

Last

First

MI

Chemistry 234-002
Exam 3

Spring 2017

Dr. J. Osbourn

Instructions: The first 20 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 IA 1 H 1.01	2 IIA 4 He 4.00																	18 VIIIA 2 He 4.00					
3 Li 6.94	4 Be 9.01																	13 IIIA 5 B 10.81	14 IVA 6 C 12.01	15 VA 7 N 14.01	16 VIA 8 O 16.00	17 VIIA 9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIII	10	11 IB	12 IIB	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95						
19 K 39.1	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80						
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.6	53 I 126.9	54 Xe 131.29						
55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)						
87 Fr (223)	88 Ra (226)	89 Ac^ (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (264)	108 Hs (265)	109 Mt (268)	110 Ds (271)	111 Rg (272)													

* ^	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
	90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

Name: _____
Last First MI

Grading Page: Exam 3

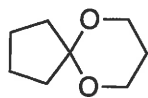
Page	Points Possible	Points Earned
Multiple Choice (3-4)	40	
5	19	
6	25	
7	21	
TOTAL	105	

Although you can score a possible of 105 points, your score will be recorded out of 100 (i.e. 5 possible bonus points)

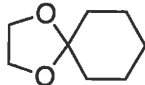
Multiple Choice

Choose the one best answer for each of the following questions. Bubble each answer in on the provided Scantron sheet. (2 points each)

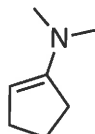
1. Which of the following has/have cyclopentanone as a hydrolysis (H^+/H_2O) product?



a



b



c

A and C

☒ d

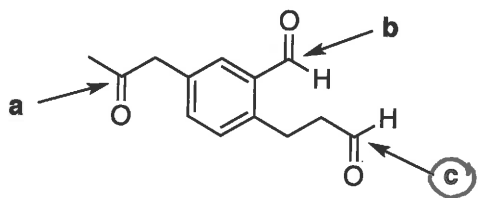
A, B, and C

e

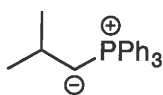
2. What is the driving force for the Wittig reaction?

- a. Conversion of a ketone into a more stable alkene product.
- ☒ b. Formation of the triphenylphosphine oxide ($O=PPh_3$) byproduct.
- c. Formation of the cyclic oxaphosphetane.
- d. Nucleophilic attack of the ketone with the phosphorous ylide.

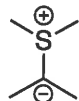
3. Which one of the indicated carbonyls is the most reactive toward a nucleophile?



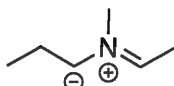
4. Which of the following would be classified as an ylide?



a



b

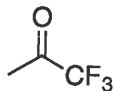


c

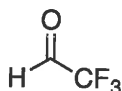
A, B, and C
are all ylides

☒ d

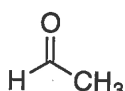
5. Which compound will give the highest percentage of hydrate at equilibrium?



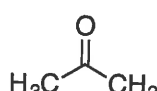
a



☒ b

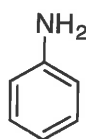


c

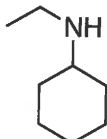


d

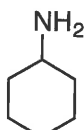
6. Which one of the following is the strongest base?



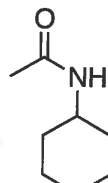
a



☒ b

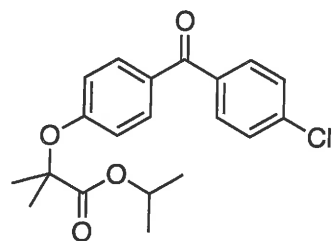


c



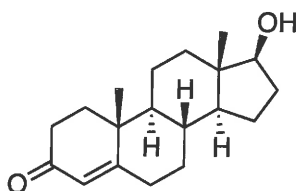
d

7. Three pharmaceutical drugs are shown below. Which one is most likely to be sold as the hydrochloride salt?



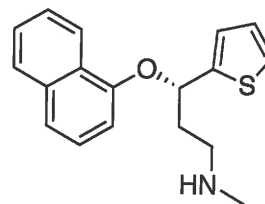
Fenofibrate

a



AndroGel

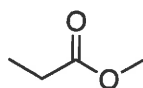
b



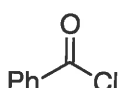
Cymbalta

(c)

