Student Generated Chemistry Midterm Study Guide

Note: This is a student-generated study guide for the Chemistry Midterm. This is a great tool to use to practice and quiz yourself before your mid-term.
Keep in mind, as this is student-generated, it may not be all encompassing. This is meant to be additional review on top of the review sheet already provided to you. Please seek your notes or textbook for any clarifications.

Questions & selected answers are provided for:

Lab Safety and Scientific Method: Chapter 2 section 1 p.57

Big Ideas

Scientific Method: Scientific Method is made up of 5 different steps. Those steps are purpose/ problem, hypothesis, materials, procedures, results, and conclusion. First there is purpose which is you've got a problem that you want to have solved. The purpose step in the scientific method is a restatement of what you want accomplished, in question form. Pretty much it is the reason you conduct a lab. The next step is hypothesis the hypothesis step is always written in the form "If , then, because" ."If" is called the independent variable. The independent variable is just whatever you are going to do to solve the problem. "Then" is the dependent variable. The dependent variable is what you think will happen when you do whatever the independent variable is. Next is materials what they are ,is pretty much everything you need to conduct the experiment. After that is procedure. This is what your going to be doing during the experiment. You have to make sure you list everything your going to be doing in this experiment. Next is Results its pretty much like what you did in the experiment and what was going on during it. Last is conclusion that is like analyzing your results like was the hypothesis you wrote correct.

Lab Safety: Lab Safety there are many different rules with lab safety. First and foremost is you should report all accidents no matter how small. Its important they know what is going on. You should never work in the lab if the teacher is not present. Also never fool around and horseplay. You should always use goggles and lab aprons. Before working in the lab you should clean the bench top. Another rule that is pretty serious is never look directly into a test tube or smell a material directly. Food, drink and gum are prohibited. Make sure you always know where the eyewash is and chemical shower and how to use them. There are many rules but just always remember to be safe.

Vocabulary

- Fume Hood
- MSDS Manual
- Fire Extinguisher

- Fire Bucket
- Eye Wash / Safety Shower
- wafting
- MSDS
- Smoke detector
- Fire Blanket
- Phone
- Scientific method
- observation
- problem
- hypothesis
- experiment
- data
- variable
- independent variable
- dependent variable
- controlled conditions/constants
- control
- Accuracy
- Precision

Questions:

1. Why is the Scientific Method important?
2. What should be included in a hypothesis?
3. What are three safety measures that should be taken when working in the lab?
4. What are the steps to creating a successful experiment?
5. Explain how a hypothesis is used in an experiment.
6. Explain the difference between the constant and the control.
7. What are three things you shouldn't do while performing an experiment in the lab?
8. What are 3 things that you should do in the lab to stay safe? What are three things that you should not do?

Application Questions

1.) Two girls with long hair go into the lab to do an experiment. They walk to the lab table and start conducting the experiment immediately. What is wrong with this?

2.) In case of a fire, what should you do?

3.) When scientists make observations, what does that eventually lead to. What must it be tested by?

4.) Two students want to test if different types of water (salt water, colored water, tap water) can affect the growth of a plant. Detail the steps of the scientific method that the students should apply.

Selected Lab Safety & Scientific Method Answers

Matter: Chapter 1 section 1&2 (pages 2-47), Chapter 2 section 1 (pages 48-66)

Big Idea

This section was about composition and the properties of matter and how one would classify/ identify matter. You learn how matter behaves differently and undergoes a certain change depending on its characteristics, and the differences between physical/chemical changes/ properties. Qualitative and quantitative observations help to classify matter. Energy is an important part of this section (energy is required for matter to change/matter releases energy during changes).

