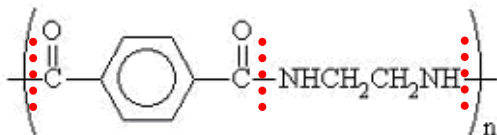


Part A: Multiple Choice Section [2 points each]

For each question, circle the letter of the one correct answer on your examination paper and enter this answer on the Test Scoring Sheet **in pencil only**. The Test Scoring Answer Sheet will be considered final. There is no penalty for incorrect answers. Answers must be transferred to the Test Scoring Answer Sheet **within** the time given for the examination.

1. What are the formulas of the monomers used to produce the nylon polymer below?



- condensation polymer; polyamide
- rxn: (dioate or diol acid) + diamine

- A) $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$ and $(\text{OHC})\text{-C}_6\text{H}_4\text{-(CHO)}$ (substituents are *para*) - diamine + dial X
 B) CH_3CH_3 and $(\text{H}_2\text{NOOC})\text{-C}_6\text{H}_4\text{-(COONH}_2)$ (substituents are *para*) - ethane + diamide X
 C) $\text{HOCH}_2\text{CH}_2\text{OH}$ and $(\text{H}_2\text{NOOC})\text{-C}_6\text{H}_4\text{-(COONH}_2)$ (substituents are *para*) - diol + diamide X
 D) $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$ and $(\text{CH}_3\text{OOC})\text{-C}_6\text{H}_4\text{-(COOCH}_3)$ (substituents are *para*) - diamine + dioate ✓

2. Polyacrylonitrile, whose trade name is Orlon, resembles wool fibres.

Two repeating units of this polymer are: $\text{---CH}_2\text{---CH(CN)---CH}_2\text{---CH(CN)---}$

- 2C repeating unit
- addition polymer

Which of the following is the monomer used to produce this polymer?

- requires alkene: $\text{CH}_2=\text{CH(CN)}$

- A) $\text{CH}_2\text{CH(CN)}$
 B) $\text{CH}_2\text{BrCH}_2\text{(CN)}$
 C) CH(Br)CH(CN)
 D) $\text{CH}_3\text{CH}_2\text{(CN)}$

3. The ester $\text{CH}_3(\text{CH}_2)_2\text{COO}(\text{CH}_2)_4\text{CH}_3$ is responsible for the odour of apricots.

This ester can be prepared from

Rxn: (carboxylic acid or acid halide) + alcohol

- A) $\text{CH}_3(\text{CH}_2)_2\text{COOH}$ and $\text{CH}_3(\text{CH}_2)_3\text{CHO}$
 B) $\text{CH}_3(\text{CH}_2)_2\text{COOH}$ and $\text{CH}_3(\text{CH}_2)_3\text{CH}_2\text{OH}$
 C) $\text{CH}_3(\text{CH}_2)_2\text{CHO}$ and $\text{CH}_3(\text{CH}_2)_3\text{COOH}$
 D) $\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{OH}$ and $\text{CH}_3(\text{CH}_2)_3\text{COOH}$

- carboxylic acid + aldehyde X
 - carboxylic acid + alcohol (correct # C's) ✓
 - aldehyde + carboxylic acid X
 - alcohol + carboxylic acid (wrong # C's on each) X

4. Treatment of ethanol with $\text{Na}_2\text{Cr}_2\text{O}_7(\text{aq})/\text{H}^+(\text{aq})$ yields compound A which reacts further to give B.

Identify A and B, respectively.

Rxn: $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{oxidation}} \text{aldehyde} \xrightarrow{\text{oxidation}} \text{carboxylic acid}$

- A) CH_3OCH_3 and CH_3CH_3
 B) CH_3CHO and CH_3COOH
 C) CH_3COCH_3 and CH_3COOH
 D) CH_3CHO and CH_3OCH_3

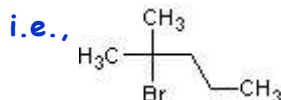
- ether & alkane
 - aldehyde & carboxylic acid
 - ketone & carboxylic acid
 - aldehyde & ether

5. What is the **major** product of the following reaction $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{CH}_3 + \text{Br}_2/h\nu \rightarrow ?$

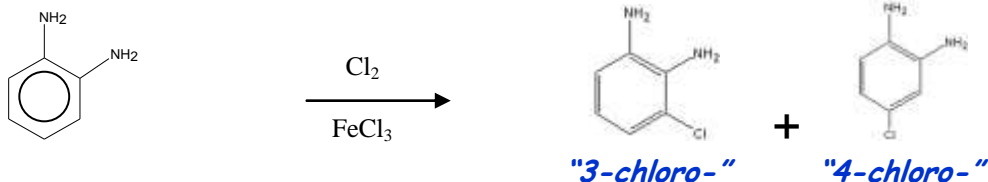
- A) 5-bromo-2-methylpentane
 B) 1,5-dibromo-2-methylpentane
 C) 2,3-dibromo-4-methylpentane
 D) 1-bromo-2-methylpentane
 E) 2-bromo-2-methylpentane

