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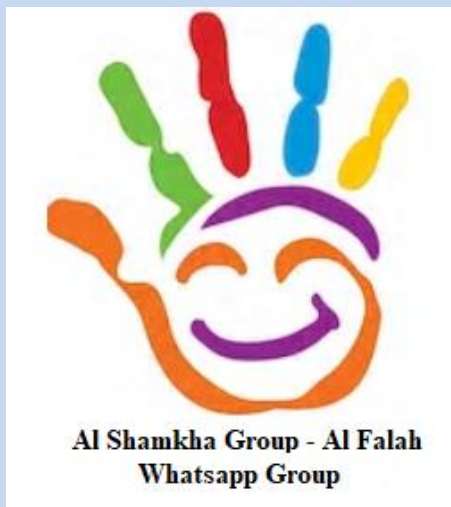
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Science

GRADE 7

Summary & Practice Sheets

Ch:1 Scientific Explanations

Ch:2 Foundations of Chemistry

Ch:3 Understanding the Atom

Ch:4 The Periodic Table

Ch:5 Motion, Forces, and Newton's Laws

CHAPTER 1: SCIENTIFIC EXPLANATIONS

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)



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

CHAPTER 2: FOUNDATIONS OF CHEMISTRY

Mass MATTERS!

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

Matter can be SOLID, LIQUID, or GAS.

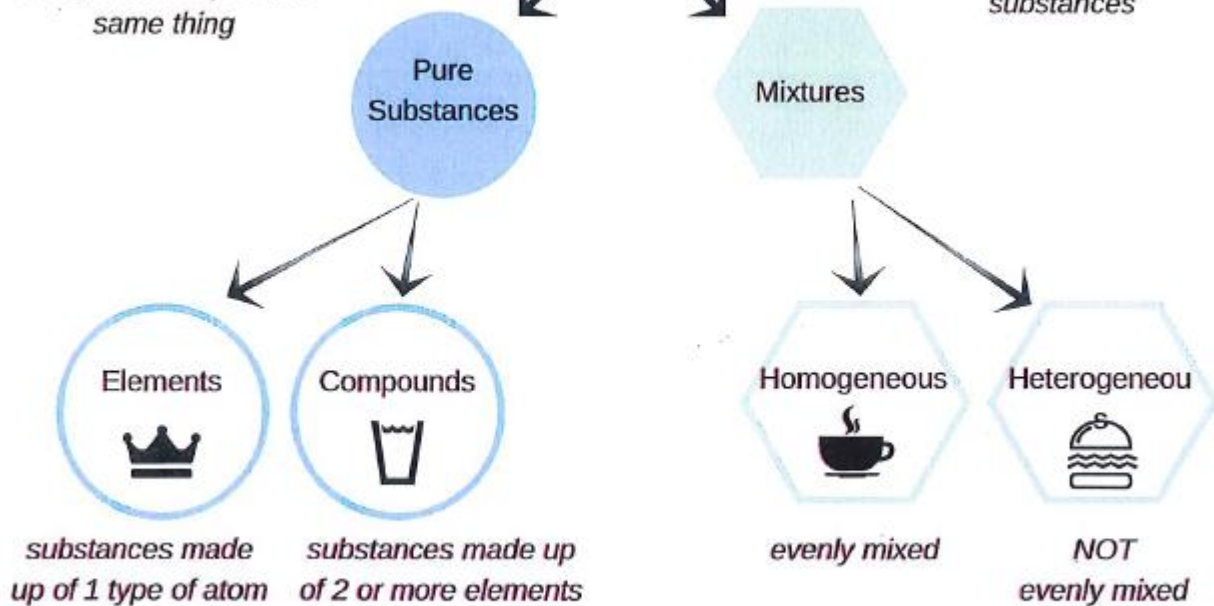
Energy does not have mass and is NOT matter.



Matter

substances that are always made up of the same thing

2 or more pure substances



1

ELEMENTS

gold, helium, hydrogen, oxygen

2

COMPOUNDS

water (H₂O), carbon dioxide (CO₂)

Examples

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)



Water
250 mL

+



Lemon Juice
45 mL

+

Sugar
52 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

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



pure substance



heterogeneous mixture



heterogeneous mixture



heterogeneous mixture



pure substance



heterogeneous mixture



heterogeneous mixture



pure substance

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

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.

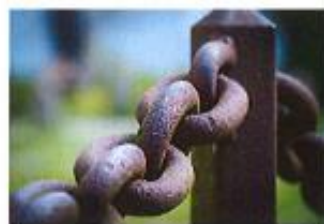


- Changes shape
- Silver in color
- Density: 7.87

- 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 matter's 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

- 1 Fatima 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?

