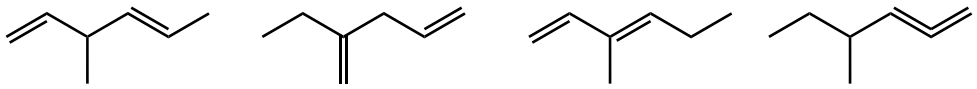
CHM 224
Test 1
Chapters 17, 18, 19

NAME:

1. From the series of compounds below, label the most and least stable isomer:



A B C D

MOST STABLE:

LEAST STABLE:

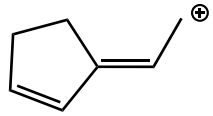
2. Which one of the following compounds is expected to undergo an ***S_N1 reaction the fastest and which one the slowest***?

A. 1-bromo-2-pentene
B. 4-bromo-1-pentene
C. 3-bromo-2-pentene
D. 5-bromo-2-pentene

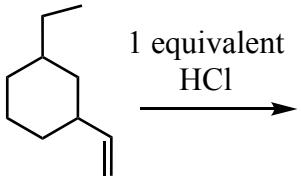
fastest:

slowest:

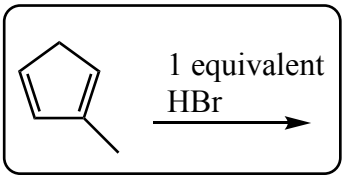
3. Draw all reasonable contributing resonance forms for the carbocation below using curved arrows and appropriate conventions:

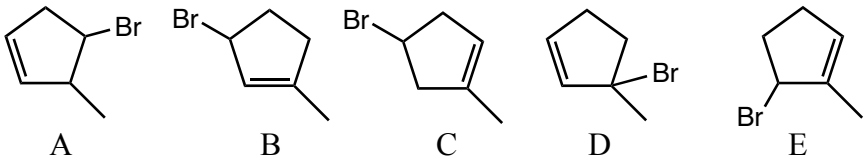


4. What is the major product expected for the following reaction? Show your work:



5. Which of the following are major products of the following reaction?



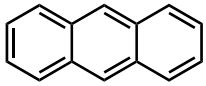


A B C D E

6. Which one of the following statements correctly describes *aromatic molecules*?

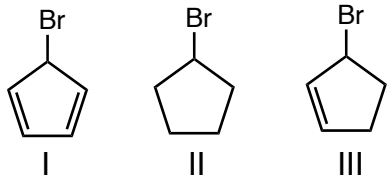
A. they typically exhibit non-alternating bond lengths and undergo substitution reactions
B. they typically exhibit alternating bond lengths undergo substitution reactions
C. they typically exhibit alternating bond lengths and undergo addition reactions
D. they typically exhibit non-alternating bond lengths and undergo addition reactions

7. Answer the questions regarding the structure of the compound provided below:



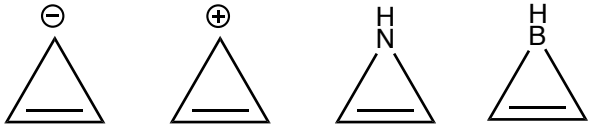
A. What is the number of pi electrons?
B. Is there a value for "n" that satisfies the Huckel rule? n =
C. Is there an even or odd number of pairs of electrons?
D. Is this compound predicted to be aromatic?
E. The type of ring current exhibited in NMR spectroscopy would be:

8. Which of the following correctly ranks the order in which the compounds below will undergo an S_N1 reaction (from fastest to slowest):



A. I > II > III
B. I > III > II
C. II > I > III
D. II > III > I
E. III > I > II
F. III > II > I

9. Which of the following compounds are predicted to exhibit **aromaticity**?

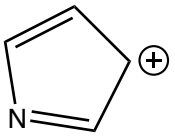


A B C D

10. Cyclobutadiene is a rare example of an anti-aromatic compound because:

A. It has two unpaired electrons in its pi orbitals and is planar
B. It has two unpaired electrons in its pi orbitals and is nonplanar
C. It has no unpaired electrons in its pi orbitals and is planar
D. It has no unpaired electrons in its pi orbitals and is nonplanar

11. Answer the two questions below based on the structure provided:

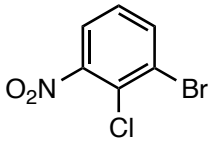


i. Do you predict the compound to be aromatic or antiaromatic? Clearly describe how you account for pi electrons, including lone pairs.