$2 \times 1^\circ \quad 3^\circ \quad 2^\circ \quad 2^\circ \quad 1^\circ$

major product - substitution of 3° H w/ Br

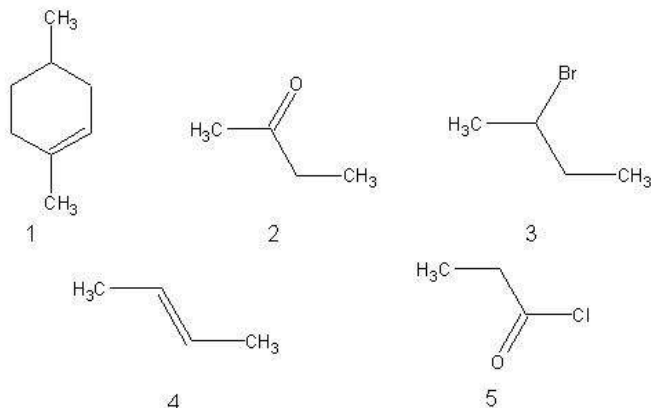


6. How many monochlorination products are predicted for the reaction below?



- A) 1
 B) 3
 C) 4
 D) 2

7. Which of the following compounds would be attacked ONLY by an electrophilic reagent?



- electrophilic reagents look for electrons

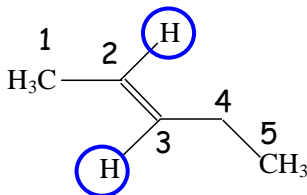
- if ONLY attacked by electrophilic reagent, can't have dipole moment

- looking for C=C sites

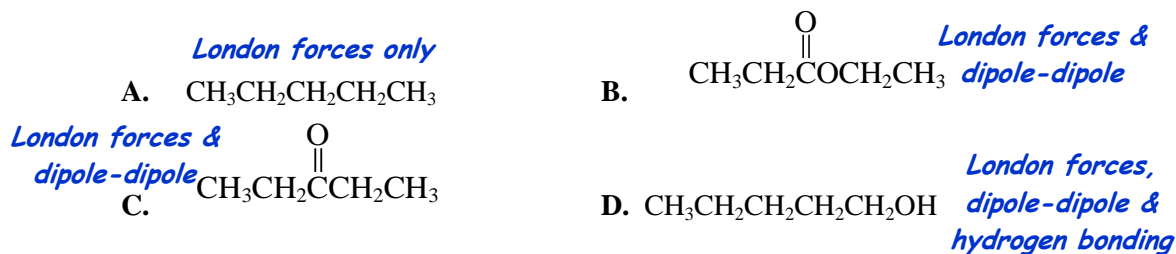
- A) 1, 2, 4 and 5 B) 2, 4 and 5 C) 2 and 5 D) 1 and 4 E) 3

8. Name the following compound.

- A) *trans*-2-pentene
 B) *trans*-1-methyl-1-butene
 C) *trans*-2-hexene
 D) *trans*-ethylmethylethene
 E) *trans*-1-ethyl-1-propene



Consider the following molecules for questions 9 and 10:



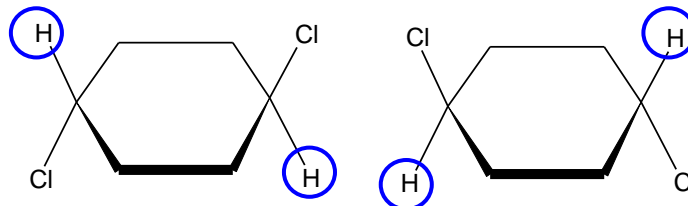
9. Which of the above molecules, A, B, C or D, has the highest water solubility?

