DATA SHEET TO ACCOMPANY UNIT TWO TEST DOCUMENT CHEMISTRY 115 AW0953 / BW0953

$M = \frac{\text{mol solute}}{\text{L sol'n}}$ $\quad M_c V_c = M_D V_D$

$\Delta E = E_{FINAL} - E_{INITIAL}$ $\quad \Delta E = q + w$ FIRST LAW

$q = SH \cdot MASS \cdot \Delta T$ $\quad SH = C_A$ = SPECIFIC HEAT

$\Delta H^\circ_{RXN} = \sum \Delta H^\circ_f (\text{PRODUCTS}) - \sum \Delta H^\circ_f (\text{REACTANTS})$

$c = \lambda \nu$ $\quad E = h\nu$

$\lambda = \frac{c}{\nu}$ $\quad h = 6.626 \times 10^{-34}\ J \cdot s$

$c = 3 \times 10^{8}\ m/s$

BOHR ATOM

$$\Delta E = h\nu = -R_H \left[\frac{1}{n_f^2} - \frac{1}{n_i^2}\right]$$

RYDBERG CONSTANT $R_H = 2.18 \times 10^{-18}\ J$

USE THIS → FOR ABOVE EQUATION

UNIT TWO
CHAPTER 4

KEY SKILLS:

A) ELECTROLYTES VS. NON ELECTROLYTES
2-6

EXAMPLES

$NaCl_{(s)} \xrightarrow{H_2O} Na^+_{(aq)} + Cl^-_{(aq)}$

$HC_2H_3O_2 \rightleftharpoons H^+ + C_2H_3O_2^-$

B) PRECIPITATION RXNS
7-8

MOLECULAR TOTAL IONIC NET IONIC EQNS

9-11

C) NEUTRALIZATION RXNS

ACID + BASE → SALT + WATER

14

D) RED-OX RXNS
16-22

RED-OX CONTINUED

$$Fe_{s} + Ni(NO_3)_{2\,aq} \rightarrow Fe(NO_3)_2 + Ni_{s}$$

HALF REACTIONS

$$Fe^{0} \longrightarrow Fe^{+2} + 2e^{-}$$

$$Ni^{+2} + 2e^{-} \longrightarrow Ni^{0}$$

NO_3^- IS SPECTATOR ION

PREDICTING ACTIVITY

25

E) MOLARITY = $\frac{\text{MOLES SOLUTE}}{\text{LITERS SOL'N}}$

26

KEY ROADMAP

27

E) KEY RXN EQUATIONS

TITRATION MOLES ACID = MOLES BASE AT EQUIVALENCE PT.

$$M_A V_A = M_B V_B$$

DILUTION

$$M_C V_C = M_D V_D$$

ACID + BASE → SALT + WATER

AT EQUIVALENCE POINT $\text{MOLES}_{\text{ACID}} = \text{MOLES}_{\text{BASE}}$

EXAMPLE $HCl + NaOH \rightarrow NaCl + H_2O$

$\text{MOLES}_{HCl} = \text{MOLES}_{NaOH}$ AT EQ. PT.

$$M_A \cdot V_A = M_B \cdot V_B$$

PROBLEM: WHAT VOLUME OF 0.015 M NaOH IS NEEDED TO NEUTRALIZE 150 ml OF 0.025 M HCl?

$$V_B = \frac{M_A V_A}{M_B} = \frac{0.025\,M \cdot 150\,ml}{0.015\,M} = 250\,ml$$

NOTE: DIPROTIC ACIDS AND DIBASIC BASES:

0.100 M H_2SO_4 = 0.200 M $H^{\oplus}$

0.100 M $Ca(OH)_2$ = 0.200 M $OH^{\ominus}$

DILUTION:

HOW MUCH WATER IS NEEDED TO MAKE A 200 ml SOL'N OF 0.050 M DRUG WHEN THERE IS A STOCK SOL'N OF 0.100 M DRUG? HOW MUCH OF STOCK SOL'N IS USED?

$$M_C V_C = M_D V_D$$

$$V_C = \frac{M_D V_D}{M_C} = \frac{0.050\,M \cdot 200\,ml}{0.100\,M} = 100\,ml \text{ STOCK SOLN}$$

THEN ADD 100 ml WATER

UNIT TWO
CHAPTER FIVE

KEY CONCEPTS:

A) FIRST LAW OF THERMODYNAMICS 8

$$\Delta E = q + w$$

— SIGN CONVENTION! 13-16

— ENERGY, HEAT, WORK FUNCTION
20

B) ENTHALPY EXO + ENDO
25 - 27, 30

EXAMPLE PROBLEM ①

GIVEN $2\ C_6H_6 + 15\ O_2 \rightarrow 12\ CO_2 + 6\ H_2O$
$\Delta H = -6535$ KJ

WHAT IS ΔH IF 160g C_6H_6 IS USED?

