**Principles of Science Final Exam Study Guide**

**Unit 1: Heat and Energy**

**D 1. Describe the effects of adding energy to matter in terms of the motion of atoms and molecules, and the resulting phase changes.**

Topics covered:

* Phases changes
* Kinetic and Potential Energy
* Heat/temperature
* Specific Heat
* Temperature scales

Students will be able to…

* Identify the four phases of matter and describe their properties.
* Explain the difference between kinetic and potential energy and give multiple examples of each.
* Describe the effect of adding energy to matter on a micro and macro level.
* Explain how heating and cooling happens and their effects.
* Explain what specific heat is and what role it plays in our world.
* Demonstrate the difference between heat and temperature.

**D 2. Explain how energy is transferred by conduction, convection and radiation.**

Topics covered:

* Conduction
* Convection
* Radiation

Students will be able to…

* Identify which heat transfer process is being used and how in a given situation.
* Explain the process of convection, conduction and radiation.
* Explain the similarities and differences between conduction, convection and radiation.
* Identify the phase of matter each is most efficient in and explain why.
* Create a device to utilize multiple energy transfers to trap energy and analyze the results.

**D 3. Describe energy transformations among heat, light, electricity and motion.**

Topics covered:

* Types of energy
* Energy transformations that take place
* Law of conservation of energy

Students will be able to…

* Identify the different energy forms that are present in any situation.
* Analyze the Law of Conservation of Energy and its effects.

**Unit 2: Electricity and Magnetism**

**D 4. Explain the relationship among voltage, current and resistance in a simple series circuit.**

Topics covered:

* Electricity (static & current)
* Ohm’s Law
* Voltage, current, power & resistance.
* Circuits (Series & Parallel)

Students will be able to…

* Use the Ohm’s Law formula to calculate voltage, current, resistant and power.
* Recognize the effect of adding/removing resistors on the current within a series and parallel circuit.
* Explain how a Van de Graff generator works and is a representation of induction.
* Create a functional series and parallel circuit.

**D 5. Explain how electricity is used to create heat and light in incandescent bulbs and heating elements.**

Topics covered:

* Function of an incandescent light bulb.
* Function of CFLs
* Function of LEDs

Students will be able to…

* Draw and explain the function of an incandescent, CFL and LED light bulb.
* Examine the transformation of energy taking place within an incandescent, CFL and LED light bulb.
* Identify the advantages and draw backs of an incandescent, CFL and LED light bulb.

**D 6. Describe the relationship between current and magnetism.**

Topics covered:

* Magnets
* Electromagnets
* Motors
* Generators

Students will be able to…

* Establish what a magnetic field, domains and ferromagnetic materials are.
* Explain how to “make” and/or “break” a magnet.
* Demonstrate how a magnet works.
* Explain how the Earth is a magnet and give evidence to support this theory.
* Examine the interaction between a magnet and electricity.
* Build an electromagnet and explain its function.
* Identify the three major variables affecting the strength of an electromagnet.
* Give real life examples of an electromagnet and their importance in society.
* Examine the difference between a permanent and an electromagnet.

**Unit 3: Sources of Energy**

**9.3 - Various sources of energy are used by humans and all have advantages and disadvantages.**

**D. 7** Explain how heat is used to generate electricity.

**D.8** Describe the availability, current uses and environmental issues related to the use of fossil and nuclear fuels to produce electricity.

**D.9** Describe the availability, current uses and environmental issues related to the use of hydrogen fuel cells, wind and solar energy to produce electricity.

Topics covered:

-Parts of Power Plant: Generators, turbines, etc

-Energy Sources

-Environmental effects of energy production

Students will be able to…

* Create a diagram of a steam power plant, label all its parts, and **explain how heat is used to generate electricity.**

* Explain how each of the ten energy sources we learned about in class are used to generate electricity. Start by where it comes from and end with the generation of electricity.
* Name one major environmental advantage and disadvantage for each energy source.

(Uranium, Coal, Petroleum, Natural Gas, Propane, Geothermal, Wind, Solar, Hydropower, Biomass)

**Unit 4: Chemistry**

**D 10. Describe the general structure of the atom and explain how the properties of the first 20 elements in the periodic table are related to their atomic structure.**

Topics covered:

* History of the atom and periodic table
* Atomic structure
* Subatomic particles (protons, electrons and neutrons)
* Organization of the periodic table
* Isotopic symbols,

Students will be able to…

* Create a model of the atom.
* Utilize the periodic table to find the number of the electrons, protons and neutrons.
* Calculate atomic number and atomic mass from an isotopic symbol.
* Draw the Bohr-Rutherford model of the first 20 elements of the periodic table.
* Define valence electrons and identify how many an atom has using the periodic table.
* Draw a Lewis Dot Model for each of the first 20 elements of the periodic table.