10. Which of the above molecules A, B, C or D, has the lowest melting point?

11. Indicate the relationship between the following pairs of compounds:

Choose from:

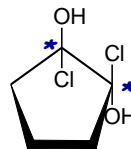
- A) not isomers
- B) structural isomers
- C) geometric isomers
- D) enantiomers
- E) identical**



not geometric b/c both trans; symmetrical & achiral; ∴ identical

12. Indicate what type of stereoisomers (if any) the following molecule has:

- A) enantiomers only
- B) geometric isomers only
- C) both geometric isomers and enantiomers**
- D) neither geometric isomers nor enantiomers

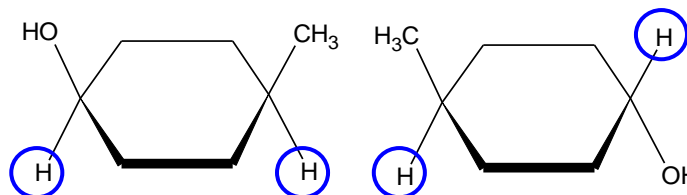


2 chiral centres; different groups to form cis/trans isomers

13. Indicate the relationship between the following pairs of compounds:

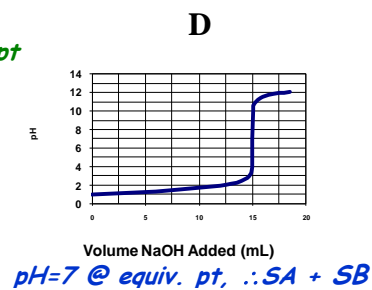
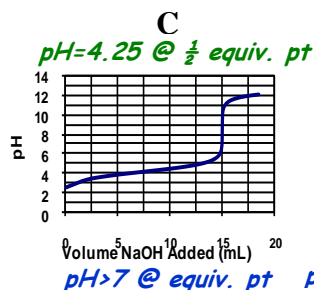
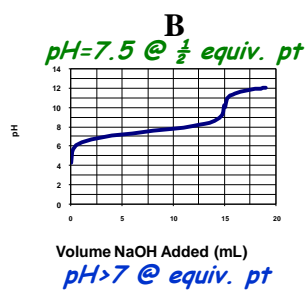
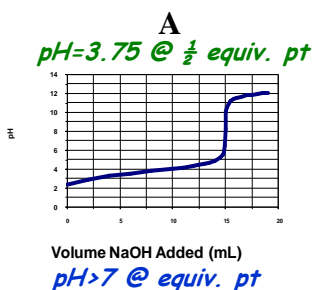
Choose from:

- A) identical
- B) enantiomers
- C) geometric isomers**
- D) not isomers
- E) structural isomers



cis and trans geometric isomers

The following graphs are for the titration of 15.0 mL of different acids with 0.100 M NaOH(aq).



14. Which of the above graphs, **A, B, C** or **D** is most likely a titration of a strong acid?

15. Which of the above graphs **A, B, C** or **D**, is the titration of a weak acid with the largest K_a value?

pH = pK_a @ ½ equiv. pt

16. Based on graph B, identify the acid: *pK_a = 7.5; K_a = 10^{-7.5} = 3.2 × 10⁻⁸*

- A) HCl
- B) HClO**
- C) CH₃COOH
- D) HF
- E) Need more information.

17. Which of the following indicators would be most suitable for the titration of 1.00 M NH₃(aq) with 1.00 M HCl(aq)?



acidic salt ∴ pH < 7 @ equiv. pt.

NH₄⁺(aq) is a weak acid; K_a = 5.6 × 10⁻¹⁰

∴ pK_{in} = 5.0 most suitable

- A) alizarin (pK_{IN} = 11.7)
- B) phenolphthalein (pK_{IN} = 9.4)
- C) bromothymol blue (pK_{IN} = 7.1)
- D) methyl red (pK_{IN} = 5.0)**
- E) thymol blue (pK_{IN} = 1.7)

18. For the titration of 25.0 mL of 0.100 M $\text{HClO}_{(aq)}$ ($\text{p}K_a = 7.5$) with 0.100 M $\text{NaOH}_{(aq)}$, the main species in solution after addition of 6.0 mL of base are

A) $\text{ClO}^-_{(aq)}$ and $\text{Na}^+_{(aq)}$.

B) $\text{HClO}_{(aq)}$.

C) $\text{HClO}_{(aq)}$, $\text{OH}^-_{(aq)}$ and $\text{Na}^+_{(aq)}$.

D) $\text{ClO}^-_{(aq)}$, $\text{Na}^+_{(aq)}$ and $\text{OH}^-_{(aq)}$.

E) $\text{HClO}_{(aq)}$, $\text{ClO}^-_{(aq)}$ and $\text{Na}^+_{(aq)}$.



I 0.60 mmol(LR) 0

E 1.9 mmol 0 0.60 mmol

~3: 1 buffer solution!

19. At the equivalence point in the titration of 0.300 M $\text{HCOOH}_{(aq)}$ and 0.150 M $\text{KOH}_{(aq)}$,

A) $[\text{HCO}_2^-] = 0.100 \text{ M}$.

B) $[\text{HCO}_2^-] = 0.150 \text{ M}$.

C) the pH is less than 7.

D) $[\text{HCOOH}] = 0.075 \text{ M}$.

E) $[\text{HCOOH}] = 0.150 \text{ M}$.



