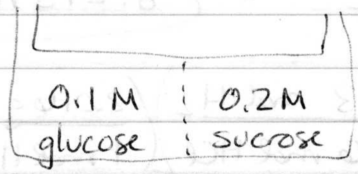
1. RBCs will burst, because inside them, conc of particles = 0.3 M. Water will flow in to try to equalize the concentrations - will dilute the more concentrated solution.

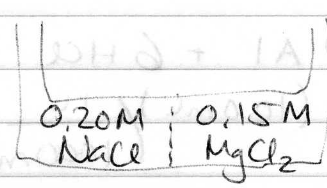
2. Water will flow out to try to dilute the more concentrated solution. Cells will shrink, dehydrate.

3.




→

both are molecular
water flows to more concentrated solution to try to dilute it.




both are ionic and will split into ions.
NaCl splits into 2 ions → $Na^+ + Cl^-$
$MgCl_2$ splits into 3 → $Mg^{2+} + 2Cl^-$
so conc of particles

| | |
|---|---|
| 0.20 x 2 | 0.15 x 3 |
| = 0.40 M particles | 0.45 M particles more concentrated |

water flows →
to dilute the more concentrated solution.

4. Bal. eq: $2\ NaOH + H_2C_2O_4 \rightarrow 2H_2O + Na_2C_2O_4$

$Na^+,\ OH^- \quad H^+,\ C_2O_4^{2-}$

$$(0.03849\ L)\left(\frac{0.5022\ mol\ NaOH}{1\ L}\right)\left(\frac{1\ mol\ H_2C_2O_4}{2\ mol\ NaOH}\right) = 0.00966484\ mol\ H_2C_2O_4$$

$$\frac{0.00966484\ mol\ H_2C_2O_4}{0.02500\ L\ H_2C_2O_4} = 0.3866\ M\ H_2C_2O_4$$

p. 2

5. $2\,H_3PO_4 + 3\,Ba(OH)_2 \longrightarrow 6\,H_2O_{(l)} + Ba_3(PO_4)_{2(s)}$

$H^+,\ PO_4^{3-},\ Ba^{2+},\ OH^-$

$$\left(0.01500\ L\right)\left(\frac{0.1002\ mol\ Ba(OH)_2}{1\ L}\right)\left(\frac{2\ mol\ H_3PO_4}{3\ mol\ Ba(OH)_2}\right)\left(\frac{1\ L}{0.1220\ mol\ H_3PO_4}\right) =$$

$= 0.008213\ L = 8.213\ mL$

6. $2\,Al + 6\,HCl \longrightarrow 2\,AlCl_3 + 3\,H_2$

a. $$\left(10.0\ mL\right)\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{6.00\ mol\ HCl}{1\ L}\right)\left(\frac{3\ mol\ H_2}{6\ mol\ HCl}\right)\left(\frac{2.016\ g\ H_2}{1\ mol\ H_2}\right) =$$

$0.0605\ g\ H_2$

$$\left(0.06048\ g\ H_2\right)\left(\frac{1\ mol\ H_2}{2.016\ g\ H_2}\right) = 0.0300\ mol\ H_2$$

b. $PV = nRT$ $\qquad \left(727\ mmHg\right)\left(\frac{1\ atm}{760\ mmHg}\right) = 0.95658\ atm$

$$V = \frac{nRT}{P} = \frac{(0.0300\ mol)\left(0.08206\ \frac{L\cdot atm}{K\,mol}\right)(298\ K)}{0.95658\ atm} = 0.767\ L$$

7. $[OH^-] = 3.1\times10^{-5}\ M$ $\qquad K_w = 1.0\times10^{-14} = [H_3O^+][OH^-]$

$$[H_3O^+] = \frac{K_w}{[OH^-]} = \frac{1.0\times10^{-14}}{3.1\times10^{-5}} = 3.2258\times10^{-10} = 3.2\times10^{-10}\ M\ H_3O^+$$

$[OH^-] > [H_3O^+]$ so basic overall. $\qquad pH = -\log[H_3O^+]$

$pH = 9.49$

8. pH 4.43

$[H_3O^+] = 10^{-4.43} = 3.715\times10^{-5}\ M = 3.7\times10^{-5}\ M\ H_3O^+$

$K_w = [H_3O^+] = [OH^-]$

$$[OH^-] = \frac{K_w}{[H_3O^+]} = \frac{1.0\times10^{-14}}{3.715\times10^{-5}} = 2.69\times10^{-10}\ M = 2.7\times10^{-10}\ M\ OH^-$$

9. $HNO_2$ and $NO_2^-$ buffer

a. HCl will react with the base component of the buffer

$H_3O^+ + NO_2^- \longrightarrow HNO_2 + H_2O$

9b. strong base ($OH^-$) will react with the acid component of the buffer

$OH^- + HNO_2 \rightarrow H_2O + NO_2^-$

10. $HPO_4^{2-} + HF \rightarrow H_2PO_4^- + F^-$

B (proton acceptor) A (proton donor) A B

$CO_3^{2-} + H_2O \rightleftarrows HCO_3^- + OH^-$

B A A B

11. need a reaction: $Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$

acid-base rxn.

$$(3.00g\ Ca(OH)_2)\left(\frac{1\ mol\ Ca(OH)_2}{74.096\ g}\right)\left(\frac{2\ mol\ HCl}{1\ mol\ Ca(OH)_2}\right)\left(\frac{1L}{2.00\ mol\ HCl}\right) = 0.04048\ L$$

$= 40.5\ mL$

12. max $\frac{35.8\ g\ NaCl}{100\ g\ H_2O}$

a) 30 g NaCl in 100 mL — all will dissolve. Get an unsaturated solution.

b) 50 g NaCl in 100 mL — 35.8 g NaCl will dissolve.