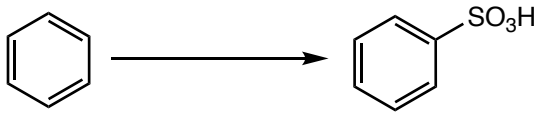
ii.The predicted heat of hydrogenation for the compound above is 240 kJ/mol. The actual (experimental) heat of hydrogenation was determined to be 350 kJ/mol. Does this information support your answer above (use specific data, not just yes or no).

13. Draw the structure of ortho-bromophenol

14. Provide an acceptable name for the following compound:

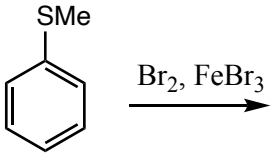


15. Provide the reagents necessary to complete the following reaction:

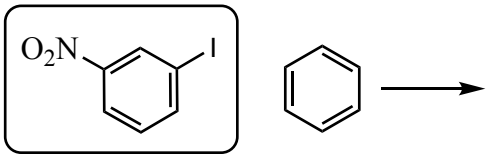


Reagents:

16. Methylphenyl sulfide (below) reacts *fifty times faster than benzene* towards Br_2, $FeBr_3$. Given this information, what would you predict to be the major product(s) of the following reaction?



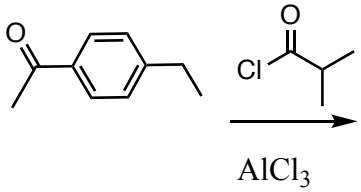
17. Provide a synthesis of the following compound starting with benzene.



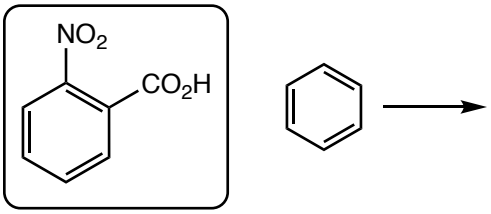
18. Which one of the following substituents *activates* the reaction of the benzene ring with electrophiles to the greatest extent?

A. OH B. CN C. CH_3 D. SO_3H E. NO_2

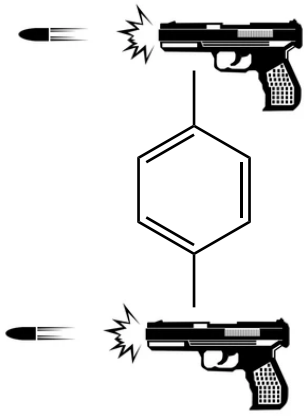
19. What is the expected major product of the following reaction:



20. Provide a synthesis for the following compound starting with benzene.



Bonus! (1 pt). What is the name of the following compound?



