version: 335

Exam 3 - S23 - McCord - ch302n

last name _____ first name _____ signature _____

1																	18
1 H 1.008	2											13	14	15	16	17	2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3	4	5	6	7	8	9	10	11	12	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 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	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 65.38	31 Ga 69.72	32 Ge 72.64	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 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.20	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (267)	105 Db (268)	106 Sg (269)	107 Bh (270)	108 Hs (270)	109 Mt (278)	110 Ds (281)	111 Rg (282)	112 Cn (285)	113 Nh (286)	114 Fl (289)	115 Mc (290)	116 Lv (293)	117 Ts (294)	118 Og (294)

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
90 Th 232.04	91 Pa 231.04	92 U 238.03	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 (266)

constants

$R = 0.08206$ L atm/mol K

$R = 8.314$ J/mol K

$N_A = 6.022 \times 10^{23}$ /mol

$h = 6.626 \times 10^{-34}$ J·s

$c = 3.00 \times 10^8$ m/s

$g = 9.81$ m/s^2

conversions

1 atm = 760 torr

1 atm = 101325 Pa

1 atm = 1.01325 bar

1 bar = 10^5 Pa

°F = °C(1.8) + 32

K = °C + 273.15

conversions

1 in = 2.54 cm

1 ft = 12 in

1 yd = 3 ft

1 mi = 5280 ft

1 lb = 453.6 g

1 ton = 2000 lbs

1 tonne = 1000 kg

1 gal = 3.785 L

1 gal = 231 in^3

1 gal = 128 fl oz

1 fl oz = 29.57 mL

water data

$C_{s,ice} = 2.09$ J/g °C

$C_{s,water} = 4.184$ J/g °C

$C_{s,steam} = 2.03$ J/g °C

$\rho_{water} = 1.00$ g/mL

$\rho_{ice} = 0.9167$ g/mL

$\rho_{seawater} = 1.024$ g/mL

$\Delta H_{fus} = 334$ J/g

$\Delta H_{vap} = 2260$ J/g

$K_w = 1.0 \times 10^{-14}$

This exam should have exactly 25 questions. Each question is equally weighted at 4 points each. Bubble in your answer choices on the online bubblehseet provided. Your score is based on what you bubble on the bubblesheet and not what is circled on the exam.

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1. Which of the following plastics is NOT formed by an addition mechanism?

a. LDPE

●b. PET

c. PS

d. HDPE

e. PVC

f. PP

Explanation: PET is formed via condensation.

---

2. Which of the following polymers is the "new" version of the steel-belted radial tire?

a. silk

b. bakelite

●c. kevlar

d. nylon

e. teflon

f. polypropylene

Explanation: Kevlar is used to make belted radial tires (and bulletproof vests).

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3. Identify the plastic from the structure of its monomer.

a. PET

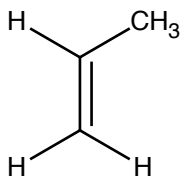
b. PS

c. LDPE

d. HDPE

●e. PP

f. PVC



Explanation: This is propene, or propylene which makes PP (polypropylene).

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4. Which feature differentiates RNA nucleotides and allows them to code for the production of different proteins?

a. the R-group

●b. the nitrogenous base

c. the ribose sugar

d. the phosphate group

e. the deoxyribose sugar

Explanation: The nitrogenous base of an RNA nucleotide differentiates it. All RNA nucleotides consist of a ribose sugar and a phosphate group.

---

5. Five of the Big 6 plastics are all either composed or direct substitutions of which monomer?

a. polychloroethane

b. diamine

c. ethyne

d. methylamine

●e. ethylene

Explanation: Five of the Big 6 plastics are composed of ethene (ethylene), $H_2C{=}CH_2$.

---

6. Which of the following functional groups contain a carbonyl group?

I. ketone

II. aldehyde

III. alcohol

IV. carboxylic acid

a. II and IV

b. I and IV

c. I, III, and IV

●d. I, II, and IV

e. I, II, III, and IV

Explanation: A carbonyl group is a carbon with a double bond to oxygen. Ketones, carboxylic acids, and aldehydes all contain carbonyl groups.

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7. The structure show below is that of a psychoactive stimulant drug that is found in tobacco products. What is the *complete* chemical formula of this drug?

a. $C_9H_8N_2$

b. $C_9H_{10}N_2$

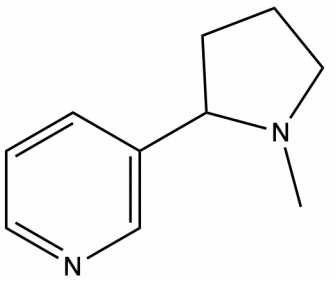
●c. $C_{10}H_{14}N_2$

d. $C_{10}H_7N_2$

e. $C_{10}H_{12}N_2$

f. $C_{10}H_{10}N_2$

g. $C_9H_{12}N_2$



Explanation: There are 10 carbons, 14 hydrogens, and two nitrogens.

