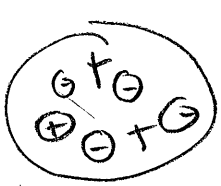
Review Packet

A.

1. protons
2. electrons
3. neutrons
4. protons + neutrons
5. electrons
6. protons
7. electrons
8. protons + neutrons
9. neutrons
10. false, nitrogen has 7 protons (atomic #)
11. true
12. false - protons = electrons, so it's neutral
13. yes because it has 8 neutrons but carbon-12 has 6 (6 protons + 6 neutrons = 12)
14. false (no charge because $p^+ = e^-$)
15. Dalton - matter is made of indivisible particles called atoms
16. Thomson - atoms look like a chocolate chip cookie with a sphere of positive charge with negative particles inside



← discovered electron

17. Bohr-atom has a positive nucleus with electrons in fixed energy levels around it

18. Lithium (has $3p^+$)

19. Be^+ ↖ positive charge because it lost an e^-

20. An isotope with +1 mass $^{9}_{4}Be \rightarrow ^{10}_{4}Be$ ← extra neutron

21. atoms are neutral but ions have a charge

22. An atom of the same element (same # of p^+) but a different mass (different # of n^o)

23. The relative abundance (%) of each isotope and their mass is used to calculate atomic mass

24. $^{14}_{6}C$ (mass # on top + atomic # on bottom)

25. See # 23

26. Where two lighter atoms are joined together to form a heavier atom

B.

27. metalloids

28. metals, non-metals, hydrogen (over by the metals, but it's a non-metal)

29. right

30. atom's ability to attract electrons in a chemical bond

31. energy needed to remove an electron from an atom

32. as you add more p^+ from left to right, the pull from the nucleus pulls in the electrons (negative/opposite charge)

33. It increases due to more energy levels

34. decreases (harder to remove e^- from small atoms)

35. $1s^2 2s^2 2p^6 3s^1$ 36. $[Ar] 3s^1$

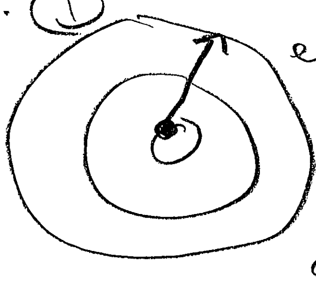
37. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^1$

38. $[Ar] 4s^2 3d^{10} 4p^1$

39. 4 40. 5 (ends in $3p^5$) # of electrons in sub level

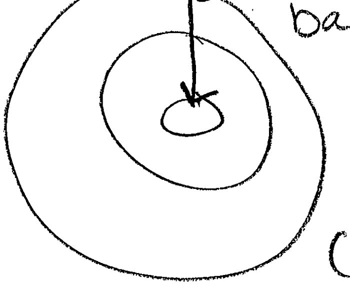
41. because they have the same # of valence e^- so they will bond in similar ways to fill their octets (get like their nearest noble gas)

42. 1



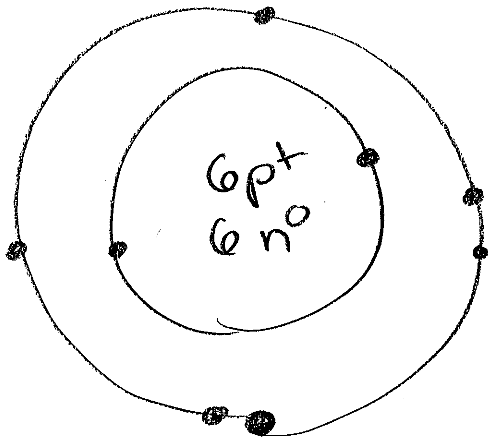
electons gets excited By energy (heat or light) & goes up energy levels