8. Which molecule shown below cannot be hydrolyzed to a carboxylic acid?



a



b



c

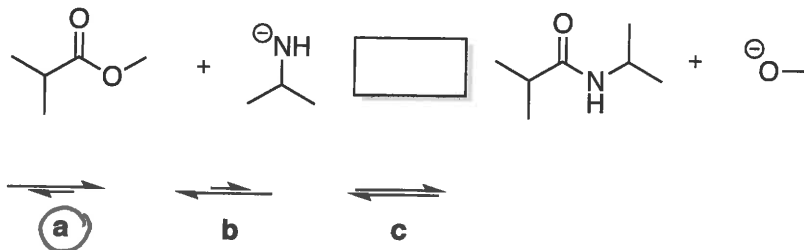


(d)

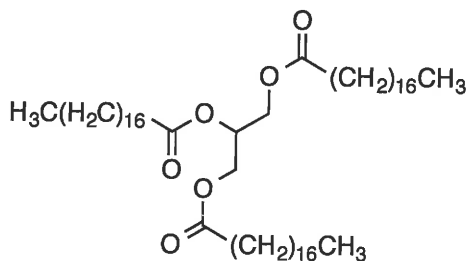
all of these can be hydrolyzed to give a carboxylic acid

e

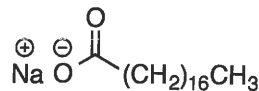
9. Which arrow best describes the reaction shown below?



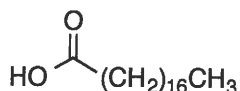
10. Which of the following depicts a soap molecule?



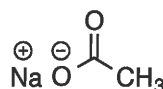
a



(b)



c



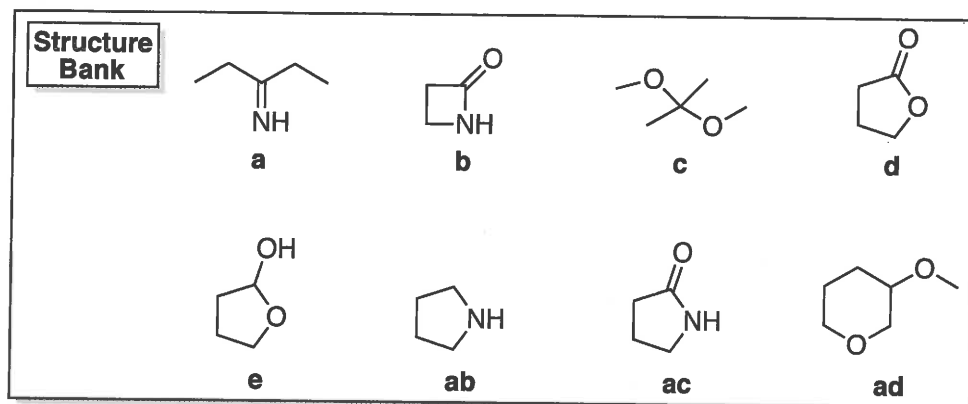
d

For questions 11-13, match each term below with the appropriate structure from the structure bank. Record each answer on your Scantron sheet.

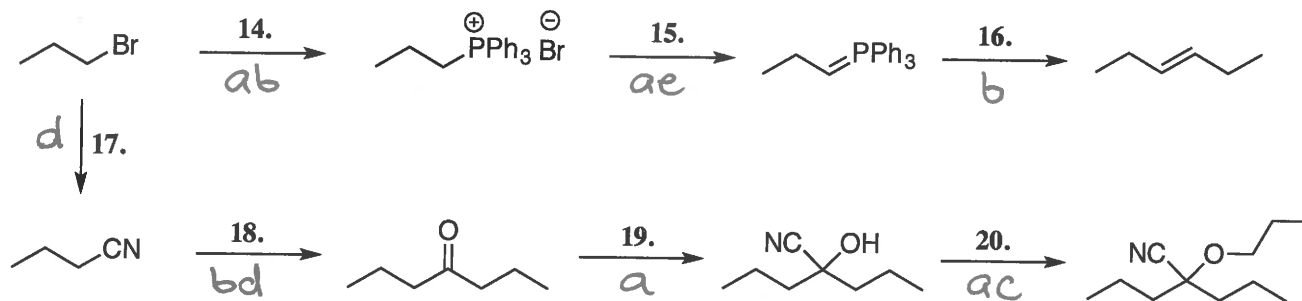
11. Hemiacetal *e*

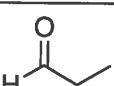

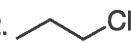
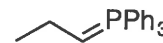

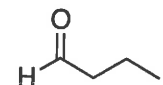
12. Gamma-lactam *ac*

13. Schiff Base *a*



For questions 14-20, match each transformation below with the appropriate reagent from the reagent bank. Record each answer on your Scantron sheet.

