

Summary & Practice Sheets

Grade 7

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Scientific Explanations

Motion, Forces, and Newton's Laws

Foundations of Chemistry

Understanding the Atom

The Periodic Table

The Scientific Method



1

Make Observations
(use your senses to gather information)



2

Ask a Question



3

Formulate a Hypothesis
(explanation that can be tested)



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4

Test a Hypothesis

(design an experiment, research, or more observations)



5

Collect Data



6

Draw a Conclusion

(a written summary that states whether the hypothesis is correct or not)



Measurement and Scientific Tools

Scientists across the world use a measurement system called the International System of Units (SI).

Many different tools can be used to collect both quantitative and qualitative data.

graduated cylinders



scale



ruler



thermometer



microscope



UNITS:

Length: meter (m)

Mass: kilogram (kg)

Time: second (s)

Temperature: Kelvin (K)

Accuracy is how close a measurement is to the true value.

Precision is the degree to how close measurements are to other measurements taken the same way.

Data should be both accurate and precise!



high accuracy
low precision



low accuracy
high precision



low accuracy
low precision



high accuracy
high precision

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MOTION!

An object is in motion when it is changing its position based on a reference point.

Scalar

physical quantity that has only magnitude

example: length, distance, temperature

Vector

physical quantity that has magnitude and direction

example: weight, displacement, force

Speed is how fast an object is traveling.

Velocity is speed in a given direction.



$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

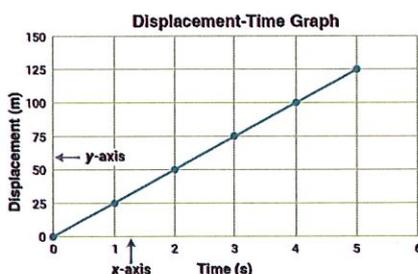
$$s = \frac{d}{t}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{change in time}}$$

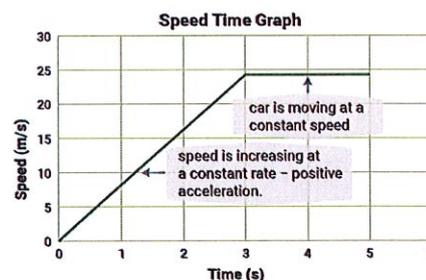
$$a = \frac{V_f - V_i}{t_f - t_i}$$

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Representing motion using graphs



A displacement-time graph shows the relationship between the displacement traveled by an object and time.



The speed-time graph below shows the relationship between speed and time.

Forces push or pull

Contact forces
forces between objects
that are touching

Non-contact forces
forces between objects
that are not touching



applied force



frictional force



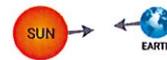
tension force



magnetic force

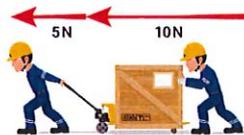


electrical force



gravitational force

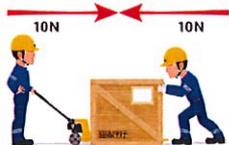
If two forces act on an object in the same direction, the net force is the sum of the two forces.



$$\text{Net force} = 5 \text{ N} + 10 \text{ N} = 15 \text{ N}$$



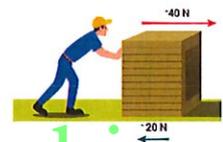
When the net force on an object is 0 N, the forces are called balanced forces.



$$\text{Net force} = 10 \text{ N} + -10 \text{ N} = 0 \text{ N}$$

If two forces act on an object in opposite directions, the net force is the difference between the two forces.

When the net force on an object is not 0 N, the forces are called unbalanced forces.



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Newton's First Law of Motion:
the motion of an object remains constant unless acted on by an outside force.



Newton's Second Law of Motion:
the force experienced by an object is proportional to its mass times the acceleration it experiences.
($F = ma$)



Newton's Third Law of Motion:
for every action force there is an equal but opposite reaction force

Revision Sheet

Chapter 2- Motion, Forces, and Newton's Laws

Part A- True/False

Indicate whether the statement is true or false.

- _____ 1. To calculate speed, multiply the distance by the time.
- _____ 2. The average speed of a moving object is equal to the total distance traveled plus the total amount of time taken to travel it.
- _____ 3. To calculate average speed, use only the total time and the total distance.
- _____ 4. To find an object's velocity, you must know the speed and direction of the moving object.
- _____ 5. Weight is the upward force of Earth's gravity on all objects.
- _____ 6. There is only one type of force.
- _____ 7. The metric unit which measures force is the Newton.
- _____ 8. Net force is one force acting on an object.

Part B- Multiple Choice

Identify the choice that best completes the statement or answers the question.

- _____ 9. Runners competing in a race speed up and change direction as they run around a track. The runners are _____.
 - a. increasing electrical energy
 - b. increasing potential energy
 - c. accelerating
 - d. decelerating
- _____ 10. Newton's third law of motion states that for every action there is an equal and opposite _____.
 - a. acceleration
 - b. mass
 - c. force
 - d. reaction
- _____ 11. A change in an object's position is called _____.
 - a. motion
 - b. velocity
 - c. distance
 - d. acceleration
- _____ 12. An object at rest tends to stay at rest, and an object in motion tends to stay in motion. Which one of Newton's laws of motion does this statement represent?
 - a. fourth
 - b. third
 - c. second
 - d. first

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- _____ 23. Which unit measures force?
- a. watt
b. kilometer
c. gram
d. Newton
- _____ 24. When one object exerts a force on another object, the pair of forces that act are called _____.
- a. action-reaction forces
b. balanced-unbalanced forces
c. friction-drag forces
d. positive-negative forces

Part C- Matching

Match each term with its correct description

- | | |
|-----------------|----------------------------------|
| a. acceleration | f. Newton's first law of motion |
| b. distance | g. Newton's second law of motion |
| c. force | h. speed |
| d. friction | i. velocity |
| e. motion | |
- _____ 25. A change in the velocity of an object over time.
- _____ 26. A push or pull exerted by one object on another, possibly causing a change in motion.
- _____ 27. The length between two places.
- _____ 28. How fast an object's position changes over time
- _____ 29. A description of a moving object's speed and direction.
- _____ 30. A force that opposes the motion of an object in contact with a surface.
- _____ 31. A change in an object's position compared to fixed objects around it.
- _____ 32. An object at rest tends to stay at rest, and an object in motion tends to stay in motion.
- _____ 33. An object's acceleration depends on the object's mass and the amount of net force applied to it.