2

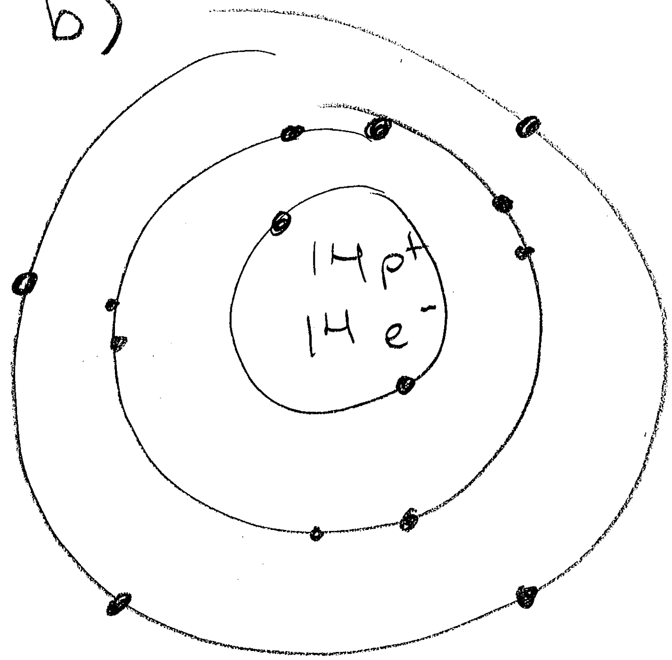


electron falls back to ground state & release light (photons)

43. a) carbon



b)



Part C

44. to get 8 valence electrons / fufill the octet rule

45. atoms will gain or lose e⁻ to get 8 valence electrons (except for H + He)

46. hydrogen + helium have a full octet with 2 valene e⁻

47. Between a metal and non-metal and electrons are transferred from the cation (+/metal) to the anion (−/non-metal)

48. Occurs between two non-metals. Electrons are <u>shared</u> and no ions formed

49. Both occur so atoms can fill octets

50.

Ionic	Covalent
Metal + non-metal	2 non-metals
E⁻ transferred	E⁻ shared

51. +1, +2, +3, ±4, -3, -2, -1

Group: 1, 2, 13, 14, 15, 16, 17

52. Use Greek prefixes (mono, di, tri, etc) except on first element which does not get mono. Drop the end of the 2nd element name + add -ide

53. ① H + anion that ends in -ide

hydro $\underline{\text{anion root}}$ ic acid

Ex. HCl (hydrogen + chlor<u>ide</u>)

hydro<u>chloric</u> acid

② H + anion that ends in -ite

$\underline{\text{anion root}}$ ous acid

Ex. H_2SO_3 (H + sulf<u>ite</u>)

<u>sulfur</u>ous acid

③ H + anion that ends in -ate

$\underline{\text{anion root}}$ ic acid

Ex. H_2SO_4 (H + sulfate)

<u>sulfur</u>ic acid

54. Ionic - cations (+ or metals) must go first + drop end of anion + add -ide except with polyatomic ions

a) contains polyatomic ion -
do not alter name of ion

Ex. $NaSO_4$
sodium sulfate

b) contains metal + non-metal (no polyatomic ions)
- write metal name + anion (drop end + -ide)

Ex. NaS
sodium sulfide

c) contains metal from d-block or another metal that has multiple charges (Sn, Sb, Pb, etc)
- Indicate charge as a Roman numeral

Ex. CuS → the copper is 2+ because Sulfide is -2
copper(II) sulfide

55. a) SiF_4 (covalent b/c 2 non-metals)

silicon tetrafluoride (no mono on 1st)

b) N_2S_3 (covalent)

dinitrogen trisulfide

c) CO (covalent)

carbon monoxide (use mono on 2nd)

d) H_2S (acid - starts with H)

hydrosulfuric acid

56. a) B_2H_6

b) NBr_3

c) Na_2O

+ -- ← charges

+

d) P_2O_5

e) $Ca(ClO_3)_2$

++ -

-

f) NaF

+ -

g) $CuCl_2$

++ -

-

Roman numeral is the charge

h) Fe_2S_3

+++ --

+++ --

--

☆ Remember # of circles (particles) is the subscript (small # to bottom right)

57. cation

↑

+ sign

58. anion

↑

n for negative

★ Chart on p. 194 for values

59. a) $3.04 - 3.04 = 0 \rightarrow$ non-polar
(N - N)

b) (C - H)
$2.55 - 2.20 = .15 \rightarrow$ non-polar

c) $3.44 - 2.20 = 1.24 \rightarrow$ ★polar
(O - H) ★polar is above .5 difference in electronegativity