0.300 M 0.150 M @ equiv. pt. # moles must equal!

1 L

0.300 moles \rightarrow 0.300 moles \therefore need 2L of KOH & $V_{\text{total}} = 3\text{L}$

$[\text{HCOO}^-] = 0.300 \text{ moles}/3 \text{ L} = 0.100 \text{ M}$ at equiv. pt.

20. If 100 mL of each of the following solutions is mixed, which one produces a buffer?

A) 1.0 M $\text{NH}_3_{(aq)}$ + 1.0 M $\text{HCl}_{(aq)}$ **WB + SA w/ equal moles = equiv. pt.**

B) 1.0 M $\text{NH}_3_{(aq)}$ + 0.40 M $\text{HCl}_{(aq)}$ **WB + SA w/ SA LR = buffer!**

C) 1.0 M $\text{NH}_3_{(aq)}$ + 0.45 M $\text{KOH}_{(aq)}$ **WB + SB = basic sol'n/ not a bufer**

D) 1.0 M $\text{NH}_4\text{Cl}_{(aq)}$ + 1.0 M $\text{KOH}_{(aq)}$ **WA + SB w/ equal moles = equiv. pt.**

E) 1.0 M $\text{NH}_4\text{Cl}_{(aq)}$ + 0.35 M $\text{HCl}_{(aq)}$ **WA + SA = acidic sol'n/ not a bufer**

21. Calculate the equilibrium constant for any reaction that occurs when potassium hydroxide is added to a hydrofluoric acid/sodium fluoride, $\text{HF}_{(aq)}/\text{NaF}_{(aq)}$, buffer.

A) 2.9×10^3

B) 3.4×10^{-4}

C) 2.9×10^{14}

D) 2.9×10^{-11}

E) 3.4×10^{10}

Added SB will only react with weak acid in buffer solution.



Water on product side of equ'n, $\therefore K_{\text{eq}} = 1/K$ (reverse expression to definitions)

Water w/ weak base, $\therefore K_{\text{eq}} = 1/K_b(\text{F}^-) = K_a(\text{HF})/K_w$

22. Which one of the following salts gives a basic aqueous solution?

A) FeCl_3 **acidic salt b/c of Fe^{3+}**

B) $\text{CH}_3\text{NH}_3\text{Cl}$ **acidic salt b/c of CH_3NH_3^+**

C) NaHCO_3 **basic salt b/c of HCO_3^-**

D) NH_4ClO_4 **acidic salt b/c of NH_4^+**

E) NaHSO_4 **acidic salt b/c of HSO_4^-**

23. The following 0.10M aqueous solutions are arranged in order of increasing pH.



Which one of the following 0.10 M aqueous solutions is the unknown?

A) HF **$K_a = 3.4 \times 10^{-4}$ - too strong**

B) $(\text{CH}_3)_3\text{N}$ **$K_b = 6.5 \times 10^{-5}$**

C) $(\text{C}_2\text{H}_5)_3\text{N}$ **$K_b = 1.0 \times 10^{-3}$ - too strong**

D) CH_3COOH **$K_a = 1.8 \times 10^{-5}$ - too strong**

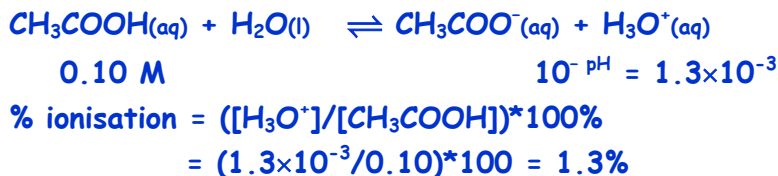
E) $\text{C}_5\text{H}_5\text{NHBr}$ **$K_a = K_w/K_b(\text{C}_5\text{H}_5\text{N}) = 5.6 \times 10^{-6}$ - too strong**

$\text{HClO} - K_a = 3.2 \times 10^{-8}$

\therefore looking for an acid weaker than HClO or a base weaker than CH_3NH_2

24. The pH of 0.10 M CH₃COOH is 2.87. What is the percent ionisation of CH₃COOH(aq)?

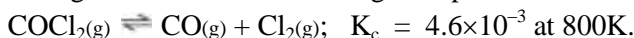
- A) 1.3%
- B) 10%
- C) 0.13%
- D) 5.0%
- E) 13%



25. Which pairs of ions can exist in large concentrations simultaneously in aqueous solution?

- A) Ag⁺ and Cl⁻ → AgCl(s)
- B) Ca²⁺ and CO₃²⁻ → CaCO₃(s)
- C) H₃O⁺ and I⁻ → no rxn b/c I⁻ is unreactive.
- D) Ba²⁺ and SO₄²⁻ → BaSO₄(s)
- E) H₃O⁺ and CN⁻ → HCN(aq) + H₂O(l)