$160g \times \frac{1\ mole}{78g} = 2.05$ moles

$$\frac{-6535}{2} = \frac{x}{2.05}$$

$x = -6698.4$ KJ

EXAMPLE PROBLEM ② HESS LAW

39-41

GIVEN:

	ΔH [kJ]
$N_2 + O_2 \rightarrow 2NO$	180.7
$2NO_2 \rightarrow O_2 + 2NO$	113.1

WHAT IS ΔH FOR:

$4NO \rightarrow 2NO_2 + N_2$?

(-293.8)

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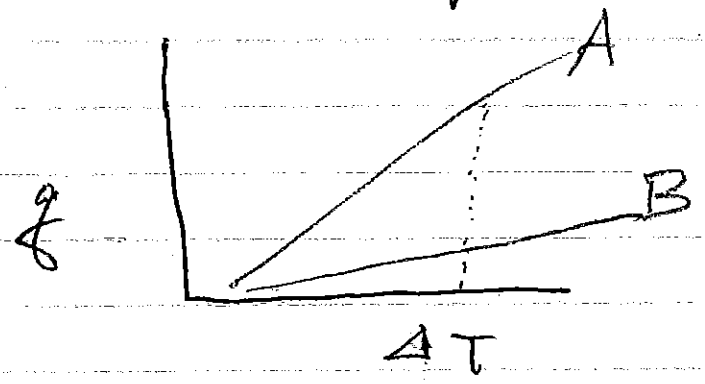
① CALORIMETRY EQN 33, 36

$q = SH \cdot MASS \cdot \Delta T$

$\Delta T = T_{FINAL} - T_{INITIAL}$

CALORIMETRY CONTINUED

q vs Temp



$q = \text{MASS} \cdot SH \cdot \Delta T$

SH Pb is 0.13 $\frac{J}{g \cdot K}$

How many J of heat req to raise T from 22°C → 37°C for a 30 g sample?

58 J

Al metal SH = 0.90 J/g·K
If a 1.5 g sample at 23.2°C absorbs 9.86 J of heat what is T_f?

30.5°C

PRACTICE

30 g Pb @ 22°C

58.5 J heat added

$$q = SH \cdot MASS \cdot [T_f - T_i]$$

$$\frac{q}{SH \cdot MASS} = T_f - T_i$$

$$T_f = T_i + \frac{q}{SH \cdot MASS}$$

$$22 + \frac{58.5\ J}{\frac{0.135}{1\ g} \cdot 30\ g}$$

PRACTICE

100 g H_2O @ 25°C mixed with

58 g H_2O @ 45°C what is T_f

$SH_{H_2O} = 4.18\ J/g \cdot °C$

$$-q_{\text{LOST HOT}} = q_{\text{GAINED BY COLD}}$$

$$-(SH)(MASS)(T_f - T_i) = (SH)(MASS)(T_f - T_i)$$

$$-[MASS_H(T_f) - MASS_H(T_i)] = MASS_C(T_f) - MASS_C(T_i)$$

over

How many g CH_3CH_2OH must be added to 500 ml H_2O to make a 0.5 M sol'n

for 500 ml of .5 M need $\frac{.5 \text{ moles}}{1000 \text{ ml}} = .25$ moles

$.25 \text{ moles } CH_3CH_2OH \times \frac{46 \text{ g}}{1 \text{ mole}} = 11.5 \text{ g}$

UNIT TWO
CHAPTER SIX

KEY CONCEPTS

A) EM SPECTRUM 2
WAVELENGTH FREQUENCY SPEED LIGHT

B) PLANCK EQN 3

$$E = h\nu$$

$$c = \lambda\nu \qquad c = 3\times10^{8}\ \frac{m}{s}$$

C) BOHR MODEL 9

$$\Delta E = -R_H\left[\frac{1}{n_f^2} - \frac{1}{n_i^2}\right]$$

D) QUANTUM THEORY 12 – 24
QUANTUM NUMBERS
FILLING ORBITALS

E) 1H ATOM VS MANY $\bar{e}$ ATOM
25, 26

PHOTON
LIGHT OF 660 nM

WHAT IS ν?
" " E?

