Батыс Қазақстан облысы
білім басқармасының
mektepke дейінгі, жалпы орта,
teхникалық және кәсіптік
білім беру ұйымдарының
облыстық оку-әдістемелік кабинеті

«Teachers Resource Book»

2019 жыл
Батыс Қазақстан облыстық білім басқармасының мектепке дейінгі, жалпы орта,техникалық және қасіптік білім беру ұйымдарының облыстық оку-әдістемелік кабинетінің сараптама кенесінде қаралып, облыс педагогтарына таратуға ұсынылды.

Хаттама №1 25.01.2019

Құрастырушы:
Битингалеева Д.А., Ащысай орта жалпы білім беретін мектеп-балабақшасының І санатты химия пәні мұғалімі.
Каукиева А.Г., А.Тихоненко атындағы орта жалпы білім беретін мектебінің жоғары санатты химия пәні мұғалімі.

Пікір жазғандар:
Еркегалиева Ж.А., «Өрлеу» БАУО» АҚ филиалы БҚО ПҚБАИ тұлғаны тәрбиеleiу және алеуметтendіру кафедрасының аға оқытуысы, ағылшын тілі пәні бойынша тренер
Өтегұл Г.К., «Өрлеу» БАУО» АҚ филиалы БҚО ПҚБАИ тұлғаны тәрбиеleiу және алеуметтendіру кафедрасының аға оқытуысы, химия пәні бойынша тренер
Мусаева А.У., Аудандық білім беру бөлімінің әдіскері

Усынылған әдістемелік құралда мұғалімге химия пәнін ағылшын тілінде өткізу барысында қосымша қолдануға арналған бекіту тапсырмалары мен тест жұмыстары берілген.
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Introduction

One very simple way of checking that pupils have engaged in meaningful learning is to ask questions that require pupils to interpret some common experience. Like it or not, pupils gear their studying to satisfy the demands of teacher-constructed tasks. We engineer the mental processing of our pupils by what we require them to do. Exclusively asking questions that can be answered by rote memorization of definitions assures a low level of mental work, and also lowers the likelihood that the information will be available for retrieval from long-term memory when a relevant problem or situation arises. Retrieval from memory is facilitated when information is initially stored with a rich network of connections. Memorization of facts without reflection on how the ideas they represent fit in with the rest of what we know, will result in these facts being lost to us, unless they are frequently practiced. (Such is the fate of phone numbers or names we no longer use). Attention must be paid not only to what we test but how we test it as the process of studying dictates the level and meaningfulness of what is learned.

The 5 E’s Approach

A more structured method for developing activities that help pupils construct meaningful connections and dispel misconceptions is the 5 E’s approach. This is based on the learning cycle introduced by Atkins and Karplus in 1962. The 5 E’s are: engage; explore; explain; elaborate (or extend); and, evaluate.

Engage – This stage is designed to pique pupil interest and elicit pupils’ current understanding so that connections can be made between what they know.

Explore – This part allows pupils to be actively involved in manipulating materials (or watching the teacher do so) and making observations that address the target concept. Not only does this provide experience that may contradict what they think should happen but it provides all pupils with a common experiential base to promote concept discussion.

Explain – Once pupils have explored they can now discuss what they observed, put correct vocabulary with what they did and recorded, and reconcile their former ideas with what they think as a result of the exploration.

Elaborate – In this stage, pupils can apply their understanding of the target concept to new situations to reinforce correct understanding or uncover problems with their knowledge. This also provides chances to relate science concepts to real-world situations.

Evaluate – This stage should actually happen throughout each of the 4 previous parts. This stage should allow the pupils and teacher to check the veracity of pupil knowledge and the development of process skills.
1. Classify the following characteristics into solids, liquids or gases:

<table>
<thead>
<tr>
<th>Solids</th>
<th>Changeable volume</th>
<th>Hardness</th>
<th>Molecules close and tidy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Liquids</th>
<th>Changeable volume</th>
<th>Expansion</th>
<th>Molecules close and untidy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Completing the phrases with *solid*, *liquid* and *gas*:
- When a *solid* melts, it becomes a *liquid*.
- When a *gas* condenses, it becomes a *liquid*.
- When a *liquid* evaporates, it becomes a *gas*.
- When a *liquid* freezes, it becomes a *solid*.
- The molecules move quickly in a *gas*.
- The molecules move past each other in a *gas*.
- The molecules can only vibrate in a *solid*.
- You can pour a *gas* and a *liquid* into a different container.

3. Match pictures with sentences

**Solids**

| The particles in a solid are tightly packed and in a regular pattern. |
|--------------------------|--------------------------|
| 4                        | 2                        | 3                        |
| ![Picture 1]             | ![Picture 2]             | ![Picture 3]             |
| 1                        | 4                        | 5                        |
| ![Picture 4]             | ![Picture 5]             | ![Picture 6]             |
| 2                        | 3                        | 6                        |
| ![Picture 7]             | ![Picture 8]             | ![Picture 9]             |
| 7                        | 8                        | 9                        |
| ![Picture 10]            | ![Picture 11]            | ![Picture 12]            |
| 10                       | 11                       | 12                       |
| ![Picture 13]            | ![Picture 14]            | ![Picture 15]            |

**Liquids**

<table>
<thead>
<tr>
<th>The particles in a liquid are not so tightly packed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Picture 1]</td>
</tr>
<tr>
<td>![Picture 2]</td>
</tr>
<tr>
<td>![Picture 3]</td>
</tr>
<tr>
<td>They can move past each other.</td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>The liquid changes shape to fit its container.</td>
</tr>
<tr>
<td>You cannot squash a liquid.</td>
</tr>
</tbody>
</table>

### Gases

<table>
<thead>
<tr>
<th>The particles in a gas are widely spaced.</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>They can move freely.</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>The gas fills its container.</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>You can squash a gas.</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

4. Complete the sentences. Some answers may be used more than once.

Space, mass, liquid, solid, fixed, energy, vibrate, separate, slide, roll, state, melting point, throughout, evaporation

(a) Matter is anything that takes up **space** and has **mass**.
(b) The amount of matter in an object is its **mass**.
(c) The three states of matter are **solid**, **liquid** and **gas**.
(d) The diagram shows molecules in a solid, a liquid and a gas.
In the solid, the molecules are in a fixed position. Each has enough energy to vibrate slightly.

In a liquid, the molecules have enough energy to slide and roll over and around each other.

In a gas, the molecules have enough energy to separate completely from each other.

The state of matter depends on the amount of energy its molecules have.

When a substance is heated, its molecules are given energy which can be used to change the state of the substance.

The temperature at which both the solid and liquid states of a substance occur together is called the melting point of the substance.

The boiling point of a liquid is the temperature at which evaporation begins to occur throughout the liquid.

Theme: Elements, Compounds and mixture
Your name: __________

Fill in the blanks. Some answers may be used more than once.

**Atom, iron, copper, silver, gold, carbon, sulfur, oxygen, nitrogen**

1. Elements.
   (a) An atom is the smallest part of an element that still is that element.
   (b) An element consists of only one kind of atom.
   (c) Four examples of elements which are metals are iron, copper, silver and gold.
   (d) Four examples of elements which are non-metals are carbon, sulfur, oxygen and nitrogen.
   (e) The element carbon occurs in two forms, one being a soft, grey-black substance known as graphite, which is used as pencil 'lead'.
   (f) The element copper is a reddish-brown metal used for wiring.
   (g) The element sulfur is a solid, yellow, non-metal used to make matches.

**Compound, water, sugar, molecule, atom, H_2O, new**

2. Compound.
   (a) A substance consisting of two or more types of atoms bonded together is called a compound. Examples include water and sugar.
   (b) The smallest possible part of a compound is a molecule of that compound.
   (c) Each molecule of carbon dioxide consists of one atom of carbon and two atoms of oxygen chemically bonded together.
   (d) A molecule of water consists of two atoms of hydrogen and one atom of oxygen chemically bonded together. Its chemical formula is there for H_2O.
   (e) A compound is a completely new substance.

