Exam Prep

1. $2Al_{(s)} + 6HCl_{(aq)} \rightarrow 3H_{2(g)} + 2AlCl_{3(aq)}$.

$$r_{H_2\ gas} = \frac{270.230 - 270.170\ g}{min}$$

$$= 0.06 \frac{g}{min}$$

mole ratio of Al : H_2

$$\frac{2}{x} = \frac{3}{0.03}$$

$$n = \frac{0.06 g}{2.016 \frac{g}{mol}}$$

$$= 0.03\ mol/min$$

$$2(0.03) = 3x$$

$$\frac{2(0.03)}{3} = x$$

$$\boxed{x = 0.02 \frac{mol}{min} Al}$$

2. $C_2H_{2(g)} + \frac{5}{2}O_{2(g)} \rightarrow 2CO_{2(g)} + H_2O_{(g)}$.

$\Delta H^\circ_{RX} = \sum \Delta H_f^\circ$ products $- \sum \Delta H_f^\circ$ reactants

$$= [2(-393.5) + (-241.8)] - [227 + 0]$$

$$= -1028.8 - 227$$

$$\boxed{= -1255.8\ KJ/mol\ C_2H_2}$$

3. $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$

1) x 2 $\quad 2N_2(g) + 2O_2(g) \rightarrow 4NO(g) \quad \Delta H = -361$

2) Flip x 2 $\quad 4NH_3(g) \rightarrow 2N_2(g) + 6H_2(g) \quad \Delta H = +183.6$

3) x 3 $\quad 6H_2(g) + 3O_2(g) \rightarrow 6H_2O \quad \Delta H = -1450.8$

$\boxed{\Delta H_{rx} = -1628.2\ \text{KJ}}$ per 4 mol of NH_3

4. $C_6H_5OH_{(aq)} + H_2O_{(l)} \rightleftharpoons C_6H_5O^-_{(aq)} + H_3O^+_{(aq)}$

	C_6H_5OH	$C_6H_5O^-$	H_3O^+
I	0.550 mol/L	0	0
C	-8.51138×10^{-6}	$+8.51138\times10^{-6}$	8.51138×10^{-6}
E	$[0.550 - 8.51138\times10^{-6}]$	8.51138×10^{-6}	8.51138×10^{-6}

$pH = -\log[H_3O^+] = 5.07$

$\therefore [H_3O^+] = 10^{-pH}$

$= 10^{-5.07}$

$= 8.51138\times10^{-6}$

$$K_a = \frac{[C_6H_5O^-][H_3O^+]}{[C_6H_5OH]}$$

$$= \frac{[8.51138\times10^{-6}]^2}{[0.550 - 8.51138\times10^{-6}]}$$

$$\boxed{= 1.32\times10^{-10}}$$

5. $2A + B + 2C \rightarrow 3X$

a) $r = K[A]^x [B]^y [C]^z$

b) Effect of [A]

Exp $\frac{2}{1}$ $\left[\frac{0.2}{0.1}\right]^x = \left[\frac{1.2\times10^{-3}}{3.0\times10^{-4}}\right]$

$2^x = 4$

$x = 2$

Effect of [B]

Exp $\frac{3}{1}$ $\left[\frac{0.3}{0.1}\right]^y = \left[\frac{3.0\times10^{-4}}{3.0\times10^{-4}}\right]$

$3^y = 1$

$y = 0$

Effect of [C]

Exp $\frac{4}{2}$ $\left[\frac{0.2}{0.1}\right]^z = \left[\frac{2.4\times10^{-3}}{1.2\times10^{-3}}\right]$

$2^z = 2$

$z = 1$

$r = K[A]^2[C]^1$

Second order A
Zero order B
first order C
} 3rd order overall

b) $r = K[A]^2[C]^1$

$3.0 \times 10^{-4}\ mol \cdot L^{-1} \cdot s^{-1} = K[0.1\ mol \cdot L^{-1}]^2[0.1\ mol \cdot L^{-1}]^1$

