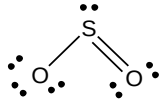
2018 WYSE Regional Chemistry Solution Set

Answer	Explanation
1. Answer is A.	Self-explanatory by the chemical formulas.
2. Answer is A.	Two products are formed from one reactant.
3. Answer is C.	V ∝ T in K.
4. Answer is E.	In endothermic reactions energy enters the system from outside.
5. Answer is B.	Alpha particles are helium nuclei with 2+ charge ($_2^4\mathrm{He}^{2+}$) and beta particles are electrons ($_{-1}^{0}\mathrm{e}^{-}$).
6. Answer is D.	Empirical formula displays the lowest whole numbers as subscripts in the formula.
7. Answer is E.	$\upsilon\lambda = c \quad \lambda = \frac{c}{\nu} = \frac{3.00 \times 10^8 \ \mathrm{m.s^{-1}}}{107.1 \times 10^6 \ \mathrm{s^{-1}}} = 2.80 \ \mathrm{m}$
8. Answer is A.	All oxidation numbers must add up to the charge of the specie. [+4 + 3(–2) = 2–]
9. Answer is E.	 The presence of the lone pair on S causes the non-cancellation of the bond polarity and makes the species to be polar overall.
10. Answer is D.	More compact phases have less degree of freedom.
11. Answer is B.	Stomach acid (HCℓ) is a strong acid. Neutralizing it with strong base will cause additional stress. That is why all antacids are weak bases.
12. Answer is D.	$7 \ \mathrm{mol\ C\ell_2} \times \frac{2 \ \mathrm{mol\ I_2}}{3 \ \mathrm{mol\ Cl_2}} \times \frac{254 \ \mathrm{g\ I_2}}{1 \ \mathrm{mol\ I_2}} = 1185 \ \mathrm{g\ I_2}$
13. Answer is B.	$\mathrm{PV = nRT} \quad \mathrm{T} = \frac{\mathrm{PV}}{\mathrm{nR}} - 273 = \frac{2 \ \mathrm{atm} \times 10 \ \mathrm{L}}{1 \ \mathrm{mol} \times 0.0821 \ \mathrm{L.atm.mol^{-1}.\ K^{-1}}} - 273 = -29.4°\mathrm{C}.$
14. Answer is E.	Formula of iron(III) oxide is Fe_2O_3. $\% \ \mathrm{Fe} = \frac{\#\ \mathrm{atoms\ of\ Fe} \times \mathrm{mass\ Fe}}{\mathrm{mass\ Fe_2O_3}} \times 100 = \frac{2 \times 55.8 \ \mathrm{amu}}{(2 \times 55.8 \ \mathrm{amu}) + (3 \times 16 \ \mathrm{amu})} \times 100 = 70\%$
15. Answer is D.	The five orbitals in the d sublevel can hold 2 x 5 = 10 electrons when full.
16. Answer is C.	Self-explanatory.
17. Answer is A.	The H-bonding ability of water brings another water molecule closer, which causes more energy to separate (an indication of higher boiling point). Dihydrogen sulfide is not capable of H-bonding.
18. Answer is B.	It is the minimum whole number coefficient for oxygen.
19. Answer is C.	Ideal gas law is expressed by $\mathrm{PV = n\ RT}$. Therefore, mathematically $\mathrm{V} \propto \frac{1}{\mathrm{P}}$ at constant n and T.
20. Answer is C.	$424 \ \mathrm{g\ K_3PO_4} \times \frac{1 \ \mathrm{mol\ K_3PO_4}}{212.3 \ \mathrm{g\ K_3PO_4}} \times \frac{3 \ \mathrm{mol\ KNO_3}}{1 \ \mathrm{mol\ K_3PO_4}} \times \frac{101 \ \mathrm{g\ KNO_3}}{1 \ \mathrm{mol\ KNO_3}} = 605 \ \mathrm{g\ KNO_3}$
21. Answer is B.	The general formula for an alkane is C_nH_{2n+2}.

22. Answer is D.	Elements in group IIA lose two electrons (becoming positively charged) and elements in group VIIA gain one electron (becoming negatively charged) to acquire an electron configuration similar to that of the nearest noble gas.
23. Answer is C.	Accuracy describes the difference between the measurement and the actual value, while precision describes the variation seen when one measures the same part repeatedly with the same device.
24. Answer is C.	Flammability is a chemical property because combustion is a chemical change.
25. Answer is B.	Strontium as an ion has a charge of 2+ and nitrogen as an ion as a charge of 3-. Using the concept of least common multiples, three strontium atoms are needed for every two nitrogen atoms.
26. Answer is A.	The group of elements on the far right of the periodic table is known as the noble gases, which are known for their inert behavior.
27. Answer is B.	Solute is defined as the minor component in a solution and is dissolved in the solvent.
28. Answer is A.	In each of the answer choices, the solvent listed is water and the solute is NaCl. The solutions with the highest concentration of solute will have the lowest vapor pressure.
29. Answer is D.	The equilibrium constant is a ratio of the concentration of the products to the concentration of the reactants. The concentration of each is raised to a power that is equal to the stoichiometric coefficient.
30. Answer is A.	A catalyst works by providing an alternative reaction pathway to the reaction product. The rate of the reaction is increased as this alternative route has a lower activation energy.
31. Answer is E.	2 cobalt atoms + 3 sulfur atoms + 12 oxygen atoms = 17 total atoms
32. Answer is E.	0.48 dL = 0.048 L 2.1×10^3 mL = 2.1 L 110 cL = 1.1 L 3.6×10^2 kL = 360,000 L 18 cm^3 = 0.018 L
33. Answer is C.	Sugar and water are two different substances. Upon mixing, they form a homogeneous mixture with only one visible phase present.
34. Answer is A.	K_2S is an ionic compound. Ionic compounds are named by stating the first element and stating the second element and changing the ending to "-ide."
35. Answer is D.	Elements found in the same group have similar properties. Potassium is the only element listed that is in the same group as sodium.
36. Answer is E.	The position of the reaction at equilibrium depends on the relative amounts of product and reactant at equilibrium. If the products dominate and the reaction lies to the right, *K* is large (because the numerator dominates over the denominator).
37. Answer is E.	Since k is constant, it can be ignored. Using theoretical numbers, if $[A_{initial}] = 1$ and $[B_{initial}] = 1$, rate = 1. If [B] is doubled, rate = $(2)^3 = 8$.
38. Answer is B.	The number and arrangement of electrons in the outermost shell, or valence shell, produce chemical properties of an atom.
39. Answer is D.	$M = \frac{n}{V} = \frac{1.50\ \text{mol}}{2.50\ \text{L}} = 0.600\ M$
40. Answer is C.	Protons and neutrons have nearly the same mass while electrons are much less massive.