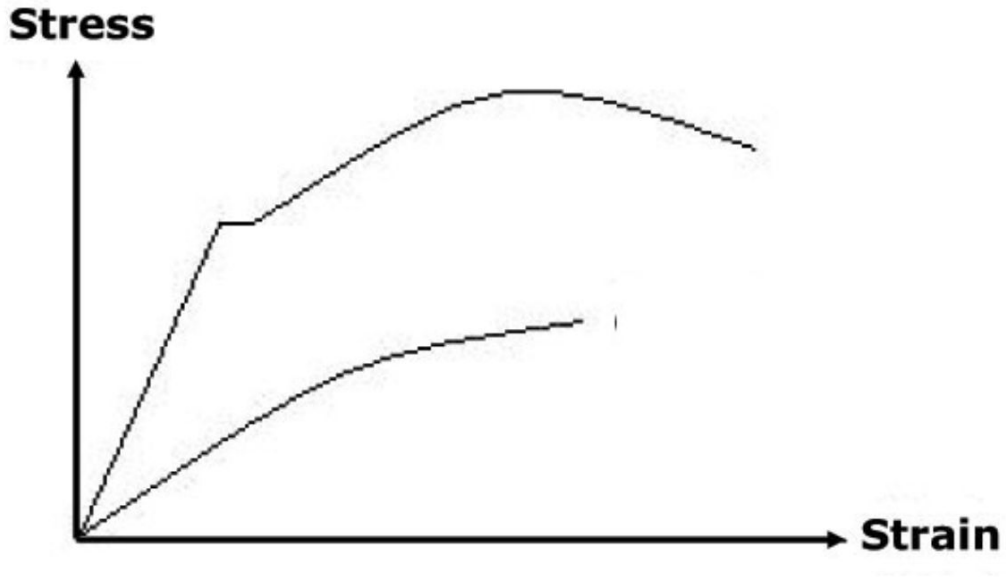
Station One -

1. The image below shows stress-strain curves for two different materials in tension. Using the image, answer the following questions. Material 1 is on the top, Material 2 is on the bottom.



a. What is the name for the initial slope of each graph?

b. ON YOUR ANSWER SHEET Circle words that accurately describe Material 1

c. ON YOUR ANSWER SHEET underline words that accurately describe Material 2

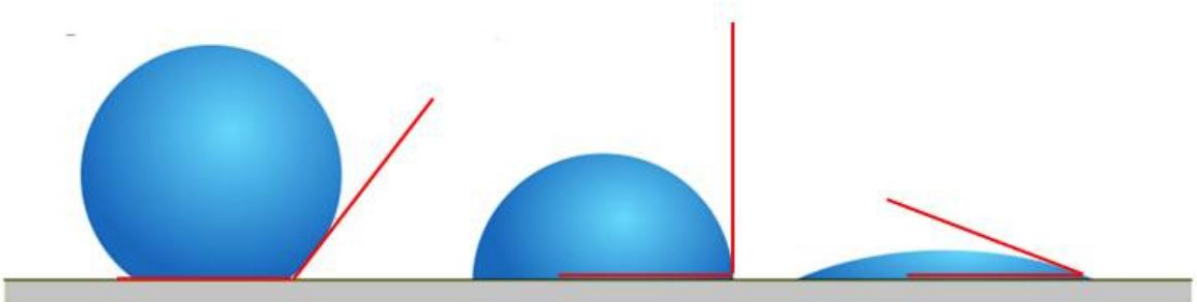
d. What is one possible material for Material 1?

e. What is one possible material for Material 2?

f. If we combined materials 1 and 2, which material class would we have made?

g. Why might we want to combine the two materials?

Station Two



The above image shows drops of water on three different surfaces.

a) Measure each contact angle.

b) Which surface is most hydrophilic?

c). Which surface is most hydrophobic?

