

**Exam I – Chapters 1, 2, & 5**

**1 mL = 1 cm<sup>3</sup>**

**1 inch = 2.54 cm**

**1 mile = 1.6093 km**

**1 lb = 453.59 g**

**T<sub>°F</sub> – 32 = 1.80 x T<sub>°C</sub>**

**1 gal = 4 qt = 3.7854 L**

**Questions 1-15 are worth 3 points each. Please circle the correct answer. There is only one correct answer.**

- Determine which of the following is considered a physical change:
  - A cornstalk grows from a seed that is watered and fertilized.
  - Dynamite explodes to form a mixture of gases.
  - Frost forms as the temperature drops on a humid winter night.**
  - A silver fork tarnishes in air.
- How many significant figures are in the answer to the following calculation?  
(23.4 cm + 14.56 cm) x (12 cm + 10.8 cm) =
  - 1
  - 2**
  - 3
  - 4
- Circle the most abundant isotope for oxygen.
  - <sup>15</sup>O
  - <sup>16</sup>O**
  - <sup>17</sup>O
  - <sup>18</sup>O
- What is the maximum number of electrons allowed in a 5d subshell?
  - 2
  - 6
  - 10**
  - 14
- How many cm are there in 19.5 km?
  - 1.95 x 10<sup>-4</sup> cm
  - 1.95 x 10<sup>-3</sup> cm
  - 1.95 x 10<sup>4</sup> cm
  - 1.95 x 10<sup>6</sup> cm**
- Which electron configuration is correct for copper?
  - [Ar] 4s<sup>2</sup>3d<sup>9</sup>
  - [Ar]4s<sup>1</sup>3d<sup>10</sup>**
  - [Ar]4s<sup>2</sup>3d<sup>10</sup>
  - [Ar]4s<sup>0</sup>3d<sup>10</sup>
- Which element would have properties most similar to P?
  - Bi
  - N**
  - As
  - Ar
- Which one of the following is an ionic compound?
  - BCl<sub>3</sub>
  - N<sub>2</sub>O<sub>4</sub>
  - XeF<sub>4</sub>
  - CoS<sub>2</sub>**
- In what group are the alkaline earth metals found?
  - IA
  - IIA**
  - VIIA
  - VIIIA
- What value remains constant between different isotopes of the same element?
  - protons**
  - electrons
  - neutrons
  - mass number
- Which scientist disproved Dalton's theory that atoms are tiny, indivisible, and indestructible?
  - Dalton
  - Millikan
  - Lavoisier
  - Rutherford**
- The temperature 153 K is equivalent to \_\_\_\_\_ °F.
  - 184 °F**
  - 120. °F
  - 67 °F
  - 307 °F
- A local radio station transmits a frequency at 96.9 MHz. What is the wavelength?
  - 3.10 x 10<sup>-3</sup> m
  - 3.10 m**
  - 3.10 x 10<sup>9</sup> m
  - 3.10 x 10<sup>12</sup> m

14. A graduated cylinder contains two liquids. Liquid A has a density of 2.369 g/mL and liquid B has a density of 1.789 g/mL. If an unknown object with a density of 1.553 g/mL was placed in the graduated cylinder, on top of which liquid would it float?

- a. liquid A                      b. liquid B                      c. both liquid A and B                      d. it would sink

Due to a bit of confusion, I accepted either b or c

15. Which of the following combinations of quantum numbers are not allowed?

- a.  $n = 3, l = 1, m_l = 1$   
 b.  $n = 3, l = 2, m_l = -1$   
 c.  $n = 3, l = 3, m_l = 2$   
 d.  $n = 4, l = 3, m_l = 0$

For questions 16-19, remember to use proper significant figures and units. Please show ALL work for full credit.

16. (6 pts) A square piece of metal has a length of 63.25 mm and a density of 0.324 lbs/in<sup>3</sup>. What is the mass, in grams, of the metal piece?  $V = (63.25 \text{ mm})(1 \text{ cm}/10\text{mm}) = (6.325 \text{ cm})^3 = 253.0 \text{ cm}^3$

$$253.0 \text{ cm}^3 \left( \frac{1 \text{ in}}{2.54 \text{ cm}} \right)^3 (0.324 \text{ lbs}) \left( \frac{453.59 \text{ g}}{1 \text{ lb}} \right) = 2268.96 \text{ grams} = 2269 \text{ g}$$

17. (6 pts) An automobile is traveling 5.5 m/s in a school zone. If the posted speed limit in the school zone is 15 miles per hour, is the automobile speeding?

$$\frac{5.5 \text{ meters} \left( \frac{1 \text{ km}}{1000 \text{ m}} \right) \left( \frac{1 \text{ mile}}{1.61 \text{ km}} \right) \left( \frac{3600 \text{ seconds}}{1 \text{ hour}} \right)}{3600 \text{ seconds}} = 12 \frac{\text{miles}}{\text{hr}} \text{ So NO}$$

$$\frac{9.5 \text{ meters} \left( \frac{1 \text{ km}}{1000 \text{ m}} \right) \left( \frac{1 \text{ mile}}{1.61 \text{ km}} \right) \left( \frac{3600 \text{ seconds}}{1 \text{ hour}} \right)}{3600 \text{ seconds}} = 21 \frac{\text{miles}}{\text{hr}} \text{ So YES}$$

YES or NO (Circle one and you must show work to receive credit!)

18. (6 pts) At what speed, in m/s, must a 138.9 g softball be traveling to have the same wavelength of green light at 512 nm?

$$\lambda = h/mv \quad 512 \text{ nm} = \frac{6.636 \times 10^{-34} \text{ Js}}{(138.9 \text{ g})(X \text{ m/s})} \quad \text{Now units need to be fixed!}$$

$$X \text{ m/s} = \frac{(6.636 \times 10^{-34} \text{ kg m s}^{-1})}{(512 \text{ nm})(1 \text{ m}/1 \times 10^9 \text{ nm})(138.9 \text{ g})(1 \text{ kg}/1000\text{g})} = 9.33 \times 10^{-27} \text{ m s}^{-1}$$

19. (6 pts) A typical X-ray at the dentist operates with a wavelength of 455 pm. How much energy does this correspond to in kilojoules per mole? *pm equals picometers*

$$c = v \lambda \quad \text{so } v = c / \lambda = \frac{3.00 \times 10^8 \text{ m s}^{-1}}{(455 \text{ pm})(1 \text{ m} / 1 \times 10^{12} \text{ pm})} = 6.59 \times 10^{17} \text{ s}^{-1}$$

$$E = h v = 6.636 \times 10^{-34} \text{ Js} (1 \text{ kJ}/1000 \text{ J})(6.59 \times 10^{17} \text{ s}^{-1})(6.022 \times 10^{23} \text{ mol}^{-1}) = 263349 \text{ kJ/mol} = 2.63 \times 10^5 \text{ kJ/mol}$$