**Substances, mingled, chemically, combined, new, dioxide carbon, oxygen, nitrogen, salt, water, steel, magnet, compound, iron sulfide, chemical, physical**

3. Mixture.
   (a) A mixture consists of two or more different substances, which are mingled together, but are not chemically combined.
   (b) When a mixture is made, nothing new has been formed.
   (c) Air is a mixture which includes the elements: oxygen and nitrogen and the compound carbon dioxide.
   (d) Sea water is a mixture of the compounds salt and water.
   (e) A mixture of iron and carbon gives steel.
   (f) A mixture of iron and sulfur is easy to separate using a magnet.
(g) When a mixture of iron filing sand sulfur is heated, a new compound called iron sulfide is formed by a chemical reaction.
(h) In a physical change, nothing new is formed.
(i) Changing the state of a substance by heating or cooling is a physical change.
(j) When something new is formed, a chemical change has taken place.

4. (a) State which of the following is an element (E), a compound (C), or a mixture (M).
- seawater (M); air (M); water (C); sulfur (E); iron (E); glass (C); sodium chloride (C); coke (M);
- sugar (M); oxygen (E); Perspex (C); carbon dioxide (C); copper (E); gold (E); iron sulfide (C); soap (C); candle wax (C); zinc (E); nitrogen (E); steel (M); ink (M); ice (C).

(b) State whether each of the following is a physical (P) or a chemical (C) change.
- Ice melting (P); burning paper (C); dissolving sugar in water (P); iron rusting (C); melting lead (P);
- cutting bread (P); making toast (P); brewing alcohol (C); boiling water in a kettle (P); chewing food (P).

Theme: Solutions
Your name: __________

Fill in the blanks. Some answers may be used more than once.

Solute, solvent, dissolves, temperature, saturated, crystals, cool, hot, concentrated, hot, long, more, curve, crystallization, water

1. (a) A solution is a mixture of a solute in a solvent.
(b) When copper sulfate is added to water, it dissolves to form a solution.
(c) The copper sulfate is the solute and the water is the solvent.
(d) A dilute solution is one with a small amount of solute and a large amount of solvent.
(e) A concentrated solution is one with a small amount of solvent and a large amount of solute.
(f) A saturated solution is one that cannot dissolve any more of the solute, without raising the temperature.
(g) If crystals of solute appear at the bottom of the test tube, we know that the solution is a saturated solution.
(h) Large crystals of copper sulfate can be grown using a hot, very concentrated solution of copper sulfate and allowing it to cool over a long period of time.
(i) In general, the hotter a solution is the more solute it can dissolve.
(j) A solubility curve is a graph used to show how the solubility of a substance increases with increasing temperature.
(k) The formation of crystals from a hot, very concentrated solution which is left to cool is called crystallization.
(l) The solubility of copper sulfate increases with increase in temperature.
(m) Tom a kea solubility curve for copper sulfate, the amount (mass) of copper sulfate that will dissolve in 100 g of water at 20°C is found. Then the amount that will dissolve at three higher temperatures is also found.

2. An investigation on the solubility of copper sulfate is shown below.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Solubility (g/100 g of water)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>40</td>
<td>29</td>
</tr>
</tbody>
</table>

In the table
(a) Plot the graph of the solubility curve for copper sulfate.
(b) From the graph, the solubility of copper sulfate at 25°C is 22 g/100 g water.
(c) From the graph, the solubility of copper sulfate at 75°C is 52 g/100 g water.
(d) 45 g of copper sulfate dissolves in 100 g of water at a temperature of 67°C.
(e) From the graph, what can you conclude about the solubility of copper sulfate at different temperatures? **The higher the temperature, the more copper sulfate will dissolve**
(f) Describe two ways that a dilute solution could be made more concentrated. 1. **add more solute** 2. **Remove some of the solvent by evaporating it.**

**Theme:** Separating mixtures

**Your name:** __________

1. (a) Substances in a mixture maybe separated if there is some physical **difference** between them.
   (b) Method A is called **filtration** and can be used to separate small, **insoluble** solids, such as and, from a liquid. However, any **soluble** would just pass straight through the filter paper.
   ![filtration](image)

   (c) Method B is called **evaporation** and can be used to separate **soluble** from a liquid. The liquid soon **evaporates** from the dish, leaving **crystals** solid behind.
   ![evaporation](image)

   (d) A mixture of sand, salt and water could be separated by first using themethod of **filtration** to remove the **sand**, followed by themethod of **evaporation**, to separate the **salt** and **water**.

   (e) Method C is called **distillation** and can be used to separate two such as, **alcohol** and **water**, which have different **boiling** points. On heating, the **alcohol** vapour enters the **Liebig** condenser first, condense then collected in the **beaker**.
   ![distillation](image)

   (f) Two changes of state that occur in the apparatus are: 1. **Evaporation** 2. **condensation**.

2. Name the method/which could best be used to separate each of the following mixtures to give a pure sample of each component.
   (a) Sand and iron filings: **magnet**.
   (b) Sand and salt: **filtration, followed by evaporation**.
   (c) Sand and water: **filtration**.
(d) Copper sulfate and water: evaporation.
(e) Alcohol and water: distillation.
(f) Alcohol, water and sand: filtration, followed by distillation.
(g) The dyes in black ink: chromatography.
(h) Minerals dissolved in mineral water: evaporation.
(i) Salt and water (sea water): evaporation.

Theme: The atom
Your name: __________

1. (a) The smallest possible piece of an element is an atom of that element.
(b) The atom is made up of three sub-atomic particles; these are the proton, the neutron, and the electron.
(c) Answer the questions on the diagram of the atom given below.

Particles A are called electrons, they orbit the nucleus, have a charge of –1, and a mass of 1 a.m.u. B and C are shells or orbit swwhich hold the electrons. D is the core or nucleus of the atom; it contains protons and neutrons. E is a positively charged particle called a proton; its mass is 1 a.m.u. F is a neutron with a charge of 0, and a mass of 1 a.m.u.
(d) An atom is electrically neutral because it has equal numbers of protons and electrons. Each positive charge cancels out each negative charge.
(e) The number written over the symbol of an element in the Periodic Table tells us the number of protons in the nucleus of an atom of that element. This number is called the atomic number of the atom.
(f) The larger number written below the symbol of an element in the Periodic Table tells us the number of protons plus neutrons in the nucleus of the atom. This number is called the mass number of the atom.

2. (a) The atom of carbon has 6 protons in its nucleus; it must have 6 electrons orbiting its nucleus; and its atomic number is 6.
(b) The first shell can hold a maximum of 2 electrons.
(c) The second shell can hold a maximum of 8 electrons.
(d) An atom of sodium (atomic number 11) has 11 protons in its nucleus and 11 electrons in orbit around the nucleus. The first shell contains 2 electrons; the second shell contains 8 electrons; and the third shell contains 1 electron.
(e) The arrangement of electrons in the sodium atom, called its electronic configuration, is therefore given as 2 8 1.

3. Four atoms, A, B, C and D are shown below.
Atom A has atomic number 10; it is an atom of **neon**.
Atom B has atomic number 5; it is an atom of **boron**.
Atom C has atomic number 18; it is an atom of **argon**.
Atom D has atomic number 15; it is an atom of **phosphorus**.

**Theme:** The periodic table

**Your name:** __________

1. Complete the sentences. Some answers may be used more than once.

<table>
<thead>
<tr>
<th>Atomic number, protons, neutrons, groups, outermost shells, electrons, alkaline earth metals, behave in the same way chemically, they all have 7 electrons in their outermost shells, they all behave in the same way chemically, alkali metals, potassium, lithium, sodium, 2 electrons, 8, 2 electrons, 11, a full outermost shell.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) The Periodic Table arranges the elements in order of increasing <strong>atomic number</strong>.</td>
</tr>
<tr>
<td>(b) Each atom has an equal number of <strong>protons</strong> and <strong>neutrons</strong>.</td>
</tr>
<tr>
<td>(c) Sodium has 11 (number) protons in its nucleus, and 11 electrons in orbit around the nucleus.</td>
</tr>
<tr>
<td>(d) For any element, the number over the symbol is the <strong>atomic number</strong> and gives the number of <strong>protons</strong> in the nucleus of an atom of that element.</td>
</tr>
<tr>
<td>(e) Vertical columns of elements are called <strong>groups</strong>.</td>
</tr>
<tr>
<td>(f) All the elements in a particular <strong>group</strong> or column have the same number of <strong>electrons</strong> in their <strong>outermost shells</strong>.</td>
</tr>
<tr>
<td>(g) Another thing that the elements in a particular vertical column have in common is that they <strong>behave in the same way chemically</strong>.</td>
</tr>
<tr>
<td>(h) Group I elements are called the <strong>alkali metals</strong>, they all have 1 <strong>electron</strong> in their <strong>outermost</strong> shells. Examples of Group I elements are <strong>lithium</strong>, <strong>sodium</strong>, and <strong>potassium</strong>.</td>
</tr>
</tbody>
</table>
Group II elements are called the alkaline earth metals, they all have 2 electrons in their outermost shells.

