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**Physical Science Honors**

**2nd Semester Exam Study Guide**

**SC.912.P.8.7 – Interpret formula representations of molecules and compounds in terms of composition and structure.**

1. Differentiate between an element and a compound (*including chemical formulas*).
2. What causes atoms to form compounds/molecules (*discuss the octet rule*)?
3. Compare ionic bonds to covalent bonds (including the cause and characteristics).
4. Identify the reactants and products in a chemical reaction (*How are they shown in a chemical equation?*).
5. How do the atoms present in the reactants compare to those present in the products? (*How is this shown in a chemical equation? Why is it important?*)
6. How is the law of conservation of mass observed during an actual chemical reaction?

**SC.912.P.8.8 – Characterize types of chemical reactions, for example: redox, acid-base, synthesis, and single and double replacement reactions.**

1. How can you classify chemical reactions as “synthesis”, “decomposition”, or “replacement” reactions?
2. Describe a neutralization reaction (*including how it relates to acids, bases, and salts, as well as how the term, “neutralization” reaction, can be misleading*).

**SC.912.P.8.11 – Relate acidity and basicity to hydronium and hydroxyl ion concentration and pH.**

1. Compare the common properties of acids and bases (*including how the different ions they produce in solution affect pH strips and litmus paper*).

**SC.912.P.10.1 - Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.**

1. List the types of energy and give a definition for each.
2. Describe examples of energy being converted between different forms and/or transferred between objects.
3. How do you calculate different types of mechanical energy? What is the metric unit of energy? Which variables have the greatest impact on an object’s kinetic and potential energy?

**SC.912.P.10.2 - Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.**

1. Differentiate between open, closed, and isolated systems.
2. Describe the changes in energy (all types involved) as a ball drops to the ground and bounces back up. Why doesn’t it bounce back to the original drop height? How does this relate to the law of conservation of energy?
3. Describe the changes in energy (all types) as a pendulum swings back and forth. Why does the pendulum eventually stop swinging? What happened to the original potential energy in the pendulum?
4. Explain why, despite appearances, thermal energy is NOT being *created* in an exothermic chemical reaction (a reaction that gives off heat).

**SC.912.P.10.4 - Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter.**

1. Relate the concepts of “thermal energy”, “temperature”, and “heat”.
2. Describe the 3 different types of heat. Give an example of each.
3. How does heat flow between substances (*which “direction”*) and when does it stop flowing?
4. What does the statement, “*There is no such thing as ‘cold’*,” mean? Explain our perception of “hot” and “cold” (*why your hand would feel “cold” when you touch an ice cube or “hot” when you touch steam*).

**SC.912.P.10.5 - Relate temperature to the average molecular kinetic energy.**

1. Describe how the molecules of a substance react as it changes temperature.

**SC.912.P.10.6 - Create and interpret potential energy diagrams.**

1. Describe the changes in kinetic and potential energy (*including how they would be shown on a graph*):
   * as a ball drops to the ground and bounces back up.
   * as a pendulum swings back and forth.
   * as a roller coaster goes up and down a hill.

**SC.912.P.10.7 – Distinguish between endothermic and exothermic chemical processes.**

1. Distinguish between endothermic and exothermic chemical processes (*describe the role of energy in the reaction*).

**SC.912.P.10.10 - Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).**

1. Rank the four fundamental forces in terms of their strength.
2. Characterize various common forces as types of fundamental forces (ex: friction, normal force).
3. Categorize the following as “contact forces” and “non-contact forces”:
   * gravity, applied force, normal force, friction, magnetic force

**SC.912.P.10.11 - Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.**

1. Compare fission reactions to fusion reactions.
2. Discuss pros and cons of nuclear energy as a power source.

**SC.912.P.10.12 - Differentiate between chemical and nuclear reactions.**

1. How are chemical reactions different from nuclear reactions?

**SC.912.P.10.18 - Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.**

1. Identify types of energy present in the Sun and which of them are transferred from the Sun to the Earth?
2. How are different kinds of radiant energy classified within the electromagnetic spectrum? List the types in order and relate the energy of electromagnetic waves related to their wavelengths.
3. Explain the term “white light” and how it relates to the concepts of “visible light” and “color”.
4. What is reflection? Explain the law of reflection. Give an example where light is reflected.
5. What is refraction? Give an example where light is refracted.
6. Explain how the absorption of certain wavelengths and the reflection of others allow us to see objects in color.
7. Discuss the cause and effect of the refraction of light.

**SC.912.P.10.21 - Describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.**

1. Explain the reason for the Doppler shift in light or sound as the source and/or observer is in motion.
2. What is the result of the Doppler shift if the source and observer are moving toward one another? What if they are moving away from one another?

**SC.912.P.12.1 - Distinguish between scalar and vector quantities and assess which should be used to describe an event.**

1. What is the difference between a scalar and a vector quantity? How does this apply to motion (speed, velocity, acceleration)?

**SC.912.P.12.2 - Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.**

1. Describe how a frame of reference is important to our perception of motion (*discuss the use of reference points*).
2. Compare the concepts of speed and velocity (*including their calculation and metric units*).
3. Describe the concept of acceleration (*including its calculation and metric units*). Identify all of the ways that an object can accelerate.
4. How can you use the line on a d vs. t graph to analyze the motion of an object (*including speed and acceleration*)?

**SC.912.P.12.3 - Interpret and apply Newton's three laws of motion.**

1. Discuss the concept of a “net force”.
2. How does a force diagram describe the forces acting on an object?
3. Compare balanced and unbalanced forces (*How do they relate to the net force? How do they influence motion?*).
4. Explain Newton’s first law of motion. How does “momentum” relate to “inertia”?
5. Explain Newton’s second law of motion. How do you calculate the net force on an object? What are the metric units of Force? How does the acceleration of an object relate to the net force? What role does friction play in the motion of an object?
6. Explain Newton’s third law of motion. How does the 3rd law relate to the concept of a “normal force”? How will a 3rd-law diagram be different from a force diagram?

**SC.912.P.12.4 - Describe how the gravitational force between two objects depends on their masses and the distance between them.**

1. Describe the force of gravity and how it affects all objects.
2. What factors affect the strength of a gravitational force?
3. How do we calculate the force due to gravity on Earth?
4. How do objects accelerate as a result of Earth’s gravity?

**SC.912.P.12.5 - Apply the law of conservation of linear momentum to interactions, such as collisions between objects.**

1. How do you calculate an object’s momentum (*including appropriate metric units*)?
2. Describe how momentum is conserved in a collision between two objects? How is this calculated?

**SC.912.P.12.7 - Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.**

1. Compare light to sound in regards to how they transmit energy?
2. Why do we say that the speed of light in a vacuum is the “universal speed limit”?

**SC.912.P.12.11 - Describe phase transitions in terms of kinetic molecular theory.**

1. Describe how the molecules of a substance react as it changes temperature and/or state (*between solid, liquid, or gas*). How is this shown on a phase change graph (temperature vs. energy)?

**SC.912.P.12.12 – Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.**

1. Describe physical signs that a chemical reaction has occurred.
2. Describe and explain the effect of temperature on the rate of a chemical reaction.
3. Describe and explain the effect of concentration on the rate of a chemical reaction.
4. How do catalysts and inhibitors affect chemical reactions?