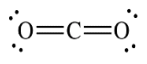
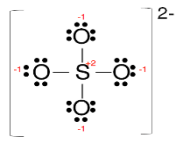
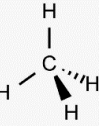


WYSE – Academic Challenge
Chemistry Test Solutions (Sectional) – 2017

Answer	Explanation
1. Answer is E.	$p^+ + n^0 + e^- = 19 + 9 = 28$
2. Answer is B.	LiCl and FeCl ₃ provide one and three mol of Cl ⁻ ion respectively, and MgI ₂ provides none.
3. Answer is C.	2.10 torr = 0.002763 atm. $\Pi = MRT$. Since, $M = n/V$ and $n = m/M$, it can be written that molar mass, $M = \frac{mRT}{\Pi V} = \frac{1.50 \text{ g} \times 0.0821 \text{ L} \cdot \text{atm} \cdot \text{mol}^{-1} \cdot \text{K}^{-1} \times 300 \text{ K}}{0.002763 \text{ atm} \times 0.8000 \text{ L}} = 16,722.5 \text{ g/mol}$
4. Answer is E.	Ionic solids form crystal due to strong lattice energy that needs to be overcome in this process.
5. Answer is A.	Density, $D = \frac{m}{V}$. Given $D_A > D_B$ leading to $\frac{m_A}{V_A} > \frac{m_B}{V_B}$. For equal mass of A and B it applies that $\frac{1}{V_A} > \frac{1}{V_B}$. The reciprocal relationship in volume supports the answer.
6. Answer is D.	Contains the functional group of a ketone.
7. Answer is D.	Excluding the noble gases increases in the periodic table from left to right along a period and from bottom to up along a group ($\rightarrow \uparrow$ resulting in overall trend $\nearrow$).
8. Answer is B.	$\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2 \text{HI}(\text{g}) \quad K_c = 4.0 = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$ At equil. $(x - 0.1) \text{ mol}$ $(x - 0.1) \text{ mol}$ 0.2 mol $4.0 = \frac{(0.2)^2}{(x-0.1)(x-0.1)}$ Leading to $x = 0.20 \text{ mol}$
9. Answer is B.	It follows the rules of the nomenclature.
10. Answer is D.	$\frac{\text{rate Expt}_2}{\text{rate Expt}_1} = \frac{k [\text{NO}_2]_2^2 \times [\text{O}_2]_1}{k [\text{NO}_2]_1^2 \times [\text{O}_2]_1} = \frac{2^2 \times 2^1}{1^2 \times 1^1} = 8 \text{ times value}$
11. Answer is C.	Self-explanatory.
12. Answer is B.	The numerical values of ppt, ppb, ppm and percent are 10^{-12} , 10^{-9} , 10^{-6} , and 10^{-2} respectively.
13. Answer is C.	Follows the significant figure rule.
14. Answer is E.	The trend in the periodic table is – along any period the size decreases moving from left to right.
15. Answer is D.	$2 \text{ A}(\text{g}) + \text{B}(\text{g}) \rightleftharpoons \text{C}(\text{g}) \quad K_c = \frac{[\text{C}]}{[\text{A}]^2[\text{B}]} = \frac{6.2 \times 10^{-3} \text{ M}}{(2.4 \times 10^{-2} \text{ M})^2(4.6 \times 10^{-3} \text{ M})} = 2339.97$
16. Answer is E.	It fits in the rules of nomenclature.
17. Answer is A.	The absence of H ₂ O in the rate expression means $[\text{H}_2\text{O}]^0$, implying to a zero-order with respect to water.
18. Answer is A.	Loss of negative charge of the electron causes positive charge on the species.
19. Answer is A.	$325 \text{ g C}_{12}\text{H}_{22}\text{O}_{11} \times \frac{1 \text{ mol}}{342 \text{ g}} = 0.9503 \text{ mol}$ $242 \text{ g H}_2\text{O}_1 \times \frac{1 \text{ mol}}{18 \text{ g}} = 13.444 \text{ mol}$ $\text{mol fraction C}_{12}\text{H}_{22}\text{O}_{11} = \frac{0.9503 \text{ mol}}{0.9503 \text{ mol} + 13.444 \text{ mol}} \times 100 = 0.0660$

