Pretest 3.4 for Test 3.4 on June 1, 2 (green class; we're trying to squeeze and extra short class to review —lunch time on May 29th, 2015 in 302 with national anthem)

1. Use standard reduction potentials to figure out whether it is safe to pass Ag^+ solution through a copper pipe.

First look up the standard reduction potentials:

$Ag^+ + e^- \rightarrow Ag$ 0.80 V

$Cu^{2+} + 2e^- \rightarrow Cu$ 0.34 V

Flip the half reaction with the lowest value:

$Cu \rightarrow Cu^{2+} + 2e^-$ -0.34 V

$2Ag^+ + 2e^- \rightarrow 2Ag$ 0.80 V (Don't double voltage)

Overall: $2Ag^+ + Cu \rightarrow Cu^{2+} + 2Ag$, so since Ag^+ reacts with copper, it would be a ***bad*** idea to pass Ag^+ solution through a copper pipe.

2. Use logic to figure this out:

MnO_4^- reacts with Cl^- to produce chlorine gas and Mn^{+2}.
Cl^- does not react with Br_2

Will MnO_4^- react with Br^-? Show why

If MnO_4^- reacts, then MnO_4^- is a better oxidizing agent than Cl_2, the product resulting form the oxidation of Cl-

If Cl- doesn't react with Br_2, then it implies that **Cl_2** is stronger than Br_2 and that Cl_2 would react with Br-

so **$MnO_4^- > Cl_2 > Br_2$**

3. a) Theoretically why doesn't the curve in a V versus P graph ever cross the x axis?

Since PV = constant,

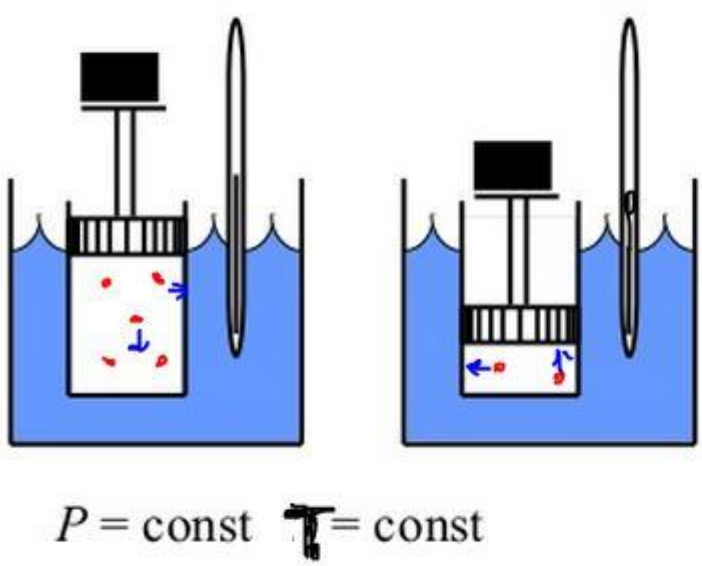
then V = constant/P

no matter how large P is, V = a number closer and closer, but not equal to zero. Really the question should read mathematically, not theoretically.

b) In reality, what will eventually happen to a gas if you keep increasing its pressure?

It will liquefy because the intermolecular bonds will become to strong for the gas molecules to keep translating

4. Draw a molecular representation of $V_1/n_1 = V_2/n_2$.

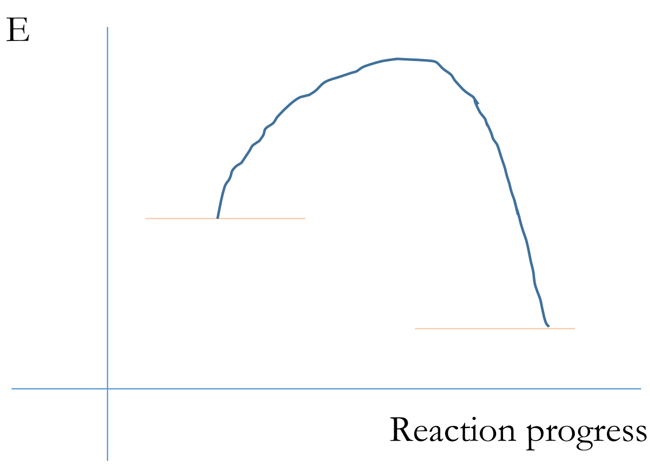


5.

$$(NH_4)_2Cr_2O_{7(s)} \rightarrow Cr_2O_{3(s)} + N_{2(g)} + 4\ H_2O_{(g)}$$

https://www.youtube.com/watch?v=yEFxXmvhf5E

a) Draw a reaction profile for the above demonstrated reaction. (a match-lit magnesium strip provides the activation energy)



b) How does it react if there's only one mole of one reactant?

