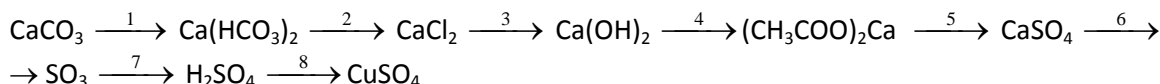


Each problem is graded from 0 to 10 points. Please write different problem solutions on different paper!

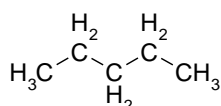
1. Write molecular equations for reactions to show how to realize such chemical transformations:



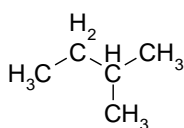
Example. State number of reaction where strong acid is formed: 7.

- State number of reaction, which is naturally occurred in nature: _____
 - State number of reaction for which requires heating: _____
 - State number of reaction, where white precipitate is obtained: _____
 - State number of reaction, where weak acid is formed: _____
2. Little John prepared sodium chloride solution by mixing 16.0 grams of sodium chloride with 100 mL of water (density 1.00 g/mL).
- Calculate mass fraction of sodium chloride in prepared solution.
 - Calculate mass of sodium chloride which has to be added to solution 1.a. to obtain 20.0% solution of sodium chloride.
 - Solubility of sodium chloride at selected conditions is 40 g per 100 g of water. Is solution obtained in question 2.b saturated or unsaturated? Justify your answer with calculations.
 - Calculate volume of water you have to add/evaporate to obtain saturated solution from 2.b solution. Calculate the mass of saturated solution!
3. An oxide of unknown metallic element **A** contains 40% of oxygen and an oxide of unknown metallic element **B** contains 40% of oxygen. It is known that **A** has smaller relative atomic mass than **B**. Determine elements **A** and **B**, justify your answer with calculations. Is it possible to use one of these metals for obtaining second metal from its compounds (for example from chloride), write equation for possible reaction (if any is possible).
4. One of most frequently used methods in analytical chemistry is titration. The simplest case of titration is acid-base titration. Little Anny had sodium hydroxide solution with unknown concentration. She took 10.0 grams of this solution and transferred it into conical (Erlenmeyer) flask, then added indicator. After these operations she from burette added solution of hydrochloric acid. For complete titration she used: 1) 13.24 mL (1st titration), 2) 10.58 mL (2nd titration), 3) 10.56 mL and 4) 10.54 mL of 10.0% hydrochloric acid solution.
- Knowing that density of hydrochloric acid can be expressed as $d(\text{HCl}) = 1.00 + w/2$, where w – mass fraction of hydrochloric acid in solution, calculate mass fraction of sodium hydroxide in analyzed solution.
 - State which indicator – phenolphthalein or methyl orange is more suitable to this titration.
5. There is list of six organic compounds. Answer questions which are related to properties of these compounds and structure.

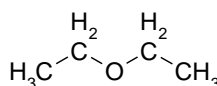
1.



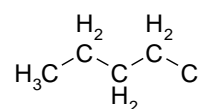
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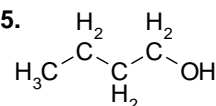
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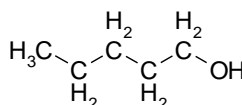
4.



5.



6.



- a. *Identify compound(-s) which belong simplest organic compounds – hydrocarbons!*
- b. *Identify compound(-s) which has good solubility in water due to formation of hydrogen bonds between compound and water molecules!*
- c. *Draw complete structural formula of compound 3., show all bonds and lone electron pairs. Determine number of sigma and pi bonds in this molecule.*
- d. *Order these organic compounds by increasing boiling points (compound with lowest boiling point comes first).*
- e. *Write equation for complete and incomplete combustion of compound 3. and 4.!*