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Part D- Short Answer

Write the correct answer for each of the following questions.

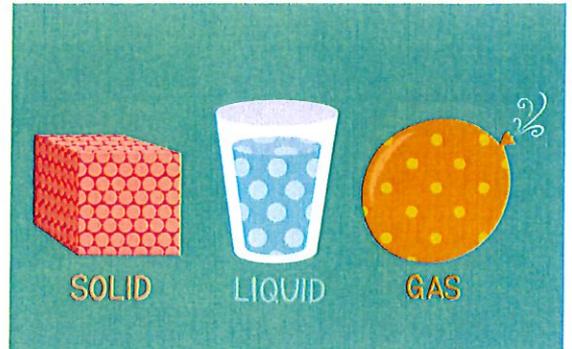
34. Car A traveled 30 miles in one half hour. Car B traveled 15 miles in one quarter of an hour. Which car traveled faster?
35. What is the difference between balanced forces and unbalanced forces?
36. The law of inertia is another name for _____.

Mass MATTERS!

You have learned matter is anything that takes up space and has a mass.

Matter can be SOLID, LIQUID, or GAS.

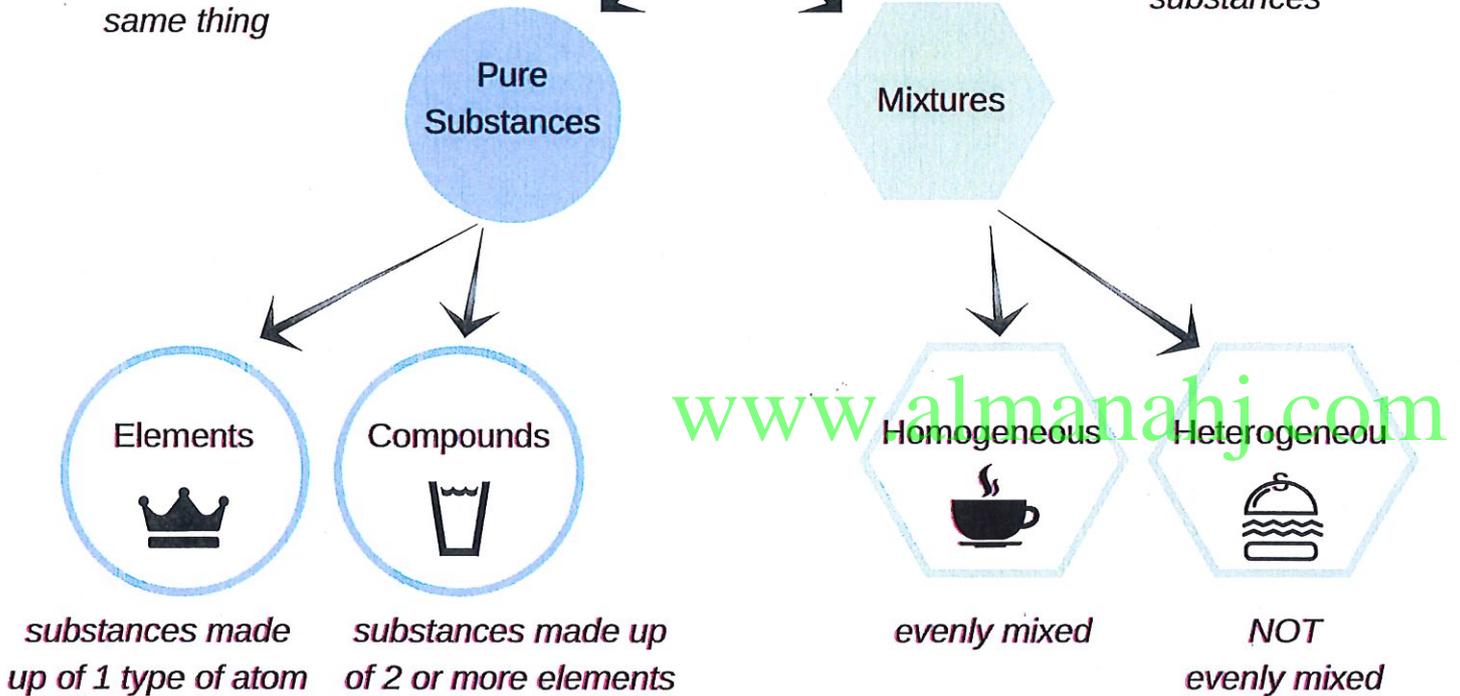
Energy does not have mass and is NOT matter.



Matter

substances that are always made up of the same thing

2 or more pure substances



Examples

1

ELEMENTS

gold, helium, hydrogen, oxygen

2 COMPOUNDS

water (H₂O), carbon dioxide (CO₂)

3

HOMOGENEOUS

salt water, air, lemonade

4

HETEROGENEOUS

salad, sand & water, burger

Homogeneous vs. Heterogeneous



Homogeneous

- Two or more substances are equally mixed.
- Not all the substances are seen
- They are also called solutions.
- Solution is made of a solute (sugar) and a solvent (water).
- Examples: tea, salt water, orange juice.