Vocab

- Atom:
- bond:
- Chemical Change:
- Chemical Property:
- Chemical Reaction:
- Chemical Symbol:
- Compound:
- Density:
- Element:
- Matter:
- Mixture:
- Molecule:
- Physical Change:
- Physical Property:
- [Pure] Substance-
- Atom
- Bond
- Chemical Change
- Chemical Property
- Chemical Reaction
- Chemical Symbol
- Compound
- Density
- Element
- Matter
- Mixture
- Molecule
- Physical Change
- Physical Property
- (Pure) Substance
- Law of Conservation of Mass (pg.42)
- Exothermic Reaction (pg.42)

- Endothermic Reaction (pg.43)
- Atom-
- Proton-
- Electron-
- Neutron-
- Atomic Number-
- Atomic Mass/Atomic Weight/Mass Number-
- Isotope-
- Average Atomic Mass-
- Democritus-
- Dalton-
- Thompson-
- Rutherford-
- Bohr-
- Bond-
- Ion-

1. A proton has a _____ charge:
a. positive b. negative c. no charge

2. A change in matter that does not involve a change in the identity of a substance
   a. physical property b. physical change c. pure substance

3. An element is
   a. The simplest form of matter that cannot be broken down into simpler substances
   b. The smallest particles of matter that retain their own unique properties
   c. A property of matter that relates the mass and volume of a substance

4. Where is the nucleus located?
   a. outside of the atom b. in the electrons c. in the center of the atom

5. An atom with the same number of protons but a different number of neutrons are called
   a. neutrons b. atomic mass c. isotopes

BIG IDEAS
1) What is Matter?
2) Explain how elements, compounds, and mixtures are related to each other.
3) Think back to the “Striking It Rich” lab. What kind of change was occurring in this lab? (Chemical or Physical) Explain why.
4) When ice melts and becomes liquid water, it has undergone what kind of change? Explain why.
5) Why is the number on the bottom of the square on the Periodic Table always a decimal?

6) What are the three major components of an atom?
7) What determines the identity of an element?
8) What does the nucleus of an atom consist of?
9) What charge does a single proton have?
10) What are the three states of matter?
11) When a solid turns into a liquid, what is it called?
12) What are the three physical states of matter?
13) All chemical changes involve a/an _____.
14) Burning wood is an example of a _____ change.
15) What does the law of conservation of mass state?
16) Rusting is an example of a _____ reaction.
17) Melting point is an example of a _____ property.
18) Boiling is an example of a _____ change.
19) What particles are in a nucleus?
20) What is the negative part of the atom?
21) Why is a stable atom neutral?
22) Which man first proposed the idea of small atomic particles?
a) Dalton b) Aristotle c)Democritus d)Bohr
23) Which scientist theorized that electrons orbit the nucleus?
a) Dalton b) Bohr c)Thomson d)Rutherford
24) Explain the gold foil experiment performed by Rutherford.
25) What is the atomic number of sulfur?

26) Write the symbol and isotope notation for oxygen.

Challenge Questions
1)How can the periodic table be used to determine the number of valence electrons in a given element?
2) How can you figure out the amount of protons, neutrons, and electrons in an atom?
3) Compare and contrast the modern atomic theory with the Bohr model.
4) Explain the relationships between an energy level, sublevel, and orbital.
5)What are the two categories into which matter is classified? How is matter further classified within each category?
6) What are compounds and mixtures? Explain how they are similar and different to each other.

7) Who was responsible for the gold foil experiment? Describe the experimental design and findings. How did the experiment change atomic theory at the time?
8) How are mixtures and compounds similar? How are they different?
9) What is the difference between a physical change and a chemical change? Give examples of each.
10) Is the melting point a physical change or a chemical change?
11) Sugar is a mixture. What elements can it be broken down into?
12) Explain how mixtures and compounds are different.
13) What is the difference between **qualitative** and **quantitative**?
14) Is the rusting of iron a chemical change or a physical change?
15) Define a compound.
16) What is the difference between a homogeneous mixture and a heterogeneous mixture?
17) If a scientist studies a beam of particles, and those particles are attracted to a negatively charged plate, the particles are most likely _____.

a) protons b) electrons c) neutrons d) photons

18) What is a good comparison of the charge of an electron and the charge of a proton?
19) How many electrons does phosphorus have? How many valance electrons?
20) What was the first atomic particle discovered?
21) Draw the lewis dot diagram for the following elements.