**D 11. Describe how atoms can combine to form new substances by transferring electrons (ionic bonding) or sharing electrons (covalent bonding).**

Topics covered:

* How/why atoms combine
* Types of bonding:
  + Ionic bonding
  + Covalent bonding

Students will be able to…

* Explain how ionic and covalent bonding happens.
* Draw out the process of ionic and covalent bonds.

**D 12. Explain the chemical composition of acids and bases, and explain the change in pH in neutralization reactions.**

Topics covered:

* Acids and bases
* Salts
* Neutralization reactions

Students will be able to…

* Use various lab techniques to identify acids, bases and salts.
* Examine the properties of acids and bases.
* Draw a pH scale and place solutions properly on it.
* Recognize and conduct a neutralization reaction.

**Unit 5 & 6: Carbon Chemistry & Polymer Technology**

**D 13. Explain how the structure of the Carbon atom affects the type of bonds it forms in organic and inorganic molecules.**

Topics covered:

* Chemical and physical properties of Carbon
* Inorganic vs. organic molecules
* Type of bonds Carbon forms
* Type of structures Carbon forms
* Importance of Carbon

Students will be able to…

* Discuss how and why Carbon is unique when compared to other elements on the periodic table.
* Discuss why Carbon is so important to life.
* Identify and describe inorganic vs. organic compounds.
* Create/draw carbon molecules with the appropriate amount of bonds.
* Create/draw the types of structures Carbon can form.

**D 14. Describes combustion reactions of hydrocarbons and their resulting by-products.**

Topics covered:

* Properties of hydrocarbons
* Naming of hydrocarbons
* Saturated vs. unsaturated hydrocarbons
* Reactants and products of combustion reactions
* Complete and incomplete combustion reactions

Students will be able to…

* Draw hydrocarbons (both saturated and unsaturated).
* Name various hydrocarbons.
* Explain what is required for a combustion reaction to happen and what results from the reaction.
* Examine different combustion reactions and determine if it is complete or incomplete and why.
* Create real life scenarios in which combustion reactions are used.

**D 15. Explain the general formation and structure of Carbon based polymers, including synthetic polymers, such as polyethylene, and biopolymers, such as carbohydrate.**

Topics covered:

* Polymers
* Monomers
* Synthetic vs biopolymers
* Formation of polymers (Polymerization)

Students will be able to…

* Examine different materials to determine if they are monomers or polymers.
* Explain the difference between monomers and polymers (and be able to support with examples.)
* Identify and describe synthetic vs. biopolymers.
* Explain how polymers are formed.
* Create a polymer from monomers (bouncy ball lab).

**D 16. Explain how simple chemical monomers can be combined to create linear, branched and/or cross-linked polymers.**

Topics covered:

* Types of synthetic polymers
* Polymerization
* Vulcanization

Students will be able to…

* Explain how the structure of a polymer affects its chemical and physical properties.
* Describe the process of vulcanization and give an example.
* Describe the process of polymerization and give an example.

**D 17. Explain how the chemical structure of polymers affects their physical properties.**

Topics covered:

* Stress tests

Students will be able to…

* Identify the polymer structure of a plastic based on the results of various stress tests (Plastic Lab).

**D 18. Explain the short- and long-term impacts of landfills and incineration of waste materials on the quality of the environment.**

Topics covered:

* Pros and cons of landfills.
* Pros and cons of incinerators.

Students will be able to…

* Debate the advantages and disadvantages of landfills and incinerators.
* Choose their preference for disposing of garbage and support their opinion.

