Station 1: Every part is worth 2 points.

1. (a) Isothermal
   (b) It decreases
   (c) Boyle's Law
   (d) It will become more ideal. Everything else being equal, lower pressures mean we have particles hitting each other less vigorously. Thus, their collisions should approach purely elastic.
2. (a) Monatomic means "consisting of one atom". Nitrogen gas is not monatomic; it is diatomic.
   (b) 6.919×10^{-6}
3. (a) Low temperatures. At high temperatures, the molecules are moving too fast for IMFs to matter much.
   (b) Water vapor has stronger IMFs, since it has hydrogen bonding.
   (c) Helium. The stronger IMFs of water vapor will cause the molecules to stay "closer" together and "bunch up" more, reducing the pressure exerted on the walls of the container.
   (d) If the atoms are very small, then the distances they travel will be very large compared to their size. IMFs fall off very quickly with distance between molecules, so if the distances are large, then the IMFs are effectively nonexistent.

Station 2: Every part is worth 2 points.

4. (a) 26.32 grams
   (b) 0.450 moles
   (c) 1.25 grams
   (d) 2222 ppb
5. (a) $(\rho_1 V_1 + \rho_2 V_2)/(V_1 + V_2)$
   (b) The density will probably go down. Heating a substance typically causes molecules to speed up and get slightly farther from each other, occupying a larger volume that results in an decrease in density. (There are some exceptions, however.)
6. (a) 0.25 moles
   (b) 50 M
   (c) Endothermic

Station 3: Every part is worth 4 points.

7. (a) The pressure is very, very low.
   (b) 1.67×10^{-21} kg/m^3
   (c) 6.022×10^{20} L/mol
   (d) 1.38×10^{-16} Pa
8. (a) πr^2
   (b) $\sigma \langle v \rangle t$
   (c) The most correct answer is $1/(\sqrt{2} n\sigma)$. Anything resembling $1/n\sigma$ was accepted.
9. (a) 10^{-4} m^3
   (b) $0.95^{100} \approx 0.0059$

Station 4: Every part is worth 3 points.

10. (a) 0.796 g/cm^3
    (b) 79.6%
    (c) Same; the amount of fluid displaced is the same in both cases.
    (d) The density changes the same, as density is an intensive property.
    (e) Gauge pressure does not include outside pressure from the atmosphere.

11. (a) $\rho_f g A h_1$
    (b) At h_1: $\rho_f g h_1$; at h_2: $\rho_f g h_2$.
    (c) $\rho_f g A h$
    (d) Atmospheric pressure is added to gauge pressure, but when we take the difference of the absolute pressures, it will cancel out. As a result, our result is independent of the pressure of the atmosphere.

Station 5: Every part is worth 5 points.

12. (a) It gets lighter
    (b) You are splitting the layers of graphite and separating the carbon atoms

13. (a) 5.24×10^{-20} m^2
    (b) 3
    (c) 3.99×10^{-20} mg
    (d) 0.761 mg/m^2

Place your piece of tape from this lab below! +5 points for attempting the hands-on activity.