GENERAL CHEMISTRY BC2001x – PRACTICE PROBLEMS – SET 1

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1. Exponential notation and significant figures

Express each of the following numbers in exponential notation (often misleadingly called "scientific notation"), and state the number of significant figures in each. If the number of significant figures is ambiguous, explain.

(a) 0.0002008 **(b)** 20,772,000 **(c)** 0.010570 **(d)** 7,030

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2. Rounding, significant figures, exponential notation

An electronic calculator displays the results as shown for the following calculations. Round the answers given to the correct number of significant figures, and express the results in exponential notation.

(a) $\dfrac{(2.1)(0.0821)(295)}{4.32} = 11.77336806$

(b) $\dfrac{(0.00323)(107.87)}{1.023} = 0.340586608$

(c) $\dfrac{(0.928)(0.00520)}{(0.082056)(297.25)} = 0.000197842$

(d) $\dfrac{9.753 - 9.512}{15.9994} = 0.015063065$

(e) $\dfrac{26.923 - 26.062}{63.54} = 0.013550519$

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3. Conversion of temperatures from °C to K

What is the Kelvin temperature, expressed to the correct number of significant figures, corresponding to each of the following temperatures on the Celsius scale (also denoted the centigrade scale)?

(a) 24 °C **(b)** 25.0 °C **(c)** 26.8 °C **(d)** 24.35 °C **(e)** 77 °C

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4. Unit conversion factors

Obtain the factor for converting density in grams per liter to the SI unit of density, kilograms per cubic meter.

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5. Physical relations, calculation of results from data measured in laboratory and from reference sources

To determine accurately the volume of a certain flask, it is weighed when empty, and then weighed filled with distilled water. The temperature of the water is measured, and the density of water at that temperature found by consulting the *Handbook of Chemistry and Physics*. In a certain experiment, the following data were obtained:

weight of flask full of water = 45.0078 g
weight of empty flask = 20.0324 g
temperature of water = 26.00 °C
density of water at 26.00 °C = 0.99681 $g \cdot mL^{-1}$

Calculate the volume of the flask.

6, Physical relations, calculation of results from data measured in laboratory and from reference sources

A block of copper has dimensions 5.0 mm x 3.0 mm x 2.0 mm. The density of copper (Cu) is 8.92 g·cm^{-3}. How much does the block weigh (a) in grams and (b) in mg?

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7. Physical relations, calculation of results from data measured in laboratory and from reference sources

Liquid mercury has a very high density, 13.594 g·cm^{-3} at room temperature. Some mercury is poured into a glass tube with a uniform diameter of 9.0 mm. The measured height of the column of mercury is 683 mm. What is the mass of mercury in the tube?

8, Physical relations, calculation of results from data measured in laboratory and from reference sources

A pycnometer is a flask specially designed for measuring the density of liquids. A certain pycnometer is known to have a volume of 50.02 mL. The evacuated pyconometer is weighed, then filled with liquid and reweighed. In a certain experiment, when the temperature of the liquid was 25.0 °C, the following data were obtained:

mass of pyconometer full of liquid = 62.8365 g
mass of evacuated pycnometer = 18.4631 g

What is the density of this liquid at 25.0 °C? Report the answer to the correct number of significant figures and specify the units of the density.

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9. Physical relations, calculation of results from data measured in laboratory and from reference sources

A solution of the simple sugar fructose in water is 20.0% fructose by weight, and has a density of 1.082 g·mL^{-1}. How many grams of fructose are in 45.00 mL of this solution?

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10. Physical relations, calculation of results from data measured in laboratory and from reference sources

A sample of hydrogen gas, H_2, is collected over liquid water at 23 °C. To obtain the pressure of dry hydrogen, the vapor pressure of water is subtracted from the barometric pressure, which is measured as 758.3 mmHg. The *Handbook of Chemistry and Physics* lists the value of the vapor pressure of H_2O at 23 °C as 21.068 mmHg. Calculate the pressure of dry hydrogen gas.

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11. Physical relations, calculation of results from data measured in laboratory and from reference sources

A solution of ethanol and water is prepared by mixing 40.0 mL of ethanol with 62.5 mL of water at 20.0 °C. The densities of ethanol and water at this temperature are, respectively, 0.7893 g·mL^{-1} and 0.99823 g·mL^{-1}. What is the percentage by weight of ethanol in this mixture?