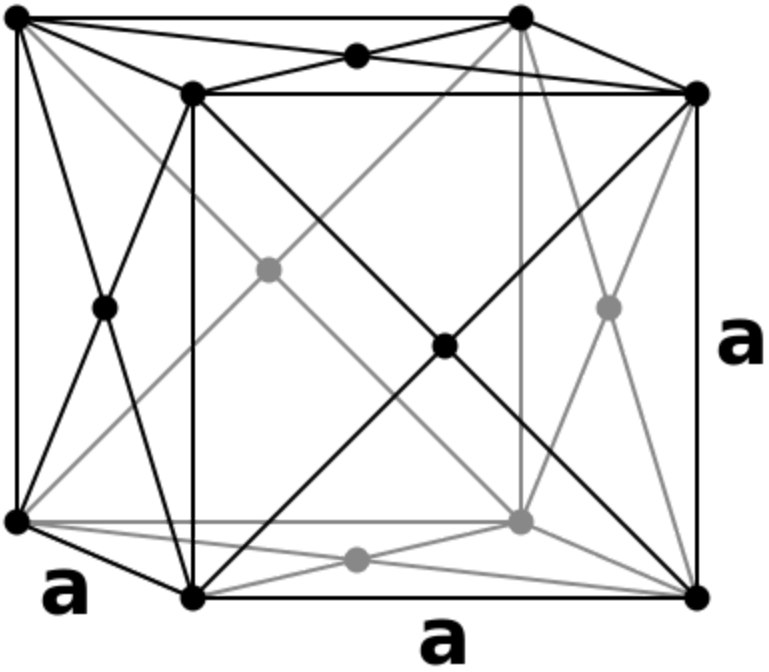
d). What is a possible use of hydrophilic surfaces?

e). Name an example of a hydrophobic surface.

f) Explain on a particle level the difference between the shape of the water droplet in A and C.

Station 3 -

At this station, you will find the *theoretical* density of Aluminum. Aluminum has a crystal structure shown below. The length of each edge of the unit cell is 404.96 pm. Each atom of aluminum has a mass of 4.48×10^{-23} g.



1) What type of crystal structure does aluminum have?
2) How many atoms are present in one unit cell?
3) What is the total mass (in g) of aluminum present in one unit cell?
4) What is the volume of one unit cell in pm^3?
5) What is the density of a unit cell in g/pm^3?
6) What is the density of a unit cell in g/cm^3?

Station 4

At this station will determine the empirical density of the aluminum cylinders and tools at this station. Please alert the proctor if you think a tool may be missing or not functioning correctly.

You should have: 3 bars of aluminum, a caliper, a graduated cylinder, a beaker filled with water, a balance, a weigh boat.

On your answer sheet, record your data and then answer the questions on your answer sheet. You will not be able to answer them all until you have finished station 3. :

Answers

Station One--10pts

1. Young's modulus
2. Ductile, stronger
3. Brittle, weaker
4. Steel
5. Concrete
6. Composites
7. combine the benefits of each while making up for their weaknesses - e.g. reinforced concrete.

Station Two--9pts

a) Answers vary A=greater than 90, B= 90 and C is less than 90
b) C
c) A
d) Conducting water along the surface, absorbent materials, etc.
e) Paper, etc
f) A, water particles are more attracted to themselves than they are to the surface or air making a rounded drop (cohesion) C, water particle more attracted to surface than themselves (Adhesion)

Station Three--12pts--NO PARTIAL CREDIT, but error carried forward

1. FCC
2. 4 atoms (⅛ at each of 8 corners, ½ on each of 6 faces)
3. 1.792×10^{-22} g
4. 6.64×10^{7} pm^3
5. 2.698×10^{-30} g/pm^3
6. 2.698 g/cm^3 (accepted value: 2.70 g/cm^3)

Station 4--10 pts
Looking for data with the right number of sig figs for the instrument, all three pieces measured
2 decimals for mass, 1 decimal for volume

Graph labeled axes, with unit, Mass on the Y and Volume on the X so that the slope = density
Density of material from best fit line, slope and NOT from average.

Lab errors: mismeasurement of every variety--MUST be consistent though with error, so if empirical is higher than theoretical, mass cannot be too small… Specific, not just "mass mismeasured or we read the meniscus wrong" read from the top of meniscus would give less volume difference
Material reasons: inclusions, crystal boundaries, etc.