Chemical change – new substance is formed

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



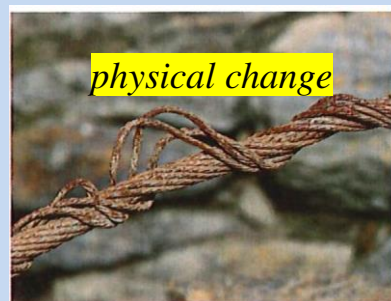
physical change



physical change



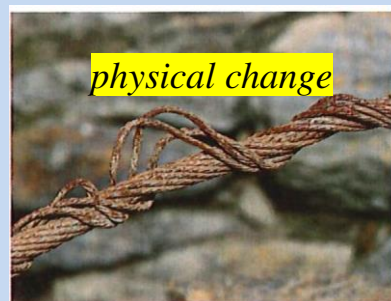
physical change



physical change



Chemical change



Chemical change

Part A- Modified True/False

Indicate whether the statement is true or false. If false, change the identified word or phrase to make the statement true.

I. A fruit salad is a <i>homogeneous</i> mixture.	F	heterogenous
2. <i>Matter</i> is anything that has mass and takes up space	T	
3. <i>Matter</i> that can vary in composition is a substance.	F	compound
4. A(n) <i>element</i> is two or more atoms that are held together by chemical bonds and act as a unit	F	compound
5. The properties of a compound are usually the same as the properties of the elements from which it is made	T	
6. A <i>homogeneous</i> mixture is a mixture in which the substances are not evenly mixed.	F	Heterogeneous
7. Table salt is a compound of sodium and chlorine	T	
8. <i>Density</i> is an example of a size-dependent property.	F	Mass
9. Volume is an example of a size-dependent property.	T	
10. The ability of a match to burn is an example of a chemical change	T	
II. A <i>physical</i> property is a characteristic of something that allows it to change to something new	F	chemical
12. Matter is made up of <i>motionless</i> particles	F	motion
13. The ability to react with oxygen is a <i>physical</i> property	F	chemical
14. In a physical change, the substance does not change its identity	T	

Part B-Multiple Choice

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

15. is another name for a homogeneous mixture.

- a. Liquid
- b. **Solution**
- c. substance
- d. suspension

16. When two or more substances are combined so each substance can be separated by physical means, the result is a(n) _____.

- a. chemical change
- b. compound
- c. element
- d. **mixture**

17. Which of the following is a pure substance?

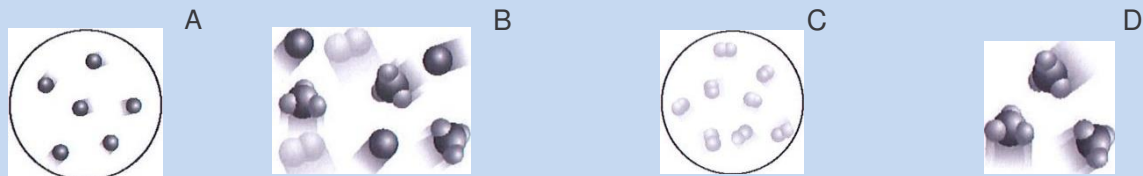
- a. soda
- b. trail mix
- c. granite
- d. **gold**

18. Which diagram shows a compound?



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

19. Which diagram shows individual atoms?



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

20. The following are examples of physical properties EXCEPT _____.

- a. density c. color
b. shape d. **ability to react with oxygen**

21. A characteristic of matter that allows it to change to something new is a _____.

- a. physical property c. **chemical property**
b. physical change d. chemical change

22. The following are examples of chemical properties EXCEPT .

- a. the ability to burn c. the ability to react with oxygen
b. **the ability to be crushed** d. toxicity

23. All of the following are examples of physical changes EXCEPT

- a. melting c. **burning**
b. evaporating d. solidifying

24. Which of the following is an example of a chemical change?

- a. painting a house c. bending steel
b. freezing water 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** c. chemical change
b. physical change d. physical property

27. The mass of the products of a chemical reaction _____ the mass of the reactants.

- a. is greater than c. **is the same as**
b. is less than d. may be more or less than

28. Which formula listed below correctly finds density?

- a. **$D = m/V$** c. $D = g/V^3$
b. $D = V/m$ d. $D = g^3/V$

29. The rusting of iron is not a physical property because.

- a. it cannot be observed c. a new substance with new properties formed
b. iron is magnetic d. The identity of iron remains unchanged

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

Part C- Matching

Match each term with its correct description

- | | |
|--------------|-------------|
| a. element | d. compound |
| b. mixture | e. matter |
| c. substance | |

32. matter that can vary in composition (b)
 33. anything that has mass and takes up space (e)
 34. two or more elements chemically combined (d)
 35. consists of just one type of matter (a)
 36. it has a definite composition (c)

Part D- Short Answer

Write the correct answer for each of the following questions.