Group VII elements are called the halogens. Two things all these elements have in common are:
1. They all have 7 electrons in their outermost shells; and 2. They all behave in the same way chemically.

Group 8 elements, called the noble gases are very unreactive because they all have a full outermost shell.

2. You’ve probably noticed that some of the names of the elements do not match the symbols. That’s because some symbols are made from Latin name of the element. Look up the symbol on the Periodic Table and see if you can match the English name to the Latin name. Use each letter once.

<table>
<thead>
<tr>
<th>English</th>
<th>Latin</th>
<th>Correct answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Antimony</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>Copper</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>Gold</td>
<td>C</td>
</tr>
<tr>
<td>4</td>
<td>Iron</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>Lead</td>
<td>E</td>
</tr>
<tr>
<td>6</td>
<td>Mercury</td>
<td>F</td>
</tr>
<tr>
<td>7</td>
<td>Potassium</td>
<td>G</td>
</tr>
<tr>
<td>8</td>
<td>Silver</td>
<td>H</td>
</tr>
<tr>
<td>9</td>
<td>Sodium</td>
<td>I</td>
</tr>
<tr>
<td>10</td>
<td>Tin</td>
<td>J</td>
</tr>
<tr>
<td>11</td>
<td>Tungsten</td>
<td>K</td>
</tr>
</tbody>
</table>

Antimony – Stibium
Aurum
Cuprum
Ferrum
Hydrargyrum
Kalium
Natrium
Plumbum
Stannum
Stibium

3. The electronic configuration of sodium is: 2, 8, 1.
The electronic configuration of neon is: 2, 8.
The electronic configuration of chlorine is: 2, 8, 7.
All the elements in row 3 have 3 shells of electrons.
The Periodic Table may also be divided into the metals on the left and middle, and the non metals on the right hand side.

4. Include the symbols for each of the following elements: Copper (Cu); zinc (Zn); aluminium (Al); lead (Pb); iron (Fe); silver (Ag); gold (Au); carbon (C); oxygen (O); sulfur (S); hydrogen (H) and nitrogen (N).

Theme: Chemical bonding I Ionic bonding
Your name: __________

Use the Periodic Table of Elements in your textbook to answer the following:
1. Elements combine with each other chemically to form compounds.
2. An atom of sodium (symbol Na) will combine with an atom of chlorine (Cl) to form sodium chloride (formula NaCl).
3. Elements that have 8 electrons in their outer shells are very stable. These elements are in Group 8 and are called the noble gases.
4. All other elements would like to have this stable state and there by satisfy the Octet Rule.
5. Atoms of other elements can only achieve this stable state by either giving or taking or sharing outer electrons.
6. An ionic bond is formed when atoms either give or take electrons in order to satisfy the Octet Rule.
7. In an ionic bond, both atom send up with a full outer shell of electrons.
8. Sodium, in Group 1, has 1 outer electron which it gives away when it forms an ionic bond with another atom or atoms. The sodium atom is then called a sodium ion-it now has a total of 10 electron sand 11 protons, and therefore it now has an overall electrical charge of +1.
9. Chlorine, in Group 7, has 7 outer electrons, it will therefore need to gain an electron when it bonds. It will then have 18 electrons and 17 protons, and therefore it will have an electrical charge of -1.
10. After bonding, the chlorine atom is called a chloride ion.
11. An ion is a charged atom or group of atoms.
12. An ionic bond is formed by the force of attraction between a positive and a negative ion.
13. The electronic configuration of the sodium atom is: 2, 8, 1.
14. The electronic configuration of the sodium ion is: 2, 8.
15. The electronic configuration of the chlorine atom is: 2, 8, 7.
16. The electronic configuration of the chloride ion is: 2, 8, 8.

Complete the electronic configuration diagrams below by adding in the electrons to show how sodium and chlorine bond together to form sodium chloride:

**Theme:** Chemical bonding II Covalent bonding

**Your name:** __________

Fill in the gap.

1. A covalent bond is formed when atoms share electrons, so that each atom has a full outer shell.
2. A single covalent bond is formed when atoms combine by sharing one pair of electrons. Examples of this are found in molecules of hydrogen, water, and methane.
3. A double covalent bond is formed when atoms combine by sharing two pairs of electrons. An example of this is found in the oxygen molecule.
4. A hydrogen atom has one electron in its outer shell, it needs to have two electrons to have a stable, full outer shell.
5. In the hydrogen molecule, two hydrogen atoms share their outer electrons.
6. Use the Periodic Table to complete the electronic configurations for the atoms shown:
7. In the spaces provided, draw similar diagrams to show the molecules named:

<table>
<thead>
<tr>
<th>Hydrogen molecule (H₂)</th>
<th>Water molecule (H₂O)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Methane molecule (CH₄)</th>
<th>Oxygen molecule (O₂)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Theme: Chemical formula
Your name: __________

1. Sodium chloride is a compound. For each sodium atom (Na) there is one chlorine atom (Cl). It can be shown as

```
Na  Cl
```

Look at the drawings of these molecules. Draw lines to match them to the correct formulae.

```
CO₂
HCl
H₂O
H₂O₂
```
Composition of compounds

2. Count the atoms present in the different compounds by using the coefficients and subscripts.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Coefficients</th>
<th>Atoms Present</th>
<th>Total Atoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>K₂CO₃</td>
<td>2</td>
<td>2 potassium atoms</td>
<td>Total 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 carbon atom</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 oxygen atoms</td>
<td></td>
</tr>
<tr>
<td>Ba₃(PO₄)₂</td>
<td></td>
<td>3 CaCl₂</td>
<td></td>
</tr>
<tr>
<td>Na₂CrO₄</td>
<td></td>
<td>4 Al₂(CO₃)₃</td>
<td></td>
</tr>
<tr>
<td>Pb(NO₃)₂</td>
<td></td>
<td>2 (NH₄)₂Cr₂O₇</td>
<td></td>
</tr>
</tbody>
</table>

Theme: The relative atomic and molecular masses
Your name: __________

1. Read the definition and provide a suitable terms and translation for them from the box

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>The relative atomic mass</td>
<td>is the average mass of an atom according to relative abundances of its isotopes, on a scale where the mass of one atom of is 12 exactly. It has no units</td>
</tr>
<tr>
<td>The relative molecular mass</td>
<td>is the relative mass expressed in g and has units of g/mole</td>
</tr>
<tr>
<td>The molar mass</td>
<td>is the sum of the relative atomic masses of the atoms in the molecular formula.</td>
</tr>
<tr>
<td></td>
<td>is the amount of a substance</td>
</tr>
</tbody>
</table>

2. The molar mass of the following compounds

a. KNO₃

\[ M(KNO₃) = A(K) + A(N) + 3A(O) = 39 + 14 + 3*16 = 101 \text{ g/mole} \]

b. UF₆

…………………………………………………………………………………………………………

c. (NH₄)₂CO₃

…………………………………………………………………………………………………………

d. Ag₂CrO₄

…………………………………………………………………………………………………………

e. H₃PO₄

…………………………………………………………………………………………………………
f. Ca(NO$_3$)$_2$

g. CH$_3$COOH

h. PbSO$_4$

i. Pb(NO$_3$)$_2$

j. Mg(OH)$_2$

k. Al$_2$(SO$_4$)$_3$

Theme: Unknown element “X”
Your name: __________

1. For each of the following compounds “X” is an unknown element. The molecular mass of the compound is given in the bracket. Work out which element X represents.

a) XO (40)
M(XO) = A(X) + A(O) = A(X) + 16 = 40
A(X) = 40-16 = 24, so X is Mg - magnesium

b) X$_2$O (62)

c) XCl$_2$ (110)

d) MgX$_2$ (94)

e) CX$_2$ (44)

f) XNO$_3$ (63)

g) X(OH)$_2$ (171)
Theme: Percent composition by mass
Your name: __________

Solve the following.

