1. ^{19}F: $9e^-$, $9p^+$, $10n^0$ Ar-40: $18e^-$, $18p^+$, $22n^0$
2. a) Al_2S_3 b) MgO
3. NaF = 4.0 – 0.9 = 3.1: ionic, London.
   H_2O = 3.5 – 2.1 = 1.4: dipole-dipole (specifically H-bonding), London.
   O_2 = 3.5 – 3.5 = 0: London
4. H: 3.03/98 x 100 = 3.1% H
   P: 30.97/98 x 100 = 31.6% P
   O: 64/98 x 100 = 65.3% O
5. 4.89 ÷ 6.77 + 1.2782 x 2.78
   = 0.7223 + 3.5534 = 4.2757 = 4.28
6. (0.199)(10) + (0.801)(11) = 10.801
7. $7.3\ \text{g}\ C_2H_4 \times \frac{1\ \text{mol}\ C_2H_4}{28.06\ \text{g}\ C_2H_4} \times \frac{6.02\times10^{23}\ \text{particles}}{1\ \text{mol}\ C_2H_4} \times \frac{6\ \text{atoms}}{1\ \text{particle}\ C_2H_4}$
   $= 2.64\times10^{25}$ atoms

8. # g $CuSO_4$ = 3.8 mol x 159.1 g/mol = 606 g
9. 63.2 g C x 1 mol/12.01 g = 5.26 mol (3.01)
   8.8 g H x 1 mol/1.01 g = 8.71 mol (4.98)
   28.0 g O x 1 mol/16.0 g = 1.75 mol (1)
   Simplest formula = C_3H_5O
10. CH_2O: 30 g/mol, 180 g/mol ÷ 30 g/mol = 6
    Molecular formula: $C_6H_{12}O_6$
11. $^{210}_{83}Bi \rightarrow {}^{4}_{2}He + {}^{206}_{81}Tl$
    $^{75}_{34}Se \rightarrow {}^{0}_{-1}e + {}^{75}_{35}Br$
12. $\#\text{mL}\ O_2 = 1\ \text{mL}\ C_4H_{10} \times \frac{13\ \text{mL}\ O_2}{2\ \text{mL}\ C_4H_{10}}$
    = 6.5 mL used, ∴ 2.5 mL remain
13. $\#\text{g}\ O_2 = 592\ \text{g}\ KNO_3 \times \frac{1\ \text{mol}\ KNO_3}{101.11\ \text{g}\ KNO_3} \times \frac{1\ \text{mol}\ O_2}{2\ \text{mol}\ KNO_3} \times \frac{32.00\ \text{g}\ O_2}{1\ \text{mol}\ O_2}$
    $= 93.7\ \text{g}\ O_2$

14. # g Fe_3O_4=
$$100\ \text{g}\ O_2 \times \frac{1\ \text{mol}\ O_2}{32.00\ \text{g}\ O_2} \times \frac{1\ \text{mol}\ Fe_3O_4}{2\ \text{mol}\ O_2} \times \frac{231.55\ \text{g}\ Fe_3O_4}{1\ \text{mol}\ Fe_3O_4} = 362\ \text{g}\ Fe_3O_4$$
$$4.91\ \text{mol Fe} \times \frac{1\ \text{mol}\ Fe_3O_4}{3\ \text{mol Fe}} \times \frac{231.55\ \text{g}\ Fe_3O_4}{1\ \text{mol}\ Fe_3O_4} = 379\ \text{g}\ Fe_3O_4$$
15. # g $BaSO_4$=
$$18.0\ \text{g}\ BaCl_2 \times \frac{1\ \text{mol}\ BaCl_2}{208.23\ \text{g}\ BaCl_2} \times \frac{1\ \text{mol}\ BaSO_4}{1\ \text{mol}\ BaCl_2} \times \frac{233.39\ \text{g}\ BaSO_4}{1\ \text{mol}\ BaSO_4} = 20.175\ \text{g}\ BaSO_4$$
% yield = actual ÷ theoretical x 100%
= 13.2 g ÷ 20.175 g x 100% = 65.4%
16. 15 g ÷ 42 g x 100% = 35.7%