VS

Heterogeneous

- Two or more substances are not equally mixed.
- All the substances are seen.
- They can be in solids, liquids, gases. Or two or more different states together.
- Examples: Nuts, salad, air, sparkling water.

substances physically mix

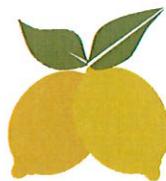


Parts of a Solution (Homogeneous)

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+



+

Sugar
52 mL

=



Water
250 mL

Lemon Juice
45 mL

Lemonade

Which ingredient is the most in the lemonade? **WATER**

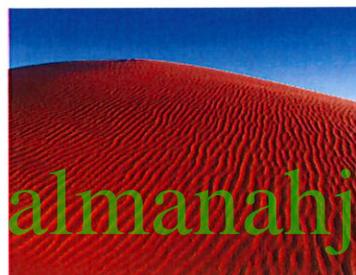
Water is the **SOLVENT**.

Lemon juice and sugar are the **SOLUTES**.

SOLVENT + SOLUTE = SOLUTION

PRACTICE-MATTER

Classify the following pictures as a pure substance, homogeneous mixture or heterogeneous mixture.



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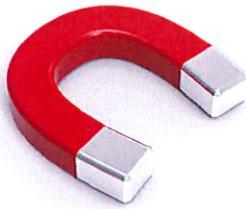
Separating MIXTURES!



You can use different ways to separate mixtures

Magnetism

Separate metals from non-metals using a magnet.
example: paper clips and rubber bands



Picking Apart

Big substances can be picked by hand.
example: crayons and pens



Filtration

Separate particles that don't dissolve in liquids.

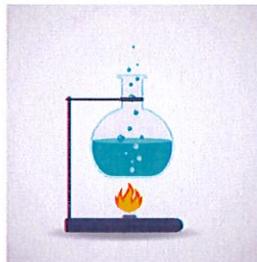


examples:
rocks and water
coffee and water

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Evaporation

Separate solids that dissolve in a liquid.
example: water and sugar



Distillation

Separate solvent from a solution by heating and then cooling.
example: water from another liquid



Physical

VS

Chemical

PHYSICAL PROPERTIES

Matter you can see without changing the identity of the substances that make it up.

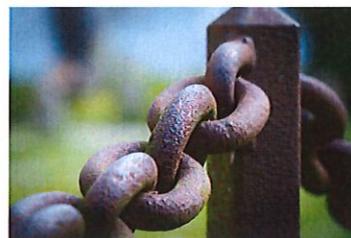


- Changes shape
- Silver in color
- Density: 7.87

- Boiling point: 3,000• C
- Melting point: 1,536• C

CHEMICAL PROPERTIES

A substance can or cannot combine with or change into one or more new substances.



- Iron can rust
- Reacts with acid

PHYSICAL CHANGE

A change in the size, shape, form or matter that does not change the matters identity.



CAN reverse!



EXAMPLES

- melting
- boiling
- mixing
- dissolving

- changing shape
- changing state

CHEMICAL CHANGE

A change in which something new is made with different properties.



CANNOT reverse!



EXAMPLES

- burning
- rusting
- rotten food
- digestion

SIGNS

- release a gas
- color change
- solid forms
- heat is released

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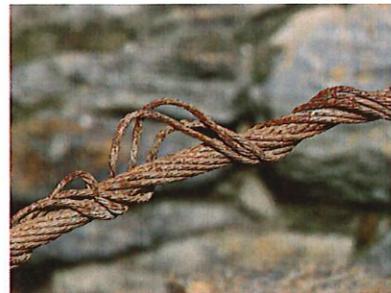
PRACTICE - MATTER

- 1** Aisha left her bicycle in the garden for a few weeks. The bicycles' color changed to an orange color. What is the type of change that happened? How did you know?

- 2** Determine whether each picture is a physical or chemical change.

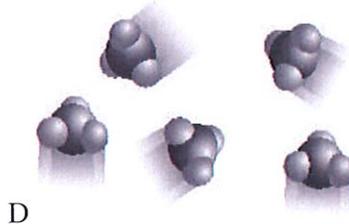
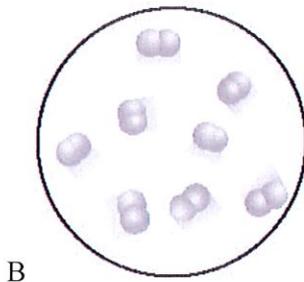
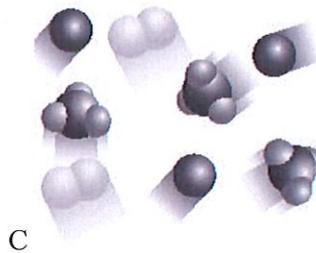
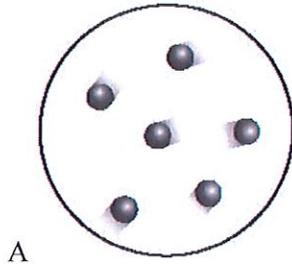


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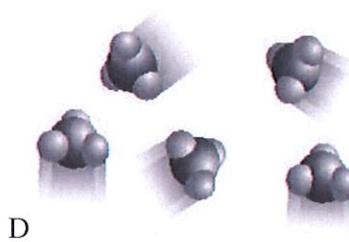
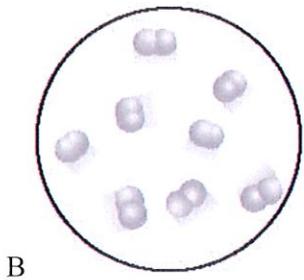
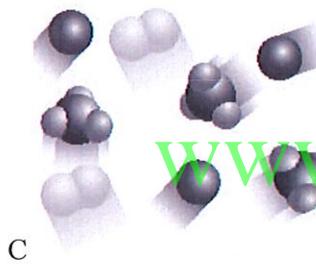
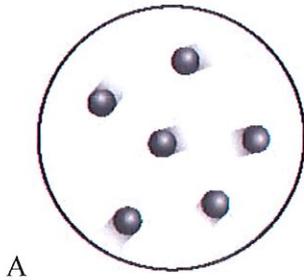
- ___ 17. Which of the following is a pure substance?
- | | |
|--------------|------------|
| a. soda | c. granite |
| b. trail mix | d. gold |

- ___ 18. Which diagram shows a compound?