**Unit 7: Cycles of the Earth**

**D. 19 Explain how chemical and physical processes cause carbon to cycle through the major earth reservoirs.**

Students will be able to:

1. Identify Reservoirs Carbon Resides In
   1. Atmosphere
   2. Oceans
   3. Soil
   4. Earth
2. Identify Carbon Sinks
   1. Forests
   2. Deep Ocean
   3. Fossil Fuels
3. Identify and Describe The Processes by Which Carbon is Exchanged Between Reservoirs
   1. Photosynthesis
   2. Respiration
   3. Death
   4. Decomposition
   5. Feeding
   6. Combustion
4. Explain The Role Humans Play in the Carbon Cycle
5. Identify That Carbon is Present in Finite Amounts on Earth and Simply Moves Between Reservoirs
6. **Explain how solar energy causes water to cycle through the major earth reservoirs.**

Students Will Be Able To:

1. Identify Heat Transfer The Predominantly Heats Earth- Radiation
2. Explain Each Phase of the Water Cycle
   1. Evaporation
   2. Condensation
   3. Transpiration
   4. Precipitation
3. Identify Land Use Pattern Changes as They Affect the Water Cycle
   1. Pavement
   2. Deforestation
4. Explain Possible Role a Warmer Earth May Have on Water Cycle
5. Explain The Role Sea Ice Plays in the Water Cycle
6. Identify Sinks Within the Water Cycle
   1. Cryosphere
   2. Atmosphere
   3. Deep Ocean
7. Identify That Water is Present in Finite Amounts on Earth and Simply Moves Between Reservoirs

**D.21 Explain how internal energy of the Earth causes matter to cycle through the magma and the solid earth.**

Students Will Be Able To:

1. Identify Convection as the Major Fuel Driving the Rock Cycle
2. Identify Major Zones of Earth
   1. Crust
   2. Mantle
   3. Core
3. Identify That Earth’s Crust is Broken Up Into Distinct Plates
4. Identify That Earth’s Plates Have/Do Move
5. Diagram the Rock Cycle
6. Describe Process By Which Rocks Are Formed And Named
   1. Cooling=Igneous
   2. Heating/Compression=Metamorphic
   3. Compaction/Cementation=Sedimentary
7. Identify Ongoing Processes That Can Alter A Rock at Any Time
   1. Heating
   2. Compression
   3. Erosion
8. Explain Subduction Zones As Main Recycler of Rock Material
9. Identify Spreading Zones As Source of New Parent Material
10. Identify Major Causes of Erosion
    1. Chemical
    2. Physical
       1. Wind
       2. Water
       3. Ice
       4. Transform Faults

**Units 8 & 9 Human Impact on the Environment**

1. **Explain how the release of sulfur dioxide (SO2) into the atmosphere can form acid rain, and how acid rain affects water sources, organisms and human-made structures.**

Topics covered:

* Acid precipitation
* Sources of SOx, NOx,,  and CO2
* Effects on the Biosphere
* Effects on man-made structures

Students will be able to…

* Describe the source, pathway, and effects of acid rain.
* Explain the mechanism by which the biosphere is affected by acid rain.
* Explain the mechanism by which the man-made structures are effected by acid rain

**D 23. Explain how the accumulation of carbon dioxide (CO2) in the atmosphere increases Earth’s “greenhouse” effect and may cause climate changes.**

Topics covered:

* Combustion of fossil fuels releases CO2 into the atmosphere.
* Daily human activities that contribute to the release of CO2.
* Cooking, Heating, Electiricty and Driving.

Students will be able to…

* Explain how combustion releases CO2 into the atmosphere.
* Explain the effect of CO2 on outgoing radiation.
* Discuss climate change as it relates to combustion.

**D 24. Explain how the accumulation of mercury, phosphates and nitrates affects the quality of water and the organisms that live in rivers, lakes and oceans.**

Topics covered:

* Fertilizers and agriculture.
* Heavy metals and industry.

Students will be able to…

* Explain biomagnification.
* Explain bioaccumulation.
* Explain the effects of overfarming and overfishing to produce food to feed human populations.

**D 25. Explain how land development, transportation options and consumption of resources may affect the environment.**

Topics Covered

* Effect of agriculture on the environment.
* Effect of heating/cooling, electrical production and transportation on the environment.
* All advances in society have pros and cons.

Students will be able to…

* Identify the environmental impacts of agricultural and energy production
* Comprehend the benefits and drawbacks of technology

**D26. Describe human efforts to reduce the consumption of raw materials and improve air and water quality.**

Topics Covered

* Effect of agriculture on the environment.
* Effect of heating/cooling, electrical production and transportation on the environment.
* All advances in society have pros and cons.

Students will be able to…

* Identify solutions to reduce air pollution and to increase efficiency when processing raw materials
* Generate solutions to environmental problems caused by technologies