50 − 35.8 = 14.2 approx 14 g NaCl solid will remain undissolved

⇒ saturated solution

c) 25 g NaCl in 50 mL ←

half the amount of solvent.

$(50\ mL)\left(\frac{35.8\ g\ NaCl}{100\ mL}\right) = 17.9\ g$ NaCl dissolve in 50 mL

so 17.9 g will dissolve and 25 g − 17.9 g = 7.1 g remains undissolved.

saturated solution.

13. 2.00 M NaOH means $\frac{2.00 \text{ mol NaOH}}{1 \text{ L solution}}$

$$\left(50.0 \text{ mL solution}\right)\left(\frac{1 \text{ L solution}}{1000 \text{ mL}}\right)\left(\frac{2.00 \text{ mol NaOH}}{1 \text{ L solution}}\right)\left(\frac{40.00 \text{ g NaOH}}{1 \text{ mol NaOH}}\right) = 4.00 \text{ g NaOH}$$

14. $$\text{mass \% NaCl} = \frac{\text{mass NaCl}}{\text{total mass solution}} \times 100$$

$$\text{mass \% NaCl} = \frac{12.3 \text{ g NaCl}}{12.3 \text{ g NaCl} + 50.0 \text{ g water}} \times 100 = 19.7 \text{ \% NaCl}$$

15. 16.0 g $H_2SO_4$ in 435 mL solution. Find $M = \frac{\# \text{mol}}{\# \text{L}}$

$$\left(16.0 \text{ g } H_2SO_4\right)\left(\frac{1 \text{ mol } H_2SO_4}{98.086 \text{ g } H_2SO_4}\right) = 0.163122 \text{ moles } H_2SO_4$$

$$\left(435 \text{ mL}\right)\left(\frac{1 \text{ L}}{1000 \text{ mL}}\right) = 0.435 \text{ L}$$

$$M = \frac{0.163122 \text{ mol } H_2SO_4}{0.435 \text{ L}} = 0.374993 \text{ M} \approx 0.375 \text{ M}$$

16. Find mass % 0.100 mol $HC_2H_3O_2$ in 557 g solution

$$\left(0.100 \text{ mol } HC_2H_3O_2\right)\left(\frac{60.052 \text{ g } HC_2H_3O_2}{1 \text{ mol } HC_2H_3O_2}\right) = 6.0052 \text{ g } HC_2H_3O_2$$

$$\text{mass \%} = \frac{\text{mass } HC_2H_3O_2}{\text{mass solution}} \times 100 = \frac{6.0052 \text{ g } HC_2H_3O_2}{557 \text{ g solution}} \times 100$$

$$= 1.0781 \text{ \%} = 1.08\text{\% acetic acid by mass}$$

17. KBr solution 5.00 % by mass

means $\frac{5.00 \text{ g KBr}}{100 \text{ g solution}}$

$$\left(8.00 \text{ g KBr}\right)\left(\frac{100 \text{ g solution}}{5.00 \text{ g KBr}}\right) = 160. \text{ g solution (3 sf)}$$

18. a. V solution + 4V water so total V = 5V
volume increases by a factor of 5
so M decreases to (1/5) of original conc.
b. Dilute by a factor of 10 $V_2 = 10V_1$
molarity will be 1/10 of original molarity.

19. a. 100 mL 2.00 M NaOH + 100 mL water
V doubles, M half so (1.00 M)
b. 20 mL 1.00 M HCl $V_{total}$ 100 mL
V × 5 so M × 1/5 so (M = 0.200 M)

c. ? water to add 10 mL 2.00 M HCl
dilute to 0.200 M
Dilution → M is 1/10 of original
$V_{total}$ is 10 × original so $V_{total}$ = 100 mL
$V_{water}$ to add is 100 $V_2$ − 10 mL $V_1$ = (90 mL water to add)

20. pOH = 9.44 $[OH^-]$ = ?
$pOH = -\log[OH^-]$ $[OH^-] = 10^{-pOH} = 10^{-9.44} = 3.63 \times 10^{-10}$ M
pH = 14.00 − pOH (3.6 × $10^{-10}$ M $OH^-$)
pH = 14.00 − 9.44 = (4.56) pH (acidic)

21. pH = 3.57 $[H_3O^+] = 10^{-3.57} = 2.69 \times 10^{-4}$ M $H_3O^+$
($2.7 \times 10^{-4}$ M $H_3O^+$)