1. What is the mass percentage of magnesium in magnesium bromide, MgBr₂?
2. What is the mass percentage of carbon in glucose, C₆H₁₂O₆?
3. What is the mass percentage of zinc in of Zn₃(PO₄)₂?
4. What is the mass percentage of Cu in CuCO₃?
5. What is the mass percentage of copper in CuCl₂?
6. What is the mass percentage of silver in AgNO₃?
7. Which has more aluminum by mass, Al₂O₃ or Al(NO₃)₃?

h) X₂O₃ (188)
8. A class of compounds called sodium metaphosphates were used as additives to detergents to improve cleaning ability. One of them has a molecular mass of 612g. Analysis shows the composition to be 22.5% Na, 30.4% P, and 47.1% O. Determine the molecular formula of this compound.

9. Glucose, one of the main sources of energy used by living organisms, has a molecular mass of 180.2g. Chemical analysis shows that glucose is 40.0% C, 6.71% H and 53.3% O. Determine glucose’s molecular formula.

Theme: Acids and Bases
Your name: __________

1. Fill in the gap. Some answers may be used more than once.

| Hydrochloric, HCl, sulfuric, corrosive, carbonic, sharp, sour, alkalis, opposite, citric, sodium hydroxide, NaOH, calcium hydroxide, soap, window cleaner, toothpaste, neutralize, salt, indicator, acid, litmus, blue, red, strong, weak, base, 0, 14, universal indicator, 7, lower |

(a) Strong acids such as hydrochloric acid, formula HCl; and sulfuric acid are very corrosive which means they will eat into substances.
(b) Weak acids such as carbonic acid in fizzy drink sand citric acid in oranges and lemons, like all acids, have a sharp, sour taste.
(c) Bases that are dissolved in water are called alkalis.
(d) Bases (or alkalis) are the opposite to acids.
(e) The base sodium hydroxide, formula NaOH, is known as caustic soda because it is so corrosive.
(f) The base calcium hydroxide form slime water when dissolved in water.
(g) Commonly used substances in the home that contain bases include, toothpaste, soap, and window cleaner.
(h) Bases dissolved in water (alkalis) have a soapy feel.
(i) When they mix, an acid and an alkali neutralize each other to form a harmless, non-corrosive substance called a salt.
(j) An indicator is a chemical which shows, by mean sofa colour change, whether a substance is an acid or an alkali.
(k) An example of such a chemical is litmus—it turns red in an acid and blue in an alkali.
(l) The pH scale shows how strong or weak an acid or alkali is; the scale goes from 0 for a strong acid to 14 for a strong base.
(m) To find the pH of a substance, universal indicator paper is used.
(n) A neutral substance, such as sodium chloride has a pH of 7.
(o) The stronger the acid the lower its pH will be.

2. Compete the sentences.
   An acid and a base neutralize each other in a neutralization reaction. Hydrochloric acid, formula HCl and sodium hydroxide, formula NaOH, react together to form the salt called sodium chloride, formula NaCl, and water.
   The chemical equation for this reaction is: HCl+NaOH → NaCl+H₂O.
   The experiment shown below is used to find out exactly how much acid is needed to neutralize a certain amount of alkali; it is called a titration.
The apparatus, A and B, used are: A = burette; B = pipette. The chemical C used is hydrochloric acid; and chemical D is sodium hydroxide, to which a few drops of litmus are added.

3. The substances A, B, C, D and E, whose pH was tested for as shown in the diagram, include: rain water, lemon juice, window cleaner, sulfuric acid and sodium hydroxide solution.

The substances are:
A = sulfuric acid;
B = lemon juice;
C = rain water;
D = window cleaner;
E = sodium hydroxide.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turns red</td>
<td>yellow/orange</td>
<td>yellow</td>
<td>blue</td>
<td>navy/black</td>
<td>pH</td>
</tr>
<tr>
<td>pH</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>10</td>
<td>14</td>
</tr>
</tbody>
</table>

Theme: Air
Your name: __________

Complete the sentences.

(a) Air is a mixture of separate gases, consisting mainly of nitrogen (78%) and oxygen (21%).
(b) The compounds present in air are carbon dioxide and water vapour.
(c) Oxygen is prepared in the laboratory by the breakdown of hydrogen peroxide (formula $H_2O_2$), into water and oxygen. The black powder called manganese dioxide (formula $MnO_2$) acts as a catalyst to make the action go faster.

In the space below, draw a fully labeled diagram (as given in your textbook) to show how oxygen is prepared in the laboratory.
(d) The test for oxygen is that it will **relight a glowing splint**.
(e) Oxygen is a **colour-less, odour-less, tasteless** gas. It is slightly **denser** than air and is slightly **soluble** in water. This is important as it allows **fish** to breathe. Oxygen is very reactive and will react with other elements to form **oxides**. For example it reacts with magnesium to form **magnesium oxide** which is a white powder. It reacts with carbon to form **carbon dioxide** which can be tested for using **lime water**.
(f) Three uses of oxygen are:
1. **Breathing**
2. **Welding**
3. **Burning**

**Theme: Water**

**Your name: __________**

(a) Water is a **covalently** bonded compound consisting of the elements **hydrogen** and **oxygen**. The formula for water is **H₂O**.
(b) The test for water is **cobalt chloride** paper, which turns colour from **blue** to **pink** if water is present.
(c) Pure water freezes at 0°C and boils at 100°C at normal atmospheric pressure.
(d) Water **expands** when it freezes; therefore the **density** of ice is less than that of water. Ice therefore **floats** in water.
(e) Many substances can **dissolve** in water because it is an excellent solvent.
(f) What two scientific processes are occurring at A and B?
   A: **evaporation**
   B: **condensation**

**Theme: Groups of Elements**

**Your name: __________**

1. Complete the sentences.
   (a) Groups of elements are arranged into **vertical columns** in the Periodic Table.
(b) All the elements in a particular Group have the same number of electrons in their outer shells; and they all behave in a similar way chemically.

(c) Alkali Metals, such as lithium, sodium, and potassium will float in water because they all have very low density.

(d) The Alkali Metals must be stored in oil because they react readily with elements in the air such as oxygen.

(e) Alkali Metals react with oxygen to form oxides.

(f) Sodium reacts with water to form sodium hydroxide (formula NaOH) and hydrogen. The solution is then alkaline and turns red litmus blue.

(g) In the Alkali Metals, reactivity increases as we go down the Group.

(h) The Alkali Metal sodium is used in street lighting.

(i) The Alkali Metal lithium is used to manufacture camera and watch batteries.

2. The diagram shows potassium reacting with water. The gas given off is hydrogen. The product potassium hydroxide is also formed. This product forms an alkaline solution in the water which turns red litmus paper blue in colour. Write a word equation for the reaction: potassium+water→potassium hydroxide+hydrogen

3. With reference to the diagram, explain why potassium is more reactive than sodium. The outer electron in potassium is further away from the positive nucleus and is therefore easier to remove. This means that potassium will react faster. Of the three elements shown, lithium is the least reactive.

Theme: Metals
Your name: __________

1. (a) Metals are found on the left and in the middle of the Periodic Table. (b) When cut with a knife, metals have a shiny, metallic appearance. (c) All metals are solids except for mercury which is a liquid at room temperature. (d) Metals can be hammered out into thin sheets-i.e. they are malleable. (e) Metals can best retched out into thin wires-i.e. they are ductile. (f) Metals usually have very high melting point. (g) Metals are good conductors of heat and electricity. (h) Metals react with elements in the air, such as oxygen, to form oxides. (i) Iron, in the presence of water, slowly reacts with
oxygen in the air to form rust, the chemical name for which is iron oxide. (j) Corrosion returns metals to their ore state (i.e. as they were in the ground).

2. (a) The apparatus shown below was setup to investigate the: conditions necessary for rusting.
   (b) X = calcium chloride
   Y = oil layer
   Z = boiled water
   (c) X removes water from the test tube. (d) Z has been boiled in order to remove any oxygen from it.
   (e) Y ensures that no further oxygen can get at the nail. (f) The nail in tube A has both water and oxygen; so it will rust.

