

Chemistry Honors 2014

First Semester Exam Review Packet

Sample Problems

1. What are the 5 steps of the scientific method?
 - a. observation
 - b. hypothesis
 - c. experimentation
 - d. data collection
 - e. conclusion
2. What is the difference between a law and a theory?

Law: observation

Theory: a well-tested reason for the observation
3. Define and list the three states of matter? Draw pictures to describe each state of matter.

Gas, liquid, solid.
4. What is the difference between a physical property and a chemical property? Give an example of each.

Physical property: Describes the appearance and the physical states of a specific matter. For example, the melting point of water.

Chemical property: Describes how the specific matter reacts. For example, “flammable,” “halogen.”
5. What constitutes a chemical change? Give examples of chemical changes.

A chemical change happens when the substance changes. For example, iron rusting.
6. What constitutes a physical change? Give examples of physical changes.

A physical change happens when the substance changes shape or form, but not the substance itself. For example, ice melting.
7. If water changes state, is that a physical or chemical change?

It is a physical change

8. If salt is dissolved in water, is that a physical or chemical change?

It is a physical change.

9. What are the different types of mixtures? Define the different mixtures and provide examples of each.

Homogeneous mixture (solution): a mixture whose pure substances cannot be distinguished with raw eyes.

10. What is the difference between an element and a compound?

An element is made with one element, and cannot be broken apart by physical or chemical means.

A compound is two or more elements combined chemically.

11. What is a pure substance? What is the opposite of a pure substance?

A pure substance is a matter composed only of one substance, either an element or a compound. The opposite of a pure substance is mixtures.

12. Can a compound be a pure substance? Why or why not?

Yes. A compound cannot be broken apart by physical means, and therefore a pure substance.

13. Convert 10m to km

$$10 \text{ m} = 0.01 \text{ km}$$

14. Convert 10 kg to mg

$$10 \text{ kg} = 10000000 \text{ mg}$$

15. Convert 42 micrograms to grams

$$42 \mu\text{g} \times \frac{1 \text{ mg}}{1000 \mu\text{g}} \times \frac{1 \text{ g}}{1000 \text{ mg}} = 4.2 \times 10^{-5} \text{ g}$$

16. Convert 15 km³ to m³

$$15 \text{ km}^3 \times \frac{10^3 \text{ m}^3}{1^3 \text{ km}^3} = 1.5 \times 10^4 \text{ m}^3$$

17. What is the most abundant element on earth? In the human body?

The most abundant element on both the earth and in the human body is oxygen.

18. What are the total number of atoms in the following compounds:

- a. KOH – 3
- b. N₂O₃ – 5
- c. CCl₄ – 5
- d. Na₃PO₄ – 8

19. What did the following scientists do:

- a. Ernest Rutherford
Discovery of nucleus of atoms.
- b. J.J. Thomson
Discovery of electrons.
- c. Dalton
Atomic theory.

20. What were the three main points of Dalton's atomic theory?

1. Law of Definite Proportions

All molecules of the same compound have the same proportion of the mass of the constituent elements.

2. Law of Multiple Proportions

Different compounds can be formed from different proportions of the same elements.

3. Law of the Conservation of Mass

In no circumstances is mass gain or lost.

21. Write the **chemical formula** of the following: a compound with 6 atoms of Hydrogen and 2 atoms of Nitrogen.



22. What is the **atomic number** and where would you find it when looking at the periodic table?

The number of protons in an element. It is usually listed on the top left corner of the box of the element. The periodic table is sorted with the atomic numbers.

23. What is the **mass number** and where would you find it when looking at the periodic table?

The mass number of an atom is the total of numbers of protons and neutrons. It is usually listed on the bottom of the box of the element.

24. How many protons, electrons, and neutrons are in the following:

- a. ${}_{92}^{238}\text{U}$ – 92 protons, 92 electrons, 146 neutrons.
- b. ${}_7^{17}\text{N}$ – 7 protons, 7 electrons, 10 neutrons.

25. What is the charge of an ionic compound?

The electric tendency of an ionic compound.

26. How does an ionic compound form?

When an elemental atom gains or loses one or more electrons.

27. Write the proper formula and charge for the following polyatomic ions:

- a. carbonate – CO_3^{2-}
- b. sulfite – SO_3^{2-}
- c. sulfate – SO_4^{2-}
- d. peroxide – O_2^{2-}
- e. phosphate – PO_4^{3-}
- f. hydroxide – OH^-
- g. cyanide – CN^-

28. Write the type of compound and the formula associated with it:

- a. barium hydroxide

Type I ionic compound, $\text{Ba}(\text{OH})_2$.

- b. magnesium fluoride

Type I ionic compound, MgF_2 .

- c. lead (II) oxide

Type II ionic compound, PbO .

- d. carbon monoxide

Type III covalent compound, CO .

- e. dinitrogen tetroxide

Type III covalent compound, N_2O_4 .

f. Fe_2O_3

Type II ionic compound.

g. BCl_5

Type III covalent compound.

h. Li_2SO_4

Type I ionic compound.

