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| ***Insight into Aluminum*** |

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| 1. What properties of aluminum might cause you concern if you had to use the aluminum tableware that Napoleon employed to impress his guests?

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| *ANSWER:* | Al tableware would be very susceptible to rapid oxidation and would have to be polished frequently. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Insight into Al |
| *TOPICS:* | Insight into Aluminum |
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| 2. Use the web to determine the amount of aluminum used in the US in a single year. What is the primary use for this material?

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| *ANSWER:* | Utilize a world wide web search engine to acquire the reference. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
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| 3. Use the web to determine the difference in how much aluminum is recycled in states where there are deposits on aluminum cans versus states in which recycling is voluntary. What is the most reliable way to estimate this value? What uncertainty is there in this estimate?

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| --- | --- |
| *ANSWER:* | Utilize a world wide web search engine to acquire the reference. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Insight into Al |
| *TOPICS:* | Insight into Aluminum |
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| ***The Study of Chemistry*** |

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| 4. Which of the following items are matter and which are not?

|  |  |
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| a) | A flashlight |
| b) | Sunlight |
| c) | An echo |
| d) | Air at sea level |
| e) | Air at the top of Mount Everest |

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| *ANSWER:* |

|  |  |
| --- | --- |
| a) | matter |
| b) | not matter |
| c) | not matter |
| d) | matter |
| e) | matter |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | The Study of Chem |
| *TOPICS:* | The Study of Chemistry |
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| 5. How can a liquid be distinguished from a fine powder? What type of experiment or observation might be undertaken?

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| *ANSWER:* | Experiments related to the physical properties of the liquid and the fine powder would prove useful. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | The Study of Chem |
| *TOPICS:* | The Study of Chemistry |
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| 6. Do the terms element and atom mean the same thing? If not, how do they differ?

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| *ANSWER:* | The terms element and atom are not the same. An element is a pure substance, but the natural occurring form of an element may contain two atoms. An example of this is elemental nitrogen (N2). In this case, the element has two atoms. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | The Study of Chem |
| *TOPICS:* | The Study of Chemistry |
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| 7. Why do physical properties play a role in chemistry if they do not involve any chemical changes?

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| *ANSWER:* | Physical properties can be used to identify substances in qualitative and quantitative analysis and can provide a wide range of useful information. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | The Study of Chem |
| *TOPICS:* | The Study of Chemistry |
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| 8. Explain chemical properties with an example.

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| *ANSWER:* | Chemical properties are associated with the types of chemical changes that a substance undergoes. For example, some materials burn readily, whereas others do not. Burning of any substance in the presence of oxygen is a chemical reaction called combustion. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | The Study of Chem |
| *TOPICS:* | The Study of Chemistry |
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| 9. All molecules attract each other to some extent, and the attraction decreases as the distance between particles increases. Based on this idea, which state of matter would you expect has the strongest interactions between particles----: solids, liquids or gases?

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| --- | --- |
| *ANSWER:* | Intermolecular forces of attraction are greatest in solids, as we will learn in further detail in Chapter 8. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | The Study of Chem |
| *TOPICS:* | The Study of Chemistry |
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| ***Observations and Models*** |

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| 10. Data that have a small random error may be: (accurate, precise, both, or neither).

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| --- | --- |
| *ANSWER:* | Data that have a small random error are precise and may be accurate. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Observations and Models |
| *TOPICS:* | The Science of Chemistry: Observations, Models, and Systems |
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| 11. Two golfers are practicing shots around a putting green. Each golfer takes 20 shots. Golfer 1 has 7 shots within 1 meter of the hole, and the other 13 shots are scattered around the green. Golfer 2 has 17 shots that go into a small sand trap near the green and three just on the green near the trap. Which golfer is more precise? Which is more accurate?

|  |  |
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| *ANSWER:* | Golfer 2 is more precise because his efforts are grouped more tightly about a central point (the small sand trap) even if it's not the intended spot. Golfer 1 is more accurate as there are more shots very close to the accepted "value" (the hole). |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Observations and Models |
| *TOPICS:* | The Science of Chemistry: Observations, Models, and Systems |
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| 12. James provides Martha with two statements: "All bald men are intelligent" and "Lance is bald." Based on the statements, Martha concludes that Lance is intelligent. What type of reasoning (deductive or inductive) did Martha use to arrive at this conclusion?

|  |  |
| --- | --- |
| *ANSWER:* | Martha used deductive reasoning to arrive at this conclusion. The two statements represent pieces of information that are processed and lead to the conclusion that "Lance is intelligent." |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Observations and Models |
| *TOPICS:* | The Science of Chemistry: Observations, Models, and Systems |
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| 13. What is the difference between a hypothesis and a question?