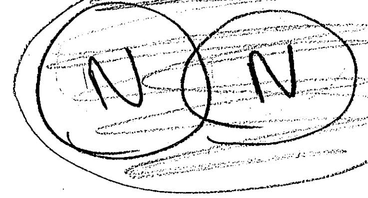
60. a) Al_2O_3 ← correct subscripts to make neutral (others were reversed)
+++ = +++ = =

b) $B(OH)_3$ → cations go first
$\uparrow$ +3 $\uparrow$ -1

c) CaO → only 1 of each is needed to be neutral
++ --

61. ionic
62. covalent
63. ionic
64. ionic
65. ionic
66. covalent

67. polar covalent bonds share e^- equally between atoms



$\uparrow$
e^- evenly shared

67. continued

<u>Polar bond</u> – δ^-  δ^+

electrons pulled more to N side of molecule because it's more electronegative

EN= 3.04

EN= 2.19

difference is $> .5$

68. 0.5 or more for polar

69. less than .5 for non-polar

70. Mass cannot be created or destroyed
<u>NOTE</u> – this is why the mass of of the products + reactants must be equal + is why we balance equations

71.

a) $2H_2 + O_2 \rightarrow 2H_2O$

b) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

$\boxed{\text{SKIP C - error on problem}}$

~~c) $2(NH_4)_2CO_3 \rightarrow 2N_2 + 8H_2O + CO_2$~~

~~error on sheet it's → it's $(NH_4)_2CO_3$ not NH_4CO_3~~

~~this isn't neutral because NH_4^+ + CO_3^{-2}~~

72. a) synthesis

$A + B \rightarrow AB$

Ex. $2Mg + O_2 \rightarrow 2MgO$

b) Combustion

$C_xH_y + O_2 \rightarrow CO_2 + H_2O$
(some hydrocarbon)

Ex. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

c) Decomposition

$AB \rightarrow A + B$

Ex. $2MgO \rightarrow 2Mg + O_2$

☆ Notice it's the reverse of synthesis

d) single replacement

$A + BC \rightarrow AC + B$

Ex. $F_2 + 2NaCl \rightarrow 2NaF + Cl_2$

☆ notice the F_2 (non-metal) switches for the non-metal + remember to use the activity series (half sheet) to check if the reaction occurs.

e) double replacement

$AB + CD \rightarrow AD + CB$

Ex. $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

<u>Honors</u>- this is the precipitate, so the reactions occurs. Check your solubility roles! No reaction occurs if all products are soluble

73. a) synthesis b) combustion
c) decomposition

74 a) $2Al + 3O_2 \rightarrow 2Al_2O_3$

balance charges!

b) $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

always the product of combustion

c) $2CuO \rightarrow 2Cu + O_2$

diatomic

d) $2Fe_2O_3 \rightarrow 4Fe + 3O_2$

2 needed if charge is 3+

+++ −−
+++ −−
−−

75. the amount of particles needed to have the mass on the periodic table in grams (aka 6.02×10^{23} particles)

76. 6.02×10^{23}

77. a) $C_6H_{12}O_6$ (add up 6 C's, 12 H's + 6 O's)

180.18 g

b) $Ba(NO)_2$ 197.29 g

78. On-level: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

$$\frac{19.4\text{ g }CO_2}{1} \times \frac{1\text{ mol }CO_2}{44.01\text{ g }CO_2} \times \frac{1\text{ mol }C_6H_{12}O_6}{6\text{ mol }CO_2} \times \frac{180.18\text{ g}}{1\text{ mol }C_6H_{12}O_6} =$$

from balanced equation

clap for coefficents

$\boxed{13.23\text{ g}}$

78. HONORS

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6$

B	.441 mol		0
C	−6x	−6x	+x
A	0		.0735 mol

$$\frac{19.4\text{ g }CO_2}{1} \times \frac{1\text{ mol }CO_2}{44.01\text{ g }CO_2} =$$

.441 mol

$.441 - 6x = 0$

$-6x = -.441$

$x = .0735$

$$\frac{.0735\text{ mol }C_6H_{12}O_6}{1} \times \frac{180.18\text{ g}}{1\text{ mol glucose}}$$

13.24 g glucose

79. On-level can skip

Honors:

	$2 AlCl_3$ +	$3Br_2$ →	$2 AlBr_3$ +	$3Cl_2$
B	.631 mol	.428 mol	0	0
C	$-2x$	$-3x$	$+2x$	$+3x$
A	.345 mol	0		$\boxed{}$ ← solve for

Must figure out the limiting

① Find moles of each given reactant & put in BCA

$$\frac{84.2 \text{ g } AlCl_3}{1} \times \frac{1 \text{ mol } AlCl_3}{133.34} = .631 \text{ mol } AlCl_3$$

$$\frac{68.4 \text{ g } Br_2}{1} \times \frac{1 \text{ mol } Br_2}{159.81 \text{ g} Br} = .428 \text{ mol } Br_2$$

② The smallest x is the limit

so $.428 - 3x = 0$ is the smallest

$x = .143$, so Br_2 runs out & gets the 0 in the A (after) row.