" " $= K[0.01\ mol^2 \cdot L^{-2}][0.1\ mol^1 \cdot L^{-1}]$

" " $= K[1 \times 10^{-3}\ mol^3 \cdot L^{-3}]$

$$\frac{3.0 \times 10^{-4}\ mol \cdot L^{-1} \cdot s^{-1}}{1.0 \times 10^{-3}\ mol^3 \cdot L^{-3}} = K$$

$K = 0.3\ mol^{-2} \cdot L^2 \cdot s^{-1}$

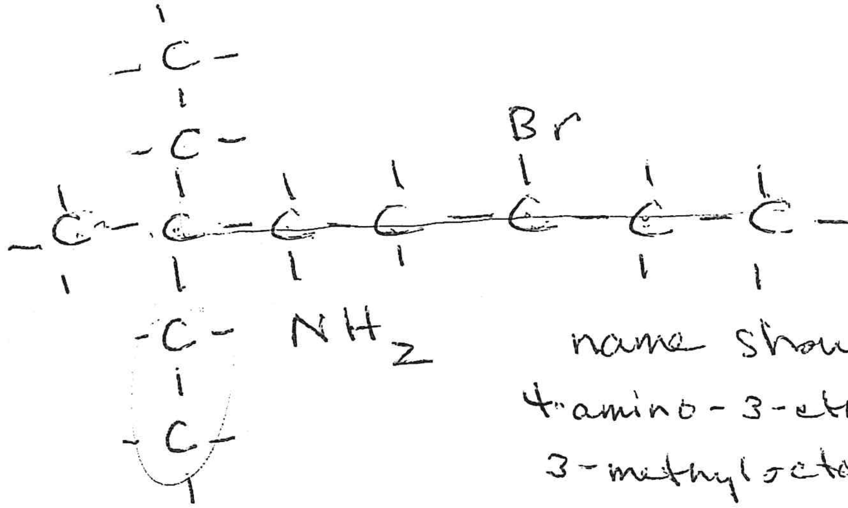
$$\boxed{K = 0.3 \frac{L}{mol^2 \cdot s}}$$

c) $r = 0.3 \frac{L}{mol^2 \cdot s}[0.4\ mol \cdot L^{-1}]^2[0.4\ mol \cdot L^{-1}]^0[0.4 \frac{Mol}{L}]^1$

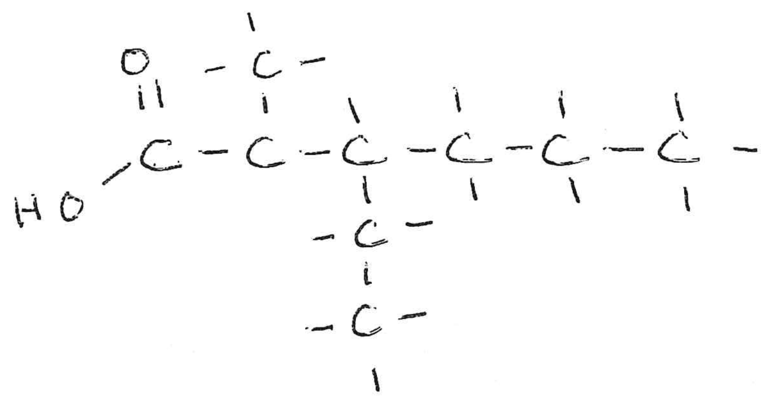
$$\boxed{r = 0.0192 \frac{mol}{L \cdot S}}$$

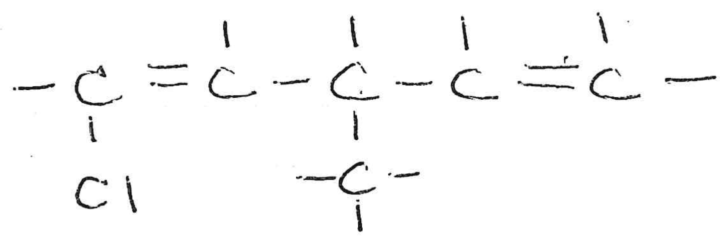
d) when [A] is doubled rate is 4x faster

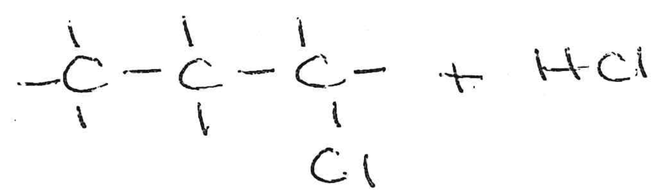
6.