1. C 2. O 3. At 4. S

Selected Matter Method Answers

Nuclear Chemistry: Chapter 21 (pages 738-777)

Big Idea

Nuclear energy is used for many things. Fusion produces more energy, yet requires more energy to be produced. Fission has modern applications. It's used as a medicine or treatment, for diseases like cancer, and it's used to power things such as factories. The energy is created in a power plant. There's two different ways to produce the energy: Fission and fusion. Fission is when the nucleus is split. Fission has more waste, but requires less energy. Fusion is when two smaller nuclei are combined to make one big nucleus. There are three different types of radiation. Those are known as Alpha, Beta, and Gamma. An Alpha particle is a positively charged particle consisting of two protons and two neutrons, emitted in radioactive decay or nuclear fission. It's also the nucleus of a helium atom. A Beta particle is a fast moving electron emitted from an atomic substance. A Gamma ray is a high frequency of electromagnetic energy that's emitted as high ionizing energy.

- Alpha-
- Curie-
- non ionizing radiation-

- Radon-
- Gamma-
- Roentgen-
- Beta-
- Half life-
- Fission-
- control rods-
- Fusion-
- Critical mass-
- Nuclear-
- Alpha Particle-
- Beta particle-
- Gamma Ray-
- Half-Life-
- Nuclear Fission-
- Nuclear Fusion-
- Nuclear Reactor-
- Radioactivity-
- Control Rods-
- Critical mass-
- Curie-
- Roentgen-

Knowledge Questions

1. 1. The whole range of electromagnetic waves from radio through visible to gamma and cosmic makes up_____.
   A) rainbow B) decay series C) spectrum D) periodic table
2. 2. The part of the atom that “decays” is known as the:
   A) radioisotope B) electron cloud C) nucleus D) orbit
3. 3. Which type of radiation will most likely penetrate the walls of a house?
   A) alpha B) betaC) gamma D) ultraviolet
4. What is fission?
5. What is fusion?
6. What is the function of control rods in a power plant?
7. What is the common fuel used in a power plant?
8. Where is energy produced in a power plant?
9. What is the leading cause of background radiation, that can be found in basements of some homes.
10. What are the three types of radiation?
11. What type of radiation will penetrate a house wall?
12. Is high energy radiation nonionizing or ionizing?
13. Is a microwave cooking food ionizing or nonionizing radiation?

Skill/Application

1. What is the radioisotope carbon 14 used for?
2. What are the differences between alpha rays, beta rays and gamma rays?
3. The half life of a 100 gram sample of a substance is 10 hours. How much would be left after 30 hours?
4. What did Marie Curie discover?
5. What is the difference between ionizing, and nonionizing radiation?
6. What is the difference between fission and fusion? Make sure you include atomic size, and the possibilities of a reactor in your answer.
7. Explain the belt of stability. What do the different parts of the belt represent?

Selected Nuclear Answers

Electrons: Chapter 2 section 2 and Chapter 7

Big Ideas

The electromagnetic spectrum: Electromagnetic radiation includes radio waves that carry broadcasts to your radio and TV, microwave radiation used to heat food in a microwave oven, radiant heat used to toast bread, and the most familiar form, visible light. All forms of radiant energy are parts of the electromagnetic spectrum. White light is a mixture of all colors of visible light. Whenever white light passes through prism or diffraction grating, it is broken into a range of colors called visible light spectrum. When sunlight passes through raindrops, it is broken into the colors of the rainbow. Different elements emit different colors on the spectrum.

-or-

The Emission Spectrum is the photons electrons emit when they absorb energy and rise in an excited state or fall back to their ground state. Depending on what energy level the electrons are on in the atom, the electrons will emit different colors. If they fall from the third energy level, the electrons emit an orange photon, from the fourth energy level, the electrons emit a green photon, from the fifth energy level, they emit a blue photon and from the sixth energy level, the electron emits a purple photon.

Periodic table: the shape of the modern periodic table is a direct result of the order in which electrons fill energy sublevels and orbitals. The periodic table is divided into blocks that show the sublevels and the orbitals occupied by the electrons of the atoms. Groups 1 to 2 are the S region group 13 to 18 are the P region and groups 3 to 12 is the D region.

Valence electrons: The periodic table reflects each elements electron arrangement the # of valence electrons is equal to the group number for elements in group 1 and 2 and is equal to the second digit of the group # for group 13 through group 18. The number represents the outermost energy level in which valence electrons are found.