③ Solve for A for $AlCl_3$ $.631 - 2(.143) = .345$ mol

④ Solve for Cl_2

$0 + 3(.143) = .429$ mol

⑤ Convert to grams from moles

$$\frac{.429 \text{ mol } Cl_2}{1} \times \frac{70.9 \text{ g}}{1 \text{ mol } Cl_2} = 30.42 \text{ g } Cl_2$$

On-level

80. $\frac{5.8 \text{ mol } AgNO_3}{1} \times \frac{1 \text{ mol Cu}}{2 \text{ mol } AgNO_3} = 2.9 \text{ mol Cu}$

ratio from balanced equation

Honors

$Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$

	Cu	$2AgNO_3$	$Cu(NO_3)_2$	$2Ag$
B	$\boxed{}$	5.8 mol	0	0
C	$-x$	$-2x$		
A	0	0		

$x = 2.9$ mol

so Cu = 2.9 mol because

$2.9 \text{ mol} - \underset{2.9}{x} = 0$

81. 

1 step

$\frac{223 \text{ g S}}{1} \times \frac{1 \text{ mol S}}{32.07 \text{ g}} = 6.95 \text{ mol S}$

82. 

1 step

$$\frac{3.89 \text{ mol } C_2H_5OH}{1} \times \frac{46.06 \text{ g } C_2H_5OH}{1 \text{ mol } C_2H_5OH}$$

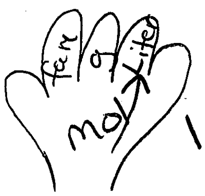
179.17 g $C_2H_5O_5$

83. 

2 steps

$$\frac{27.2 \text{g NaCl}}{1} \times \frac{1 \text{ mol NaCl}}{58.44 \text{g NaCl}} \times \frac{6.022 \times 10^{23} \text{ f. units}}{1 \text{mol NaCl}}$$

$= 2.80 \times 10^{23}$ formula units NaCl

84. 

1 step

same for all gases

$$\frac{5.8 \text{ mol } O_2}{1} \times \frac{22.4 \text{ L } O_2}{1 \text{ mol } O_2} =$$

129.92 L O_2

85. % to mass, (a) mass to mole, (b) ÷ by small, x 'til whole

93.3 so rest is 6.7% H

$$\text{a) } \frac{40.0 \text{g C}}{1} \times \text{ b) } \frac{1 \text{mol C}}{12.01 \text{g C}} = \text{ c) } \frac{3.33 \text{ mol C}}{3.33} = 1 \text{ mol C}$$

$$\frac{53.3 \text{ g O}}{1} \times \frac{1 \text{ mol O}}{16.00 \text{g O}} = \frac{3.33 \text{ mol O}}{3.33} = 1 \text{ mol O}$$

$$\frac{6.7 \text{g H}}{1} \times \frac{1 \text{ mol H}}{1.01 \text{g H}} = \frac{6.7 \text{g H}}{3.33} = 2 \text{ mol C}$$

85 cont. CH_2O

(spell CHO w/ organic compounds)

CH_2O is empirical

$$\frac{\text{Molecular Mass (always given)}}{\text{Empirical Mass}} = \text{multiplier for empirical subscripts}$$

$$\frac{60\ g/mol}{30\ g/mol \leftarrow \text{mass of } CH_2O} = 2$$

~~so~~ molecular formula is

$C_2H_4O_2$

86. $CH_3O \rightarrow$ the emp. + molecular are the same b/c it can't be reduced

87. Limiting will run out + determine how much product will be formed while excess will be left over when the reaction is complete

88. Must balance first!

$2H_2 + O_2 \rightarrow 2H_2O$

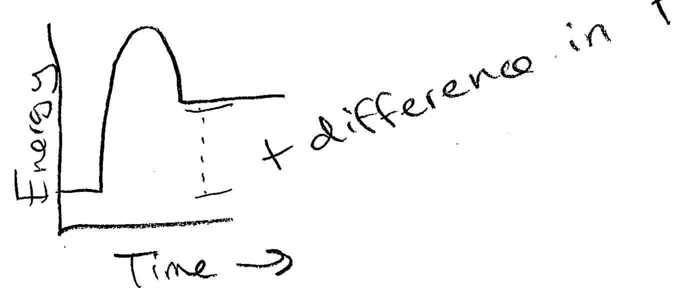
1 to 1 (2 to 2 reduces)