- | | |
|------|------|
| a. A | c. C |
| b. B | d. D |

- ___ 19. Which diagram shows individual atoms?



- | | |
|------|------|
| a. A | c. C |
| b. B | d. D |

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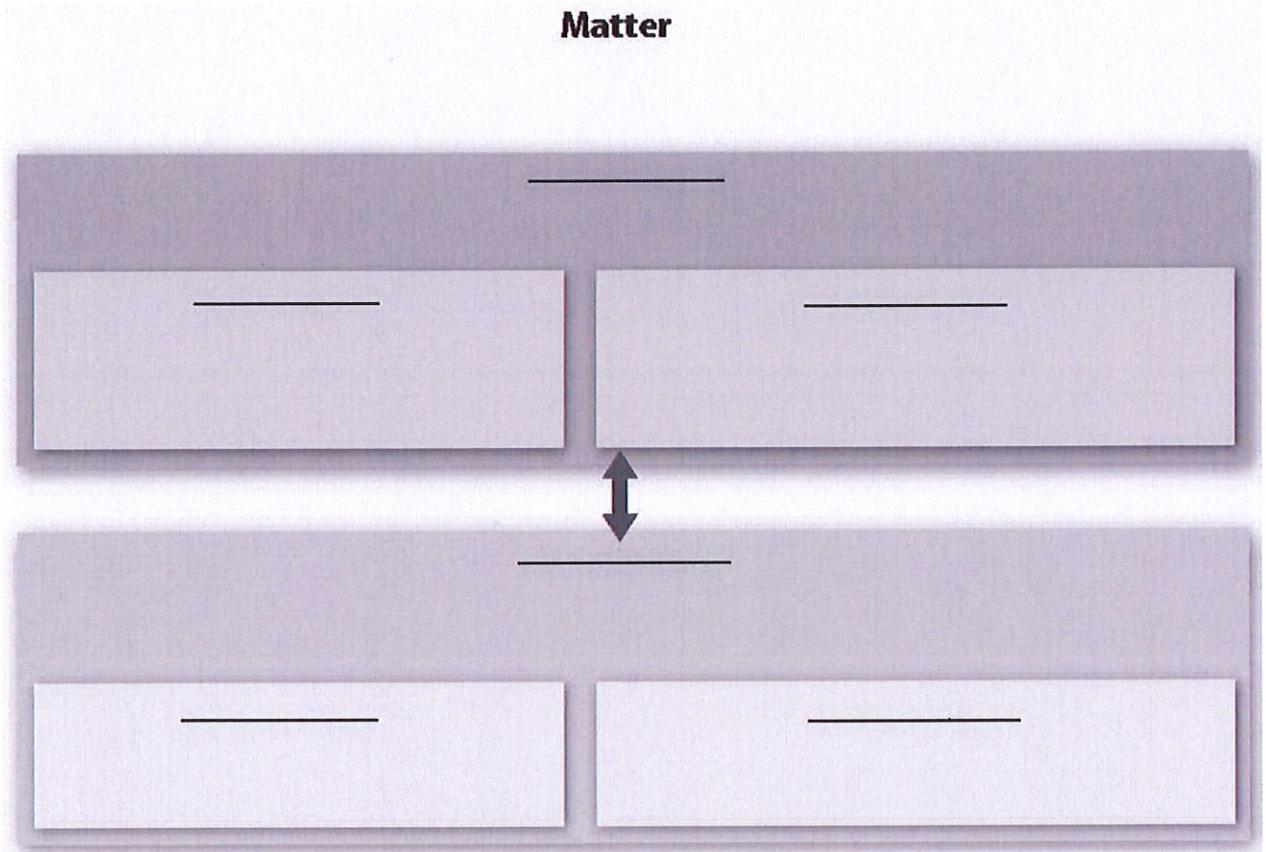
- _____ 20. The following are examples of physical properties EXCEPT _____.
a. density
b. shape
c. color
d. ability to react with oxygen
- _____ 21. A characteristic of matter that allows it to change to something new is a _____.
a. physical property
b. physical change
c. chemical property
d. chemical change
- _____ 22. The following are examples of chemical properties EXCEPT _____.
a. the ability to burn
b. the ability to be crushed
c. the ability to react with oxygen
d. toxicity
- _____ 23. All of the following are examples of physical changes EXCEPT _____.
a. melting
b. evaporating
c. burning
d. solidifying
- _____ 24. Which of the following is an example of a chemical change?
a. painting a house
b. freezing water
c. bending steel
d. baking soda in water
- _____ 25. Density depends on _____.
a. weight
b. mass
c. mass and volume
d. volume
- _____ 26. Titanium reacts less with oxygen than most metals do. This is a _____.
a. chemical property
b. physical change
c. chemical change
d. physical property
- _____ 27. The mass of the products of a chemical reaction _____ the mass of the reactants.
a. is greater than
b. is less than
c. is the same as
d. may be more or less than
- _____ 28. Which formula listed below correctly finds density?
a. $D = m/V$
b. $D = V/m$
c. $D = g/V^3$
d. $D = g^3/V$
- _____ 29. The rusting of iron is not a physical property because _____.
a. it cannot be observed
b. the identity of iron remains unchanged
c. a new substance with new properties formed
d. iron is magnetic
- _____ 30. Which explains the law of conservation of mass?
a. Mass cannot be created or destroyed in a reaction.
b. The total mass before a chemical reaction is the same as the total mass after the reaction.
c. Every reaction creates an equal amount of mass related to the amount of energy required for the reaction.
d. The total amount of mass is equal to the volume of both chemicals in the reaction.
- _____ 31. Photosynthesis is a chemical reaction which uses _____ as a form of energy.
a. heat
b. light
c. iron
d. gravity