$K_w = [H_3O^+][OH^-] = 1.0 \times 10^{-14}$

$$[OH^-] = \frac{K_w}{[H_3O^+]} = \frac{1.0 \times 10^{-14}}{2.69 \times 10^{-4}} = 3.715 \times 10^{-11} \text{ M } OH^-$$
= ($3.7 \times 10^{-11}$ M $OH^-$)

22. 0.040 M $HNO_3$ (a strong acid)
so $[H_3O^+]$ = 0.040 M pH = −log (0.040) =
splits into pH = 1.3979
0.040 M $H_3O^+$ and (pH = 1.40)
0.040 M $NO_3^-$

23. 0.20 M $Ba(OH)_2$ splits into 0.20 M $Ba^{2+}$ and 0.40 M $OH^-$
↳ 1 $Ba^{2+}$, 2$OH^-$

pOH = $-\log(0.40)$ = 0.3979
pH = 14.00 − 0.3979 = (13.60) = pH

24. A weak electrolyte is something that dissociates a little bit into ions. (it's not complete..)
example: any weak acid, like $HC_2H_3O_2$.

25. a. $C_7H_{15}OH$ long nonpolar section but can H-bond with water
b. $C_8H_{18}$ completely nonpolar
c. $CH_3CH_2NH_2$ 2 C and 1 hydrogen bonding group
d. $CH_3CH_2F$ polar but can't H-bond short C chain

most soluble
(c) short carbon chain + H-bonding group - can form H-bonds to water, most polar, most compatible w/water.
(d) 2 C and one F - polar - similar to c but not as soluble in water.
(a) can H-bond to water but has a long nonpolar section, so mostly nonpolar. Not very compatible w/ $H_2O$.
(b) completely nonpolar - won't be soluble in water at all, since water is polar and like dissolves like.

boiling point: need to also consider molar mass.
a. MM = 116 g/mol b. 114 g/mol c. 45 g/mol d. 48 g/mol

(a, b) similar MM, similar London forces much stronger than these → (c, d) similar MM, similar London forces.

25 continued. Highest bp - strongest IMFs - harder to separate the molecules + form a gas.
a and b have very strong London forces - strong enough to outweigh all forces in c and d.
comparing a and b, a can H-bond but b can't, so (a) has the highest and (b) a lower bp.
comparing c and d - c can H-bond, and is polar while d is polar but can't H bond.

so c has ~~the~~ stronger IMFs than d (similar MM but more types of forces.)
overall order highest bp (a, b, c, d)

26. It can H-bond if H is attached to N, O, or F.
can H-bond: d, e     can't H-bond a, b, c

27. a. $K_2CO_3 + 2HI \rightarrow H_2O_{(l)} + CO_{2(g)} + 2KI_{(aq)}$
carbonate   acid
$K^+, CO_3^{2-}$   $H^+, I^-$

b. we know V, T, P of $CO_2$ - find moles $CO_2$ first.
$PV = nRT$   $V = (45.8 \text{ mL})\left(\frac{1 \text{ L}}{1000 \text{ mL}}\right) = 0.0458 \text{ L}$
$n = \frac{PV}{RT}$   $P = (752 \text{ mmHg})\left(\frac{1 \text{ atm}}{760 \text{ mmHg}}\right) = 0.98\bar{9}47 \text{ atm}$

$26°C + 273 = 299 \text{ K}$

$$n = \frac{(0.98\bar{9}47 \text{ atm})(0.0458 \text{ L})}{(0.08206 \frac{\text{L atm}}{\text{K mol}})(299 \text{ K})} = 0.0018\bar{4}7 \text{ mol } CO_2$$

now convert to $K_2CO_3$

$$(0.0018\bar{4}7 \text{ mol } CO_2)\left(\frac{1 \text{ mol } K_2CO_3}{1 \text{ mol } CO_2}\right)\left(\frac{138.21 \text{ g } K_2CO_3}{1 \text{ mol } K_2CO_3}\right) = 0.255 \text{ g } K_2CO_3 \text{ used.}$$

0.300 M HI means $\frac{0.300 \text{ mol HI}}{1 \text{ L solution}}$



c. we already calculated moles of $CO_2$ in part b:
0.001847 mol $CO_2$ now convert to moles HI

$$\left(0.001847 \text{ mol } CO_2\right)\left(\frac{2 \text{ mol HI}}{1 \text{ mol } CO_2}\right)\left(\frac{1 \text{ L solution}}{0.300 \text{ mol HI}}\right) = 0.012313 \text{ L solution}$$

× 1000

= 12.3 mL HI solution

28. a. diamond - covalent network
b. $Fe(NO_3)_2$ - ionic (metal + nonmetal)
c. $N_2O_5$ - molecular - all nonmetals
d. Ag - a metal - metallic solid

29. molecular solids - consist of molecules held next to each other by intermolecular forces such as London forces, dipole-dipole forces, and hydrogen bonding.
ionic - held together by electrostatic attractions between ⊕ and ⊖ charges.
metallic - held together by a "sea" of valence electrons.
covalent network - held together by covalent bonds.

