Chemistry Book

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Contents

Introduction

This booklet came out as the result of some chemistry exercises developed by the students of the school partners of the project ”Schools for a Greener Europe”.

During these three school years the students were able to try some experiments where they could reuse, reduce and recycle. Besides creating new products, they also learned about preserving the nature and the environment.

By developing those experiments, mixing up elements and observing, they concluded that the substances can react and originate chemical or physical changes.

As Lavoisier said ” Life is chemical process”.

Chemistry in everyday life. Many of the changes you observe in the world around you are caused by chemical reactions. It can be used to make colors change, alter recipes, color flames, make things glow in the dark, or even make stuff explode. Many people study chemistry not because it's a requirement for a class but because they are interested in using it to explore the world and to try science projects.

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Italy

1. DIY natural pesticide.

At the I.C. Giovanni XXIII in Terrasini (Italy), students make their own natural pesticide for the school's garden.These pesticides made from naturally occurring ingredients, rid the plants of pests so students can grow healthy produce and avoid negative environmental impacts.

What you'll need:

1 teaspoon of baking soda

1/3 cup of olive oil or cooking oil

1 cup of water



Directions:

Mix all ingredients and put in a spray bottle. Shake thoroughly.

This spray works great to kill aphids, spider mites, and whiteflies. It can be used on almost any type of vegetable or flower.

2. Compost

A compost system uses water, air and microorganisms to oxidize and break down, or biodegrade, complex materials into simpler elements and molecules. Students are making compost for the school garden. They have 38 Kg of *browns (carbon organic material)*. Considering the ideal ratio of browns and greens is 30:1. How many gr of greens (nitrogen organic material) will be needed?

3. Separating salt from water through evaporation

Step 1. Mix salt and water in a bowl.

Step 2. Put the solution in a pan and bring it to a boil.

Step 3. Continue to boil until the water completely evaporates leaving the salt behind.

Evaporation is used to separate homogeneous mixtures. That is, mixtures where solids mix well with liquids. For example, separating salt from water. Water is separated from the salt when it is heated, leaving behind the salt. Just like in the salt field, the salt water is heated by the sun leaving the sea salt behind.

Salt pans in Trapani, Sicily

4. Trees and Co_2

A typical fully grown tree can absorb around 21 kilograms of carbon dioxide (CO_2) per year. How much carbon dioxide can a tree absorb over a lifetime of 100 years? How much carbon dioxide is released from the Nature park that has 450 trees in 5 years?

5. Water pollution experiment

You'll need:

- 2 stalks of celery
- 2 jars, bowls, or containers that are at least 3" deep
- food coloring
- water

Fill jar 1 with clear tap water

Fill jar 2 with a mix of water and food coloring (we used red)

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After a while the colored water will slowly be absorbed through the stem and move throughout the stalk and leaves through capillary action.

When you check back later in your day you can see the *pollution* has impacted all parts of the celery stalk and changed the color.
Take this experiment one step farther and have students move the colored celery stalk into the clear, *non-polluted* water. After some time students will see that the celery stalk improves.

Think and discuss

-What is the impact of water pollution on us humans, animals and ecosystems?
-If we work to protect our planet and remove the pollution. Can we heal the Earth and make things better?

Latvia

How to make soap?

Disclaimer: even though I have had the opportunity to make it myself I couldn't find

the photos, so sadly I'll have to use internet.

There're multiple methods of making soap but since I have to write only about one, I chose the so called rebatching. It's really easy and it's basically just reusing batches of poorly made soap (also it ties up with the whole recycling and zero waste topic).

1) Choose the soap you want to reuse
2) Grate or cut the soap
3) Add liquid. There're actually multiple choices on what liquid to use, for example, water, although a lot of people prefer using milk (cow's, goat's and coconut milk). "How much liquid" would probably be the question to ask at this point, and just like "what liquid to use" to this question there's also multiple answers, the best answer would be to do according to the senses, but there's also the option to use about 85 grams of liquid per 453 grams of grated soap (3 ounces of liquid per pound of grated soap).
4) Use a crock pot or oven dish to rebatch soap. Take the grated soap, put it into the container (it has to have a lid).
5) Add the liquid and stir it up gently.
6) Set the crockpot on low or if you use oven 65°C to 76°C.
7) After an hour or so open the lid and stir gently and let it "cook" for another hour.
8) The result should be that the soap has become "pourable". At this point it's time to add any other additives. Stir it up so that the additives are well incorporated into the soap.
9) After waiting a bit (so that the soap has solidified a bit, but not completely) scoop it into a mold of choice.
10) Push the soap down with a rubber spatula or a spoon, tap it so that it settles into the mold
11) Let the soap set up for 24 hours or so,
12) After that you should be able to pop it out of the mold and slice it.
13) Let it cure until it's completely hardened (cure time will depend on how much liquid was used)
And that's it. Nothing too complicated and most of the time you just have to wait. I also added a YouTube link below to easier understand and follow along the process. Rebatching Soap / How To Make Soap – YouTube