Energy levels and sublevels: Sublevels are the divisions within an level-exist within a given energy level. If electrons are distributed over one or more sublevels within an energy level. An energy level is the area where you are most likely to most likely find an electron and larger

energy levels require more energy in order for more electrons and sublevels.
-or-
Energy Levels and Sublevels: Energy levels are made up of sublevels and within sublevels there are orbitals. Energy sublevels are designated as s, p, d, or f. S is spherical shaped, p is peanut or dumbbell, d is a 3d clover and f is funky. S orbitals can hold 2 electrons, p can hold 6 electrons, d 14 electrons, and f can hold 14 electrons.

Orbital Diagrams: You can find how many electrons are in an element by drawing an energy diagram putting a maximum of two electrons in each orbital (box) and by following the rules you have to in order to correctly fill in the diagram.

Vocab

1. p	A. An orbital with a spherical shape
2. orbital	B. An orbital with a dumbbell shape
3. Heisenberg Uncertainty Principle	C. Divisions within each energy level
4. Aufbau Principle	D. The three-dimensional region where there is a high probability of finding an electron in an atom 95% of the time
5. sublevel	E. The principle that states that it is impossible to measure the position and velocity of an electron at the same time
6. s	F. The principle that states that each electron occupies the lowest energy sublevel available

atom
electromagnetic spectrum
energy level
electron cloud
valence electron
lewis dot diagram
catalyst
sublevel
heisenberg uncertainty principle
orbital
electron configuration
orbital
Excited State-
Ground State-
Photon-
Valence Electrons-
Aufbau Principle-
Hund's Rule-
Pauli Exclusion Principle-
Heisenburg Uncertainty Principle-

Orbital-
Sublevel-
Energy Level-
Visible Emission Spectrum-
ROYGBIV-

1. Write the electron configuration for Chromium.
2. What is the total # electrons in an atom that has the following electron configuration.
   [Ar]$4s_1$
3. The last electron found in an element in Group 15 would be in which sublevel?
   1.s 2.p 3.d 4.f
4. What element has the electron configuration $1s_2\ 2s_2 2p_6$
5. Is this a correct or incorrect configuration. Why or why not?
   $1s_2\ 2s_2\ 2p_6\ 3p_3$
6. What is an electron?
7. What are valence electrons?
8. what element has an electron configuration of 1s2 2s22p63s23p64s1.
9. what is the electron configuration of Iridium.
10. compare the relationship between orbital, energy level, and sublevel.
11. what are valence electrons and why are they important.
12. how many valence electrons are in oxygen, and draw the lewis dot diagram.
13. Explain why elements produce discrete lines and not a continuous spectrum like white light, and why no two elements have the same emission spectrum.

Selected Electrons Answers

Selected Answers Lab Safety & Scientific Method

Vocab + Definition

- Smoke detector- An object that detects if there is an unsafe amount of smoke or gas.
- Fume hood- Sucks up gas and puts it outside.
- MSDS manual- A booklet that informs the reader about details about lab material.
- Fire Blanket- The object used to suffocate flames.
- Fire extinguisher- The object used to put out fires.
- eye wash/ safety shower- A place to remove harmful material from your eyes/ body.
- Power/ gas shut off - A place where you turn on or off gas and electricity.
- Fire bucket- A place where you put flammable material.
- Phone- The object used to communicate to others incase of an emergency.
- Scientific Method- A systematic way to perform a lab.
- Observe- To watch and take in what is going on.
- State a Problem- Find out what you need to be testing

- Form a Hypothesis- A statement in an if, then and because format
- Experiment- The Action of performing the problem.
- Scientific method: The Scientific method is a series of multiple steps that are done to solve a problem
- Observation: The act of observing something
- Problem: A clearly stated question confined to a single main idea
- Hypothesis: is a prediction about problem or a possible explanation or solution to the problem
- Experiment: used to test the hypothesis, and relies heavily on keeping good notes on the information/steps used
- Data: information gathered through conducting an experiment
- Variable: a factor in an experiment that can be changed
- Independent variable: the factor in an experiment that is intentionally changed
- Dependent variable: the factor in an experiment that depends on the Independent Variable, and observations are usually made concerning this factor
- Controlled conditions/Constants: are constant through all trials. ideally, the entire experiment would be filled with controlled conditions to ensure that the Independent Variable was responsible for any observed change in the behavior of the Dependent Variable
- Control: is the standard for comparison. it is usually a trail of the experiment that has the Independent Variable removed
- Accuracy: how close to a measured value is to an accepted value, comparing to a standard
- Precision: how close repeated measurements are to each other
- Wafting: The hand motion used when determining a smell, without getting too close
- MSDS: Material safety data sheet.

