1a. $1.5x10^{24}$ atoms of lithium (2SD).
(2.5mol Li / 1) * ($6.02x10^{23}$ atoms Li / 1 mol Li)
The above expression is the shorthand for the following:

$$\frac{2.5\text{mol Li}}{1} * \frac{6.02x10^{23}\text{ atoms Li}}{1\text{ mol Li}}$$

1b. $6.25x10^{-2}$ mol of sulfur atoms (3SD).
($3.76x10^{22}$ atoms S / 1) * (1 mol S / $6.02x10^{23}$ atoms S)
2a. 39.098g K/mol K, 39.098g K = 1 mol K
Use the periodic table.
2b. 31.998g O_2/mol O_2, 31.998g O_2 = 1 mol O_2
(15.999 g O_2/mol O_2 * 2 mol O_2)
2c. 98.142g $KC_2H_3O_2$/mol $KC_2H_3O_2$
(39.098g K / mol K * 1 mol K) + (12.011g C / mol C * 2 mol C) + (1.008g H/ mol H * 3 mol H) + (15.999g O / mol O * 3 mol O)
3. Given the reaction: $4Na(s) + O_2(g) \rightarrow 2Na_2O(s)$
a. 0.25 mol O_2 (2SD)
(1.0 mol Na / 1) * (1 mol O_2 / 4 mol Na)
b. 4 mol Na (1SD)
(1 mol O_2 / 1) * (4 mol Na / 1 mol O_2)
c. 8 atoms of sodium (exact)
(2 molecules O_2 / 1) * (4 atoms Na / 1 molecule O_2)
d. 4.50 mol sodium (3SD)
(2.25mol Na_2O / 1) * (4 mol Na / 2 mol Na_2O)
e. 4.0g of Na_2O (2SD)
(3.0g Na / 1) * (1 mol Na / 22.990g Na) * (2 mol Na_2O / 4 mol Na) * (61.979g Na_2O / 1 mol Na_2O)
f. 1.0g of O_2 (2SD)
(3.0g Na / 1) * (1 mol Na / 22.990g Na) * (1 mol O_2 / 4 mol Na) * (31.998g O_2 / 1 mol O_2)
4. Given the reaction: $6K(s) + N_2(g) \rightarrow 2K_3N(s)$
a. 7.8 moles K (2SD)
(1.3 mol N_2 / 1) * (6 mol K / 1 mol N_2)
b. 1.1 moles K_3N (2SD)
(3.4 mol K / 1) * (2 mol K_3N / 6 mol K)
c. 0.80 moles N_2 (2SD)
(1.6 mol K_3N / 1) * (1 mol N_2 / 2 mol K_3N)
d. 0.60g N_2 (2SD)
(5.0 g K / 1) * (1 mol K / 39.098g K) * (1 mol N_2 / 6 mol K) * (28.014 g N_2 / 1 mol N_2)
e. 5.6g K_3N (2SD)
(5.0 g K / 1) * (1 mol K / 39.098g K) * (2 mol K_3N / 6 mol K) * (131.301g K_3N / 1 mol K_3N)
f. 0.64g N_2 (2SD)
(6.0 g K_3N / 1) * (1 mol K_3N / 131.301g K_3N) * (1 mol N_2 / 2 mol K_3N) * (28.014 g N_2 / 1 mol N_2)

5a. toluene is a nonpolar hydrocarbon like heptane (like dissolves like rule). Water, alcohol, and ketones are polar because they contain oxygen, but an ether would be a nonpolar, oxygen-containing hydrocarbon derivative.
5b. formic acid (like dissolves like). Hexane, heptane, and chloroform are nonpolar.
5c. dissolve in each other (by the definition of miscible)
5d. water (sucrose and water are polar, like dissolves like)
5e. toluene (toluene and napthalene are nonpolar)
5f. water (water and sodium chloride are polar, sodium chloride is polar enough to be called ionic)
6a. 7.7% KCl (2SD)
Use given definition of mass percent: 5.3g / (5.3g + 63.5g) * 100%
6b. 3.8g solution (2SD)
(0.17g NaI / 1) * (100g solution / 4.5g NaI)
6c. 3.0g LiBr (2SD)
(37g solution / 1) * (8.1g LiBr / 100g solution)
7a. 0.350M, 0.350mol NaCl/L solution (3SD)
(7.16g NaCl) * (1 mol NaCl / 58.443g NaCl) * (1 / 0.350L)
7b. 9.8mL (2SD)
(6.4g $Ca(NO_3)_2$ / 1) * (1 mol $Ca(NO_3)_2$ / 164.086g $Ca(NO_3)_2$) * (1L / 4.0 mol $Ca(NO_3)_2$) * (1mL / $1x10^{-3}$ L)
7c. 0.32mol HCl (2SD)
(48.5mL / 1) * ($1x10^{-3}$L / 1 mL) * (6.5 mol HCl / L)
8a. 25mL
8b. 0.44M HBr
8c. $1.0x10^3$mL

9. Given this reaction: $CO_2(g) + H_2(g) \rightarrow CH_4(g) + H_2O(l)$
a. C is +4, and O is −2.
b. H is 0.
c. C is −4, and H is +1.
d. H is +1, and O is −2.
e. H_2
f. CO_2
g. CO_2
h. H_2

10a. N is +3, and F is -1.
10b. S is +4, and O is −2.
10c. 0
10d. +2
10e. 0
10f. −2
10g. C is +1,H is +1, and O is -2.

11. Given this reaction: $4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$
a. 0
b. 0
c. Al is +3, and O is −2.
d. Al
e. O_2
f. O_2
g. Al

12. Research answers in class notes

13a. 7.5mg
13b. 28 days.
13c. 1.88mg

14a. Be able to classify molecules using these terms: hydrocarbon, hydrocarbon derivative, saturated hydrocarbon, unsaturated hydrocarbon, aromatic hydrocarbon.
14b. Be able to go between any of the following for organic compounds: name of compound, class/family name, functional group, general formula.
14c. CH_4 (hydrocarbon, alkane)
14d. CH_3Cl (hydrocarbon derivative, organic halide, R-Cl)

14e. acetone (hydrocarbon derivative, ketone, R-C=O)

15a. Be able to provide definitions of and classify biological compounds as carbohydrates, lipids, nucleic acids, or proteins.
15b. Be able to provide the names, composition, examples, and structures of carbohydrates, lipids, nucleic acids, and proteins.
15c. Classify glucose using the above terms (carbohydrate, sugar).
15d. proteins. (amino acids)
16) 44.009g/mol
17) 0.240mol
18) 22.990
19) 133.341g/mol
20) 5.71mol CO_2
21) 18.0g H_2O