$$660\ \text{nM} \times \frac{\text{M}}{10^{9}\ \text{nM}} = 660 \times 10^{-9}\ \text{M}$$

$$\nu = \frac{c}{\lambda} = \frac{3 \times 10^{8}\ \text{M/s}}{660 \times 10^{-9}\ \text{M}} = 4.54 \times 10^{14}\ \text{A}^{-1}$$

$$E = (6.626 \times 10^{-34}\ \text{J} \cdot \text{A}) \cdot (4.54 \times 10^{14}\ \text{A}^{-1})$$

h $\quad$ ν

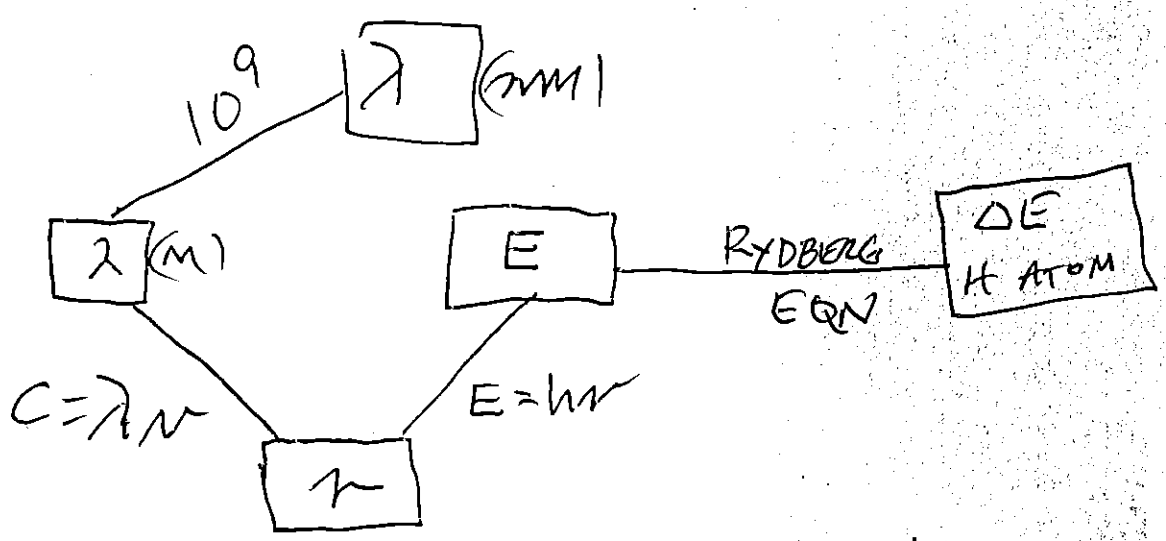
$E = 3.01 \times 10^{-19}\ \text{J}$

$\nu = E/h = 6.17 \times 10^{14}\ \text{A}^{-1}$

$\lambda = \frac{c}{\nu} = 4.86 \times 10^{-7}\ \text{M}$

$4.86 \times 10^{2} = 486\ \text{nM}$

$M_{MIXT.} = \frac{\text{TOTAL MOLES}}{\text{TOTAL L}}$ $\quad$ MOL = M · L



CALC E EMITTED IN $n=4$ TO $n=2$ TRANSITION IN H ATOM.

$$\Delta E = -2.18 \times 10^{-18}\ J \cdot \left[\frac{1}{2^2} - \frac{1}{4^2}\right]$$

$$\boxed{\Delta E = -4.09 \times 10^{-19}\ J}$$

FREQUENCY $\equiv \nu \equiv \frac{\text{WAVES}}{\text{SEC}} \equiv \frac{1}{\text{SEC}} \equiv \frac{1}{s} \equiv s^{-1} \equiv$ HERTZ Hz