Adele Jakoviča

Eco self made scrub.

Don't you want to try something fresh, without toxins and easy self care made product for your sckin or as a gift? I can help you.

Things you'll need:

Coffee

Cinnamon

Sugar

Bowl

Jar with a cover

Step by step.

1st step...

Take a bowl and all the ingredients.

2nd step

In the bowl put Coffee, coconut cream and sugar. I put in 20 grams of each. And tablespoon of cinnamon.

*of course put sugar depending on your skin sensitivity.

3rd step

Then stir it together then cover the jar and keep it in cold place.

The final product...

Use it when you need it or want it. Maybe make it as a gift, beacause nothing is better than a self made gift.

How to use blueberrys in clothes painting

Have you ever had idea to paint your clothes with berrys? I have a option!

This will save your old clothes to new ones!

All you need is:

More than half cup of salt

Bowl of blueberries

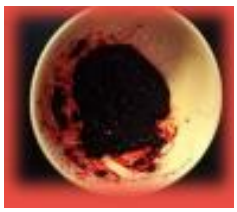
Withe t-shirt or whatever you want to paint

Rubbers

Process:

First of all you need to pour ten glases of water and put them in the pot. Add salt, stir all the time and let it boil.

When salt is dissolved, put the T-shirt in water. Keep it boiling for 30 minutes. Salt will let blueberries color better paint your clothes.



Blend the blueberries in homogeneous mass.

After 30 minutes of bowling take out T-shirt from pot. Put blueberries in saltwater and bowl them for 40 minutes.

While blueberries are bowling, tie a T-shirt with rubbers.

After 40 minutes take out bluberries from water take a T-shirt and put it in.

Leave T-shirt in bluberrys for 12 hours

Look how pretty it is!

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This is a perfect gift to someone who likes cool clothes. Merry Christmas!

Self-made paper

Raw materials:

- Used paper / newspapers
- Plastic tub
- Hot water
- Corn starch
- Aluminium foil
- Spoon
- Scissors
- Sharp pencil
- Strain
- Books or anything heavy

Making process:

1. Cut the paper into small pieces. Use about five pieces of A4 paper.
2. Put the paper into the plastic tub pour over some hot water and mix thoroughly.
3. Leave the substance for a couple of hours and from time to time mix it. The mixture is ready when it's a mush.
4. Add five spoons of cornstarch to the mix.
5. Add more hot water and mix. it is supposed to become a watery mass.
6. Strain the mass of excess water.
7. Make a template out of Aluminium foil (the shape of the template will be the shape of the paper).
8. Poke small holes into your template with a sharp pencil.
9. Place the template on some newspaper so it absorbs the water.
10. With your spoon place the mass of paper on the template.
11. Push on the mass with your strain so most of the water drains.
12. If there are some holes in your mass push them together with your finger.

13. Place some Aluminium over the mass and put your weights on it.

14. Leave it for 12 hours to dry and when it's done you've finished, good job!!!!

Visual material:




BIO BEESWAX CANDLE

Instructions on how to make a candle.

Things needed: Beeswax, candle wick, silicone candle mold, small pot, small metal bowl, 1l with water, 5 rubber bands .

1. Crush the old bee cells and place them in a metal bowl.
2. Pour water in the pot insert the metal bowl with wax in the pot.
3. Start boiling water, wait until the wax melts.
4. Prepare silicone candle mold.
5. Insert the candle wick in the candle shape and put rubber bands aroun the mold.
6. Slowly pour the wax inside the silicone form.
7. Leave the candle mold with wax on the table for 4-5h so that the wax in the candle form can harden.

8. Carefully pull the candle out of the shape.
9. Enjoy your work. Haralds Mednis

This is a wonderful gift for someone, because beeswax smells very good and no one really buys beeswax candles nowadays everyone buys paraffin candles. This candle personally didn't cost me anything because I farm bees, which I would recommend that you all grow at least one hive with bees because bees are very helpful to nature and without bees we wouldn't have any fruit or flowers.

