

1. How many cubic nanometers are present in 0.012 cubic micrometers ? how many  $\mu\text{m}^3$  in  $125 \text{ nm}^3$

$$0.012 \mu\text{m}^3 \times \left\{ \frac{10^{-6} \text{ m}}{1 \mu\text{m}} \right\}^3 \times \left\{ \frac{1 \text{ nm}}{10^{-9} \text{ m}} \right\}^3 = 1.2 \times 10^7$$

$$1.25 \times 10^{-7}$$

2. A coin is made of 40.0% Ag ( $d = 10.5 \text{ g/cm}^3$ ) and 60.0% Pt ( $d = 21.5 \text{ g/cm}^3$ ).

- a) What is the density of the coin ?

$$0.400 \times 10.5 + 0.600 \times 21.5 = 17.1 \text{ g/cm}^3$$

$$0.600 \times 10.5 + 0.400 \times 21.5 = 14.9 \text{ g/cm}^3$$

- b) If this coin is 1.50 mm in thickness and weighs 60.0 g, what is its diameter ? (assume the coin is a perfect cylinder) (version 2 = 1.20 mm) recall:  $V = \pi r^2 h$

$$.. V = m/d = 60/17.1 = 3.51 \text{ cm}^3$$

$$\text{or } V = 60/14.9 = 4.03 \text{ cm}^3$$

$$\text{solving for } r = 2.72 \times 2 = 5.46 \text{ cm}$$

$$\text{Diameter} = 6.54 \text{ cm}$$

3. An element has three isotopes. The first has 12 protons and 12 neutrons and has an abundance of 78.6%.  
.. The second isotope has 13 neutrons and has an abundance of 10.1% The third isotope has 14 neutrons with an abundance of 11.3%. Note – the mass numbers are good to 3 sig figs.

- .... a) Write the symbols of the isotopes showing their atomic numbers and masses  ${}_{12}\text{Mg}^{24}$   ${}_{12}\text{Mg}^{25}$   ${}_{12}\text{Mg}^{26}$

- .... b) Calculate the atomic mass of the element (showing setup).

$$24.0 \times 0.786 + 25.0 \times 0.101 + 26.0 \times 0.113 = 24.3$$

4. Recall the formula for heat transfer:  $Q = m c \Delta T$   $c$  for water =  $4.184 \text{ J/g/K}$   $Q_w = -Q_m$

- .. Calculate the final temperature of a system (water and metal) in a calorimeter, after a piece of silver weighing 80 grams ( $c = 0.232 \text{ J/gK}$ ) initially at a temperature of  $200.0^\circ\text{C}$  is immersed in  $100.0 \text{ g}$  water initially at a temperature of  $20.0^\circ\text{C}$ . Ignore any minor heat loss to the air or calorimeter.

$$m_{\text{H}_2\text{O}} c_{\text{H}_2\text{O}} \Delta T_{\text{H}_2\text{O}} = - m_m c_m \Delta T_m \quad \text{second version – using incorrect value for Cu } c = 0.0835$$

$$100 \times 4.184 \times (T_f - 20.0) = -80 \times 0.232 \times (T_f - 200.0)$$

$$T_f = 21.3 \text{ C}$$

$$418.4T - 8368 = -18.56T + 3712$$

$$437 T = 12080$$

$$T_f = 27.6 \text{ C}$$

$$\text{third version – using correct value for } c = 0.385$$

$$T_f = 32.4$$

5. An 80.0 g piece of Ag/Au alloy  $d = 14.9 \text{ g/cm}^3$  version 2 Cu/Au  $13.6 \text{ g/cm}^3$   $V = 80/13.6 = 5.88 \text{ ml}$   
.. immersed in water so  $V = 80/14.9 = 5.37 \text{ ml}$  version 3 Cu/Au  $14.1 \text{ g/cm}^3$   $80/14.1 = 5.67 \text{ mL}$

- a) Predict how many grams it will appear to weigh once immersed in water. ( $d_{\text{H}_2\text{O}} = 1.00 \text{ g/mL}$ ).

$$80.0 - 5.37 = 74.6 \text{ g}$$

$$80 - 5.88 = 74.1 \text{ g}$$

$$80 - 5.67 = 74.3 \text{ g}$$

- b) If ethanol ( $d = 0.790 \text{ g/mL}$ ) is used as the liquid for immersion, how many grams will the metal piece appear to weigh ?

$$\text{displaced } 5.37 \text{ mL} \times 0.790 \text{ g/mL} = 4.24 \text{ g weight lost } 75.8 \text{ g etc}$$

\*\* c) bonus . What is the % composition of the alloy ? (% Ag, % Au )

