

## First-Year IB Chemistry

### **Presumed knowledge for IB Chemistry**

#### **Resources:**

On the [www.dorjegurung.com](http://www.dorjegurung.com) site follow either the Chemistry index or Chemistry IB 1<sup>st</sup> year link to Laboratory Related Resources page. Go over the slides on that page. For nomenclature, look over the Nomenclature slide found on the Pre-knowledge page which also appears on both the Chemistry Index page and IB 1<sup>st</sup> Year index page.

#### **Concept**

You must be able to do three things: define the concept, explain the concept, and give an example of the concept.

- scientific method, observation, experiment, law, hypothesis, theory, Occam's razor
- system, matter, substance, compound, element, symbol, mixture, homogeneous, heterogeneous, solution, colloid, suspension, solute, solvent
- filtration, distillation, crystallization
- density, temperature, Celsius (Centigrade), Kelvin,
- number, quantity, unit, base unit, metric system, prefixes, deci, centi, milli, micro, nano, pico, femto, deka, hecto, kilo etc.
- intensive property, extensive property, chemical property, physical property
- states of matter, phases of matter, solid, liquid, gas, plasma, melting, fusion, freezing, boiling, vaporization, evaporation, condensation, sublimation, deposition,
- heating curve, cooling curve, heat of fusion, heat of vaporization, latent heat of fusion, latent heat of vaporization, heat of sublimation, latent heat of sublimation
- variables, independent variable, dependent variable, control variable
- standard state, standard temperature, standard pressure
- periodic table, Mendeleev, nomenclature, metal, nonmetal, metalloid, transition metal, post transition metal, lanthanides, actinides, alkali metal, alkaline metal (earth), halogen, inert gas, noble gas, coinage metal, noble metal, period, group, family, group number, cation, anion
- acid, oxoacid (oxyacid), ionic compound, covalent compound, molecule, monatomic ion, polyatomic ion, binary compound
- Dalton's Atomic Theory, electron, proton, neutron, atomic number, mass number, isotope, stable isotope, radioactive isotope
- potential energy, kinetic energy, force, gravitational force, electrical force, (magnetic force), repulsive force, attractive force, chemical species
- Law of Conservation of Mass, Law of Conservation of Energy, Law of Conservation of Mass and Energy
- accuracy, precision, uncertainty, significant figures, scientific notation, factor-label method (dimensional analysis)

#### **Skills**

You must be able to recognize when the skill is needed, recognize what information is needed to execute the skill, execute the skill, and assess whether the skill has been executed correctly.

Further  
problems

- Given two of density of a homogeneous system, mass of a homogeneous system, and volume of a homogeneous system, compute the third.

- Use conversion factors to convert from one unit to another
- Convert from a prefixed unit to a non-prefixed unit
- Convert from a non-prefixed unit to a prefixed unit
- Convert from a prefixed unit to a different prefixed unit
- Convert a decimal number to a scientific (exponential) notation
- Perform arithmetic operations with numbers written in scientific notation
- Describe the parts of the metric system and their interrelationship
- Describe heating and cooling curves
- Determine the charge on a main group element in a binary compound.
- Given the formula for a binary compound, provide the name.
- Given the formula for a compound containing polyatomic ions, provide the name.
- Given the formula for an acid, provide the name.
- Given the name of a binary compound, provide the formula.
- Given the name of a compound containing a polyatomic ion, provide the formula.
- Given the name of an acid, provide the formula.
- Given the symbol of the element, determine the number of protons and electrons in an atom of that element
- Given a mass number of an isotope of an element, determine the number of protons and neutrons in the nucleus of that isotope
- Given the charge on a monatomic ion, determine the number of electrons in that monatomic ion
- Describe the relationship between forces between charged particles and electrical potential energy and relate that to motion of charged particles from rest and minimization of potential energy
- Describe the conservation of energy with respect to changes in potential and kinetic energy using both electrical and gravitational forces
- Round off answers to numerical problems to the appropriate number of significant figures
- Given a measuring instrument, estimate the uncertainty associated with a single measurement made using it
- Determine error and uncertainty for a set of experimental data

**Problems:** 1.30, 31, 34, 38, 40, 42, 44, 46, 48, 49, 50, 52, 72, 74, 104

**Further problems:**

1. What do the horizontal lines in a heating curve represent?
2. What do positive slopes of some parts of heating curve represent?
3. What is temperature a measure of? (What energy does temperature measure?)
4. What is latent heats a measure of?
5. A sample of water at 100 degree Celsius converts into steam at the same temperature. State the enegy changes it has undergone.
6. What is the relationship between the energy of a substance and its physical state?