89. ~~A~~ Spells AT

$$\frac{\text{Actual}}{\text{Theoretical}} \times 100 \qquad \frac{15.6\,g}{19\,g} = 82.1\%$$

G. Thermo + Gas

90. $+\Delta H \rightarrow$ endothermic. Energy is absorbed during the reaction

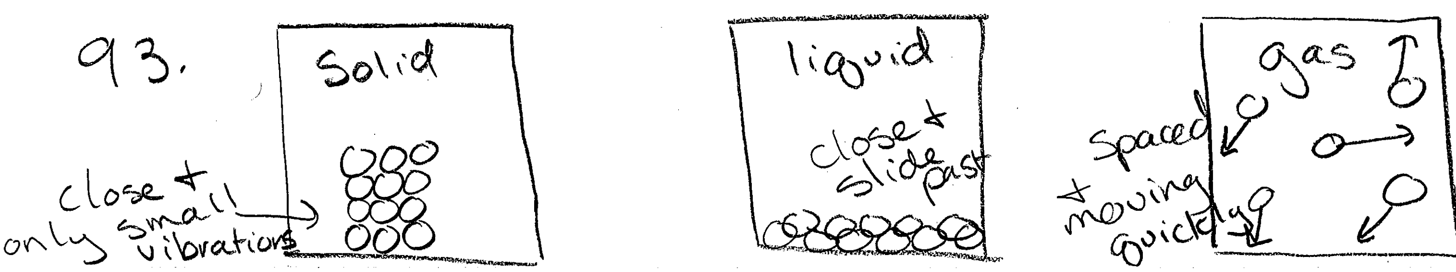


$-\Delta H \rightarrow$ exothermic Energy is released during the reaction

91. You don't talk about thermodynamics ◡̈ Just kidding - Energy cannot be Created or destroyed

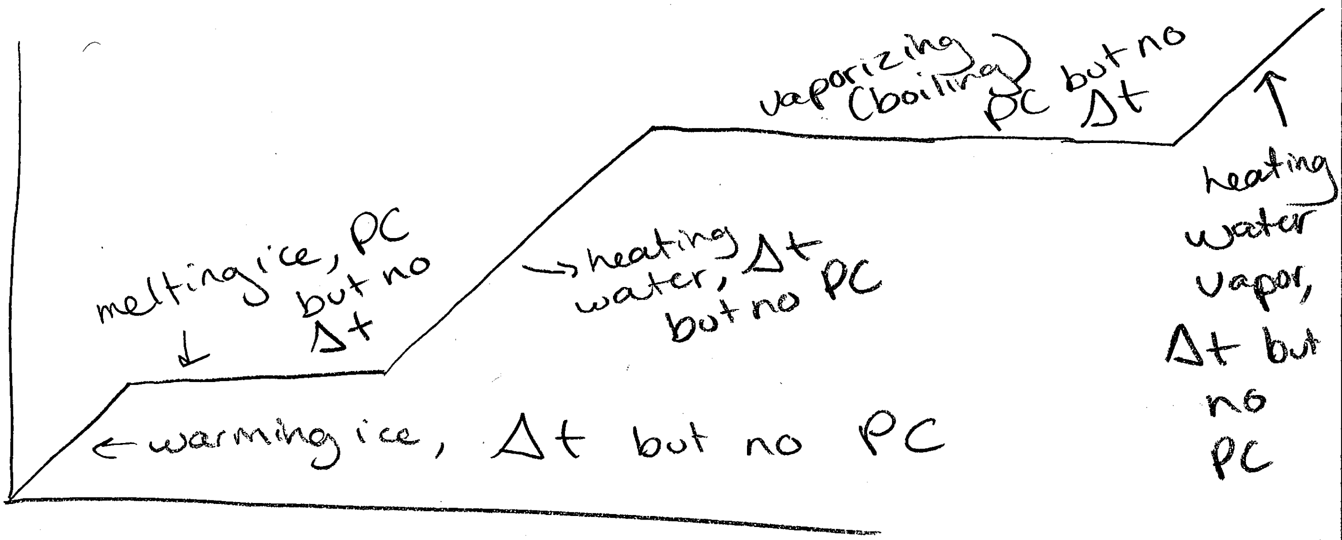
92. endothermic - you must put energy in

93.