Questions:

1)What are the steps to creating a successful experiment?

You can create a successful experiment by following the steps of the Scientific method.

2)What are three safety measures that should be taken when working in the lab?

Tie back hair, wear goggles and secure loose clothing,Etc.

3)Explain how a hypothesis is used in an experiment.

The hypothesis is an educated guess, which will be either proven correct or incorrect by the results of the experiment

4) Explain the difference between the constant and the control.

The difference between the constant and the control is that the constant stays the same throughout the entire experiment, while being tested and the control has nothing being done to it at all.

5) What are three things you shouldn't do while performing an experiment in the lab?

Horse around, taste chemicals and eat or drink.

6) What are the steps to the Scientific Method?

1. Observe
2. State a problem

3. Form a hypothesis
4. Experiment
5. Collect data
6. Draw conclusion

7) What are three things that you should not do?

- Horse play
- Drink the chemicals
- Play with fire

8) What are 3 things that you should do in the lab to stay safe?

To Stay Safe:

- Tie your hair up if you have long hair
- Waft with your hand when trying to smell a substance rather than to putting your face up to it and smelling it.
- Always wear safety goggles and an apron when working with chemicals

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Selected Answers Matter

- Atom: Smallest particles of matter that retain their own unique properties.
- bond: A chemical connection between two or more atoms.
- Chemical Change: A change of one or more substances into other substances.
- Chemical Property: Characteristics that can only be observed when there is a change in the composition of the substance.
- Chemical Reaction: Examples are decomposing, exploding, rusting, oxidizing, corroding, tarnishing, fermenting, burning, and rotting.
- Chemical Symbol: A one, two or three letter abbreviation for an element.
- Compound: A chemical combination of two or more different elements joined together in a fixed proportion.
- Density: A property of matter that relates the mass and volume of a substance.
- Element: The simplest form form of matter that cannot be broken down into simpler substances.
- Matter: Anything that takes of space and has mass.
- Mixture: A combination of two or more substances in which the basic identity of each substance is not changed.
- Molecule: A chemical combination of two or more atoms to create the smallest particle of a given compound.
- Physical Change: A change in matter that does not involve a change in the identity of the substance.
- Physical Property: Characteristics of a sample of matter that can be observed or measured without any change in its identity
- [Pure] Substance- Matter with the same fixed composition and properties.
- *Atom*- smallest particles of matter that retain their own unique properties
- *Bond*- a chemical connection between two or more atoms
- *Chemical Change*- a change of one or more substances into other substances
- *Chemical Property*- characteristic that can only be observed when there is a change

- *Chemical Reaction*- examples are decomposing, exploding, rusting, oxidizing, corroding, tarnishing, fermenting, burning and rotting
- *Chemical Symbol*- a one, two or three letter abbreviation for an element
- *Compound*- a chemical combination of two or more different elements joined together in a fixed proportion
- *Density*- a property of matter that relates the mass and volume of a substance
- *Element*- the simplest form of matter that cannot be broken down into simpler substances
- *Matter*- anything that takes up space and has mass
- *Mixture*- a combination of two or more substances in which the basic identity of each substance is not changed
- *Molecule*- a chemical combination of two or more atoms to create the smallest particle of a given compound
- *Physical Change*- a change in matter that does not involve a change in the identity of the substance
- *Physical Property*- characteristics of a sample of matter that can be observed or measured without any change in its identity
- *(Pure) Substance*- matter with the same fixed composition and properties
- *Law of Conservation of Mass (pg.42)*- in a chemical change, matter is neither created nor destroyed (also known as the Law of Conservation of Matter)
- *Exothermic Reaction (pg.42)*- chemical reactions that give off heat energy
- *Endothermic Reaction (pg.43)*- chemical reactions that absorb heat energy
- Atom- the smallest particle of matter
- Proton- positively charged subatomic particle
- Electron-negatively charged subatomic particle that orbits outside and atom
- Neutron- a subatomic particle with no charge
- Atomic Number-tells the number of protons in an atom
- Atomic Mass/Atomic Weight/Mass Number- represents the weight of the number of protons and neutrons in the nucleus
- Isotope- atoms with the same number of protons but different number of neutrons
- Average Atomic Mass- a weighted mass average, this is why many of the elements on the periodic table have decimals as their mass
- Democritus- (400 BC) first to propose that matter is made up of atoms
- Dalton- (1803) scientist who came up with the modern atomic theory
- Thompson-(1897) used a cathode ray to discover the electron, he called this the Plum Pudding Model
- Rutherford- (1911) conducted the gold foil experiment that led to the theory that the atom is a sphere of mostly empty space, and with a positively charged nucleus with electrons around it
- Bohr- (1913) a scientist that predicted that electrons travel in a definite path around the nucleus of the atom