3. (a) A list of metals placed in order of how reactive they are is called the activity series of metals. (b) The metals are arranged on the basis of how quickly they react with oxygen, water, and dilute hydrochloric acid. (c) Only the least reactive metals are found free in Nature, because the more reactive ones would react with other elements to form compounds of the metal.
   (d) The diagram shows samples of metals placed in four test tubes, containing cold water. A = magnesium; B = calcium; C = zinc and D = copper. Only the metal in test tube B react vigorously, giving off a large amount hydrogen gas. On close inspection, a few bubbles of hydrogen gas are seen on the surface of the metal in test tube A. From experiment, it is concluded that calcium is most reactive metal, and magnesium is the next most reactive.

4. (a) When metals react with hydrochloric acid, hydrogen gas is given off, and the chloride of the metal is formed.
   (b) The diagram shows the preparation of hydrogen by reacting with dilute hydrochloric acid.
   (c) The (I) word and (II) chemical equations for the reaction are:
   (I) zinc + hydrochloric acid → zinc chloride + hydrogen.
   (II) Zn + 2HCl → ZnCl₂ + H₂.
   (d) The gas collected is tested for by placing a lit taper over the mouth of the test tube. The gas hydrogen is present if it goes ‘pop’.
   (e) The gas collected forms an explosive mixture with air.

Theme: Balancing Act Practice
Your name: __________

Balance each equation. Be sure to show your lists! Remember you cannot add subscripts or place coefficients in the middle of a chemical formula.
1. Na + MgF₂ → NaF + Mg
2. Mg + HCl → MgCl₂ + H₂
3. Cl₂ + KI → KCl + I₂
4. NaCl → Na + Cl₂
5. Na + O₂ → Na₂O
6. Na + HCl → H₂ + NaCl
7. K + Cl₂ → KCl

**Theme:** Balancing Equations Practice

**Your name:** 

1. Balance the following equations:

1) ___ NaNO₃ + ___ PbO → ___ Pb(NO₃)₂ + ___ Na₂O
2) ___ AgI + ___ Fe₂(CO₃)₃ → ___ FeI₃ + ___ Ag₂CO₃
3) ___ C₂H₄O₂ + ___ O₂ → ___ CO₂ + ___ H₂O
4) ___ ZnSO₄ + ___ Li₂CO₃ → ___ ZnCO₃ + ___ Li₂SO₄
5) ___ V₂O₅ + ___ CaS → ___ CaO + ___ V₂S₅
6) ___ Mn(NO₂)₂ + ___ BeCl₂ → ___ Be(NO₂)₂ + ___ MnCl₂
7) ___ AgBr + ___ GaPO₄ → ___ Ag₃PO₄ + ___ GaBr₃
8) ___ H₂SO₄ + ___ B(OH)₃ → ___ B₂(SO₄)₃ + ___ H₂O
9) ___ S₈ + ___ O₂ → ___ SO₂
10) ___ Fe + ___ AgNO₃ → ___ Fe(NO₃)₂ + ___ Ag

**Solutions for the Balancing Equations**

1) 2 NaNO₃ + PbO → Pb(NO₃)₂ + Na₂O
2) 6 AgI + Fe₂(CO₃)₃ → 2 FeI₃ + 3 Ag₂CO₃
3) C₂H₄O₂ + 2 O₂ → 2 CO₂ + 2 H₂O
4) ZnSO₄ + Li₂CO₃ → ZnCO₃ + Li₂SO₄
5) V₂O₅ + 5 CaS → 5 CaO + V₂S₅
6) Mn(NO₂)₂ + BeCl₂ → Be(NO₂)₂ + MnCl₂
7) 3 AgBr + GaPO₄ → Ag₃PO₄ + GaBr₃
8) 3 H₂SO₄ + 2 B(OH)₃ → B₂(SO₄)₃ + 6 H₂O
9) S₈ + 8 O₂ → 8 SO₂
10) Fe + 2 AgNO₃ → Fe(NO₃)₂ + 2 Ag

2. Choose two balanced equations from above and represent them using the ball model:

**Example:** 2 H₂ + O₂ → 2 H₂O

Balanced Equation:

Model:
Balanced Equation:

Model:

Theme: Pure substances and mixtures, Metals and nonmetals, Allotropes.
Your name: __________

1. Which statements are correct?
I. An aqueous solution of table salt is a homogeneous mixture
II. A steel is a pure substance
   A) Only I statement is correct
   B) Only II statement is correct
   C) Both statements are correct
   D) Both statement are wrong

2. Which statements are correct?
I. Sea water is a mixture
II. Ozone is a pure substance
   A) Only I statement is correct
   B) Only II statement is correct
   C) Both statements are correct
   D) Both statement are wrong

3. Which statements are correct?
I. A natural gas is a pure substance
II. A diamond is a pure substance
   A) Only I statement is correct
   B) Only II statement is correct
   C) Both statements are correct
   D) Both statement are wrong

4. Which statements are correct?
I. A vinegar is a pure substance
II. Iodine solution used as a medicine is a mixture
   A) Only I statement is correct
   B) Only II statement is correct
   C) Both statements are correct
   D) Both statement are wrong

5. Choose the statement in which oxygen is a pure substance
   A) Hydrogen is found in all acids
   B) Hydrogen is the lightest gas
   C) Mass percentage of hydrogen in water is 11%
   D) Electronegativity of hydrogen is 2,1

6. You have sulfur, white phosphorus, nitric acid. Which ones are compounds?
   A) Only sulfur
   B) White phosphorus and Nitric acid
   C) Only white phosphorus
   D) Only nitric acid

7. Choose the statement in which oxygen is a pure substance
   A) oxygen is found in water molecule
   B) carbon dioxide molecule is composed of carbon and two oxygen atoms
   C) in air there is 21% of oxygen
   D) three oxygen atoms form ozone molecule

8. Which one of the following is a pure substance?
   A) Air
   B) Copper
   C) Glass
   D) Soil

9. Which statements are correct?
I. A mixture of table salt and sand is a heterogeneous mixture
II. Dissolving of table salt in water gives a heterogeneous mixture
   A) Only I statement is correct
   B) Only II statement is correct
   C) Both statements are correct
   D) Both statement are wrong

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10. Both of the following is a pure substance:
   A) sea water and table salt
   B) sulfuric acid and sand
   C) iron ore and sodium hydroxide
   D) oxygen and sodium sulfate crystals

11. In which series of elements there are only metals?
   A) K, Br, Fe
   B) Ca, Cu, C
   C) Na, Mg, K
   D) Cl, Br, N

12. In which series of elements there are only nonmetals?
   A) H, N, As
   B) C, Ca, K
   C) Na, k, Mg
   D) He, Na, Ne

13. Both of the following is a mixture
   A) distilled water and table salt
   B) sulfur and nitric acid solution
   C) steel and air
   D) ozone and iron

14. Allotropes of Carbon atom
   A) carbide, diamond, graphite
   B) diamond, graphite, charcoal
   C) carbonate, diamond, graphite
   D) carbonate, carbide, charcoal

15. Both of the following is a pure substance
   A) nitric acid solution, iodine solution
   B) sodium, brass
   C) copper (II) oxide, oxygen
   D) copper ore, sodium carbonate

16. Which one of the following is a complex compound?
   A. Graphite
   B. Methane
   C. Diamond
   D. Sodium

17. Which one of the following is a complex compound?
   A. Graphite
   B. Copper
   C. Ammonia
   D. Sodium

18. Which one of the following is a simple compound?
   A. Water
   B. Ammonia
   C. Ozone
   D. Methane

19. Which one of the following is a complex compound?
   A. Iodine
   B. Ammonia
   C. Ozone
   D. Nitrogen

20. Which one of the following elements doesn’t have allotropes?
   A. Phosphorus
Theme: Physical and chemical changes.
Your name: __________

1. Which of the following is an example of physical change?
   A) Mixing baking soda and vinegar together, and this causes bubbles and foam.
   B) A glass cup falls from the counter and shatters on the ground.
   C) Lighting a piece of paper on fire and the paper burns up and leaves ashes.
   D) Baking a birthday cake for your mother.

2. Which of the following is an example of chemical change?
   A) Filling up a balloon with hot air.
   B) Taking a glass of water and freezing it by placing it in the freezer.
   C) A plant collecting sunlight and turning it into food.
   D) Your dog ripping up your homework.

