

Name of the Student: _____

Max. Marks : 17 Marks

Time : 17 Minutes

Q1.

The molar enthalpy of vaporisation (ΔH_{vap}) of a liquid is the enthalpy change when one mole of liquid is converted to vapour at the boiling point of the liquid.

A student does an experiment to determine ΔH_{vap} for water.

The student:

- places a large beaker on a balance
- pours 500 cm^3 of water into the beaker
- uses a 2.4 kW heater to raise the temperature of the water to 100°C
- records the mass of the beaker and hot water
- uses the 2.4 kW heater to boil the water for 100 s
- records the mass of the beaker and remaining water.

The loss in mass is 103 g

(a) Calculate ΔH_{vap} for water.

[1 kW = 1 kJ s^{-1}]

ΔH_{vap} _____ kJ mol^{-1}

(3)

The table below shows some data about three compounds that all contain the same number of electrons.

Compound	$\text{CH}_3\text{CH}_2\text{OH}$	$\text{CH}_3\text{CH}_2\text{NH}_2$	CH_3OCH_3
Boiling point / K	352	290	248

(b) All three compounds in the table above are polar.
Ethanol is the most polar and ethylamine is the least polar.

Explain why all three molecules are polar and why ethylamine is the least polar.
In your answer refer to the shapes around, and relative electronegativities of, the most electronegative atoms.

(4)

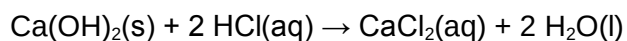
- (c) Explain the trend in the boiling points of the three compounds.
Refer to the intermolecular forces in all three compounds in your answer.

(3)

(Total 10 marks)

Q2.

Calcium hydroxide is almost insoluble in water, but it reacts with dilute hydrochloric acid.



A student adds 100 cm^3 of $0.100 \text{ mol dm}^{-3}$ hydrochloric acid to 0.600 g of solid calcium hydroxide.

(a) Show, by calculation, that the calcium hydroxide is in excess.

(2)

(b) The final mixture contains a saturated solution of Ca(OH)_2 at 293 K

At 293 K

- the solubility of Ca(OH)_2 in this solution is 0.400 g dm^{-3}
- $K_w = 6.80 \times 10^{-15} \text{ mol}^2 \text{ dm}^{-6}$

Calculate the pH of this solution.
Give your answer to two decimal places.

pH _____

(5)

(Total 7 marks)