26. Phosgene was used as a poisonous gas in World War I. At high temperatures it decomposes as follows:

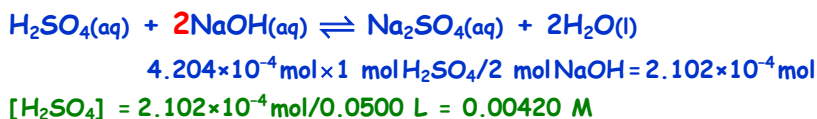


If 1.5 millimoles of COCl₂, CO & Cl₂ are mixed in a 1 L container at 800K, which of the following statements is true?

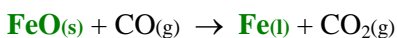
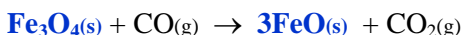
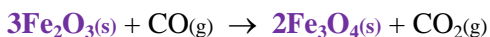
- A) [COCl₂] = [CO] = [Cl₂] at equilibrium. **Q = ([CO][Cl₂])/[COCl₂]**
- B) The system is at equilibrium and therefore no net change occurs. **Q = (1.5 × 10⁻³)(1.5 × 10⁻³)/(1.5 × 10⁻³)**
- C) COCl₂(g) will be formed until equilibrium is reached. **Q = 1.5 × 10⁻³ < K**
- D) CO(g) and Cl₂(g) will be formed until equilibrium is reached. **∴ too few products & rxn moves L→R**

27. A 50.0-mL sample of sulphuric acid from a lake near a mine was titrated to the stoichiometric point with 4.204 × 10⁻⁴ moles sodium hydroxide. What is the molarity of sulphuric acid in the sample?

- A) 0.00420 M
- B) 0.000210 M
- C) 0.0105 M
- D) 0.00841 M
- E) 0.0168 M



28. The production of iron from its ores involves several chemical processes that take place in several stages and in different temperature zones within a blast furnace. Here are the key reactions:



If 6.0 megamoles of Fe(l) are to be produced, how many megamoles of Fe₂O₃(s) are required?

- A) 6.0
- B) 2.0 **6.0 Mmol × (1 mol FeO/1 mol Fe) = 6.0 Mmol FeO**
- C) 12 **6.0 Mmol × (1 mol Fe₃O₄/3 mol FeO) = 2.0 Mmol Fe₃O₄**
- D) 1.0 **2.0 Mmol × (3 mol Fe₂O₃/2 mol Fe₃O₄) = 3.0 Mmol Fe₂O₃**
- E) 3.0

29. Penicillin G contains 9.59% sulphur. If there is one sulphur atom per penicillin molecule, what is the molar mass of penicillin G?

- A) 2990 g mol⁻¹
- B) 102 g mol⁻¹
- C) 307 g mol⁻¹
- D) 334 g mol⁻¹**
- E) 3070 g mol⁻¹

$$(9.59/100) = (S/\text{penicillin G}) = (32.06 \text{ g}\cdot\text{mol}^{-1} / x)$$

$$x = 334 \text{ g}\cdot\text{mol}^{-1}$$

30. The Recommended Daily Allowance (RDA) for vitamin C (C₆H₈O₆) is 90 mg or 5.1 × 10⁻⁴ moles. How many oxygen atoms are in the RDA for vitamin C?

- A) 1.4 × 10⁻²⁸ atoms
- B) 1.8 × 10²¹ atoms**
- C) 5.1 × 10¹⁹ atoms
- D) 5.1 × 10⁻²⁷ atoms
- E) 3.1 × 10²⁰ atoms

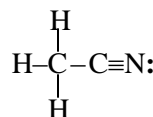
$$5.1 \times 10^{-4} \text{ mol vit. C} \times (6 \text{ mol oxygen atoms} / 1 \text{ mol vit C}) = 3.1 \times 10^{-3} \text{ moles O atoms}$$

$$3.1 \times 10^{-3} \text{ moles O atoms} \times (6.022 \times 10^{23} \text{ atoms} / 1 \text{ mol}) = 1.8 \times 10^{21} \text{ oxygen atoms}$$

31. How many sigma and how many pi bonds are present in acetonitrile, CH₃CN?

- A) 4 sigma and 3 pi
- B) 5 sigma and 1 pi
- C) 7 sigma and 0 pi
- D) 5 sigma and 2 pi**
- E) 3 sigma and 3 pi

