

Practice Questions for Chapter 1 AK

1. **(7 points)** In the process of attempting to characterize a substance a chemist makes the following observations:

Distinguish between the difference between a physical and chemical property.

Identify the physical properties with a **P**, and the chemical properties with **C**.

The substance is a silvery white, lustrous metal. (2) It melts at 649°C and boils at 1105°C. (3) Its density is 1.738 g/cm³. (4) It burns in air, producing an intense white light. (5) It reacts with chlorine gas to give a brittle, crystalline solid.

Physical properties are characterized by measurement and description. The matter is not changed if crushed or cut, because no bonds are broken. Chemical properties refer to how the matter changes when the matter is reacted. Bonds are broken and new bonds are formed, creating new matter from the old. Statements 1, 2, & 3 are physical properties of this metal. They describe the appearance of the metal and its physical behavior that can be measured without destroying the metal. Statements 4 & 5 describe two typical reactions of the metal, burning in an atmosphere of chlorine gas to create a salt, and burning in an atmosphere of oxygen to create an oxide and light.

2. **(4 points)** Classify each of the following as an element [E], a compound [C] or a mixture [M]
- a) M muddy water that settles on standing
 - b) M A filtered cup of coffee , no cream, no sugar
 - c) M blood
 - d) M Chocolate Chip Cookie
 - e) C Salt (NaCl)
 - f) M A bowl of beef noodle soup
 - g) E Aluminum foil E Liquid bromine

Elements are the building blocks of matter. They consist of a single type of atom. We have elements (not many) in our homes, and I am not talking about elements of style. Aluminum foil made from a block of aluminum that is pressed to a desired thickness. A compound is a substance composed of more

than one type of atom, like NaCl. Molecules are made when two or more atoms combine to form a substance using strong attractive forces. Bromine is an element, and a molecule. A mixture is composed of two or more different types of matter that can be separated by physical means into their individual components. Blood is a mixture because it contains cells and such.

3. **(4 points)** Clarify the following confusing statements using the appropriate units of either °C, °F or K for temperature, oz, liters, or gal for volume, and ft, km, or mi for distance. For each value, only one of the units makes sense. [Hint: how far is 3000 ft compared to 3000 mi?] Explain your choices.

"I was thirsty today. I drank 8 of coke in 3 minutes. Then I ran 20 in about half a minute to catch a bus. Inside the bus it was hot. I think it was 90 because the air conditioning was not working and people were sweating."

I drank 8 oz of coke in 3 minutes. 8 liters is a lot. The human body holds about 5 liters of blood, so I think it would tax my fluids and kidneys to drink so much, so fast. The same can be said for 8 gal. Since a gallon is about 4 L, I would say the process would be worse than drinking 8 L. (This information is on the equation sheet in front of the exam)

I ran 20 ft in about half a minute to catch a bus. 20 Km, and 20 mi seem like an excessive distance to run in half a minute, since there are 5280 ft in a mile, so I would have to be the Flash or something. So big can of NOPE!

If the inside of the bus was hot and we are still alive, the temperature could be close to 90°F. That value seems reasonable. 90°C is close to the boiling point of water; we would be par-boiled (normal body temp is about 37°C). 90K would be very cold, and we would be frozen solid, since this value is -183°C. YIKES

4. **(4 points)** These values are not written in the most appropriate metric prefix. Rewrite them please. Show the math and reasoning you used to support your answer.

a) $1.234 \times 10^{12} \text{ nL}$

$1.234 \times 10^{12} \text{ nL}$	10^{-9} L	1 kL	1.234 kL
	1 nL	10^3 L	

b) $9.73 \times 10^9 \text{ pg}$

$9.73 \times 10^9 \text{ pg}$	10^{-12} g	1mg	9.73 mg
	1 pg	10^{-3} g	

c) $7.564 \times 10^{17} \text{ nm}^3$

$7.564 \times 10^{17} \text{ nm}^3$	$(10^{-9} \text{ m})^3$	$(1 \text{ mm})^3$	0.7564 mm^3
	1 nm^3	$(10^{-3} \text{ m})^3$	

5. **(6 points)** Indicate which of the following are exact numbers or inexact numbers by designating your choice with an (E) or (I):

- I the mass of a paper clip
- I the surface area of a dime
- E The number of pennies in a nickel
- I The temperature of the surface of the sun
- E The number of toes on your feet .
- Differentiate between exact and inexact and explain your choices with complete sentences.

Exact numbers are values that are counted or are used as a definition to define connections between measurement systems. They do not change the number of significant figures of a value.

Inexact numbers arise from measurement. They have a degree of uncertainty and are based on the precision of the tool used for the measurement. They have inherent error. Therefore, the value is known only to a certain degree and is based on the 'goodness' of the tool and the skill of the user.

6. **(5 points)** Indicate the number of significant figures in each of the following measured quantities:

- | | |
|----------------------------------|---|
| a) 8.1441 mg | 5 |
| b) 0.00050 m ² | 2 |
| c) 6,480,100 s | 5 |
| d) -15.20°C | 4 |
| e) 10.0800 × 10 ⁻² cg | 6 |

7. **(5 points)** Perform the following calculation and report your answer with the correct significant figures and units.

