

Examination 1

Multiple Choice Questions

- Which of the following is a chemical process?
 - A cup of Water is boiled in the microwave.
 - A spoon full of Sugar is dissolved in a cup of Water.
 - A strainer full of tea is steeped in a kettle of hot Water.
 - A pot roast is cooked in an oven. *******

- Which of the following is a physical property of a substance?
 - Becomes dull in Air.
 - melting point = 145°C *******
 - Reacts with conc. Nitric Acid.
 - Develops a green tint when exposed to moist Air.

- Which of the following is an intensive physical property of matter?
 - surface area
 - length
 - density ***** (does not depend on the amount of the sample of present)**
 - mass

- The intensive physical properties of a substance are important because they:
 - allow us to determine how much of the substance is required in a chemical reaction.
 - help us identify or characterize the substance. *******
 - provide information about the atomic structure of the substance.

- The following are errors which can occur when making a reading of the volume of a liquid in a graduated cylinder. Which is an example of a Random Error?
 - Not making the reading with your eye level with the bottom of the meniscus. ***** (Eye level will not always be at the same level and so readings will be random.)**
 - The temperature of the liquid is well above the cylinder's calibration temperature.
 - The true reading is mistakenly recorded in the lab book with two digits inverted.

6. Which of the following errors can be eliminated by calibrating the measuring device?

- a) Random errors.
- b) Systematic errors. *******
- c) Gross errors.

7. Systematic errors lead to a lack of:

- a) accuracy in the measurement. *******
- b) significant digits in the measurement.
- b) precision in the measurement.
- c) gradation of the measuring instrument.

8. How many significant figures does the following measurement contain?

$$\text{temperature} = 3.70^{\circ}\text{C}$$

- a) 1
- b) 2
- c) 3 ***** (zeros on the right are significant)**
- d) 4

9. How many significant digits does the following mass measurement contain?

$$\text{mass} = 0.03021\text{g}$$

- a) 1
- b) 2
- c) 3
- d) 4 ***** (zeros on the left are place holders and so are not significant)**

10. What is the result of the following calculation, reported to the correct number of significant figures?

$$4.521\text{g} - 3.19\text{g} = ?$$

- a) 1.331g
- b) 1.33g ***** (least precise number is 3.19; uncertain digit in 1/100th's place)**
- c) 1.3g
- d) 1.g

11. How many significant figures does the result of the following calculation contain?

$$3.915^{\circ}\text{C} - 0.00041^{\circ}\text{C}$$

- a) 1
- b) 2
- c) 3
- d) **4 ***** (result is 3.915°C; precision is at the 1/1000th's level)**

12. What is the result of the following calculation, reported to the correct number of significant figures.

$$0.91 \text{ A} \times 657.1 \text{ s}$$

- a) 597.96
- b) 598.0
- c) 598.
- d) **6.0×10^2 ***** (measurement with the fewest sig figs is 0.91 A at 2 digits)**

13. What is the following number in standard decimal notation?

$$3.41 \times 10^{-4}$$

- a) **0.000341 *******
- b) 0.0341
- c) 341.
- d) 34100.

14. Which of the following represents the most precise measurement of length?

- | | |
|---|---------------|
| a) 3.1×10^{-1} | 0.31 |
| b) $4.766 \times 10^{+2}$ | 476.6 |
| c) 1.6×10^{-3} ***** | 0.0016 |
| d) $8.20 \times 10^{+3}$ | 8200 |

15. What is the result of the following calculation to the correct number of significant figures?

$$(4.53 \times 10^7) \times (3.771 \times 10^3)$$

- a) $1. \times 10^{+11}$
- b) $1.7 \times 10^{+11}$
- c) **$1.71 \times 10^{+11}$ ***** (fewest number of sig figs in a measurement is 3)**
- d) $1.708 \times 10^{+11}$

16. What is the result of the following calculation to the correct number of significant figures?

$$(9.332 \times 10^3) - (1.12 \times 10^2)$$

- a) **9.220×10^3 *******
- b) 9.22×10^3
- c) 9.2×10^3
- d) $9. \times 10^3$

$9.332 \times 10^{+3} + 0.112 \times 10^{+3}$; precision is at the 1/1000th's place

Short Answer Questions

1. Below is the *Merck Index* entry for Ceric Fluoride. Circle the listed physical properties of this substance and underline the chemical properties.

1950. Ceric Fluoride. CeF_4 ; mol wt 216.13. Ce 64.84%, F 35.16%. Prepd from CeF_3 and F_2 : Klemm, Henkel, *Z. Anorg. Allgem. Chem.* **220**, 181 (1934); von Wartenberg, *ibid.* **244**, 343 (1940); Kwasnik in *Handbook of Preparative Inorganic Chemistry*, vol. 1, G. Brauer, Ed. (Academic Press, New York, 2nd ed., 1963) pp 247-248; from CeO_2 and F_2 : Asker, Wylie, *Aust. J. Chem.* **18**, 959 (1965).