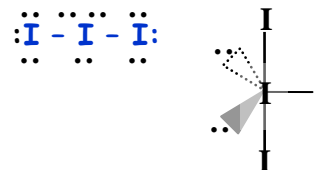
1 sigma bond - for every bond
1 pi bond in a double bond
2 pi bonds in a triple bond



32. What type of hybrid orbitals are used by the central iodine atom in I₃⁻?

- A) sp³d²
- B) sp²
- C) sp³d**
- D) sp³
- E) sp

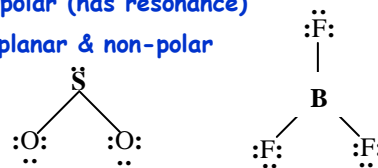
V = (7*3)+1 = 22 electrons
AB₂E₃; steric# = 5
hybrid: sp³d



33. In the case of SO₂ and BF₃, are they polar molecules?

- A) Both are polar molecules.
- B) Only SO₂ is a polar molecule.**
- C) Only BF₃ is a polar molecule.
- D) Neither are polar molecules.

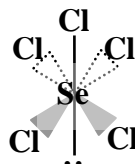
SO₂: V=(3*6) = 18 e⁻s; AB₂E = bent & polar (has resonance)
BF₃: V=3+(3*7)=24 e⁻s; AB₃ = trigonal planar & non-polar



34. What is the shape of SeCl₅⁻?

- A) seesaw
- B) square planar
- C) tetrahedral
- D) trigonal bipyramidal
- E) square pyramidal**

V = 6 + (5*7) + 1 = 42 e⁻s
AB₅E; steric# = 6



35. The F-S-F bond angle in SF₂ is

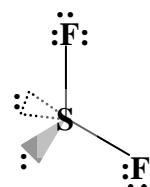
- A) < 109.5°
- B) 109.5°
- C) < 120° but > 109°
- D) 120°
- E) 180°

$$V = 6 + (2 \times 7) = 20 \text{ e}^- \text{ s}$$

$$AB_2E_2; \text{ steric\#} = 4$$

framework = tetrahedral (109.5°)

shape = bent (\therefore < 109.5°)



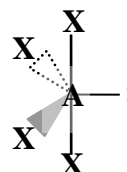
36. What is the shape of a molecule that has the formula AX₄ **plus** one pair of non-bonding electrons on the central atom?

- A) tetrahedral
- B) square pyramidal
- C) square planar
- D) seesaw
- E) trigonal bipyramidal

$$AX_4E; \text{ steric\#} = 5$$

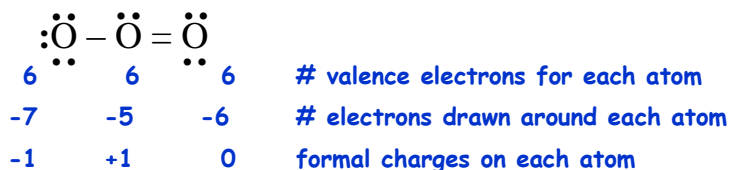
framework = trigonal bipyramidal

shape = seesaw



37. For the Lewis structure below, the formal charges on the atoms moving **from left to right** are

- A) +1, -1, 0
- B) 0, +1, -1
- C) -1, +1, 0
- D) -1, 0, +1
- E) +1, 0, -1



38. How many unpaired electrons are there in an ion of iron(III), Fe³⁺?

- A) 1
- B) 3
- C) 5
- D) 2
- E) 4

$$\text{Fe (Z=26): } [\text{Ar}]3d^64s^2$$

$$\text{Fe}^{3+}: [\text{Ar}]3d^5$$

39. What is the ground-state electron configuration of chromium (Cr)?

- A) [Ar]3d⁴4s²
- B) [Ar]3d⁵4s¹
- C) [Ar]4d⁴4s²
- D) [Ar]4d⁵4s¹
- E) [Ar]3d⁶

$$\text{Cr (Z=24): } [\text{Ar}]3d^44s^2 \rightarrow [\text{Ar}]3d^54s^1$$

40. Which one of the following has the **highest** first ionisation energy?

- A) oxygen
- B) nitrogen
- C) carbon
- D) boron
- E) beryllium

General Trend: IE increases across a row, i.e., Be < B < C < N < O

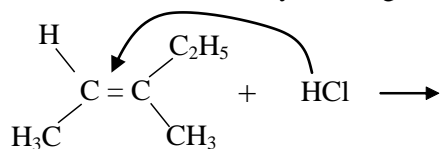
Changes due to electron configurations: B < Be < C < O < N

$$\text{i.e., } 2p^1 < 2s^2 < 2p^2 < 2p^4 < 2p^3$$

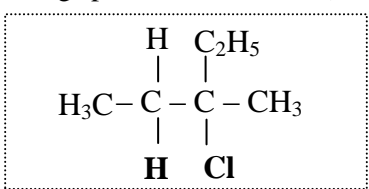
i.e., it takes more energy to remove an e⁻ from a filled or half-filled shell

Part B [20 points]

(a) For the reactions below by entering the missing species in each box. **(2 marks per box)** - 1 for each mistake within structures, i.e., too many H's; 5 bonds on C, etc..



addition reaction



- 1 if Cl and H are on the wrong C's.