30. $\Delta H_{vap}$ - energy needed to vaporize. If IMFs are strong, it will take more energy to vaporize.

a. $CH_3OH$ or $CH_3CH_3$

$CH_3OH$: can H-bond, dipole-dipole forces, London forces, more types of forces

$CH_3CH_3$: nonpolar - only London forces

for these, MM's are very similar so they have similar London forces.

$CH_3OH$ has stronger IMFs overall, so higher $\Delta H_{vap}$.

b. $CH_3F$ or $C_6H_{14}$

$CH_3F$: polar, has dipole-dipole forces + London

$C_6H_{14}$: London forces only, but much higher MM than $CH_3F$, so stronger IMFs overall.

$C_6H_{14}$ has higher $\Delta H_{vap}$

31. Higher vapor pressure - would have weaker IMFs.
(if IMFs are weak, it will be easier to evaporate.

a) $CH_3CH_3$ has weaker IMFs so higher vp

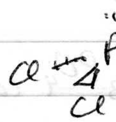
b) $CH_3F$ has weaker IMFs so higher vp.

32. Which will mix? Like dissolves like.

a. $C_6H_6$ and $C_4H_{10}$ -will mix - both are nonpolar.

b. $CO_2$ and $CH_3CH_2CH_2CH_3$ - will mix - both nonpolar.
$O=C=O$ linear so nonpolar

c. $PCl_3$ and $H_2O$ both are polar - they will mix.




polar (asymmetric)

d. $CH_3CH_2OH$ and $H_2O$ both are polar and both can H-bond. They will mix

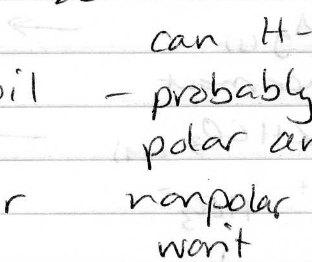
e. $CH_3OH$ and oil - probably won't mix - one is polar and one is nonpolar

f. $C_6H_6$ and KBr nonpolar and ionic - probably won't mix. incompatible.

33. water has a low vapor pressure because there are very strong intermolecular forces between water molecules. Water molecules can form lots of hydrogen bonds with other water molecules. Because they are so strongly attracted to each other, it's hard to vaporize water, so not much will evaporate

34. Yes - if the atmospheric or external pressure is lower than 1 atm.

35. water boils when its vp = external P




at high altitudes, $P_{atm}$ is lower than 1 atm, water can boil at a lower T

36. melt 50.0 g ice
use $\Delta H_{fus}$

$$\left(50.0\,g\ ice\right)\left(\frac{1\ mol\ H_2O}{18.016\,g}\right)\left(\frac{6.02\ kJ}{1\ mol}\right) = 16.7\ kJ$$

needed

37. vaporize water

$\Delta H_{vap} = 40.7$ kJ/mol

$\left(500.\text{ kJ}\right)\left(\frac{1 \text{ mole}}{40.7 \text{ kJ}}\right)\left(\frac{18.016 \text{ g } H_2O}{1 \text{ mol } H_2O}\right) =$

$221.3$ g $H_2O$

$221$ g $H_2O$ vaporize

38. a. $Li_2CO_{3\,(aq)} + HNO_{3\,(aq)}$

$Li^+$, $CO_3^{2-}$ $H^+$ $NO_3^-$

$$Li_2CO_{3\,(aq)} + 2\,HNO_{3\,(aq)} \rightarrow H_2O_{(l)} + CO_{2\,(g)} + 2\,LiNO_{3\,(aq)}$$

b. $H_3PO_4 + 3\,NaOH \rightarrow 3H_2O_{(l)} + Na_3PO_{4\,(aq)}$

$H^+$, $PO_4^{3-}$, $Na^+$, $OH^-$

c. $2\,HCl_{(aq)} + Mg_{(s)} \rightarrow MgCl_{2\,(aq)} + H_{2\,(g)}$

single replacement

d. $HI_{(aq)} + KHCO_{3\,(aq)} \rightarrow H_2O_{(l)} + CO_{2\,(g)} + KI_{(aq)}$

$H^+$ $I^-$ $K^+$ $HCO_3^-$

39. 1.00 g Ar, 5.00 L, 45°C P = ?

$PV = nRT$

$P = \frac{nRT}{V}$

$\left(1.00 \text{ g Ar}\right)\left(\frac{1 \text{ mol Ar}}{39.95 \text{ g}}\right) = 0.02503$ mol Ar

$$P = \frac{(0.02503 \text{ mol Ar})\left(0.08206 \frac{\text{L·atm}}{\text{K·mol}}\right)(318 \text{ K})}{5.00 \text{ L}}$$

$P = 0.131$ atm

40. $CO_2$ 45.0 L STP ← $\frac{22.4 \text{ L}}{1 \text{ mole}}$ any gas at STP

$\left(45.0 \text{ L}\right)\left(\frac{1 \text{ mol}}{22.4 \text{ L}}\right)\left(\frac{44.01 \text{ g } CO_2}{1 \text{ mol } CO_2}\right) = 88.4$ g $CO_2$

