

CHEM1101 Problem Sheet 1 (Week 1)

There are a number of important learning resources available on your unit area on the First Year Chemistry website: <http://firstyear.chem.usyd.edu.au/chem1101>

Spend some time getting yourself familiar with this website and have a look at available resources, which include self help quizzes, games and calculators.

One of the most important resources is **ChemCAL**, an interactive tutorial/quiz program which covers most of the first year chemistry topics. Past students have found the program's interactive tutorials very useful. A link to ChemCAL is provided on the menu of all First Year Chemistry webpages. You log on to ChemCAL using your course code ('1101') as username, and *helium* as the password. (Note that none of the marks you receive in the various ChemCAL quizzes are ever recorded or assessed, and multiple attempts are OK!)

**Work through the ChemCAL module "*Atomic and Nuclear Structure*".**

Solutions to the problems below can be accessed from the 'Resources' page on your unit area on the First Year Chemistry website and on eLearning. If you have any problems, remember to ask your tutor for help during your first tutorial in week 1.

1. Classify each of the following as either *element*, *mixture* or *molecular compound*.

liquid mercury		ice	
neon gas		liquid nitrogen	
milk		copper pipe	
blood		air	
gaseous CO <sub>2</sub>		gaseous oxygen	
solid sodium		brass	

2. How many neutrons are there in one atom of  $^{234}_{90}\text{Th}$ ?
3. Which of the following atoms and ions have exactly 10 electrons?  
O<sup>2-</sup>, He, Ar, F<sup>-</sup>, Sr, S<sup>2-</sup>, Cl<sup>-</sup>, O, F, Ne
4. Which *one* of the following groups consists solely of *d*-block (transition) metals?
- (a) carbon, silicon, germanium, lead, mercury  
 (b) arsenic, antimony, bismuth, tungsten, tellurium  
 (c) chromium, manganese, iron, cobalt, nickel  
 (d) aluminium, gallium, indium, thallium, bismuth
5. Which *one* of the following groups contains only elements that form anions?

- (a) hydrogen, lithium, sodium, potassium
  - (b) boron, aluminium, gallium, indium
  - (c) helium, neon, argon, krypton
  - (d) fluorine, chlorine, bromine, iodine
6. What is the molecular mass of  $\text{CH}_3\text{NH}_2$  and how many moles are there in 1 g?
7. What amount (in moles) of copper is involved when 24.9 g of crystalline  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  is consumed in a reaction?
8. Calculate the atomic mass of silicon from the isotope information provided below.

Isotope	Mass of isotope (a.m.u.)	Relative abundance
$^{28}\text{Si}$	27.97693	92.21%
$^{29}\text{Si}$	28.97649	4.70%
$^{30}\text{Si}$	29.97376	3.09%

9. Liquid water has a density of  $0.997 \text{ g mL}^{-1}$ .
- (a) How many moles of water are there in 1.00 L?
  - (b) What is the concentration of liquid water?
  - (c) In a 1.00 M NaCl solution, what is (roughly) the ratio of water molecules:  $\text{Na}^+$  ions :  $\text{Cl}^-$  ions?