Let  $x = d_{\text{Ag}} = 10.5 \text{ g/cm}^3$  or  $x = d_{\text{Cu}} = 8.92$       $10.5x + 19.3y = 14.9$

Let  $y = d_{\text{Au}} = 19.3 \text{ g/cm}^3$       $10.5x + 19.3(1-x) = 14.9$

Au= 0.5 = 50%/50%

Version 2 45%/55%

Version 3 50%/50%

6. Name these elements: refer to a periodic table,

a) Ti    b) Sn    c) Kr    d) Co    e) Hg    f) K    a) Mn    b) Si    c) Sn    d) Ni    e) Hg    f) Pb

7. What are two allotropes of oxygen – O , O<sub>2</sub> , O<sub>3</sub>    What are two allotropes of carbon ? C<sub>60</sub> , (fullerene)

Graphite , diamond

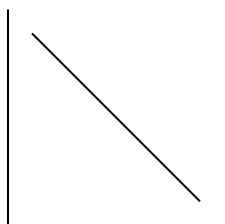
8. Name these items from your locker.(3 pts)    (complete names)



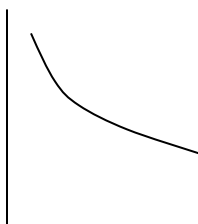
a) \_\_wash bottle\_\_    b) \_\_Erlenmeyer flask\_\_    c) \_\_evaporating dish\_\_

9. Which of these graphs describe an inversely proportional relationship between x and y ? (circle letter below)

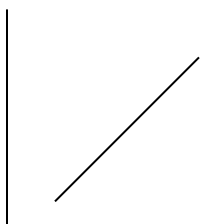
2 pts



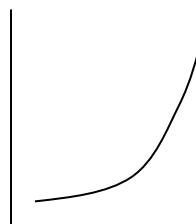
a  
 $y = -kx$



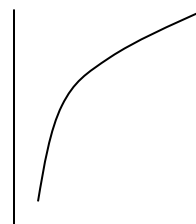
**b**  
 $xy = k$



c  
 $y = kx$



d  
 $y = x^k$



e

10. Define these and explain or give an example. 10 pts

a)  $\beta^+$  particle = positron like the electron but with + charge, emitted from an unstable nucleus

b) exothermic process emission of energy from a chemical reaction or a change of state such as liq – solid  
Endothermic                      absorption

c) isobars isotopes of different elements with the same mass #

d) alpha ( $\alpha^{+2}$ ) particle He<sup>2+</sup> ion emitted during nuclear decay of heavy elements.

e) molecule 2 or more atoms bonded together, I.e, H<sub>2</sub> CO<sub>2</sub>

11. Predict which ions will be formed by the following elements based on gain or loss of electrons. (Write the .. positive or negative charge above and to the right of the symbol. Example Fe<sup>3+</sup>    5 pts

a) Li<sup>+</sup>    b) Ca<sup>++</sup>    c) P<sup>3-</sup>    d) Br<sup>-</sup>    e) Al<sup>3+</sup>

12.. Which of these are chemical properties, and which are physical properties (Write P or C ) 5 pts

a) flammability \_C\_ b) density \_P\_ c) melting point \_P\_ d) solubility P\_ e) corrosion \_\_C\_\_

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a) Mg<sup>2+</sup> b) K<sup>+</sup> c) As<sup>-3</sup> d) I<sup>-</sup> e) Sc<sup>+3</sup> gain or lose electrons to = noble gas configuration

13. Write the symbol of the isotope, including charge if any, and mass number or the number of particles in the following table 5 pts

Symbol	# protons	# neutrons	# electrons
<sup>68</sup> Zn <sup>+2</sup>	30	38	28 .
<sup>234</sup> U	92	142	92 .
<sup>3</sup> He <sup>2+</sup>	2	1	0 .

Other versions: <sup>92</sup>Zr<sup>2+</sup> <sup>66</sup>Zn<sup>2+</sup> <sup>3</sup>H<sup>-</sup> <sup>2</sup>H<sup>-</sup>

12. Describe some chemical achievements of two of these great scientists. Take your pick. 10 pts

A. Lavoisier , discoverer of oxygen, law of conservation of mass, metric system

J Berzelius, atomic symbols, atomic masses, precision work, discovered some elements

D Mendeleev arranged the symbols of the elements according to increasing atomic mass and repetition of chemical properties in groups.

, E Rutherford, gold foil experiment proved the existence of a small dense nucleus in the atom containing most of the mass and all the positive charge

J. Thomson, charge/mass ratio on the electron. Plum pudding model of the atom

R. Millikan, measured the charge per electron in his oil drop experiment.

J Priestley discovered oxygen, founded the ACS

C Scheele – discovered oxygen, fluorine and many compounds.