37. Give three examples of mixtures.

- ① Sand and water. ② Salt and water. ③ Sugar and salt. ④ Air. ⑤ Soda.

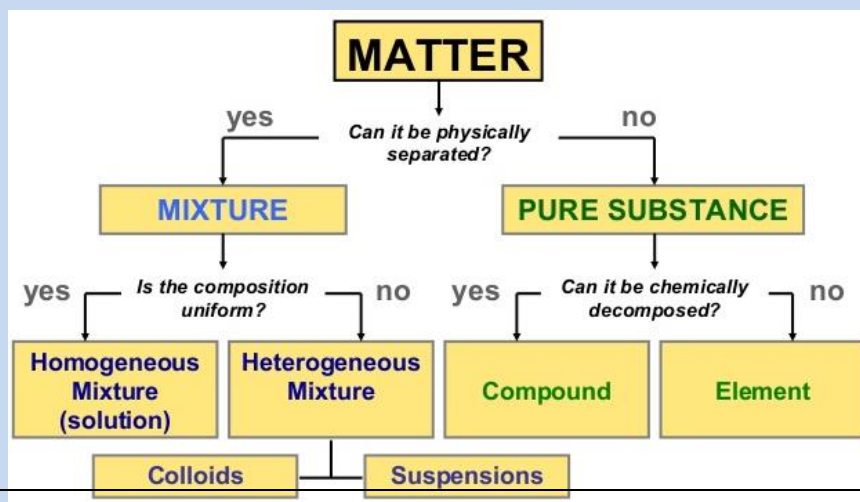
38. What are three physical properties of a banana?

- ① Shape (curved) ② colour (yellow/ green) ③ texture (soft)

39. What is a chemical property of a banana?

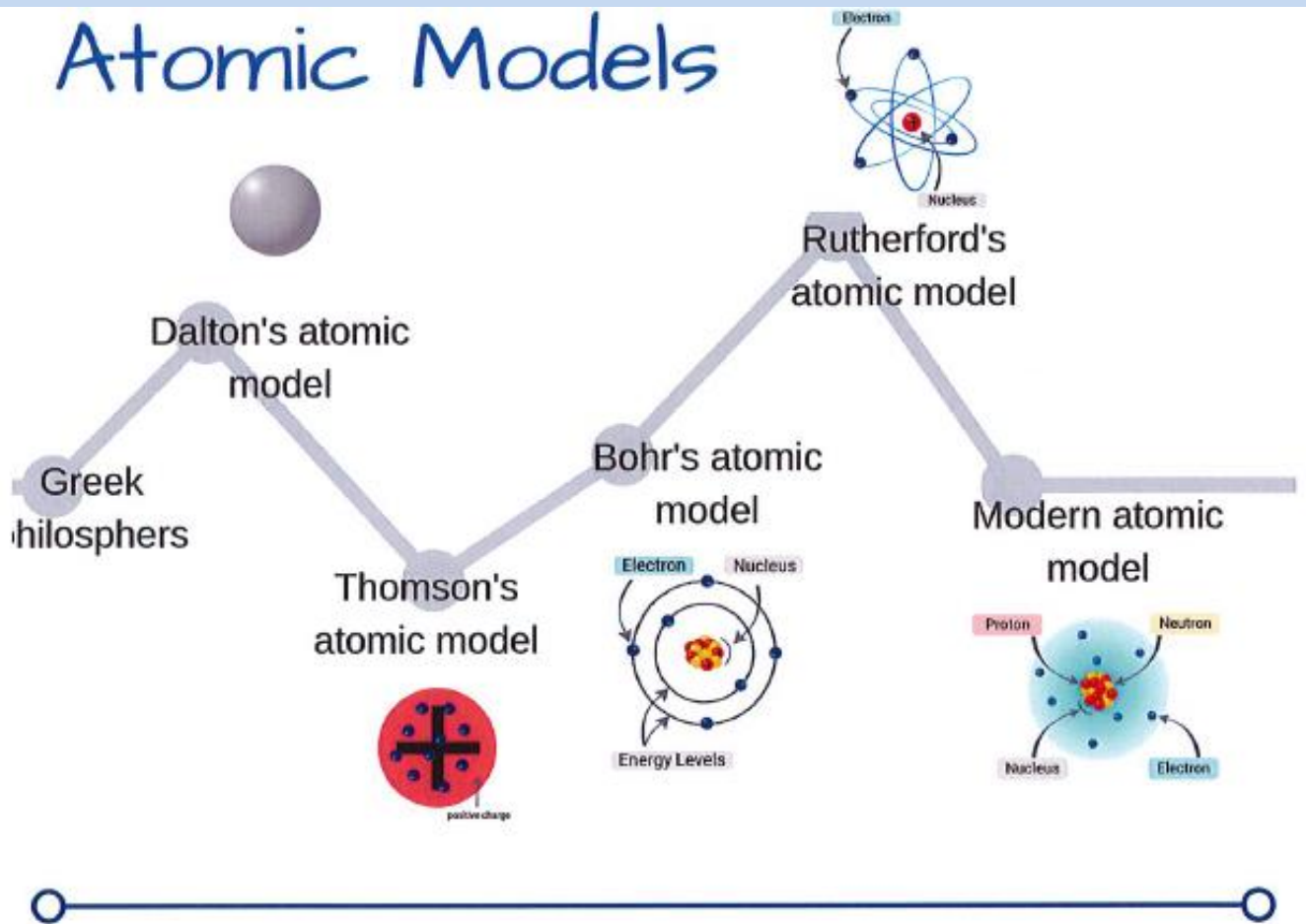
Bananas turns brown when left for a while because of oxidation - / when exposed to oxygen