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Part E- Essay

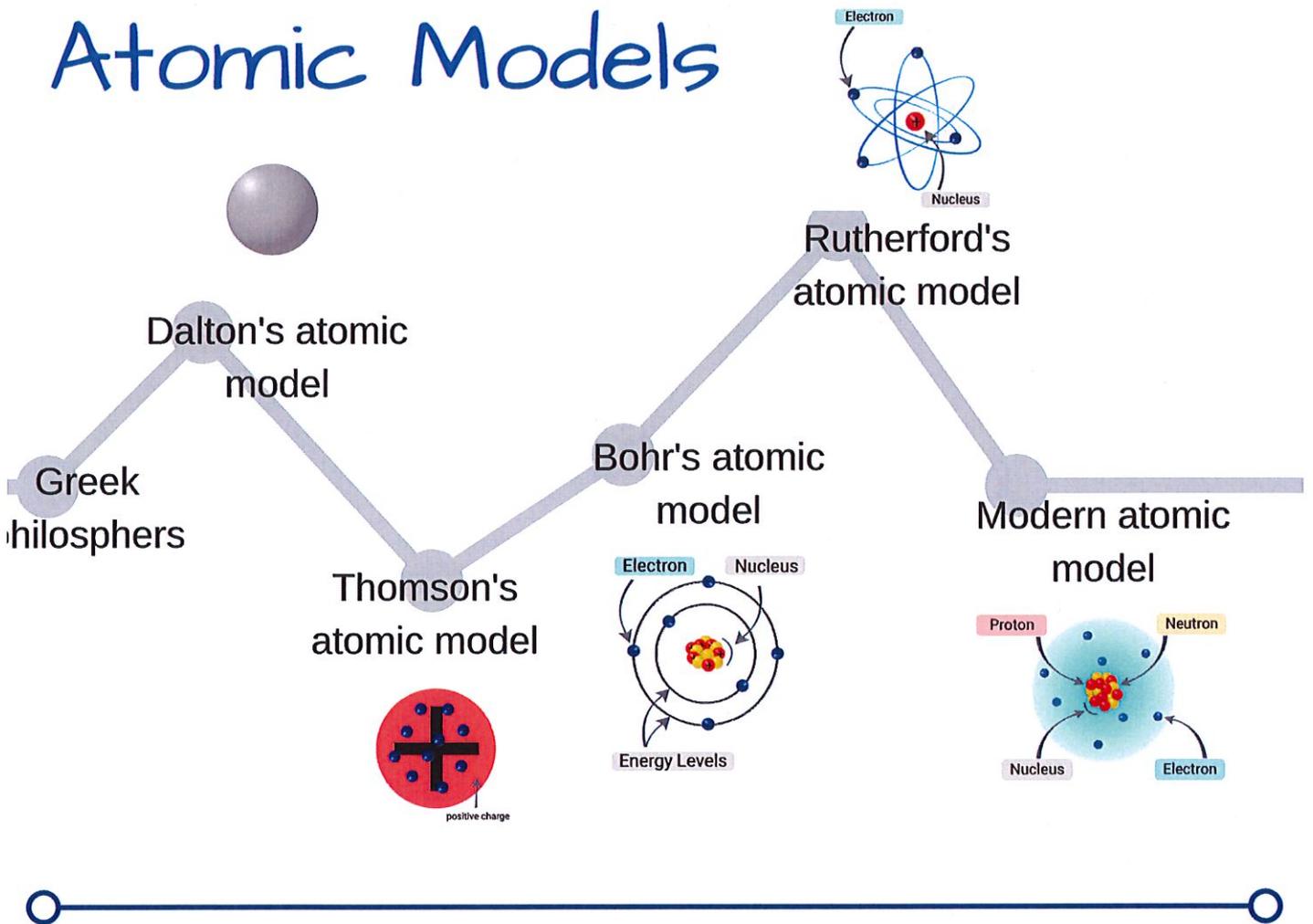
Answer the following questions

40. Fill in the chart to show the classification of matter. Describe how matter is classified.



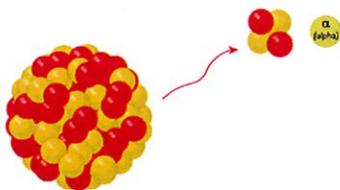
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Atomic Models



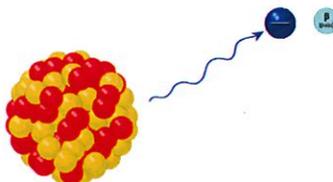
Types of Decay

Alpha Decay



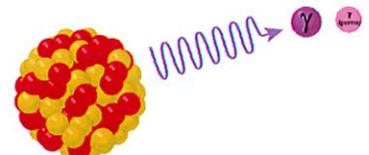
the nucleus loses 2 protons and 2 neutrons, so the atom becomes a new element

Beta Decay



the nucleus gains a proton, so the atom becomes a new element

Gamma Decay



no change in proton number occurs, so the atom does not become a new element

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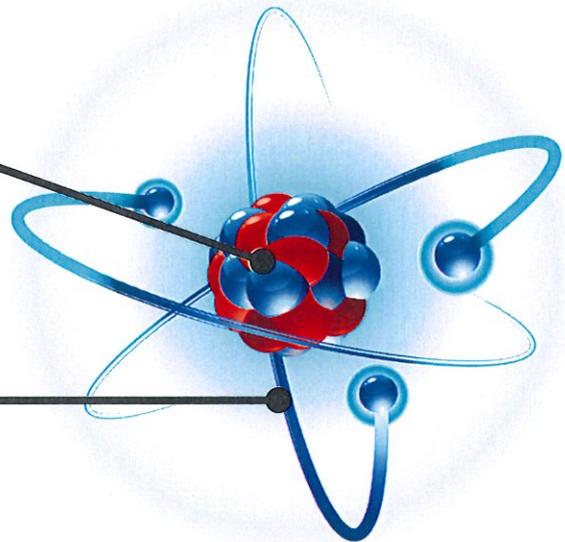
ALL about **ATOMS!**