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| *ANSWER:* | A hypothesis is a statement related to observation(s). The hypothesis is either accepted or rejected based on experimentation. A question is simply posed. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Observations and Models |
| *TOPICS:* | Critical Materials |
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| 14. What is a law of nature? Are all scientific laws examples of laws of nature?

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| --- | --- |
| *ANSWER:* | A law of nature is an irrefutable, self-evident fact. All scientific laws are not examples of laws of nature. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Observations and Models |
| *TOPICS:* | The Science of Chemistry: Observations, Models, and Systems |
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| ***Numbers and Measurements*** |

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| 15. What is the difference between a qualitative and a quantitative measurement?

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| --- | --- |
| *ANSWER:* | A quantitative measurement provides information as to *how much* analyte is present. A qualitative measurement answers the question, 'is the analyte present?' |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
| *TOPICS:* | Numbers and Measurements in Chemistry |
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| 16. What is a "derived" unit?

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| *ANSWER:* | A derived unit is a unit that is made up of two or more base units. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
| *TOPICS:* | Numbers and Measurements in Chemistry |
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| 17. The largest computers now include disk storage space measured in terabytes. How many bytes are in a terabyte? (Recall that in computer terminology, the prefix is only "close" to the value it designates in the metric system.)

|  |  |
| --- | --- |
| *ANSWER:* | 1 terabyte = 1,000,000,000,000 bytes |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
| *TOPICS:* | Numbers and Measurements in Chemistry |
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| 18. Use the web to determine how the Btu unit was initially established. For the engineering applications where this unit is still used today, why is it a sensible unit?

|  |  |
| --- | --- |
| *ANSWER:* | Utilize a world wide web search engine to acquire the reference. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
| *TOPICS:* | Numbers and Measurements in Chemistry |
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| 19. Convert the value 38.4 ppm into ppb.

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| --- | --- |
| *ANSWER:* | 3.84 × 104 ppm |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
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| 20. Oxygen boils at −186°C. What is this temperature in Kelvin?

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| --- | --- |
| *ANSWER:* | 87 K |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
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| 21. Express each of the following temperatures in °C.

|  |  |
| --- | --- |
| a) | 177 K |
| b) | 298 K |
| c) | 4 K |
| d) | 1500 K |

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| *ANSWER:* |

|  |  |
| --- | --- |
| a) | −96°C |
| b) | 25°C |
| c) | −269°C |
| d) | 1227°C |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
| *TOPICS:* | Numbers and Measurements in Chemistry |
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| 22. How many significant figures are present in each of the following experimental measurements?

|  |  |
| --- | --- |
| a) | 0.003 m |
| b) | 6030 kg |
| c) | 400.3 s |
| d) | 0.000701 L |
| e) | 31.624 km |

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| *ANSWER:* |

|  |  |
| --- | --- |
| a) | one |
| b) | three |
| c) | four |
| d) | three |
| e) | five |

 |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
| *TOPICS:* | Numbers and Measurements in Chemistry |
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| 23. Assuming the numbers given are measurements, carry out the indicated arithmetic operations and give the answer with the correct number of significant figures.

|  |  |
| --- | --- |
| a) | 7.132 / 6 |
| b) | 3.65 × 102 + 8.1 × 103 |
| c) | 18.13 − 1.3 |
| d) | 9 × 10−6 × 1.33 × 10−3 |

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| *ANSWER:* |

|  |  |
| --- | --- |
| a) | 1.189 |
| b) | 8.5 × 103 |
| c) | 16.8 |
| d) | 1 × 10−8 |

 |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
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| 24. In an attempt to determine the velocity of a person on a bicycle, an observer uses a stopwatch and times the length of time it takes to cover 25 "squares" on a sidewalk. A measurement of one of the squares shows it to be 1.13 m long. The bicycle takes 4.82 seconds to travel this far. What velocity, in m/sec, should the observer report?

|  |  |
| --- | --- |
| *ANSWER:* | 5.87 m/s |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
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| 25. Measurements indicate that 23.6% of the residents of a city with a population of 531,314 are college graduates. Considering significant figures, how many college graduates are estimated to reside in this city?

|  |  |
| --- | --- |
| *ANSWER:* | 1.25 × 105 |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
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| 26. A rock is placed on a balance and its mass is determined to be 22.410 g. When the same rock is placed in a graduated cylinder that originally contains 11.34 mL of water, the new volume of water is 17.82 mL. What should the density of the rock be reported as?