3. Which change can be easily be reversed?
   A) Chemical Change
   B) Physical Change
   C) Both a physical and chemical change
   D) Neither a physical or chemical change

4. When a new substance is formed with different properties than the original substance it is called a
   A) Chemical change
   B) Physical change
   C) Freezing
   D) Boiling

5. Which is an example of a physical change?
   A) Metal rusting
   B) Silver tarnishing
   C) Water boiling
   D) Paper burning

6. Which is an example of chemical change?
   A) Water freezes
   B) Wood is cut
   C) Bread is baked
   D) Wire is bent

7. Which is not a clue that could indicate a chemical change?
   A) Change in color
   B) Change in shape
   C) Change in energy
   D) Change in odor

8. A chemical change
   A) Changes matter from one form to another.
   B) Destroys matter.
   C) Creates matter.
   D) Does not change matter in any way

9. Which of the following is a physical change?
   A) Iron is oxidized to iron oxide
   B) Aluminum meal is pounded into thin sheets
   C) Copper reacts with a strong acid
   D) Sodium metal explodes on contact with water

10. Which of the following is an example of a chemical change?
11. Which of the following is a common sign that a chemical change has occurred?
A) A chemical has changed size.
B) A chemical has changed to a different state (solid, liquid or gas)
C) A chemical has become a different shape.
D) A chemical has turned a different color.

12. When silver metal comes in contact with sulfur, silver sulfide forms and the silver appears darker. This is a
A) Change of form
B) Chemical change
C) Change of state
D) Physical change

13. Two solutions are added together and the new solution becomes hot. This tells you that
A) A gas is being produced.
B) The solutions are not soluble.
C) The physical properties are the same.
D) A chemical change is taking place.

14. A solid brown metal is added to a clear acidic solution. A white powder appears and the acid solution becomes cloudy. Which type(s) of change have/has occurred?
A) Both chemical and physical
B) Only physical
C) Neither chemical nor physical
D) Only chemical

15. A physical change occurs when…
A) Both the appearance of a substance and its identity change.
B) The appearance of a substance changes but its identity does not.
C) The identity of a substance changes but its appearance does not.
D) Neither the appearance of a substance nor its identity changes.

16. Which of the following is a physical change?
A) Photosynthesis
B) Burning of sulfur
C) Dissolving of baking soda in a vinegar
D) Dissolving of salt

17. Which of the following is a chemical change?
A) Combustion of sulfur
B) Sublimation of iodine
C) Melting of copper
D) Evaporation of alcohol

18. Which of the following is a physical change?
A) Decomposition of malachite
B) Rusting of iron
C) Crashing of blue vitriol crystals
D) Souring of milk

19. Which of the following statements best describes what happens when chocolate melts?
A) This is a physical change, and the molecules move farther apart.
B) This is a chemical change, and the molecules move farther apart.
C) This is a physical change, and the molecules move closer together.
D) This is a chemical change, and the molecules move closer together.

20. Which of the following is not a chemical change?
A) Burning  C) Forming a Precipitate
B) Melting     D) Production of a Gas

**Theme:** Atomic structure, Isotopes.

**Your name:** __________

1. The same number of valence electrons is there in elements with atomic numbers:
   A) 6 and 14
   B) 19 and 20
   C) 7 and 17
   D) 2 and 10

2. Number of valence electrons of an atom with nucleus charge of +14 is
   A) 6
   B) 2
   C) 8
   D) 4

3. What is the charge of the nucleus of an element placed in 3rd period IIA group?
   A) +12
   B) +2
   C) +10
   D) +8

4. How many valence electrons are there in an atom containing 6 protons?
   A) 1
   B) 2
   C) 6
   D) 4

5. Both elements has 3 energy levels
   A) C and Cl
   B) Mg and S
   C) B and Al
   D) P and N

6. Charge of nucleus and number of valence electrons of aluminum atom are correspondingly
   A) +13 and 3
   B) +27 and 3
   C) +13 and 27
   D) +3 and 13

7. Number of valence electrons of an atom containing 11 protons is
   A) 1
   B) 6
   C) 3
   D) 8

8. Boron and aluminum atoms have same number of
   A) energy levels
   B) protons
   C) valence electrons
   D) neutrons

10. Charge of nucleus of silicon atom is
    A) +14
    B) +28
    C) +3
    D) +4

11. Atomic number of a chemical element equals to:
    A) period number
    B) group number
12. What is the number of neutrons in sodium atom?
   A) 12
   B) 11
   C) 23
   D) 34

13. The charge of the nucleus of 15N is
   A) +14
   B) +7
   C) +8
   D) +5

14. Highest oxide of nitrogen is
   A) NO
   B) N₂O₃
   C) NO₂
   D) N₂O₅

15. Volatile hydrogen containing compound of phosphorus and nitrogen is (E is nitrogen or phosphorus)
   A) HE
   B) H₂E
   C) H₃E
   D) H₄E

16. Highest oxide of sulfur is
   A) SO₂
   B) SO₃
   C) H₂SO₄
   D) H₂SO₃

17. Highest oxide of chlorine is
   A) Cl₂O₃
   B) Cl₂O₇
   C) Cl₂O
   D) Cl₂O₅

18. Volatile hydrogen containing compound of carbon is written as (E is carbon)
   A) HE
   B) H₂E
   C) H₃E
   D) H₄E

19. Which of the following elements form an acid H₂XO₃
    A) phosphorus
    B) carbon
    C) nitrogen
    D) chlorine

20. Which of the following elements form an acid H₂XO₃
    A) phosphorus
    B) carbon
    C) nitrogen
    D) chlorine

**Theme:** Periodic trends

**Your name:** __________

1. In which one of the following metallic properties of chemical elements decreases?
   A) P → S → Cl
2. Which one of the following metals is more active?
   A) Ca
   B) Cu
   C) Al
   D) Na

3. In which one of the following atomic radii of the chemical elements increases?
   A) K, Na, Li
   B) F, O, N
   C) P, S, Cl
   D) Ca, Mg, Be

4. Which of the following elements has the largest atomic radius?
   A) Carbon
   B) Silicon
   C) Germanium
   D) Tin

5. Which of the following elements has the largest atomic radius?
   A) Nitrogen
   B) Oxygen
   C) Fluorine
   D) Neon

6. Which has the highest electronegativity?
   A) Na
   B) Al
   C) S
   D) Cl

7. Which has the lowest electronegativity?
   A) F
   B) I
   C) Br
   D) Cl

8. Which element is most reactive?
   A) Li
   B) Rb
   C) K
   D) Na

9. Which element has more metallic properties?
   A) Chlorine
   B) Aluminum
   C) Phosphorus
   D) Magnesium

10. Which element has more non-metallic properties?
    A) Se
    B) S
    C) Po
    D) O

11. Which of the following elements has the largest atomic radius?
    A) Aluminum
    B) Chlorine
    C) Silicon
    D) Phosphorus
12. Oxidizing properties are best shown for
   A) Silicon
   B) Nitrogen
   C) Carbon
   D) Oxygen

13. Which has the lowest electronegativity?
   A) C
   B) Ge
   C) Si
   D) Sn

14. Oxidizing properties are least shown for
   A) Beryllium
   B) Aluminum
   C) Boron
   D) Magnesium

15. Which of the following elements has the smallest atomic radius?
   A) Iron
   B) Potassium
   C) Bromine
   D) Krypton

16. Based on periodic table trends, which of the following elements has the largest atomic radius?
   A) Aluminum
   B) Fluorine
   C) Sulfur
   D) Potassium

17. Which of these elements has the highest electronegativity?
   A) Lithium
   B) Potassium
   C) Nitrogen
   D) Arsenic

18. As you move left to right across the periodic table, which of the following is generally true?
   A) Atomic radius increases.
   B) Atomic radius decreases.
   C) Electronegativity decreases.
   D) Ionization energy decreases.

