Materials science

Your test will be composed of a lab component as well as a knowledge test. You will be testing evaporation rates and some of the liquids may take an extended amount of time to evaporate so do not wait until all the drops have evaporated to start the test portion or you may not get done.

1) Obtain a well plate and lamented paper. You will be testing evaporation rates of 5 liquids. You will graph three alcohols, also an alkane and water will be observed for comparison purposes and will not be placed in your graph so data for these will not need to be as precise.
2) Place one drop of water in the well plate and note the time it was placed in the well plate on the wall clock. Exact seconds will not need to be recorded as this data will only be used for qualitative comparison.
3) Use the well plates as your evaporation surface and only one drop of each alcohol for your data. You may wish to practice dispensing a single drop into the storage container first as obtaining one drop can be a bit challenging if you have not done it before. Time how long it takes each drop to completely evaporate.
4) Create a graph of evaporation rates versus molar mass for methanol(CH_3OH), ethanol(CH_3CH_2OH) and n-proponal($CH_3CH_2CH_2OH$).
5) Graph your results. What is the trend you see?_____ Propose as reason for the trending you observed.

   _____

   _____
6) Given what you have graphed predict the amount of time you expect it should take for butanol($CH_3CH_2CH_2CH_2OH$) to evaporate .(Show your work, you are allowed to use linear regression but you must show your work including all values.)

7) If hexane has the same type of intermolecular attractions as the alcohols you should be able to use your graph to determine the possible evaporation rate of hexane C_6H_{14}. Write the predicted evaporation time for hexane from your alcohol graph. Use a drop of hexane. Explain any differences you observe between the predicted evaporation times from the graph and your actual results.

8) The water drop may not have evaporated as of yet. Explain any differences you may see between waters predicted evaporation time from the alcohol graph and what you are actually observing.

In this portion you will be given 5 examples of solid materials and fill in the qualitative the table below. Then answer the questions about each substance. A hint sheet is provided with the structure of some of the less commonly known formulas.

SOLID LARGE	Conductivity	Brittleness
Quartz (Sand) (SiO_2)		
Sodium Chloride		
Aluminum		
Sugar		
Stearic Acid		

Answer the following questions about quartz.

1) The predominant type of bonding or attraction that holds quartz in a solid state is….
   a. Metallic bonding
   b. Covalent network bonding
   c. Hydrogen bonding
   d. London dispersion forces
   e. Ionic bonding
   f. None of the above
2) Circle all that apply. Quartz would be expected to be soluble in …
   a. Water
   b. Hexane
   c. Ethanol
   d. All of the above
   e. None of the above
3) Based on its bonding or attraction the melting point of quartz would be expected to be…
   a. Extremely high (over 1,000^{o}C)
   b. High(500^{o}C to 1,000^{o}C)
   c. Moderate (200^{o}C to 500^{o}C)
   d. Low (50^{o}C to 200^{o}C)
   e. Bonding or attraction has no effect on melting point.
4) True or False Quartz will conduct electricity when dissolved in distilled water.
5) True or False Quartz will have an extremely low volatility.
6) The most likely packing structure for quartz is
   a. FCC
   b. BCC
   c. HCP
   d. Commonly demonstrates all of the above
   e. The material does not not demonstrate a packing structure.
7) The predominant type of bonding or attraction that holds sodium choride in a solid state is….
   g. Metallic bonding
   h. Covalent network bonding
   i. Hydrogen bonding
   j. London dispersion forces
   k. Ionic bonding
   l. None of the above

