



KXA Solutions

PROJECT REQUEST

DATE OF INCIDENT	REPORTED BY	ASSIGNED ANALYTICAL CHEMISTS
May 25 th , 2021	Vander Waals, Manager	Student Name(s):

ATTENTION!

An employee in the manufacturing department of **acetone, isopropyl alcohol, water, and ethyl acetate** has prepared batches of *three* solvents, but has forgotten to label their containers. To avoid scrapping the product, we request that you determine the *identity of these three liquids* using a physical property. Recall that a *physical property* is a property of a chemical compound that can be investigated or measured without changing the chemical composition of the compound itself. Below, we have outlined the list of materials that will be available to you to make this determination. We trust that you will be able to efficiently, effectively, and safely determine the identity of each liquid and are confident in your expertise.

PROVIDED MATERIALS

MATERIAL	QUANTITY	MATERIAL	QUANTITY
Unknown solution 1	10 mL	Open-ended capillary tubes	3
Unknown solution 2	10 mL	Pasteur pipette	3
Unknown solution 3	10 mL	Magnetic stir bar	1
10 mL sample test tubes	3	Stands and clamps	1
500 mL beaker	1	Thermometer with rubber bands or clamps	1
Electric hot plate	1	Water	400 mL

EXPERIMENTAL DESIGN

1. With the provided materials, which **physical property** will you investigate in order to determine the identities of the unknown liquids?

2. In the space below, please provide a detailed description of the experiment you plan to carry out to determine the identity of each liquid based on the provided information and materials. Be sure to provide a diagram of the anticipated experimental set-up. Your experimental procedure **must** make use of every provided material in the table shown above.

EXPERIMENTAL PROCEDURE

3.. In the space below, provide a detailed explanation on the expected outcomes of your experiment. How will you use the obtained data after investigating the physical property of interest to draw your conclusion about the identity each liquid? In your explanation, be sure to incorporate chemical terminology and explanations, including **intermolecular forces** and **bonding interactions**.

EXPECTED OUTCOMES

4. Indicate and explain any **safety hazards** to be cautious of. What steps will you take to ensure that your experiment will be both **safe** and **effective**?

APPROVAL

Additional notes from instructor:

This experimental design has been approved by _____ on _____.



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PROJECT STATUS REPORT

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DATA OBTAINED

PHYSICAL PROPERTY OF INTEREST: _____	
UNKNOWN LIQUID	OBSERVATION(S)
1	
2	
3	

CONCLUSION

In the space below, formulate your conclusion about the identity of the unknown clear liquids. Be sure to explain how you came to this conclusion referring to the appropriate and necessary chemical terminology and concepts.

DISCUSSION QUESTIONS

1. KXA Solutions is also a major manufacturer for other solvents such as propane, ethanol, and heptane. In case this mix-up of liquids happens again in the future, we'd like to use your experiment to determine the identity of the liquids. For each provided chemical compound, draw the chemical structure, and predict which chemical compound would have the highest boiling point and which chemical compound would have the lowest boiling point.

Propane

Ethanol

Heptane

Lowest boiling point		Highest boiling point	
Structure:		Structure:	

2. Distinguish between *intermolecular* and *intramolecular forces* and identify which of the two influences boiling point.

3. Provide definitions for each of the following terms and identify which of the three solvents experience those interactions.

Covalent bonding:
Ionic bonding:
Hydrogen bonding:
Van der Waal's forces:
Dipole-dipole interactions:
Dipole-induced dipoles:

4. In the case that you were given complete freedom with available materials, provide a general explanation of another experiment you could have carried out in order to determine the identity of each unknown liquid. Which physical property, other than boiling point, would you choose to investigate? How would your experiment, based on another physical property, aid in the determination of identity?