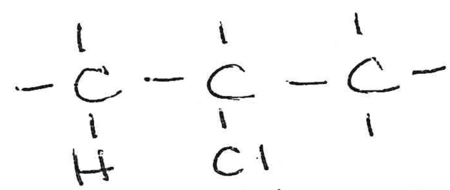
a) 

name should be
4-amino-3-ethyl-6-bromo-
3-methyloctane.

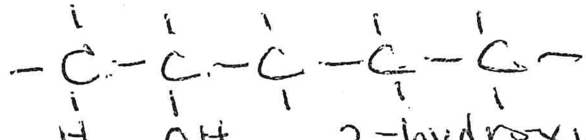
b) 

c) 

7. a) 

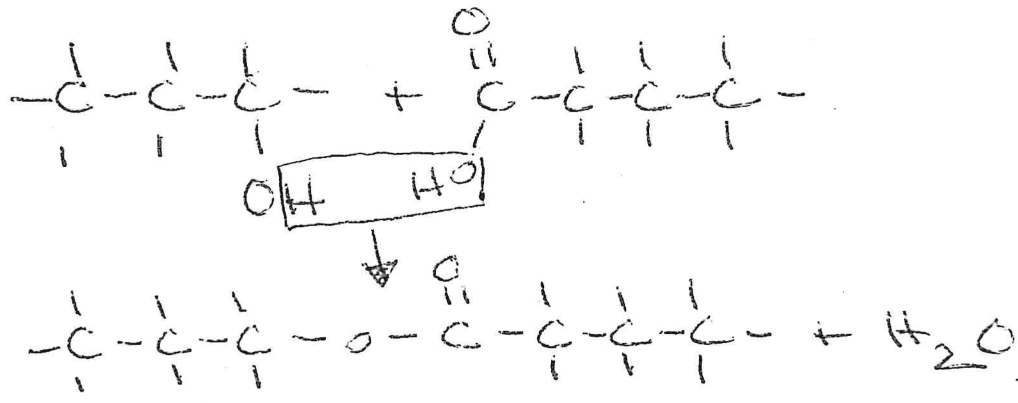
b) 

2-chloro propane

c) 