20. Answer is B.	Comparing experiment 1 and 2 where [O ₂] is kept constant increasing [NO] by 2x causes rate to increase twice, meaning a first order dependence with respect to NO. Comparing experiment 2 and 3 where [NO] is kept constant increasing [O ₂] by 4x causes rate to increase by 16 times (4 ² = 16), meaning a second order dependence with respect to O ₂ .
21. Answer is C.	Despite all being haloacids, HF is not a strong acid.
22. Answer is C.	The best strategy for solving this equation is to write the first chemical (toluene) simply as a hydrocarbon, C ₇ H ₈ + O ₂ → CO ₂ + H ₂ O. From there, balance the carbons first, the hydrogen second, and oxygen last.
23. Answer is D.	Because it shows a linear relationship between V and P ⁻¹ .
24. Answer is A.	$q = C \times m \times \Delta T = (0.385 \text{ J/(g} \times \text{K)})(10.0 \text{ g})(598 \text{ K} - 298 \text{ K}) = 1160 \text{ J}$
25. Answer is D.	A beta particle is the same as an electron.
26. Answer is A.	$\% \text{ H in NH}_3 = \frac{\text{mass, 3 H atoms} = 3.03 \text{ amu}}{\text{mass, NH}_3 \text{ molecule} = 17.04 \text{ amu}} \times 100 \% = 17.78\%$
27. Answer is B.	$c = \lambda \nu = \lambda = \frac{c}{\nu} = \frac{2.998 \times 10^8 \text{ m/s}}{1.12 \times 10^9 \text{ 1/s}} = 0.268 \text{ m}$
28. Answer is A.	Zn → Zn ⁺² involves a loss of electrons, which is an oxidation.
29. Answer is E.	The central atom, C, of this species is surrounded by four bonding electron domains. A.  B.  C.  D.  E. 
30. Answer is A.	BF ₃ is an electron acceptor making it a Lewis acid.
31. Answer is D.	A combustion reaction for a hydrocarbon is the addition of oxygen to form carbon dioxide and water.
32. Answer is C.	$d = \frac{PM}{RT} = \frac{(1.00 \text{ atm})(44.0 \frac{\text{g}}{\text{mol}})}{(273 \text{ K})[0.082057 \text{ L} \times \text{atm}/(\text{mol} \times \text{K})]} = 1.96 \text{ g/L}$
33. Answer is E.	A state function is a property whose value does not depend on the path taken to reach that specific function or value. Considering this definition, all of the choices are state functions.
34. Answer is D.	$454 \text{ g C}_3\text{H}_8 \times \frac{36.03 \text{ g C}}{44.10 \text{ g C}_3\text{H}_8} = 370.92 \text{ g}$
35. Answer is E.	The anode is where the oxidation occurs.
36. Answer is C.	HF has the largest difference in electronegativity between the bonded atoms.
37. Answer is C.	Because sodium chloride is a salt, an ionic compound and water is polar covalent, the correct answer is ion-dipole.
38. Answer is B.	This is both a stoichiometry and limiting reagent problem. Glucose is the limiting reagent in this problem. Therefore: $25.0 \text{ g glucose} \times \frac{1 \text{ mol glucose}}{180.2 \text{ g glucose}} \times \frac{6 \text{ mol water}}{1 \text{ mol glucose}} \times \frac{18.0 \text{ g water}}{1 \text{ mol water}} = 15.0 \text{ g water}$ $27.0 \text{ g oxygen} \times \frac{1 \text{ mol oxygen}}{32.0 \text{ g oxygen}} \times \frac{6 \text{ mol water}}{6 \text{ mol oxygen}} \times \frac{18.0 \text{ g water}}{1 \text{ mol water}} = 15.2 \text{ g water}$
39. Answer is B.	Self explanatory.
40. Answer is E.	Sublimation is the direct-transition of a substance from solid to gas.