|  |  |
| --- | --- |
| *ANSWER:* | 3.46 g/mL |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Numbers and Measurements |
| *TOPICS:* | Numbers and Measurements in Chemistry |
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| ***Problem Solving in Chemistry and Engineering*** |

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| 27. If the cost to fill a gasoline tank is $78.42 and gasoline costs $3.66/gal, how many gallons can the tank hold? How many liters of gasoline could be purchased for $50.00?(1 gallon = 3.78 liter)

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| *ANSWER:* |

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| a) | 21.4 gallons |
| b) | 51.7 L |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Problem Solving Chem&Eng |
| *TOPICS:* | Problem Solving in Chemistry and Engineering |
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| 28. The distance between two atoms in a molecule is 148 pm. What is this distance in meters?

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| *ANSWER:* | 1.48 × 10−10 m |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Problem Solving Chem&Eng |
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| 29. Carry out the following unit conversions.

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| --- | --- |
| a) | 82 *μ*g to mg |
| b) | 6.73 × 10−4 mm to nm |
| c) | 1.37 × 106 nA to mA |
| d) | 4.8 × 1018 mW to GW |

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| *ANSWER:* |

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| a) | 8.2 × 10−2 mg |
| b) | 6.73 × 102 nm |
| c) | 1.37 mA |
| d) | 4.8 × 106 GW |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Problem Solving Chem&Eng |
| *TOPICS:* | Problem Solving in Chemistry and Engineering |
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| 30. If a particle is traveling at 98% of the speed of light in a vacuum (2.998 x 108 m/s), what is its velocity in miles per hour? 1.00 mile = 1.61 kilometers.

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| --- | --- |
| *ANSWER:* | 6.57 x 108 mi/hr |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Problem Solving Chem&Eng |
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| 31. A metallic cylinder displaces 91.0 mL and has a mass of 245.7 g. What is the density of the metal?

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| *ANSWER:* | 2.70 g/mL |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Problem Solving Chem&Eng |
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| 32. Mercury has a density of 13.6 g/mL. What is the mass of 4.72 L of mercury?

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| --- | --- |
| *ANSWER:* | 6.42 × 104 g |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Problem Solving Chem&Eng |
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| 33. Draw a molecular scale picture to show how a crystal differs from a liquid.

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| *ANSWER:* | The drawing should represent the increase in intermolecular forces in the solid that gives rise to the crystal. This means a sketch that shows each atom interacting with its neighbors. This interaction would not be all encompassing in a liquid leaving the structure free to assume the volume of a container for example. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Problem Solving Chem&Eng |
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| 34. Use the web to determine the chemicals that are involved in the precipitation process while refining aluminum and draw a molecular scale drawing of this reaction.

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| *ANSWER:* | Utilize a world wide web search engine to acquire the reference. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Problem Solving Chem&Eng |
| *TOPICS:* | Problem Solving in Chemistry and Engineering |
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| ***Insight into Materials Selection and Bicycle Frames*** |

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| 35. Rank aluminum, steel, and titanium in order of increasing stiffness.

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| *ANSWER:* | Aluminium < titanium << steel (see Table 1.3 Chapter 1) |
| *POINTS:* | 1 |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Insight into Materials |
| *TOPICS:* | Insight into Materials Selection and Bicycle Frames |
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| 36. Aluminum is not as strong as steel. What other factor should be considered when comparing the desirability of aluminum versus steel if strength is an important consideration for a design?

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| *ANSWER:* | Density (and hence mass) of material. |
| *POINTS:* | 1 |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Insight into Materials |
| *TOPICS:* | Insight into Materials Selection and Bicycle Frames |
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| 37. Use the web to research the elastic modulus and yield strength of carbon fiber composites. How do these materials compare to aluminum, steel and titanium?

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| --- | --- |
| *ANSWER:* | Utilize a world wide web search engine to acquire the reference. |
| *POINTS:* | 1 |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Insight into Materials |
| *TOPICS:* | Insight into Materials Selection and Bicycle Frames |
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| ***Focus on Problem Solving Exercises*** |

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| 38. A student was given two metal cubes that looked similar. One had an edge of 1.05 cm and had a mass of 14.32 grams, and the other had an edge of 2.66 cm and had a mass of 215.3 grams. How can the student determine if these two cubes of metal are the same material using only the data given?