7. State the types of motion that particles can have. Are all the motions found in all states of a substance? Identify the motions found in each state of matter.
8. Identify each of the following as matter and/or substance (some may be both) (a) paper, (b) milk, (c) iron, (d) air
9. Look up the term *plasma*. Is it a state of matter? To which state of matter is it most similar? Explain your answer.
10. A charcoal-gray powder, when heated to over 100°C, gives off a colorless gas and leaves a gray powder, which melts at 962°C. Is this change physical or chemical? Evaluate the possibility of the original material being an element, a compound, or a mixture. Explain your answer carefully.
11. Indicate whether each of the following materials is a substance, a heterogeneous mixture, or a solution: (a) bromine, (b) gasoline, (c) magnesium.
12. Which of the following are pure substances and which are mixtures? For each, list all of the different phases present.
  - (a) a sugar solution with sugar crystals at the bottom
  - (b) ink containing a liquid solution with fine particles of carbon
  - (c) a sand containing quartz (silicon(IV) oxide) and calcite (calcium carbonate)
  - (d) liquid water and steam at 100°C.
13. Classify the following properties as intensive or extensive:
  - (a) color, (b) mass, (c) density, (d) temperature, (e) melting point
14. Two scientists analyzed substances containing only copper and oxygen. One scientist found 1.26 g of oxygen was combined with 10.0 g of copper. The other found 10.0 g of copper was combined with 2.51 g of oxygen. A second determination by the same scientist gave 3.78 g of oxygen combined with 15.0 g of copper. Are any of these results consistent with the law of definite proportions? What is a possible explanation for these results?
15. A charcoal-gray powder, when heated to over 100°C, gives off a colorless gas and leaves a gray powder which melts at 962°C. Is this change physical or chemical? Evaluate the possibility of the original material being an element, a compound, or a mixture. Explain your answer carefully.
16. In the atmosphere, ozone (O<sub>3</sub>) decomposes to give oxygen (O<sub>2</sub>). According to the definitions of an element given on pages 13 and 15, is ozone an element? Should it be considered to be an element? Explain your answers. If ozone should be classified as an element, give more appropriate definition that would include ozone.
17. What quantity has a unit of dm<sup>3</sup>?
18. A type of medicine to treat glaucoma (a disease of the eye) costs \$50 for 2.5 cm<sup>3</sup> of an aqueous solution. The solution contains 0.005% of the active ingredient. What is the cost of 1 g of the compound in solution?
19. Name the following compounds: HI, NaBr, Na<sub>2</sub>O, HCl, NaOH, KNO<sub>3</sub>, KI, MgO, CaCO<sub>3</sub>, CaF<sub>2</sub>, AlCl<sub>3</sub>, SO<sub>2</sub>, N<sub>2</sub>O<sub>3</sub>, FeI<sub>2</sub>, FeBr<sub>3</sub>, PbCl<sub>2</sub>, HCl (aq), CuCl<sub>2</sub>, CuCl, MgBr, SF<sub>4</sub>, HBr (aq), PCl<sub>5</sub>, ZnBr<sub>2</sub>, ZnO.
20. Give the formula of the following compounds: sodium hydrogencarbonate, magnesium sulfate, calcium thiosulfate, aluminum nitrate, lithium nitrite, barium phosphate, calcium hydroxide, barium carbonate, copper (I) chloride, copper (II) chloride, silver nitrate, zinc sulfate, nitrogen dioxide, carbon tetrachloride, sulfur hexafluoride.