$T_1$ = 298 K; +273 = 266 K ($T_2$)

41. 2.5 L ($V_1$), 25°C, 1.00 atm ($P_1$) → 967 mmHg ($P_2$), −7°C, V = ? ($V_2$?) ($P_1 11$)

T and P and V are all changing. Use

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

make sure T is in T

P's should have consistent units.

$$(967\ mmHg)\left(\frac{1\ atm}{760\ mmHg}\right) = 1.2724\ atm\ (P_2)$$

$$V_2 = \frac{P_1V_1T_2}{T_1P_2} = \frac{(1.00\ atm)(2.5L)(266K)}{(298K)(1.2724\ atm)} = 1.754\ L = 1.8\ L$$

42. 45.0 L, 2.00 atm, 25°C → 1.00 atm, 25°C

T is not changing – just V and P are changing.

$P_1V_1 = P_2V_2$ so $V_2 = \frac{P_1V_1}{P_2} = \frac{(2.00\ atm)(45.0L)}{(1.00\ atm)}$

$V_2 = 90.0L$ makes sense – Pressure halved, V doubled.

43. $P_{CO_2} = 348$ torr, $P_{Ar} = 122$ torr, $P_{O_2} = 259$ torr.

$P_{total} = P_{CO_2} + P_{Ar} + P_{O_2} = 729$ torr

fraction $O_2$: $\frac{P_{O_2}}{P_{total}} = \frac{259\ torr}{729\ torr} = 0.355$ = fraction $O_2$

($35.5\%\ O_2$)

44. See lecture notes! Explain what the molecules are doing. Boyle's Law P-V  Charles's Law V-T  Avogadro V-n

a. If V is decreased, molecules don't have to travel as far to hit the walls of their container. There will be more frequent collisions of molecules with the walls, so the walls experience a higher pressure (higher force per area)

b. If T increases, molecules have higher kinetic energy.

p.12

If they have higher KE, they travel faster, and hit the walls of the container more often + with greater force. This pushes out on the walls, causing the volume to expand.

c. Adding more moles of gas to a container means there will be more frequent collisions of molecules with the walls of the container. This pushes out on the walls, expanding the container.

45 0.258 g gas, 285 mL, 97°C, 746 mmHg

molar mass?

