Merck State Science Day 2015 Answer Section

Chemistry

MULTIPLE CHOICE

1. E **2.** A 3. D 4. D a) did not K and inverted (2.05*27)/(6.50*37)=X b) used (2.05atm*300K)/(6.50mL*310K)=X c) math error: (2.05*310*1)/ (6.50*300) = X d) correct (6.50mL*310K*1atm)/ (2.05atm*300K) = X e) did not use Kelvin (6.50*37*1)/ (2.05*27) = X **5.** B 50g/415.1 = 0.120 mol 5g/17g = 0.29 mol only 0.240 mol NH₃ needed for KTCP to react completely a) used KTCP and found mass of NH₃ used b) correct: KTCP is the limiter: 0.120 mol KTCP yields 0.120 mol cis-platin*330.1g/mol =36.1g c) used NH₃ as the limiter d) used NH₃ and found mass of KTCP needed e) used NH₃ but then forgot to divide by 2. 6. C 7. D 8. D Eliminated **9.** E

- **10.** B
- **11.** D

PV=nRT, n=(0.0821)(25+273)/((550/760)*0.25) = 0.0074 mol; 0.118g/0.0074 mol = 15.96 g/mol

- **12.** A
- **13.** D

100 g water yields 22.2 g of methane, 75 g aluminum carbide could yield 40 g of methane

- A)
- 14. A
- **15.** C
- **16.** C
- **17.** C
- **18.** E
- **19.** D
- **20.** D
- **21.** C
- **22.** A
- 23. В
- **24.** A

36000 sec x 0.5 amp = 18000 coul; 18000 coul/96500/6 e- x 22.4 L mol= **25.** B 26. C 27. D $K_{sp} = 6.7 \text{ x } 10^{-31} = \text{X} \cdot (3 \text{ x})^3$ 28. C **29.** B ΔH = bond energy of products – bond energy of reactants = (2*800*2+2*460) – (835+2*410+2.5*494) = 1230 **30.** C **31.** A 32. A **33.** C **34.** B 35. B delta G = $-nFE^{\circ}$ **36.** C c) correct: the mass ratio of nitrogen to oxygen in each is: N₂O, 28:16 NO, 14:16 NO₂, 14:32 N₂O₅, 28:80 **37.** C C is correct: amount of CO₂ is determined by amount of C and amount of H₂O is determined by the amount of H 38. A The weakest acid has the strongest conjugate base ($K_W = K_a \times K_b$). At the equivalence point all that is left is the weak base. **39.** E e is correct: there are 8 C-H and 6 C-C sigma bonds, and 4 C-C multiple pi bonds **40.** A ans: $Q = [C]^2/[A]^2[B]$ a) correct $(1)^2/(2)^2(2) = 0.13 \text{ K}_c > Q$ therefore reaction proceeds to right b) $(1)^2/(0.2)^2(0.2) = 125 \text{ K}_c < \text{Q}$ c) $(5)^2/(2)^2(0.2) = 31 \text{ K}_c < \text{Q}$ d) $(0.1)^2/(0.1)^2(0.1) = 10 \text{ K}_c = Q$ e) $(10)^2/(2.0)^2(.10) = 25,000 \text{ K}_c < \text{Q}$ **41.** C reordered answers & moved correct 1.3 to C ans: a correct; $K_p = 1/P_{CO2} 1/0.75 = 0.13$ b) 0.75/2 =0.38 c) $K_p = P_{CO2}$ d) at equilibrium so P_{CO2} must equal 1 e) thinks you need solid amounts **42.** B **43.** B **44.** C **45.** E ans: E the anions of weak acids are basic and will increase in solubility in acids **46.** B a) the CO2(g) produced dissolves in the water in the beaker, thus the total volume of gas in the beaker is reduced, so the water takes its place ans: **b** $C_{25}H_{52}(s) + 38 O_2(g) \rightarrow 25CO_2(g) + 26 H_2O(g)$ as shown by the equation for every $38O_2(g)$ reacted a total of 51 moles of gas is produced so the pressure is increased until the $CO_2(g)$ dissolves in the water and the $H_2O(g)$ condenses

47. D

ans: **d** BrF₃ is T-shaped so 90⁰, NF₃ is trigonal pyramidal so 107⁰, CF₄ is tetrahedral so 109.5⁰

- **48.** B
- **49.** A
- **50.** A
- 51. C52. A
- 52. А 52 г
- **53.** E

MATCHING

- **54.** E
- **55.** C
- **56.** B
- **57.** A
- **58.** E
- **59.** D
- **60.** B
- **61.** A
- **62.** B