Homemadecandles

What you'll need

Old candles

A container for the candle

Something that you can heat the wax in

Fragrance oils if you want to add a specific sent to your candle

Crayons if you want to add a specific color to your

Candle

Making

the candle

1. Cut your candle wax into small peaces so it's easier to melt
2. Place the pieces of wax into a container , place the container into a pot of water and then heat it.
3. Add the fragrance and the chopped up crayons
4. While your wax is heating place the wick in the middle of your candle container
5. When the wax has completely melted , pour it into your prepared container
6. Wait for your candle to harden
7. Once it's ready enjoy your new candle

My xperience:

I used the same containers that the old candles were in . Because those containers are small I was able to make many candles with the wax I had

Be careful with the melted wax ! It doesn't just burn you if you get it on your skin , it also makes a mess if it gets on any surface

Good luck

ANNA TREKŠE

Homemade crayons made with egg shells

Needed materials:

- 4/5 egg shells.
- Hot water.
- Flour.
- Food coloring (It can also be colors, that you bought for Easter egg painting).

Step 1: Wash the egg shells, and try to separate the white layer, that is inside the shell.

Step 2: Put the egg shells into a bowl and grind as much as you can. If possible try to grind it till it turns into a sort of powder. If a coffee grinder is available, use it!

Step 3: In a different bowl, mix one teaspoon of flour with one teaspoon of hot water,

until dough forms.

Step 4: Add one spoon of grinded egg shells, and a bit of food coloring to the dough.

Step 5: Mix all the ingredients together into a crayon form.

Step 6: Wrap the crayons into a paper towel and let them dry for 3 5 days.

Step 7: Put the crayons into an oven for 90 minutes, and heat them at 70 degrees Celsius. After that, let the homemade crayons harden, leaving them to “rest” for 24 hours.

All finished!

After 24 hours, the crayons should be done!

Viestards Kalnins 7.a

Romania

CHEMISTRY PROBLEMS

1 -What is the pure water?

Solution: The pure water is the distilled water.

2- Dissolve one gram of alcohol in 999 grams of distilled water. What is the mass percent concentration of the solution obtained?

Solution:

Solution mass: 1 g + 999 g = 1000 g

For 1000 g- we have 1 g alcohol

For 100 g – we have 0.1 g alcohol ⇒ c = 0.1 %

Or

$C = \frac{md}{ms} \times 100$

$C = 1 \times \frac{100}{1000} = \frac{1}{10} = 0.1\ \%$

3- A gaseous solution consists of 555.5 g of carbon dioxide and 555 g of oxygen. What is the mass percent composition of the solution?

Solution:

We notice that we have half CO_2 and half O_2.

⇒ fifty – fifty

⇒ c = 50%

50% CO_2

50% O_2

4- How much oxygen do we have in 1000 m^3 of air?

Solution: The air has 21% O_2

$\Rightarrow m_{O_2} = \frac{21}{100} \times 1000\ m^3 = 210\ m^3\ O_2 = 210 \times 1000\ l\ O_2 = 21 \times 10^4\ l\ O_2$

5- How much do 224 l O_2 weigh in normal conditions (NC)?

Solution:

1 mole (NC)---------- 22.4 l

⇒ 224 l O_2 = 10 moles O_2 in NC

$M_{O_2} = 2 \times A_0 = 2 \times 16 = 32$

⇒ 1 mole of O_2 molecules = 32 g

⇒ 10 moles of O_2 = 320g of O_2

6- How much water can be formed by combining hydrogen with 64 g of oxygen?

Solution:

	1 mole	2 moles
	32 g	2x18 g
$2H_2$ +	O_2 ⇒	$2H_2O$
	64 g	x

M = 2 x A_0 = 2 x 16 = 32

O_2

⇒ 1 mole of O_2 molecules = 32 g

M = 2 x A + A = 2 x 1 + 16 = 18

H_2O H O

⇒ 1 mole of H_2O molecules = 18 g

$\frac{32\ g}{64\ g} = \frac{2 \times 18\ g}{x}$

$x = \frac{64\ g \times 2 \times 18\ g}{32\ g} = 4 \times 18\ g = 72\ g$ water obtained