94. Average kinetic energy of a substance

95.



Δt means change in temperature

PC - means phase change

Notice that the substance can be heated or change phases but not both.

96. The temperature will decrease, so the volume will decrease. (Charles' Law)

$$\frac{V}{T} = \frac{V}{T}$$ (direct relationship)

97. $PV = nRT$ ← temperature is alway K° for gases!

$$T = \frac{PV}{nR} \rightarrow T = \frac{(5.4\,atm)(120\,L)}{(4\,mol)(.0821)} =$$

1973.2°K

98. See # 97

99. $\frac{PV}{T} = \frac{PV}{T}$ (pave the track)

$$\frac{(12\text{ atm})(23\text{ L})}{200\text{ K}} = \frac{14\text{ atm}\,(x)}{300\text{ K}}$$

cross multiply & divide

$$(200\text{ K})(14\text{ atm})\,x = (12\text{ atm})(23\text{ L})(300\text{ K})$$

$$\frac{2800\,x}{2800} = \frac{82800}{2800}$$

$$x = 29.57\text{ L}$$

* Honors only

100. The ΔH is 49 kJ/mol (moles wasn't stated)

So, use dimensional analysis

$$\frac{1.95\text{ g C}}{1} \times \frac{1\text{ mol C}}{12.01\text{ g C}} \times \frac{49\text{ kJ}}{6\text{ mol C}} = 1.33\text{ kJ}$$

go to moles

cancel moles using coefficient from balanced equation

101. $\frac{V}{T}$ = Charles's Law

102. Remember - each substance has a unique specific heat, so you can identify substances based on their specific heat values :)

$$Q = m C_p \Delta t$$ ← Final - initial
$70 - 10 = 60°C$

$$C_p = \frac{Q}{m \Delta t} \quad C_p = \frac{(2.5 \times 10^3 \, J)}{(1000g)(60°C)}$$

$$= .04 \frac{J}{g \cdot °C}$$

103. $$m = \frac{Q}{C_p \Delta t} \quad m = \frac{2.20 \times 10^4 \, J}{(4.184 \frac{J}{g \cdot C})(66°C)}$$

100-34

$$m = 72.43g \; H_2O$$

104. $$Q = m C_p \Delta t$$

35-25

$$Q = (50g)(4.184 \tfrac{J}{g \cdot C})(10°C)$$

always the same for a substance

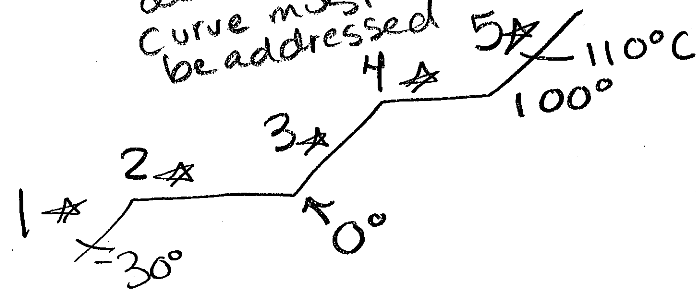
$$Q = 2092 \, J$$

105. Hess' Law - where you have to add up/cancel reactions to make desired reaction

See example 5 on p. 536

106.

all 5 sections of curve must be addressed



☆ These #'s are coming from the back of the periodic table to convert

Section 1:

$Q = mC_p\Delta t$

$Q = (50g)(2.09\ J/g \cdot C)(30°)$ → $\underline{3{,}135\ J}$

C_p of ice

Δt only covers that single leg of the graph

Section 2

ΔH of fusion

$\frac{50\,g}{1} \times \frac{334\,J}{g} =$ → $\underline{16{,}700\ J}$

Section 3

$Q = mC_p\Delta t$

$Q = (50g)(4.18\ J/gC)(100°)$ → $\underline{20{,}900\ J}$

Section 4

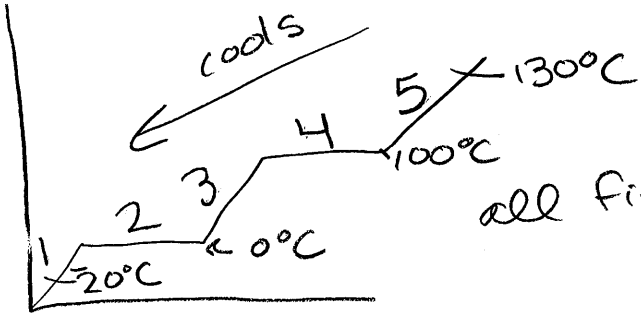
$\frac{50\,g}{1} \times \frac{2257\,J}{g} =$ → $\underline{11{,}2850\ J}$