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



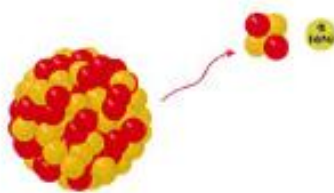
CHAPTER:3 UNDERSTANDING THE ATOM

Atomic Models



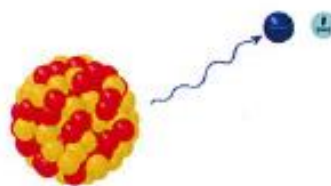
Types of Decay

Alpha Decay



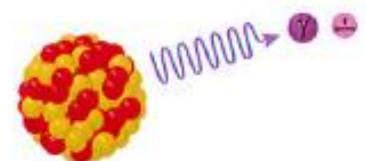
the nucleus loses 2 protons and 2 neutrons, so the atom becomes a new element

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

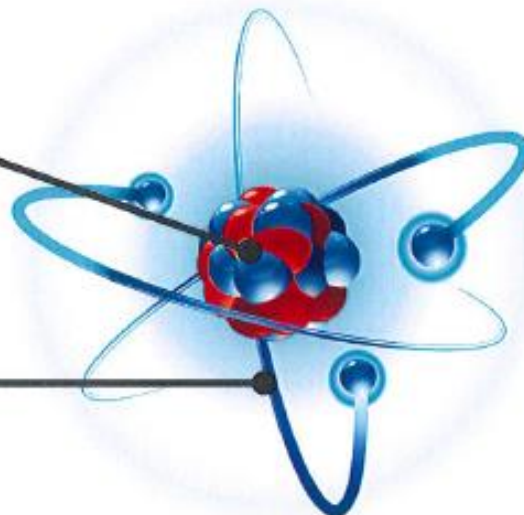
ALL about **ATOMS!**

NUCLEUS

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

ELECTRON CLOUD

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



ELEMENT NAME

ATOMIC NUMBER
(number of protons)

SYMBOL

ATOMIC MASS

ELEMENTS

COMPOUNDS

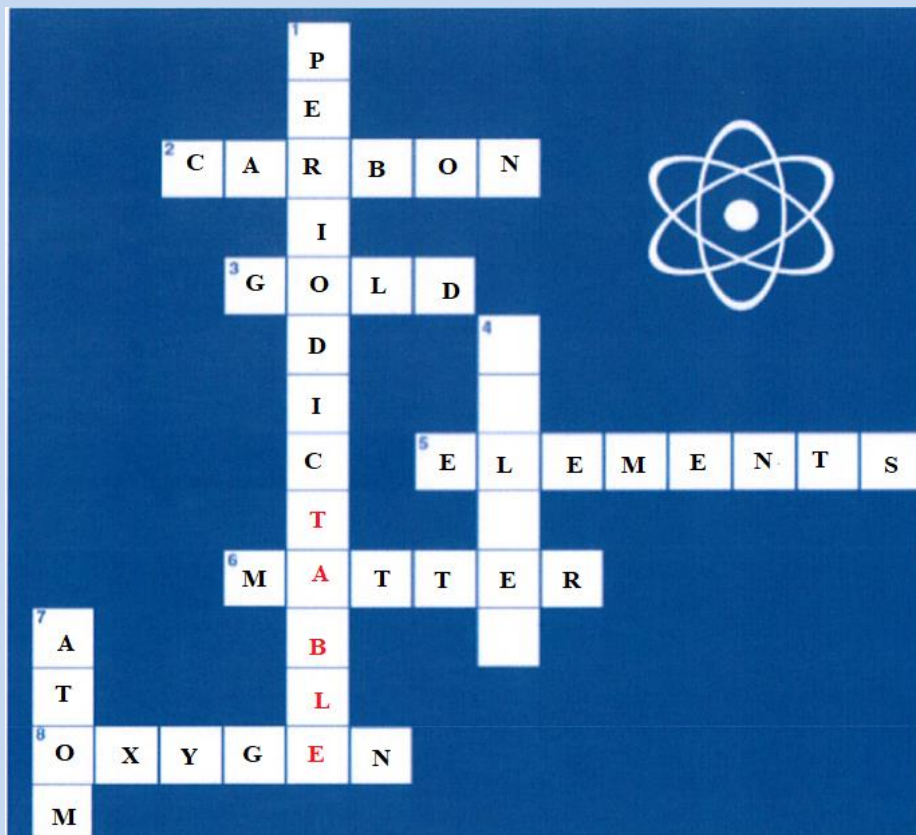
When 2 or more elements **CHEMICALLY BOND** together.