- Bond- the sharing and transferring of electrons
- Ion- a charged atom

1. a
2. b
3. a
4. c
5. c

BIG IDEAS

1) What is Matter?

Matter is anything that takes up space/ has mass. There are also properties of matter. There are chemical and physical properties of matter...

2) Explain how elements, compounds, and mixtures are relative to each other.

An element is is a substance that can be broken down into simpler substances, and a compound is a chemical combo of two or more different elements. Mixtures are two or more substances which have been combined such that each substance retains its own chemical identity. So, compounds are chemical combinations of 2 elements and a mixture is a combination of 2 elements but they do not chemically combine.

3) Think back to the "Striking It Rich" lab. What kind of change was occurring in this lab? (Chemical or Physical) Explain why. Answer:

A physical change occurred because the metals were just mixed together. Both metals kept their chemical properties separate throughout the experiment.

4) When ice melts and becomes water, it has undergone what kind of change? Explain why.

It is undergone a physical change. After ice melts into liquid water, you can refreeze it into solid ice. Freezing and melting are both physical changes.

5) - 10)

No student answers provided.

6) What are the three physical states of matter?

solid, liquid, gas

7) All chemical changes involve a/an _____.

an energy change

8) Burning wood is an example of a _____ change.

chemical

9) What does the law of conservation of mass state?

In a chemical change, matter is neither created nor destroyed.

10) Rusting is an example of a _____ reaction.

chemical

11) Melting point is an example of a _____ property.

physical

Challenge Questions

1)How can the periodic table be used to determine the number of valence electrons in a given element?

- The number of the family that a given element is in determines the number of its valence electrons. Families 13-18 have 3-8 valence electrons with the exception of helium in family 18, which only has 2.

2) How can you figure out the amount of protons, neutrons, and electrons in an atom?

3) How does the present-day model of the atom differ from the Bohr model in terms of electron behavior?

- In the present-day model of the atom, electrons are found in 3D regions rather than specific energy levels as stated in the Bohr model.

4)What are the two categories into which matter is classified? how is matter further classified within each category?

- The two categories into which matter is classified are substances and mixtures. pure substances are elements and compounds.
- There are 2 types of mixtures
- 1)Homogenous
- 2)Heterogenous

5)Where is the nuclease, electron, proton, and neutron located in an atom and what is the type of charge they have?

Answer: The nuclease is located in the center of the atom and is positively charged. The nuclease contains the protons and neutrons.

7) Who was responsible for the gold foil experiment? Describe the experimental design and findings. How did the experiment change atomic theory at the time?

8) How are mixtures and compounds similar? How are they different?

Mixtures and compounds are easily confused because both are a combination of 2 or more substances. they are different in the case that mixtures are like chocolate milk or salt water. a mixture would be 2 things added together, that could, by some physical means such as boiling, be separated. Compounds however, are chemically combined, like sugar with $C_6H_{12}O_6$. These can only be separated chemically, such as using another chemical to break them apart.

9) A physical change is a change of the substance's appearance (ex. ice melting to liquid). A chemical change is a change of the actual substance (ex. photosynthesis).

10) The melting point is a physical property.

11) Sugar can be broken down into carbon, oxygen, and hydrogen

12) Mixtures and compounds are different because a mixture can be broken back up to its original components, but a compound is chemically bonded together, so it can't.