Reaction follows Markovnikov's rule – H's go with friends; Cl on higher ordered carbon (3° C).

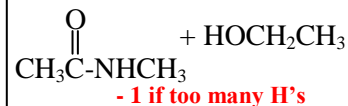
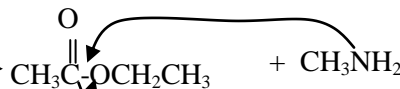
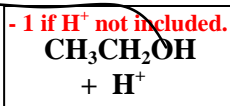
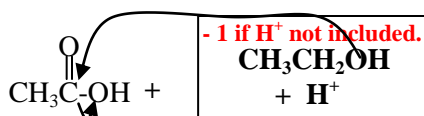
major product

8

/8



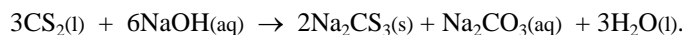
substitution reaction (alkyl halide + nucleophile = amine)



- 1 if too many H's

substitution rxn (carboxylic acid + alcohol/H⁺ = ester) substitution rxn (ester + amine = amide)

(b) A side reaction in the manufacturing of rayon from wood pulp is



If 117 g of CS₂ (MM = 76.0 g/mol) and 7.00 L of a 0.400M NaOH are reacted, determine how many moles of Na₂CS₃ are produced. **Show your work!**

CS₂: 117 g × 1 mol/76.0 g = 1.54 moles **(1 pt)**

1.54 moles CS₂ × 2 mol Na₂CS₃/3 mol CS₂

= 1.03 moles Na₂CS₃ **(1 pt)**

NaOH: 7.00 L × 0.400 M = 2.80 moles **(1 pt)**

2.80 moles NaOH × 2 mol Na₂CS₃/6 mol NaOH

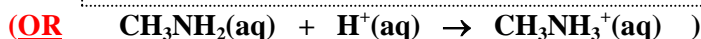
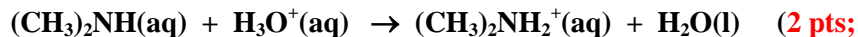
= 0.933 moles Na₂CS₃ **(1 pt)**

Final Answer: 0.933 moles Na₂CS₃ are produced **(1 pt for correct LR)**

5

(c) A buffer is prepared by adding 0.0550 moles of HBr to 200.0 mL of 0.675 M dimethylamine, (CH₃)₂NH(aq). Write the **net ionic equation** for the reaction. Show your work as you **calculate the pH** of this buffer, assuming no volume change.

Net Ionic Equation:



-1 for each mistake

I	0.135	0.0550	0	
C	<u>-0.0550</u>	<u>-0.0550</u>	<u>+0.0550</u>	
E	0.080 (1 pt)	0	0.0550 (1 pt)	

moles of CH₃NH₂ = 0.200 L × 0.675 M = 0.135 moles

OR

0.400 M 0.275 M

K_b((CH₃)₂NH) = 5.4 × 10⁻⁴; pK_b((CH₃)₂NH) = 3.27

K_a(CH₃NH₃⁺) = 1.0 × 10⁻¹⁴/5.4 × 10⁻⁴ = 1.85 × 10⁻¹¹

pK_a = -log(K_a) = 10.73 (1 pt)

pH = pK_a + log(CH₃NH₂)/(CH₃NH₃⁺) = 10.73 + log(0.080 mol)/(0.0550 mol)

OR = 10.73 + log(0.400M)/(0.275M) **(1 pt for correct sub)**

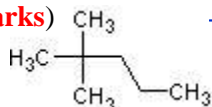
pH = 10.73 + 0.163 = 10.89

Final Answer: pH = 10.89 (± 0.02 = 10.87 – 10.91) (1 pt)

7

/7

BONUS QUESTION: How many monochlorination products are possible if 2,2-dimethylpentane reacts with Cl₂/hν? Write the number in the box. **(2 marks)**



- 1-chloro-2,2-dimethylpentane
- 3-chloro-2,2-dimethylpentane
- 4-chloro-2,2-dimethylpentane
- 5-chloro-2,2-dimethylpentane

4

Bonus

2/2

PAGE TOTAL

22/20

Intials:

DATA PAGE AND ROUGH WORK

Avogadro's Number = $6.022 \times 10^{23} \text{ mol}^{-1}$

Gas constant, $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$
 $= 8.314 \text{ L kPa mol}^{-1} \text{ K}^{-1}$
 $= 0.0821 \text{ L atm mol}^{-1} \text{ K}^{-1}$

1 atm = 101.3 kPa = 760 Torr

$h = 6.626 \times 10^{-34} \text{ J s}$

$c = 2.998 \times 10^8 \text{ m/s}$

$K_w = 1.0 \times 10^{-14}$ at 25°C

$273.15 \text{ K} = 0^\circ\text{C}$

1 megamole = 1×10^6 moles

Acidity and Basicity Constants at 25°C

Acid	K_a	Base	K_b
HSO_4^-	1.2×10^{-2}	$(\text{C}_2\text{H}_5)_3\text{N}$	1.0×10^{-3}
HCOOH	1.8×10^{-4}	CH_3NH_2	3.6×10^{-4}
HF	3.4×10^{-4}	$(\text{CH}_3)_2\text{NH}$	5.4×10^{-4}
CH_3COOH	1.8×10^{-5}	$(\text{CH}_3)_3\text{N}$	6.5×10^{-5}
HClO	3.2×10^{-8}	NH_3	1.8×10^{-5}
HBrO	2.0×10^{-9}	$\text{C}_5\text{H}_5\text{N}$ (pyridine)	1.8×10^{-9}
HCN	4.9×10^{-10}	$\text{C}_6\text{H}_5\text{NH}_2$ (aniline)	4.3×10^{-10}

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	H ¹																He ²	
2	Li ³	Be ⁴										B ⁵	C ⁶	N ⁷	O ⁸	F ⁹	Ne ¹⁰	
3	Na ¹¹	Mg ¹²										Al ¹³	Si ¹⁴	P ¹⁵	S ¹⁶	Cl ¹⁷	Ar ¹⁸	
4	K ¹⁹	Ca ²⁰	Sc ²¹	Ti ²²	V ²³	Cr ²⁴	Mn ²⁵	Fe ²⁶	Co ²⁷	Ni ²⁸	Cu ²⁹	Zn ³⁰	Ga ³¹	Ge ³²	As ³³	Se ³⁴	Br ³⁵	Kr ³⁶
5	Rb ³⁷	Sr ³⁸	Y ³⁹	Zr ⁴⁰	Nb ⁴¹	Mo ⁴²	Tc ⁴³	Ru ⁴⁴	Rh ⁴⁵	Pd ⁴⁶	Ag ⁴⁷	Cd ⁴⁸	In ⁴⁹	Sn ⁵⁰	Sb ⁵¹	Te ⁵²	I ⁵³	Xe ⁵⁴
6	Cs ⁵⁵	Ba ⁵⁶	La ⁵⁷	Hf ⁷²	Ta ⁷³	W ⁷⁴	Re ⁷⁵	Os ⁷⁶	Ir ⁷⁷	Pt ⁷⁸	Au ⁷⁹	Hg ⁸⁰	Tl ⁸¹	Pb ⁸²	Bi ⁸³	Po ⁸⁴	At ⁸⁵	Rn ⁸⁶
7	Fr ⁸⁷	Ra ⁸⁸	Ac ⁸⁹	Rf ¹⁰⁴	Db ¹⁰⁵	Sg ¹⁰⁶	Bh ¹⁰⁷	Hs ¹⁰⁸	Mt ¹⁰⁹	Ds ¹¹⁰								

Molar Masses

H	1.01	O	16.00	Al	26.98	Cl	35.45
C	12.01	F	19.00	Ar	39.95	Cu	63.54
N	14.01	Na	22.99	S	32.06	Ba	137.33

Solubility Rules for some ionic compounds in water

1.	All alkali metal and ammonium salts are SOLUBLE.
2.	All nitrate, acetate, chlorate & perchlorate salts are SOLUBLE.
3.	Most chloride, bromide & iodide salts are SOLUBLE -- EXCEPT for silver, lead or mercury (I) halides.
4.	Most sulphate salts are SOLUBLE -- EXCEPT for silver, lead, mercury (I), calcium, strontium or barium sulphates.
5.	Carbonate, phosphate & oxalate salts are NOT SOLUBLE -- EXCEPT for alkali metal or ammonium salts.
6.	Hydroxides, oxides & sulfides are NOT SOLUBLE -- EXCEPT for alkali metal, ammonium, calcium, strontium or barium salts.
7.	Chromate salts are NOT SOLUBLE -- EXCEPT for alkali metal, ammonium, calcium or magnesium chromates.

Circle how well you feel you did overall (out of 100) on this exam.

80 – 100	70 – 79	60 – 69	50 – 59	0 – 49
A	B	C	D	F