Name	Chemical Formula	Molecular Structure
Water	H ₂ O	

Water contains
1 hydrogen and 2 oxygens.

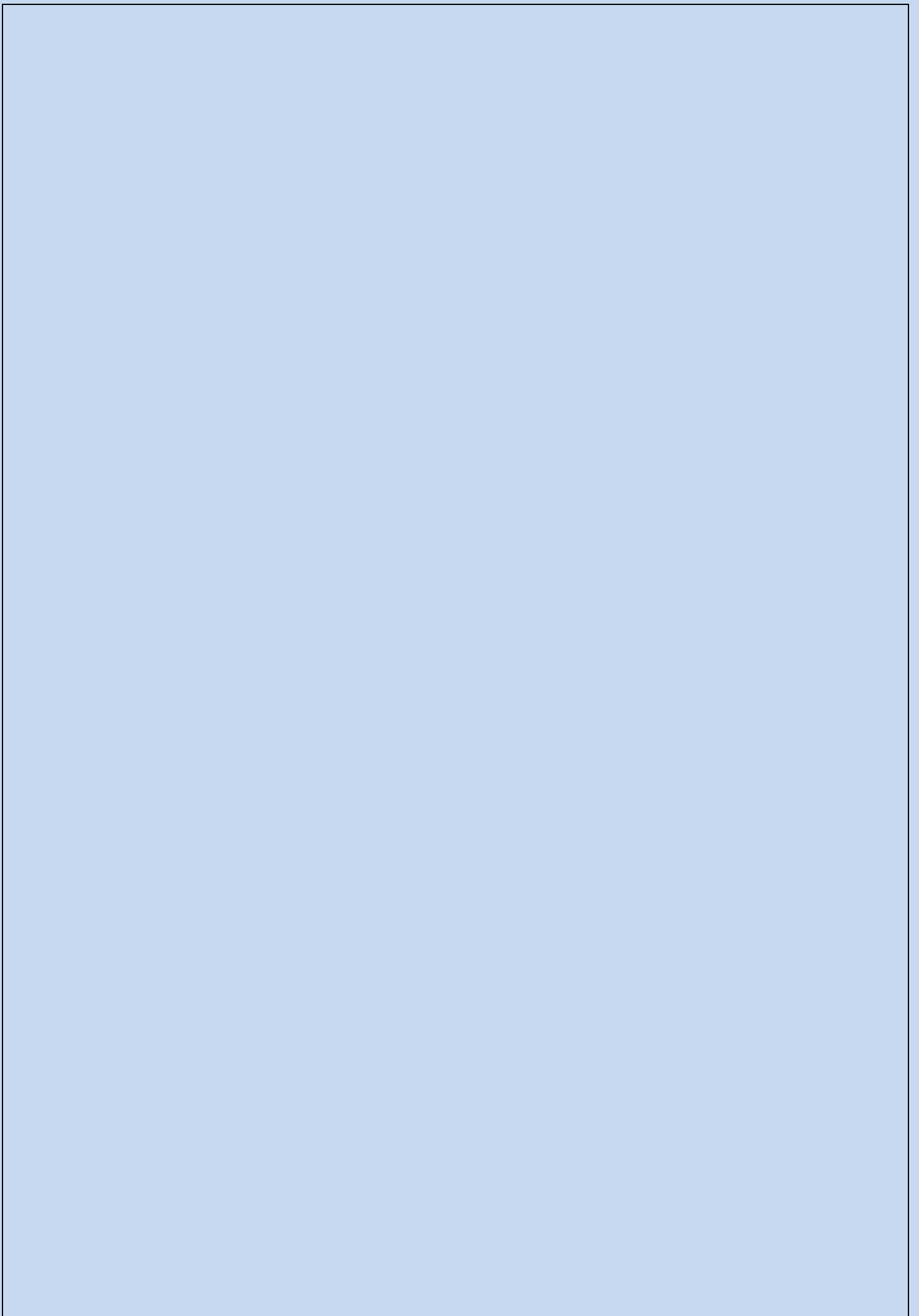
How many carbon atoms are in one molecule of
C₆H₁₂O₆?