13) Qualitative measurements are observations using the senses, like seeing, hearing, smelling, tasting, and feeling. Quantitative has to do with things like temperature, density, weight, etc.

14) Iron rusting is a chemical change.

15) A chemical combination of two or more different elements joined together in fixed proportions.

16) A homogeneous mixture is a mixture that looks the same throughout the entire process. A heterogeneous mixture is a mixture of two or more substances that are in the form of a solution.

Selected Answers Nuclear Chemistry

- Alpha- this type of decay occurs when there are more than 83 protons present in the nucleus.
- Curie- scientist credited with discovering Radium and polonium.
- non ionizing radiation- Low energy radiation that causes matter to vibrate.
- Radon- source responsible for over ½ of all ionizing background radiation.
- Gamma- type of radiation that has no mass and does not take up space.
- Roentgen- scientist credited with discovering x-rays.
- Beta- This type of decay increases the atomic number by one.
- Half life-the amount of time it takes for ½ of a sample to spontaneously decay.
- Fission- nuclear reaction that is currently used in nuclear power plants to produce energy.
- control rods- used to absorb neutrons and slow down rates of reactions in a nuclear power plant.
- Fusion- nuclear reaction that typically requires more energy than is produced.
- Critical mass- required for nuclear chain reaction to occur.
- Nuclear- Denoting, relating to, or powered by the energy released in nuclear fission or fusion.
- Alpha Particle- A helium nucleus consisting of two protons and two neutrons.
- Beta particle- A high-energy electron with a 1 - charge.
- Gamma Ray- A high-energy form of electromagnetic radiation with no charge and no mass.
- Half-Life- The time it takes for half of a given radioisotope to decay (into a different isotope or element.)
- Nuclear Fission- The process in which an atomic nucleus splits into two or more large fragments.
- Nuclear Fusion- The process in which two or more nuclei combine to form a larger nucleus.
- Nuclear Reactor- The device used to extract energy from a radioactive fuel.
- Radioactivity- The spontaneous emission of radiation by an unstable atomic nucleus.
- Control Rods- Used to absorb neutrons and slow down rates of reactions in a nuclear power plant.
- Critical mass- Required for nuclear chain reaction to occur.
- Curie- Scientist credited with discovering Radium and Polonium
- Roentgen- Scientist credited with discovering x-rays.

Knowledge Questions

1. The whole range of electromagnetic waves from radio through visible to gamma and cosmic makes up_____.
   A) rainbow B) decay series C) spectrum D) periodic table
2. The part of the atom that "decays" is known as the:
   A) radioisotope B) electron cloud C) nucleus D) orbit
3. Which type of radiation will most likely penetrate the walls of a house?
   A) alpha B) beta C) gamma D) ultraviolet
4. What is fission?
   Fission splits the nuclei.
5. What is fusion?
   Fusion joins two smaller nuclei into one big nucleus
6. What is the function of control rods in a power plant?
   The main function of control rods are to absorb neutrons.
7. What is the common fuel used in a power plant?
   The fuel in a nuclear reactor is usually uranium oxide.
8. Where is energy produced in a power plant?
   Energy is produced in the fuel rods
9. What is the leading cause of background radiation, that can be found in basements of some homes.
   Radon
10. What are the three types of radiation?
    Alpha, Beta, and Gamma rays.
11. What type of radiation will penetrate a house wall?
    Gamma Radiation
12. Is high energy radiation nonionizing or ionizing?
    Ionizing
13. Is a microwave cooking food ionizing or nonionizing radiation?
    Nonionizing

Skill/Application

1. What is the radioisotope carbon 14 used for?
   Carbon dating, finding out the age of a material through the use of half lifes and mathematical equations
2. What are the differences between alpha rays, beta rays and gamma rays?
   Alpha particles are large low energy helium atoms released. Beta rays are high speed electrons that are released through nuclear decay and gamma rays are the most dangerous and pure energy. Alpha particles are heaviest, beta particles are lighter than alpha particles and gamma rays are weightless.
3. The half life of a 100 gram sample of a substance is 10 hours. How much would be left after 30 hours?
   0hrs= 100g 10hrs= 50g 20hrs= 25g 30hrs= 12.5g
4. What did Marie Curie discover?

