

# Conceptual Physics Review

## Chapter 17, Periodic Table, 18.2, Significant Figures

### Chapter 17 & Periodic Table of Elements

- Describe atoms and elements.
- Compare the ages of atoms to the ages of the materials they compose.
- Give examples that illustrate the small size of atoms.
- Describe molecules.
- Describe compounds.
- Know the relative masses and charges of the subatomic particles, as well as their locations in the atom.
- Explain the organization of the periodic table referring to the significance of both the period and the group an element is in, as that position relates to the arrangement of electrons in the atom.
- Describe the solid, liquid, gaseous, and plasma states of matter.
- Know what the atomic number of an element tells you about that element.
- Know what the average atomic mass of an element tells you about that element, and explain why it is not a whole number.
- Describe, briefly, how the electrons are arranged around the nucleus of an atom.
- Describe the result if the number of protons in an atom is changed.
- Describe the result if the number of neutrons in an atom is changed.
- Describe the result if the number of electrons in an atom is changed.
- What is an isotope? What is meant by carbon-12 and what is meant by carbon-14? How do these two isotopes of carbon differ from each other and how are they alike?
- What is an ion? How do atoms form ions? Which group of elements never forms ions?

### Chapter 18 (section 18.2)

- Define mass density.
- Explain why density is the same for different amounts of the same material.

### Significant Figures

- Distinguish between precision and accuracy for data.
  - Define precision for an instrument.
  - Describe what is meant by uncertainty in measurement and explain how many digits a measurement should include.
  - Be able to count how many significant figures a particular measurement has.
  - Know and apply the rules for how many sig figs the answer to a multiplication or division problem should have.
  - Know and apply the rules for how many sig figs the answer to an addition or subtraction problem should have.
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## Sample Calculations

1. Fill in the table:

Symbol (Atom or Ion)	Atomic #	Average Atomic Mass	Mass # of most common isotope	# of Protons	# of Neutrons in most common isotope	# of Electrons
Xe						
Se <sup>2-</sup>						
Ca						
Cs <sup>-</sup>						
P						
I <sup>-</sup>						
N <sup>3-</sup>						
Li <sup>+</sup>						
He						
Sr <sup>2+</sup>						

2. How many protons are in a neutral atom of flourine?
3. How many electrons are in a neutral atom of flourine?
4. How many neutrons are in a typical neutral flourine atom?
5. Draw a symbol for the flourine ion that has gained one electron.
6. How many neutrons does a typical neutral atom of rubidium contain?
7. A calcium ion has a charge of +2. What does this mean? Draw the symbol.
8. Carbon-12, Carbon-13 and Carbon-14 are all isotopes of carbon. What are the similarities and differences between these isotopes?
9. What does it mean when a neutral sodium atom loses one electron? Draw a diagram to aid in your explanation. Why does the sodium atom tend to lose one electron?

10. How many electron shells (energy levels) does a neutral calcium atom have? How many electrons are in its outermost shell? How can you answer these two questions using the location of Ca on the periodic table?
11. How many electron shells does a calcium ion (+2 charge) have? How many electrons are in its outermost shell? What element (in its neutral state) has the same electron arrangement as the calcium ion?
12. If the ion formed from magnesium and the ion from fluorine were to form a compound, what ratio would they combine to make the compound electrically neutral? Write the formula for the compound.
13. Label each of the following substances as an element or a compound.
- $\text{N}_2$
  - $\text{Li}_2\text{O}$
  - Mg
14. Label each of the following substances as a molecule or an atom.
- $\text{N}_2$
  - $\text{H}_2\text{O}_2$
  - Ar

***For problems 16-23, refer to Table 18.1 on p. 261 of your textbook as necessary.***

15. Which has a greater density – one kilogram of ice or one kilogram of water (at  $4^\circ\text{C}$ )?
16. Which has a greater mass – one cubic meter of iron or one cubic meter of gold?
17. Which has a greater volume – one kilogram of lead or one kilogram of platinum?
18. Which has a greater density – one kilogram of lead or two kilograms of lead?
19. Which has a greater density – a single uranium atom or Earth?
20. Which has a greater volume – 10 kg of lead or 5 kg of aluminum?

21. What is the mass of  $5.4 \text{ m}^3$  of aluminum?
22. What is the volume of  $6.72 \text{ kg}$  of platinum?
23. What is the weight (in Newtons) of  $1.0$  cubic meters of cork? The density of cork is  $200.0 \text{ kg/m}^3$ .
24. Find the density of a  $5.0\text{-kg}$  solid cylinder that is  $10.0 \text{ cm}$  tall with a radius of  $3.0 \text{ cm}$ .
25. The planet Saturn has a mass of  $5.69 \times 10^{26} \text{ kg}$  and a volume of  $8.01 \times 10^{23} \text{ m}^3$ . What is the density of Saturn?
26. You are handed a  $5.00 \times 10^{-3} \text{ kg}$  coin and told that it is gold. You discover (by using water displacement) that the coin has a volume of  $5.90 \times 10^{-7} \text{ m}^3$ . Is the coin really gold, or simply a good imitation?
27. For each of the following pairs, circle the quantity that is greater.
- |                    |                 |                            |                |
|--------------------|-----------------|----------------------------|----------------|
| a. $1 \text{ nm}$  | $1 \text{ mm}$  | d. $1 \text{ m}$           | $1 \text{ Mm}$ |
| b. $1 \text{ Gm}$  | $1 \text{ pm}$  | e. $1 \text{ g}$           | $1 \text{ cg}$ |
| c. $1 \text{ kHz}$ | $1 \text{ MHz}$ | f. $1 \text{ }\mu\text{m}$ | $1 \text{ km}$ |
28. For each of the following conversions, SHOW your steps, including conversion factors WITH UNITS.
- a.  $470 \text{ nm}$  to  $\text{pm}$
- b.  $4.9 \text{ Gm}$  to  $\text{km}$
- c.  $2.4 \text{ g}$  to  $\text{mg}$

d.  $5.5 \times 10^{14}$  Hz to MHz

e.  $(20.0 \text{ m} \times 5.0 \text{ m} \times 3.0 \text{ m})$  to  $\text{mm}^3$

f. 1.40 g/mL to kg/L

29. How many significant figures does each of the following measurements have?

a. 0.0002020 g

e. 3.42 inches

i. 13225 cm

b. 4.000 m

f. 2.5 seconds

j. 20.01 mm

c. 40.0 cm

g. 0.00101 kg

k. 0.9906 cg

d. 5000 miles

h. 7070 m

l. 0.00760 ml

30. For each problem, calculate the solution and leave your answer with the correct number of significant figures.

a.  $3.4 \text{ cm} \times 5239 \text{ cm} =$

d.  $55.5 \text{ mm} \times 32 \text{ mm} =$

b.  $5.0 \text{ ft} / (1.00 \times 10^2) \text{ minutes} =$

e.  $0.099 \text{ kg} / 0.110 \text{ L} =$

c.  $4001.6 \text{ miles} / 2.5 \text{ hours} =$

f.  $720 \text{ m} \times (3.0 \times 10^1) \text{ m}$

31. For each problem, calculate the solution and leave your answer with the correct number of significant figures.

a.  $4.25 \text{ m} + 2.1 \text{ m} =$

d.  $1.087 \text{ km} - 0.056 \text{ km} =$

b.  $52.4 \text{ ft} - 0.5 \text{ ft} =$

e.  $33.6 \text{ L} + 0.033 \text{ L} =$

c.  $1248.72 \text{ m} + 36 \text{ m} =$

f.  $220.1 \text{ g} + 0.17 \text{ g} =$