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| UNIT 3  Physical Properties and Changes |

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| **KEY IDEAS** | | |
| Vocabulary | What does it mean? | Example |
| hypothesis |  |  |
| experiment |  |  |
| observation |  |  |
| data |  |  |
| law |  |  |
| theory |  |  |
| qualitative observation |  |  |
| quantitative observation |  |  |
| chemical property |  |  |
| physical property |  |  |
| hardness |  |  |
| malleability |  |  |
| ductility |  |  |
| luster |  |  |
| diffusion |  |  |
| vapour |  |  |

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| **KEY IDEAS** | | |
| Vocabulary | What does it mean? | Example |
| matter |  |  |
| element |  |  |
| compound |  |  |
| atom |  |  |
| molecule |  |  |
| ion  (anion, cation) |  |  |
| particle |  |  |
| homogeneous substance |  |  |
| heterogeneous substance |  |  |
| pure substance |  |  |
| mixture |  |  |
| mechanical mixture |  |  |
| solution |  |  |
| solvent |  |  |
| solute |  |  |
| hand separation |  |  |
| filtration |  |  |
| evaporation |  |  |

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| **KEY IDEAS** | | |
| Vocabulary | What does it mean? | Example |
| distillation |  |  |
| solvent extraction |  |  |
| immiscible |  |  |
| miscible |  |  |
| chemical change |  |  |
| physical change |  |  |
| melting |  |  |
| freezing |  |  |
| sublimation |  |  |
| deposition |  |  |
| condensation |  |  |
| melting point |  |  |
| freezing point |  |  |
| boiling point |  |  |
| condensation point |  |  |
| kinetic energy |  |  |

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| **3.0 - Classification of Matter** |

**Matter**: anything that has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (takes up space)

* exists in three states (or phases)

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| **Solid**  http://italianmamachef.files.wordpress.com/2011/06/jar.jpg   * particles are packed tightly * low kinetic energy * fixed shape * not compressible | **Liquid**  http://italianmamachef.files.wordpress.com/2011/06/jar.jpg   * particles packed less tightly * more kinetic energy * shape depends on container * not compressible | **Gas**  http://italianmamachef.files.wordpress.com/2011/06/jar.jpg   * particles are very spread out * higher kinetic energy * shape depends on container * compressible |

* matter is made of particles

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| atom | molecule | cation | anion |
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* the appearance of matter can be described as

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| The substance looks the same everywhere  (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_). The substance only contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | The substance doesn’t look the same everywhere  (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_). The substance may contain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |

Activity: Classification of Matter

Matter can be classified depending on the composition.

1. Match each classification with the correct description and example.
2. Arrange the classifications into a flow chart on the next page.

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| Description |  | Classification |  | Example |
| Made of a single type of atom |  | Matter |  | Ca, Na, Pb, Cu, Cr |
| Anything that has mass and volume |  | Pure substance |  | Iced tea, saline drip, rubbing alcohol |
| Elements that are on the left side of the periodic table. They usually are solids, shiny, and can conduct electricity. |  | Mixture |  | Au, Kr, Ag, O |
| Made of a single substance with constant (uniform) composition throughout |  | Element |  | Any substance in the universe |
| Has more than one substance. Some substances can be **physically** separated by hand. |  | Compound |  | Water, vinegar |
| Made of more than one substance with variable composition throughout. |  | Solution |  | C2H2, SiO2, CO2 |
| Has **undissolved** fine particles in a liquid. Under the right conditions, the particles can settle to the bottom. |  | Suspension |  | Fried rice, sediments |
| Has a substance **uniformly dissolved** in a liquid. The substance will not settle. |  | Mechanical mixture |  | Sugar water |
| A particle made of a metal and a non-metal bonded together. |  | Metal |  | Muddy water |
| A particle made of more than one type of atom |  | Non-metal |  | NaCl, SiO2, Li2O, N2 |
| Elements that are on the right side of the periodic table. They generally cannot conduct electricity. |  | Ionic compound |  | NaCl, MgO, Ag2O |
| A particle that is made of a non-metal bonded to other non-metals. |  | Covalent compound |  | O, N, F, Cl, Br, S, He |

**Classification of Matter**

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| **3.1 - Separation Techniques** |

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|  | Diagram | | How Does it Work? | Types of mixtures for this technique? |
| Hand Separation |  |  |  |  |
| Filtration | http://www.sciencequiz.net/jcscience/jcchemistry/practicals/images/filtration.jpg  filter paper  mixture  **residue**  funnel  **filtrate** | |  |  |
| Evaporation | http://www.mikecurtis.org.uk/images/evaporation.gif | |  |  |
| Distillation | http://www.ssc.education.ed.ac.uk/bsl/pictures/distill.jpg | |  |  |
| Solvent Extraction |  | |  |  |
| Recrystallization |  | |  |  |
| Gravity Separation |  | |  |  |
| Chromatography | http://www.chemguide.co.uk/analysis/chromatography/column3.gif | |  |  |

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| **3.2 - Changes in Matter** |

There are two types of changes matter can undergo.

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| **PHYSICAL CHANGE** | **CHEMICAL CHANGE** |
| What is it?   * no \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ formed * is a change in the \_\_\_\_\_\_\_\_\_ of a substance   How it occurs:   * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bonds are broken * the distance between molecules changes   How do you know if a change is physical:   * no new colour * no new smell * change in shape * change in state/phase   Examples:   * mixing things together * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * phase change   Types of phase changes:      http://www.how-to-draw-funny-cartoons.com/image-files/cartoon-water-2.gif | What is it?   * new \_\_\_\_\_\_\_\_\_\_\_\_\_with new \_\_\_\_\_\_\_\_\_\_\_ are formed   How it occurs:   * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bonds (chemical bonds) are broken * atoms are rearranged   How do you know if a change is chemical:   * new smell * new colour * heat/light might be given off * bubbles or gas formed * solid material forms in liquid (precipitate) * difficult to reverse (undo)   Examples   * burning * explosions * stove top cooking   Types of energy changes:   * exothermic: releases heat (KABOOM!!)   http://i633.photobucket.com/albums/uu54/non-white_alliance/nuclear-explosion.jpg   * endothermic: absorbs heat |

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| **3.3 - Heating Curves** |

* **kinetic energy** is energy that molecules possess as a result of **motion**
* average kinetic energy = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* we can plot KE vs. time to obtain a heating curve

Heating Curve of Chemical X

140

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| 120 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 100 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Temp.  (°C)  80 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| -20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Time (min)

A/C/E:

* kinetic energy (temperature) increases
* distance between particles begins to increase

B/D:

* substance is absorbing heat to break \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bonds
* all heat is used to break these intermolecular bonds, so temperature stays \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* when intermolecular bonds are broken, we get a phase change

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ undergo phase changes in fixed temperatures:

**Melting point (m.p)**: temperature at which (solid🡪liquid)

**Freezing point**: temperature at which (liquid🡪solid)

**Boiling point (b.p)**: temperature at which (liquid🡪gas)

**Condensation temperature**: temperature at which a (gas🡪liquid)