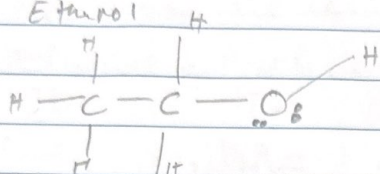


Lab 9: Intermolecular forces

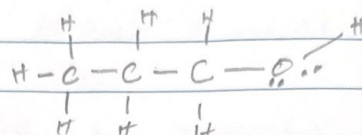
A) Lewis Structures

① Ethanol



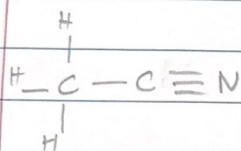
• Hydrogen Bonding

② 1-Propanol



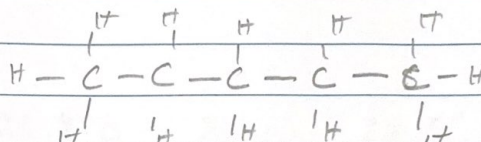
• Hydrogen Bonding

③ Acetonitrile



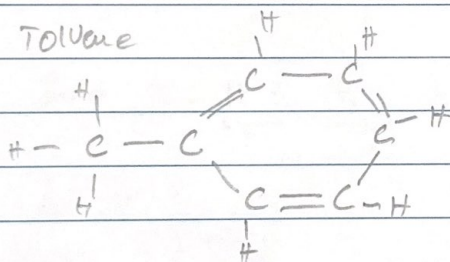
• Dipole-Dipole

④ Pentane



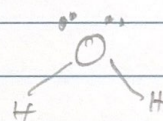
• LDF

Toluene



• LDF

H₂O (water)



• H-Bond

Ranking

Strongest ←

→ Weakest

H₂O, Ethanol, 1-Propanol

Acetonitrile, Toluene, Pentane

asse

Evaporation Rates

slowest



fastest

Pentane, Toluene, Acetonitrile, 1-Propanol, Ethanol

Temperature & Diffusion Evaporation

slowest ΔT



fastest ΔT

Pentane, Toluene, Acetonitrile, 1-Propanol, Ethanol

Part B: Tol

Initial Press:

Temp (°C)

23.1

27.4

30.5

33.2

35.4

37.9

Part C:

Initial

Toluene

Initial

Final

Liquid

ethanol

1-Propanol

Acetonitrile

Pentane

Water

Smallest
Partial, Ethanol

Smallest ΔT
Ethanol

Part B: Toluene

Initial Press: 97.9 kPa

Initial T: 23.1 °C

TEMP (°C)	P (kPa)	Vapor P (kPa)
23.1	97.7	0.8
27.4	99.9	2
30.5	100.9	3
33.2	101.2	3.3
35.4	101.7	3.8
37.9	102.5	4.6

Part C:

Initial T: $\frac{26.4^\circ\text{C}}{T_1}, \frac{26.64}{T_2} = 26.5^\circ\text{C}$

Initial T (evaporating): $\frac{26.3}{T_1}, \frac{24.6}{T_2} = 25.3^\circ\text{C}$

Final T: $\frac{18.3}{T_1}, \frac{18.92}{T_2} = 18.6^\circ\text{C}$

Liquid	T_i	T_f
ethanol	24.1	17.2
1-Propanol	27	19.2
Acetonitrile	26.8	12.7
Pentane	21.9	14.0
Water	26.0	20.7

Part D: Evap Rates / $M_{Beaker} = 22.967$

Molecule	M_i	M_f	M_{evap}
Ethanol	23.235	23.228	.07
1-Propanol	23.257	23.254	.003
Toluene	23.333	23.324	.09
Acetonitrile	23.360	23.344	.16
Water	23.595	23.595	0
Pentane	23.127	23.044	.083

$$\left(\frac{M_{evap}}{M_i - M_{Beaker}} \right) \cdot 100$$

%/min of evaporation

Ethanol - 13.06 %/min

1-Propanol - .5172 %/min

Toluene - 12.3 %/min

Acetonitrile - 20.36 %/min

Water - 0

Pentane - 25.94 %/min

Analysis: The dominant intermolecular forces DO impact the properties of evaporation. Those with stronger IMFs (water for ex.) have lower evaporation rates while those with weaker IMFs have a higher rates.

Part B: Remo

Temp

23.1

30.9

35.9

38

41

42

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

22.967

Mevap

27

003

09

6

Part B: Remind 5 liquids

Temp	VP	T	VP	
23.1	2.4	32.6	.004	
30.9	4.9	27.1	.001	Wafco
35.9	6.2	32.2	.001	
38	7.1	37.2	0	
41	8.3	38.8	0	
42	7.8	39.6	.001	
23.5	1.3			
27.8	.5			
31.8	.5			
35	.6			
37.8	.8			
40.4	1			
23.5	98.1			
28	100.4			
30.4	101.6			
33.1	103.1			
34.8	104.1			
37.1	105.1			
23.5	23.5			
23.8	25.7			
24	32.5			
34.5	16.9			
38.1	10.3			
40.6	0.1			

Ethanol

1-Propanol

Acetone

Butane

DO

Tlog

ave

tore

es;