$MM = \frac{\#g}{\#mol}$

find # mol

$PV = nRT$

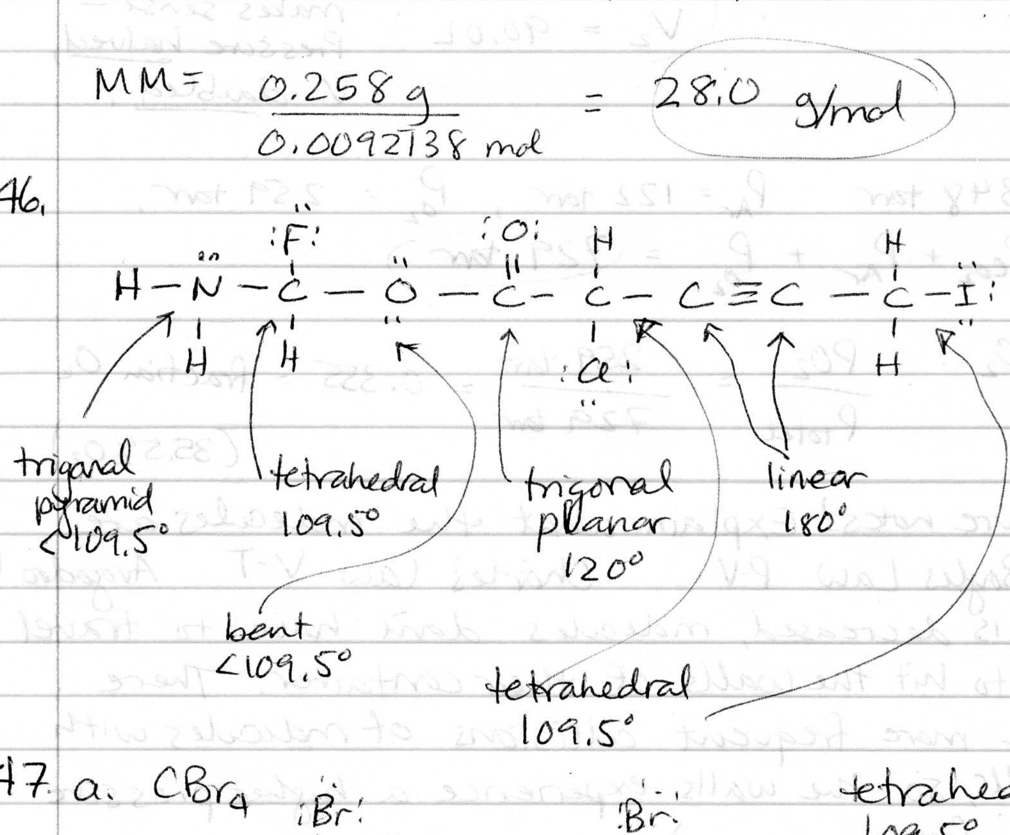
$n = \frac{PV}{RT}$

$(746\ mmHg)\left(\frac{1\ atm}{760\ mmHg}\right) = 0.98158\ atm$

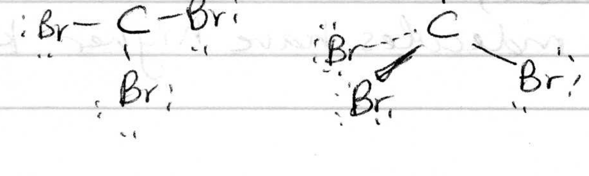
$n = \frac{PV}{RT} = \frac{(0.98158\ atm)(0.285\ L)}{(0.08206\ \frac{L \cdot atm}{K \cdot mol})(370.K)} = 0.0092138\ mol$

$MM = \frac{0.258\ g}{0.0092138\ mol} = 28.0\ g/mol$

46.




47 a. $CBr_4$



tetrahedral 109.5°

nonpolar - symmetric

$T_1$ 298K, $+273 = 266K$, $T_2$

41. $V_1$ 2.5 L, $T_1$ 25°C, $P_1$ 1.00 atm → $P_2$ 967 mmHg, $T_2$ −7°C, $P_1$ 11 $V = ?$ $V_2$?

T and P and V are all changing. Use

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

make sure T is in T

P's should have consistent units.

$$(967 \text{ mmHg})\left(\frac{1 \text{ atm}}{760 \text{ mmHg}}\right) = 1.2724 \text{ atm} \quad P_2$$

$$V_2 = \frac{P_1V_1T_2}{T_1P_2} = \frac{(1.00 \text{ atm})(2.5 L)(266K)}{(298K)(1.2724 \text{ atm})} = 1.754 L = 1.8 L$$

42. 45.0 L, 2.00 atm, 25°C → 1.00 atm, 25°C

T is not changing – just V and P are changing.

$P_1V_1 = P_2V_2$ so $V_2 = \frac{P_1V_1}{P_2} = \frac{(2.00 \text{ atm})(45.0 L)}{(1.00 \text{ atm})}$

$V_2 = 90.0 L$ makes sense – Pressure halved, V doubled.

43. $P_{CO_2} = 348$ torr $P_{Ar} = 122$ torr, $P_{O_2} = 259$ torr.

$P_{total} = P_{CO_2} + P_{Ar} + P_{O_2} = 729$ torr

fraction $O_2$: $\frac{P_{O_2}}{P_{total}} = \frac{259 \text{ torr}}{729 \text{ torr}} = 0.355$ = fraction $O_2$

($35.5\%$ $O_2$)

44. See lecture notes! Explain what the molecules are doing. Boyle's Law P-V Charle's Law V-T Avogadro V-n

a. If V is decreased, molecules don't have to travel as far to hit the walls of their container. There will be more frequent collisions of molecules with the walls, so the walls experience a higher pressure (higher force per area)

b. If T increases, molecules have higher kinetic energy.

p.12

If they have higher KE, they travel faster, and hit the walls of the container more often + with greater force. This pushes out on the walls, causing the volume to expand.

c. Adding more moles of gas to a container means there will be more frequent collisions of molecules with the walls of the container. This pushes out on the walls, expanding the container.