Minute crystals, d 4.77. mp above 650° . Practically insol in water; very slowly hydrolyzed by cold water. Thermally stable below 550° . May be reduced to CeF_3 by H_2 at 300° .

Monohydrate, white powder. Sol in acids.

USE: Fluorinating agent.

Physical Properties

Minute Crystals

d 4.77

mp 650°

practically insol in water

thermally stable below 550° (could be viewed as a chemical property)

Chemical Properties

very slowly hydrolyzed by cold water

may be reduced to CeF_3 by H_2 at 300°

2. Identify one substance in this room and indicate one physical and one chemical property of that substance.

Example: Oxygen

Physical Property: very low boiling point

Chemical Property: reacts with most metals

3. Provide definitions for accuracy and precision. Which of the two quantities can we always determine? Explain.

Accuracy = How close the measurement is to the true (accepted) values.

Precision = How close repeated measurements are to each other.

Can always determine the precision because you can always make repeated measurements; but you don't always know the true result.

4. Antoine Lavoisier was the first chemist to determine the percentage Oxygen in the atmosphere. He determined the atmosphere is (1/6) Oxygen. Current measurements put the percentage closer to (1/5). What is the percentage error in Lavoisier's determination?

$$\% \text{ error} = ((1/5) - (1/6)) / (1/5) \times 100 = 17\%$$

5. What is the difference between an instrument's resolution and the precision with which it can be used?

The instrument's resolution is determined by its ability to distinguish between two different measurements. It is definitely tied to the gradation of the instrument. Precision involves both the instrument's resolution and the ability of the user to use the instrument such that repeated measurements are close together.

6. Why do we use the significant figure approximation when reporting measurements?

Provides with a method for representing the precision of a measurement.

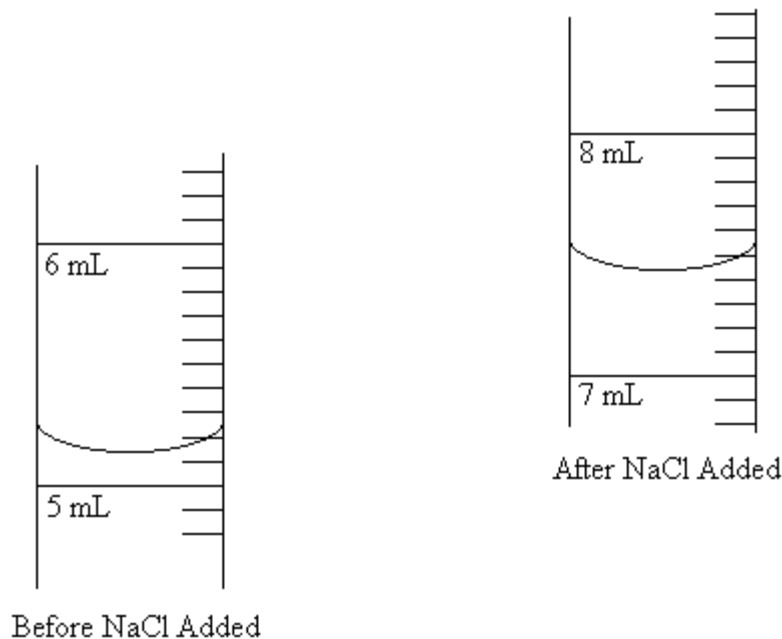
7. Report the following result to the correct number of significant figures:

$$8.771 \times (4.17 \times 10^{-6} + 0.19 \times 10^{-5})$$

$$4.17 \times 10^{-6} + 1.9 \times 10^{-6} = 6.07 \times 10^{-6} \quad (\text{"7" is not significant})$$

$$(6.07 \times 10^{-6}) / 8.771 = 5.3 \times 10^{-5} \quad (\text{only 2 sig figs allowed in result})$$

8. It is found that Table Salt does not dissolve in liquid Hexane. So, to determine the volume of some irregular crystals of Table Salt, some liquid Hexane is added to a graduated cylinder, and the volume is read. Then the Table Salt is added to the graduated cylinder. The graduated cylinder is as pictured below:



- a) Report the following values to the correct number of significant digits:

Volume w/ NaCl 7.42 mL

Volume w/ no NaCl 5.13 mL

- b) Calculate the volume Table Salt used; to the correct number of significant digits.

$$7.42 \text{ mL} - 5.13 \text{ mL} = 2.29 \text{ mL} \quad (\text{precision in the } 1/100^{\text{th}}\text{'s placed})$$

9. Identify at least two places on campus where you can seek tutoring services for this class.

Lavender Lounge in Jones Hall

Study Lounge in South Hall

Success Center in Fidel Hall