NUCLEUS

- the center of every atom
- has protons (+ charge)
- has neutrons (no charge)

ELECTRON CLOUD

- around the nucleus
- has electrons (- charge)
- mostly empty space



silver

47

Ag

107.87

ELEMENT NAME

ATOMIC NUMBER
(number of protons)

SYMBOL

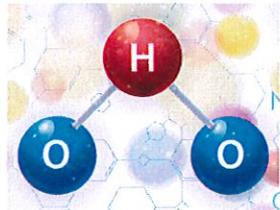
ATOMIC MASS

ELEMENTS

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When 2 or more elements **CHEMICALLY BOND** together.

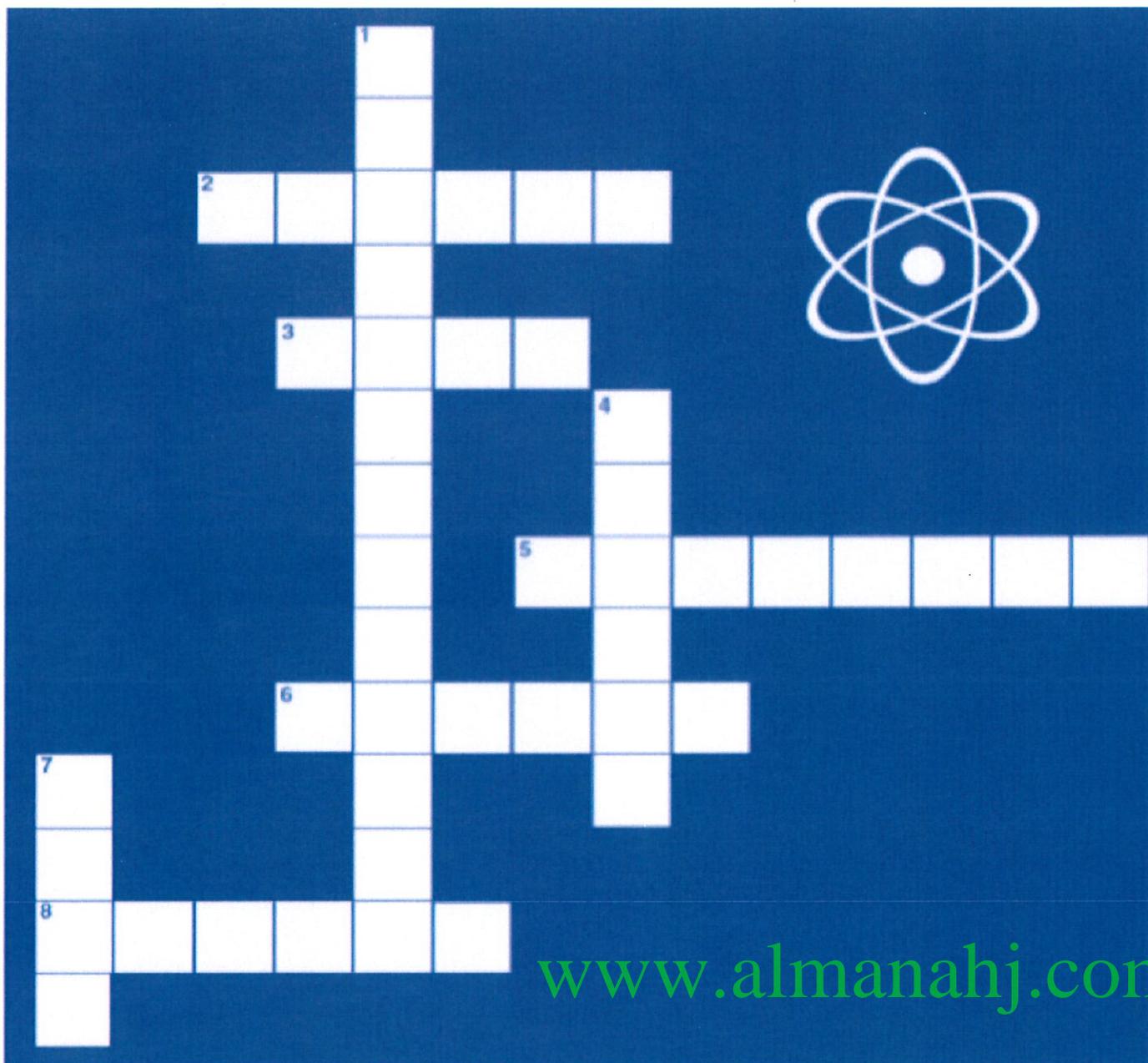
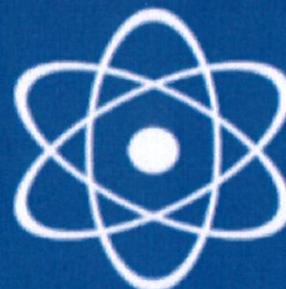
COMPOUNDS

Name	Chemical Formula	Molecular Structure
Water	H ₂ O	

Water contains
1 hydrogen and 2 oxygens.

How many carbon atoms are in one molecule of
C₆H₁₂O₆?

PRACTICE-ATOMS



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Across
→

Down
↓

2. Has a chemical symbol (C) and an atomic number = 6.

3. A shiny metal used for jewellery.

5. There are 115 of them arranged in a chart.

6. has mass and takes up space.

8. A gas in the air

1. A chart where all elements are arranged.

2. The second place medals are made of this shiny metal.

7. Tiny particles that make up all elements.

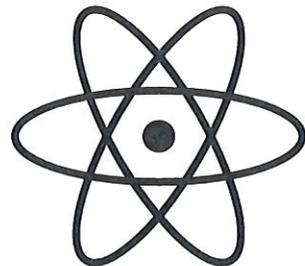
PRACTICE-ATOMS

True or False?