45 0.258 g gas, 285 mL, 97°C, 746 mmHg

molar mass? find # mol $n = \frac{PV}{RT}$

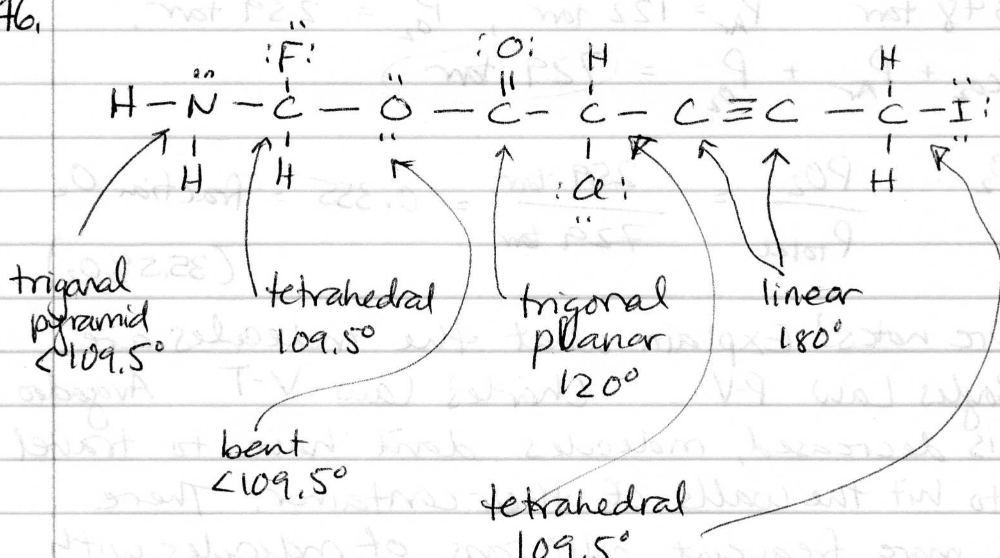
$MM = \frac{\# g}{\# mol}$ $PV = nRT$

$(746\ mmHg)\left(\frac{1\ atm}{760\ mmHg}\right) = 0.98158\ atm$

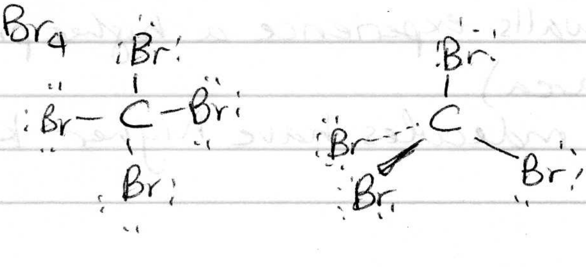
$n = \frac{PV}{RT} = \frac{(0.98158\ atm)(0.285\ L)}{\left(0.08206\ \frac{L \cdot atm}{K \cdot mol}\right)(370\ K)} = 0.0092138\ mol$

$MM = \frac{0.258\ g}{0.0092138\ mol} = 28.0\ g/mol$

46.

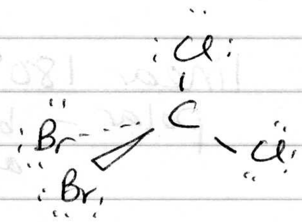



47 a. $CBr_4$



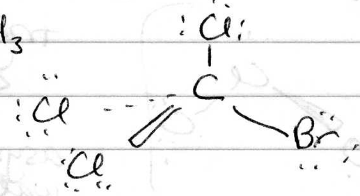

tetrahedral
109.5°
nonpolar - symmetric

47 b. $CBr_2Cl_2$



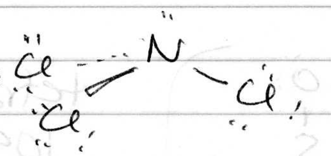
tetrahedral
109.5°
polar — not symmetric, dipoles don't cancel.

c. $CBrCl_3$



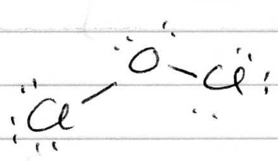
tetrahedral
109.5°
polar — not symmetric, dipoles don't cancel,

d. $NCl_3$



trigonal pyramid
< 109.5°
polar — not symmetric

e. $Cl_2O$

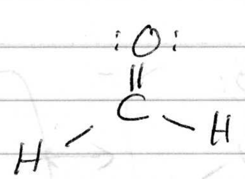


bent
< 109.5°
polar — not symmetric

f. $CO_2$ $O=C=O$

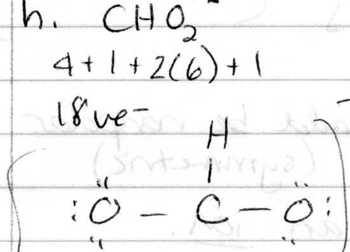
linear
180°
nonpolar — symmetric

g $CH_2O$

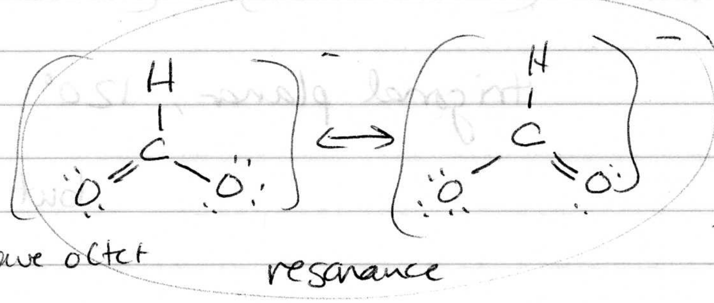


trigonal planar
120°
polar — not symmetric, dipoles don't cancel.

h. $CHO_2^-$
4 + 1 + 2(6) + 1
18 ve⁻



↑ C doesn't have octet



resonance

trigonal planar
120°
would be polar
- but an ion

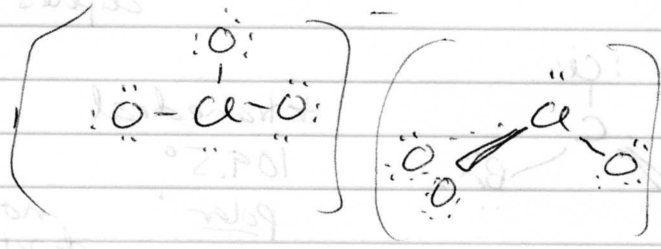
i $CN^-$

4+5+1
= 10 ve-

linear 180°
polar – but really it's an ion

j $ClO_3^-$

7 + 3(6) + 1
26 ve-

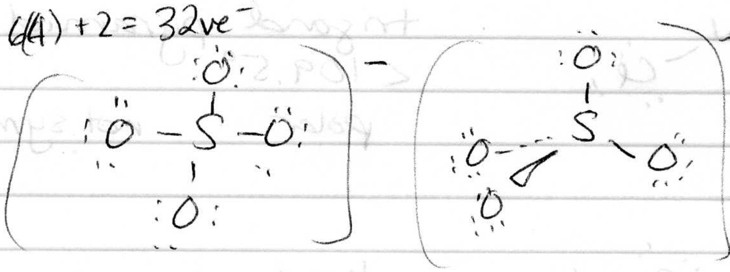


trigonal pyramid
< 109.5°

asymmetric – would be polar but it's an ion.