RULES FOR ELECTRONS IN ORBITALS

28

PAULI EXCLUSION PRINCIPLE

NO 2 ELECTRONS CAN HAVE SAME 4 Q.N. VALUES

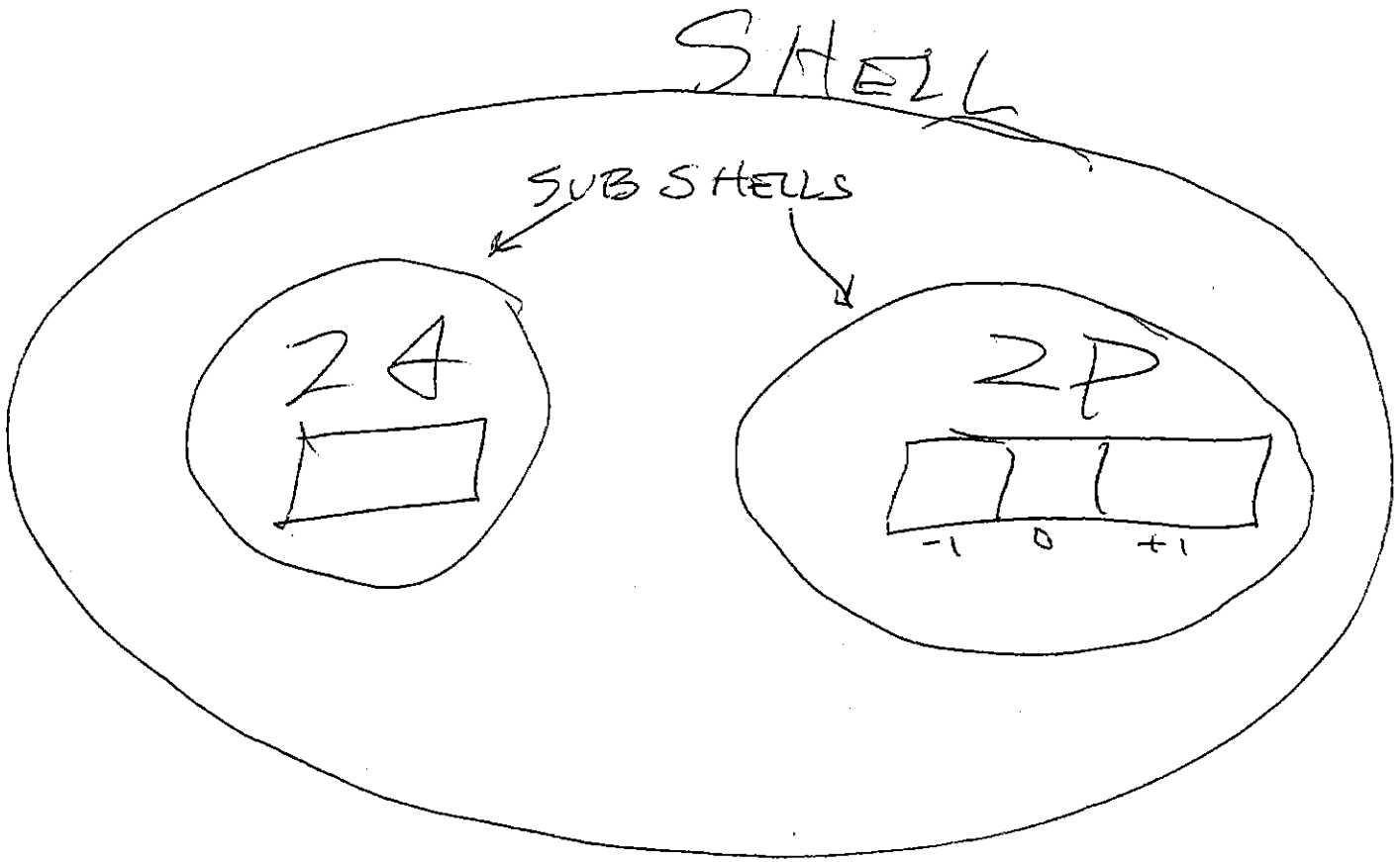
AUFBAU PRINCIPLE

FILL LOWER ENERGY ORBITALS FIRST

33

HUNDS RULE

HALF FILL ORBITALS IN A SUBSHELL BEFORE ADDING SECOND ELECTRON


SHELL
SUB SHELLS
2s
2p
-1
0
+1

MATCH UNITS TO QUANTITY

QUANTITY		UNITS
7.62	___	Y ___ Miles
120/60	___	R ___ PSI
60 FT 6	___	S ___ LITERS
351	___	M ___ IN^3
3.1415	___	H ___ MM Hg
22.4	___	C ___ MM
3600	___	T ___ SECONDS
32	___	I ___ UNITLESS
26.2	___	E ___ INCHES