1. Scientists can see atoms with microscopes. _____
2. Neutrons are positively (+) charged. _____
3. The center of the atom is called the brain. _____
4. Protons are found in the electron cloud. _____

Fill in the Blanks!

This is a picture of an _____. The center is called the _____ and the outside is called the _____.



Lets Match!

- Name
- Symbol
- Atomic Number
- Atomic Mass



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Pick the correct answer.

1. Oxygen has an atomic number of 6. How many protons does oxygen have?

- A. 4
- B. 8
- C. 16

2. What are atoms are made up of?

- A. electrons
- B. protons
- C. neutrons
- D. all of the above

Revision Sheets

Chapter 4 – Discovering Parts of an Atom

Part A- True/False

Indicate whether the statement is true or false.

- _____ 1. The mass of an electron is about equal to the mass of a proton.
- _____ 2. For an atom to be neutral, the number of protons must equal the number of neutrons.
- _____ 3. The neutrons make up most of the volume of an atom.
- _____ 4. Dividing an element into smaller pieces results in a molecule.
- _____ 5. Two isotopes of the same element contain different numbers of protons.
- _____ 6. Nuclear decay occurs when an unstable atomic nucleus changes into another more stable nucleus by emitting radiation.

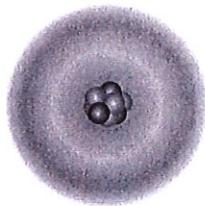
Part B- Multiple Choice

Identify the choice that best completes the statement or answers the question.

- _____ 7. The atomic number of calcium is 20. What can you tell about an atom of this element?
 - a. the sum of its protons and neutrons is 20
 - b. it has 20 protons
 - c. it has 40 protons
 - d. it has 20 neutrons
- _____ 8. Where is the densest part of an atom?
 - a. electron cloud
 - b. space around the nucleus
 - c. nucleus
 - d. All parts of the atom are equally dense.
- _____ 9. How small are atoms?
 - a. about the size of dust specks
 - b. about the size of pin holes
 - c. about the size of grains of salt or sand
 - d. too small to be seen by the unaided eye
- _____ 10. The sum of an atom's protons and neutrons is its _____.
 - a. atomic mass
 - b. periodic number
 - c. atomic number
 - d. atomic weight

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___ 11. What are the smallest particles of an element that have the same chemical properties as the element?



- a. atoms
- b. molecules
- c. protons
- d. electrons

___ 12. What did Democritus believe an atom was?

- a. a solid, indivisible object
- b. a tiny particle with a nucleus
- c. a nucleus surrounded by an electron cloud
- d. a tiny nucleus with electrons surrounding it

___ 13. What determines the identity of elements?

- a. its mass number
- b. the charge of the atom
- c. the number of its neutrons
- d. the number of its protons

___ 14. If an ion contains 10 electrons, 12 protons, and 13 neutrons, what is the ion's charge?

- a. 2-
- b. 1-
- c. 2+
- d. 3+

Part C- Matching

Match each term with its correct description

- a. atom
- b. electron
- c. neutron
- d. isotope
- e. mass number
- f. average atomic mass
- g. nucleus
- h. proton
- i. nuclear decay
- j. ion

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___ 15. The smallest particle of an element that still has the same chemical properties of that element.

___ 16. A positively charged particle inside an atom's nucleus.

___ 17. A particle with a negative electric charge.

___ 18. The center of the atom which contains most of the atom's mass.

___ 19. A particle that is found in the nucleus of an atom and has no electrical charge.

___ 20. The average mass of the element's isotopes.

___ 21. Atoms of the same element that have different numbers of neutrons.

- _____ 22. An atom that is no longer neutral because it has gained or lost electrons.
- _____ 23. A process that occurs when an unstable atomic nucleus changes into another more stable nucleus by emitting radiation.

Part D- Short Answer

Write the correct answer for each of the following questions.

24. When the same element has different atomic masses, it is called a(n) _____.
25. Electrons in an atom move throughout the _____ surrounding the nucleus.
26. How can radioactive decay produce new elements?
27. How can radioactive decay produce new elements?

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The Periodic Table of ELEMENTS

PERIODS

1 hydrogen H 1.008	2 helium He 4.003																												
3 lithium Li 6.941	4 beryllium Be 9.012	5 boron B 10.811	6 carbon C 12.011	7 nitrogen N 14.007	8 oxygen O 15.999	9 fluorine F 18.998	10 neon Ne 20.180																						
11 sodium Na 22.990	12 magnesium Mg 24.305	13 aluminum Al 26.982	14 silicon Si 28.086	15 phosphorus P 30.974	16 sulfur S 32.065	17 chlorine Cl 35.453	18 argon Ar 39.948																						
19 potassium K 39.098	20 calcium Ca 40.078	21 scandium Sc 44.956	22 titanium Ti 47.88	23 vanadium V 50.942	24 chromium Cr 51.996	25 manganese Mn 54.938	26 iron Fe 55.933	27 cobalt Co 58.933	28 nickel Ni 58.693	29 copper Cu 63.546	30 zinc Zn 65.39	31 gallium Ga 69.723	32 germanium Ge 72.61	33 arsenic As 74.922	34 selenium Se 78.96	35 bromine Br 79.904	36 krypton Kr 83.80												
37 rubidium Rb 85.468	38 strontium Sr 87.62	39 yttrium Y 88.906	40 zirconium Zr 91.224	41 niobium Nb 92.906	42 molybdenum Mo 95.94	43 technetium Tc 98.907	44 ruthenium Ru 101.07	45 rhodium Rh 102.905	46 palladium Pd 106.42	47 silver Ag 107.868	48 cadmium Cd 112.411	49 indium In 114.818	50 tin Sn 118.71	51 antimony Sb 121.760	52 tellurium Te 127.6	53 iodine I 126.905	54 xenon Xe 131.29												
55 cesium Cs 132.905	56 barium Ba 137.327	57-71 lanthanides	72 hafnium Hf 178.49	73 tantalum Ta 180.948	74 tungsten W 183.85	75 rhenium Re 186.207	76 osmium Os 190.23	77 iridium Ir 192.22	78 platinum Pt 195.08	79 gold Au 196.967	80 mercury Hg 200.59	81 thallium Tl 204.383	82 lead Pb 207.2	83 bismuth Bi 208.980	84 polonium Po 209	85 astatine At 210	86 radon Rn 222												
87 francium Fr 223	88 radium Ra 226	88-103 actinides	104 rutherfordium Rf 261	105 dubnium Db 262	106 seaborgium Sg 266	107 bohrium Bh 264	108 hassium Hs 269	109 meitnerium Mt 268	110 darmstadtium Ds 269	111 roentgenium Rg 272	112 copernicium Cn 277	113 nihonium Nh 278	114 flerovium Fl 285	115 moscovium Mc 288	116 livermorium Lv 293	117 tennessine Ts 289	118 oganesson Og 294												
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Metals, Nonmetals & Metalloids