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8. Identify the plastic from the structure of its monomer.

a. LDPE

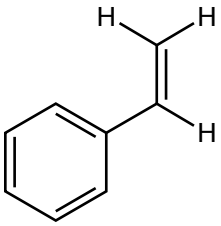
b. PVC

c. PET

●d. PS

e. PP

f. HDPE



Explanation: This is PS.

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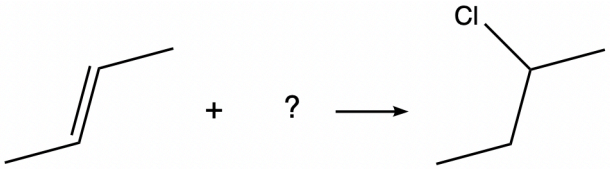
9. Given the reaction below, what reactant should be used in order to create the product?



a. CH_3Cl

●b. HCl

c. HOCl

d. Cl_2

e. BrCl

Explanation: HCl is added across the double bond

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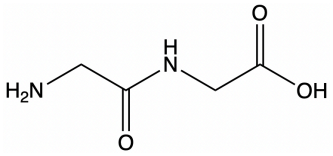
10. The image below is a dipeptide, an organic compound derived from two amino acids.



Which of the following statements is true?

a. The two amino acids that formed this dipeptide reacted in an addition reaction mechanism.

●b. The compound contains an amide link.

c. The compound contains a primary amine and a tertiary amine.

d. The compound contains an ester link.

Explanation: none

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11. Name the compound shown below.

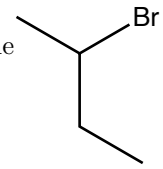
a. 3-bromobutane

b. 1-bromo-1-methylpropane

c. 2-bromopentane

●d. 2-bromobutane

e. 4-bromobutane



Explanation: longest chain is 4-carbons and the there is a bromine on position 2. 2-bromobutane.

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12. Which of the following is a set of two sugar-based polymers?

a. cellulose and PET

b. starch and PET

c. wool and silk

d. wool and rubber

● e. cellulose and starch

Explanation: Cellulose and starch are repeating glucose monomers.

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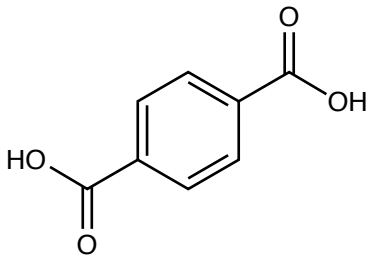
13. The following structure is a precursor (reactant) to make one of the polymers we have studied. Which polymer (plastic) is it?



a. cellulose

b. bakelite

c. PS

d. nylon

● e. PET

f. proteins

Explanation: The structure is terephthalic acid which is mixed with glycol to make PET (polyethylene terephthalate).

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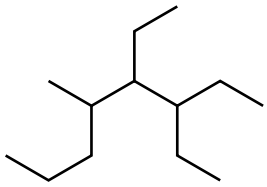
14. What is the name of this compound?



a. 2-propyl-3,4-diethyloctane

b. 5,6-diethyl-4-methyloctane

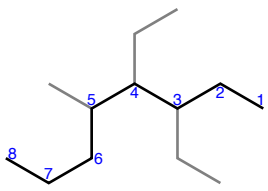
c. 3,4,5-triethyloctane

d. 2-propyl-3,4-diethylhexane

e. 3,4-diethyl-2-propylhexane

● f. 3,4-diethyl-5-methyloctane

Explanation: There are 8 carbons in the chain. 3 branch points with two ethyl groups at positions 3 and 4, and a methy group at position 5. Go alphabetical on ordering, so ethyls are first to get 3,4-diethyl-5-methyloctane.



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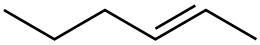
15. What is the name of the product for the following addition reaction?



● a. 2,3 - dibromohexane

b. 4 - bromohexane

c. 1,2 - bromohexane

d. 4,5 - dibromohexane

e. 2 - bromohexane

Explanation: In the addition reaction, one bromine atom will be placed on each of the carbons sharing a double bond to create the following product: The IUPAC name for this organic compound is 2,3 - dibromohexane because the carbons with the bromine substituents are at carbons 2 and 3, and there are a total of six carbons for the molecule to be a hexane.