a) 2.17 g + 4.32 g + 401.278 g + 21.826 g

$$2.17 \mid$$

$$4.32 \mid$$

$$401.27 \mid 8$$

$$\underline{21.82 \mid 6}$$

$$429.594 \rightarrow$$

$$429.59$$

b) $2.156\,934 \times 10^{114} \text{ }^{\circ}\text{C} + 2.314\,276 \times 10^{115} \text{ }^{\circ}\text{C} + 2.954\,681 \times 10^{116} \text{ }^{\circ}\text{C}$

$$2.156\,934 \times 10^{114} \text{ }^{\circ}\text{C} + 2.314\,276 \times 10^1 \times 10^{114} \text{ }^{\circ}\text{C} + 2.954\,681 \times 10^2 \times 10^{116} \text{ }^{\circ}\text{C}$$

$$2.156\,934 \times 10^{114} \text{ }^{\circ}\text{C} + 23.14\,276 \times 10^{114} \text{ }^{\circ}\text{C} + 295.4\,681 \times 10^{114} \text{ }^{\circ}\text{C}$$

$$= 320.7977 \mid 94 \times 10^{114} \text{ }^{\circ}\text{C}$$

8. **(5 points)** 25 family members attended my birthday party. I served each member 3 hamburgers, 22 French fries, 2 cans of soda, and 1 piece of cake. The piece of cake was 1.5 in long, 1.5 in wide, and 1.5 in high. I collected 1 bag of recyclable material with a mass of 112 kg and 2 bags of compostable material each with a mass of 201 kg.
Of the following values 3, 22, 2, 1.5, 112 presented in the paragraph above, which are exact numbers? Explain

3 hamburgers, 22 French fries (independent of size!), 2 cans of soda (or 2 bags of compostable) are all exact because they are values that are counted. Exact numbers are values that are counted or used as a universal definition. They have no error when physically counted. 1.5 in and 112 kg are measured values and are inexact because measured values have a degree of imprecision which leads to guessing and error. They are imprecise.

9. (4 points) In the opening scenes of the movie Raiders of the Lost Ark, Indiana Jones tries to remove a gold idol from a mass sensitive booby-trapped pedestal. He replaces the idol with a bag of sand of approximately equal volume to that of the idol. (Density of gold = 19.32g/mL; Density of sand = 1.91 g/mL). The idol has a radius of 7.50 cm. Volume of a sphere = $(4/3) \pi r^3$ What is the mass of the gold idol? What is the mass of sand bag? Did Indiana Jones have a reasonable chance for not activating the mass sensitive booby trap? Explain in one or two brief sentences.

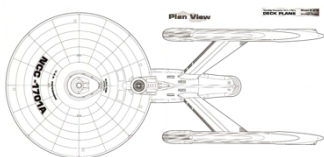
Volume of the idol and the sandbag that Indiana Jones used:

$$V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi (7.50 \text{ cm})^3 = 1767.1 \text{ cm}^3$$

Mass of sand			Mass of gold		
1,767.1 cm ³ sand	1.91g sand	1mL sand	1,767.1 cm ³ Au	19.32 g Au	1ml Au
	1mL sand	1 cm ³		1 mL Au	1 cm ³ Au
3,375.2 g sand => 3.38 X10 ³ g sand 3.38 kg sand			34,141 g Au, => 3.41 X10 ⁴ g, 34.1 kg Au		

Indie triggered the trap because he confused volume with density and mass. Density is the ratio of the volume to the mass. Sand has a lower density than gold. Since the volumes were the same, the mass becomes important. For the same volume, gold delivers more mass than sand. Indie would need 10X the volume of sand to be safe from the trap, since the mass of the sand was 1/10th that of gold.

1. (5 points) Science fiction often uses nautical analogies to describe space travel. In the words of Captain Picard, "It's continuing mission: to explore strange new worlds, to seek out new life and new civilizations, to boldly go where no one has gone before. If the starship *U.S.S. Enterprise* is traveling to this new world at warp factor 2.56, what is its speed in yd/s?



(Warp factor 1.709 = 5 times the speed of light; the speed of light is 299,792,000 m/s; 1 knot is **exactly** $1.200\ 00 \times 10^5$ yd/s, 1 meter = 1,093.6133 yd)

2.56 warp	5	299,792,000 m	1,093.6133 yd	= 4.20x10 ⁹ yd
	1.709 warp	Sec	1 m	sec

10. (7 points) Copper can be drawn into thin wires. How many kilometers of 34gauge wire (diameter = 6.304×10^{-3} in) can be produced from the copper in 5.1256 lb of covellite, an ore that is 66.013% copper by mass. The volume of a cylinder is $\pi r^2 h$, $d_{\text{Cu}} = 8.95 \text{ g/cm}^3$.

5.126 lb ore	453.592 g ore	6.6103 g Cu	1cm ³ Cu	= 171.481 cm ³ Cu
	1 lb ore	100.00 g ore	8.95 g Cu	

Diameter/2 = r; $6.304 \times 10^{-3} \text{ in}/2 = 0.003151 \text{ in}$

171.481 cm ³ Cu	• ← leaving 1 cm on top	1 in ²	10 ⁻² m	1 km	= 8.52 km
π	(0.003151 in) ²	(2.54 cm) ²	1 cm	10 ³ m	

1. (6pt) Answers the questions below:

- a) (1 point) What is the length of the pencil if the ruler reads in centimeters? (It is cut off because it won't all fit on the page.)



b)

8.30 cm

- a) (1 point) What is the volume contained in the graduated

25.8 mL



cylinder?

- b) (4 point) Burt (A), Ernie (B), Kermit (C), and Gonzo (D) enter a dart contest. The prize is an all-expense paid trip to Sesame Street. The winner will be the archer who is the most accurate and precise. Explain your choice by differentiating between precision and accuracy of each competitor.

11.



A



B



C



D

A & C shows poor precision and accuracy, B shows good precision but poor accuracy, D shows good precision and accuracy Gonzo wins.