Answers to my 2014 January final exam.

I just developed these today. Errors are not unlikely, so if you find any, please notify me at labine41@gmail. com There are no questions 19 and 20.

|  |  |
| --- | --- |
| 1 | B |
| 2 | C |
| 3 | A |
| 4 | B |
| 5 | A |
| 6 | C |
| 7 | B |
| 8 | B |
| 9 | C |
| 10 | C |
| 11 | B |
| 12 | D |
| 13 | A |
| 14 | C |
| 15 | B |
| 16 | B |
| 17 | C |
| 18 | C |
| 19 |  |
| 20 |  |
| 21 | C |
| 22 | D |
| 23 | B |
| 24 | B |
| 25 | B |
| 26 | C |
| 27 | C |
| 28 | D |
| 29 | C |
| 30 | B |
| 31 | B |
| 32 | C |
| 33 | A |
| 34 | D |
| 35 | C |
| 36 | A |
| 37 | A |
| 38 | A |
| 39 | B |
| 40 | C |

Free response I.

The standard state of Sulfur is solid, not gas, so the ∆H for the formation of SO2 from gaseous Sulphur does not equal ∆Hf of Sulfur dioxide

B. 279 kJ ( -576 = -297 – x)

C. 495 – 2x = -576. x = 536 kJ/mol.

D. ii There is resonance, so that the pi bonds are distributed evenly over the two S-O bond sites.

iii. +1

E. Shows three double bonds.

F. The structure with double bonds seems better because the bond energy of a double bond is close to the calculated average bond energy of the Sulfur-oxygen bonds.

II. A. 8.00 g B) i. The total mass of the solution is 99.7 g of water + 8.00 g of ammonium nitrate, or 107.7 g. ii. 4.5 x 107.7 x 3.90/0.100 = 18.9 kJ, or 19 to 2 sig figs.

C. Flawed question; It depends on whether the room is warmer than 19.5 degrees. I intended the answer to be “smaller, because heat flows form the room to the solution, producing a higher final temperature, and thus a smaller change in temperature.

D. For insulation from the environment.

E. 585 J was transferred, but to 2 sig figs, 590 J.

ii. 0.38 J/g°

III. 0.00105 mol of Mg with 0.100 mol of HCl, so the Mg is limiting.

A) V = 0.00105 mol(0.0821 L atm./mol K)(298 K) / 1.00 atm = 0.0404 L

B.The volume would be greater, since water vapor would increase the total number of moles of gas collectd.

C. 0.00165 mol Mg ( 2 HCl/1 Mg) = 0.0033 mol. HCl.

ii. 0.100 mol HCl - 0.0033 mol consumed =0.0967 mol remaining. In a volume of 0.050 L that would be 1.93 molar.

D. 0.00165 mol ( 466 kJ/ mol) = 0.769 kJ. ( note that problem would now say “-466 kJ/mol rxn”)

ii. The net reactions are identical, since both are strong acids, and nearly completely ionized.

iii. Acetic acid is weak, and not completely ionized, so that covalent bonds are broken when acetic acid loses an H+ in the reaction. That absorbs energy, so the whole process produces less.

IV. B sp2 C. The C-O bonds in the formate are two identical bonds due to resonance. They are shorter than the single C-O bond in formic acid, and longer than the double bonds.