K. $SO_4^{2-}$

6 + 4(6) + 2 = 32 ve-



tetrahedral
109.5°

symmetric – would be nonpolar but it's an ion.

l. $SO_3^{2-}$

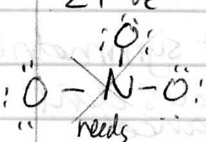
6 + 3(6) + 2
26 ve-

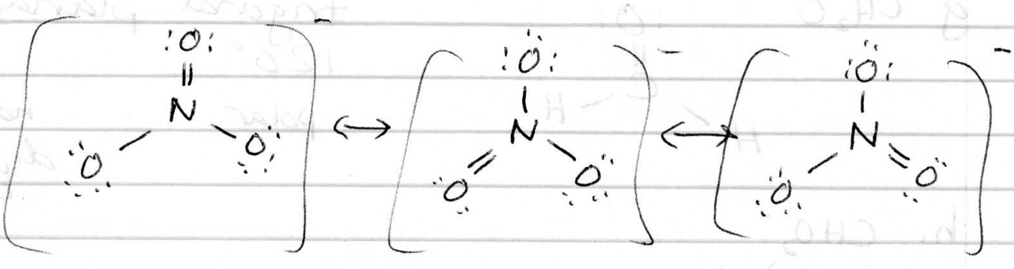
trigonal pyramid
< 109.5°

would be polar (asymmetric) but it's an ion.

m. $NO_3^-$

5+3(6)+1
24 ve-



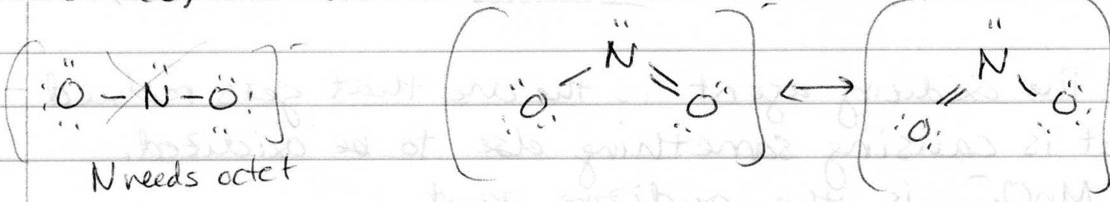



trigonal planar, 120°

would be nonpolar (symmetric) but it's an ion.

47n. $NO_2^-$

$5 + 2(6) + 1 = 18$ ve-



N needs octet

bent, < 120°, would be polar but it's an ion

48. $Pb_{(s)}$ + $HCl_{(aq)}$

a. reacts

this means Pb is more active than H.

If A + BC → B + AC reacts,
then A is more active than B. If not, it's the reverse.

b. $Pb_{(s)} + 2\,HCl_{(aq)} \longrightarrow H_{2(g)} + PbCl_{2(s)}$

Pb: Ø; H: +1, Cl: −1; $H_2$: 0; Pb: +2, Cl: −1 (insoluble)

c. Pb

Ø → +2 gets oxidized

H +1 → Ø gets reduced

49. Zn more active than Ni

Ni + $ZnCl_2$ → Zn + $NiCl_2$ will not happen.

See above explanation.

50. Cu + HCl no reaction

so H is more active than Cu.

51. $2\,MnO_4^- + 5\,C_2O_4^{2-} + 16\,H^+ \longrightarrow 2\,Mn^{2+} + 10\,CO_2 + 8\,H_2O$

Mn: (+7), O: (−2); C: (+3), O: (−2); H: (+1); Mn: (+2); C: (+4), O: (−2); H: (+1), O: (−2)

$Mn + 4(-2) = -1$

$Mn - 8 = -1$

$Mn = +7$

$2(C) + 4(-2) = -2$

$2C - 8 = -2$

$2C = +6$

$C = +3$

p.16

51 b. Mn $+7 \rightarrow +2$ reduced (ox # decreases)
C $+3 \rightarrow +4$ oxidized (ox # increases)

c. The oxidizing agent is the one that gets reduced - it is causing something else to be oxidized.
$MnO_4^-$ is the oxidizing agent.
$C_2O_4^{2-}$ is the reducing agent (it gets oxidized)

52. $^{131}_{53}I \rightarrow {}^{0}_{-1}e + {}^{131}_{54}Xe$

53. $^{247}_{97}Bk \rightarrow {}^{4}_{2}He + {}^{243}_{95}Am$

54. $^{98}_{42}Mo + {}^{2}_{1}H \rightarrow {}^{99}_{43}Tc + {}^{1}_{0}n$

100 100 totals
43 43