Marie Curie names the property radioactivity and discovered polonium and radium.

5. What is the difference between ionizing, and nonionizing radiation?
   The difference between ionizing and nonionizing radiation is that nonionizing radiation is that nonionizing radiation is radiation that isn't harmful to people. Some things in this category are radio waves, microwaves, and tv. Ionizing radiation consists of x-rays and gamma radiation which can harm people if they're exposed to them too much.
6. What is the difference between fission and fusion? Make sure you include atomic size, and the possibilities of a reactor in your answer.
   The difference between fusion and fission is that fusion uses very small atoms and fission would use an extremely large nucleus for producing energy. Fusion would use hydrogen and helium atoms and would be more productive, but the temperature required would melt any material used to contain it. Fission uses uranium or plutonium for energy by breaking them apart to create heat.
7. Explain the belt of stability. What do the different parts of the belt represent?
   The line through the middle of the graph is the representation of a one to one ration of protons to neutrons. The Belt itself is the representation of the stable elements in the periodic table. Once the proton count goes past 83 however, the belt doesn't have any huge atoms because they're unstable and subject to alpha decay to become smaller and more stable nuclei. Over the belt is how far the atoms diverge from the one to one ratio. These atoms would be subject to beta decay to get the atoms back down towards the one to one ratio of protons to neutrons. All of the parts of the belt of stability are subject to gamma radiation because they all change the atom and gamma radiation is always released when a partical (alpha or beta) is emitted from the atom.

Selected Answers Electrons

Big Ideas

The electromagnetic spectrum: Electromagnetic radiation includes radio waves that carry broadcasts to your radio and TV, microwave radiation used to heat food in a microwave oven, radiant heat used to toast bread, and the most familiar form, visible light. All forms of radiant energy are parts of the electromagnetic spectrum. White light is a mixture of all colors of visible light. Whenever white light passes through prism or diffraction grating, it is broken into a range of colors called visible light spectrum. When sunlight passes through raindrops, it is broken into the colors of the rainbow. Different elements emit different colors on the spectrum.

Energy Levels and Sublevels: Energy levels are made up of sublevels and within sublevels there are orbitals. Energy sublevels are designated as s, p, d, or f. S is spherical shaped, p is peanut or dumbbell, d is a 3d clover and f is funky. S orbitals can hold 2 electrons, p can hold 6 electrons, d 14 electrons, and f can hold 14 electrons.

Vocab

1. B

2. D
3. E
4. F
5. C
6. A

atom : smallest particle of given a type of matter
electromagnetic spectrum : The range of wavelengths or frequencies over which electromagnetic radiation extends.
energy level
electron cloud
valence electron
lewis dot diagram
catalyst : substance that speeds up the rate of a reaction
sublevel
hiesenberg uncertainty principle
orbital
electron configuration
orbital : space in which there is a high probability of finding an electron

Excited State- The energy level where an electron jumps to when it gains energy
Ground State- The energy level where an electron is at when it has not gained any energy
Photon- A light particle emitted when an electron drops back down to the ground state from the excited state
Valence Electrons- Electrons in the outermost energy level
Aufbau Principle- Electrons enter orbitals of lowest energy first
Hund's Rule- When electrons occupy orbitals of equal energy, one electron enters each orbital until all the orbitals contain one electron
Pauli Exclusion Principle- An atomic orbital contains a maximum of two electrons
Heisenburg Uncertainty Principle- It is impossible to tell where an electron is and where it is going at any time
Orbital- An area around the nucleus where there is a 95% chance an electron will exist
Sublevel- Tells you what shape the Energy level is
Energy Level- Tells how far away the orbital is from the nucleus
Visible Emission Spectrum-This is the only part of the emission spectrum which is visible to the human eye
ROYGBIV- Red, Orange, Yellow, Green, Blue, Indigo, Violet; these are the colors of the visible emission spectrum

Questions

1. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3s^6\ 4s^2\ 3d^4$
2. 19
3. p
4. neon
5. incorrect
6. What is an electron?

- An electron is a subatomic particle that carries a negative electric charge.

7. What are valence electrons?

-an electron associated with an atom in other words the electrons in the last shell or energy level of an atom.