---

16. Dr. McCord said he still has a lot of old records (LPs) that play on a turntable. What are these records made from?

● a. PVC

b. PET

c. PS

d. LDPE

e. PP

f. HDPE

Explanation: PVC is used to make vinyl records. The "V" in PVC stands for vinyl. Now very trendy and your hipster friends talk about their lit vinyl collection.

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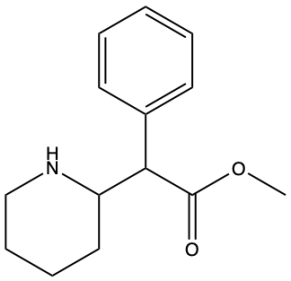
17. Methylphenidate, better known as Ritalin, is a medication that can treat ADHD and narcolepsy. What are two functional groups shown on the ritalin molecule below?



a. secondary amine, ether

● b. secondary amine, ester

c. nitrile, ether

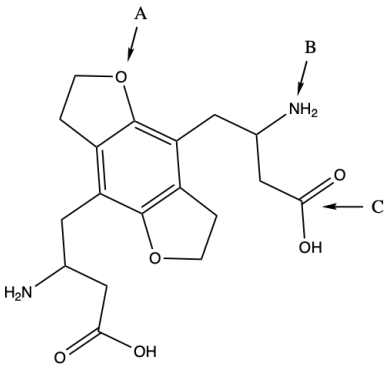
d. nitrile, ketone

e. primary amine, ester

Explanation: The main functional groups on this molecule include a secondary amine and an ester.

---

18. (Part 1 of 2) If you look at it long enough, the following molecule starts to look like an adorable little critter. What is the functional group labeled A?



a. amide

b. alcohol

c. carboxylic acid

● d. ether

e. aldehyde

f. amine

g. ketone

Explanation: The R-O-R group is an ether.

---

19. (Part 2 of 2) What is the functional group labeled B?

a. amide

b. alcohol

c. carboxylic acid

● d. amine

e. aldehyde

f. ketone

Explanation: The -NH_2 group is an amine.

---

20. (Part 3 of 3) What is the functional group labeled C?

a. aldehyde

● b. carboxylic acid

c. amine

d. ketone

e. amide

f. alcohol

Explanation: This is a carboxylic acid.

---

21. Polyethylene can be fashioned into strong milk containers and flimsy plastic bags. Which particular type of polyethylene is used to make the opaque milk containers and why?

● a. HDPE because it a linear polymer

b. HDPE because it is more branched

c. LDPE because it is a linear polymer

d. LDPE because it is more branched

Explanation: HDPE can make liquid containers because it is more linear, creating a more rigid plastic.

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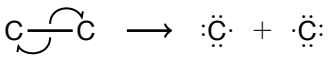
22. Chlorine is exposed to radiation and breaks into two identical chlorine radicals (shown below).This is an example of...



a. homonuclear fusion

b. heterolytic cleavage

● c. homolytic cleavage

d. homoisomeric cleavage

e. condensation

Explanation: The cleavage of a molecule into two identical parts is known as homolytic cleavage.

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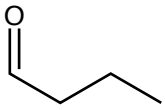
23. What is the functional group on propanal (shown below)?



● a. aldehyde

b. alcohol

c. alkene

d. hydroxyl

e. ketone

Explanation: A terminal carbonyl group is an aldehyde.

---

24. Which step of the addition mechanism will create a free radical on a growing polymer chain?

a. elimination

b. initiation

c. substitution

d. termination

● e. propagation

Explanation: The propagation step will grow the polymer chain by one monomer unit and create a radical on the opposite end.

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25. What is one major difference between LDPE and HDPE?

a. HDPE has a lower melting point than LDPE because LDPE is a stronger substance.

b. LDPE contains less branching which makes it more rigid and a much more crystalline-like substance.

c. Unlike HDPE, LDPE is not made via radical initiated reaction.

● d. Unlike LDPE, HDPE uses a special catalyst to make a completely straight chain with little branching.

Explanation: none

After you are finished and have all your answers circled, go to the front of the room and then use the QR code show below to pull up the virtual answer page for your exam. Enter the appropriate info plus all your answers - click the SUBMIT button. Double check your choices on the next page. Once your are sure, click the submit button on that page to enter your answers. Make sure you get the confirmation screen (different background color!) and show it to the TA or proctor. After that, turn in your exam and scratch paper. You're free to leave after that.

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