The Periodic Table of the Elements

1 **H** Hydrogen 1.00794																	2 **He** Helium 4.003
3 **Li** Lithium 6.941	4 **Be** Beryllium 9.012182											5 **B** Boron 10.811	6 **C** Carbon 12.0107	7 **N** Nitrogen 14.00674	8 **O** Oxygen 15.9994	9 **F** Fluorine 18.9984032	10 **Ne** Neon 20.1797
11 **Na** Sodium 22.989770	12 **Mg** Magnesium 24.3050											13 **Al** Aluminum 26.981538	14 **Si** Silicon 28.0855	15 **P** Phosphorus 30.973761	16 **S** Sulfur 32.066	17 **Cl** Chlorine 35.4527	18 **Ar** Argon 39.948
19 **K** Potassium 39.0983	20 **Ca** Calcium 40.078	21 **Sc** Scandium 44.955910	22 **Ti** Titanium 47.867	23 **V** Vanadium 50.9415	24 **Cr** Chromium 51.9961	25 **Mn** Manganese 54.938049	26 **Fe** Iron 55.845	27 **Co** Cobalt 58.933200	28 **Ni** Nickel 58.6934	29 **Cu** Copper 63.546	30 **Zn** Zinc 65.39	31 **Ga** Gallium 69.723	32 **Ge** Germanium 72.61	33 **As** Arsenic 74.92160	34 **Se** Selenium 78.96	35 **Br** Bromine 79.904	36 **Kr** Krypton 83.80
37 **Rb** Rubidium 85.4678	38 **Sr** Strontium 87.62	39 **Y** Yttrium 88.90585	40 **Zr** Zirconium 91.224	41 **Nb** Niobium 92.90638	42 **Mo** Molybdenum 95.94	43 **Tc** Technetium (98)	44 **Ru** Ruthenium 101.07	45 **Rh** Rhodium 102.90550	46 **Pd** Palladium 106.42	47 **Ag** Silver 107.8682	48 **Cd** Cadmium 112.411	49 **In** Indium 114.818	50 **Sn** Tin 118.710	51 **Sb** Antimony 121.760	52 **Te** Tellurium 127.60	53 **I** Iodine 126.90447	54 **Xe** Xenon 131.29
55 **Cs** Cesium 132.90545	56 **Ba** Barium 137.327	57 **La** Lanthanum 138.9055	72 **Hf** Hafnium 178.49	73 **Ta** Tantalum 180.9479	74 **W** Tungsten 183.84	75 **Re** Rhenium 186.207	76 **Os** Osmium 190.23	77 **Ir** Iridium 192.217	78 **Pt** Platinum 195.078	79 **Au** Gold 196.96655	80 **Hg** Mercury 200.59	81 **Tl** Thallium 204.3833	82 **Pb** Lead 207.2	83 **Bi** Bismuth 208.98038	84 **Po** Polonium (209)	85 **At** Astatine (210)	86 **Rn** Radon (222)
87 **Fr** Francium (223)	88 **Ra** Radium (226)	89 **Ac** Actinium (227)	104 **Rf** Rutherfordium (261)	105 **Db** Dubnium (262)	106 **Sg** Seaborgium (263)	107 **Bh** Bohrium (262)	108 **Hs** Hassium (265)	109 **Mt** Meitnerium (266)	110 (269)	111 (272)	112 (277)	113	114				

58 **Ce** Cerium 140.116	59 **Pr** Praseodymium 140.90765	60 **Nd** Neodymium 144.24	61 **Pm** Promethium (145)	62 **Sm** Samarium 150.36	63 **Eu** Europium 151.964	64 **Gd** Gadolinium 157.25	65 **Tb** Terbium 158.92534	66 **Dy** Dysprosium 162.50	67 **Ho** Holmium 164.93032	68 **Er** Erbium 167.26	69 **Tm** Thulium 168.93421	70 **Yb** Ytterbium 173.04	71 **Lu** Lutetium 174.967
90 **Th** Thorium 232.0381	91 **Pa** Protactinium 231.03588	92 **U** Uranium 238.0289	93 **Np** Neptunium (237)	94 **Pu** Plutonium (244)	95 **Am** Americium (243)	96 **Cm** Curium (247)	97 **Bk** Berkelium (247)	98 **Cf** Californium (251)	99 **Es** Einsteinium (252)	100 **Fm** Fermium (257)	101 **Md** Mendelevium (258)	102 **No** Nobelium (259)	103 **Lr** Lawrencium (262)

1995 IUPAC masses and Approved Names from http://www.chem.qmw.ac.uk/iupac/AtWt/
masses for 107-111 from C&EN, March 13, 1995, p. 35
112 from http://www.gsi.de/z112e.html