Quest Chapter 18

#	Problem	Hint
1	(part 1 of 2) In everyday use, the word “dense” is often used interchangeably with the word “hard.” In physics, density and hardness have completely different meanings. Which object is the densest? 1. lead 2. aluminum 3. diamond 4. iron	Density is the ratio of mass to volume. We might interpret density physically by noticing the differences in weight between similarly sized pieces samples.
2	(part 2 of 2) Which object is the hardest? 1. aluminum 2. diamond 3. lead 4. iron	If you don’t already know, check out the materials online, or read #4.
3	Consider a cube of soft, spongy material. Which piece below has the larger density? 1. compressing the cube until it has one-eighth the volume 2. Unable to determine 3. cutting out a piece of the cube that has one-eighth the volume 4. Densities are the same.	Which answer has more mass in a certain size volume? That object will have a higher density.
4	Diamond is a hard transparent material made of only carbon atoms. Graphite is a black, soft material used to make pencil lead and is also made of only carbon atoms. Do graphite and diamond have the same density? Why? 1. No; the atoms in diamond and graphite are different. 2. Yes; they are made of the same kind of atom. 3. No; the atoms are arranged differently.	What is the difference between graphite and diamonds? Would that difference change mass or volume?

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5	In one scene in the movie The Godfather II, a solid gold phone is passed around a large table for everyone to see. Suppose the volume of gold in the phone were equal to the volume of a 10-centimeter cube of gold. The density of gold is 19,300 kg/m^3. Could such a phone be casually passed around a table from hand to hand? What is the weight of the phone? 1 kg of mass is about 2.2 lb. 1. No; it weighs about 45 lbs. 2. Yes; it weighs about 9 lbs. 3. Yes; it weighs about 4.5 lbs. 4. No; it weighs about 90 lbs.	You have to convert 10 cm to meters. Then find the volume. Substitute and solve the equation, d = m/V for the mass. Convert the mass (kg) to weight (lbs.)
6	(part 1 of 2) Martin finds a piece of metal in a scrap yard and weighs it. Its mass is found to be 2311 kg and its volume is 0.26 m^3 as determined by immersion in water. What is the likely identity of this metal? The densities of common metals are Metal Cu Fe Al Hg Pb g/cm^3 8.9 7.9 2.7 13.6 11.3 1. copper 2. lead 3. mercury 4. None of these 5. aluminum 6. iron	Find the density. Then convert the density to g/cm^3. (The table uses these units.) You will have to remember how many grams are in a kilogram and how many centimeters are in a meter. (Also, note the CUBE.) Then select the best match.
7	(part 2 of 2) The density of gold is 19300 kg/m^3. What would be the volume of the scrap metal if it had the same weight and were made of gold?	Use the mass of the metal identified in #6 and the density of gold. Use d = m/V to find the volume of the gold scrap.

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8	The uranium atom is the heaviest among the naturally occurring elements. Why then, isn't a solid bar of uranium the densest metal? 1. A solid uranium bar contains a lot of oxygen. 2. The uranium atoms lose most of their neutrons when forming a solid bar. 3. Density is determined by the spacing between the atoms as well as mass. 4. There are a lot of dangling bonds inside a solid bar of uranium.	What affects density? Mass and volume. So, if something is massive, like uranium, what could bring its density down?
9	Which has more volume – a kilogram of gold or a kilogram of aluminum? 1. It cannot be determined. 2. a kilogram of aluminum 3. a kilogram of gold 4. They have same volumes.	Which is denser? Will being denser produce a larger or smaller volume for the same mass? (d = m/V
10	(part 1 of 3) A solid aluminum cube has sides each of length L . A second cube of the same material has sides four times the length of the first cube, i.e., 4 L. Compared to the first cube, what is the density of the second cube? 1. four times as much as the first cube 2. None of these 3. nine times as much as the first cube 4. two times as much as the first cube 5. sixteen times as much as the first cube 6. sixty-four times as much as the first cube 7. the same as the first cube 8. twenty-four times as much as the first cube 9. eight times as much as the first cube 10. twenty-seven times as much as the first cube	Is it the same material? Yes. Do the dimensions of a material change its density? Think before answering. What is the definition of density? d = m/V If you scale up the dimensions, you increase volume. So, if volume increases, can mass change randomly or is it bound by the equation? It is bound.