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| *ANSWER:* | Determine the density of each cube. If the densities vary significantly, the cubes are not of the same material. If the densities are similar, the student can suggest that the materials "appear" to be similar but still can be unsure about the result. In this particular case, the first cube has a density of 12.4 g/cm3 and the second has a density of 11.4 g/cm3. This difference suggests that the two materials are not the same. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Focus on Prob Solving Ex |
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| 39. Battery acid has a density of 1.285 g/mL and contains 38.0% sulfuric acid by mass. Describe how you would determine the mass of pure sulfuric acid in a car battery, noting the item(s) you would have to measure or look up.

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| *ANSWER:* | Measure the volume of the battery acid using the mass of the battery acid and the density value provided. Once this is done, the % of sulfuric acid would provide a reliable measure of the mass of pure sulfuric acid. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Focus on Prob Solving Ex |
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| 40. A solution of ethanol in water has a volume of 54.2 mL and a mass of 49.6 g. What information would you need to look up and how would you determine the percentage of ethanol in this solution?

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| *ANSWER:* | To determine the % of ethanol one would have to know the density of ethyl alcohol. Make the assumption that the primary components are water and ethanol. Set "x" equal to the percentage of ethanol in the sample, and "1-x" is the percentage of water. Multiply "x" by the density of ethanol and to this quantity add "1-x" multiplied by the density of water. The sum of these two components should equal the overall density found by mass/volume. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Focus on Prob Solving Ex |
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| 41. If corn is traded by the "bushel" and an acre of crop land yields an average of 240 bushels of corn, how would you determine that the volume of corn in L is produced by a 160 acre field? What would you have to look up to solve the problem?

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| *ANSWER:* | One would need to look up the volume of corn in one bushel (35.24 L). From there, the problem is solved by calculating the total bushels produced on the plot and converting this product to "L". |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Focus on Prob Solving Ex |
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| 42. Imagine you place a cork measuring 1.30 cm × 4.50 cm × 3.00 cm in a container filled with water. On top of this cork you place a small lead cube of side 1.15 cm. Describe how you would determine if the combination of the cork and the lead cube will still float in the water. Note any information you would need to look up to answer this question.

|  |  |
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| *ANSWER:* | Find the mass of the cork and the lead cube. The sum of the masses can be divided by the sum of the volumes (19.1 cm3) to find an average density for the pair. If it is less than 1 g/cm3, the pair is expected to float. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Focus on Prob Solving Ex |
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| ***Problem Solving in Chemistry and Engineering*** |

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| 43. An engineer designed a process to manufacture ball bearings. The mass of each bearing was measured to be within 0.15% of 100 grains. What range of bearing masses, in mg, will meet this tolerance? 1 grain = 64.79891 mg.

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| --- | --- |
| *ANSWER:* | 5.5 × 103 mg to 7.45 × 103 mg |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Problem Solving Chem&Eng |
| *TOPICS:* | Problem Solving in Chemistry and Engineering |
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| 44. A load of hematite has a density of 5.3 g/cm3. If the mass of the load is 150 metric tons, how many dump trucks, each with a capacity of 15 cubic yards, will be needed to haul the whole load. Assume that the truck(s) can carry the load from the mine to the dumping zone only once.

|  |  |
| --- | --- |
| *ANSWER:* | 3 dump trucks |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Difficult |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *PREFACE NAME:* | Problem Solving Chem&Eng |
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| 45. The vast majority of touchscreen devices rely on a material called \_\_\_\_\_.

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| --- | --- | --- |
|   | a.  | ferrous oxide |
|   | b.  | indium tin oxide |
|   | c.  | germanium |
|   | d.  | silicon |

|  |  |
| --- | --- |
| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *QUESTION TYPE:* | Multiple Choice |
| *HAS VARIABLES:* | False |
| *TOPICS:* | Touchscreen Technology |
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| 46. Describe the layers of a typical touchscreen display.

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| *ANSWER:* | A typical touchscreen display consists of a number of stacked layers. The LCD screen at the bottom of the stack produces the image. Two thin, transparent layers of indium tin oxide (ITO) are separated by a transparent insulating layer. When the screen is touched, one ITO sheet locates the *x*-coordinate and the other locates the *y*-coordinate. The entire assembly is covered by a glass sheet designed to resist breakage. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *TOPICS:* | Touchscreen Technology |
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| 47. What are the two important features that make indium tin oxide a reliable material for touchscreen devices?

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| *ANSWER:* | The utility of indium tin oxide arises from two important features. First, it is an example of a doped semiconductor, which is needed in order for the current to be detectable. Second, it is optically transparent, which means that it doesn't interfere with the light that is going through the touchscreen and generating the images you see—and swipe or pinch. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *QUESTION TYPE:* | Subjective Short Answer |
| *HAS VARIABLES:* | False |
| *TOPICS:* | Touchscreen Technology |
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