One of the ions is the oxidizing agent ($Cr_2O_7^{2-}$) and the other is the reducing agent (NH_4^+)

c) Why does the lid get stuck to the container hosting the reaction?

The pressure inside drops as the hot steam (especially—4:1 ratio) and nitrogen push the air out. But when the steam condenses under the subsequently closed lid, pressure drops inside the container. Then there is an imbalance of pressure; the atmospheric pressure is able to push down on the lid and keep it sealed.

Flashbacks Common to both Classes:

6. Given:

1) $CO_{(g)} + H_{2(g)} \rightarrow C_{(graphite)} + H_2O_{(l)}$ $\Delta H = -172$ kJ

2) $C_{(graphite)} + 2H_{2(g)} \rightarrow CH_{4(g)}$ $\Delta H = -74.8$ kJ

3) $H_2O_{(g)} \rightarrow H_2O_{(l)}$ $\Delta H = -40.7$ kJ

Find $CH_{4(g)} + H_2O_{(g)} \rightarrow CO_{(g)} + 3H_{2(g)}$ $\Delta H° = ??$

Reverse (2):

$CH_{4(g)} \rightarrow C_{(graphite)} + 2H_{2(g)}$ $\Delta H = +74.8$ *kJ*

Reverse (1):

$C_{(graphite)} + H_2O_{(l)} \rightarrow CO_{(g)} + H_{2(g)}$ $\Delta H = +172$ *kJ*

Keep (3):

$H_2O_{(g)} \rightarrow H_2O_{(l)}$ $\Delta H = -40.7$ *kJ*

Sum: *$CH_{4(g)} + H_2O_{(g)} \rightarrow CO_{(g)} + 3H_{2(g)}$* *74.8 + 172 - 40.7 = 206.1 kJ = 206 kJ (3SF)*

7. Conditions are making a forest fire even worse: (1) A wind is blowing. (2) it has not rained in the last three weeks. (3) The forest contains Jeffrey Pines(figure 1), which release heptane, flammable compounds.
Relate each of the three factors to the fire triangle.

Figure 1 Jeffrey Pines

(1) A wind is blowing. More oxygen
(2) it has not rained in the last three weeks.
(less heat needed to start the fire because of the lower specific heat of dry wood)
(3) The forest contains Jeffrey Pines, which release heptane, flammable compounds
More fuel is provided

8. What normally happens to ideal gas behaviour at very low temperatures and why?

It breaks down because attractions between molecules start to take over.

9. During hibernation of a certain animal, the rate of oxygen consumption decreases to 0.5 g/day. Find the average rate of consumption of glucose in moles/h.

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + energy

0.5 g O_2/day (mole/32g) = (0.5/32) = 1/64 moles O_2/day

1/64 moles O_2/day (1 $C_6H_{12}O_6$/6O_2) = 1/384 mole $C_6H_{12}O_6$/ day

(1/384 mole) $C_6H_{12}O_6$ / day (day/24 h) = 1 X 10^{-4} mole $C_6H_{12}O_6$ /h

GreenClass Only Flashback Questions(Reds, see #12-13 for yours)