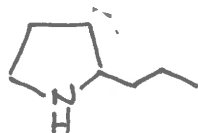


Reagent Bank			
NaCN HCl a	 b	 c	NaCN d
HCl e	PPh ₃ ab	1. NaH 2.  ac	 ad
BuLi ae	Br-PPh ₃ bc	1.  2. H ⁺ /H ₂ O bd	 be

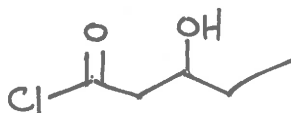
Completion Section: Answer the remaining questions on the exam itself. Read the questions carefully and provide complete explanations.

21. Draw the structure for each compound listed below. (2 points each)

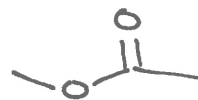
(a) 2-propylpyrrolidine



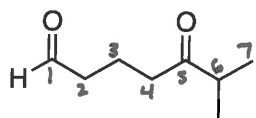
(b) β -hydroxyvaleryl chloride



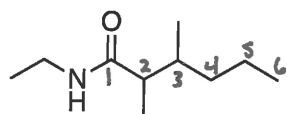
(c) methyl ethanoate



22. Provide the IUPAC Name for each structure shown below. (2 points each)

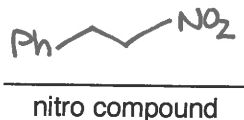
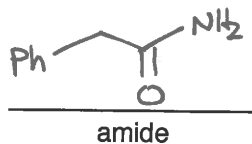
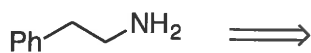


6-methyl-5-oxoheptanal

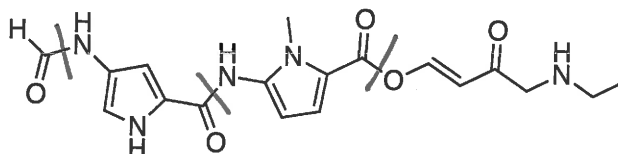


N-ethyl-2,3-dimethylhexanamide

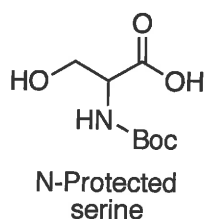
23. The amine shown below can be prepared by reducing an amide, a nitro compound, or a nitrile. Show the structure for each of these three potential starting materials. (1 points each)



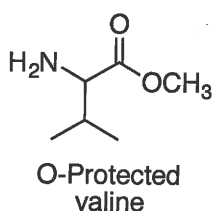
24. In the compound below, draw a line through every bond that would be cleaved under acid mediated hydrolysis conditions (H^+/H_2O). (3 points)



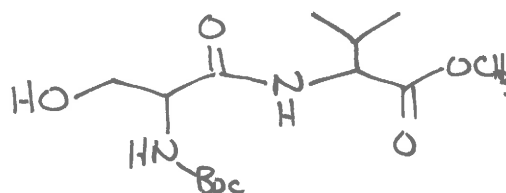
25. Below are the structures of serine (N-protected with a Boc group) and valine (O-protected as a methyl ester). Show the dipeptide fragment that results from a DCC coupling reaction. (3 points)