8) Circle all that apply. Sodium chloride would be expected to be soluble in …
   f. Water
   g. Hexane
   h. Ethanol
   i. All of the above
   j. None of the above
9) Based on the bonding or attraction the melting point of sodium chloride would be expected to be…
   f. Extremely high (over 1,000^{o}C)
   g. High(500^{o}C to 1,000^{o}C)
   h. Moderate (200^{o}C to 500^{o}C)
   i. Low (50^{o}C to 200^{o}C)
   j. Bonding or attraction has no effect on melting point.
10) True or False sodium chloride will conduct electricity when dissolved in distilled water.
11) True or False sodium chloride will have an extremely low volatility.
12) The most likely packing structure for sodium chloride is
   f. FCC
   g. BCC
   h. HCP
   i. Commonly demonstrates all of the above
   j. The material is more likely to be an amorphous material.
13) The predominant type of bonding or attraction that holds aluminum in a solid state is….
   m. Metallic bonding
   n. Covalent network bonding
   o. Hydrogen bonding
   p. London dispersion forces
   q. Ionic bonding
   r. None of the above
14) Circle all that apply. Aluminum would be expected to be soluble in …
   k. Water
   l. Hexane
   m. Ethanol
   n. All of the above
   o. None of the above

15) Based on the bonding or attraction the melting point of aluminum would be expected to be…
    k. Extremely high (over 1,000^{o}C)
    l. High(500^{o}C to 1,000^{o}C)
    m. Moderate (200^{o}C to 500^{o}C)
    n. Low (50^{o}C to 200^{o}C)
    o. Bonding or attraction has no effect on melting point.
16) True or False aluminum will conduct electricity when dissolved in distilled water.
17) True or False aluminum will have an extremely low volatility.
18) The most likely packing structure for aluminum is
    k. FCC
    l. BCC
    m. HCP
    n. Commonly demonstrates all of the above
    o. The material is more likely to be an amorphous material.
19) The predominant type of bonding or attraction that holds sugar in a solid state is….
    s. Metallic bonding
    t. Covalent network bonding
    u. Hydrogen bonding
    v. London dispersion forces
    w. Ionic bonding
    x. None of the above
20) Circle all that apply. Sugar would be expected to be soluble in …
    p. Water
    q. Hexane
    r. Ethanol
    s. All of the above
    t. None of the above
21) Based on the bonding or attraction the melting point of sugar would be expected to be…
    p. Extremely high (over 1,000^{o}C)
    q. High(500^{o}C to 1,000^{o}C)
    r. Moderate (200^{o}C to 500^{o}C)
    s. Low (50^{o}C to 200^{o}C)
    t. Bonding or attraction has no effect on melting point.
22) True or False sugar will conduct electricity when dissolved in distilled water.
23) True or False sugar will have an extremely low volatility.

24) The predominant type of bonding or attraction that holds stearic acid in a solid state is….
    y. Metallic bonding
    z. Covalent network bonding
    aa. Hydrogen bonding
    bb. London dispersion forces
    cc. Ionic bonding
    dd. None of the above
25) Circle all that apply. Stearic acid would be expected to be soluble in …
    u. Water
    v. Hexane
    w. Ethanol
    x. All of the above
    y. None of the above
26) Based on the bonding or attraction the melting point of stearic acid would be expected to be…
    u. Extremely high (over 1,000^{o}C)
    v. High(500^{o}C to 1,000^{o}C)
    w. Moderate (200^{o}C to 500^{o}C)
    x. Low (50^{o}C to 200^{o}C)
    y. Bonding or attraction has no effect on melting point.
27) True or False stearic acid will conduct electricity when dissolved in distilled water.
28) True or False stearic acid will have a high volatility.
29) The most likely packing structure for aluminum is
    p. FCC
    q. BCC
    r. HCP
    s. Commonly demonstrates all of the above
    t. The material is more likely to be an amorphous material.

Using the original list of solids select those that best match the listed property or use. More than one material may be used.

30) Shows ABAB layering_____
31) Shows ABCABC layering_____
32) Shows AAA layering_____
33) Exhibits the closest type of packing structure. _____
34) Shows good malleability_____
35) Exhibits good ductility_____
36) Can be used to make detergents_____
37) Has a base structure seen in many ceramics._____
38) Exhibits a crystalline lattice structure._____
39) Has more than one hydrogen bonding sites._____
40) Has layers that may slide past each other when exposed to stress._____
_____

41) TIE BREAKER
Sketch a unit cell for NaCl