19. As you move up and to the right on the periodic table:
   A) atomic radius increases and electronegativity increases
   B) atomic radius decreases and electronegativity increases
   C) atomic radius increases and electronegativity decreases
   D) atomic radius decreases and electronegativity decreases

20. As you move from the top to the bottom of the periodic table:
   A) ionization energy increases and electronegativity increases
   B) ionization energy decreases and electronegativity increases
   C) ionization energy increases and electronegativity decreases
   D) ionization energy decreases and electronegativity decreases

**Theme:** Types of chemical bonds and crystal grains

**Your name:** __________

1. Covalent polar bond is formed between
   A) Sodium and Bromine
   B) Sulfur and Oxygen
   C) Hydrogen atoms
2. Which one of the following compounds has a covalent polar bond?
   A) NaCl
   B) H$_2$S
   C) H$_2$
   D) CaCl$_2$

3. Compound which has ionic bond
   A) SO$_3$
   B) NH$_3$
   C) Ca
   D) CaO

4. Both of the following compounds have ionic bond
   A) NH$_3$, N$_2$
   B) CaCl$_2$, Na$_2$O
   C) Cu, CaF$_2$
   D) CuO, N$_2$O$_5$

5. Which one of the following compounds have ionic bond?
   A) hydrogen sulfide
   B) hydrogen fluoride
   C) sodium fluoride
   D) sulfur trioxide

6. What is the type of chemical bond in sodium sulfide molecule?
   A) Ionic bond
   B) Metallic bond
   C) Covalent polar bond
   D) Covalent non polar bond

7. Which one has an ionic bond?
   A) Hydrogen chloride
   B) Calcium chloride
   C) Chlorine
   D) Chloric acid

8. Compounds with same type of chemical bond
   A) Sulfur dioxide and Ammonia
   B) Barium oxide and Sulfur trioxide
   C) Water and Hydrogen
   D) Hydrogen and Methane

9. Compound which has covalent non polar bond
   A) Chlorine molecule
   B) Dichloro monoxide
   C) Hydrogen chloride
   D) Calcium chloride

10. Both of the following compounds have covalent polar bond
    A) CO and P$_4$
    B) NH$_3$ and SO$_2$
    C) O$_3$ and Br$_2$
    D) CCl$_4$ and K$_2$O

11. Compounds with same type of chemical bond
    A) Sulfur dioxide and Potassium bromide
    B) Barium oxide and Sodium chloride
    C) Water and Hydrogen
    D) Hydrogen and Methane

12. What are the types of chemical bond in diphosphorus pentaoxide and lithium oxide correspondingly
    A) both of the following have non polar covalent bond
    B) both of the following have covalent polar bond
    C) covalent non polar and ionic bond
13. Compound which has both ionic and covalent polar bond is
   A) NaOH
   B) HNO₃
   C) Na₂O₂
   D) HClO₃

14. Compounds which have only covalent polar bond
   A) SCl₂ and PH₃
   B) HI and Cl₂
   C) I₂O₇ and FeCl₂
   D) Ag₂S and PbCl₂

15. Compounds which have covalent polar and ionic bonds correspondingly
   A) PCl₅ and KBr
   B) SCl₂ and O₂
   C) Na₂O and K₂S
   D) Ba and O₃

16. Compounds which have only covalent non-polar bond
   A) Chlorine and zinc
   B) Diamond and bromine
   C) Sodium chloride and hydrogen chloride
   D) Zinc and barium

17. Compounds which have only ionic bond
   A) Calcium oxide and carbon monoxide
   B) Dinitrogen monoxide and potassium chloride
   C) Calcium oxide and calcium chloride
   D) Nitrogen and fluorine

18. Compounds which have only covalent nonpolar bond
   A) Dichloropentaoxide and hydrogen
   B) Nitrogen and chlorine
   C) Copper (II) oxide and sodium chloride
   D) Hydrogen chloride and chlorine

19. What is the type of chemical bond in CaF₂?
   A) Ionic
   B) Metallic
   C) Covalent polar
   D) Covalent nonpolar

20. Compound with molecular structure
   A) Si
   B) SiO₂
   C) C
   D) CO₂

**Theme:** Oxidation number and valency

**Your name:** __________

1. Oxidation number of nitrogen in ammonia is
   A) -3
   B) 0
   C) +3
   D) +5

2. Compound in which oxidation number of chlorine is zero
   A) Cl₂
   B) NaCl
3. Chlorine has oxidation number +1
   A) HClO
   B) CaCl₂
   C) CCl₄
   D) Ca(ClO₂)₂

4. In which of the following compounds oxidation number of chlorine is +7?
   A) HCl
   B) Cl₂O
   C) KClO₃
   D) HClO₄

5. Oxidation number of chlorine in KClO₃
   A) -1
   B) +3
   C) +5
   D) +7

6. Nitrogen and carbon atoms have the same oxidation number in the following compounds
   A) NH₃ and CO
   B) NO₂ and CCl₄
   C) N₂O₃ and CO₂
   D) Na₃N and CH₄

7. In which of the following compounds sulfur has a negative oxidation number?
   A) CuS
   B) CuSO₄
   C) SO₂
   D) SF₆

8. Oxidation number of phosphorus in sodium phosphate
   A) +5
   B) -3
   C) 0
   D) +3

9. In which of the following compounds oxidation number of phosphorus is -3?
   A) K₃P
   B) Na₃PO₃
   C) H₃PO₃
   D) Ca₃(PO₄)₂

10. In which of the following compounds oxidation number of nitrogen is +3?
    A) N₂O₃
    B) Ca₃N₂
    C) HNO₂
    D) KNO₃

11. Carbon has an oxidation number -4 in the following compound
    A) CO
    B) CO₂
    C) Na₂CO₃
    D) Al₄C₃

12. In which of the following compound oxidation number of sulfur +4?
    A) SO₃
    B) NaHSO₄
    C) K₂S
    D) Fe₂(SO₄)₃

13. In which of the following compounds nitrogen has the lowest oxidation number?
A) NaNO₃  
B) N₂  
C) KNO₂  
D) NH₄Cl

14. Nitrogen and carbon atoms have same oxidation numbers in  
A) NH₃ and CO  
B) NO₂ and CCl₄  
C) N₂O₃ and CO₂  
D) Na₃N and CH₄

15. In which of the following compounds nitrogen has the highest oxidation number?  
A) KNO₃  
B) Ca₃N₂  
C) NaNO₂  
D) NH₄Cl

16. Oxidation number of chlorine is same as in HCl in which of the following compounds?  
A) Cl₂O  
B) NH₄Cl  
C) HClO  
D) Cl₂O₇

17. In which one of the following compounds nitrogen has highest oxidation number?  
A) Ca₃N₂  
B) (NH₄)₂S  
C) NO₂  
D) KNO₃

18. Nitrogen has the same oxidation number in the following pair of compounds  
A) NH₃ and NO  
B) NO₂ and N₂O₅  
C) NO and NO₂  
D) N₂O₃ and HNO₃

19. Chlorine has the same oxidation number in the following pair of compounds  
A) Cl₂O₇ and HClO₄  
B) Cl₂O and KClO₃  
C) CaCl₂ and Mg(ClO₂)₂  
D) Cl₂O and NaClO₂

20. Carbon has the lowest oxidation number in  
A) Sodium carbonate  
B) Carbon monoxide  
C) Methane  
D) Carbon dioxide

**Theme:** Classification of inorganic compounds

**Your name:** _________
5. Acid and alkali base are correspondingly
   A) HCl and Cu(OH)₂
   B) HNO₃ and Ba(OH)₂
   C) NaCl and KOH
   D) HBr and Zn(OH)₂

6. Amphoteric oxide and acid are correspondingly
   A) ZnO and H₂S
   B) BaO and H₂N
   C) P₂O₃ and HClO
   D) BeO and NaOH

7. CaO and KOH are
   A) Basic oxide and alkali base
   B) Acidic oxide and alkali base
   C) Amphoteric oxide and acid
   D) Amphoteric oxide and basic oxide

8. Which one of the following is an basic oxide?
   A) Magnesium oxide
   B) Dichloroheptaoxide
   C) Silicon dioxide
   D) Dinitrogen pentaoxide

9. Both of the following compounds are acidic oxides
   A) H₂O and Al₂O₃
   B) SO₂ and P₂O₅
   C) Na₂O and Fe₂O₃
   D) ZnO and N₂O₅

