

16/20

Chemistry Department

Chemistry 239

Date: 10/04/2013

Section: (0-1) الأثنين

Exam I

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Name (in Arabic):

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***** and the unknown compound is found. ~ mixture

Melting point: (6 points) the mixture with the ~~narrowest~~ narrowest m.p range and with m.p closest to the one first measured Describe briefly how the melting point determination can be used: is considered to be a pure

1. to identify an unknown compound by measuring the m.p of the unknown compound, then ~~then~~ make some predictions about what the unknown compound may be, then form mixtures with the unknown, and ^{with} each prediction made.
2. as an indication of the purity of a substance. IF the melting point is sharp and the substance had a narrow melting point range then the substance is pure however if the substance had a broad melting point \Rightarrow impure range.
- Which of the following will increase, decrease or not affect the melting point range?

- a) Presence of some solvent within the crystals decrease \times
- b) Presence of glass in the sample no effect \checkmark
- c) Using too large sample increase \checkmark
- d) The paraffin oil bath is not pure no effect \checkmark

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Boiling point and distillation (6 points)

Bumping can be prevented during distillation by ... the ... addition ... of ... boiling ... stones .

A liquid with a constant boiling point is not necessarily pure. Explain.

Because a mixture of liquids with the same boiling point will have a constant boiling point.

The boiling point of hexane is 68°C and that of 2,2-dimethylbutane is 50°C at 760 mmHg. The boiling point of a solution of hexane and 2,2-dimethylbutane will be :

- (a) between 50°C and 68°C b. lower than 50°C c. higher than 68°C \times
- d. more information is needed

11-5

\Rightarrow What is the effect of the presence of non-volatile insoluble impurity on the boiling point of a liquid? (Increase decrease, no effect)

How can you distill hexane at a temperature lower than 68°C ? ~~By distilling it at a pressure lower than 760 mm Hg.~~

By distilling it at a pressure lower than 760 mm Hg.

0.5

Name the best technique that can efficiently separate a solution of hexane and 2,2-dimethylbutane? ...Fractional....distillation.

Recrystallization (7 points)

During re-crystallization experiment:

Why is it preferable to allow the hot solution to cool gradually instead rapid cooling in an ice-bath? Because rapid cooling will lead to the formation of the solid in the powder form rather than crystals. 0-5

Soluble impurities are removed by... ~~filtration~~... Suction Filtration 1

Colored impurities are removed by... ~~filtration~~... Charcoal 1

Insoluble impurities are removed by... gravity Filtration "hot Filtration" 1

Premature crystallization in the filter funnel is minimized by:

1. heating... the... Funnel... and Flasks in the oven 1
2. ~~allow~~... allow... the... solution to boil and pour it through the filter paper when hot. 2

Concerning the solubility of compound (A) in different solvents:

| CH ₃ OH ✓ | | H ₂ O | | CH ₂ Cl ₂ | |
|----------------------|-----|------------------|-----|---------------------------------|-----|
| Cold | Hot | Cold | Hot | Cold | Hot |
| -ve | +ve | -ve | -ve | +ve | +ve |

Compound (A) can be best recrystallized using:

- a) A pair of H₂O and CH₂Cl₂ b) A pair of H₂O and CH₃OH
c) H₂O only (d) CH₃OH only 1

Extraction (7 points)

Give an example of a solid-liquid extraction (hint: you need to specify the solid and the liquid)

...the... extraction... of... Caffeine... from... tea leaves...
Solid → caffeine liquid → water. 1

Caffeine can be recovered from dichloromethane solution by ...liquid-liquid

organic
phase.

2

extraction; and heating the solution on a hot plate in the fume hood.

(anhydrous salt such as CaCl_2)

Traces of water can be removed from dichloromethane by adding a drying agent

How can you improve the extraction of organic compounds from aqueous media by an organic solvent? 1- Saturating the aqueous layer through the addition of a salt such as NaCl or Na_2CO_3 . 2- Prevent the formation of emulsions through avoiding vigorous shaking of the two layers.

The solubility of compound (B) in different solvents is given below:

| Solvent | Ethanol | Water | Dichloromethane | Ether |
|----------------------|---------|-------|----------------------------|-------|
| Solubility (g/100ml) | 8 | 2 | 4 CCl_2H_2 | 6 |

Which is the best solvent to extract (B) from water? ~~ethanol~~ dichloromethane X

If the solubility of compound (B) in ethyl acetate is 10 g/ 100 ml, calculate the distribution coefficient K_D between ethyl acetate and water.

$$K_D = \frac{S_o}{S_w} = \frac{10 \text{ g/100 ml}}{2 \text{ g/100 ml}} = 5$$

(3)

If a solution of 1 g in 50 ml of water was extracted by 100 ml of ethyl acetate. Calculate the mass of (B) extracted by ethyl acetate.

$$K_D = \frac{\left(\frac{m_B}{V}\right) \text{ in ethyl acetate}}{\left(\frac{m_B}{V}\right) \text{ in water}}$$

$$\frac{\frac{m_B}{100}}{\frac{1}{50}} = 5 \Rightarrow \frac{m_B}{100} = 0.1$$

$m_B = 10 \text{ g}$

Steam distillation (6 point)

Which fraction in the distillate has the highest bromobenzene ratio?

- a. the first fraction in the distillate
- b. the last fraction in the distillate
- (c) All have the same ratio
- d. more information is needed to decide

The boiling point of bromobenzene – water mixture at 760 mmHg will be:

- (a) Lower than that of water.
- b. Higher than that of bromobenzene.
- c. Between the boiling points of water and bromobenzene.
- d. Depends on the ratio of bromobenzene to water.

(3)

Suggest a method that can be used to separate essential oil from spices other than steam distillation. liquid-liquid extraction

At 50 °C the vapor pressure of water = 300 mmHg, and for bromobenzene = 200 mmHg.
Calculate the total vapor pressure of a 1:1 molar mixture.

$$P_T = P_w^\circ + P_{BB}^\circ$$

$$= 300 + 200$$

$$= 500 \text{ mm Hg}$$

(3)

Name one advantage and one disadvantage of using steam distillation as a method of purification.

Advantage: Can be used for high-boiling, steam volatile organic compound at temperatures below the b.p of water.

Disadvantage: Not all substances can be purified by steam distillation; their properties are:

- 1) steam volatile
- 2) inert towards steam
- 3) immiscible with H₂O.

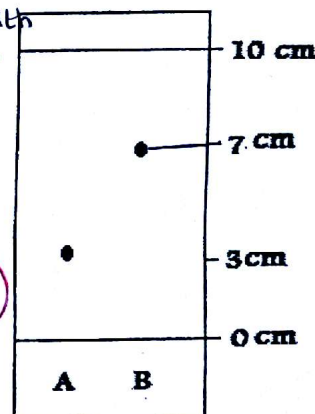
Chromatography (8 pts)

Calculate the R_F value of (B) $\frac{7 \text{ cm}}{10 \text{ cm}} = 0.7$

Which compound A or B would you expect to have a lower polarity? compound B

R_F ↑, polarity ↓

Which compound is less strongly adsorbed on silica gel; ortho- or para-nitroaniline? Explain. ortho-nitroaniline because its R_F value is greater than that of para-nitroaniline.



Name two methods that can be used to visualize colorless compounds on TLC?

1. Under UV light
2. exposing the slide to iodine vapor or spraying it with sulfuric acid [through the addition of a colorful indicator]

What does the abbreviation TLC stand for?

Thin Layer Chromatography

From the result obtained of the paper chromatography experiment of a food dye; which is less soluble in water blue or yellow dye? Blue; because it has a higher R_F value.