Slovakia

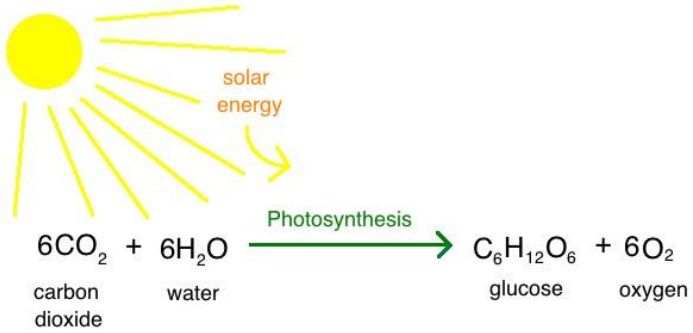
1- The air contains 0.15% of pollutants, mainly sulfur and nitrogen oxides. How many grams of pollutants are in 250 kilograms of air?

2- As a result of air pollution, the content of carbon dioxide in the air is constantly

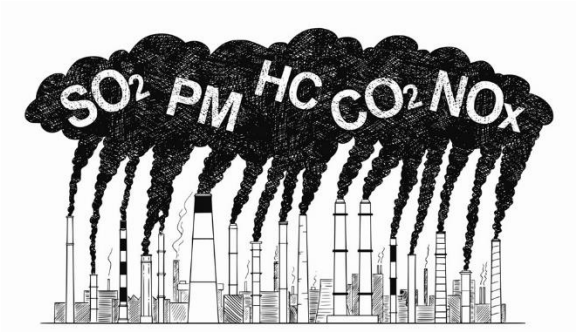
increasing. How much % CO_2 is in the air, if 50 kilograms of air contains 15 grams of

CO_2?

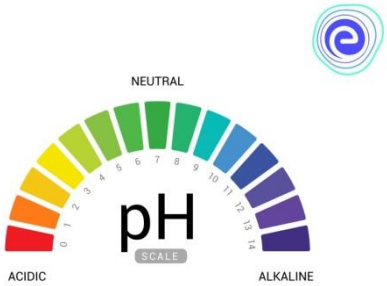
3- Through photosynthesis, plants produce the oxygen we need for our breathing. A beech that grows for 100 years will produce about 6,600 kilograms of oxygen for us during its lifetime. How much carbon dioxide does it process?



4- Sulfur dioxide, carbon dioxide and nitrogen dioxide are among the substances that pollute the air the most. Calculate their molar masses.



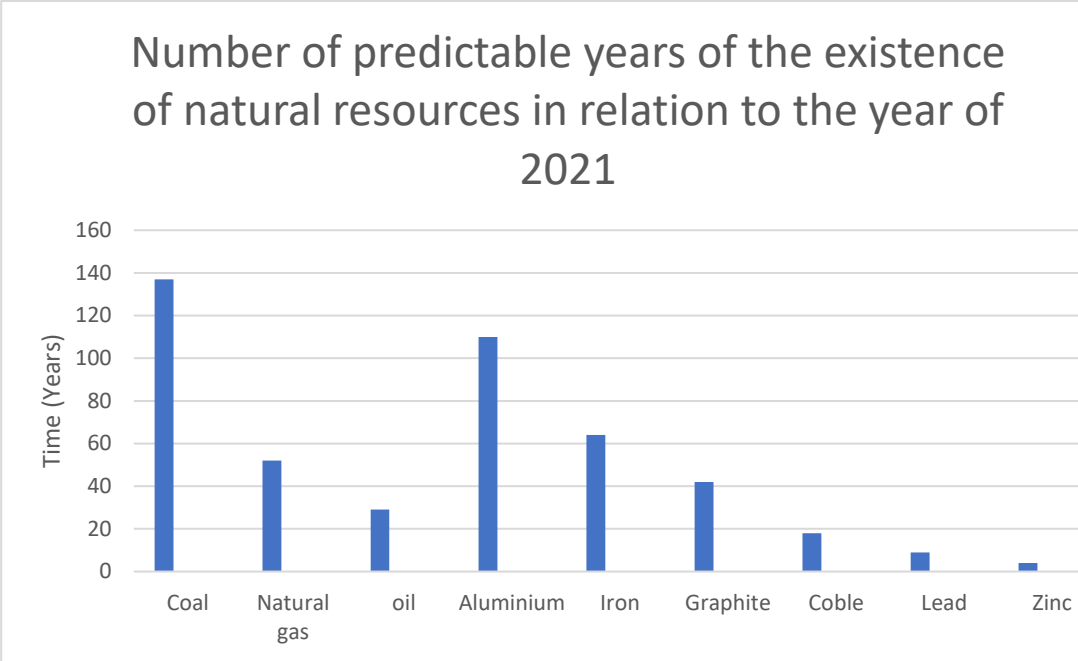
5- The water in the home pool should be clean and clear. The basis of clean water is the correct pH value. The recommended pH value for swimming pools is 6.6-7.4. How are the indicators: methyl orange, phenolphthalein and litmus colored if the pH value drops below the lower limit?