Section 5

$Q = (50g)(1.84\ \frac{J}{gC})(10)$ → $920\ J$

$154{,}505\ J$

107. Energy is <u>released</u> not required so exothermic
& all segment are <u>negative</u> enthalpy



all five sections needed again

<u>Section 1</u>

$Q = (80g)(2.09 \, J/gC)(-20°C)$ — $-3344 \, J$

<u>Section 2</u>

$\frac{80g}{1} \times \frac{334J}{g} =$ — $-26720 \, J$

<u>Section 3</u>

$Q = (80g)(4.18 \, J/gC)(-100°C) =$ — $-33440 \, J$

<u>Section 4</u>

$\frac{80\,g}{1} \times \frac{2257J}{g} =$ — $-180560 \, J$

<u>Section 5</u>

$Q = (80g)(1.84 \, J/gC)(-30°C) =$ — -4416

$+$

$-248480 \, J$

108. See cut/paste graphic organizer

Acid	Base
Sour	Bitter
more H^+ ions	more OH^- ions
Litmus Red	Litmus Blue

109. Arrhenius acids contain H^+ and creates H^+ in water → example HCl

Arr. bases contain OH^- and create OH^- in water → example NaOH

but not NH_3

110. Bronsted-Lowry acid – donates H^+

" " base – receives H^+

$$SO_4^{2-} + HBr \rightarrow HSO_4^- + Br^-$$

acid

base

111. measure of hydrogen/hydronium (H^+ or H_3O^+) in solution → $-\log[H^+]$

112. agitation (stirring), temperature & surface area (crushing/making smaller helps)

113. Molarity - measure of concentration of solution $M = \frac{mol}{L}$

114. $M = \frac{2.5\ mol}{.3\ L} = 8.33\ M$

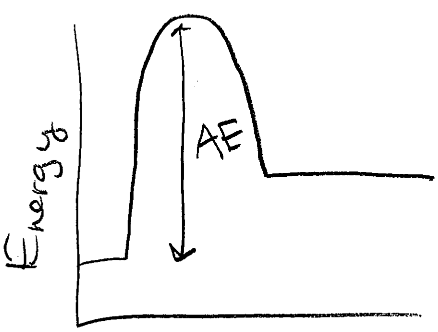
115. Colligative properties are properties of a solution that are changed when more solute is added to a solution (ex. ↑ boiling pt + ↓ freezing pt)

116. Adding salt decreases the freezing pt

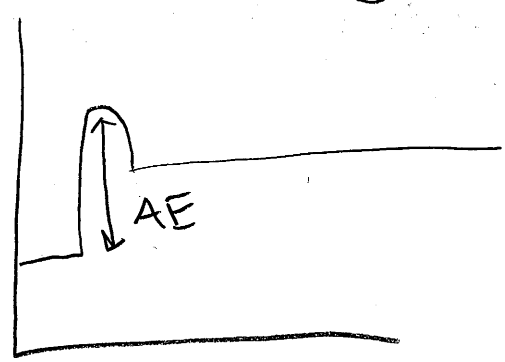
117. Mountain Dew - Solvent = water
Solute = sugar + dyes

118. A substance that speeds up a reaction by lowering the activation energy (AE)

without catalyst:



w/ catalyst:



119. Crush, heat, agitate (stir)

120. When the rate of the forward + reverse reactions are equal

121. Reactions goes toward side with less gas with ↑ pressure and away with less pressure

only 2 particles of gas

$2H_2 + O_2 \rightarrow 2H_2O$

3 particles of gas

decrease pressure shifts left, for example ←

122. Reaction goes toward heat when temp is dropped and away from heat when temp ↑

heat + $NaHCO_3 \rightarrow CO_2 + H_2O + Na_2CO_3$

if temp ↑

$\longrightarrow$

shifts toward products

if temp ↓

$\longleftarrow$

shifts toward reactants