Metalloids

- have metallic and nonmetallic properties

C Carbon 75.07		Fire extinguisher
Si Silicon 28.085		Glass
Ge Germanium 72.63		Transistors
Sn Tin 118.71		Tin roof
Pb Lead 207.2		Paint

Nonmetals

- poor conductors of heat and electricity
- brittle
- non-ductile

F Fluorine 18.998		Fluoroplastics
Cl Chlorine 35.45		Chlorinating liquid
Br Bromine 79.904		Photographic film
I Iodine 126.904		Liquid iodine
At Astatine [210]		Radioactive

La Lanthanum 138.905	Ce Cerium 140.12	Pr Praseodymium 140.908	Nd Neodymium 144.24	Pm Promethium [145]	Sm Samarium 150.36	Eu Europium 151.964	Gd Gadolinium 157.25	Tb Terbium 158.925	Dy Dysprosium 162.50	Ho Holmium 164.930	Er Erbium 167.259	Tm Thulium 168.930	Yb Ytterbium 173.054	Lu Lutetium 174.967
Ac Actinium [227]	Th Thorium 232.037	Pa Protactinium 231.036	U Uranium 238.029	Np Neptunium [237]	Pu Plutonium [244]	Am Americium [243]	Cm Curium [247]	Bk Berkelium [247]	Cf Californium [251]	Es Einsteinium [252]	Fm Fermium [257]	Md Mendelevium [258]	No Nobelium [259]	Lr Lawrencium [260]

Metals

- good conductors of heat and electricity
- malleable
- ductile

Group 1 Alkali metals

Li Lithium 6.941		Lithium battery
Na Sodium 22.990		Baking soda
K Potassium 39.098		Banana
Rb Rubidium 85.468		Fireworks
Cs Cesium 132.905		Atomic clock
Fr Francium [223]		Radioactive

Group 2 Alkaline metals

Be Beryllium 9.012		Spacecraft structure
Mg Magnesium 24.305		Banana
Ca Calcium 40.078		Shell
Sr Strontium 87.62		Fireworks
Ba Barium 137.327		X-ray
Ra Radium [226]		Radioactive

Group 3-13 Transition metals

Sc Scandium 44.956		Bicycle frame
Fe Iron 55.845		Weight
Y Yttrium 88.906		Computer monitor
Ru Ruthenium 101.07		Solar cell
La Lanthanum 138.905		Camera lens
Os Osmium 192.22		Ballpoint pen

Revision Sheets

Chapter 5 – The Periodic Table

Part A- True/False

Indicate whether the statement is true or false.

- ___ 1. A metalloid is an element with all of the same properties as metals.
- ___ 2. Elements were arranged in order of increasing atomic mass on Mendeleev's first periodic table.
- ___ 3. Elements on the far right of the periodic table are classified as nonmetals.
- ___ 4. Copper is a metal and is a conductor of electricity.
- ___ 5. Ductility is not a property of metals
- ___ 6. Most metals are on the right side of the periodic table.

Part B- Multiple Choice

Identify the choice that best completes the statement or answers the question.

- ___ 7. The atomic number of calcium is 20. What can you tell about an atom of this element?
 - a. the sum of its protons and neutrons is 20
 - b. it has 20 protons
 - c. it has 40 protons
 - d. it has 20 neutrons
- ___ 8. The scientist best known for contributions to the development of the periodic table is _____.
 - a. Dmitri Mendeleev
 - b. Democritus
 - c. John Dalton
 - d. Albert Einstein
- ___ 9. A solid solution, such as sterling silver, is a(n) _____.
 - a. alloy
 - b. metalloid
 - c. colloid
 - d. emulsion
- ___ 10. Moving from left to right across the periodic table, how do the elements change?
 - a. They change from nonmetals to metalloids to metals.
 - b. They change from metals to metalloids to nonmetals.
 - c. They decrease in atomic number.
 - d. They are in alphabetic order.

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- ____ 21. The columns on the periodic table.
- ____ 22. The elements that are in group 2 on the periodic table.

Part D- Short Answer

Write the correct answer for each of the following questions.

23. Describe five physical properties that can help to identify copper.
24. The _____ increases by one for each element as you move left to right across a period.
25. Classify each of the following elements as a metal, nonmetal, or a metalloid:
boron _____
carbon _____
aluminum _____
silicon _____
26. An element that is sometimes a good conductor of electricity and sometimes a good insulator is a(n) _____.
27. An element that is a poor conductor of heat and electricity, but is a good insulator is a(n)_____.
28. What are two properties that make a metal a good choice for use as wires in electronics?

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