

Chem 209 Final - F2016 - © Pavel Sedach + Prep 101

1.C $(\underbrace{4.1}_{1 \text{ decimal}} + 12.530) \times 2.14$
 $(16.6) \times 2.14 = 35.6$

2.C A \rightarrow instantaneous rate at $t = 0$ (aka initial rate)

B \rightarrow instantaneous rate at $t = 8$ s

C \rightarrow avg. rate 0 to 8 secs.

D \rightarrow avg. rate 0 to 20 secs

3.A $0.100 \text{ min}^{-1} \leftarrow$ first order units

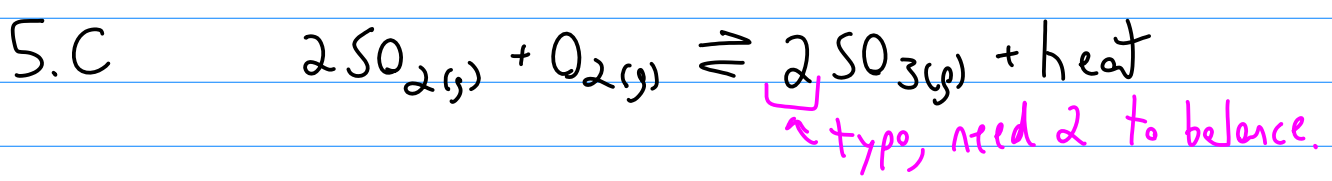
$$\ln(A_t) = \ln(A_0) - kt$$

$$\ln(A_t) = \ln(1.00M) - 0.100 \text{ min}^{-1} \cdot 30.0 \text{ min}$$

$$\ln(A_t) = -3.00, A_t = 0.0498M$$

4. B $\text{rate} = k[\text{NO}_2][\text{O}_3]$ ← slow step of answer must match these reactants.

- a) $\text{rate} = k[\text{N}_2\text{O}_4]^2[\text{O}_3]$
- b) $\text{rate} = k[\text{NO}_2][\text{O}_3]$** * also steps must add up to net rxn. We didn't need to use that here.
- c) $\text{rate} = k[\text{NO}_5]^2$
- d) $\text{rate} = k[\text{NO}_2]^2$



- i. ↓V = shift to less moles gas = shift right
- ii. Add heat (a product) shift left
- iii. ↑[O₂], shift right

6. A

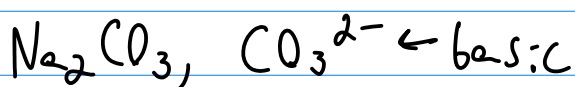
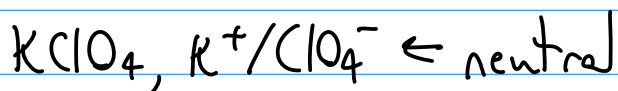
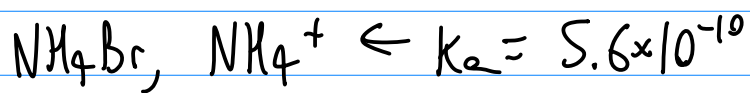
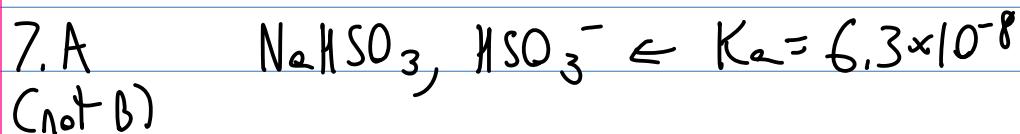
$$\ln\left(\frac{K_2}{K_1}\right) = \frac{\Delta H}{R} \left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

9.25×10^5 (above K_2) 278.15K (above T_2)
 2.25×10^4 (below K_1) 298.15K (below T_1)
 $8.314 \frac{\text{J}}{\text{molK}}$ (below R)

$$\ln(4.11 \times 10^1) = \frac{\Delta H}{8.314 \frac{\text{J}}{\text{molK}}} (-2.41166 \times 10^{-4})$$

$$3.716 = \Delta H \cdot -2.901 \times 10^{-5}$$

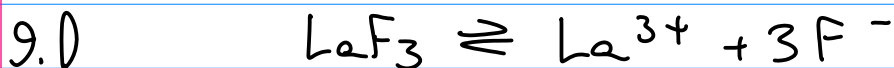
$$\Delta H = -1.28 \times 10^5 \text{ J} = -1.28 \times 10^2 \text{ kJ}$$



* this question is asking for the best acid (lowest pH), without K_a values it's not possible to pick $\text{HSO}_3^-/\text{NH}_4^+$.
Actually, the professor key is wrong, HSO_3^- is the better acid if K_a 's are available (lowest pH)