29. Put the following numbers in **scientific notation or add/subtract using sig fig rules**:

a. 125667.2

$$1.256672 \times 10^5$$

b. .000457

$$4.57 \times 10^{-4}$$

c. 120,000,001

$$1.20000001 \times 10^8$$

d. .00070

$$0.70 \times 10^{-4}$$

e. -1456.90

$$-1.45690 \times 10^{-3}$$

f. $12.2 + 10.9 + 9$

$$23.1 + 9 = 32$$

g. $16.798 - 12.0$

$$16.798 - 12.0 = 4.8$$

h. $16.0 \times 7 \times 8.2$

$$918.4 \rightarrow 9.00 \times 10^2$$

i. $17/3.88 \times 10^3$

$$4.4 \times 10^{-3}$$

30. How many sig figs are in the following numbers:

a. $134.009 - 6$

b. $.000003 - 1$

c. $0.30000 - 5$

d. $123,000,000. - 9$

e. $20 - 1$

31. If water has a density of 5.00g/mL and a mass of 25 g, determine its volume.

$$25 \text{ g} \div \frac{5.00 \text{ g}}{1 \text{ mL}} = 5.0 \text{ mL}$$

32. What is the density of an object of mass 76.5g and a volume of 1.5 mL?

$$\frac{76.5}{1.5} = 51 \frac{\text{g}}{\text{mL}}$$

33. Convert 244 K to degrees Celsius.

$$244 - 273.15 = -29.15^{\circ}\text{C}$$

34. What is the molar mass of the following:

a. CuBr_2

$$63.55 + 2 \times 79.90 = 223.35$$

b. NaCl

$$22.99 + 35.45 = 58.44$$

c. $\text{Mg}(\text{OH})_2$

$$24.31 + 2 \times (16.00 + 1.01) = 58.33$$

d. $\text{Al}(\text{OH})_3$

$$26.98 + 3 \times (16.00 + 1.01) = 78.01$$

35. What is the mass of 7.5 moles of potassium sulfide?

$$7.5 \text{ mol K}_2\text{S} \times \frac{(2 \times 39.10 + 32.06) \text{ g K}_2\text{S}}{1 \text{ mol K}_2\text{S}} = 830 \text{ g K}_2\text{S}$$

36. What is the mass of 15 moles of chlorine gas?

$$15 \text{ mol Cl}_2 \times \frac{(2 \times 35.45) \text{ g Cl}_2}{1 \text{ mol Cl}_2} = 1.0 \times 10^3 \text{ g Cl}_2$$

37. What is the number of moles of 5.2×10^{23} molecules of NaBr?

$$\frac{5.2 \times 10^{23} \text{ NaBr}}{6.022 \times 10^{23} \text{ mol}^{-1} \text{ NaBr}} = 0.86 \text{ mol NaBr}$$

38. What is the mass percent of oxygen in CO_2 ?

$$\text{C} \rightarrow 12.01 \frac{\text{g}}{\text{mol}}$$

$$\text{O} \rightarrow 2 \times 16.00 = 32.00 \frac{\text{g}}{\text{mol}}$$

$$\text{CO}_2 \rightarrow 12.01 + 32.00 = 44.01 \frac{\text{g}}{\text{mol}}$$

$$\text{O} \rightarrow \frac{32.00}{44.01} = 72.71\%$$

39. Calculate the number of moles in 12 grams of water.

$$12 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{(2 \times 1.01 + 16.00) \text{ g H}_2\text{O}} = 0.67 \text{ mol H}_2\text{O}$$

40. Name the type of reaction:

a. $3 \text{ Mg (s)} + 2 \text{ AlCl}_3 \text{ (aq)} \rightarrow 2 \text{ Al (s)} + 3 \text{ MgCl}_2 \text{ (aq)}$ – single replacement reaction; oxidation–reduction reaction.

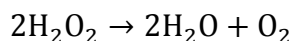
b. $\text{FeS} + \text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2\text{S}$ – double replacement reaction.

c. $\text{CH}_4 + 2 \text{ O}_2 \rightarrow \text{CO}_2 + 2 \text{ H}_2\text{O}$ – combustion reaction.

d. $\text{Ba} + \text{F}_2 \rightarrow \text{BaF}_2$ – oxidation–reduction reaction; synthesis reaction.

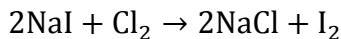
e. $\text{H}_2\text{O} \rightarrow \text{H}_2 + \text{O}_2$ – decomposition reaction.

41. What mass of hydrogen peroxide must decompose to produce 1.77g of water?



$$1.77 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} \times \frac{2 \text{ mol H}_2\text{O}_2}{2 \text{ mol H}_2\text{O}} \times \frac{(18.02 + 16.00) \text{ g H}_2\text{O}_2}{1 \text{ mol H}_2\text{O}_2} = 3.34 \text{ g H}_2\text{O}_2$$

42. What mass of sodium chloride is produced when chlorine reacts with 0.39g of sodium iodide?



$$0.39 \text{ g NaI} \times \frac{1 \text{ mol NaI}}{(22.99 + 126.90) \text{ g NaI}} \times \frac{2 \text{ mol NaCl}}{2 \text{ mol NaI}} \times \frac{(22.99 + 35.45) \text{ g NaCl}}{1 \text{ mol NaCl}} = 0.15 \text{ g NaCl}$$