

Chemistry 101 - Solutions to Exam 1
Fall 2003
100 points (104 possible)

1. (3 pts) Write the following numbers in scientific notation and be sure to keep the correct number of significant figures:

- (a) 0.0560 5.60×10^{-2}
(b) 0.00004 4×10^{-5}
(c) 22,000,000 2.2×10^7

2. (3 pts) Write the following numbers in conventional notation and be sure to keep the correct number of significant figures:

- (a) 3.21×10^{-3} 0.00321
(b) 9.81×10^2 981
(c) 3.4×10^{-2} 0.034

3. (6 pts) Report the following quantities to the correct number of significant figures:

- (a) $54.3 \times 0.54 \times 1.42 = 42$ for multiplication - keep the same number of significant figures as in the number with the smallest number of significant figures. In this case, 0.54 has 2 sig. figs, so the answer should be rounded off to 42.
(b) $2.731 + 87.01 + 0.331 = 90.07$ for addition - keep the same number of digits after the decimal as in the number with the smallest number of significant figures after the decimal. In this case, 87.01 has 2 sig. figs. after the decimal so the answer should be rounded off to 90.07.

4. (4 pts) Convert:

- (a) 37°C to Kelvin (K) $37 + 273 = 310\text{K}$ (b) 85°F to $^\circ\text{C}$ $\frac{85-32}{1.8} = 29^\circ\text{C}$

5. (8 pts) Complete the following conversions (keep the correct number of significant figures):

- (a) Convert 71 dL into L $71 \text{ dL} \times \frac{1 \text{ L}}{10 \text{ dL}} = 7.1 \text{ L}$
(b) Convert 124 mL into L $124 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.124 \text{ L}$
(c) Convert 1.35 L into mL $1.35 \text{ L} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 1350 \text{ mL}$
(d) Convert 117 lbs into kg $117 \text{ lbs} \times \frac{1 \text{ kg}}{2.20 \text{ lbs}} = 53.2 \text{ kg}$

6. (4 pts) Convert 55.0 miles per hour into meters per minute. (keep the correct number of significant figures)

$$\frac{55.0 \text{ miles}}{\text{hr}} \times \frac{1 \text{ km}}{0.621 \text{ miles}} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ hr}}{60 \text{ min}} = 1480 \text{ m/min}$$

report to 3 s.f. because 55.0 has 3

7. (6 pts) George finds a clear crystal while he is hiking. He takes it back to the lab and finds that it has a mass of 21.6 g. He drops it into a graduated cylinder containing water. The graduated cylinder originally reads 37.2 mL. The water rise to 45.4 mL after dropping in the crystal. The density of diamond is 3.52 g/mL, the density of quartz is 2.64 g/mL. Is the crystal diamond or quartz?

$$\text{volume} = 45.4 \text{ mL} - 37.2 \text{ mL} = 8.2 \text{ mL} \qquad \text{density} = \frac{m}{V} = \frac{21.6 \text{ g}}{8.2 \text{ mL}} = 2.6 \text{ g/mL}$$

The crystal is most likely quartz, not diamond.

8. (6 pts) The density of a particular salt solution is 1.03 g/mL. What is the mass of 11.20 L of the solution? Report this value to the correct number of significant figures.

$$m = \text{density} \times \text{volume} = \frac{1.03 \text{ g}}{\text{mL}} \times \frac{11.20 \text{ L}}{1 \text{ L}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 11500 \text{ g}$$

9. (6 pts) The density of olive oil is 0.79 g/mL. What is the volume of 50.0 g? Report this value to the correct number of significant figures.

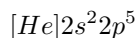
$$V = \frac{\text{mass}}{\text{density}} = \frac{50.0 \text{ g}}{0.79 \text{ g/mL}} = 63 \text{ mL}$$

10. (6 pts, 2 each row) Complete the following table for neutral atoms:

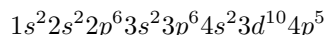
Symbol	Atomic number	Mass number	number of protons	number of neutrons	Number of electrons
${}_{38}^{90}\text{Sr}$	38	90	38	52	38
${}_{1}^{4}\text{H}$	1	4	1	3	1
${}_{17}^{39}\text{Cl}$	17	39	17	22	17

Note that H-4 and Cl-39 are hypothetical isotopes.

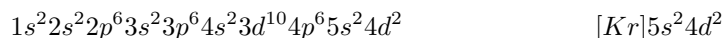
11. (2 pts) The electron configuration of fluorine is $1s^2 2s^2 2p^5$. Write this same electron configuration using the noble gas notation.



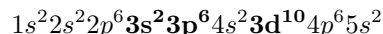
12. (4 pts) Write out the full electron configuration of bromine (Br), without using the noble gas notation.



13. (6 pts) Write out the full electron configuration of zirconium (Zr), with **and** without using the noble gas notation.



14. (4 pts) How many electrons does an atom of strontium (Sr) have in shell 3?



so 18 electrons in shell 3

15. (4 pts) What is the maximum number of electrons that the 3p subshell can hold?

p subshells can hold up to six electrons

16. (4 pts) How many electrons are in the outer most shell of neon (Ne)?

$1s^2 2s^2 2p^6$ Outer shell = $n=2$ shell, so eight electrons.

17. (6 pts) The element gallium has two naturally occurring isotopes, ${}^{69}\text{Ga}$ at 60.1% and ${}^{71}\text{Ga}$ at 39.9%.

- (a) (4 pts) What is the average atomic mass of gallium? Show all your work

$$\text{avg. mass} = (0.601)(69 \text{ amu}) + (0.399)(71 \text{ amu}) = 69.8 \text{ amu} = 70 \text{ amu}$$

- (b) (2 pts) What is the primary difference between the two isotopes that leads to the different masses?
the number of neutrons.

18. (3 pts) Identify each as a metal or non-metal:

- (a) krypton (Kr) *nonmetal*
- (b) nickel (Ni) *metal (transition metal)*
- (c) calcium (Ca) *metal (alkaline earth metal)*

19. (6 pts) Identify the ion likely to be formed by the following elements. Also indicate whether electrons are **gained** or **lost** and how many are gained or lost.

- (a) Ba *forms Ba^{2+} by losing two electrons.*
- (b) N *forms N^{3-} by gaining three electrons.*
- (c) Se *forms Se^{2-} by gaining two electrons.*

20. (6 pts) (a) Predict the formulas of the ionic compounds that would be formed by the combination of each pair of elements. (b) name each compound.

- (a) Ba and Cl *$BaCl_2$ barium chloride*
- (b) Cs and F *CsF cesium fluoride*
- (c) Ca and N *Ca_3N_2 calcium nitride*

21. (2 pts) Draw lewis dot structures for an atom of each of following elements:

- (a) Ca *see below*
- (b) Se
- (c) Ar
- (d) P

22. (5 pts) Draw a lewis dot structure for the molecule HI.

see below