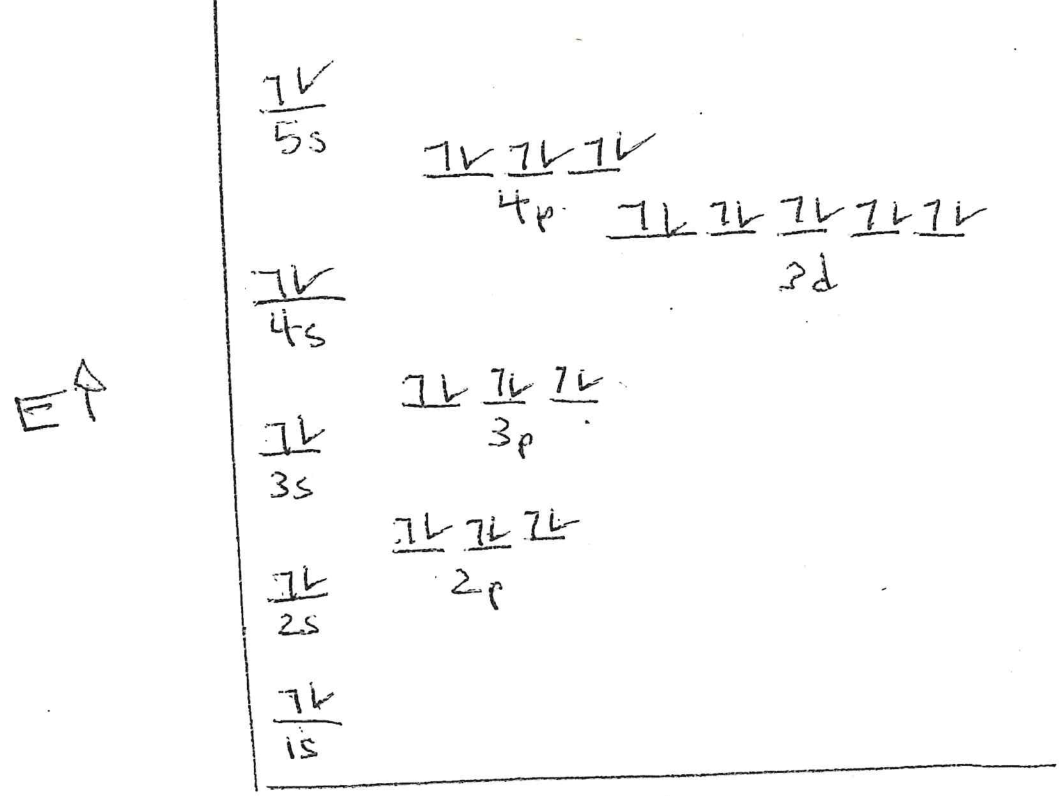
2-hydroxypentane
2-pentanol

7 d)



propyl butanoate

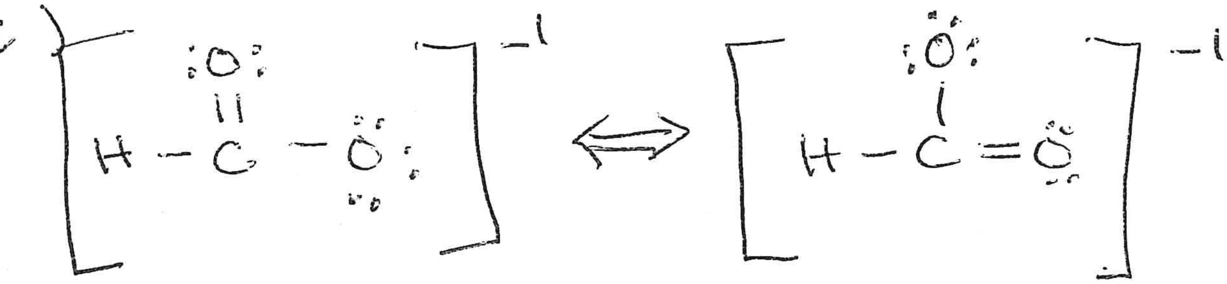
8. ^{38}Sr



9. i) Valence Shell Electron Pair Repulsion.

• used to predict geometry 3D. where electrostatic forces between a molecule's valence electrons are minimized around a central atom.

ii)



iii) Shape - Trigonal Planar
Hybridization - sp^2
around C

10.

a) Write the equation for Step 3 in the following reaction mechanism.

Step 1	$2NO \rightarrow N_2O_2$
Step 2	$N_2O_2 + H_2 \rightarrow N_2O + H_2O$
Step 3	$N_2O + H_2 \rightarrow N_2 + H_2O$
Overall Reaction	$2NO + 2H_2 \rightarrow N_2 + 2H_2O$

b) Identify a reaction intermediate in the above mechanism.

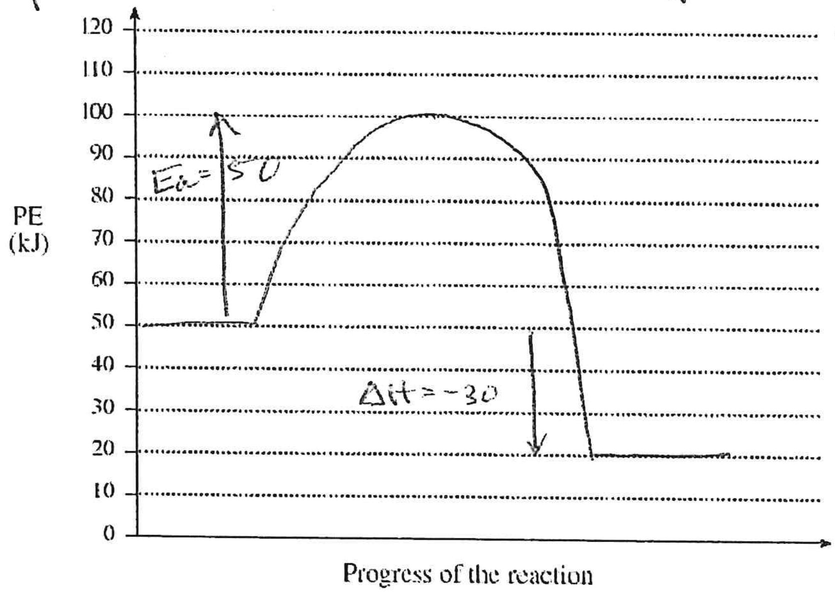
N_2O, N_2O_2.