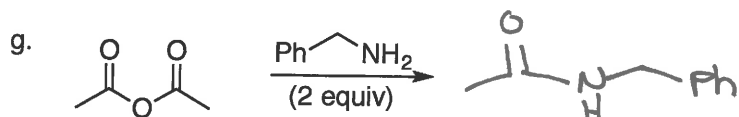
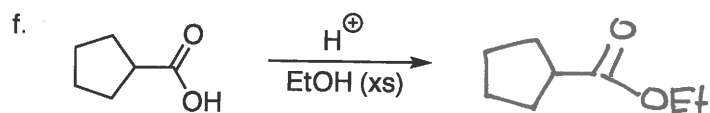
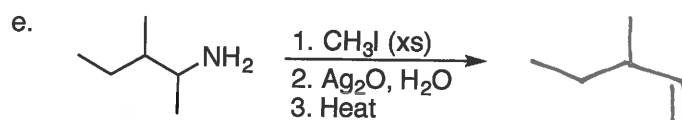
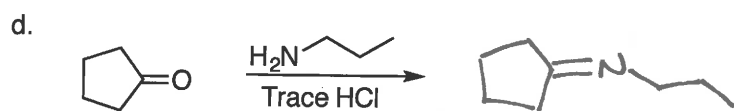
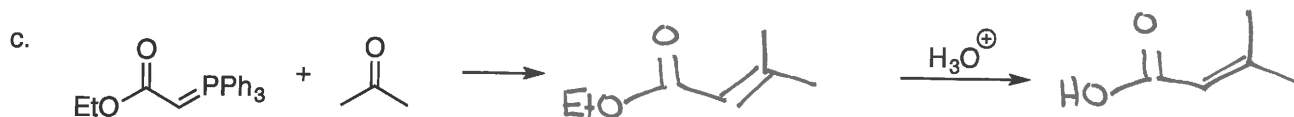
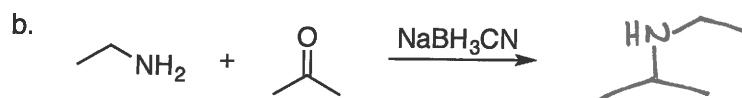
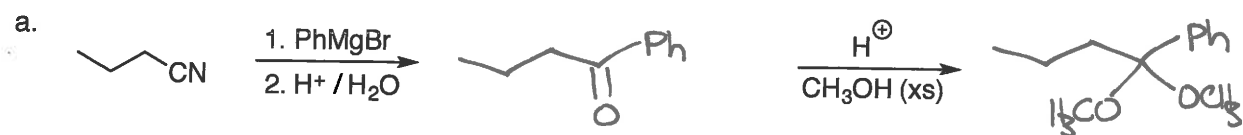
+