Across →	Down ↓
2. Has a chemical symbol (C) and an atomic number = 6.	1. A chart where all elements are arranged.
3. A shiny metal used for jewellery.	2. The second place medals are made of this shiny metal.
5. There are 115 of them arranged in a chart.	7. Tiny particles that make up all elements.
6. has mass and takes up space.	
8. A gas in the air	



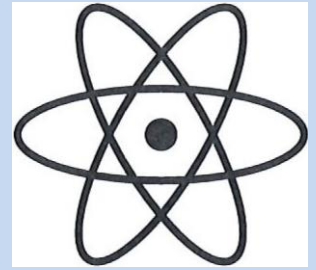
True or False:

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



Fill in the Blanks:

This is a picture of an (atom). The center is called the (nucleus) and the outside is called the electric cloud /shells.



Match:

- Name magnesium
- Symbol: Mg
- Atomic Number: 12
- Atomic Mass: 24.3



choose 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 made up of?

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

CHAPTER 4: THE PERIODIC TABLE

The Periodic Table of ELEMENTS

GROUPS

PERIODS																		
1 H 1.008																	2 He 4.003	
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180	
11 Na 22.990	12 Mg 24.305											13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.06	17 Cl 35.453	18 Ar 39.948	
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.88	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.38	31 Ga 69.723	32 Ge 72.64	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80	
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc 98.906	44 Ru 101.07	45 Rh 102.905	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.818	50 Sn 118.71	51 Sb 121.757	52 Te 127.6	53 I 126.905	54 Xe 131.29	
55 Cs 132.905	56 Ba 137.327	57-71		72 Hf 178.49	73 Ta 180.948	74 W 183.85	75 Re 186.207	76 Os 190.23	77 Ir 192.22	78 Pt 195.084	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po 209	85 At 209	86 Rn 222
87 Fr 223	88 Ra 226	88-103		104 Rf 101.07	105 Db 102.906	106 Sg 102.906	107 Bh 104.898	108 Hs 106.105	109 Mt 108.904	110 Ds 110.437	111 Rg 111.905	112 Cn 112.904	113 Uut 113.903	114 Fl 114.904	115 Uu 115.904	116 Uus 116.904	117 Uuh 117.904	118 Uuo 118.904
89 La 138.905	90 Ce 140.116	91 Pr 140.908	92 Nd 144.24	93 Pm 144.913	94 Sm 150.36	95 Eu 151.964	96 Gd 157.25	97 Tb 158.925	98 Dy 162.50	99 Ho 164.930	100 Er 167.255	101 Tm 168.930	102 Yb 173.04	103 Lu 174.967				
104 Ac 227.028	105 Th 232.038	106 Pa 231.036	107 U 238.029	108 Np 237.048	109 Pu 244.04	110 Am 243.061	111 Cm 247.070	112 Bk 247.070	113 Cf 251.080	114 Es 252	115 Fm 257.081	116 Md 258	117 No 259	118 Lr 261				

ACTIVITY 1 Let's number the periods and groups of the periodic table!

2 Circle the examples in the periodic table by predicting the symbol.

Gold: used in jewelry

Iron: found in blood

Calcium: found in bones

Oxygen: in the air we breath

Aluminum: used for spoons, cans ...

Metals

- good conductors of heat and electricity
- malleable
- ductile

Group 1 Alkali metals	Group 2 Alkaline metals	Group 3-13 Transition metals
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Li Lithium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Lithium batteries</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Na Sodium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Sodium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">K Potassium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Potassium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Rb Rubidium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Rubidium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Cs Cesium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Cesium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Fr Francium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Francium metal</div> </div>	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Be Beryllium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Beryllium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Mg Magnesium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Magnesium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Ca Calcium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Calcium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Sr Strontium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Strontium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Ba Barium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Barium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Ra Radium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Radium metal</div> </div>	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Sc Scandium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Scandium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Fe Iron</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Iron metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Y Yttrium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Yttrium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Ru Ruthenium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Ruthenium metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">La Lanthanum</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Lanthanum metal</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Os Osmium</div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> Osmium metal</div> </div>