10. Balance the following redox reaction:

$MnO_4^- + I^- \text{-->} I_2 + Mn^{2+}$

$2I^- \rightarrow I_2 + 2e$

$8\ H^+ + MnO_4^- + 5e \rightarrow Mn^{2+} + 4\ H_2O$

$10I^- \rightarrow 5\ I_2 + 10\ e$

$16\ H^+ + 2\ MnO_4^- + 10e \rightarrow 2\ Mn^{2+} + 8\ H_2O$

Sum: $10I^- + 16\ H^+ + 2\ MnO_4^- \rightarrow 5\ I_2 + 2\ Mn^{2+} + 8\ H_2O$

11. Show how HCO_3^- can act as both an acid and a base. Use water.

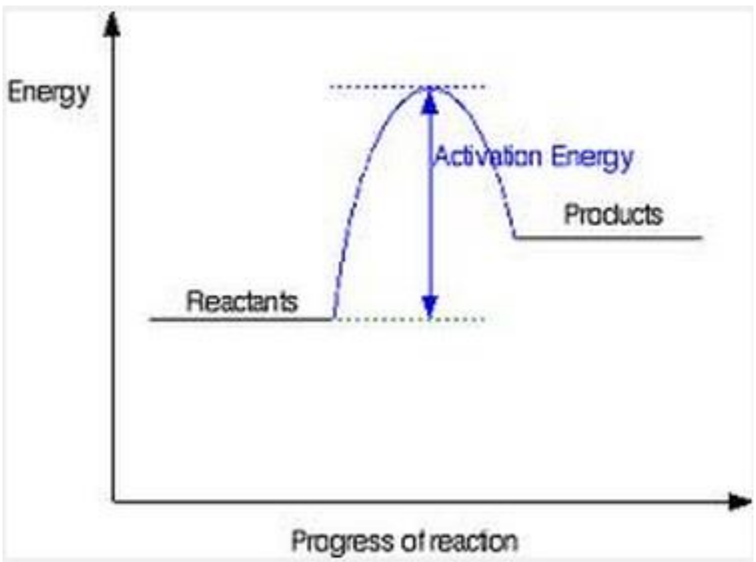
Acid: H^+ donor: $HCO_3^- + H_2O = CO_3^{-2} + H_3O^+$

Base: H^+ acceptor: $HCO_3^- + H_2O = OH^- + H_2CO_3$

Red Class Only Flashback Questions

12. **Kidney beans** contain the lethal phytohaemaglutin which breaks down and becomes harmless after cooking. Draw a reaction profile for the conversion of phytohaemaglutin into harmless products.

Cooking is endothermic:

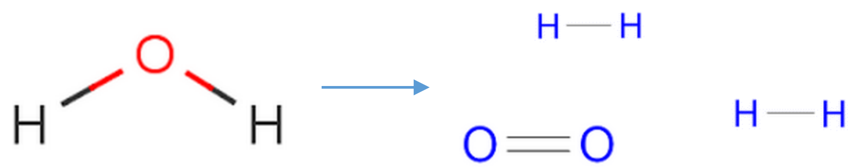


13.

Average Bond Energies (kJ/mol)							
Single Bonds						*Multiple Bonds*	
H—H	432	N—H	391	I—I	149	C = C	614
H—F	565	N—N	160	I—Cl	208	C ≡ C	839
H—Cl	427	N—F	272	I—Br	175	O = O	495
H—Br	363	N—Cl	200			C = O*	745
H—I	295	N—Br	243	S—H	347	C ≡ O	1072
		N—O	201	S—F	327	N = O	607

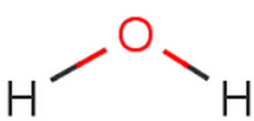
C—H	413	O—H	467	S—Cl	253	N = N	418
C—C	347	O—O	146	S—Br	218	N ≡ N	941
C—N	305	O—F	190	S—S	266	C ≡ N	891
C—O	358	O—Cl	203			C = N	615
C—F	485	O—I	234	Si—Si	340		
C—Cl	339			Si—H	393		
C—Br	276	F—F	154	Si—C	360		
C—I	240	F—Cl	253	Si—O	452		
C—S	259	F—Br	237				
		Cl—Cl	239				
		Cl—Br	218				
		Br—Br	193				

Estimate the enthalpy of $2\ H_2O \rightarrow 2\ H_2 + O_2$



4(467) + 2(-432) + 1(-495) = 509 kJ

(actual experimental value is 484 kJ for gas; 572 for the liquid form, for an average of 528 kJ Remember it's only an approximation-method, just like rock'n roll, but I like it.)



14. For your final theory exam do not forget to do as many examples as possible from the June exam review center at:

http://www.emsb.qc.ca/laurenhill/science/chemacademy3.html

- **If you run into any problems, I will often be in my room or email me at enricouva@gmail.com with your questions.**
- **Enrichment(quantum chem will be taught on June 29th and 30th)**
- **Finally, in the summer stay in touch with current chem topics at uvachemistry.com**