10. Which one is an alkali base?
    A) Ba(OH)₂
    B) Cu(OH)₂
    C) Zn(OH)₂
    D) Mg(OH)₂

11. Only neutral oxides are
    A) FeO, Fe₂O₃
    B) CO, CO₂
    C) N₂O₃, NO₂
    D) N₂O, NO

12. Compounds Ca₃(PO₄)₂ and Na₂O are correspondingly
    A) base and acidic oxide
    B) salt and base
    C) salt and basic oxide
    D) acid and amphoteric oxide

13. Barium hydroxide and potassium phosphate are
    A) base and neutral salt
    B) basic oxide and acid
    C) amphoteric hydroxide and neutral salt
    D) base and basic oxide

14. Match class of the inorganic compound and chemical formula of a compound

<table>
<thead>
<tr>
<th>Class of compound</th>
<th>Chemical formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Acidic salt</td>
<td>1) HNO₃</td>
</tr>
<tr>
<td>B) Neutral salt</td>
<td>2) NaHCO₃</td>
</tr>
<tr>
<td>C) Acid</td>
<td>3) (NH₄)₂SO₄</td>
</tr>
<tr>
<td>D) Base</td>
<td>4) Fe(OH)₂</td>
</tr>
<tr>
<td></td>
<td>5) Fe(OH)Cl</td>
</tr>
</tbody>
</table>

15. Only basic oxides are shown in
A) Na₂O, MgO
B) Li₂O, BeO
C) B₂O₃, Al₂O₃
D) CO, CuO

16. Only alkali bases are shown in
   A) NaOH and Ba(OH)₂
   B) NH₄OH and Cu(OH)₂
   C) LiOH and Al(OH)₃
   D) Be(OH)₂ and Mg(OH)₂

17. Match class of the inorganic compound and chemical formula of a compound

<table>
<thead>
<tr>
<th>Class of compound</th>
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<tbody>
<tr>
<td>A. Basic oxide</td>
<td>1. H₂SO₄</td>
</tr>
<tr>
<td>B. Base</td>
<td>2. P₂O₅</td>
</tr>
<tr>
<td>C. Acid</td>
<td>3. NaCl</td>
</tr>
<tr>
<td>D. Salt</td>
<td>4. FeO</td>
</tr>
<tr>
<td></td>
<td>5. Ca(OH)₂</td>
</tr>
</tbody>
</table>

18. Which one of the following is an amphoteric oxide?
   A) FeO
   B) ZnO
   C) BaO
   D) Na₂O

19. Amphoteric oxide and acid are
   A) ZnO and H₂S
   B) BaO and NH₃
   C) P₂O₃ and HClO
   D) BeO and NaOH

20. Which one of the following is an amphoteric?
   A) Al₂O₃
   B) MgO
   C) KOH
   D) Na₂O

Theme: Types of chemical reactions

Your name: __________

1. Match type of reaction and chemical equation

<table>
<thead>
<tr>
<th>Type of reaction</th>
<th>Chemical equation</th>
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<tbody>
<tr>
<td>A. Combination reaction</td>
<td>1. Cu + AgNO₃ = Cu(NO₃)₂ + Ag</td>
</tr>
<tr>
<td>B. Decomposition reaction</td>
<td>2. CaCO₃ = CaO + CO₂</td>
</tr>
<tr>
<td>C. Single displacement reaction</td>
<td>3. 2NO + O₂ = 2NO₂</td>
</tr>
</tbody>
</table>

2. Match type of reaction and chemical equation

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<tbody>
<tr>
<td>A. Combination reaction</td>
<td>1. MgO + CO₂ → MgCO₃</td>
</tr>
<tr>
<td>B. Decomposition reaction</td>
<td>2. Cu(OH)₂ + 2HCl → CuCl₂ + 2H₂O</td>
</tr>
<tr>
<td>C. Double displacement reaction</td>
<td>3. 2AgI = 2Ag + I₂</td>
</tr>
</tbody>
</table>
3. **Match type of reaction and chemical equation**

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<tbody>
<tr>
<td>A. Double displacement reaction</td>
<td>1. FeO + H₂ = Fe + H₂O</td>
</tr>
<tr>
<td>B. Decomposition reaction</td>
<td>2. CaO + 2HCl = CaCl₂ + H₂O</td>
</tr>
<tr>
<td>C. Single displacement reaction</td>
<td>3. Cu(OH)₂ = CuO + H₂O</td>
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4. **Match type of reaction and chemical equation**

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<tbody>
<tr>
<td>A. Combination reaction</td>
<td>1. H₂SO₄ + Zn = ZnSO₄ + H₂</td>
</tr>
<tr>
<td>B. Single displacement reaction</td>
<td>2. Na₃PO₄ + 3HNO₃ = 3NaNO₃ + H₃PO₄</td>
</tr>
<tr>
<td>C. Double displacement reaction</td>
<td>3. Fe(OH)₂ + O₂ + 2H₂O = 4Fe(OH)₃</td>
</tr>
</tbody>
</table>

5. **Match type of reaction and chemical equation**

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<td>A. Combination reaction</td>
<td>1. Zn(OH)₂ = ZnO + H₂O</td>
</tr>
<tr>
<td>B. Decomposition reaction</td>
<td>2. 2K + 2H₂O = 2KOH + H₂</td>
</tr>
<tr>
<td>C. Single displacement reaction</td>
<td>3 CH₄ + 2O₂ = CO₂ + 2H₂O</td>
</tr>
</tbody>
</table>

6. **Match type of reaction and chemical equation**

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<tbody>
<tr>
<td>A. Double displacement reaction</td>
<td>1. Fe + 2HCl = FeCl₂ + H₂</td>
</tr>
<tr>
<td>B. Decomposition reaction</td>
<td>2. 2HCl + Ba(OH)₂ = BaCl₂ + 2H₂O</td>
</tr>
<tr>
<td>C. Single displacement reaction</td>
<td>3. 2Al(OH)₃ = Al₂O₃ + 3H₂O</td>
</tr>
</tbody>
</table>

7. **Match type of reaction and chemical equation**

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</tr>
</thead>
<tbody>
<tr>
<td>A. Double displacement reaction</td>
<td>1. 2KNO₃ = 2KNO₂ + O₂</td>
</tr>
<tr>
<td>B. Decomposition reaction</td>
<td>2. 2SO₂ + O₂ = 2SO₃</td>
</tr>
<tr>
<td>C. Combination reaction</td>
<td>3. 2HCl + MgO = MgCl₂ + H₂O</td>
</tr>
</tbody>
</table>

8. **Match type of reaction and chemical equation**

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<tbody>
<tr>
<td>A. Combination reaction</td>
<td>1. H₂SO₄ + Zn = ZnSO₄ + H₂</td>
</tr>
<tr>
<td>B. Decomposition reaction</td>
<td>2. (CuOH)₂CO₃ = 2CuO + CO₂ + H₂O</td>
</tr>
<tr>
<td>C. Single displacement reaction</td>
<td>3. SO₃ + Na₂O = Na₂SO₄</td>
</tr>
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9. **Match type of reaction and chemical equation**

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<tbody>
<tr>
<td>A. Double displacement reaction</td>
<td>1. Ca + 2H₂O = Ca(OH)₂ + H₂</td>
</tr>
<tr>
<td>B. Combination reaction</td>
<td>2. Na₂SO₃ + BaCl₂ = 2NaCl + BaSO₃</td>
</tr>
<tr>
<td>C. Single displacement reaction</td>
<td>3. NH₃ + HNO₃ = NH₄NO₃</td>
</tr>
</tbody>
</table>

10. **Match type of reaction and chemical equation**

<table>
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<th>Type of reaction</th>
<th>Chemical equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Double displacement reaction</td>
<td>1. 2FeCl₂ + Cl₂ = 2FeCl₃</td>
</tr>
<tr>
<td>B. Combination reaction</td>
<td>2. 2Al + 3H₂SO₄ = Al₂(SO₄)₃ + 3H₂</td>
</tr>
<tr>
<td>C. Single displacement reaction</td>
<td>3. AgNO₃ + HCl = AgCl + HNO₃</td>
</tr>
</tbody>
</table>
References

1. Discovering science Second Edition. Teachers Resource Book [74] [76] [82] [103]
3. Introduction to Chemistry Peter G. Nelson
4. Introduction to Chemistry Author: Tracy Poulsen [41] [55] [59]
5. Chemistry. Brian Murphy, Gary Horner, David Tarcy, Sergey Bylikin. OXFORD