8.D The most dissociated acid has most $\frac{[\text{A}^- \text{ at equilibrium}]}{[\text{HA initial}]}$,

i. most $\frac{\text{product}}{\text{reactants}}$



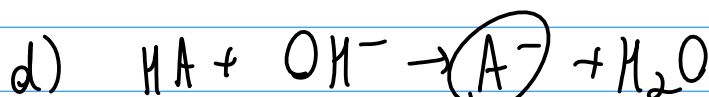
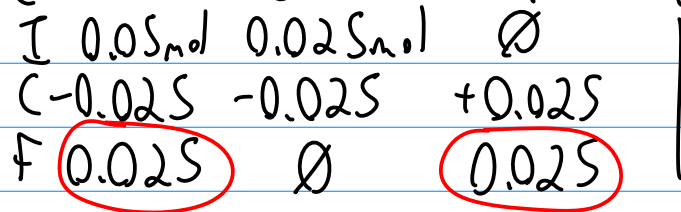
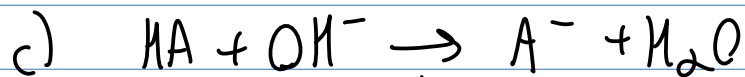
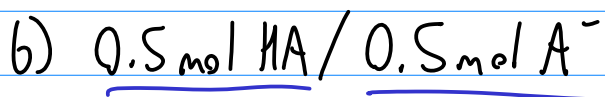
a) Add HF = $\uparrow \text{F}^-$ = shift left

b) Add NaCl = no effect

c) Cooling usu. lowers solubility

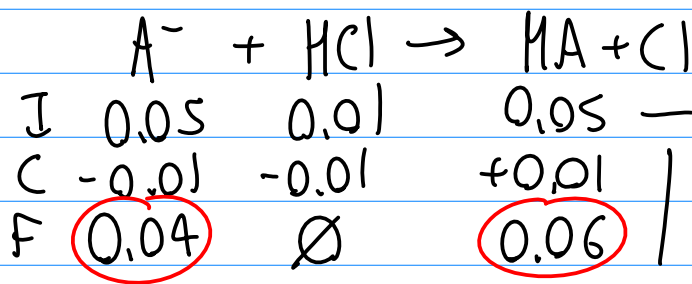
d) Add HCl, $\text{F}^- + \text{H}^+ \rightleftharpoons \text{HF}$, F^- is removed as HF, so should be more soluble, shift left if right!

10. B



∅ all A^- , not a buffer after stoich!

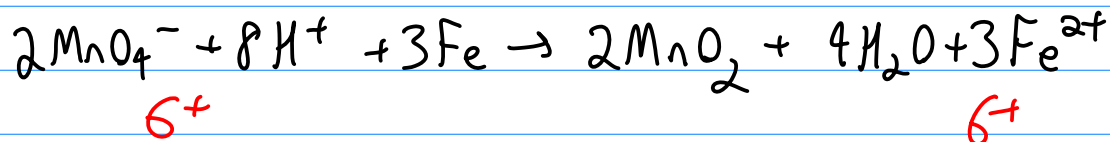
11. B



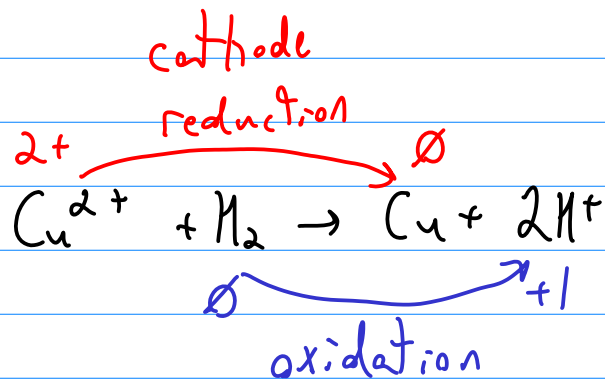
* Acidity (H^+) will also increase slightly

12. D

Charges balance and atoms balance:



13. C



14. A

To increase V , add reactants OR remove products

- a) shift right
- b) shift left
- c) Decreases $[\text{Cu}^{2+}]$, shift left
- d) Lower H^+ ... but in right hand beaker = ???

15. A

a) describes role of sacrificial anode

16. B

but no correct answer

Size

$\text{C} > \text{N} > \text{H}$

Should be $\text{H} < \text{C} < \text{N}$

IE

$\text{H} > \text{N} > \text{C}$

$2p^3$ \uparrow $2p^2$

EA

$\text{C} > \text{H} > \text{N} \dots$ the professor key is wrong.

Can simply look up real value online and discuss for full marks,

N is $2p^3$, doesn't want e^- .

Unless they are looking for most endothermic electron attachment enthalpy ... but then key is still wrong.

22. C

a. Ionic ← crystalline & low conductivity

b. Covalent ← low conductivity

c. Metallic

d. Polar ← type of covalent

high conductivity... but debatable if you can consider them crystalline.