Metals, Nonmetals & Metalloids

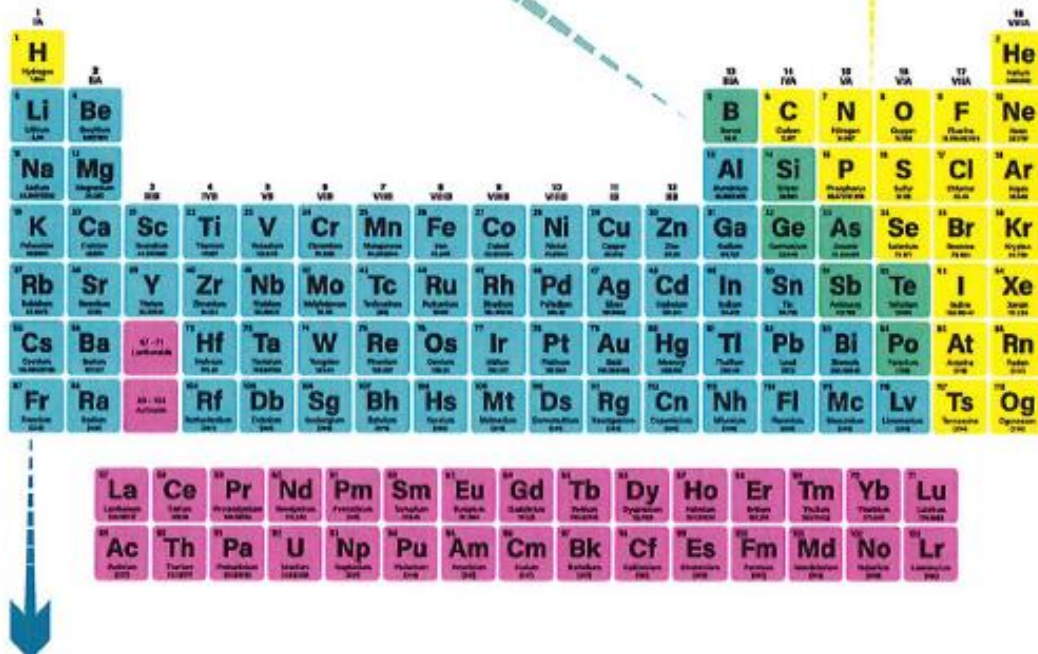
Metalloids

- have metallic and nonmetallic properties



Nonmetals

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



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

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 mass
- c. atomic number
- d. atomic weight

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 electron surrounding it

13. What determines the identity of elements?

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

15. The smallest particle of an element that still has the same chemical properties of that element. (a)
16. A positively charged particle inside an atom's nucleus. (h)
17. A particle with a negative electric charge. (b)
18. The center of the atom which contains most of the atom's mass. (g)
19. A particle that is found in the nucleus of an atom and has no electrical charge. (c)
20. The average mass of the element's isotopes. (f)
21. Atoms of the same element that have different numbers of neutrons. (d)
22. An atom that is no longer neutral because it has gained or lost electrons. (j)
23. A process that occurs when an unstable atomic nucleus changes into another more stable nucleus by emitting radiation (i)

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) .(isotopes)
25. Electrons in an atom move throughout the _____ surrounding the nucleus. (electron cloud /shells)
6. How can radioactive decay produce new elements?

When a spontaneous breakdown of an atomic nucleus, release of energy and forming a new nucleus

N

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. (F)
2. Elements were arranged in order of increasing atomic mass on Mendeleev's first periodic table. (T)
3. Elements on the far right of the periodic table are classified as nonmetals. (T)
4. Copper is a metal and is a conductor of electricity. (T)
5. Ductility is not a property of metals. (F)
6. Most metals are on the right side of the periodic table. (F)

Part B- Multiple Choice

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

7. 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.
11. The sum of an atom's protons and neutrons is its _____.
 - a. atomic mass
 - b. Periodic number
 - c. atomic number
 - d. atomic weight
12. When Mendeleev published his periodic table, there were some spaces for undiscovered elements. The image below is a section of a similar table. A reasonable value for the atomic mass of the missing element is _____.
 - a. 101
 - b. 72.3
 - c. 68.2
 - d. 34.8
13. Iodine is a solid nonmetal. What is one property of iodine?
 - a. conductivity
 - b. dull appearance
 - c. malleability
 - d. ductility
14. The elements F, Cl, Br, I and At all appear in the same column of the periodic table and share many _____.
 - a. atomic numbers
 - b. chemical formulas
 - c. physical properties
 - d. chemical properties

Al 27.0	Si 28.1	P 31.0
Ga 69.7	?	As 74.9
In 115	Sn 119	Sb 122

Part C- Matching

Match each term with its correct description.

- | | |
|--------------------------|------------------|
| a. atomic number | b. nonmetals |
| c. alkaline earth metals | d. group |
| e. periodic table | f. alkali metals |
| g. metal | h. period |

- The number of protons in an atom of an element. (a)
16. A chart that shows the elements in order of increasing atomic number. (e)
17. Elements that have no metallic properties. (b)
18. The elements that are in group 1 on the periodic table. (f)
19. An element that is generally shiny and hard. (g)
20. The rows on the periodic table. (h)
21. The columns on the periodic table. (d)
22. The elements that are in group 2 on the periodic table. (c)

Part D- Short Answer

Write the correct answer for each of the following questions.