Portugal

1- Natural resources forever?

Observe the graphic



1.1 – What is the first non-renewable natural resource to run out?

1.2- Mention two actions that can promote the sustainable use of natural resources on earth.

1.3- Aluminium and zinc are inorganic natural resources. Do you agree with this statement? Justify your answer.

Answers

1.1- Zinc

1.2- For example, avoid the use of plastic bags. Choose not packed products.

1.3- Yes, because they have their origin in the terrestrial crust.

2- Do you know how many liters of water your jeans "drink"?

A simple pair of jeans consumes, on average, 5220 liters water, which would be enough to meet the daily needs of

47 people. The researchers conclude that the cotton planting phase absorbs 4247 L, weaving consumes 127 L and clothing accumulate 327 L and there are also home washes during the life of the product.

2.1- In a chemistry class, a student said ” water is a renewable natural resource, therefore, it is unlimited”.

Do you agree with this statement?

Comment on the statement using relevant information from the text above.

2.2- Show two solutions to preserve the quality of water.

Answer

2.1- No, although the water is a renewable resource it is limited. When you use water as a raw material, there is a possibility of polluting it.

This happens in the production of jeans once the washing of the pieces of clothing wastes and pollutes high quantities of water. Besides, the greatest part of water that exists in the planet in unreachable.

2.2- Por example, wash the clothes only when necessary and use the right quantity of detergent.

3- Water

3.1- Choose the words to make correct sentences:

“The water that comes from a spring is a natural/synthetic and organic/inorganic resource”.

3.2- Which of the following statements isn’t a rational usage of water

a) always use the washing machines with maximum load

b) take immersion baths instead of quick showers

c) never water the garden when it is hottest because the water evaporates quicklier

d) Turn off the water while you rub your hands

3.3- Explain the following statement. “Water is a renewable resource but limited”.

Answers

3.1- natural and inorganic

3.2- b)

3.3- Although water is a renewable resource, only 0,03 of sweet water existing on the planet is ok for human consumption what makes it a limited resource.

4- A company of energy supply used in an advertisement this sentence: “energy creates energy”.

This sentence is scientifically correct because_ _ _

4.1- … right because it is possible to create energy (dams)

4.2- … right but incomplete because energy can also be destroyed

4.3- … wrong because it is possible to create energy, but you destroy it immediately

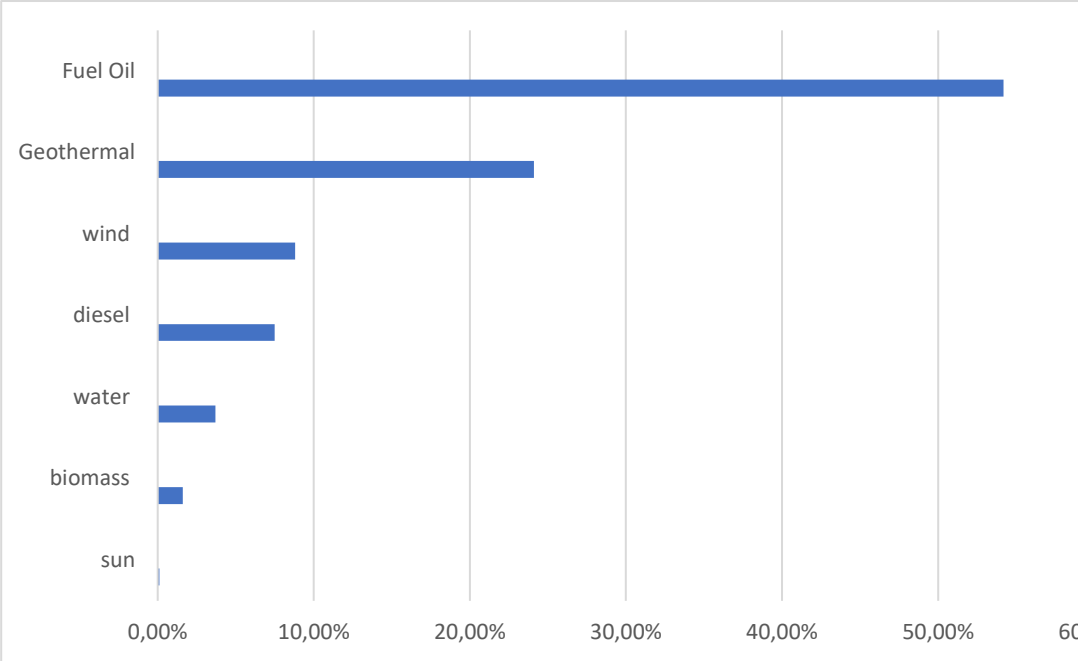
4.4- … wrong because energy neither is created nor is destroyed, it only transforms or transfers