11. **1.** Using the axes below, sketch a PE diagram for the reacting system where:

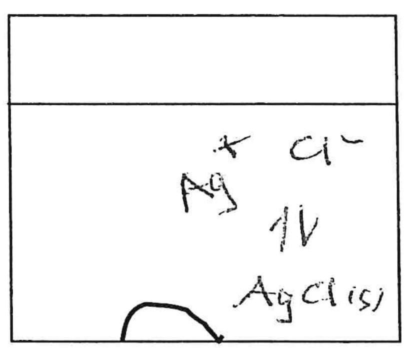
$\Delta H = -30$ kJ/mol

$E_a = 50$ kJ/mol

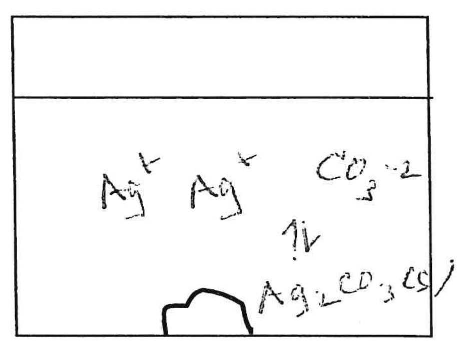
You can choose any P.E value to start at as long as Ea & ΔH yield appropriate values



12. Consider the following solutions at 25 °C



Saturated $AgCl_{(aq)}$ Ksp = 1.56×10^{-10}



Saturated $Ag_2CO_{3(aq)}$ Ksp = 6.15×10^{-12}

Using calculations, identify the solution with the greater $[Ag^+]$. You will need to look up Ksp for each salt.

$AgCl_{(s)} \rightleftharpoons Ag^+_{(aq)} + Cl^-_{(aq)}$

0 0

x x

$Ksp = [Ag^+][Cl^-]$

$1.56 \times 10^{-10} = [x][x]$

$1.56 \times 10^{-10} = x^2$

$Ag_2CO_{3(s)} \rightleftharpoons 2Ag^+ + CO_3^{-2}$

0 0

2x x

$Ksp = [Ag^+]^2[CO_3^{-2}]$

$6.15 \times 10^{-12} = [2x]^2[x]$

$6.15 \times 10^{-12} = 4x^3$

in AgCl $[Ag^+] = 1.25\times10^{-5}$ in Ag_2CO_3 $[Ag^+] = 2(1.15\times10^{-4}) = 2.3\times10^{-4}$

∴ $[Ag^+]$ higher in Ag_2CO_3

13.

s p d f
l 0 1 2 3

Supply the missing quantum numbers and sublevel names:

n	l	m_l	Name
4	1	0	4p
2	1	0	2p
3	2	-2	3d
2	0	0	2s

14. List all the Le Chatelier "stressors" that could be applied to this equilibrium reaction, which would cause an increase in the concentration of water vapor.

$4HCl_{(g)} + O_{2(g)} \leftrightarrow 2H_2O_{(g)} + 2Cl_{2(g)}$

• ↑ [HCl] or [O_2] • remove [H... - Cl_2]
• ↑ pressure / ↓ volume

15. Identify the conjugate acid base pairs in the following reactions.

$HOCl + NH_3 \rightarrow NH_4^+ + ClO^-$

a b c.a c.b

$H_2SO_4 + OH^- \rightarrow HSO_4^- + H_2O$

a b c.b c.a

16. Draw the Lewis dot diagram for the following and identify the molecular geometry.

a) BeF_2 b) BCl_3 c) CCl_4 d) PBr_5 e) SI_6