23. Describe five physical properties that can help to identify the copper.

- ① lustrous ② malleable ③ ductile ④ good conductor of heat & electricity

24. The (atomic number) 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 (metalloid) ⇒ carbon (nonmetal)
⇒ aluminum (metal) ⇒ silicon (metalloid)

26. An element that is sometimes a good conductor of electricity and sometimes a good insulator is a(n) (metalloid)

27. An element that is a poor conductor of heat and electricity, but is a good insulator is a(n) (nonmetal)

28. What are two properties that make a metal a good choice for use as wires in electronics?

- ① They are good conductor of electricity ② They are ductile

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.



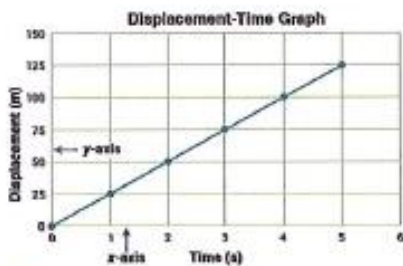
$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

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

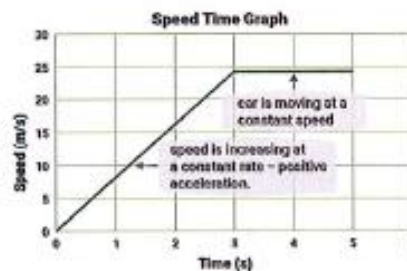
$$\text{acceleration} = \frac{\text{change in velocity}}{\text{change in time}}$$

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

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



SUN

EARTH

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.



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

True/False

Indicate whether the statement is true or false.

- (F) 1.To calculate speed, multiply the distance by the time.
- (F) 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.
- (F) 3.To calculate average speed, use only the total time and the total distance.
- (T) 4.To find an object's velocity, you must know the speed and direction of the moving object.
- (F) 5.Weight is the upward force of Earth's gravity on all objects.
- (F) 6.There is only one type of force.
- (T) 7.The metric unit which measures force is the Newton.
- (F) 8.Net force is one force acting on an object.

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
13. If you walk 1.5 kilometers in 30 minutes what is your average speed?
- a. 10 km/h
 - b. 0.75 km/h
 - c. 0.05 km/h
 - d. 3.0 km/h
14. If you know the speed and direction of an object, which could you find?
- a. acceleration
 - b. velocity
 - c. size
 - d. apparent motion
15. Any push or pull on an object is called a _____
- a. lift
 - b. force
 - c. thrust
 - d. friction

16. As the distance between two objects increases, the gravitational force between the objects?
- a. increases
 - b. decreases
 - c. creates friction
 - d. stays the same
17. Acceleration is a change in the _____ of an object over time.
- a. speed
 - b. direction
 - c. motion
 - d. velocity
18. An airplane travels 290 km between Austin and Dallas in 1h and 15 min. What is its average speed?
- a. 160 km/h
 - b. 200 km/h
 - c. .232 km/h
 - d. 250 km/h
19. When net forces are equal in strength and opposite in direction, they are said to be “
- a. balanced
 - b. unbalanced
 - c. negative
 - d. opposite
20. Which represents a force pair?
- a. A book pushes down on the table, and gravity pulls the book down toward the floor.
 - b. A boy's foot pushes down on a bicycle pedal, the pedal pushes up on his foot.
 - c. A golf club hits a golf ball Gravity pulls the ball back down to Earth.
 - d. A person's foot pushes on the floor, and the person's weight pushes on the floor.
21. If you take the distance that an object moves and divide it by the time it takes to move the distance, what are you calculating?
- a. the object's acceleration
 - b. the object's speed
 - c. the object's net force
 - d. the object's friction
22. In order to accelerate, an object must be acted on by a(n) _____
- a. force pair
 - b. large mass
 - c. unbalanced force
 - d. balanced force
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

Matching

Match each term with its correct description

a. acceleration	b. distance	c. force
d. friction	e. motion	f. Newton's first law of motion
g. Newton's second law of motion	h. speed	i. velocity

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

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?

→ Speed of car A is $(30 \text{ miles} \div 1.5 \text{ h} = 20 \text{ miles/h})$

→ Speed of car B $(15 \text{ miles} \div 1.25 \text{ h} = 12 \text{ miles/h})$

car A travel faster than car B

35. What is the difference between balanced forces and unbalanced forces?

In balanced forces, the magnitude of the two forces is equal

In unbalanced forces, the magnitude of the two forces are unequal

36. The law of inertia is another name for _____

Newton's 1st law of motion