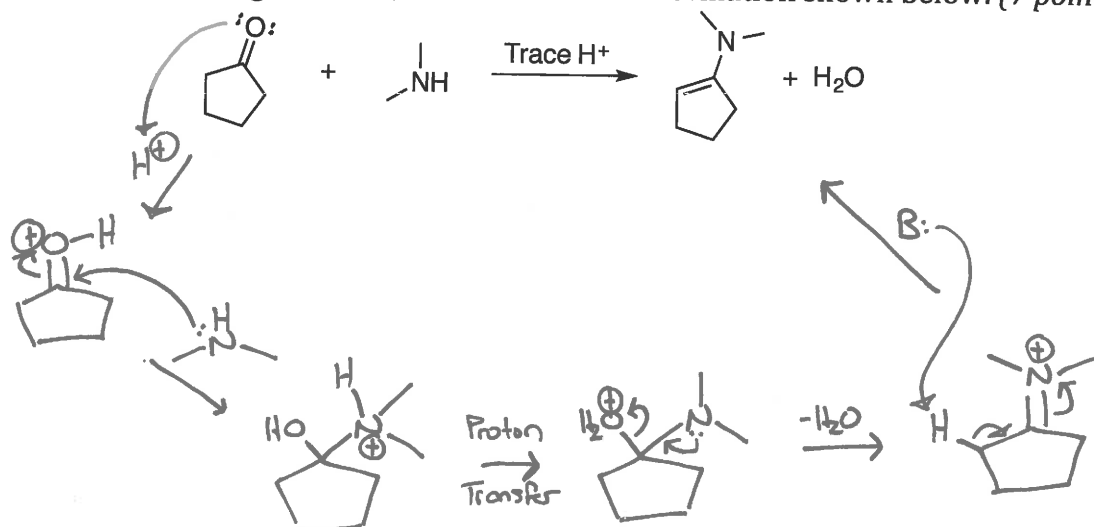
DCC



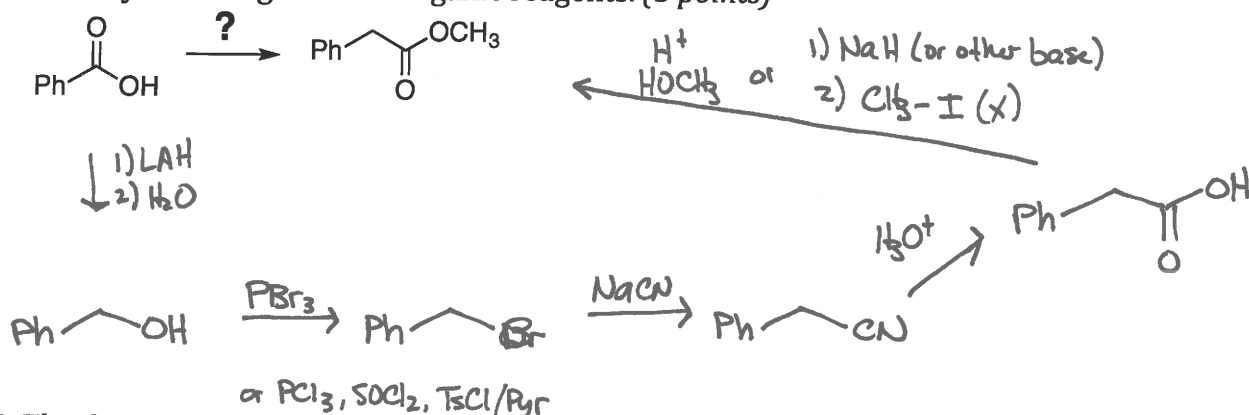
26. Predict the major organic product for each reaction shown below. Note: some reactions have multiple steps associated with them. (2 points each)



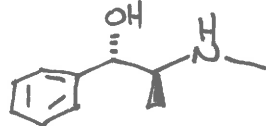
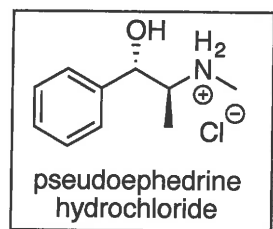
27. Draw the electron pushing mechanism for the enamine formation shown below. (7 points)



28. Propose a reasonable synthesis for the compound below using the provided starting material and any other organic or inorganic reagents. (5 points)



29. The decongestant pseudoephedrine is typically sold as a hydrochloride salt. Draw the "free-base" form of pseudoephedrine and list two reasons why it might be sold in the salt form. (4 pts)

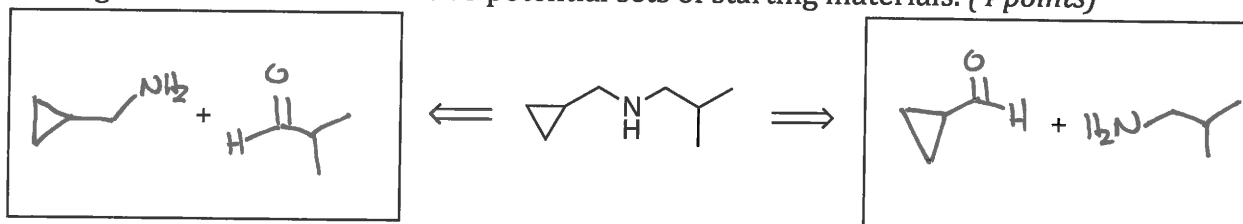


"Free Base"

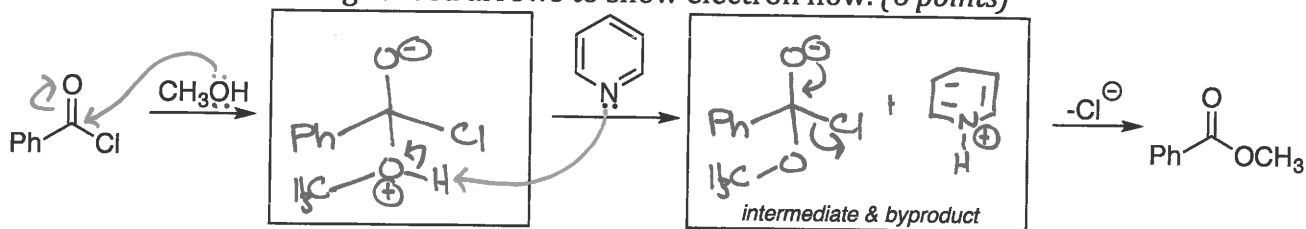
Sold as an HCl salt because:

- Salt does not have amine odor
- Salt has longer shelf life
- Salt is a solid = easier to handle
- easier to put salt in tablet form
- Salt is H_2O soluble \rightarrow can be put into liquid medicine.
- H_2O soluble \rightarrow will go into bloodstream faster

30. The amine shown below can be prepared via a reductive amination using two different sets of starting materials. Provide the two potential sets of starting materials. (4 points)



31. Show the full electron pushing mechanism for the reaction below by filling in the boxes with the intermediates and adding curved arrows to show electron flow. (6 points)



32. **Bonus:** Identify all products that are formed upon treatment of the compound below with aqueous acid. (+2 points)

