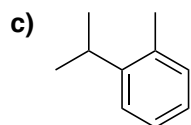
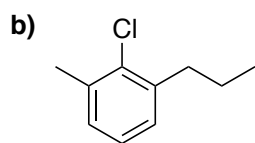
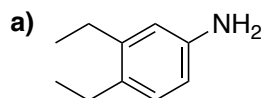


- a. IV < II < I < III
- b. IV < II < III < I
- c. IV < III < II < I
- d. II < IV < I < III

Completion Section

Answer the remaining questions directly on the exam itself. Please write neatly and **darkly** as your answers will be scanned for grading.

17. Provide IUPAC systematic names for each compound shown below. (3 points each)



18. Draw a representative structure for each of the following. (1 point each)

 vinyl cation

 acetanilide

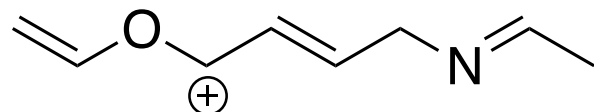
 di-substituted alkene

 pyridine

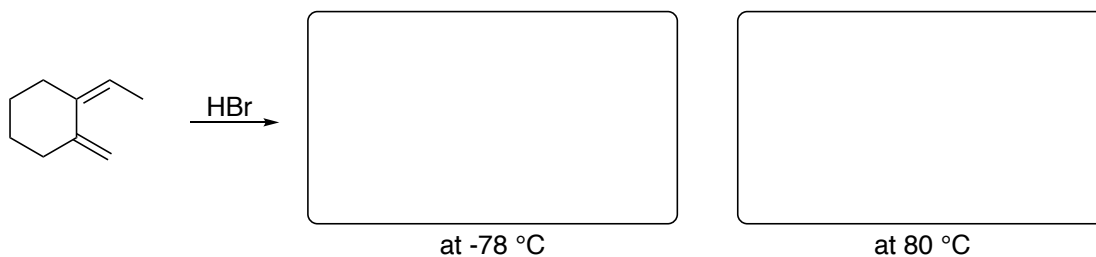
19. Draw the other resonance structures for the structure shown below. Circle the major contributor to the resonance hybrid. (5 points)



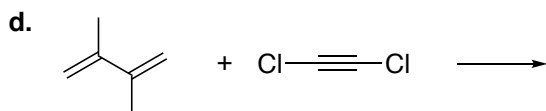
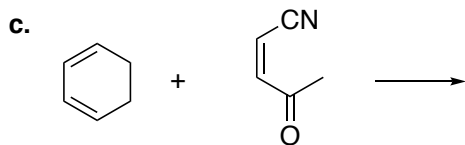
20. Draw in all p-orbitals on the following molecule. Then circle the atoms involved in conjugation. (4 points)



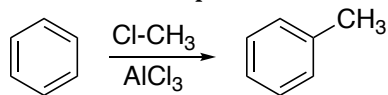
21. Predict the product(s) for the following reaction at the given temperatures. (2 points each)



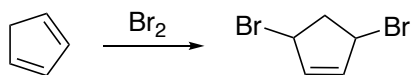
22. Predict the major organic product for each of the following reactions. Note: some parts have two steps you must complete. (2 points each)



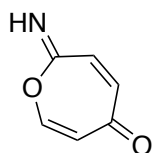
23. Draw the complete electron pushing mechanism for the following reaction. (6 points)



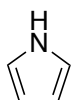
24. Draw the complete electron pushing mechanism for formation of the following product. (4 points)



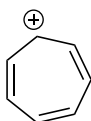
25. Select the appropriate classification for each molecule below. (2 points each)



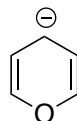
aromatic
antiaromatic
non-aromatic



aromatic
antiaromatic
non-aromatic



aromatic
antiaromatic
non-aromatic

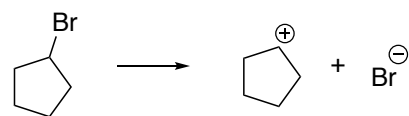
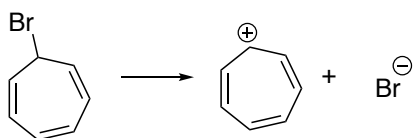


aromatic
antiaromatic
non-aromatic

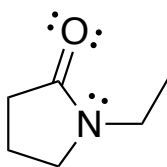


aromatic
antiaromatic
non-aromatic

26. Circle the reaction that takes place at the faster rate. Briefly explain your choice. (4 points)



27. Consider the following structure and answer the questions below. (2 points each)



a. What is the hybridization of the oxygen and the nitrogen?

O =

N =

b. In what orbital does the nitrogen lone pair reside?

c. Is either lone pair on the oxygen involved in conjugation?