Answer

4.4

5- What sources of energy de we use to the production of electricity?

The following graph shows the main sources of energy used in the Autonomous Region of Azores for the production of electric energy from January to December of 2019.



5.1- Identify the non-renewal sources of energy

5.2- What is the main renewal source of energy?

5.3- How do you call the electric central that use geotherm as a source of energy?

5.4- Identify two advantages of the renewable sources of energy comparing to the non-renewable?

Answers

5.1- Fuel oil and diesel

5.2- geothermal

5.3-geothermic centrals

5.4- They are renewable and have a low environmental impact.

6- Mothballs

Mothballs can be used as repellent from moths.

The following table shows the temperature values according to the time, obtained in the laboratory by heating a solid portion of mothballs.

Time (minutes)	Temperature of moth balls (ºC)
0,0	20,0
1,0	30,0
2,0	40,0
3,0	50,0
4,0	60,0
5,0	70,0
6,0	80,0
7,0	80,0
8,0	80,0
9,0	90,0
10,0	100,0

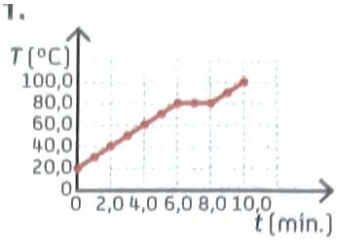
6.1- Using the data from the table, build a graphic temperature – time

6.2- What is the physical state of the substance at 30,0 º C, 80,0 º C and 90,0 º C?

6.3- Is it possible to find out the point of fusion of the mothballs by analysing the graphic? Justify your answer.

Answers

6.1-



6.2- 30 – solid

80-solid and liquid

90- liquid

6.3- yes, because the graphic observation shows that between 60 and 80 minutes, even though you heat the substance, the temperature keeps on the 80,0 ºC. This temperature if the fusion point of the moth balls.

7- Process of identification

In a laboratory, two unlabelled flasks were found, both containing colourless liquids. To identify their content, a sample of each was heated.

Time (min)	Temperature of sample A (º C)	Temperature of sample B (º C)
0	20	18
1	40	38
2	60	58
3	80	78
4	100	78
5	100	78

7.1- What was the initial temperature of the two samples?

7.2- Build up the temperature-time graph for sample A, based on the data on the table.

7.3- What is the boiling point of each sample?

7.4- What are the substances present in the flasks?

Conclude on the degree of purity of samples A and B.

7.5- Disregarding evaporation, indicate the physical states of

a) sample A at a temperature of 78.0 ºC

b) sample B at a temperature of 100.0 ºC

c) of sample A at 100.0 ºC?

7.6- Which liquid is the most volatile?

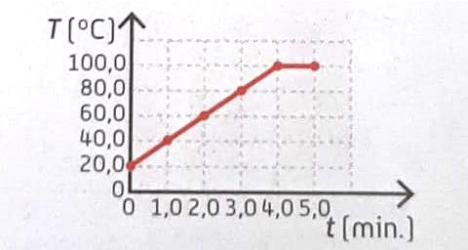
7.7- What is the physical state of the two substances minutes after starting heating?

Answers

7.1- A) 20 º C

B) 18 º C

7.2-



7.3- A) 100 º C

B) 78 º C

7.4- A) Water B) Ethanol

The degree of purity of the sample is high.

7.5- a) liquid

b) gaseous

c) liquid and gaseous

7.6- B

7.7- Liquid