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11	(part 2 of 3) Compared to the first cube, what is the weight of the second cube? 1. sixteen times as much as the first cube 2. sixty-four times as much as the first cube 3. nine times as much as the first cube 4. twenty-four times as much as the first Cube 5. two times as much as the first cube 6. twenty-seven times as much as the first cube 7. four times as much as the first cube 8. the same as the first cube 9. None of these 10. eight times as much as the first cube	If the sides are multiplied by a certain number, 4 in this case, how does the volume change? x side –> $x^3 = V$ 4x side –> $(4x)^3 = 64V$ So, if the volume increases, in this case, by a factor of 64, how would the mass and the weight change? By the same factor.
12	(part 3 of 3) Compared to the first cube, what is the total surface area of the second cube? 1. ninety-six times as much as the first cube 2. sixty-four times as much as the first cube 3. four times as much as the first cube 4. the same as the first cube 5. two times as much as the first cube 6. sixteen times as much as the first cube 7. twenty-seven times as much as the first cube 8. None of these 9. eight times as much as the first cube 10. nine times as much as the first cube	Volume changes as the cube of the multiplier. Surface area changes by the square of that multiplier. In this case, 16 times: x side –> $x^2 = A$ 4x side –> $(4x)^2 = 16A$
13	Why does crushed ice melt so much faster than an equal mass of ice cubes? 1. The crushing process raised the temperature of the crushed ice. 2. Crushed ice is smaller. 3. Crushed ice has more exposed surface.	What is the dominant method of heat transfer? Conduction. Conduction requires direct contact. Which form, cubes or crushed has more direct contact with its surroundings? How do we measure that increased direct contact? Surface area.

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14	Why do ice cubes float? 1. Ice cubes are less dense than water. 2. Ice cubes are lighter than water. 3. Ice cubes are in a solid state.	What does water do when it freezes? It expands. What happens to the volume when it expands? What happens to the density when it expands?
15	The force required to stretch a spring varies directly with the amount the spring is stretched. A force of 81 pounds is needed to stretch a spring 13 inches, as shown in the right-hand figure below. How much force is required to stretch the spring 10 inches?	What does “varies directly” mean? Set up a proportion with the right-hand spring force/displacement = to the other spring values. Then, solve for the unknown force.
16	What is the mass of a substance divided by its volume? 1. weight 2. inertia 3. density 4. pressure	Check your notes.
17	A block of wood has a volume of 75 cm^3 and a mass of 750 g. What would be its density? Answer in units of g/cm^3	Which equation would you use for this problem. Substitute and solve.
18	Calculate the density of a solid cube that measures 6.08 cm on each side and has a mass of 446 g. Answer in units of g/cm^3	What do you need to calculate density? Do you have mass? Do you have volume? $V_{cube} = s^3$
19	A block of material has dimensions 4.9 cm by 7.9 cm by 3 cm. Its mass is 572 g. What is the density? Answer in units of g/cm^3	How do you find the volume of a box? H x W x D

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20	A load of 54 N attached to a spring that is hanging vertically stretches the spring 0.29 m. What is the spring constant? Answer in units of N/m	The spring constant is a ratio of Force and displacement (distance). F = –kx. Substitute and solve.
21	An ideal spring obeys Hooke's law: F = −kx. A mass of m = 0.6 kg hung vertically from this spring stretches the spring 0.13 m. The acceleration of gravity is 9.8 m/s^2. Calculate the value of the force constant k for the spring. Answer in units of N/m	You have to find the weight of the mass for this calculation. That is why they give you a_g. Substitute and solve.
22	Janet wants to find the spring constant of a given spring, so she hangs the spring vertically and attaches a 0.42 kg mass to the spring's other end. The acceleration of gravity is 9.81 m/s^2. If the spring stretches 3.4 cm from its equilibrium position, what is the spring constant? Answer in units of N/m	You have to find the weight of the mass for this calculation. That is why they give you a_g. Substitute and solve.