17. ppm = mg/kg, 4.0 ppm = x mg / 50000 kg
    x = 200 000 mg = 200 g = 0.20 kg
18. # mol = 16 g x 1 mol / 40 g = 0.40 mol NaOH
    [NaOH] = 0.40 mol / 2.00 L = 0.20 M
19. $M_1V_1 = M_2V_2$
    (12.0 M)(V_1) = (0.175 M)(3.00 L)
    V_1 = 0.04375 L = 43.8 mL
20. 3.5 L x 1.3 mol/L + 2.0 L x 0.75 mol/L = 6.05 mol
    3.5 L + 2.0 L = 5.5 L
    mol/L = 6.05 mol / 5.5 L = 1.1 mol/L
21. g/100 mL H_2O: at 52°C = 90, at 20°C = 32.
    90 – 32 = 58 g/100 mL H_2O precipitates
    58 g/100 mL x 70 mL = 40.6 g precipitate

22. First, we need a balanced equation:
$2Na_3PO_4(aq) + 3CaCl_2(aq) \rightarrow Ca_3(PO_4)_2(s) + 6NaCl(aq)$
g $Ca_3(PO_4)_2$=
$$0.35\ \text{L} \times \frac{0.175\ \text{mol}\ CaCl_2}{1\ \text{L}} \times \frac{1\ \text{mol}\ Ca_3(PO_4)_2}{3\ \text{mol}\ CaCl_2} \times \frac{310\ \text{g}\ Ca_3(PO_4)_2}{1\ \text{mol}\ Ca_3(PO_4)_2} = 6.3\ \text{g}\ Ca_3(PO_4)_2$$
23. $[H^+] = 10^{-pH} = 10^{-7.5} = 3.16 \times 10^{-8}$
    $pH = -\log[H^+] = -\log[1.85\times10^{-12}] = 11.7$
24. $M_A \times V_A \times \#H = M_B \times V_B \times \#OH$
    (0.600 mol/L)(4.42 mL)(2) = (M_B)(5.00 mL)(1)
    M_B = 1.06 mol/L
25. K = °C – 273, or °C = K + 273
    a) 22 K = -251°C, b) 756°C = 1029 K

26. P_1 = 150 kPa, T_1 = 298 K
    P_2 = ? kPa, T_2 = 473 K, $V_1 = V_2$
    P_2 = 238 kPa
    $\frac{P_1}{T_1} = \frac{P_2}{T_2}$
27. P_1 = 103 kPa, V_1= 22 L, T_1 = 288 K
    P_2 = 15 kPa, V_2 = 108, T_2 = ?
    T_2 = 206 K = –67°C
    $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
28. P_1 = 97 kPa – 2.34 kPa = 94.66 kPa
    V_1= 35.7 mL, T_1 = 293 K
    P_2 = 101.3 kPa, V_2 = ?, T_2 = 273 K
    V_2 = 31 mL
29. PV = nRT g/mol = 2.62 g/0.065512 mol
    $n = \frac{(110\ \text{kPa})(1.46\ \text{L})}{(8.31\ \text{kPa•L/K•mol})(295\ \text{K})}$ = 0.065512 mol
    = **40.0 g/mol**

30. # g H_2O=
$$2.4\ \text{L}\ O_2 \times \frac{1\ \text{mol}\ O_2}{24.8\ \text{L}\ O_2} \times \frac{2\ \text{mol}\ H_2O}{1\ \text{mol}\ O_2} \times \frac{18.02\ \text{g}\ H_2O}{1\ \text{mol}\ H_2O} = 3.49\ \text{g}\ H_2O$$
31. $C_{27}H_{56} + 41\ O_2 \rightarrow 27\ CO_2 + 28\ H_2O$
32. # mol = 1.37 g ÷ 342.34 g/mol = 0.00400 mol
    $q = cm\Delta T$
    = (4.18 J/g°C)(2300 g)(2.37°C) = 22785 J
    J/mol= 22785 J ÷ 0.00400 mol = 5694 kJ/mol

33. $H_2 + Br_2 \rightarrow 2HBr$

Bond	kJ/mol	#	required	#	released
H-H	436	1	436		
Br-Br	193	1	193		
H-Br	366			2	732
			629		732

$H_2 + Br_2 \rightarrow 2HBr + 103$ kJ